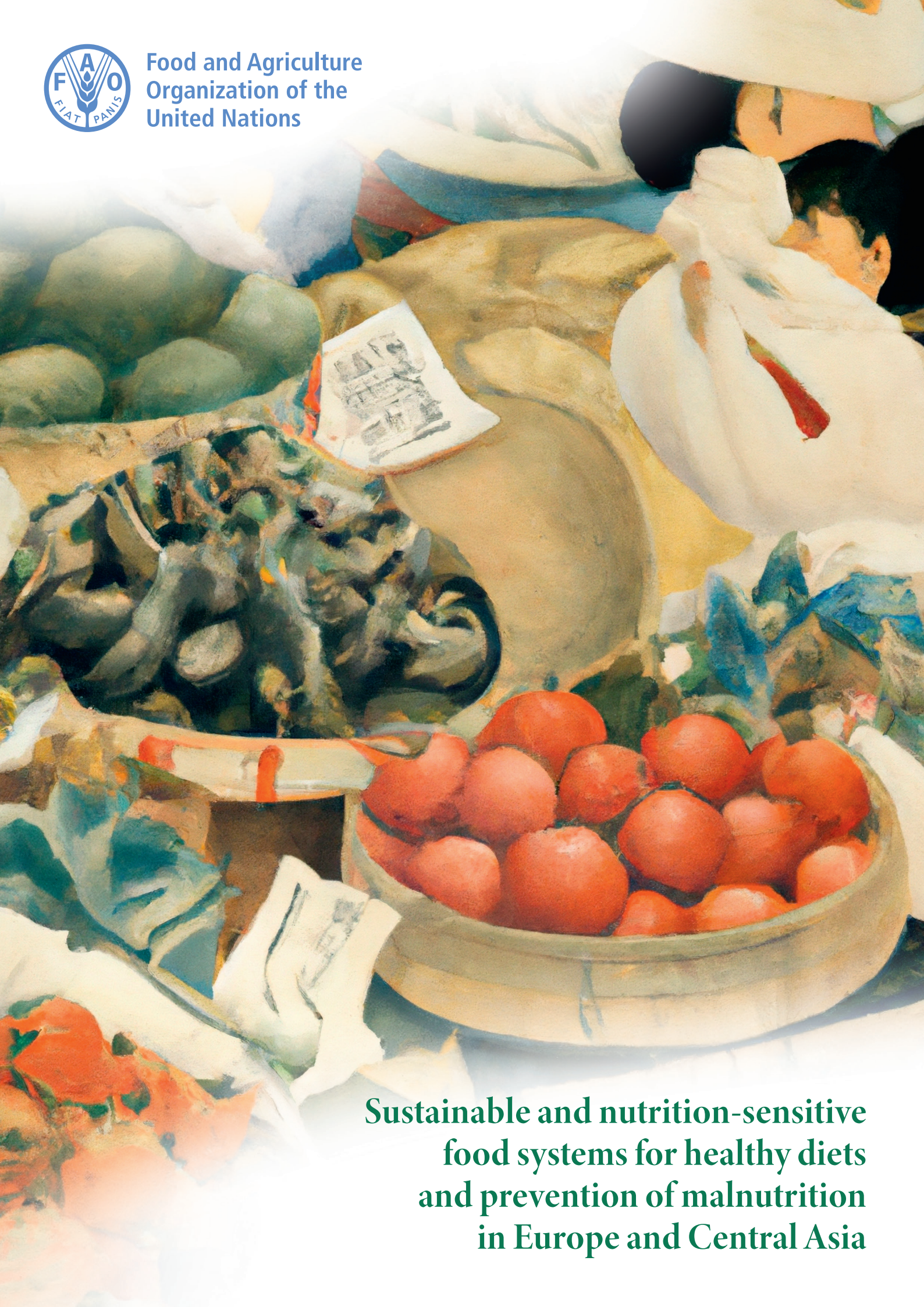




Food and Agriculture
Organization of the
United Nations



**Sustainable and nutrition-sensitive
food systems for healthy diets
and prevention of malnutrition
in Europe and Central Asia**

Sustainable and nutrition-sensitive food systems for healthy diets and prevention of malnutrition in Europe and Central Asia

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Preparation of this document

The nature of food insecurity and malnutrition have considerably changed in the ECA region during recent decades. In three main sections, this book addresses the role of food systems in the transition of diets and the prevention of malnutrition in the ECA region. **Part I** provides an introduction and executive summary of the book and shares key points for policy actions that can help bring about sustainable and nutrition-sensitive food systems for healthy diets and the prevention of malnutrition. **Part II** shares normative studies and a regional-level review, and **Part III** shares case studies from selected ECA countries.

Sustainable and nutrition-sensitive food systems for healthy diets and prevention of malnutrition in Europe and Central Asia was produced under the direction and guidance of editors **Cheng Fang** and **Mirjana Gurinović**, who jointly developed and decided on the outline and content of the publication and coordinated the preparation of the book.

Several studies reported in this book were carried out by the FAO Regional Office for Europe and Central Asia for a regional project on food system analysis titled “Programme support for the role of food systems in the transition of diets and prevention of malnutrition in the ECA region.” Under this project, a workshop titled “Awareness raising on the food system approach to address malnutrition” was held 27 October 2020 in Belgrade, Serbia.¹ During the workshop, drafted papers were presented and awareness-raising activities carried out to promote a better understanding of the food system approach in the prevention of malnutrition in the region. The event served as a platform for multistakeholder engagement and dialogue, including the sharing of methodologies, tools and lessons learned to strengthen beneficiary countries’ evidence base for addressing nutrition-related challenges from the food system perspective.

¹ For more information on this workshop, which was held online, see <https://www.capnutra.org/events/>.

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Foreword

Globally, we have not been on track to meet our commitments to end world hunger and malnutrition in all its forms by 2030. Now, the COVID-19 pandemic has made this significantly more challenging. In the past two decades in the Europe and Central Asia (ECA) region, many countries have made significant progress in combating undernourishment. However, despite that hunger is not a major issue at the country level in the region, the prevalence at the moderate or severe level is quite high. A lack of regular access to nutrition and sufficient food has put many people at greater risk of malnutrition and poor health – not only in low- or middle-income countries, but also in developed countries. A large majority of countries in the region risk not meeting the targets set by the 2030 Agenda for Sustainable Development. In particular, there are alarmingly high – and increasing – rates of adult obesity in most countries in the region.

Healthy and nutritious foods are expensive to many households in the region, resulting in poor diets that contribute to obesity, malnutrition and diet-related non-communicable diseases. This nutrition transition poses a major challenge for the public sector in terms of its ability to anticipate and mitigate possible negative nutritional and health impacts. Major drivers of transformation in food consumption and diets include rising incomes, urbanization, trade liberalization and market integration of food chains, and changes in food cultures and consumer preferences. Considering the complexity of the underlying causes of malnutrition, these challenges need to be addressed in a multisectoral approach. However, malnutrition is still considered a health sector issue in the ECA region, and there is a lack of supportive policies – particularly in Central Asia and the Caucasus – in sectors such as agriculture, food processing and distribution, food marketing and trade, environment, and education.

A sustainable food system is a system that delivers food security and nutrition for all in such a way that the economic, social and environmental bases that help ensure food security and nutrition for future generations are not compromised. A key outcome of sustainable food systems is the provision of sufficient, safe, healthy, nutritious and affordable food that meets the nutritional needs of all, including children and adolescents. Countries will need to reorient their food and agricultural policies towards more nutrition-sensitive investments and social protection to adapt and transition to healthy dietary production and trade systems. Specific policy interventions can promote mindset and behavioural changes among all food systems actors, bring about desirable shifts in food production and consumption patterns, and lead to more inclusive and equitable agrifood systems.

The roles of agriculture and the rural sector remain unclear, largely because of a limited understanding of the nutritional impacts of food systems. A comprehensive situation and policy analysis of the region is needed as a basis for planning effective policy responses. This book aims to contribute knowledge and understanding regarding the nutritional impacts of food systems. The ECA region contains great diversity in income levels and in food insecurity, malnutrition and other socioeconomic deprivations. This book supports countries suffering from various forms of malnutrition (undernutrition, micronutrient deficiencies and overnutrition) in strengthening their evidence base for addressing nutrition-related challenges from the food system perspective. In so doing, this book can serve as a basis for multistakeholder engagement and stakeholder dialogue.

This book aims to promote a holistic agrifood systems approach to achieving food security and improved nutrition in all its forms, including the promotion of nutritious food and increasing access to healthy diets for better nutrition.



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¹ For more information on this workshop, which was held online, see <https://www.capnutra.org/events/>.

Abbreviations and acronyms

ADB	Asian Development Bank
AL	Albania
AMR	antimicrobial resistance
BA	Bosnia and Herzegovina
BG	Bulgaria
BMI	body mass index
CA	Central Asia
CAP	Common Agricultural Policy
CAPNUTRA	Capacity Development in Nutrition Network
CFS	Committee on World Food Security
CHD	coronary heart disease
CIS	Commonwealth of Independent States
CIS FTA	Commonwealth of Independent States Free Trade Area
COICOP	Classification of Individual Consumption by Purpose
COSI	European Childhood Obesity Surveillance Initiative
COVID-19	Coronavirus Disease 2019
CSO	civil society organization
CZ	Czechia
DALY	disability-adjusted life years
DAP	Diet Assess and Plan tool
DES	dietary energy supply
DRVs	National Dietary Reference Values
EAEU	Eurasian Economic Union
ECA	Europe and Central Asia
ECO	Economic Cooperation Organization
EE	Estonia
EFSA	European Food Safety Authority
ERC	FAO Regional Conference for Europe
EU	European Union
EuroFIR	European Food Information Resource Network
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	Food and Agriculture Organization Corporate Statistical Database
FBDGs	food-based dietary guidelines
FBS	Food Balance Sheet
FCDB	Food Composition Data Base
FDI	foreign direct investment
FF	food fortification
FfA	Framework for Action
FIES	Food Insecurity Experience Scale
FLW	food loss and waste
FNH-RI	Food, Nutrition and Health Research Infrastructure
FS	food systems
g	gram
GBD	Global Burden of Disease study
GDP	gross domestic product
GHG	greenhouse gas
GNI	gross national income
GSP	Global Soil Partnership

HBS	Household Budget Survey
HFSS	high fat, sugary and salty foods
HLPE	High-Level Panel of Experts
HR	Croatia
HU	Hungary
ICN2	Second International Conference on Nutrition
IFAD	International Fund for Agricultural Development
I-TF	industrially produced trans fats
KGS	Kyrgyz som
LT	Lithuania
LV	Latvia
MD	Republic of Moldova
ME	Montenegro
MSB	monthly social benefit
NCD	non-communicable disease
NMK	North Macedonia
NoU	number of undernourished
OECD	Organisation for Economic Co-operation and Development
PHN	public health nutrition
PL	Poland
PoU	prevalence of undernourishment
PPP	purchasing power parity
PRIs	population reference intakes
R&I	research and innovation
RIs	reference intake
RO	Romania
RS	Serbia
SPIs	science–policy interfaces
SDGs	Sustainable Development Goals
SFN	school food and nutrition
SFS	sustainable food systems
SHD	sustainable and healthy diets
SL	Slovenia
SK	Slovakia
SMART	specific, measurable, achievable, relevant, time-bound
TFA	trans-fatty acids
TR CU	Technical Regulations of the Customs Union
UN FSS	United Nations Food Systems Summit
UN	United Nations
UNICEF	United Nations Children’s Fund
USD	United States dollar
WFP	World Food Programme
WHA	World Health Assembly
WHO	World Health Organization
UNICEF	United Nations International Children’s Emergency Fund
USAID	United States Agency for International Development
WTO	World Trade Organization

Introduction and context

Cheng Fang and Mirjana Gurinović

Global agrifood systems are facing a range of challenges to healthy diets and the prevention of malnutrition from climate change, resource scarcity, biodiversity loss, soil degradation, a growing and ageing population, urbanization, food waste and food poverty, and conflict. The *State of Food Security and Nutrition in the World* report has shown that the number of undernourished has been slowly increasing for several years, and at the same time the number of overweight and obese people all over the world is increasing at an alarming rate (FAO *et al.*, 2020).

The *Regional Overview of Food Security and Nutrition in Europe and Central Asia 2021* report indicated that the ECA region has a low prevalence of undernourishment and severe food insecurity when compared with the worldwide state of food insecurity (FAO, 2021). However, reductions in the numbers of people affected by hunger and severe food insecurity in some countries of the region have slowed since 2014. The COVID-19 pandemic has worsened food security and nutrition, adding more than 10 million people in 2020 alone to those who are moderately or severely food insecure (HLPE, 2017).

The situation is more challenging in reducing various forms of malnutrition in the region. In general, the ECA region is making progress in reducing malnutrition, but it is not on track regarding childhood overweight, adult obesity, anaemia and exclusive breastfeeding. The triple burden of malnutrition – undernutrition, overweight and obesity, and micronutrient deficiencies – is present to varying degrees in all countries of the region. Poor dietary diversity, inadequate dietary patterns and frequent consumption of foods of high energy density and minimal nutritional value are contributing to malnutrition and non-communicable diseases in later life. The alarming trend towards overweight and obesity in the region needs to be reversed. Similar to other regions, large sections of the population in vulnerable groups (including women, children and adolescents) can neither afford sufficient nutritious foods nor access healthy diets.

Changes are happening in the nutrition-related policy environment, with an increasing number of countries taking regulatory action to improve the food environment promote healthy diets and better nutrition, but current progress in achieving the related Sustainable Development Goals (SDGs) and the global nutrition- and diet-related non-communicable disease (NCD) targets for 2025 and 2030 is not sufficient. Given the complexity of agrifood systems, dietary behaviours, and the wide range of factors that influence diets, improving diets requires the active collaboration of a variety of actors throughout agrifood systems, along with policies targeting multiple sectors. Recent major international policy process in nutrition has been generated by FAO and the World Health Organization (WHO) in the Second International Conference on Nutrition (ICN2) Rome Declaration on Nutrition and its Framework for Action (FfA) and policy recommendations, which acknowledged that “current food systems are being increasingly challenged to provide adequate, safe, diversified and nutrient-rich food for all that contribute to healthy diets” (FAO/WHO, 2014a, 2014b).

The way food is produced and consumed is taking a toll on the environment and natural resource base, with concerns over the loss of biodiversity, pressures on water, deforestation, increase in greenhouse gas emissions, and one-third of all food being lost or wasted. Food systems need to be transformed for food to be produced sustainably and inclusively.

Sustainable, healthy diets are essential to the achievement of all of the SDGs. The SDG vision for nutrition is to end all forms of malnutrition, address nutritional needs throughout the life course, give universal access to safe and nutritious food that is sustainably produced, and ensure universal coverage of essential nutrition actions. Beyond that, the High-Level Panel of Experts on Food Security and Nutrition has stated that “a food system gathers all the elements (environment, people, inputs, processes, infrastructures, institutions, etc.) and activities that relate to the production, processing, distribution, preparation and consumption of food, and the output of these activities, including socioeconomic and environmental outcomes” (HLPE, 2017). Food supply chains, food environments and consumer behaviour are the key connection points for nutrition and health.

As stated in the United Nations Decade of Action on Nutrition 2016–2025 and the Decade of Action to achieve the SDGs by 2030, many of the world’s food systems are fragile and not fulfilling the right to adequate food for all. The United Nations Food Systems Summit 2021 was intended to mark a decisive step in the Decade of Action towards achieving the SDGs by 2030. A growing number of stakeholders, including governments, policymakers and corporate businesses, acknowledge the crucial role played by food systems in delivering sustainable growth and food systems transformation.

The current COVID-19 pandemic and the measures taken to reduce its spread have disrupted food environments around the world. Unhealthy diets leading to overweight and obesity are the leading cause of NCDs, including diabetes, heart disease, cancer and chronic respiratory disease. Lockdowns, policy responses and COVID-19 itself are showing an evolving impact on both external and personal food environment domains. There is a need for the development of effective pandemic policy responses and actions to mitigate changes, improve food environments and build resilient food systems that incorporate healthy nutrition.

To improve contributions to healthy diets and ensure the transformation of food systems, it is necessary to identify and evaluate the state of various elements of food systems and related needs at national, regional and global levels. This understanding can aid in evidence-based policy- and decision-making and help create mechanisms for monitoring and evaluating the progress in food systems transformation. The Food Systems Dashboard is one example (Fanzo *et al.*, 2020).

The roles of agriculture and the rural sector in addressing malnutrition remain unclear, largely due to a limited understanding of the nutritional impacts of food systems globally and in the ECA region. A comprehensive situation and policy analysis of the region is needed as a basis for planning effective policy responses.

To see future progress in strengthening food and nutrition security, we also need to create adequate targets and indicators for monitoring – indicators that cover the whole food system and reflect overall outcomes. Measuring progress will demonstrate momentum towards future-proofing European food systems in a sustainable, resilient, responsible, diverse, competitive and inclusive manner.

The chapters of this book represent a normative and empirical contribution to the development of sustainable and nutrition-sensitive food systems for healthy diets and the prevention of malnutrition in Europe and Central Asia.

The book is divided into three parts.

Part I starts with executive summary of the book and then shares key points for policy actions towards food systems transformation for healthy diets and the prevention of malnutrition in Europe and Central Asia, by Mirjana Gurinović, Jelena Milešević and Cheng Fang. This section shares an introduction to food systems and offers a summary of regional-level analysis regarding the development of sustainable and nutrition-sensitive food systems, including findings from Albania, Armenia, Bosnia and Herzegovina, Bulgaria, Czechia, Estonia, Hungary, Kyrgyzstan, Latvia, Lithuania, Republic of Moldova, Montenegro, North Macedonia, Poland, Romania, Serbia, Slovenia and Ukraine. This executive summary is an overview of food security and nutrition, food availability for consumption, and pathways towards sustainable and nutrition-sensitive food systems transformation for healthy diets and the prevention of malnutrition in the selected case countries of Armenia, Kyrgyzstan, North Macedonia, Poland, Ukraine and Western European countries. It concludes with key points for policy actions based on the comparative analyses of the situations in the ECA.

Part II contains four chapters:

Chapter 1, by Mirjana Gurinović, Jelena Milešević, Milica Zeković, Maria Glibetić, Marina Nikolić, Raimund Jehle, Eleonora Dupouy, Cheng Fang, Keigo Obara, Marija Ranić, Marija Knez and Pieter van't Veer, discusses challenges and opportunities related to support for food systems transformation for healthier diets in central and southeastern Europe. The objective of this review is to assess, evaluate and recommend priorities in policy development that are most relevant to sustainable food systems for healthy diets in the countries of central and southeastern Europe.

Chapter 2, by Eleonora Dupouy, describes food safety in the context of accelerating the flow of the food supply and the dynamic change of food systems. This chapter highlights the polyvalent importance of food safety and the enhancements in three food safety-supportive areas that may benefit the ongoing accelerations in global megatrends and dynamic changes in food systems, bringing into focus food safety governance, emergency response preparedness, and the professional training and education of agrifood system specialists.

Chapter 3, by Dragan Milićević and Jelka Pleadin, studies the incidence of mycotoxins in southeastern European countries and the implications for the food supply chain. This chapter provides insight into fungal sources of major mycotoxins, their ecology, occurrence in foodstuffs, toxicity, significance to human health, methods of analysis, governing regulations, and strategies to manage pertinent risks. In addition, Chapter 3 reviews the impacts of climate change on mycotoxin contamination of feed and food.

Chapter 4, by Keigo Obara, provides a detailed analysis of the nutrition transition in Central Asia from food systems perspectives. This chapter provides an overview of the changing nature of food and nutrition security in the countries of Central Asia. A food systems framework was used for understanding the dynamic transitions in diets, food affordability, and food environments experienced in Central Asia.

Part III contains six country case studies, with reviews of national food security and nutrition, food availability, composition of food consumption, and lessons learned to strengthen the countries' evidence base for addressing nutrition-related challenges from the food system perspective.

The ECA region is heterogeneous in terms of the composition of countries and their economic structures, climate conditions, and rates of economic growth and food systems transitions. This book covers case studies from countries with various food insecurity and malnutrition situations, with some

countries suffering from the triple burden of malnutrition (undernutrition, micronutrient deficiencies and overnutrition) and others mainly with obesity issues. The results will be useful in strengthening countries' evidence bases for addressing nutrition-related challenges from the food system perspective in various situations. The countries were selected from four country groups:

- Group 1: undernutrition and micronutrient deficiencies: Kyrgyzstan
- Group 2: triple burden of malnutrition: Armenia, North Macedonia and Ukraine
- Group 3: overnutrition: Poland
- Group 4: good practices: Western Europe

The case studies examine the potential effects of various policy options throughout the food system, in particular policies in agriculture, food marketing and trade, social protection, gender, foreign direct investment in the food industry, nutrition, environment, education and more. Good practices and lessons learned are summarized, and the results will serve as a basis for multistakeholder engagement and stakeholder dialogue.

The six case studies are presented as separate chapters:

- Armenia, by Meline Beglaryana and Davit Pipoyana
- Kyrgyzstan, by Kanat Tilekeyev, Michael Onah, Mariia Iamshchikova and Zalina Enikeeva
- Ukraine, by Tamara Ostashko and Hanna Lienivova
- North Macedonia, by Aleksandra Martinovska Stojcheska
- Poland, by Ewa Halicka
- Western European countries, Youngseo Kim, Cheng Fang and Mary Kenny

Each country case study chapter covers the following areas:

- an introduction and background of food insecurity and malnutrition, with a review of the country's historical trends and statuses in all forms of malnutrition;
- analyses of the transformation of dietary change and food systems based on the FAO country food balance sheets and based on household survey data, identifying the gaps and challenges of dietary changes and sharing good practices;
- a review of the market and trade structure and policies to identify how policies may address the key food systems issues identified;
- a review of the agricultural and food production systems structure and identification of the elements of existing production that contribute to less desirable nutritional outcomes, undernutrition, overweight, obesity and diet-related NCDs and how have they evolved over time;
- a review of the food processing and marketing structure and how it has changed over time, and an overview of the policies and drivers for the change (such as food additives, food fortification, advertising practices, taxation on foods of high energy density and minimal nutritional value, food price policies for promoting healthy diets, and food labelling and public procurement);
- a review of consumer demand, awareness, school food, education and social protection, food-based dietary guidance and rural–urban food systems; and
- a review of cross-cutting issues, such as nutrition-sensitive value chains, pesticides and soil health.

The case study for Western Europe provides an overview of the nutritional approach of countries of lesser concern in food security and nutrition (but with rising overnutrition issues) to mitigate the predominant nutritional problem of the ECA region. This chapter analyses the successful nutritional policies, reflecting on good practices for the future in high-income countries. Among the less-concerned group, Finland was selected regarding school food and nutrition education, Denmark and Austria for public food procurement, and France and the Kingdom of the Netherlands for urban food systems. Last, the city of Rome, Italy, was chosen for an in-depth analysis of integrated nutritional policy.

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Part I

TRANSFORMATION TOWARDS SUSTAINABLE AND NUTRITION- SENSITIVE FOOD SYSTEMS FOR HEALTHY DIETS AND PREVENTION OF MALNUTRITION IN EUROPE AND CENTRAL ASIA – SYNTHESIS AND RECOMMENDATIONS

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Contents

This chapter outlines the pathways towards sustainable and nutrition-sensitive food systems transformation for Healthy Diets and Prevention of Malnutrition in Europe and Central Asia.

It gives overview of regional studies and comparative analyses of the situation in countries in the context of international engagement and opportunity frameworks concluding with key points for policy actions.

Background

The *State of Food Security and Nutrition in the World* report shows that the number of undernourished has been slowly increasing for several years, and at the same time the number of overweight and obese people all over the world is increasing at an alarming rate (FAO *et al.*, 2020). The *2021 Regional Overview of Food Security and Nutrition in Europe and Central Asia* showed that this region has a low prevalence of both undernourishment and severe food insecurity compared with the world (FAO, WFP, UNECE, UNICEF, WHO, 2021). However, reductions in the numbers of people affected by hunger and severe food insecurity in some countries of the region have slowed since 2014. The COVID-19 pandemic has worsened the food security and nutrition status, causing more than 10 million people to become moderately or severely food insecure in 2020, in just one year (FAO, 2020c).

The situation is more challenging in reducing various forms of malnutrition in the region. In general, the ECA region is making progress in reducing malnutrition, but it is not on track regarding childhood overweight, adult obesity, anaemia and exclusive breastfeeding (FAO, WFP, UNECE, UNICEF, WHO, 2021). The triple burden of malnutrition – undernutrition, overweight and obesity, and micronutrient deficiencies – is present to varying degrees in all countries of the ECA region (Dupouy and Gurinović, 2020; FAO, 2015a; FAO, WFP, UNECE, UNICEF, WHO, 2021).

Agrifood systems in the ECA region have achieved high levels of food security, but a shift towards more sustainable and healthy diets is required for better nutrition. The region's agrifood systems remain diverse, with different structural and policy contexts in terms of development status, natural resources and structural characteristics. While agriculture remains key for income and livelihoods in many countries in the region, the gross domestic product (GDP) share does vary considerably, with the commonality that smallholder family farms predominate farming's structural characteristics in many countries.

International engagement and opportunity frameworks: sustainable food systems for healthy diets

Food systems need to be transformed to sustainably provide high-quality diets for all, which are key to improving nutrition and preventing malnutrition in all its forms. Recent major international policy processes in nutrition generated by the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO) in the Second International Conference on Nutrition (ICN2) Rome Declaration on Nutrition (FAO/WHO, 2014a) and its Framework for Action (FfA) (FAO/WHO, 2014b), with 60 policy recommendations, acknowledged that “current food systems are being increasingly challenged to provide adequate, safe, diversified and nutrient-rich food, for all, that contribute to healthy diets” (FAO/WHO, 2014b). In September 2015, Member Nations adopted the 2030 Agenda for Sustainable Development and its SDGs (UN, 2015).

To address these challenges, United Nations Resolution 70/259, adopted by the General Assembly in April 2016, proclaimed the United Nations Decade of Action on Nutrition 2016–2025 (UN, 2016; UN General Assembly, 2016), putting a specific focus on the transformation of food systems to promote healthy diets that are sustainable, improve nutrition and all forms of malnutrition by 2025, and achieve global nutrition and diet-related NCD targets in line with the commitments of the ICN2 and the SDGs (FAO & WHO, 2018; UN, 2016). There are six pillars of the United Nations Decade of Action on Nutrition

2016–2025: sustainable food systems for healthy diets; aligned health systems providing universal coverage of essential nutrition actions; social protection and nutrition education; trade and investment for improved nutrition; safe and supportive environments for nutrition at all ages; and strengthened governance and accountability for nutrition. The six action areas of the Decade of Action on Nutrition and the recommendations of the Framework for Action of the ICN2 provide countries with a broad range of policy options for customizing and extending their activities. As a part of the Decade of Action on Nutrition, governments and partners are encouraged to make SMART (specific, measurable, achievable, relevant and time bound) commitments (FAO & WHO, 2016) that build upon and extend existing food and nutrition policies and actions.

Sustainable, healthy diets are essential for all of the SDGs. The SDG vision for nutrition is to end all forms of malnutrition, address nutritional needs throughout the course of life, give universal access to safe and nutritious food that is sustainably produced, and ensure universal coverage of essential nutrition actions. Beyond that, the High-Level Panel of Experts on Food Security and Nutrition has stated that “a food system gathers all the elements (environment, people, inputs, processes, infrastructures, institutions, etc.) and activities that relate to the production, processing, distribution, preparation and consumption of food, and the output of these activities, including socioeconomic and environmental outcomes.” Food supply chains, food environments and consumer behaviour are the key connection points for nutrition and health (HLPE, 2017).

Several events in the past few years have promoted practical applications of the food system perspective and have provided a platform for multispectral interaction, involving representatives from food and agriculture, health, education and social protection sectors:

- the FAO/WHO International Symposium on Sustainable Food Systems for Healthy Diets and Improved Nutrition, held in Rome, Italy, in 2016 (FAO, 2016), with its key messages (FAO & WHO, 2017) and proceedings (FAO/WHO, 2018a); and
- the Regional Symposium on Sustainable Food Systems for Healthy Diets and Improved Nutrition, FAO/WHO/WFP, in collaboration with UNICEF, held in Budapest, Hungary, 4–5 December 2017, <https://www.fao.org/europe/events/detail-events/en/c/1034293/> (FAO Regional Office for Europe and Central Asia, 2017), with its main outcome (FAO/WHO, 2018b), <https://www.fao.org/3/mw166en/mw166en.pdf>.

Beside these framework documents, FAO and WHO released *Strengthening Nutrition Action: A resource guide for countries*, developed based on the policy recommendations of ICN2 (FAO & WHO, 2018). This resource guide is structured around 24 themes that unpack the ICN2 Framework for Action policy recommendations; it is intended primarily for policy advisers supporting decision-makers and development partners involved in multisectoral food and nutrition-related policymaking processes.

Recently, the Farm to Fork strategy for a fair, healthy and environmentally friendly food system (European Union, 2020) gives European Union Members a strong and integrated policy framework to redesign their food systems, rethink the use of soils and the role of livestock, and provide healthy and sustainable diets.

Making the shift to sustainable nutrition with food systems is one cornerstone of the Food 2030 strategy as it is presented by the European Commission in the report *Food 2030 pathways for action: Research and innovation (R&I) policy as a driver for sustainable, healthy and inclusive food systems* (European Commission, 2020). Food 2030 applies a systemic approach to connect, scale up and boost European Union research and innovation and investments to provide solutions to four overarching priorities: nutrition for sustainable and healthy diets; climate-smart and environmentally sustainable food systems; circular and resource-efficient food systems; and food systems innovation and empowerment of communities.

The multi-actor engagement process involves a wide diversity of sectors, including primary production, food processing, logistics, retailing, food services (e.g. restaurants, canteens), public health, etc. It will also engage a wide range of stakeholders, including researchers and academia, policymakers, small and medium enterprises and industry, non-governmental organizations (NGOs), educators, knowledge brokers, consumers and civil society members (den Boer *et al.*, 2021; European Commission, 2020). The role of science–policy interfaces (SPIs) on the international level, and potential options for enhancing SPIs to better support food systems transformation, are currently being debated (Singh *et al.*, 2021).

There is an urgent need to promote diets that are healthy, that have low environmental impact, and that are socially and culturally acceptable and economically accessible to all. FAO and WHO prepared some guiding principles for sustainable healthy diets that take a holistic approach to diets. The guidelines consider international nutrition recommendations, the environmental cost of food production and consumption, and adaptability to local social, cultural and economic contexts, with the aim of supporting countries as they work to transform food systems to deliver on sustainable healthy diets and contribute to the achievement of the SDGs at the country level (FAO & WHO, 2019).

The Committee on World Food Security (CFS) Voluntary Guidelines on Food Systems and Nutrition aim to contribute to the transformation of food systems and the promotion of sustainable food systems to ensure that the food that contributes to sustainable healthy diets is available, affordable, accessible, safe and of adequate quantity and quality while in compliance with beliefs, culture and traditions, dietary habits and preferences of individuals, in accordance with national and international laws and obligations (CFS, 2021).

As we entered the Decade of Action to achieve the SDGs by 2030, many of the world's food systems were fragile, not fulfilling the right to adequate food for all. The United Nations Food Systems Summit in 2021 was intended to mark a decisive step forward. A growing number of stakeholders, including governments, policymakers and corporate businesses, have acknowledged the crucial role played by food systems in delivering sustainable growth and food systems transformation (Von Braun *et al.*, 2021; UN Secretary-General, 2021).

To improve contributions to healthy diets and ensure the transformation of food systems, it is necessary to identify and evaluate the state of various elements of food systems and related needs at national, regional and global levels. This understanding can aid in evidence-based policy- and decision-making and help create mechanisms for monitoring and evaluating the progress in food systems transformation. The Food Systems Dashboard is one example (Fanzo *et al.*, 2020).

A recent meeting of the WHO European Office for the Prevention and Control of NCDs brought together Member States of the WHO European Region and expert stakeholders to discuss various aspects of food production, promotion, marketing and distribution for healthy and sustainable diets (WHO, 2021).

The current COVID-19 pandemic and the measures taken to reduce the spread of the disease have disrupted food environments around the world. Unhealthy diets leading to overweight and obesity are the leading cause of NCDs, including diabetes, heart disease, cancer and chronic respiratory disease. Unhealthy diets are also a primary cause of poor control of NCDs and resulting adverse health outcomes. Lockdowns, policy responses, and COVID-19 itself are showing an evolving impact on both external and personal food environment domains (UNSCN, 2020).

There is a need for the development of effective pandemic policy responses and actions to mitigate changes, improve food environments and build resilient food systems that incorporate healthy nutrition (Fanzo *et al.*, 2020; WHO, 2021).

Sustainable and nutrition-sensitive food systems for healthy diets and the prevention of malnutrition in Europe and Central Asia: Regional studies

Inadequate diets are a major contributing factor to the rising prevalence of malnutrition in all its forms, and the way food is produced and consumed is taking a toll on the environment and natural resource base.

Chapter 1 presents a review of the status of food systems elements and the identification of challenges and opportunities for transformation toward sustainable, healthy diets in central and southeastern Europe. The inventory of the current state of different food system elements was conducted in 2018 using a comprehensive online survey distributed to 17 countries in central and southeastern Europe, of which 15 responded. Country representatives were from various institutions from the agrifood, nutrition and health sector. The review of food system elements in the countries of central and southeastern Europe revealed various challenges and opportunities in food systems. As seen in the review, policy implementation in countries across the ECA region have demonstrated significant improvements in food systems. However, further encouragement and guidance for countries to focus on transformations of specific food system elements is necessary. Moreover, this review assesses, evaluates and recommends priorities in policy development that are most relevant to sustainable food systems for healthy diets in the countries of central and southeastern Europe. Conclusions and recommendations were made by an expert panel and formalized in the Belgrade Declaration for strengthening regional capacities on sustainable food systems for healthy diets and nutrition in central and southeastern Europe. These recommendations propose a number of specific actions related to governance and public health nutrition, the food supply chain and food environment, consumer behaviour, research, education and training of (future) professionals, networking, and sharing knowledge and experience for establishing collaborations among capacity development networks.

Highlights and key points

- The review of the status of food system elements in countries of central and southeastern Europe reveals various challenges in food systems and highlights opportunities for their transformation towards sustainability and healthier diets across the region.
- The transformation of food systems towards sustainability and the overall improvement of nutrition requires governmental support and collaboration with the agriculture, health, education, trade, environment, and social protection sectors.
- Research projects and cooperation with other European partners and networks enhance regional capacity development in food, nutrition and public health – through training, the exchange of information and the transfer of knowledge – stimulating and contributing to food systems transformation in the region.
- Analyses of the status of certain food systems elements in central and southeastern Europe will contribute to the comprehensive situation and policy analysis of the region necessary for planning effective policy responses and further monitoring of the progress in food systems transformation (Gurinović *et al.*, 2022).
- There is a need to develop and establish harmonized food systems data collection with indicators that measure components, status, progress, drivers, and outcomes of food systems at national level and that are comparable across countries, regions and worldwide.

International recommendations, including key messages from the Regional Symposium on Sustainable Food Systems for Healthy Diets in Europe and Central Asia and the Belgrade Declaration define specific actions to be taken towards the development of sustainable food systems in the region.

Unsafe food has high costs for the social, economic and environmental dimensions of sustainability. Ensuring food safety is a complex task that requires integrated multidisciplinary contributions, engagement and multisectoral collaboration at all levels, including local, national, regional and global. The two-way food safety risk communication from global to local and from local to global is critical for maintaining a safe food supply. **Chapter 2** highlights the polyvalent importance of food safety and the enhancements in three food safety-supportive areas that may benefit the ongoing accelerations in global megatrends and dynamic changes in food systems, bringing into focus food safety governance, emergency response preparedness, and the professional education of specialists for agrifood systems. The impact on food safety of dynamic changes in global megatrends and agrifood systems necessitates the recognition of essential connections, integrated all-levels food safety governance and upgraded education in line with the One Health approach for adequate prevention, mitigation and trade-offs, aiming to ensure safe food through the optimized health of people, animals and ecosystems.

Highlights and key points

- The impact on food safety of dynamic changes in global megatrends and in agrifood systems necessitates the recognition of essential connections for adequate mitigation measures.
- Effective food control systems require both sound technical knowledge, soft skills and inclusive and collaborative food safety governance.
- By prioritizing effective participation in the work of the FAO/WHO Codex Alimentarius Commission and in the food safety risk communication actions of the FAO/WHO International Food Safety Authority Network (INFOSAN), countries have opportunities to contribute to global food safety governance and to benefit from the exchange of good practices.
- Defining criteria and classifying the scalability of hazardous food safety events is an essential step in emergency response preparedness.
- The modernization of food safety education with the One Health approach would equip the new generation of professionals with knowledge and skills needed for robust food safety governance and for coping with various potential disruptive challenges and threats to agrifood systems. Food safety assurance, as the prerequisite for hunger and malnutrition prevention, is one of the major issues that still needs to be addressed to protect human health and ensure global economic development. Huge efforts are invested in reducing mycotoxin contamination in countries of southeastern Europe.

Chapter 3 informs on the incidence of mycotoxins in countries of southeastern Europe and its implications for the food supply chain. This chapter provides insight into fungal sources of major mycotoxins and fungal secondary metabolites and their ecology, with an emphasis on the most important among them, mycotoxins, as contaminators of food and feed. It covers the considerable impact of mycotoxins on food safety systems, their occurrence in foodstuffs, toxicity, significance to human health, methods of analysis, regulations governing them, strategies to manage the pertaining risks, regional and international trade, and the global economy. In addition, the chapter reviews the impacts of climate change on mycotoxin contamination of feed and food. Mycotoxins are toxic chemical substances produced by fungal species that can colonize crops in the field, after harvest, or during storage; they pose a potential threat to human and animal health. The biological effects of many mycotoxins, their organ toxicity, mutagenicity, carcinogenicity, teratogenicity, and modulation of the immune system are well documented. The most prominent members of the group are aflatoxins, ochratoxin A, fumonisins, trichothecene, zearalenone, patulin and ergot alkaloids.

Highlights and key points

- Mould and mycotoxin contamination significantly compromise food and feed safety in countries of southeastern Europe.
- Particular mycotoxins possess carcinogenic, cytotoxic, immunosuppressive, neurotoxic, estrogenic or teratogenic activity.
- The impacts of climate change have been identified as an emerging issue for food and feed safety in association with mycotoxins.
- The literature data reveal that the food supply chains in countries of southeastern Europe are vulnerable to mycotoxin contamination.
- This study highlighted the predictions of mycotoxin contamination, adaptation strategies and research priorities.
- Monitoring and control measures represent key factors in the controlling of food and feed mycotoxin contamination.

Chapter 4 provides an analysis of the nutrition transition in Central Asia from food systems perspectives and offers an overview of the changing nature of food and nutrition security in the countries of Central Asia. A food systems framework was used to understand the dynamic transitions in diets, food affordability, and food environments experienced in Central Asia. Data were collected from FAO food security resources, including FAOSTAT, Food Price Monitoring and Analysis, and recently conducted surveys. It was notable that the availability of sugar for human consumption has sharply increased in Central Asia, and the changes of food consumption patterns in Central Asia are associated with certain trends in the region, including increased disposable incomes, remittances from labour migrants, price volatilities of basic food items, rapid urbanization, and an increased variety of food available in urban areas. The observed transition in various dimensions of food systems – particularly in diet, food affordability and food environments – in Central Asia are related to significant shifts in demography, economy and food security. This requires a response with an interdisciplinary approach that includes inputs from multiple sectors, including agriculture, education, urban planning and public health. The evolution of these trends and how they associate with changes in diets and nutrition will be key in moving towards ending all forms of malnutrition.

Highlights and key points

- A food systems approach allows for an analysis of supply and demand in food systems within an integrated analytical framework.
- Central Asian countries face multiple burdens of malnutrition, with persistently high rates of undernourishment, increasing obesity, and increasing occurrences of NCDs.
- The transition of nutrition in Central Asia has been occurring simultaneously with significant shifts in demographics, the economy and food security.
- The recent rise in obesity and NCDs requires a systematic analysis of food access, diets and food environments.

Country case studies

This chapter shares a summary and comparative analyses of the status of various elements of food systems and the development of sustainable and nutrition-sensitive food systems, including findings from Albania, Armenia, Bosnia and Herzegovina, Bulgaria, Czechia, Estonia, Hungary, Kyrgyzstan, Latvia, Lithuania, Republic of Moldova, Montenegro, North Macedonia, Poland, Romania, Serbia, Slovenia and Ukraine.

Overview of poverty, food security and malnutrition

The causes of malnutrition are complex, and diet is one of the most important contributors to malnutrition, which itself is influenced by many factors, from personal preferences to the broad national availability of foods. The ECA region is characterized by the coexistence of undernutrition, overweight and obesity, with some countries having relatively high prevalence of more than one form of malnutrition. The high prevalence of the triple burden of malnutrition in Europe and Central Asia – undernutrition, micronutrient deficiencies and overnutrition – urges countries to prevent all forms of malnutrition and improve diets and the food environment. The indicators on various forms of malnutrition reviewed in this section are: three key indicators referring to malnutrition among children younger than 5 – stunting (SDG Indicator 2.2.1), wasting (SDG Indicator 2.2.2) and overweight (SDG Indicator 2.2.2) – and indicators on low birth weight, anaemia among women of reproductive age, and adult obesity. Selected indicators of food insecurity and malnutrition in selected countries and subregions are present in the Annex (FAO, WFP, UNECE, UNICEF, WHO, 2021; UNICEF, 2021).

Prevalence of undernourishment

Food security in the ECA region has improved substantially during the past two decades, with countries making important progress in decreasing the prevalence of undernourishment (PoU), or hunger. The PoU was below 2.5 percent in 2009–2011 and 2018–2020 for most of ECA countries. For the same monitoring periods, the prevalence was below 2.5 percent in the EU-27 and the United Kingdom of Great Britain and Northern Ireland, Poland and Ukraine. Central Asia has improved, with the PoU dropping from 5.5 percent in 2009–2011 to 3.2 percent in 2018–2020, but still lower than in the world at large (in 2009–2011, from 9.4 percent and in 2018–2020, 8.9 percent). The PoU reduction in the ECA region occurred more rapidly than in the world as a whole, with stagnation in the reduction in recent years.

Reduction of the PoU was identified in other countries, as well, including Albania (from 4.9 percent to 3.9 percent), Armenia (from 4.3 percent to 3.4 percent), Kyrgyzstan (from 8.3 percent to 7.2 percent) and North Macedonia (from 3.4 percent to 2.7 percent).

Severe food insecurity

The trend of the prevalence of severe food insecurity in the ECA region shows there were no changes from 2014–2016 to 2018–2020, with the prevalence steady at 1.9 percent. However, in Central Asia, severe food insecurity increased from 1.7 percent to 3.1 percent. It also increased in North Macedonia (from 3.6 percent to 5.0 percent) and in Ukraine (from 2.0 percent to 2.5 percent). During the same period, a decreasing prevalence of severe insecurity was observed in the EU-27 and United Kingdom of Great Britain and Northern Ireland (from 1.6 percent to 1.2 percent), Albania (from 10.0 percent

to 8.8 percent), Armenia (from 1.2 percent to 1.1 percent), and Poland (from 1.8 percent to less than 0.5 percent). The data show that in many countries, the prevalence of moderate or severe food insecurity was high and trending upward even before the pandemic. In many other countries, the moderate or severe food insecurity prevalence – though well below the world average – hovered at or surpassed 10 percent.

Stunting

Table A0 shows that the prevalence of stunting in the world, in the ECA region, in Central Asia and in selected ECA countries for 2010 and 2020 is decreasing. Worldwide, it decreased from 27.7 percent to 22.0 percent. In the ECA region, it decreased from 10.2 percent to 7.3 percent. In Central Asia, it dropped from 17.1 percent to 10.0 percent, and in the EU-27 and United Kingdom of Great Britain and Northern Ireland, it decreased from 17.1 percent to 2.8 percent. Also seeing decreases were Albania (from 20.9 percent to 9.6 percent), Armenia (from 15.6 percent to 9.1 percent), Kyrgyzstan (from 17.7 percent to 11.4 percent), North Macedonia (from 6.6 percent to 4.1 percent), Poland (from 2.4 percent to 2.3 percent), and Ukraine (from 19.2 percent to 15.9 percent). Between 2010 and 2020, countries of concern with regard to child stunting in the ECA region made progress and are on track to achieve the 2025 and 2030 targets. However, the ongoing COVID-19 pandemic poses challenges.

Wasting

Regarding wasting among children, in general, the ECA region is making progress and is on track to achieve the 2025 and 2030 targets in most countries. According to the available data, in 2020 the prevalence of wasting in the ECA region was 1.9 percent, and in world it was 6.7 percent. In Central Asia and the Caucasus, it was 2.3 percent, and in the EU-27 and United Kingdom of Great Britain and Northern Ireland, it was 0.7 percent. In the western Balkans, it was 2.5 percent, while in North Macedonia it was 3.4 percent. Wasting declined gradually in Kyrgyzstan, from 3.3 percent in 2006 to 2.8 percent in 2014, and it was 2 percent in 2020 (FAO, WFP, UNECE, UNICEF, WHO, 2021; UNICEF, 2021). The global nutrition targets for wasting call for the reduction of childhood wasting to less than 5 percent by 2025 and to 3 percent by 2030, and maintenance at that level. Some countries need to make rapid progress in order to achieve the 2030 targets, in particular due to uncertainty caused by the ongoing COVID-19 pandemic.

Children overweight

The prevalence of overweight among children younger than 5 in the ECA countries declined from 10.4 percent in 2010 to 7.1 percent in 2020, but it remained higher than the global level (5.6 percent in 2010 and 5.7 percent in 2020). During this period, progress in reducing the prevalence of overweight among children younger than 5 was noted in Central Asia (from 9.5 percent to 5.6 percent), the EU-27 and the United Kingdom of Great Britain and Northern Ireland (from 5.9 percent to 5.7 percent), Albania (from 23.6 percent to 14.6 percent), Armenia (from 15.9 percent to 10.8 percent), Kyrgyzstan (from 8.4 percent to 5.8 percent), North Macedonia (from 14.4 percent to 10.0 percent), and Ukraine (from 27.9 percent to 17.0 percent). Only in Poland did the prevalence of overweight among children increase, from 5.6 percent to 6.7 percent. To achieve global nutrition targets for childhood overweight for 2025 (no increase in childhood overweight) and for 2030 (reduction of childhood overweight to less than 3 percent and maintenance at that level), collective efforts in ECA region will be necessary.

Adult obesity

From 2010 to 2016, there has been an increasing trend of the prevalence of adult obesity in the ECA region (from 20.8 percent to 23.3 percent), Central Asia (from 14.7 percent to 17.7 percent), the EU-27 and the United Kingdom of Great Britain and Northern Ireland (20.5 percent to 22.9 percent) and in all selected countries in the region: Albania (from 18.2 percent to 21.7 percent), Armenia (from 17.5 percent to 20.2 percent), Kyrgyzstan (from 13.4 percent to 16.6 percent), North Macedonia (from 20.1 percent to 22.4 percent), Poland (from 20.8 percent to 23.1 percent) and Ukraine (from 22.0 percent to 24.1 percent).

In 2010, the prevalence of adult obesity in the ECA region was much higher, at 20.8 percent, than the world average of 11.2 percent. The prevalence of adult obesity rose in all ECA countries from 2010 to 2016, and no countries are on track to meet the 2025 and 2030 targets (FAO, WFP, UNECE, UNICEF, WHO, 2021).

Micronutrient deficiencies

Micronutrient deficiencies are a global public health problem. Iodine, vitamin A and iron deficiencies are the most prevalent globally, and they represent a major threat to health and development, particularly among vulnerable groups, including children and pregnant women. The worldwide prevalence of anaemia in reproductive women, in 2010 as a baseline, was 28.6 percent, and it increased to 29.9 percent in 2019. In the ECA region, the prevalence grew from 16.0 percent in 2010 to 17.4 percent in 2019. The rates of anaemia in the same years were higher in Central Asia (29.9 percent and 28.1 percent), Albania (21.1 percent and 24.8 percent) and Kyrgyzstan (34.2 percent and 35.8 percent), while the rates were much lower in the EU-27 and United Kingdom of Great Britain and Northern Ireland (11.8 percent and 13.5 percent), Armenia (18.0 percent and 17.3 percent), North Macedonia (16.8 percent and 19.3 percent) and Ukraine (13.8 percent and 17.7 percent), respectively. All presented countries in the region have experienced an increased rate of anaemia since 2010 and are not on track to meet the 2025 and 2030 targets of a 50 percent reduction in anaemia in reproductive women. Recommendation 42 from the ICN2 FfA states: "Improve intake of micronutrients through consumption of nutrient-dense foods, especially foods rich in iron, where necessary, through fortification and supplementation strategies, and promote healthy and diversified diets," and Recommendation 43 states: "Provide daily iron and folic acid and other micronutrient supplementation to pregnant women as part of antenatal care; and intermittent iron and folic acid supplementation to menstruating women where the prevalence of anaemia is 20 percent or higher, and deworming, where appropriate" (FAO/WHO, 2014b).

Undernutrition, overweight, obesity and micronutrient deficiencies (anaemia in reproductive women) continue to coexist, with some countries having a relatively high prevalence of more than one form of malnutrition. In Central Asia, and particularly Kyrgyzstan, there are high rates of undernutrition and micronutrient deficiencies. Albania and Armenia bear the triple burden of malnutrition. In North Macedonia and Ukraine, there are high rates of obesity and micronutrient deficiencies, and Poland has a high rate of obesity (Table A0). Recommendation 58 of the ICN2 FfA states: "National governments are encouraged to establish nutrition targets and intermediate milestones, consistent with the timeframe for implementation (2016-2025), as well as global nutrition and NCD targets established by the World Health Assembly. They are invited to include – in their national monitoring frameworks – agreed international indicators for nutrition outcomes (to track progress in achieving national targets), nutrition programme implementation (including coverage of interventions) and the nutrition policy environment (including institutional arrangements, capacities and investments in nutrition). Monitoring should be conducted, to the fullest possible extent, through existing mechanisms" (FAO/WHO, 2014b).

Agriculture and poverty in Europe and Central Asia

After the breakdown of the Soviet Union in the early 1990s in Central Asia and the fall of the rule of communism in the countries of central and southeastern Europe, newly independent states underwent a transformation from a planned economy to a market economy. In most of these countries, land reforms were among the core reforms implemented; these reforms led to the disassembly and privatization of collective farms and to the emergence of numerous farm operators and landowners. Nowadays, in the observed countries, the majority of arable land and livestock belong to small farmers, either peasant farms or rural households, meaning that most agricultural products are produced by smallholders (FAO, 2019a).

This fact presents a risk of poverty or an opportunity for creating new employment and overall rural development, depending on multiple internal and external factors.

Countries report on a general decrease in rates of those at risk of poverty (without specific rates), but still around one-fifth of the population is at risk. The Gini coefficient, a measure of income distribution and inequality is between 25 percent and 35 percent, which is far below world's average value, indicating relative equality in ECA region (World Population Review, 2021).

Transformation of dietary change and food systems

Current dietary patterns are unhealthy, unsustainable, and inequitable for many populations and present a significant risk factor for the global burden of disease and death (Fanzo and Davis, 2019). An analysis of the impacts of inadequate consumption of major foods and nutrients across 195 countries on NCD mortality and morbidity identified as the leading risk factors for mortality diets high in sodium and sugar and low in whole grains, fruits, nuts, seeds, vegetables and omega-3 fatty acids, accounting for more than 2 percent of global deaths. Non-optimal intake of three dietary factors (whole grains, fruits and sodium) accounted for more than 50 percent of deaths and 66 percent of disability-adjusted life years attributable to diet (Afshin *et al.*, 2019b). Six of the top 11 risk factors driving the global burden of diseases are related to diet (Global Panel on Agriculture and Food Systems for Nutrition, 2016). The *State of Food Security and Nutrition in the World* shows that the number of undernourished has been slowly increasing for several years, and at the same time the number of overweight and obese people all over the world is increasing at an alarming rate (FAO, WFP, UNECE, UNICEF, WHO, 2021). Monitoring nutrition policy implementation in the WHO European Region shows that there have been significant improvements in the food and drink environment. Yet, it remains necessary to encourage and guide Member Nations towards food system transformation (Breda *et al.*, 2020). Diet improvements could potentially prevent one in every five deaths globally. Given the complexity of dietary behaviours and the wide range of influences on diet, improving diets requires the active collaboration of a variety of actors throughout the food system, along with policies targeting multiple sectors of the food system. Dietary shifts to healthy diets can play an important role in increasing the environmental sustainability of food systems.

In 2019, the EAT-Lancet Commission on Food, Planet, Health published what is referred to as the "EAT-Lancet reference diet," which quantitatively describes a universal healthy reference diet based on an increase in the consumption of nutritious foods (such as vegetables, fruits, whole grains, legumes and nuts) and a decrease in the consumption of energy-dense foods (such as red meat, sugar and refined grains) that would provide major health benefits and increase the likelihood of attainment of the SDGs (EAT-Lancet Commission, 2019a). The transformation of current food systems to improve availability, affordability and uptake of nutritious, safe, affordable and sustainable diets is key to tackling malnutrition in all its forms and diet-related NCDs. The synergies of approaches to tackle multiple forms of malnutrition

can be realized through “double duty” actions that tackle several forms of malnutrition at the same time (Branca *et al.*, 2019; Hawkes *et al.*, 2020). According to the International Scientific Symposium “Biodiversity and Sustainable Diets: United Against Hunger,” organized jointly by FAO and Bioversity International in 2010, “Sustainable diets are those diets with low environmental impacts which contribute to food and nutrition security and to the healthy lifestyles of present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources.” (FAO, 2010). Shifting dietary habits, however, presents a significant challenge for cultural, political and economic reasons and will require actions at international, European and national levels – involving governments, stakeholders and individuals – that go beyond information and education programmes and require continual capacity development (Achterbosch *et al.*, 2019; Gurinović *et al.*, 2020; Hebinck *et al.*, 2021). FAO/WHO proposed guiding principles that aim to support countries in their work to transform food systems towards delivering sustainable healthy diets and achieving the SDGs at the country level (FAO & WHO, 2019). These guiding principles take a holistic approach to diets, considering international nutrition recommendations, the environmental cost of food production and consumption, and adaptability to local social, cultural and economic contexts. On the European Union level, integrated food policy is required in order to promote healthy diets and build sustainable food systems in Europe (De Schutter, Jacobs and Clément, 2020).

To evaluate the dietary shift, longitudinal monitoring of the food consumption and diets of the population at the individual level, using harmonized methodology, is essential. FAO and WHO have developed the FAO/WHO Global Individual Food consumption data Tool (FAO and WHO, 2021), an open-access platform that collates, harmonizes and disseminates existing dietary data from various countries at a global level, with 32 data sets available. Through the European Union Menu project, the European Union Food Safety Authority (EFSA) supports harmonized food consumption data collection currently for 36 dietary surveys on children and/or adults, from 18 European Union Member Nations and four pre-accession countries (EFSA Comprehensive European Food Consumption Database) (EFSA, 2021).

Trends of food consumption based on the FAO/country food balance sheets

From the analysis of FAO country food balance sheets for 2015–2017 in six ECA countries, it was evident that daily cereal availability for consumption was higher than the scientific target for the healthy diet in both the EAT-Lancet Commission and GBD study references (Afshin *et al.*, 2019a; EAT-Lancet Commission, 2019b), with the consumption in Armenia, Kyrgyzstan, Albania, Ukraine, and the average of Central Asia somewhat higher (more than 400 g per capita) and under and closer to the world, while North Macedonia and Poland report consumption closer to the European average (Table A0-1).

Fruits and vegetables are an important part of a healthy diet, as they provide micronutrients (vitamins and minerals) required for health maintenance and mental and physical growth and development. FAO and the WHO recommend daily consumption of at least 400 g of fruits and vegetables together. The average consumption of vegetables and fruits in observed countries is above this recommended value. The EAT-Lancet Commission report (EAT-Lancet Commission, 2019b) provides guidelines of 300 g (with a range of 200–600 g) for vegetables for a healthy diet. Vegetable consumption in all observed countries is within or even above the scientific targets. The target daily value for fruit consumption is 200 g per capita (with a range of 100–300 g) in The EAT-Lancet Commission report (EAT-Lancet Commission, 2019b) and 250 g (with an optimal range of 200–300 g) in the Global Burden of Disease study (2017) (Afshin *et al.*, 2019a). In **Kyrgyzstan, Poland** and **Ukraine**, fruits are consumed below these referent values (Table A0-1).

According to the available consumption data in the six observed countries, **pulses** (peas, beans, lentils, chickpeas and others), underutilized but excellent sources of vegetable protein are consumed way below targeted references, perhaps due to their relatively low yields and low prices (Table A0-1).

The daily consumption of **sugar and sweeteners** is alarmingly high in all six countries in comparison to scientific targets (31 g per capita in EAT-Lancet and 5 g per capita in the GBD study), triple the consumption in Central Asia and double the world average consumption. However, daily consumption is in line with consumption levels in Europe (129.6 g per capita). The highest daily consumption was reported in Ukraine (171.9 g per capita) (Table A0-1).

The GBD study and EAT-Lancet Commission recommend high intake of **nuts and seeds** (21 g to 75 g). However, the consumption of these nutritionally rich foods is very low in general on the global level and in Central Asia. Consumption is somewhat higher in European Union than in the six observed countries (Table A0-1).

The reference for **vegetable oils**, in the form of unsaturated oils (including olive, soybean, rapeseed, sunflower and peanut oil) is an optimal daily intake of 40 g (with a range of 20 g to 80 g), provided by the EAT-Lancet study. From the data shown in Table A0-1, only the European Union region exceeds the daily average level (45.3 g per capita), with **North Macedonia** being on the same level (46.5 g per capita). The other observed countries fall below the optimal daily reference.

The daily consumption of **red meat** ranges from 46.2 g per capita in **North Macedonia** to 157.4 g per capita in **Poland**. The consumption of red meat observed in countries of Central Asia (Armenia, Kyrgyzstan and Ukraine) is within the observed values in the Central Asia region and the average global consumption. However, these values are double or even triple the targeted values for healthy diets by the EAT-Lancet Commission (14 g, with a range of 0–28 g) and the GBD study (23 g, with a range of 18–27 g) (Table A0-1).

Similar trends were observed in the consumption of **poultry**, with overall lower daily intake, from 10.1 g per capita in Kyrgyzstan to 79.8 g per capita in Poland. Generally, the consumption of poultry is lower in the Central Asia region, which might be related to lower availability of poultry in the region (FAO, WFP, UNECE, UNICEF, WHO, 2021). Only Poland and Ukraine have higher consumption than the EAT-Lancet Commission target (28 g, with a range of 0–58 g) (Table A0-1).

Target reference values for **milk consumption** differ between the GBD study (250 g) and the EAT-Lancet Commission (435 g), but with similar ranges, up to 500 g and 520 g, respectively. **Ukraine and North Macedonia** fall below these levels, with daily consumption at 396.6 g per capita and 427.7 g per capita, respectively. Other countries exceed point and upper levels of scientific targeted consumption of milk (Table A0-1).

Target reference values for **fish** consumption differ between the GBD study (20 g) and the EAT-Lancet Commission (28 g, with a range of 0–100 g). Consumption below these targets was reported in **Albania, Kyrgyzstan, and North Macedonia**. Generally, fish consumption was more than three times lower in Central Asia than in the world at large (FAO, WFP, UNECE, UNICEF, WHO, 2021).

Described trends of food consumption are in line with percentages of consumption levels in comparison to world average levels. The data in Table A0-2 indicate higher consumption of **vegetables and fruits** in **Albania** and **Armenia**, not only, but also in other countries, except for Poland and Ukraine.

All countries have consumption of **pulses** below the world average, but beans are being consumed at almost double the world average in **Albania, Kyrgyzstan** and **North Macedonia**. **Fish** is also consumed below the world average in all six countries. Higher consumption than the world average of **sugar, sweeteners** and **milk** is observed in all six countries. **Meat** is consumed above the world average in **Albania, Armenia** and **Ukraine**, and particularly in **Poland**.

The observed higher consumption of plant-based foods is a positive development not only for human nutrition (provided the nutritional requirements are properly managed), but also for improving the sustainability of production systems, considering the increasing impacts of climate change globally.

Trends of food consumption based on the household budget survey data

The household budget survey (HBS) is a national survey carried out by each Member nation in which information is collected on households' expenditures on goods and services. Besides the data on consumption expenditure, the HBS also collects information on household structure and income. Higher food spending may negatively affect how much people can spend on essentials such as education and health, increasing their vulnerability for food and nutrition insecurity. There is a strong link between socioeconomic status and diet quality. Socioeconomic status (education, occupation, income) is a factor in determining purchasing power, consumption patterns and choices, i.e. diet quality and micronutrient intake.

Across ECA countries, the diverse socioeconomic status of the population translates into the share of food costs in the household budget varying from about 7 percent to 66 percent. The evidence for dietary quality in ECA countries indicates that nutrient-rich foods – such as fruits and vegetables, whole grain and low-fat animal food products, nuts and fish – are often unaffordable and thus underrepresented in the diets of low-income families. Low-income groups are more exposed to poor-quality diets, including consumption products with refined wheat flour, starchy foods, and processed meat with high sodium content, which consequently leads to development of micronutrient malnutrition, obesity and NCDs in these population groups.

Although food insecurity in Europe is less of a problem, vulnerable groups and the poor are still at risk. In 2019, 21.1 percent of the population in the European Union, equivalent to 92.4 million people, were at risk of poverty or social exclusion, slightly down from 2018 (21.6 percent) (Eurostat, 2020a). When looking at the trends of consumption of food in HBS in European Union countries between 2009 and 2019, the share of total household expenditure on food decreased or stagnated in most European Union Member Nations. The data show that the mean consumption expenditure per adult was the same from 2010 to 2015 in the European Union, and 16 percent of consumption expenditure based on the Classification of Individual Consumption by Purpose (COICOP) in the European Union was on food and non-alcoholic beverages. This trend continued to 2019 (Eurostat, 2020b).

Interestingly, in almost all countries of central and southeastern Europe, decreasing trends were observed in the percentages of GDP for consumption expenditure of households by COICOP from 2010–2019 (Table A0-3), with the greatest declines in Montenegro, Serbia, North Macedonia and Bosnia and Herzegovina, followed by Latvia, Lithuania and Poland. An increase of COICOP was observed in Croatia, Albania and Czechia.

In 2019, households in the European Union spent 6.5 percent of the European Union GDP on “food and non-alcoholic beverages,” a small decline from 2010's 6.8 percent (Table A0-3). This was 13.0 percent

of total consumption expenditures, ranking as the third-largest category of household expenditures after “housing, water, electricity, gas and other fuels,” which accounted for 23.5 percent of household expenditures, and “transport,” which accounted for 13.1 percent. Countries of central and southeastern Europe were still among those in the European Union who shared the highest percentages of household expenditures on food and non-alcoholic beverages in 2019.

In 2020 in the ten main COICOP categories, more than a quarter of European Union household expenditures (25.7 percent of the total, or 13.0 percent of the GDP) was devoted to “housing, water, electricity, gas and other fuels,” followed by “food and non-alcoholic beverages” (14.8 percent of the total, or 7.5 percent of the GDP). Basic necessities – “housing, water, electricity, gas and other fuels,” “food and non-alcoholic beverages” and “transport” took more than half of the total household expenditures (52.1 percent) in 2020 (Eurostat, 2021). The next update of HBS data will take place in 2022 for the reference year 2020 (Eurostat, 2020b).

Rapid urbanization and economic growth are typically associated with an increase in the consumption of food away from home in absolute terms and as a share of calories and food expenditures. Food away from home consumption is particularly important because food consumed outside the home tends to be more calorie-dense and less nutrient-dense than food consumed at home. The increase in the amount of food consumed away from home tends to rise with increases in income. Failing to account for food away from home has been shown to affect measures of poverty and inequality, including inequality in the distribution of dietary energy consumption. There is a variety of sources for attaining food away from home, including restaurants, schools, places of work and street vendors. Implementing traditional HBS methodologies focused on household food consumption at home might underestimate consumption of food away from home and its proportion of calories and expenditures through changes in food systems (FAO and World Bank, 2018).

Structure and changes of food trade

International trade and trade agreement and domestic market development

The role of trade in food security and nutrition is increasingly coming to the attention of development practitioners in different disciplines. The 2014 Rome Declaration on Nutrition of the Second International Conference on Nutrition (ICN2) takes trade policies to be conducive to fostering food security and nutrition for all. The 2030 Agenda for Sustainable Development identified trade as a cross-cutting means for development. Trade policies influence households’ access to food and nutrition directly by affecting domestic prices, income growth and purchasing power.

Over the past two decades, the trade system and trade environment in post-Soviet countries have changed significantly. Regional and subregional integration among countries contributes to the creation of larger markets. Most of ECA countries are members of the World Trade Organization (WTO). At the regional level, policy measures in this area are mostly undertaken within the framework of the European Union and the Eurasian Economic Union (EAEU). These agreements are complemented by preferential market access arrangements, including under Generalized System of Preferences (GSP) schemes with Canada, the United States of America, Norway, Switzerland, Türkiye and Japan (FAO, 2019a).

Trade and trade policies in many countries in the region have closely followed these countries’ transition from a centrally planned to a more open, multilateral, market-based economy. All case study countries in this section are currently members of the WTO: **Albania** (joined in 2000), **Armenia** (2003), **Kyrgyzstan**

(1998), **North Macedonia** (2003), **Poland** (1995) and **Ukraine** (2008). These countries have also different regional trade agreements. **Armenia** signed the Comprehensive and Enhanced Partnership Agreement with the European Union in 2017 and became a member of the EAEU in 2015. Armenia has a GSP+ agreement with the European Union, the United States of America and Canada. Kyrgyzstan joined the EAEU in 2015. **North Macedonia** became a member of the Central European Trade Agreement (CEFTA) in 2000 and signed a Stabilization and Association Agreement (SAA) with the European Union in 2001. The European Union granted candidate status to the country in 2005. **Ukraine** entered the Deep and Comprehensive Free Trade Area (DCFTA) in 2017. Poland became a Member of the European Union in 2004.

Over the past two decades, as agrifood production and policies have shifted towards the free market, both agrifood exports and imports have increased significantly, contributing to economic growth and food security and nutrition through the increased availability of various products, in particular fruits, vegetables, meat and dairy products. **North Macedonia** is a net importer of agrifood products: meat (including poultry, beef and pork), confectionery, cheese, processed foods and grains. **Kyrgyzstan** is also a net importer of agrifood products, with imports including poultry, fruits and nuts, cereals, oils and fats, and sugar. **Armenia** is highly import-dependent on major food commodities, with a 2019 self-sufficiency of 26 percent for wheat, 6.5 percent for maize, 56 percent for pork, 22 percent for poultry and 2 percent for vegetable oil. **Ukraine** has a positive balance of trade in agricultural commodities, with export values at 386 percent of import values in 2019. Export plays significant role in the rural economy, employment, and food security and nutrition. Ukraine is among the world's largest exporters of sunflower oil, maize, wheat, rapeseeds and barley. Similarly, **Poland** is also a net importer of agrifood products and is one of the European Union leaders in food exports. It is ranked first in poultry exports and is one of the leading suppliers of apples, dairy and confectionery products. However, imports also are important for meeting national consumption, including of pork, fish, soybean cakes and other products.

The growth of trade has seen large fluctuations and disruptions (in 2000–02, 2007–08 and 2014–16) due to sharp currency depreciations, global food price crises, trade bans and non-tariff barriers as a result of climate shocks, the COVID-19 pandemic and human-caused conflicts globally and regionally.

Trade growth, especially export growth due to trade openness, contributes to economic growth, with more resources becoming available to improve citizens' access to better nutrition through increased purchasing power. However, imports of processed foods and food high in fat, sugar and/or salt also have increased, contributing negatively to nutrition and health outcomes (with particular impacts on overweight and obesity).

Through the inclusion of tariffs, trade policy and domestic market policies can effectively reduce the consumption of unhealthy food and mitigate food loss and waste. For instance, in Poland, in 2019, in order to prevent local retailers from trashing unsold food still fit for consumption, a new law was enforced, that requires the owners of retail outlets with a total surface of greater than 250 sq. metres to donate such food to charity organizations, with the disposal of edible food punishable by financial penalties.

Structure and changes of agricultural and food production systems

The food and agriculture sector has the primary role of feeding people by increasing the availability, affordability and consumption of diverse, safe and nutritious foods aligned with dietary recommendations and environmental sustainability. Improving nutrition requires multisectoral policies and strategies, supported by effective coordination and accountability mechanisms, and the capacity to transform nutrition targets into actions and impacts. The ICN2 FFA gives as its Recommendation 8: "Review national

policies and investments and integrate nutrition objectives into food and agriculture policy, programme design and implementation, to enhance nutrition-sensitive agriculture, ensure food security and enable healthy diets” (FAO/WHO, 2014b). The contribution of agriculture and food systems to nutrition can be enhanced by setting explicit nutrition objectives and improving equity, targeting, gender sensitivity and environmental sustainability.

The importance of nutrition-sensitive food and agriculture-based approaches for overcoming malnutrition and improving nutrition in general is fully recognized. FAO promotes nutrition-sensitive agriculture and food-based strategies (FAO, 2015b). Food and agriculture-based strategies (including food production, dietary diversification and food fortification) focus on food as the primary tool for improving the quality of diets and overcoming and preventing malnutrition and nutritional deficiencies. This approach stresses the multiple benefits derived from enjoying a variety of foods and recognizing the nutritional value of food for good nutrition and the importance and social significance of the food and agricultural sector for supporting rural livelihoods (FAO, 2017a). FAO points out that programmes and projects are nutrition-sensitive if they (FAO, 2015b):

- maintain or improve the natural resource base;
- are gender-sensitive and support the empowerment of women;
- improve processing, storage and preservation;
- expand markets and market access for vulnerable groups; and
- incorporate nutrition promotion and education regarding food and sustainable food systems, building on existing local knowledge, attitudes and practices.

To support country policies and programmes in nutrition-sensitive agriculture and food systems, FAO has developed an integrated package of guidance on how to design, implement, monitor and evaluate nutrition-sensitive food and agriculture policies and programmes. This is the result of a consultative process within FAO and with external partners, including development partners (in particular the World Bank and the European Commission), NGOs and academia (FAO, 2017b). The set of priority actions should be jointly implemented by countries with different food system actors to better contribute to the transformation towards sustainable food systems, with support from international actors and partners at both regional and national levels to address malnutrition in the ECA region.

Structural changes

The sustainable food systems framework calls for diversified agriculture that provides diverse and nutritious foods to all. The focus on small farmers and productivity is related to the 2030 Agenda for Sustainable Development’s target of doubling the productivity of small farmers and to SDG Target 2.4 for sustainable agriculture. Nevertheless, FAO studies have shown that the structure of agricultural production in most ECA countries underwent extensive changes during the past two decades following the transition declines. These changes were mostly driven by the need for increased domestic production to improve food security, but they were also influenced by newly established trade regimes, including customs unions.

However, despite the recorded growth, overall sustainable production and productivity gains have been undermined by factors that have discriminated against smallholders in areas such as access to land and other resources, inputs and services; support from research and extension; and finance. At present in the ECA region, a large majority of countries’ agriculture production comes from family farms and dualistic farm structures, with a large number of small farms, on one side, and a small number of large

corporate farms, on the other side. Small average farm size and excessive land fragmentation are the main negative outcomes of the conducted land reforms. Newly formed landholdings of around 1.5 ha in size and divided into three to five land plots are, for obvious reasons, not conducive to commercially oriented agriculture, representing an important major constraint for agricultural development (FAO, 2019a). On the other side, small and family farms are known to have a number of advantages over larger farms when it comes to reducing poverty, hunger and malnutrition; promoting healthy diets; and making agriculture more environmentally friendly and resilient to shocks (FAO, 2013). Armenia's agriculture is made up almost entirely (97 percent) of smallholders. A similar situation is observed in Albania, where there are geographical challenges, a lack of modern equipment, unclear property rights, and a prevalence of segregated land plots. Similarly, structural changes in Ukraine are required in the field of regulation of family farm registration, food production quality, the safety of food processing, and the provision of social guarantees to rural populations. In Kyrgyzstan, with 98 percent of arable land owned by smallholders, the overall trend in agricultural land use focuses on empowering individual farmers and rural households. In Poland, horizontal integration in agriculture and the joining of farmers in cooperative producers' organizations have proven beneficial for gaining a bargaining position on the market and ensuring lower transaction costs.

To be able to stay competitive and resilient to stresses and shocks, small-scale agricultural producers need to be well integrated into food supply chains, inputs and services. Achieving this integration into producers' associations and cooperatives would help facilitate access to productive resources such as machinery, equipment and credit and help ensure market penetration. Mutual benefits can be achieved, for example, through forward contracts: farmers receive guaranteed prices for their outputs regardless of market conditions, while processors and distributors receive products of a desired quality. Another resilience-enhancing strategy that small-scale farming households use increasingly is the adoption of more sustainable production practices, such as agroecology and agricultural biodiversity, that boost resilience to shocks and stresses, facilitate adaptation, maintain stability and support recovery from disturbances. Another option is climate-smart agriculture, which enhances food security and healthy livelihoods while promoting climate change adaptation and mitigation. These concepts recognize that conventional mainstream agriculture cannot feed the growing world population sustainably because it degrades the natural resource base (FAO, 2021a).

Policies and drivers for change

It is clear that both small and large farms will continue to coexist and play out their respective roles. The underlying premise is that, given the multiple benefits, it is desirable that small farms should be fostered and supported by policies, i.e. offered additional incentives as a reward for the multiple benefits they generate. Doing so would be consistent with the desired reorientation of agricultural policies towards enhanced food security and nutrition (FAO, 2021b). The ICN2 FfA gives a package of recommendations to guide policy development and implementation (FAO/WHO, 2014b):

- Review national food and agricultural policies and investment portfolios to make them more nutrition-sensitive for healthy diets (Recommendation 8).
- Strengthen local food production and processing, especially by smallholder and family farmers, while recognizing the role of trade in contributing to nutrition objectives (Recommendation 9).
- Promote the diversification of crops, including underutilized traditional crops; promote the production of more fruits and vegetables; and promote the appropriate production of animal-sourced products, as needed (Recommendation 10).

- Improve storage, preservation, transport and distribution technologies and infrastructure to reduce seasonal food insecurity and food and nutrient loss and waste (Recommendation 11).
- Establish and strengthen institutions, policies, programmes and services to enhance the resilience of the food supply in crisis-prone areas, including in areas affected by climate change (Recommendation 12).

Country overview

The situation in the observed ECA countries is characterized by an increasing percentage of smallholder farmers in rural areas. Various policy mechanisms are in place to support development, and shares of state subsidies are invested in technological and organizational improvements. Movements are being made towards diversification of production, implementation of the principles of organic farming and more, but the concept of nutrition-sensitive agriculture is yet to be comprehended and integrated. To see this happening, agricultural policies in the countries need to introduce these principles in their action plans and foresee how they will be promoted and implemented among stakeholders.

In Armenia, policies and action plans for food security and nutrition tend to focus primarily on food availability via agriculture and the improvement of self-sufficiency (in *The Strategy of Agricultural and Rural Sustainable Development for 2010–2020*) and the introduction of agroecological approaches (policies to promote organic and agroecology approaches).

In Albania, the farming system has evolved and adapted to governmental structural changes, which require development and investment in human and technological resources and better exploitation of available land.

In Kyrgyzstan over the past 20 years, the government has adopted numerous programmes and policies aimed at developing various agricultural sectors. State support is concentrated on subsidized credits (92 percent), maintaining on-farm reclamation networks (5 percent) and assisting seed production (3 percent). A slight increase in the GDP rate invested in agriculture (from 1.5 percent to 2.3 percent) has been observed in the past 20 years.

In North Macedonia, agricultural and rural development policies follow the overall concept of the European Union's Common Agricultural Policy (CAP) framework. The 2014–2020 framework allows for substantial funds allocated to agricultural and rural development policies, with annual increases. The agriculture budget accounts for around 4.5 percent of the total national budget. Following the CAP intervention logic, the national policy is delivered through market and direct producer support measures and structural and rural development measures, and it addresses negative environmental externalities of agriculture, such as organic agricultural practices.

In Poland, during the transformation and restructuring processes, many policy measures were introduced, including custom tariffs to prevent excessive imports, subsidies to agricultural loans and fuel, and preferential credit lines. However, it was the European Union integration process that had the main impact on the sector's transformation and modernization process.

In Ukraine, a budget programme was enacted in 2018 to support private farmers, providing partial compensation for locally produced agricultural crops, including seeds, agricultural consulting services, locally produced agricultural equipment and machinery, etc. The programme also provides support mechanisms for agricultural service cooperatives.

Structural changes of food processing and marketing

The food processing sector in ECA countries has recorded constant increases in production volume and employment rates and is majorly structured around small and medium enterprises. Food production is influenced by various economic and trade policies, world prices of commodities that direct the import, export and availability of raw commodities and consumer demands. The level of processing is lower due to a lack of access to favourable finances, contractual agreements with suppliers of raw materials (such as agricultural producers), skilled workers, and adequate storage facilities. There is insufficient investment in the development of new value-added products, innovation, joint marketing and distribution. The consequences are that unprocessed or semi-processed goods are exported at lower prices, due to inadequate quality for external markets, while final, high-priced, high-quality products are imported. The food industry needs various kinds of financial and operational support and guidance to be able to improve production and make it more nutrition-sensitive and sustainable.

Structural changes

Food processing sectors have experienced many structural changes in recent decades, including the cessation of regulation of retail food prices and increases in quality that have made products competitive with imported goods. Some food sectors, due to investments, have experienced significant increases in production and sources of modern technologies, marketing, management and organizational know-how. This has resulted in new employment, increased export possibilities and regional comparative advantages.

Policies and drivers for change

So far, policies regarding the foods sector have focused on development of the food processing industry, increases in export potential, and the setting of standards and norms for food safety and quality. However, the transformation of food systems towards sustainability requires setting new standards that take into account food consumption that can meet the requirements of a healthy diet. The development of a new, nutrition-sensitive agrifood industry should be directed by modern research and development, the implementation of green technologies that save energy and resources, and new environmentally friendly solutions for processing, storage and food waste.

Another force of change comes from increasing consumer demand for diverse, high-quality and safe foods. Thus, new food safety legislation needs to develop rapid alert systems, systems for communication with consumers, and networks of national agencies and scientific bodies.

In Armenia, national policies have aimed to promote sustainable development in the agrifood sector and increase export. In Albania, beside these developments, strategies have foreseen the improvement of the livelihoods of rural households; improvements in the economic efficiency of agriculture and the food industry; and the improvement of agricultural markets. The Government of Kyrgyzstan developed its Programme for the Development of the Food and Processing Industry (2017–2021), aiming to develop the food processing industry, increase export potential, set standards and norms for food consumption that meet the requirements of a healthy diet, and develop an agro-industrial complex. In Ukraine, measures have included the development and implementation of technologies for the production, storage and processing of high-quality crops, including the creation of energy- and resource-saving technologies for growing crops. State support for research and development in agriculture is constantly increasing in absolute value; however, its share in total agriculture support is declining. In Poland, policies have focused

on providing safe food, ensuring consumer trust, and creating an environment in which the food industry and other stakeholders work towards changing and improving the diets of consumers.

Marketing, including advertising practices

The marketing of food to children is widespread and has a negative influence on food choices and consumption patterns. In May 2010, the World Health Assembly (WHA) adopted the WHO Set of Recommendations on the Marketing of Foods and Non-alcoholic Beverages to Children (WHO, 2010). These recommendations urge Member Nations to reduce the impacts on children of the marketing of energy-dense, highly processed foods and beverages high in saturated fats, trans fats, free sugars and/or salt (HFSS). However, despite unequivocal evidence that HFSS food marketing has a harmful impact on children's eating behaviours and body weight, and despite repeated commitments made by Member Nations to halt the rise of childhood obesity by 2025, implementation of the WHO Set of Recommendations has been uneven worldwide (Sadeghirad *et al.*, 2016).

There have been many international actions, engagements and calls to reduce exposure to unhealthy food marketing, and technical support has been given to countries to take action. In the 2014 ICN2 Rome Declaration on Nutrition, it is stated: "We reaffirm that: ... (f) improvements in diet and nutrition require relevant legislative frameworks for food safety and quality ... while avoiding inappropriate marketing and publicity of foods and non-alcoholic beverages to children, as recommended by resolution WHA63.14" (FAO/WHO, 2014a). The ICN2 Framework for Action recommends (in No. 15): "Explore regulatory and voluntary instruments – such as marketing, publicity and labelling policies, economic incentives or disincentives ... – to promote healthy diets" and (in No. 40): "Regulate the marketing of food and non-alcoholic beverages to children in accordance with WHO recommendations" (FAO/WHO, 2014b). The United Nations Decade of Action on Nutrition gives examples of SMART commitments for Recommendation 15: "By December 2020, the government has implemented legislation that prohibits marketing and sale of foods and beverages high in saturated fat, trans-fat, free sugars, and/or salt in school settings where children gather, such as nurseries, primary and secondary schools, school grounds, sports facilities and preschool centres and playgrounds" (FAO & WHO, 2018). In the European region, 54 percent of countries responding to the WHO Global Nutrition Policy Review questionnaire in 2016 and 2017 reported some action to control the marketing of HFSS foods to children. Most of these actions are self-regulatory, with a main focus on broadcast media, such as television and radio, rather than digital social media platforms. According to the questionnaire, the formal monitoring of marketing to children existed in just 11 percent of the countries (Breda *et al.*, 2020).

Country overview

In the observed ECA countries, limited actions have been taken in the past regarding policy related to the control of the marketing of HFSS foods to children. Laws on the regulation of marketing exist, in general, but specific regulations regarding restrictions on food marketing to children are not included in these laws in the majority of the countries. More precisely, in **Armenia**, the Law on Advertising, adopted in 1996, only sets advertising standards and principles, including a mandate that makes Armenian the official language of advertising. A similar situation exists in **Kyrgyzstan**, where the Law on Advertising, which was first enforced in 1998 and is still in use, regulates advertising, including requirements and conditions for any advertisement published in Kyrgyzstan. The State Antimonopoly Regulation Agency is responsible for the monitoring and control of advertising. In North Macedonia, all forms of advertising are available to food producers. There are restrictions in the Law on Broadcasting and the Law on Protection from Smoking that prohibit media advertising for tobacco and tobacco products. Information was not

available about the existence of any laws or restrictions in **Albania** and **Ukraine** regarding marketing and advertising. Only in Poland are there restricting measures regarding the marketing of high fat, sugary and salty (HFSS) foods and non-alcoholic beverages to children, but they are based on voluntary and self-regulatory measures provided by the industry. National mandatory policies to restrict the advertising of HFSS foods to children in various media platforms are in place in **Hungary, Lithuania, Republic of Moldova** and **Slovenia**, as well. In **Bulgaria, Czechia** and **Romania**, these activities are voluntary. Other countries in central and southeastern Europe do not have similar policies, regulations or voluntary activities. In a recent review of similar policies across Europe, the situation was somewhat similar (Breda *et al.*, 2020). Various measures to limit the marketing of HFSS to children are mostly voluntarily.

Initially, in 2012, European Union Pledge member companies committed to not advertise products to children younger than 12 (defined as advertising to media audiences with a minimum of 50 percent of children younger than 12), except for products that fulfil specific nutrition criteria. The European Union Pledge requirements of member companies have tightened almost on an annual basis, becoming more widespread and inclusive of all kinds and forms of marketing and advertising of food. From 1 January 2022 onwards, European Union Pledge membership requires that companies:

- not advertise food and beverages to children younger than 13, except for products that fulfil the European Union Pledge common nutrition criteria;
- not market or advertise in primary schools, except where specifically requested by or agreed with the school administration for educational purposes; and
- abide by the International Chamber of Commerce (ICC) Code of Advertising and Marketing Communication Practice and the ICC Framework for Responsible Food and Beverage Marketing Communications in all marketing communications.

These rules are applicable to all European Union Pledge member companies across the European Union. Individual member companies may maintain or adopt specific policies that go beyond the European Union Pledge commitment (EU Pledge, 2021).

Key messages for the marketing of foods and non-alcoholic beverages to children

There are both a need and call for regulations that effectively limit children's exposure to unhealthy food marketing. Since marketing is quickly and ever evolving, new techniques and channels require novel and efficient ways to advance policies. Regulation specific to food marketing in the digital and retail environments is needed. Applying a child rights-based approach supports effective policy development. Governments, as key stakeholders in policy development, are encouraged to set clear definitions, thereby allowing for uniform policy implementation. Thus, there are needs to support countries on: 1. the policy development level; 2. the policy implementation level; and 3. the monitoring and evaluation level. This comprehensive approach has the highest potential to achieve the desired impact. Stakeholders in policymaking and implementation should have in mind that:

- *"Marketing" does not cover only advertising, but all other commercial communications that are designed to promote, or have the effect of promoting, HFSS foods.*
- *Reductions in both the exposure of children to marketing of HFSS foods and the power of such marketing should be sought, as both influence food preferences, purchase requests and consumption.*
- *Involve other Member Nations in cooperation to reduce the impact of cross-border marketing.*
- *Monitoring and enforcement mechanisms should be specified to ensure effective policy implementation.*

Food additives and food fortification

Regulation of the addition of food additives in ECA countries

Regulations for the application of food additives in central and southeastern Europe are enforced in all of the observed countries and majorly aligned with current requirements of the relevant international Codex Alimentarius standards and European Union directives. Countries in Central Asia, since becoming members of the EAEU, have adopted the Technical Regulations of the Customs Union (TR CU 029/2012) “Safety requirements of food additives, flavourings and processing aids,” which aligns levels of safe use of additives in foodstuff with European Union standards, opening the door for increases of exports for producers from Eurasian Economic Union member states (European Commission, 2019).

Food fortification regulation in ECA countries

Laws and regulations related to universal salt fortification are established in all observed countries in the ECA region. There have been some initiatives for the regulation of the addition of other nutrients – such as iron in flour, or vitamin D – but they have been unsuccessful or have not been implemented entirely (Kyrgyzstan, North Macedonia). In central and southeastern Europe, many countries (Czechia, Poland, Republic of Moldova, Serbia and Slovenia but not Hungary or Latvia), have adopted food fortification legislation in line with European Union regulation on the addition of vitamins and minerals and of certain other substances to foods (Regulation No. 1925/2006 permits the addition of vitamins and minerals on a voluntary basis) (European Commission, 2006). The Republic of Moldova has legislation requiring the addition of iron and folic acid to at least one kind of commonly consumed wheat flour. Some other countries in central and southeastern Europe are also considering the adoption of mandatory flour fortification (FFI, 2013).

Taxation on unhealthy food and price policies for promoting healthy diets

To reduce the consumption of unhealthy food, it is necessary to introduce taxation policies on HFSS foods and legislation that will require the reduction of these harmful compounds in food. In policy reviews from 2013 for countries in the region (Lachat *et al.*, 2013), it was observed that many ECA countries do not have policies that address and limit harmful nutrient components. Since then, there has been minimal progress in limiting these compounds in food in these countries. Price policies that would promote the purchase of food for healthy diets are far-fetched targets in the current setting. Yet, there are some initiatives in the establishment of food policies that limit the content of these harmful compounds. In 2019, the European Union Commission adopted regulation that strictly limits the amount of industrially produced trans fats to a maximum of 2 percent of total fat in foods for the final consumer.

Country overview

Studies from countries in Central Asia show a quite unregulated food market, especially in the sector of street food vendors, where foods with these harmful compounds is prevalent and where the advertising of such foods is ubiquitous. In central and southeastern Europe, so far, legislation concerning taxation of unhealthy foods high in fat, sugar and salt is available only in Hungary, Latvia and Montenegro.

Good practices: Policies that limit harmful nutrients in the food supply

Food policies that limit harmful nutrients in foods are established in Bosnia and Herzegovina, Bulgaria, Hungary, Latvia, Lithuania, Republic of Moldova, Montenegro and Slovenia. Lithuania and Republic of Moldova have policies that limit trans-fatty acids, saturated fatty acids, salt and added sugars. Bulgaria limits saturated fatty acids, salt and free sugars. Slovenia and Latvia limit trans-fatty acids and salt, while Bosnia and Herzegovina and Montenegro have regulated salt content. The other seven countries do not have policies that address and limit harmful nutrient components (Gurinović *et al.*, 2022).

In particular, industrially produced trans fats, more than any other nutrient, seriously increase the risk of coronary heart disease, the leading cause of death in Europe (European Commission, 2015). Their content is particularly high in certain processed foods, such as bakery products, cakes and biscuits, convenience food, and deep-fried products. These foods are commonplace in markets in the countries of central and southeastern Europe (Stender, 2020). Denmark, the United States of America, Hungary, Latvia and others (WHO, 2020) have established legislation that limits or eliminates industrially produced trans fats. So far, this has been shown to be effective measure in improving public health and consumer protection. The WHO has provided the REPLACE action package, which can serve as a guide to countries that are in the process of or completing the elimination of industrially produced trans fats from the food supply (WHO, 2018).

Food labelling/information

Food labelling plays a key role in sustainable food systems, e.g. in promoting sustainable consumption and production patterns in accordance with the objectives of SDG 12 (United Nations Statistics Division, 2016). Further, the ICN2 FfA recommends, in Recommendation 15, the exploration of “regulatory and voluntary instruments – such as marketing, publicity and labelling policies, economic incentives or disincentives in accordance with Codex Alimentarius and World Trade Organization rules – to promote healthy diets” (FAO/WHO, 2014b). Food labels inform consumer decisions – and not just on nutrition, but also on recycling, food origin, carbon footprint, etc. Mandatory nutritional information on foodstuffs should include information on energy value, the content of fats, saturated fats, carbohydrates, sugars, proteins and salt. In order to avoid misleading information, additional voluntary information should not confuse or mislead the consumer and, when appropriate, be based on relevant scientific data. The use of nutritional claims should be used only under strict requirements. The promotion and endorsement of policies for front-of-package labels, for example, could be effective, as these policy measures are already in place in some European countries (Breda *et al.*, 2020).

Country overview

Food labelling regulations are established and implemented in all countries of central and southeastern Europe. Bulgaria, Czechia, Estonia, Latvia, Lithuania, Romania and Slovenia have indicated that they have established national food labelling policies that are aligned with the European Union Regulation No. 1169/2011 of the European Parliament and of the Council. European Union pre-accession countries are also adapting their regulations in line with European Union regulation. Similar trends are observed in Central Asian countries, such as Kyrgyzstan and Ukraine.

Surveys of consumers' use of nutrition labels are not common in countries of central and southeastern Europe and Central Asia. Only Lithuania and Poland have conducted national consumer surveys to assess the use of nutrition labelling that encourages healthy food choices. Designing and distributing similar surveys in other countries of central and southeastern Europe would help authoritative bodies design methods and programmes to educate consumers on healthy food choices, such as the use of food labelling.

Consumer demand, awareness, education, and social protection

Food-based dietary guidelines

Food-based dietary guidelines (FBDGs), as an effective tool for supporting public health and policies that aim to reach sustainable healthy diets and reduce the triple burden of malnutrition, should be based on sound evidence and should respond to country-specific public health and nutrition issues, food production and consumption patterns. National FBDGs are an important tool that governments can use to inform, evaluate and align policy and programmes that aim to promote healthy diets. Using language and images that are intuitive and easy to understand, national FBDGs are the context-specific translation into foods and meals of what is a healthy diet and advice on how to achieve it.

FAO assists Member Nations in developing, revising and implementing FBDGs in line with current scientific evidence. This support is delivered through programmes for capacity development, the organization of global/regional/national advocacy and expert meetings, the publication of guidance documents, and the direct provision of technical assistance regarding the development of FBDGs, taking into consideration the specific country situation and the incorporation of sustainable and healthy eating. FAO is hosting a series of global webinars to support knowledge exchange and debate around FBDGs.²

Country overview

In central and southeastern Europe, national FBDGs are present in the majority of countries. In **North Macedonia**, FBDGs – available since 2008 and extended in 2014 – contain dietary recommendations that would contribute to the health benefits of the population. Key messages promote eating a balanced and nutritious diet based on diverse food groups, maintaining healthy eating habits, and restricting highly processed foods with high levels of sodium, sugar and fat. **Albania** published its dietary guidelines in 2008 using a food pyramid representing six food groups: cereals at the bottom of the pyramid; fruits and vegetables on the second level; dairy products and animal-sourced foods on the third level; and fats and products high in sugar and fat at the top. More than half of FBDGs present in central and southeastern Europe were established more than five years ago. This is important, as sustainability aspects have been captured only in the novel FBDGs of several developed countries.

Dietary guidelines for the Polish population were introduced by the Institute of Food and Nutrition (IŻŻ) in 1995 and later modified in 2009, 2016 and 2019. In October 2020, new recommendations were developed and endorsed by the National Institute of Public Health – National Institute of Hygiene, in collaboration with the Ministry of Health. Polish consumers are encouraged to eat a variety of foods every day and consume more full-grain cereals, vegetables, fruits, pulses, fish, low-fat milk products

² More information regarding FBDGs is available on the FAO website at <http://www.fao.org/nutrition/education/food-dietary-guidelines/en/>.

and nuts. Lowering the intake of salt, red meat, sugar, sweetened beverages and processed products is recommended.

In **Ukraine**, at the end of 2017, the Ministry of Health, together with the Centre for Public Health and nutrition experts, presented national recommendations on healthy nutrition and identified the most important food categories to be included in the daily diet (Ministry of Health of Ukraine, 2017). The first recommendations on healthy nutrition in Ukrainian history, in the form of a healthy nutrition plate, have become the basis for a national pro-healthy lifestyle information platform.

In many countries with FBDGs, the sustainability aspects of the guidelines are on paper but are not widely acknowledged or implemented. In all countries of central and southeastern Europe, updating the existent FBDGs to include sustainability aspects should be an objective for further work (FAO, 2020a; Herforth *et al.*, 2019).

Key message for evidence-based FBDGs

Evidence-based FBDGs do not exist in many ECA countries, e.g. in Central Asia and the Caucasus (Armenia and Kyrgyzstan) and in Balkan region (Montenegro and Serbia). In addition, many of the existing FBDGs need to be updated to include evidence-based, healthy and more environmentally sustainable advice.

School food and nutrition

Optimal nutrition and healthy diets are the most important determinants of children's growth, development, nutritional status and health. Inadequate nutrition in childhood presents potential nutritive risk factors for various forms of malnutrition. Therefore, early healthy eating habits are essential to reducing the risk of immediate and long-term health problems. Children are at the focal point of the United Nations 2030 Agenda for Sustainable Development and the SDGs, particularly Zero Hunger (SDG 2), Good Health and Well-Being (SDG 3), Quality Education (SDG 4) and Gender Equality (SDG 5). International human rights law sets obligations and standards for countries to implement national policies and legislation that aim to fulfil children's rights to adequate food, education and health. During the ICN2, in 2014, FAO and WHO Member Nations committed to developing policies, programmes and initiatives to ensure healthy diets throughout children's life cycles, emphasizing the potential of schools as platforms for integrated action (FAO/WHO, 2014a; UN, 2015). One of the ICN2 FfA specific policy recommendations (No. 16) is related to school food and nutrition: "Establish food or nutrient-based standards to make healthy diets and safe drinking water accessible in public facilities such as hospitals, childcare facilities, workplaces, universities, schools, food and catering services, government offices and prisons, and encourage the establishment of facilities for breastfeeding" (FAO/WHO, 2014b). FAO promotes a holistic approach to school food and nutrition that leverages synergies among four main areas of work: 1. promotion of a healthy school food environment and adequate and safe school food/meals; 2. integration of effective food and nutrition education throughout the whole school system; 3. stimulation of inclusive procurement and value chains for school food; and 4. creation of enabling political, legal, financial and institutional environment (Cruz, 2020; FAO, 2019b). Analysis of European national school food policies across the EU-27 plus Norway and Switzerland shows that all 29 countries have mandatory regulations or voluntary guidance on school food in place (Storcksdieck genannt Bonsmann *et al.*, 2014).

Good practices

School meals have great potential as a platform to promote healthy and sustainable food behaviour. School meal programmes are of particular interest for improving public diet, as they reach children at a population scale across socioeconomic classes and prioritize the promotion of healthy and adequate food for children and adolescents. These programmes contribute to teaching children the culinary heritage and norms around consumption, sustainability and health in their surroundings, and they can create a social and physical learning environment around food that may help tackle current challenges in health and sustainability (Oostindjer *et al.*, 2017). To support Member Nations in translating their national school food standards related to health and nutrition into food procurement specifications, the Joint Research Centre (JRC) published a technical report for the implementation and sharing of relevant examples from across Europe (Caldeira *et al.*, 2017). Also, the WHO released an action framework that provides an overview of how to develop (or strengthen), implement, assess compliance with and evaluate the effectiveness of a healthy public food procurement and service policy. It is intended for use by government policymakers or programme managers working in public food procurement or service at national, subnational, regional, provincial or city levels (WHO, 2021).

To facilitate the implementation of the European Union Action Plan on Childhood Obesity 2014–2020, the Directorate-General for Health and Food Safety of the European Commission helped 25 Member Nations and Norway gather for a Joint Action on Nutrition and Physical Activity (JANPA) in pursuit of improved nutrition for schoolchildren (Kovacs *et al.*, 2020).

FAO is implementing school food and nutrition programmes in Armenia, Kyrgyzstan and Tajikistan within the project “Developing Capacity for Strengthening Food Security and Nutrition in Selected Countries of the Caucasus and Central Asia” (FAO, 2021c). In Armenia, the programme has involved the government of Armenia, the WFP, the Nutrition Institute of the Russian Federation and other partners and has resulted in the establishment of the Sustainable School Feeding Foundation in Armenia. In Kyrgyzstan, the National School Nutrition Programme, established in 2006, has provided funds to feed schoolchildren breakfast.

Countries in the ECA region have already made some progress in the context of developing policies and action plans targeting kindergarten and school-age children. However, further analysis of the implementation needs to be performed. For instance, mandatory national nutrition standards for school meals are available in the majority of the observed countries in central and southeastern Europe, but half of the countries have not yet implemented them.

The FAO Representation in Albania, with technical support from FAO Regional Office for Europe and Central Asia in Budapest, has been providing policy and technical assistance to Albania for a national school food and nutrition programme since May 2016.

Nutrition-sensitive social protection

Social protection is one of the most effective ways to reach socially marginalized, resource-poor, nutritionally vulnerable populations. During the ICN2, countries identified social protection as a sector with high potential for improving nutrition. One of the six Action Areas of the United Nations Decade of Action on Nutrition is related to social protection and nutrition education. The ICN2 Rome Declaration for Nutrition reaffirmed that “a common vision for global action to end all forms of malnutrition – coordinated action among different actors, across all relevant sectors at international, regional, national and community levels – needs to be supported through cross-cutting and coherent policies, programmes and initiatives,

including social protection, to address the multiple burdens of malnutrition and to promote sustainable food systems” (FAO/WHO, 2014a). The ICN2 FfA recommends (in No. 22) “Incorporate nutrition objectives into social protection programmes and into humanitarian assistance safety net programmes” and, in Recommendation 23, “Use cash and food transfers, including school feeding programmes and other forms of social protection for vulnerable populations to improve diets through better access to food which conforms with the beliefs, culture, traditions, dietary habits and preferences of individuals in accordance with national and international laws and obligations, and which is nutritionally adequate for healthy diets” (FAO/WHO, 2014b).

Social protection programming comprises initiatives that protect vulnerable populations against shocks and that reduce risks, often through strengthening livelihoods, improving social status and legal rights, and increasing access to food, education and health care. Examples of social protection instruments include conditional and non-conditional cash transfers, in-kind transfers and school feeding activities. By increasing purchasing power and access to diversified and nutritious food and sanitation, health, and education services, these instruments promote better nutritional outcomes via improved food security, health, diet diversity and quality (FAO and WHO, 2018).

Key principles for making social protection more nutrition-sensitive are: target the nutritionally vulnerable; incorporate explicit nutrition objectives and indicators; empower women and make them the recipients of social protection benefits; promote strategies that enable households to diversify their diets and livelihoods; strengthen linkages to health and sanitation services; integrate nutrition education and promotion; and scale up safety nets in times of crises (FAO, 2015c).

The indicators of socioeconomic status (education, occupation and income) correlate with diet quality and micronutrient intake. Socioeconomic status is a factor in determining purchasing power, consumption patterns and choices. The increased availability and affordability of nutritious and safe food for poor people in both rural and urban areas are key to ending malnutrition in all its forms (FAO, 2015a).

Country overview

In the observed ECA countries, social protection programmes reaching vulnerable subpopulations historically have included various forms of financial aid and other benefits for the most deprived. These programmes are targeted towards the most vulnerable members of society, but not everyone is reached. Often, those who need assistance the most do not entirely benefit from what is available. Some countries report on basic household food basket assistance, school meals for all children, and packages for the elderly, adults living alone, those who are in difficult life situations, and the sick and disabled. There are, at the local level, establishments such as “public kitchens” and local community workshops – supported voluntarily by communities, NGOs, etc. – that are focused on cooking/food products, healthy eating, preventing food waste and managing household budgets. However, not much attention is being paid to the quality of food or other aspects related to the nutrition that is so much needed in these vulnerable and usually nutritionally deprived populations. This aspect presents a gap in actual social protection programmes in the ECA region; an evidence base is needed in addressing in new policies and action plans in the region.

Armenia, Kyrgyzstan and Ukraine provide, through various governmental and external programmes, financial assistance to vulnerable and disadvantaged subpopulations that do not consider nutrition-sensitive packages. In Poland, there is a long-established system of non-financial assistance, including food aid programmes, for the most deprived; this system is supported by the European Union, NGOs and other funds.

Nutrition education and behaviour change communication

Diets and eating behaviours are influenced by many factors: individual (food preferences and enjoyment, beliefs, attitudes, values, perceptions, knowledge, skills, empowerment); family/group (cultural and social practices, social support, networks, peer influence); community and institutional (rules, informal structures, child care organizations, workplaces, schools, neighbourhoods, shops, restaurants, community organizations, information available, recreational facilities, parks); and national (health care system, food assistance programmes, food industry, food and agricultural systems, policy, political and social structures, media, social and cultural norms). Nutrition education can be delivered through multiple venues from multiple stakeholders, involving activities at individual, institutional, community and policy levels (Gill *et al.*, 2019).

The four groups of actions at the core of nutrition education are public awareness campaigns; education in specific settings; skills training; and changes to the food environment that influence consumer knowledge, awareness and attitudes about food, diet and nutrition (Hawkes, 2013). Several international frameworks recommending schoolchildren nutrition education, among others, are the ICN2 Rome Declaration and Framework for Action (Recommendations 19 and 20) and the United Nations Decade of Action on Nutrition 2016–2025 (FAO/WHO, 2014a, 2014b; UN General Assembly, 2016).

School-based food and nutrition education aims to foster long-lasting food outlooks, skills, practices and habits that promote resilience and are conducive to better health and well-being in children and their families. To be effective, school-based food and nutrition education should comprise a combination of evidence-based and behaviourally focused educational strategies that are context specific; that involve the active participation of the most relevant influencers of food practices (i.e. schoolchildren, parents, school staff, local smallholder farmers and rural enterprises, community leaders, etc.); and that are reinforced by an enabling school food environment in empowering children and adolescents to become active participants in shaping the food system to be better able to deliver healthy and sustainable diets. An FAO white paper on the current state, principles of effectiveness and challenges of school-based food and nutrition education for low- and middle-income countries, with recommendations for action, can support governments in strengthening their policies related to school-based food and nutrition education (FAO, 2020b).

Country overview

Nutrition education is mandatory at the national level in primary and/or secondary school curricula in Armenia, Czechia, Estonia, Hungary, Kyrgyzstan, Lithuania, Republic of Moldova, Montenegro, North Macedonia, Poland, Slovenia and Ukraine. Meanwhile, in Albania, Bosnia and Herzegovina, Latvia, Romania and Serbia, these programmes are not yet mandatorily included in school programmes.

However, there are many various actions and initiatives in the field of school-based food and nutrition education that take place on the local level, involving such actors as NGOs, food industry and retailers, and famous sport and health promoters and influencers.

For example, in Poland, the National Centre for Nutritional Education was established and financed by the National Health Programme. A big role in educating the population is played by the hundreds of NGOs that often have motivated and competent management but do not have sustained funds to fulfil their goals. However, there is an overall lack of cooperation mechanisms among NGOs in various regions of the country.

In North Macedonia, several governmental institutions play active roles in nutrition education and communication. The ministries of Health, Labour and Social Protection, Agriculture, Forestry and Water Economy, and Education and Science constitute the main responsible bodies in the governmental framework. The Institute of Public Health and the Food and Veterinary Agency are active in the areas of nutritional coverage, safety and education. The Organisation of Consumers of North Macedonia and donor programmes such as FAO, UNICEF, the World Bank and the United Nations Development Programme (UNDP) also contribute to these policy arenas. For instance, the Institute of Public Health implements the Children's Initiative for Children's Obesity in Europe (COSI) in North Macedonia, a research initiative sponsored by the WHO to explore the trends in weight gain and obesity among schoolchildren since 2009. In 2014, a public campaign promoted healthy food and keeping a healthy lifestyle, under the slogan "Health is the choice! Healthy food and a healthy lifestyle mean a long life!" The campaign was aimed at the entire population of North Macedonia. However, there has been no measurable outcome about the success of the campaign.

Besides that, the influence of social media on the acquisition of information is not to be neglected. Children and young people are more than ever exposed to inflows of information on food, the environment and health and are becoming more aware of their importance than any generation before. They are and will be interested in taking part in building future food systems (EIT Food, 2021). Thus, school-based food and nutrition education should go beyond classrooms to produce inclusive programmes that provide scientifically proven information on nutrition, environment protection, food waste, food production and processing, food labelling, diet-health relations and many other related topics to children and youth.

Conclusions and key messages for policy action in the Europe and Central Asia region for food systems transformation

The transition to sustainable food systems in the ECA region requires a collective approach that involves public authorities at all levels of governance, private sector actors across the food value chain, NGOs, social partners, academics and citizens. It will contribute to the prevention of various forms of malnutrition and to the achievement of the SDGs at the country and regional levels, especially SDG 1 (No Poverty), SDG 2 (Zero Hunger), SDG 3 (Good Health and Well-Being), SDG 4 (Quality Education), SDG 5 (Gender Equality), SDG 12 (Responsible Consumption and Production) and SDG 13 (Climate Action). It also will contribute to global nutrition targets for 2025 and 2030, to diet-related NCD targets and to the United Nations Decade of Action on Nutrition 2016–2025. There is an urgent need for research and innovation harmonization in indicators and data collection and evidence-based policymaking. To see progress in food systems transformation and the strengthening of food and nutrition security, we also need to create adequate targets and indicators for monitoring – indicators that cover the whole food system and reflect

the outcome. Measuring progress will demonstrate movement towards future-proofing food systems so they can become more sustainable, resilient, responsible, diverse, competitive and inclusive.

To address malnutrition in the ECA region and better contribute to the transformation towards sustainable food systems, a set of priority actions harmonized with relevant international strategies and policies should be implemented by Member Nations, together with various food systems actors, with support from international actors (United Nations and Economic Commission) partners at regional and national levels.

There is growing evidence that the performance of current food systems in the ECA region needs to improve to overcome multiple challenges related to food insecurity and malnutrition; to provide access to affordable, safe and nutritious food; and to minimize environmental costs.

A commitment to transforming food systems is evident across the region, as outlined at the FAO Regional Conference for Europe in 2020 and again in 2022, and discussions continue linked to the United Nations Food Systems Summit 2021.

Based on the identified status, gaps and priority needs, the following key messages for policy action for food systems transformation in the ECA region are presented:

Essential for food systems transformation is the establishment of national food systems governance as a multisectoral, multistakeholder, transdisciplinary, national coordination mechanism that addresses countries' food security and nutrition challenges with country-specific SMART (specific, measurable, achievable, relevant and time bound) actions.

- Part of overall governmental budgets need to be allocated, yearly, for the implementation of national nutrition strategies, policies and action plans. Recent analyses of the status of food systems elements in central and southeastern Europe have identified that majority of the countries (nine of 15) have reported that they still do not have any budget allocated for the implementation of national nutrition strategies, policies and action plans. National nutrition committees have been established in six countries, while nine still do not have a similar governmental body. National nutrition plans with country-specific SMART commitments have been developed in just four of the 15 participating countries (Gurinović *et al.*, 2022).
- Methodological guidance for food systems transformation is needed to support countries and policymakers in the implementation of the recommendations, proposed policies, programmes and priority actions, harmonized with relevant international strategies and policies. These should be implemented by Member Nations with support from international actors and partners at regional and national levels to shift towards environmentally sustainable and healthy diets and food systems transformation.
- Partnership and collaboration are needed with national, regional, and international science-policy interfaces (SPIs) (Directorate-General for Research and Innovation of the European Commission *et al.*, 2022), with support from FAO, WHO, EC, UNICEF, the WFP, EFSA and others. Communication should be established with national food systems governance for the monitoring, analysis and evaluation of the status of food systems elements at national and regional levels, using standardized methodology in a harmonized way for the identification of the baseline status and evidence-based priority needs and further capacity development for food systems transformation policy recommendations and implementation. Support should be given to countries and regions for capacity development, knowledge transfer and the strengthening of SPIs for food systems transformation. Technical support and capacity development are needed from United Nations specialized agencies and EC.

- National policies, action plans and strategies, including objectives, indicators and targets as identified by countries, are strategic documents that, when adopted, are part of national development strategy for successful implementation of action for food systems transformation.
- There is an urgent need to promote diets that are healthy, socially and culturally acceptable and economically accessible for all, with low environmental impacts. Many countries don't have food-based dietary guidelines (FBDGs), which are an important tool for sustainable healthy diets. Governments, in cooperation with scientific institutions, should support developing, where appropriate, evidence-based FBDGs for various age groups and people with special dietary requirements that define context-specific sustainable, healthy diets by taking into account social, cultural, ancestral, scientific, economic, traditional, ecological, geographical and environmental drivers. Countries need methodological guidance to develop or revise existing FBDGs that take into consideration country-specific situations and environments while considering the FAO–WHO guiding principles for healthy diets. Food System Based Dietary Guidelines (FSBDG) development and implementation with technical support from FAO and other UN agencies is key policy action for transition to sustainable healthy diets and food systems transformation.
- There is need to develop and establish harmonized food system data collection in the framework with indicators that measure components, status, progress, drivers and outcomes of food systems at national levels for mapping ECA food systems and compare components of food systems across countries and regions.
- Data collection for evidence-based policymaking is critical, using established national monitoring frameworks for continual national food system data collection, monitoring and surveillance using harmonized methodology for evaluating and tracking progress in achieving national targets, gauging the effectiveness of national plans and policies, and identifying subsequent actions. The Food Systems Dashboard is one example.
- Food, nutrition and health research infrastructure is an important element for evidence-based policymaking and for monitoring, evaluating and assessing food systems. There is a need for food, nutrition and health research infrastructure development. Policies should prioritize a citizen-centred, multinational, multidisciplinary and multistakeholder research infrastructure to provide standardized and customer-friendly tools and services that generate and unify evidence from currently separate research communities into a food systems perspective.
- Capacity development is needed in the harmonization of the research infrastructure for food systems monitoring, assessment and evaluation at national, regional and global levels for evidence-based policymaking for food systems transformation.
- Also needed are education and training about sustainable food systems for healthy diets. There is a need to enhance capacity development in nutrition and food systems, promote networking and collaboration, appropriately train the workforce, and update training programmes to cover new developments in understanding foods and food systems in addition to the wider ecological context. Modules on sustainable food systems for healthy diets and improved nutrition should be integrated into extension services and delivered to actors involved in all elements of food systems.
- Capacity development and training are needed for relevant food system actors and stakeholders in sustainable and healthy diets and food systems to cover new developments.
- It is necessary to translate research and innovation knowledge into practice for policymakers in government, for consumers and citizens, for food producers, and for the private sector.
- It is important to transfer knowledge and improve food systems communication and education. To assist in the changing of dietary patterns, there is a need for communication tools and education materials about sustainable food systems and healthy diets to be made available to policymakers, consumers, media, schools, food industry, civil society organization and the entire community.

- Gaps exist in education, practical training and continuing professional development among trainees and public health practitioners related to sustainable food systems. Modules are needed on sustainable food systems for healthy diets and improved nutrition.
- Evidence-based guidance is needed on issues such as labelling, food reformulation, digital food environments and sustainable, healthy public procurement. Innovative tools (including digital tools) can be used to better inform consumers through food labelling campaigns, strategies on the link between healthy and safe food consumption practices, and other aspects such as sustainability, the environment, climate change and diversity to empower them to make conscious and responsible choices.
- The impact on food safety of dynamic changes in global megatrends and in agrifood systems necessitates the recognition of essential connections, integrated all-levels food safety governance, and upgraded education in line with the One Health approach for adequate prevention, mitigation and trade-offs, aiming to ensure safe food through the optimized health of people, animals and ecosystems.
- The global outbreak of coronavirus disease in 2019 (COVID-19) disrupted agricultural and food systems around the world and brought attention to the importance of building resilience to vulnerabilities, shocks and stress. There is a need for the development of effective pandemic policy responses and actions to mitigate changes, improve food environments and build resilient food systems that incorporate healthy nutrition.
- To achieve the integration of principles of nutrition-sensitive and sustainable agriculture into mainstream food systems, it is necessary to invest resources in research and in the education of all actors and to create integrative programmes for associations, cooperatives, and individual smallholders to adopt and improve production practices following principles of sustainable agroecology, agricultural biodiversity and climate-smart agriculture.
- There are both a need and call for regulations that effectively limit children's exposure to unhealthy food marketing. Marketing is quickly and constantly evolving, and new techniques and channels require new and efficient ways to advance policies. Regulation is needed specific to food marketing in the digital and retail environments. Applying a child rights-based approach supports effective policy development. Governments, as key stakeholders in policy development, are encouraged to set clear definitions, thereby allowing for uniform policy implementation. There is a need to support countries in policy development, policy implementation, monitoring and evaluation.
- To be effective, school-based food and nutrition education (SFNE) should comprise a combination of evidence-based and behaviourally-focused educational strategies that are context specific, that involve the active participation of the most relevant influencers of food practices (schoolchildren, parents, school staff, local smallholder farmers and rural enterprises, community leaders, etc.), and that are reinforced by an enabling school food environment in empowering children and adolescents to become active participants in shaping the food system to be better able to deliver healthy and sustainable diets.
- Schools and preschools provide an excellent opportunity to address the various causes of malnutrition by promoting healthy diets and improved nutrition. Integrated school food and nutrition education initiatives have the potential to mobilize schools and communities to act towards the improvement of nutrition and health.
- Policies must address the facilitated availability of healthy, diverse foods in schools, banning unhealthy food marketing and improving education on nutrition and healthy lifestyles. Implementation of the "whole school approach" in SFNE involves the national curriculum, extracurricular activities and/or school food and nutrition programmes. Learning activities are reinforced by a nutrition- and health- friendly school environment that involves the participation of all school personnel, families and the community.

- Harmonized and detailed food consumption data, such as what are available from the FAO/WHO Global Individual Food consumption data Tool (FAO/WHO GIFT) and EFSA, are needed to allow for the comparison of various countries and population groups, monitoring, evaluation and risk assessment.
- Due to the complex nature and multiple causes of malnutrition, improving nutrition and health requires government support with SMART commitments and the collaboration of multiple sectors, including agriculture, health, education, trade, environment and social protection. The whole food system is involved, including all elements and activities related to the production, processing, distribution, preparation and consumption of food and the outputs of these activities, including socioeconomic and environmental outcomes.
- Policymakers need to ensure that multiple stakeholders from food systems work together to achieve the SDGs, deliver high-quality diets and implement follow-up actions from the FAO/WHO ICN2 FfA policy recommendations and Declaration on Nutrition, the key messages from the Regional Symposium on Sustainable Food Systems for Healthy Diets in Europe and Central Asia, the United Nations Decade of Action on Nutrition, European Commission policy recommendations, the United Nations Food Systems Summit and Nutrition for Growth (N4G) Summit joint statement, and others.

The transformation of current food systems to improve the availability, affordability and uptake of nutritious, healthy safe, affordable and sustainable diets is key to tackling malnutrition in all its forms and diet-related NCDs. *“FAO’s Strategic Framework 2022–2031 seeks to support the 2030 Agenda through the transformation to MORE efficient, inclusive, resilient and sustainable, agri-food systems for better production, better nutrition, a better environment, and a better life, leaving no one behind.” (FAO’s Strategic Framework 2022–2031 Food and Agriculture Organization of the United Nations Rome, October 2021)*

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Annex 1. Tables

Annex Table A0. Selected indicators of food insecurity and malnutrition in selected countries and subregions of the ECA region

Regions/countries	PoU		Severe food insecurity		Stunting		Child overweight		Adult obesity		Anaemia		Wasting		Overall state of nutrition
	2009–2011	2018–2020	2014–2016	2018–2020	2010	2020	2010	2020	2010	2016	2010	2019	2010	2020	2020
World	9.4	8.9	8.2	10.5	27.7	22.0	5.6	5.7	11.2	13.1	28.6	29.9	n.a.	6.7	
Europe and Central Asia	<2.5	<2.5	1.9	1.9	10.2	7.3	10.4	7.1	20.8	23.3	16.0	17.4	n.a.	1.9	
Central Asia	5.5	3.2	1.7	3.1	17.1	10.0	9.5	5.6	14.7	17.7	29.9	28.1	n.a.	2.4	UM
EU-27 and the United Kingdom of Great Britain and Northern Ireland	<2.5	<2.5	1.6	1.2	3.2	2.8	5.9	5.7	20.5	22.9	11.8	13.5	n.a.	0.7	less concern
Albania	4.9	3.9	10.0	8.8	20.3	9.6	23.6	14.6	18.2	21.7	21.1	24.8	n.a.	1.6	OMU
Armenia	4.3	3.4	1.2	1.1	15.6	9.1	15.9	10.8	17.5	20.2	18.0	17.3	4.1	4.4*	OMU
Kyrgyzstan	8.3	7.2	n.a.	1.1	17.7	11.4	8.4	5.8	13.4	16.6	34.2	35.8	1.3	2	UM
North Macedonia	3.4	2.7	3.6	5.0	6.6	4.1	14.4	10.0	20.1	22.4	16.8	19.3	1.8	3.4	OM
Poland	<2.5	<2.5	1.8	<0.5	2.4	2.3	5.6	6.7	20.8	23.1	n.a.	n.a.	0.7	n.a.	O
Ukraine	<2.5	<2.5	2.0	2.5	19.2	15.9	27.9	17.0	22.0	24.1	13.8	17.7	8.2	n.a.	OM

Source: FAO, WFP, UNECE, UNICEF, WHO, WMO. 2021. Regional Overview of Food Security and Nutrition in Europe and Central Asia 2020: Affordable healthy diets to address all forms of malnutrition for better health. Budapest. FAO, WFP, UN, UNICEF, WHO and WMO. <https://doi.org/10.4060/cb3849en>.

*Latest data from 2015. PoU: Prevalence of undernourishment; U: underweight; O: overweight; M: micronutrient deficiencies

Annex Table A0-1. Availability for consumption (g per capita per day) of prominent food subgroups in selected countries of the ECA region, 2015–2017

Food group	Consumption (g/capita/day) 2015–2017									EAT-Lancet Commission report (2019)			The Global Burden of Disease study (2017)- GBD study		
	Armenia	Kyrgyzstan	Albania	North Macedonia	Ukraine	Poland	Central Asia	European Union	World	Target reference for healthy diet			Target reference for healthy diet		
										point	range from	to	point	range from	to
Cereals – excluding beer	400.6	451.2	408.0	359.7	445.5	390.3	455.9	350.5	480.4	232 g			130 g	150 g	
Fruits & vegetables	1339.1	598.1	1241.7	989.9	578.1	488.0	845.7	535.2	591.9						
Vegetables	1023.9	495.0	770.1	721.1	448.8	320.6	642.8	299.1	386.6	300 g	200 g	600 g	360 g	290 g	430 g
Fruits – excluding wine	315.2	103.1	471.6	268.8	129.3	167.4	202.9	236.2	205.4	200 g	100 g	300 g	250 g	200 g	300 g
Pulses	7.6	13.8	16.3	14.1	4.8	5.4	2.8	7.5	19.9	75 g	0	100 g	60 g 70 g		
Beans	4.4	13.1	15.3	9.3	0.0	2.1	1.9	2.2	6.8						
Peas	0.9	0.7	0.0	2.4	3.0	3.2	0.8	2.5	2.5						
Pulses, other and products	2.2	0.1	1.0	2.4	1.8	0.1	0.1	2.9	10.6						
Sugar & sweeteners	144.4	143.8	101.5	144.3	171.9	119.9	54.0	120.6	72.5	0	31 g	5 g			
Nuts and products	5.2	6.2	9.3	9.6	3.4	2.5	4.2	10.1	5.6	50 g	0	75 g	21 g 25 g		
Vegetable oils	26.4	16.3	21.9	46.5	29.6	19.2	34.5	45.3	28.2	40 g	20 g	80 g			
Meat	120.6	86.1	119.3	98.0	128.3	237.5	113.3	224.7	116.3						
Red meat	81.8	71.9	81.6	46.2	66.5	157.4	90.8	156.5	72.8	14 g	0	28 g	23 g	18 g	27 g
Poultry meat	38.7	10.1	37.6	51.5	60.3	79.8	18.1	63.8	41.2	29 g	0	58 g			
Milk – excluding butter	549.5	566.3	1036.4	427.7	396.6	480.9	566.4	645.5	239.5	435 g	350 g	520 g	250 g	0 500 g	
Fish total	30.5	4.9	16.9	20.0	34.2	34.8	12.2	73.3	77.3	28 g	0	100 g	20 g		
Fish, seafood	17.3	3.7	14.7	17.3	28.6	29.3	7.2	63.3	55.3						
Fresh-water fish	13.1	1.1	2.3	2.7	5.5	5.5	5.0	10.1	22.0						

Source: Calculated by authors based on FAOSTAT data

Annex Table A0-2. Percentage of consumption levels of selected ECA countries compared to world average level 2015–17

Percentage of consumption levels	Compared with World Average								
	Albania	Armenia	Kyrgyzstan	North Macedonia	Poland	Ukraine	Central Asia	European Union	World
Cereals – excluding beer	85%	83%	94%	75%	81%	93%	95%	73%	100%
Fruits & vegetables	210%	226%	101%	167%	82%	98%	143%	90%	100%
Vegetables	199%	265%	128%	187%	83%	116%	166%	77%	100%
Fruits – excluding wine	230%	153%	50%	131%	82%	63%	99%	115%	100%
Pulses	82%	38%	69%	71%	27%	24%	14%	38%	100%
Beans	224%	65%	192%	136%	31%	0%	27%	32%	100%
Peas	0%	36%	27%	97%	126%	119%	32%	99%	100%
Pulses, other and products	9%	21%	1%	22%	1%	17%	1%	27%	100%
Sugar & sweeteners	140%	199%	198%	199%	165%	237%	74%	166%	100%
Nuts and products	167%	92%	112%	172%	45%	60%	75%	181%	100%
Vegetable oils	78%	94%	58%	165%	68%	105%	122%	161%	100%
Meat	103%	104%	74%	84%	204%	110%	97%	193%	100%
Red meat	112%	112%	99%	63%	216%	91%	125%	215%	100%
Poultry meat	91%	94%	25%	125%	194%	147%	44%	155%	100%
Milk – excluding butter	433%	229%	236%	179%	201%	166%	236%	270%	100%
Fish total	22%	39%	6%	26%	45%	44%	16%	95%	100%
Fish, seafood	27%	31%	7%	31%	53%	52%	13%	114%	100%
Freshwater fish	10%	60%	5%	12%	25%	25%	23%	46%	100%

Source: FAO.2021. FAOSTAT data

Annex Table A0-3. Final consumption expenditure of households by consumption purpose (COICOP 3 digit) in selected central and southeastern European countries for 2010 and 2019

COICOP	Percentage of GDP		Percentage of total		Current prices, million euro	
	2010	2019	2010	2019	2010	2019
EU-28	6.8	6.5	12.2	12.1	875,159.80	1,078,115.20
Central and southeastern European countries						
Albania	29.7	31.5	36.6	38.0	2,670.90	4,336.40
Bosnia and Herzegovina	27.6	22.8	32.3	29.5	3,584.30	4,112.90
Croatia	12.7	13.0	18.5	18.2	5,789.30	7,228.90
Czechia	7.1	7.2	14.0	15.2	11,217.40	16,306.00
Estonia	10.7	9.5	19.8	19.3	1,572.70	2,626.00
Hungary	8.9	8.6	16.5	17.2	8,873.40	12,623.60
Latvia	12.6	10.5	20.3	18.1	2,257.30	3,211.80
Lithuania	15.4	12.2	24.1	20.3	4,308.10	5,950.10
Montenegro	29.7	22.7	30.2	24.5	929.60	1,121.50
North Macedonia	23.6	20.3	31.0	30.6	1,677.80	2,270.90
Poland	11.6	9.4	19.1	16.4	42,014.50	49,977.90
Romania	16.5	15.3	26.4	25.2	20,715.20	34,211.00
Serbia	18.9	15.7	25.6	23.6	5,977.90	7,230.50

Source: Eurostat. 2021. HBS. (https://ec.europa.eu/eurostat/databrowser/view/NAMA_10_CO3_P3__custom_271244/bookmark/table?lang=en&bookmarkId=d11abfa0-c6f5-4dda-9070-06bff2069d68)

Part II

SUSTAINABLE AND NUTRITION-
SENSITIVE FOOD SYSTEMS
FOR HEALTHY DIETS AND THE
PREVENTION OF MALNUTRITION
IN EUROPE AND CENTRAL ASIA –
REGIONAL-LEVEL STUDIES

Chapter 1

Challenges and opportunities to support food systems transformations for healthy and sustainable diets in central and southeastern Europe

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Abstract

The FAO/WHO ICN2 Rome Declaration on Nutrition and its Framework for Action, the 2030 Agenda for Sustainable Development and its SDGs, the United Nations Decade of Action on Nutrition 2016–2025 and other important related events and documents have engaged many countries worldwide in prioritizing nutrition and addressing malnutrition in all its forms by undertaking policy measures and projects to transform food systems to promote healthy diets. Policy implementation in countries across Europe and Central Asia indicates significant improvements in food systems. Encouragement and guidance for countries to focus on further food system transformations is necessary.

The objective of this review is to assess, evaluate and recommend priorities in policy development that are most relevant to sustainable food systems in the countries of central and southeastern Europe for healthy diets. A review of the current state of various food system elements was conducted in 2018 using a comprehensive online survey distributed to 17 countries in central and southeastern Europe, of which 15 responded. Country representatives were from various institutions in the agrifood–nutrition–health sector. A review of food system elements in the selected countries has revealed various challenges in food systems.

Conclusions and recommendations were made by an expert panel and formalized in the Belgrade Declaration. These recommendations proposed a number of specific actions related to governance and public health nutrition, the food supply chain and food environment, consumer behaviour, research, education, training of (future) professionals, networking, and the sharing of knowledge and experiences for establishing collaborations among capacity development networks.

Keywords: *Sustainable food systems; central and southeastern European countries; Belgrade Declaration; Healthy diets; Malnutrition prevention, Sustainable Development Goals (SDGs)*

Introduction

Low-quality diets are the primary risk factor for NCDs, as reported by the Global Burden of Disease study in 2019. Six of the top 11 risk factors driving the increase of NCDs are related to diet and are a main contributor to high DALY (disability-adjusted life years) values in the ECA region, especially in eastern European countries, which have experienced a rapid rise in income levels in the past two decades (GBD 2019 Risk Factors Collaborators, 2020). Low-quality diets contribute to all forms of malnutrition. The *Europe and Central Asia Regional Overview of Food Security and Nutrition* highlights key characteristics of malnutrition in the region, where many countries continue to experience relatively high prevalence of stunting among children younger than 5, anaemia among women of reproductive age, and obesity among adolescents and adults. The triple burden of malnutrition – undernutrition, overweight and obesity – and micronutrient deficiencies are present to varying degrees in all countries of the ECA region (FAO, 2015, 2019; Mazzocchi *et al.*, 2014).

Given the complexity of dietary behaviour and the wide range of drivers that influence diets, improving diets requires the active collaboration of a variety of actors throughout the food system, supported by dedicated policies targeting multiple food system sectors (EAT-Lancet Commission, 2019a). Major steps in international policy regarding nutrition have been taken since the FAO & WHO ICN2, which resulted in the Rome Declaration on Nutrition (FAO/WHO, 2014a), the Framework for Action (FAO/WHO, 2014b), the 2030 Agenda for Sustainable Development, the SDGs (UN, 2015), and the United Nations Decade of Action on Nutrition 2016–2025 (UN General Assembly, 2016). As a result of this important conference, many countries around the globe have repositioned nutrition as a priority on their policy agendas. Governments confirmed their commitments to addressing malnutrition in all its forms by taking action to transform food systems and promote healthy diets (Amoroso, 2018). The aforementioned policy processes have placed nutrition firmly at the heart of the sustainable development agenda, recognizing that transformation towards sustainable food systems has a fundamental role to play in promoting healthy diets and fighting malnutrition. Monitoring policy implementation in ECA countries indicates significant improvements in the food and drink environment. It is still necessary to encourage Member Nations to focus on food systems transformations (Breda *et al.*, 2020; WHO, 2018a).

Food system transitions provide a huge opportunity for the improvements of diets. According to the definition of the High-Level Panel of Experts (HLPE), a food system “gathers all the elements (environment, people, inputs, processes, infrastructures, institutions, etc.) and activities that relate to the production, processing, distribution, preparation and consumption of food, and the output of these activities, including socioeconomic and environmental outcomes” (HLPE, 2017). The HLPE’s conceptual framework for food systems contains three core elements:

1. **food supply chains** that include production systems, storage and distribution, processing and packaging, and retail and markets;
2. **food environments** that include availability and physical access (proximity), economic access (affordability), promotion, advertising and information, and food quality and safety; and
3. **consumer behaviour** that reflects choices and decisions made by consumers at the household or individual level on what food to acquire, store, prepare, cook and eat, and on the allocation of food within the household.

The conceptual framework identifies six main categories of drivers of food systems changes: biophysical and environmental, innovation, technology and infrastructure, political and economic, sociocultural, and demographic.

Sustainable food systems emphasize the role of diets as a core link between food systems and their health and nutrition outcomes. Food supply chains, food environments and consumer behaviour are key drivers for better nutrition and health. Sustainable food systems are economic, social and environmental bases that generate food security and nutrition for future generations.

The FAO/WHO International Symposium on Sustainable Food Systems for Healthy Diets and Improved Nutrition held in December 2016 in Rome, Italy, provided multiple actors with an opportunity to share practical solutions and successful country experiences in implementing sustainable food systems for healthy diets. It also served as a forum to update the global community on the actions countries have taken to comply with ICN2 commitments (FAO & WHO, 2017).

To increase comprehension of the food system perspective and its application in practice, the FAO/WHO jointly organized, in cooperation with UNICEF and United Nations World Food Programme (WFP), the Regional Symposium on Sustainable Food Systems for Healthy Diets in Europe and Central Asia, held 4–5 December 2017 in Budapest, Hungary (FAO Regional Office for Europe and Central Asia, 2017), <https://www.fao.org/europe/events/detail-events/en/c/1034293/>. The main objectives of the symposium were to:

1. support countries in their efforts to enhance the implementation of the ICN2 FfA for achieving the SDG targets and nutrition-related national priorities;
2. engage all relevant stakeholders more actively in the process launched by ICN2 and by the United Nations Decade of Action on Nutrition; and
3. facilitate the transformation of food systems to provide healthy diets and improved nutrition in a multisectoral, collaborative and coherent manner.

The important takeaways from the symposium are focused on nutrition governance, partnerships, and cooperation and capacity development in the region. These measures are seen as key steering forces in transforming food systems.

BOX 1-1. Key messages from the 2017 Regional Symposium on Sustainable Food Systems for Healthy Diets in Europe and Central Asia

The symposium discussed sustainable food systems along four thematic areas:

1. **nutrition-sensitive agriculture and food systems**
2. **food demand and food environments**
3. **improving nutrition of children**
4. **governance, leadership, and accountability for nutrition.**

A. Key messages for governments

Governments, as major actors responsible for driving changes to food systems, should formulate country-specific SMART (specific, measurable, achievable, relevant and time-bound) commitments for action towards the eradication and prevention of all forms of malnutrition at the country level, including improvements in diets through sustainable and resilient food systems for meeting the SDGs and national commitments to ICN2. Governments should define and formulate specific policies that include educating consumers on healthy

diets and on shifts in investment priorities to ensure that diverse, nutritious and safe foods that meet local requirements based on cultural preferences and taste are available and affordable to all in a sustainable manner.

Governments should ensure, wherever possible, that actions to address malnutrition in all its forms serve “double duty,” meaning that they contribute simultaneously to the prevention of both undernutrition and overweight/obesity.

Governments should involve non-state actors, the private sector (producers, processors, professional associations, etc.), civil society, academics and consumers in policy dialogues on issues related to agriculture, food and nutrition in capacity development, awareness raising and advocacy.

Governments should take action to ensure that adequate capacities of national statistical services are developed for the monitoring of SDG indicators and to strengthen data collection and analysis for evidence-based policymaking, including food consumption and nutrition data, surveillance of child growth and the nutritional status of the population, food composition data of commonly available local foods, data on food contaminants, etc.

B. Key messages for non-state actors

Non-state actors can effectively contribute to the positive transformation of the food sector and to the development of sustainable food systems. In particular:

- **The private sector should ensure the diverse and affordable supply of nutritious and safe food.**
- **The research sector should undertake more (independent) research to support the transformation of (local) food systems and explore options for supporting and enhancing biodiversity and ecosystem services. Findings should be communicated to the public, academics, researchers and consumers, ensuring the mutual interaction of the science community and society for scientific breakthroughs and food chain innovations.**
- **Education initiatives should support and create an enabling environment for effective action on nutrition, boost the development of leadership skills among nutrition professionals, and facilitate collaboration among different stakeholders.**

C. Key messages on nutrition governance and capacity development in the region

The symposium also urged good governance, leadership and accountability for nutrition. To that end, it was requested that governments:

- **establish high-level national cooperation mechanisms for nutrition-related planning, coordination and accountability;**
- **create platforms for multisectoral consultations and expert advice, knowledge-sharing, decision-making and prioritization in food security, nutrition and food systems;**
- **identify nutrition targets and indicators during the SDG nationalization process;**
- **involve the food and agriculture sector in nutrition governance; and**
- **increase resource allocation for nutrition in each relevant ministry.**

Source: FAO. 2018. Thirty-first Session: Outcome of the Regional Symposium on “Sustainable Food Systems for Healthy Diets in Europe and Central Asia”, Voronezh, Russian Federation, 16-18 May 2018. <https://www.fao.org/3/mw166en/mw166en.pdf>

Strong nutrition governance at the national level, with the involvement of multisectoral stakeholders, is of great importance for sustainable food system transformations.

The symposium provided a platform for multisectoral interaction and the sharing of good practices involving representatives from the food and agriculture, health, education and social protection sectors. Stakeholders exchanged knowledge, views, practical solutions, good experiences and lessons learned from the implementation of policy options. They also shared strategies for improving the nutritional status and health of all groups of the population.

The technical recommendations from the symposium informed policymakers and decision-makers at the Thirty-first Session of the FAO Regional Conference for Europe, held in May 2018 in Voronezh, Russian Federation (FAO/WHO, 2018). To support countries and other stakeholders in translating the ICN2 voluntary policy recommendations into concrete and SMART country-specific commitments for action on nutrition, FAO and the WHO developed a Strengthening Nutrition Action guide that includes actionable approaches for the 60 recommended policies and actions summarized in the ICN2 FfA (FAO & WHO, 2018; FAO/WHO, 2014b). Recently, a food policy special issue highlighted various good practices and food policy discussions related to the transformation of current food systems towards social, environmental and economic sustainability in the ECA region (Dupouy and Gurinović, 2020).

To draw more attention to the food system approach for healthy diets in the ECA region and disseminate key messages from the aforementioned symposium, the Network for Capacity Development in Nutrition in central and southeastern Europe³ (CAPNUTRA⁴) organized a three-day symposium on sustainable food systems for healthy diets for countries of central and southeastern Europe, with integrated training on collecting food consumption data and strengthening the thematic regional networking from 15–17 October 2018 in Belgrade, Serbia,⁵ in close collaboration with and with support from the FAO Regional Office for Europe and Central Asia.⁶

The symposium was attended by 42 participants from 26 countries, representing a wide range of stakeholders, government officials, research and academic institutions, FAO, UNICEF and the EFSA. Twenty-six oral presentations were given, and 20 posters were presented. The symposium materials are available at the CAPNUTRA website.⁷

³ Central and southeastern European countries included: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Czechia, Estonia, Hungary, North Macedonia, Republic of Moldova, Montenegro, Latvia, Lithuania, Poland, Romania, Serbia, Slovakia and Slovenia.

⁴ More information on the Network for Capacity Development in Nutrition in central and southeastern Europe (CAPNUTRA) is available at <http://www.capnutra.org/>.

⁵ Information about CAPNUTRA events is available at <https://www.capnutra.org/events/>.

⁶ The FAO Regional Office for Europe and Central Asia is online at <http://www.fao.org/europe/en/>.

⁷ Information about CAPNUTRA events is available at <http://www.capnutra.org/events/>.

The main thematic areas of the symposium were:

1. governance, leadership and accountability for nutrition
2. public health and the food system: food, nutrition and health research infrastructure
3. food supply, food demand and food environment
4. improving the nutrition of vulnerable groups
5. nutrition education and food systems
6. capacity development and training in the harmonization of food consumption collection and dietary intake survey in central and southeastern Europe
7. networking and establishing collaboration among subregional capacity development networks

During the symposium, experts highlighted the major challenges in these seven thematic areas of food systems for healthy diets and nutrition (Global Panel, 2018; Global Panel on Agriculture and Food Systems for Nutrition, 2016; HLPE, 2014, 2017). An overview of the identified status of various elements of food systems in central and southeastern Europe was presented. Participants discussed the importance of building capacity for sustainable food systems to advance public health nutrition in the central and southeastern Europe region by linking existing regional networks and further developing the research infrastructure (Van 't Veer, Poppe and Fresco, 2017). Participants emphasized that nutrition governance at the national level, with the involvement of governmental bodies, various sectors and stakeholders, is crucial for sustainable food system transformations and healthier diets (FAO/WHO, 2014a).

The transformation of current food systems should improve availability, affordability and sustainability and boost the uptake of nutritious and safe foods, which would result in healthier diets and help reduce all forms of malnutrition and diet-related NCDs. The synergetic approach to tackling multiple forms of malnutrition at the same time uses “double duty” policy measures (Branca *et al.*, 2019; Hawkes *et al.*, 2020). UNICEF's Innocenti Framework on Food Systems for Children and Adolescents proposes the main measures needed for food systems to be able to deliver nutritious, safe, accessible, affordable and sustainable diets to children and adolescents.

Major elements include four areas of improvement: food supply chains; external food environments; personal food environments; and the behaviours of caregivers, children and adolescents. A set of underlying structural factors that impact the functionality of food systems are demographic drivers (urbanization, population growth, migration), political and economic drivers (leadership, policies, trade), innovation and technological drivers (technology, infrastructure, investment), biophysical and environmental drivers (climate change, natural resources management), and social and cultural drivers (norms, traditions, and underlying social dynamics) (UNICEF Office of Research Innocenti, 2018). The EAT-Lancet Commission presents an integrated global framework that considers planetary boundaries and safe operating space for food systems, taking prosperity and healthy diets for future generations into account. For the first time, the Commission provided quantitative scientific targets for healthy diets and sustainable food production. The global adoption of healthy diets from sustainable food systems would safeguard our planet and improve the health of billions of people, now and in the future (EAT-Lancet Commission, 2019b).

Currently, food systems in the European Union, the region and around the world are affected by major challenges, including climate change, migration, a growing world population, urbanization, resource scarcity, the triple burden of malnutrition, aging populations and food poverty. These challenges have been worsened by the COVID-19 pandemic, which has posed a serious threat to the food supply and food security all over the world (HLPE, 2020). Research and innovation are crucial for developing high-impact solutions to future-proof our food systems (den Boer *et al.*, 2021; Directorate-General for Research and Innovation of the European Commission *et al.*, 2022). The Standing Committee on Agricultural Research

(SCAR) Food Systems Strategic Working Group (SWG) has revealed that in the past five years, agriculture, food production and food safety have benefited the most from research and innovation support, while food innovation and nutritional aspects linked to health have not experienced the same attention. The interconnectedness of food system elements needs to be included in various national research programmes to accommodate nutritional and health aspects and look beyond sectoral approaches by linking food system elements that simultaneously address multiple SDG objectives.

Possible solutions to fill current research and innovation gaps could be found by promoting existing working platforms to collaborate with various sectors and stakeholders, including the public. This type of “systems thinking” provides stronger and prolonged influence and co-ownership of outcomes. To see future progress in strengthening food and nutrition security, we also need to create adequate targets and indicators for monitoring – indicators that cover the whole food system and reflect overall outcomes. Measuring progress will demonstrate momentum towards future-proofing European food systems in a sustainable, resilient, responsible, diverse, competitive and inclusive manner (Directorate-General for Research and Innovation of the European Commission *et al.*, 2022).

Zurek *et al.* (Zurek *et al.*, 2018) have presented an integrated approach for assessing food systems and possible innovations, divided into five steps, based on a conceptual framework for the European Union food system. The initiative to establish food, nutrition and health research infrastructure⁸ (FNH-RI, 2019) is presented as an important facilitator to advancing the scientific, evidence-based evidence relevant to the seven thematic areas presented at the symposium and to a citizen-centred transformation of food systems.

This chapter provides an overview of the situation and various elements of food systems in central and southeastern Europe, addressing the main challenges and places for intervention in order to fortify specific food systems elements and provide key policy recommendations for food systems development in the region.

⁸ For more information about FNH-RI, visit <https://fnhri.eu/>.

Regional overview, analysis and identification of the status of various food systems elements in central and southeastern European countries

This regional overview was prepared based on the 15-country inventory conducted by CAPNUTRA, with central and southeastern Europe member state institutions,⁹ prior to the FAO symposium held in Belgrade, Serbia, in 2018. The generic needs, constraints and challenges based on the status of food system elements and horizontal assessments in individual countries are presented to identify priorities for the transformation to sustainable food systems and to provide key policy recommendations that can be used as a basis for regional initiatives.

To identify and evaluate the status of various food system elements in countries and regions, CAPNUTRA and the FAO Regional Office for Europe and Central Asia jointly designed and distributed a questionnaire based on a detailed literature review (FAO & WHO, 2018; HLPE, 2017) and expert consultation. The aim was to collect relevant and updated information on the needs, constraints and challenges in food systems and their contribution to healthy diets in central and southeastern Europe. The final assemblage of questions covered eight selected areas relevant to sustainable food systems:

1. governance, leadership and accountability for food security and nutrition;
2. food, nutrition and health research infrastructure;
3. software tools for food consumption data collection, dietary intake assessment and nutrition planning;
4. capacity in nutrition and nutritional education for professionals;
5. food-based dietary guidelines;
6. food demand and food environment;
7. nutrition of a targeted vulnerable group (children); and
8. sustainable, resilient food systems for healthy diets.

BOX 1-2. Adequate research infrastructure in food, nutrition and health is essential for nutrition epidemiology, innovative nutritional research, dietary exposure, food safety risk assessment, and effective public health nutrition strategies to address diet-related diseases, malnutrition and foodborne diseases.*

Research infrastructure provides a platform for interdisciplinary and multi-national collaboration to facilitate world-class research.**

Research infrastructure includes the associated human resources, comprehensive equipment or research instrumentation, and knowledge-containing resources such as collections, archives and data banks,*** which can be divided into two types:

- a) hard research infrastructures: major buildings, equipment and instruments, and knowledge-containing resources (e.g. e-platforms and data banks)
- b) soft research infrastructures: unique data management, interpretation and handling capacities, harmonization of data and procedures, training staff, professional networks, and knowledge transfer.

* **Source:** Gurinović, M., Milešević, J., Novaković, R., Kadvan, A., Djekić-Ivanković, M., Šatalić, Z., Korošec, M., Spiroski, I., Ranić, M., Dupouy, E. and Oshaug, A., 2016. Improving nutrition surveillance and public health research in Central and Eastern Europe/Balkan Countries using the Balkan Food Platform and dietary tools. *Food chemistry*, 193, pp.173-180. <https://doi.org/10.1016/j.foodchem.2015.03.103>

** EC, 2013

*** ESFRI, 2010

⁹ The responses in the questionnaire reflect the individual views of the national representatives and not of the organizations in which the persons are working.

Data collection was conducted through a self-administered survey distributed online. An online survey approach was selected because this platform can rapidly distribute questionnaires and reduce the cost of analysis facilitation. Experts in the field of nutrition from 17 participating countries were invited to respond to the survey. The countries invited were Albania (coded as AL, using the ISO Country Alpha-2 Code), Bosnia and Herzegovina (BA), Bulgaria (BG), Croatia (HR), Czechia (CZ), Hungary (HU), North Macedonia (MK), Montenegro (ME), Republic of Moldova (MD), Latvia (LV), Lithuania (LT), Estonia (EE), Poland (PL), Romania (RO), Serbia (RS), Slovakia (SK) and Slovenia (SI).

Regional overview and analysis of countries' food systems elements and status

Fifteen of the 17 invited countries in central and southeastern Europe participated in the survey. Data from Slovakia and Croatia were not provided until the submission of the report. The status of food system elements derived from the evaluation of responses to the questionnaire was used as a backbone for the Belgrade Declaration, strengthening regional capacities for sustainable food systems transitions for healthy diets and nutrition in central and southeastern Europe. A detailed summary of the status of food systems elements in central and southeastern Europe can be found in the Table 1-0-3 at the end of the chapter.

Governance, leadership and accountability for food security and nutrition

Nutrition governance, strategic planning and budget allocation in the countries of central and southeastern Europe

Recommendation 1 (FAO/WHO, 2014b) from the ICN2 FfA highlighted an increase in allocations for nutrition spending in national budgets¹⁰ and found that improving nutritional outcomes within existing spending on agriculture and food is a prerequisite for building a sustainable food system (HLPE, 2017). However, the majority of countries from central and southeastern Europe (nine of the 15) reported that they still do not have any budget allocated for this purpose. In six countries (Bulgaria, Lithuania, Poland, Republic of Moldova, Romania and Slovenia), a part of the overall annual budget is allocated for the implementation of the national nutrition strategy, policy and action plans. The share of the budget allocated for nutrition ranged from 0.01 percent (Republic of Moldova) to 0.18 percent (Slovenia), while data from other countries are missing.

Emphasized at the Regional Symposium on Sustainable Food Systems for Healthy Diets in Europe and Central Asia was that each country in the region should establish an authoritative body for nutrition and food systems measures – preferably including members from multiple sectors (FAO/WHO, 2018). Eight countries reported that there are national multisectoral and multistakeholder coordination mechanisms that address countries' existing food security and nutrition challenges. National nutrition committees have been established in six countries (Republic of Moldova, Bulgaria, Romania, Slovenia, Latvia, Czechia), while nine countries still do not have a similar governmental body. Despite the lack of official national nutrition committees, the majority of countries participating in the survey (87 percent) have different types of strategic documents regarding nutrition (nutrition strategies, national food and nutrition action plan, etc.) created by different ministries. Reported strategies and plans are either integrated into national health plans or are

¹⁰ ICN2 FfA Recommendation No.1: Enhance political commitment and social participation for improving nutrition at the country level through political dialogue and advocacy. FAO/WHO (2018) Strengthening Nutrition Action: A resource guide for countries based on the policy recommendations of the Second International Conference on Nutrition (ICN2) gives example of SMART commitment related to budget allocations, e.g. "As of 2019 onwards, the Ministry of Finance will ensure that XX percent of the public sector government budget will be allocated yearly to nationwide programs for enhancing food security and improving nutrition."

developed to specifically focus on nutrition. This is the case in Slovenia, which has implemented a national programme on food and physical activity for nutrition for 2015–2025. Procedures and practices to monitor and evaluate the implementation of policies, strategies and programmes exist in 11 countries (73 percent), while national nutrition plans with country-specific SMART commitments have been developed in just four of the 15 participating countries. Because making SMART commitments is the responsibility of national governments, the initiation and establishment of functional nutrition committees will take some time and might not be fully accomplished until the end of the Decade of Action for Nutrition.

Capacity development in monitoring and surveillance: nutrition data collection for evidence-based policymaking

The data management of nutrition and health indicators is essential for comparing development in central and southeastern Europe. These indicators include monitoring the dietary intake and nutritional status of the population, evaluation of the impacts of interventions, and providing information for political decision-making. The current collection of nutrition data for evidence-based policy is evaluated by screening the available data related to anthropometric measurements, biomarkers of nutrient intake, and food consumption. Anthropometric data on child growth is collected in all countries (**Table 1-0-1**). However, collection frequency and data collection/monitoring systems are diverse and are not yet regulated or harmonized. The data reported here have been collected by different institutions or within various projects or initiatives.

Table 1-0-1. Review of the collection of anthropometric data on child growth monitoring and frequency of data collection in central and southeastern Europe

Country	Anthropometric data on child growth monitoring	Frequency of data collection
AL	√	Not periodically
BA	√	Every four years
BG	√	Every five years
CZ	√	Not periodically
EE	√	Not periodically
HU	√	Annually/biannually
LT	√	Annually
LV	√	Biannually
MD	√	Annually/every five years
MNE	√	Not periodically
NMK	√	Annually
PL	√	Not reported
RO	√	Annually
RS	√	Annually
SI	√	Annually

Source: Data extracted from the survey of this study in 2018

Anthropometric data for adult populations exist in all countries of central and southeastern Europe (**Table 1-0-2**). Data on biomarkers of nutrient intake in adult populations are available in nine countries for different nutrients and different population groups. These data were collected from small survey samples for different research projects.

Table 1-0-2. Review of the collection of anthropometric data on adult population and frequency of data collection in central and southeastern Europe

Country	Data on nutritional status of adult population [Anthropometric data]	Data on nutritional status of adult population [Biomarkers of nutrient intake]	Frequency of data collection
AL	√	√	Not periodically
BA	√	X	Every two years
BG	√	X	Every five years
CZ	√	√	Irregularly
EE	√	X	Every two years/every seven years
HU	√	X	Every five years
LT	√	√	Every five years
LV	√	√	Irregularly
MD	√	√	Every five years
MNE7	√	√	Irregularly
NMK	√	X	Every six years
PL	√	√	Every five years
RO	√	√	Annually
RS	√	X	Every five years
SI	√	√	Every four years

Source: Data extracted from the survey of this study in 2018

A monitoring and surveillance system for nutrition data collection has been established in seven countries (Lithuania, Estonia, Hungary, Bulgaria, Romania, Slovenia, Czechia). Four of these countries collect data every five years. Romania and Czechia collect data continuously – i.e. (bi)annually. Other countries are at different stages of the establishment of monitoring and surveillance systems.

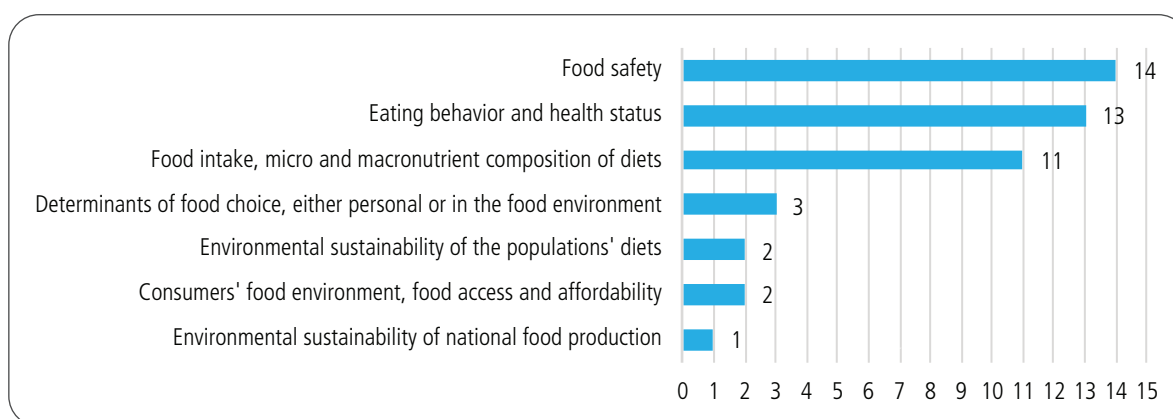
Food, nutrition and health research infrastructure

Adequate research infrastructures in food, nutrition and health are essential for nutrition epidemiology, innovative nutritional research, dietary exposure, food safety risk assessment, and effective public health nutrition strategies to address diet-related diseases, malnutrition and food-borne diseases (Brown *et al.*, 2017; Gurinović *et al.*, 2016b; Snoek *et al.*, 2018). Governments are encouraged to “support scientific research and innovation towards safer foods and healthier diets and develop and support food, nutrition, and health research infrastructure capable of creating an up-to-date, trustworthy base of evidence for policies” (FAO/WHO, 2018). So far, seven countries in central and southeastern Europe (Lithuania, Estonia, Hungary, Bulgaria, Slovenia, Serbia and Czechia) have reported that they have established some kind of information systems related to food and nutrition that provide data on food systems and nutrition policymaking. In most cases, information is derived from food consumption surveys, household budget surveys and food production and expenditures. Food balance sheets collected by FAO are freely available at FAOSTAT (2021).

Aggregated food consumption data are the basis for improving the accuracy of European Union-wide exposure assessments and support diligent nutrition surveillance and diet- and health-related studies. Since 2005, the EFSA has worked in close cooperation with food- and nutrition-related institutions towards harmonizing dietary survey methodologies and building a common European Union food consumption

database. The most important step in this process has been the development of the EFSA Comprehensive European Food Consumption Database, which compiles existing national dietary information from Member Nations. In 2011, EFSA launched the What's on the Menu in Europe? (EU Menu) project with the aim of providing financial and technical support to carry out national dietary surveys in the European Union. So far, ten central and southeastern European countries have undertaken the EFSA EU Menu project. In 2012, Latvia and Estonia started the project. In 2014, Hungary, Slovenia and Romania joined. Poland joined in 2015; Serbia, Montenegro, Bosnia and Herzegovina and North Macedonia in 2016; and in 2017, Montenegro joined for children aged 0–9 years (Gurinović *et al.*, 2022; Ioannidou, Horváth and Arcella, 2020). The most prioritized research areas on the national research infrastructure level in most of the countries are food safety, eating behaviour and health status, food intake, and micro- and macronutrient composition of diets (Figure 1-1).

Figure 1-1. Number of central and southeastern European countries that performed surveys in specific research areas (prioritized areas: food safety, eating behaviour and health status and food intake, micro and macronutrient composition of diets)



Source: Data extracted from the survey of this study in 2018

One of the essential elements related to the food, nutrition and health research infrastructure is the food composition database. Currently, eleven of the 15 central and southeastern European countries have food composition databases, while Montenegro, North Macedonia and Bosnia and Herzegovina are using and adapting the regional food composition database for central and southeastern European countries developed by CAPNUTRA (Gurinović *et al.*, 2016a). Seven of the 15 countries followed European Food Information Resource (EuroFIR) standards in structuring their food composition databases. All food composition databases are available in English and in the country's mother tongue, with the exception of Romania and Hungary, which have food composition databases only in their mother tongues. All food composition databases are available online, with the exception of the Hungarian database, which is available in electronic form with restricted access. Three prominent sources of food composition data are food labels, which are found in 11 food composition databases; laboratory analysis, found in nine food composition databases; and literature, found in seven food composition databases. Twelve food composition databases possess borrowed data.

National dietary reference values¹¹ for nutrients are established in nine of the 15 respondent countries. Albania, Bosnia and Herzegovina, Republic of Moldova, Serbia, Montenegro and Czechia have not established national dietary reference values.

¹¹ "Dietary reference values" is an umbrella term for the complete set of nutrient reference values, including population reference intakes, average requirements, adequate intakes and reference intake ranges for macronutrients. These values indicate the amount of a nutrient that must be consumed on a regular basis to maintain health in an otherwise healthy individual (or population). Source: EFSA, 2019 doi:10.2903/sp.efsa.2017.e15121

Software: nutritional tools for food consumption data collection, dietary intake assessment and nutrition planning

The collection and assessment of food consumption data and the evaluation of food and nutrient intakes require harmonized and standardized data collection, specific methods and protocols, and the application of nutritional assessment tools, which facilitate the compatibility of the results (Gurinović, M., Zeković, M., Milešević, J., Nikolić M., Glibetić, 2016). The process of harmonizing food consumption data collection on the national and regional level in Balkan countries has been initiated with EFSA EU Menu project support and was made possible by the existing Balkan Food Platform, which was developed by CAPNUTRA (Gurinović *et al.*, 2016b). This platform is a home of the Diet Assess and Plan (DAP) assessment tool (Gurinović *et al.*, 2018), a major component for standardized food consumption data collection and analysis. Serbia, Montenegro, Bosnia and Herzegovina and North Macedonia are using DAP for EFSA EU Menu dietary surveys. Beside these, other central and southeastern European countries have their own software solutions for food consumption and nutrient intake surveys, with the exception of Albania and Republic of Moldova.

All reported software solutions can be used to analyse data collected from 24-hour dietary recall/food diary surveys and the Food Frequency Questionnaire (FFQ)/Food Propensity Questionnaire (FPQ), with the exception of Slovenia, which has the capacity only for food diary collection. Lithuania, Hungary, Bulgaria and Czechia have developed PC-based software, while Estonia, Slovenia, Latvia and Serbia have web-based solutions. Bosnia and Herzegovina, Montenegro and North Macedonia are actively using web-based software developed by CAPNUTRA for their nutritional and food consumption research. Poland has developed a smartphone app to collect data for food diary/food consumption surveys.

Capacity in nutrition and nutritional education for professionals

Continuous and innovative education empowers food and nutrition professionals to create an environment in which effective action on nutrition can take place. It can boost the development of leadership, influence skills among nutrition professionals, and facilitate collaboration among different stakeholders (FAO/WHO, 2018). All central and southeastern European countries that participated in this inventory reported available university-level education and training programmes in food and nutrition. However, the number of nutrition professionals/licensed nutritionists is unknown due to the lack of regulations that define the level of education necessary to get the qualification of nutritionist. One of the important nutrition policy indicators is the number of trained nutrition professionals per 100 000 people.¹² Estonia, Hungary, Bulgaria, Romania, Slovenia, Poland and Serbia have established academic-level education and training programmes in food and nutrition. Postgraduate programmes for master's and doctorate degrees in nutrition have been established in Lithuania, Estonia, Hungary, Romania, Slovenia and Serbia. North Macedonia and Czechia have established doctorate programmes in public health and preventive medicine, respectively. These programmes could be related to nutrition, but the degree earned is not in nutrition/human nutrition but is instead classified as medicine or (food) technology. Previous data about nutrition education programmes in central and southeastern Europe identified gaps and opportunities for further capacity building at different levels of the public health nutrition workforce, including on-the-job training with distance learning as well as in-service training (Gurinović *et al.*, 2014).

¹² For information about the Nutrition Landscape Information System (NLiS), visit <https://apps.who.int/nutrition/landscape/report.aspx>.

Food-based dietary guidelines

Science-based food-based dietary guidelines (FBDGs) are guidelines for sustainable nutrition and the prevention of malnutrition in all its forms. By involving governments and other stakeholders as major responsible actors, the FBDG are among the main drivers in the transition towards sustainable food systems (Branca *et al.*, 2019; Hawkes *et al.*, 2020). The development of FBDGs can contribute to the achievement of the SDGs for healthy diets (UN, 2015) and create safe and supportive food environments for healthy nutrition at all ages (Hawkes *et al.*, 2020). Such an environment should provide food security in which “all people, at all times, have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (FAO, 1996). In central and southeastern Europe, national FBDGs are present in the majority of countries, while Serbia, and Montenegro are still developing their guidelines. More than half of FBDGs present in central and southeastern Europe were established more than five years ago. This is important, as sustainability aspects are only captured in the novel FBDGs of several developed countries. In many countries with FBDGs, the sustainability aspects of the guidelines are on paper but are not widely acknowledged or implemented. Updating existent FBDGs in all central and southeastern European countries to include sustainability aspects should be an objective for further work (FAO, 2020a; Herforth *et al.*, 2019). FBDGs are represented as pyramids in the majority of participating countries. Updating the graphics of FBDGs is also an important objective of future work, as the graphical presentation of recommended portion sizes can be imperative to the population’s understanding of what these guidelines mean (Herforth *et al.*, 2019).

Food demand and food environment

Food labelling regulations

In the context of sustainable food systems, food labelling plays a pivotal role in promoting sustainable consumption and production patterns, in accordance with the objectives of SDG 12 (United Nations Statistics Division, 2016). Food labels influence consumer choices, regarding not just nutrition but also other various elements of sustainability, such as recycling, food origin, carbon footprint, etc. Food labelling regulations are established and implemented in all countries of central and southeastern Europe. Bulgaria, Czechia, Estonia, Latvia, Lithuania, Romania and Slovenia have indicated that they have established national food labelling policies that are aligned with European Union Regulation No. 1169/2011 of the European Parliament and of the Council.

Surveys on consumers’ use of nutrition labels are not common in countries of central and southeastern Europe; only Lithuania and Poland have conducted national consumer surveys to assess the use of nutrition labelling that guide healthy food choices. Designing and distributing similar surveys in other central and southeastern European countries would help authoritative bodies design methods and programmes to educate consumers on healthy food choices. Promotion and endorsement of policies for front-of-package labels, for example, could be effective, as these policy measures are already in place in some European countries (Breda *et al.*, 2020).

Policies that limit specific nutrient components in the food supply

Food policies that limit specific nutrient components in foods are established in Bosnia and Herzegovina, Bulgaria, Hungary, Latvia, Lithuania, Republic of Moldova, Montenegro and Slovenia. Lithuania and Republic of Moldova have policies that limit trans-fatty acids, saturated fatty acids, salt and added sugars. Bulgaria limits saturated fatty acids, salt and free sugars. Latvia and Slovenia limit trans-fatty acids and salt,

while Bosnia and Herzegovina and Montenegro have regulated salt content. The other seven countries do not have policies that address and limit harmful nutrient components. This situation was observed in previous policy reviews from 2013 for countries in the region (Lachat *et al.*, 2013). Since the 2013 review, there has been minimal progress in limiting specific nutrient components in these countries.

In particular, industrially produced trans fats, more than any other nutrient, seriously increase the risk of coronary heart disease. Heart disease is the leading cause of death in Europe (European Commission, 2015). Their content is particularly high in certain processed foods, such as bakery products, cakes and biscuits, convenience food and deep-fried products. These foods are commonplace in markets in central and southeastern European countries (Stender, 2020). There is an urgent need for establishing legislation that would limit or eliminate industrially produced trans fats, as this has been shown to be the most effective measure in improving public health and consumer protection in countries such as Denmark, Hungary, Latvia, the United States of America and others (WHO, 2020). In 2019, the European Union Commission adopted a regulation that strictly limits the amount of industrially produced trans fats to a maximum of 2 percent of total fat in foods for the final consumer; this came into effect in 2021. The WHO has provided the REPLACE action package, which can serve as a guide to countries that are in the process of or are completing the elimination of industrially produced trans fats from the food supply (WHO, 2018b).

Similar approaches can apply to other detrimental nutrients: First, set reduction targets through legislation. Second, engage the whole food sector and other stakeholders towards reduction. Third, set up a vigilant monitoring system to follow the progress of reformulations (Breda *et al.*, 2020).

Legislation on foods high in fat, sugar and salt

Only Hungary, Latvia and Montenegro reported on having legislations concerning foods high in fat, sugar and salt, whereas the other 12 countries reported that they did not have this legislation.

Restricting the marketing to children of non-alcoholic beverages and foods high in fat, sugar and salt

In May 2010, at the Sixty-third World Health Assembly, WHO Member Nations endorsed a set of recommendations for the marketing of foods and non-alcoholic beverages to children, Resolution WHA63.14. This was a call to action in an effort to reduce exposure to the harmful influences of food marketing to children through relevant legislative measures that will limit and/or restrict inappropriate marketing and publicity of foods and non-alcoholic beverages (WHO, 2010). The ICN2 FfA recommends (in Recommendation 15) the exploration of regulatory and voluntary instruments such as marketing, publicity, labelling policies, and economic incentives or penalties to promote healthy diets (FAO/WHO, 2014b). National mandatory policies to restrict the advertising of foods high in fat, sugar and salt to children in various media platforms are in place in Hungary, Lithuania, Republic of Moldova, Poland and Slovenia. In Bulgaria, Czechia and Romania, these activities are voluntary. Other countries do not have similar policies, regulations or voluntary activities. In a recent review of similar policies across Europe, the situation was found to be somewhat similar. Various measures to limit the marketing of foods high in fat, sugar and salt to children are mostly voluntarily. Advertising and marketing on television and radio is restricted, either mandatorily or voluntarily, in almost 50 percent of reviewed countries, while other channels (e.g. advertising in store/streets, social media, advergames, apps, etc.) are significantly less regulated (Breda *et al.*, 2020). The implementation of regulatory instruments could contribute to achieving SDG 2 (Zero Hunger) and SDG 3 (Good health and well-being).

Food fortification legislation

Thirteen countries have established food fortification legislation, with Hungary and Latvia as the exceptions. All 15 countries have mandatory iodine fortification. Czechia, Republic of Moldova, Poland, Serbia and Slovenia have voluntary fortification of other nutrients as well. Adding vitamins and minerals to food is permitted in the European Union through regulation 1925/2006 (European Commission, 2006). Republic of Moldova has legislation requiring the addition of iron and folic acid to at least one kind of commonly consumed wheat flour. Some other countries in central and southeastern Europe are also considering the adoption of mandatory flour fortification (FFI, 2013).

Nutrition of selected vulnerable group (children)

One of the commitments communicated at the ICN2 was to “develop policies, programmes and initiatives for ensuring healthy diets throughout an individual’s lifetime, starting from the early stages of life to adulthood, including people with special nutritional needs, before and during pregnancy, and in particular, during the first 1,000 days of life, promoting, protecting and supporting exclusive breastfeeding during the first six months and continued breastfeeding until two years of age and beyond, with appropriate complementary feeding, healthy eating with families and at school during childhood, as well as other specialized feeding” (FAO/WHO, 2014a). In central and southeastern Europe, policies and practices for improving the nutrition of children, including breastfeeding and complementary feeding, are established in all of the 15 respondent countries. Legislation and regulation related to the International Code of Marketing of Breast-milk Substitutes exist in the majority of the countries of central and southeastern Europe, with the exception of Bosnia and Herzegovina, Czechia and Poland. National food and nutrition action plans and policies targeting kindergarten and school-age children (aged 3–18 years) are established in all countries of central and southeastern Europe, except for Estonia.

Mandatory national nutrition standards for school meals are available and in use in 12 of the 15 respondent countries. Albania, Bosnia and Herzegovina and Montenegro do not have school meal standards. Nutrition education, mandatory at the national level in primary and/or secondary school curriculum, does not exist in Albania, Bosnia and Herzegovina, Latvia, Romania and Serbia. Public procurement for school food is not implemented at the national level in Albania, Bosnia and Herzegovina, Estonia, Romania and Serbia.

Sustainable, resilient food systems for healthy diets

Food systems for nutrition

Recommendations 9 and 10 from the ICN2 FfA and HLPE (FAO/WHO, 2014b; HLPE, 2017) indicate that various comprehensive actions and strategies are implemented in all countries of central and southeastern Europe to support the sustainability and resilience of food systems and healthy diets. Countries of central and southeastern Europe reported on established national measures, strategies or action plans to expand local agro-industry and value chain development, enhance nutrition sensitivity, and facilitate investments in small- or medium-scale agribusiness. Eleven countries reported establishing national measures, strategies or action plans that aim to promote the diversification of crops, including underutilized traditional crops, higher fruits and vegetables yields, production of animal products, and application of sustainable food production and natural resource management practices. Bosnia and Herzegovina has adopted new strategic plans for agriculture and rural development. North Macedonia focuses on agrifood policies regarding improvements in the quality of fruits and vegetables produced, such as grapes, and has set up initiatives for the production of organic soil fertilizers. Slovenia adopted the Rural Development Programme 2014–2020 and joined European

Union and national food quality schemes. Since 2008, Latvia also has had programmes to facilitate the production, treatment and processing of local products and has created networks to distribute these products to broader retailers. Albania, Bulgaria, Hungary and Lithuania did not report details on these strategies.

It is likely that these agrifood policies are more focused on developing rural businesses and production practices and do not account for – or at least not to an adequate extent – sustainability, land use, biodiversity and nutritional needs. Better connection with updated FBDGs, life-cycle assessment databases (Nexus, 2017), and nutritional surveys should educate policymakers about better adaptation of agrifood policies and implementation (FAO, IFAD, UNICEF, 2022).

Antimicrobial resistance for food safety and nutrition

All countries of central and southeastern Europe have taken action to raise awareness among stakeholders on the problems of antimicrobial resistance and have created regulations regarding the distribution and use of antimicrobials in animal production. Bosnia and Herzegovina, Bulgaria, Montenegro, Poland and Czechia do not have established surveillance mechanisms in place for the detection and monitoring of antimicrobial resistance in humans, food-producing animals or the environment, while other central and southeastern European countries already have established such mechanisms.

Food safety for nutrition

The joint FAO/WHO Codex Alimentarius Commission develops and updates international food standards, guidelines and recommendations that serve as a single reference point for the international harmonization of food safety measures. All countries in central and southeastern Europe have established surveillance systems for food-borne diseases in humans as well as surveillance and monitoring systems for food-borne hazards across the food supply chain. Estimates on the magnitude of national food-borne diseases do not exist in Estonia, Slovenia or Poland. Effective national food control systems exist in all countries of central and southeastern Europe; this is based on ICN2 FfA Recommendation 53 to “develop, establish, enforce and strengthen, as appropriate, food control systems, including reviewing and modernizing national food safety legislation and regulations to ensure that food producers and suppliers throughout the food chain operate responsibly” (FAO & WHO, 2018; FAO/WHO, 2014b). Codex Contact Points have been established in all respondent countries; this is based on ICN FfA Recommendation 54 to actively take part in the work of the Codex Alimentarius Commission on nutrition and food safety, and implement, as appropriate, internationally adopted standards at the national level” (FAO & WHO, 2018; FAO/WHO, 2014b).

Food loss and waste prevention and reduction for nutrition

Food loss, according to the United Nations Environment Programme definition, refers to “food that gets spilled, spoiled or otherwise lost, or incurs reduction of quality and value during its process in the food supply chain before it reaches its final product stage. Food loss typically takes place at production, postharvest, processing, and distribution stages in the food supply chain” (UN Environment Programme, 2021). Food waste, according to UNEP, refers to “food that completes the food supply chain up to a final product, of good quality and fit for consumption, but still doesn’t get consumed because it is discarded, whether or not after it is left to spoil or expire. Food waste typically (but not exclusively) takes place at retail and consumption stages in the food supply chain” (UN Environment Programme, 2021). According to the most recent estimates, 88 million tonnes of food waste are generated in the European Union each year, with associated costs estimated at EUR 143 billion (Stenmarck *et al.*, 2016). These losses fundamentally affect the availability and affordability of nutritious foods and represent a major food

system dysfunction (Global Panel, 2018). While 20 percent of food produced in the European Union is being lost or wasted, every second day, around 33 million people cannot afford a meal of adequate nutritional quality (European Union, 2014). Many nutrients are wasted when retailers discard “unsellable” perishable products or when consumers discard uneaten food.

Reducing food loss and waste is seen as a way to contribute towards environmental sustainability by easing the dependency on natural resources and decreasing greenhouse gas emissions. Food production accounts for approximately 6 percent of total European Union greenhouse gas emissions (European Union, 2014). Food loss and waste is a global issue and is one of the roots for SDG 12 (responsible consumption and production), which sets a specific target to halve food loss and waste by 2030, and SDG 2 (eradicate hunger) (FAO, 2016). Actions to prevent and reduce food loss and waste also correspond with Recommendation 11 from the ICN2 FfA (FAO & WHO, 2018; FAO/WHO, 2014b).

The review of central and southeastern Europe shows that eight countries have policies in place aiming to reduce and prevent food loss and waste in the primary production, handling and storage, processing, distribution and consumption stages of agricultural, livestock, fisheries and forestry food supply chains. Albania, Bosnia and Herzegovina, Bulgaria, Estonia, Montenegro, North Macedonia and Poland are still in need of these policies and programmes. Similar results were reported on the European Union level, where many countries have no or incomplete policies and programmes to address food loss and waste issues at all food system stages (Stenmarck *et al.*, 2016).

Belgrade Declaration for strengthening regional capacities on sustainable food systems for healthy diets and nutrition in central and southeastern Europe

Based on the plenary presentations from external experts, country presentations, survey results and discussions at the Belgrade Symposium on Sustainable Food Systems for Healthy Diets in central and southeastern European countries, the experts at the FAO-CAPNUTRA meeting declared:

With respect to the development of policies and research:

- In line with international frameworks, the ICN2, the 2030 Agenda for Sustainable Development, the United Nations Decade on Nutrition and the key messages from the FAO/WHO Regional Symposium on Sustainable Food Systems for Healthy Diets in Europe and Central Asia, the experts adopt a food systems approach, envisioning consumers’ dietary patterns as the link between public health and the food environment.
- In central and southeastern Europe, CAPNUTRA is an excellent network for capacity development, sharing knowledge and experiences, and building collaborations in policy and research for diet, nutrition and food systems (Gurinovic *et al.*, 2020).
- Governments, as major actors, are responsible for driving changes to food systems at the country level and should formulate country-specific SMART commitments for action towards the eradication and prevention of all forms of malnutrition, starting from birth and lasting throughout an individual’s lifetime, including improvements in diets through sustainable and resilient food systems in order to meet the national commitments to ICN2 and the SDGs.
- Governments should define and formulate specific food system and nutrition policies that include measures for educating consumers on healthy diets and nutrition. These policies should also be supported by a shift in investment priorities to ensure that diverse, nutritious and safe foods that meet local requirements based on cultural preferences and taste are available and affordable to all in a sustainable manner.

- Policies need to be aligned with international frameworks, following the recommendations included in the FAO/WHO resource guide *Strengthening Nutrition Action*, a source guide for countries based on the policy recommendations of the ICN2 (FAO & WHO, 2018).
- Technical support and capacity development from the United Nations specialized agencies are needed for further implementation of the ICN2 FfA policy recommendations and SMART commitments in the central and southeastern Europe region.

Specific action points to improve policies and capacity building in food and nutrition in central and southeastern Europe

In line with the agreed vision of a consumer-centred food systems approach, the experts also proposed a number of specific actions with respect to governance and public health nutrition; food supply chain and food environment; consumer behaviour; research, education and training of (future) professionals; and networking and sharing knowledge and experiences for establishing collaboration among capacity development networks.

Actions proposed for governance and public health nutrition:

- Each country in the region should establish inter-sector, multistakeholder mechanisms for food security and nutrition as a part of a national coordination structure for nutrition and food system actions, preferably including members from multiple sectors such as agriculture, health, research, academia, education, trade, environment and social protection, for enhancing food security and improving nutrition (*Related to ICN2 FfA Recommendation 3*) (FAO/WHO, 2014b).
- Programming and public financing for nutrition and food systems is essential to enhancing the knowledge and skill capacity of the main policymakers on food and nutrition policy. Forces should be joined to persuade governments to allocate some of their annual budgets to nationwide programmes for strengthening nutrition governance, enhancing food security and improving nutrition (*Related to ICN2 FfA recommendations 1, 3, 6 and 7*) (FAO/WHO, 2014b).
- There is a continuous need to further develop and implement standardized monitoring systems and nutrition and health surveys, aligned with ongoing initiatives (Key message 17) (FAO/WHO, 2018), and to support initiatives for establishing a surveillance system for nutrition data collection for evidence-based policymaking. Recommendation 58 of the ICN2 FfA (FAO/WHO, 2014b) urges countries to improve and harmonize the monitoring and evaluation of nutritional data. The collection of such dietary intake data is essential for evidence-based policymaking related to leveraging the potential of nutrition-sensitive agriculture and food systems for healthy diets.
- Governments should establish the monitoring of SDG indicators and strengthen data collection and analysis for evidence-based policymaking, including food consumption and nutrition data, data monitoring of child growth and nutritional status of the population, food composition data of commonly available local foods, and data on food contaminants, etc. (Key message 17) (FAO/WHO, 2018).
- The initiative to establish a food, nutrition and health research infrastructure is strongly advised (FNH-RI, 2019). This would facilitate access to relevant data by the research community in public health nutrition. This also would support and motivate national authorities to prioritize evidence-based policies, research and innovation in order to advance dietary quality and health through behaviour changes, public health institutions, and the food supply chain (Directorate-General for Research and Innovation of the European Commission *et al.*, 2022).

Actions proposed for the food supply chain and food environment:

- Food system legislative regulations, norms and standards should be adopted in order to facilitate healthy diets and ensure healthy food environments for all age groups, starting from birth.
- Non-state actors, the private sector (producers, processors, professional associations, etc.), civil society members, academics and consumers should be involved in policy dialogues on issues related to agriculture, food and nutrition. The private sector should ensure the diverse and affordable supply of nutritious and safe food.
- National nutrition-related policies, with targets and guidelines, should be designed and established by evidence-based expert opinions. These will entail the reduction of saturated fats, free sugars and/or salt and industrially produced trans fats, with special attention paid to specific categories of food and specific population groups (e.g. children, adults, pregnant and lactating women, elderly people). National policies and/or programmes that influence food reformulation should take into account individual needs, cultural context, locally available foods and dietary customs of the target populations.
- Initiatives should be taken and support should be provided to countries that do not already have policies in place to establish mandatory restrictions to the advertising of foods high in fat, sugar and salt for all age groups, particularly for children.
- Initiatives should be taken and support should be provided to countries that are missing systems for establishing surveillance mechanisms for the detection and monitoring of antimicrobial resistance in humans, food-producing animals and the environment.
- Initiatives should be taken and suggestions should be given on the design of policies and programmes for the reduction and prevention of food loss and waste in countries that have not established policies to address these issues.
- Environmental sustainability should be incorporated in the development of FBDGs and should include key indicators relevant to planetary boundaries, such as greenhouse gas emissions, land use, energy use, water use, etc. Environmental aspects should be incorporated in the food procurement procedures of private companies, public organizations, restaurants and catering facilities.

Actions proposed with respect to consumer behaviour:

- Food systems must be reformed to improve yields and access to foods that comprise healthy diets and to empower consumers to increase their consumption of those foods, including nutrient-rich, underutilized foods and traditional recipes for diet diversity and higher nutrient intake. Initiative should be taken to develop FBDGs (*ICN2 FfA Recommendation 13*) (FAO/WHO, 2014b) and to disseminate and implement these within educational programmes and public health initiatives.
- Initiatives should be taken to develop school programmes and implement mandatory nutrition education at the national level in primary and/or secondary school curricula in countries where it was not already implemented.
- Mandatory national nutrition standards for school meals should exist. Initiatives should be taken to design nutrition-sensitive public procurement schemes from local producers, if feasible, for meals provided by schools.

- Practices that protect, promote and support breastfeeding should be implemented. Legislation on the marketing of breast milk substitutes should be implemented. Legislation that prohibits the marketing and sale of foods high in fat, sugar and salt and beverages in settings where children gather (e.g. nurseries, primary and secondary schools, school grounds, sports facilities, preschool centres and playgrounds) should be implemented.
- Awareness should be raised regarding all topics related to the selected vulnerable groups, such as children.

Actions proposed for research and education and training of (future) professionals

- Development of the nutrition and food systems curriculum: Initiatives should be taken towards empowering capacity development in nutrition and food systems, promoting networking and collaboration, and up-to-date and adequate training for all personnel, according to contemporary and visionary understandings of nutrition and food systems. Modules on sustainable food systems for healthy diets and improved nutrition should be integrated into extensional services and delivered to all actors involved in all elements of food systems (Key messages No. 20) (FAO/WHO, 2018).
- Universities and educational institutions should be supported to create doctorate programmes, curricula and education and training modules that focus on nutrition and food systems.
- Involvement of CAPNUTRA in the emerging plans to develop a food, nutrition and health research infrastructure in Europe is an opportunity to intertwine top-level European research on diet, nutrition and food systems with the building of capacity among early-career researchers that enhances knowledge-sharing and collaboration with stakeholders in policy and research in the central and southeastern Europe region.

Actions proposed with respect to strengthening the professional scientific community, capacity development and networking

- Following ICN2 FfA Recommendation 6 to promote intercountry collaboration and Key message 21 (FAO/WHO, 2018), the symposium stressed the need for networking and the sharing of knowledge and experiences for establishing close collaborations among capacity development networks.
- Capacity development on methodologies and the planning of joint activities should be fostered among CAPNUTRA, the Regional Nutrition Capacity Development and Partnership Platform for Central Asia and Caucasus, and the Eurasian Food Security and Nutrition Network within the Eurasian Centre for Food Security, related to various thematic areas of food systems.
- For top-level capacity building, it is necessary that there be innovative research and access among the public health and nutrition community to scientific, evidence-based information on all aspects of the food systems, nutrition and health.
- As an already well-recognized capacity building network situated in the central and southeastern Europe region, CAPNUTRA (Gurinović *et al.*, 2020) is advised to take a proactive role, formalizing its organizational leadership in upcoming public health nutrition and sustainable food systems, nutrition and health research infrastructure initiatives among the central and southeastern European countries of the European Union, the Caucasus/Eurasia region, and the wider research community.

Conclusions

The status of food system elements in the countries of central and southeastern Europe reveals various challenges in food systems and gives opportunities to support their transformation towards more sustainable food systems, which can result healthier diets across the region. The availability of internationally comparable data on nutrition outcomes is still limited, and those data are disaggregated. This hinders assessments and comparisons of nutritional indicators across cultures, countries/regions and time. Therefore, it is essential to invest more in food and nutrition research infrastructure, creating harmonized methodologies for nutritional assessment at global, regional and country levels. In the same vein, capacity development in nutrition research – particularly human resource development and organizational, institutional and legal framework development – is necessary to achieve proposed targets [38].

Food system transformations are at the heart of the 2030 Agenda for Sustainable Development and will support the achievement of many goals, specifically SDG 2 and many other SDGs related to nutrition. The COVID-19 pandemic has shown the vulnerabilities of food systems, the lack of resilience and adaptability to disruptions, and the crucial role that the interdependence of food systems plays in national economies and societies (FAO, 2020b).

Due to the complex nature of malnutrition, improving nutrition requires government support and collaboration from various sectors, including agriculture, health, education, trade, environment and social protection. Policymakers need to ensure that all parts of food systems work together to deliver high-quality diets and to implement actions suggested by the ICN2 FfA policy recommendations, key messages from the Regional Symposium on Sustainable Food Systems for Healthy Diets in Europe and Central Asia, and the Belgrade Declaration for strengthening regional capacities on sustainable food systems for healthy diets and nutrition in central and southeastern Europe. This means thinking well beyond agriculture to also consider the many processes and activities involved in food production, such as processing, storage, transportation, trade and retailing as key links between food systems and their nutritional, environmental and social outcomes. Food supply chains, food environments and consumer behaviour are the key components of better nutrition and overall health. To achieve the SDG targets, actions from various sectors, including governments and non-state actors, are needed. Technical support and capacity development from United Nations specialized agencies also is required. Active participation in the European Commission's research projects and cooperation with other European partners and networks to enhance nutritional training, information exchange, knowledge transfer and regional capacity development in food, nutrition and public health research can stimulate and contribute to food systems transformation in the region (European Commission, 2017). Further direction of this transformation should lean on European processes – guided by the recent Farm to Fork strategy – for fair, healthy and environmentally friendly food systems. The FOOD 2030 initiative to build a more coherent European Union research and innovation policy places sustainable food systems at its core.

The analyses of the statuses of certain food systems elements in central and southeastern Europe will contribute to the comprehensive situation and policy analysis of the region and are needed as a basis for planning effective policy responses and further monitoring of the progress in food systems transformation. Further direction is needed on the monitoring of food system elements and on the definition of appropriate indicators and factors, covering the whole food system. It is necessary to develop and establish the continual monitoring and harmonization of food systems data collection, with indicators that measure the state of various food system components. The extension within the scope of

this work could be based on the recently proposed comprehensive Food System Dashboard tool (Fanzo *et al.*, 2020).

The symposium outcome document, the Belgrade Declaration for strengthening regional capacities on sustainable food systems for healthy diets and nutrition in central and southeastern Europe, needs promotion, dissemination and implementation. This entails the establishment of nutrition governance and the engagement of stakeholders – at national, regional and European levels – following international frameworks, recommendations and strategies, with essential support from United Nations specialized agencies, the European Commission and other international authorities.

Table 1-0-3. Summary of central and southeastern Europe Country food system elements

Country	Governance, leadership and accountability for food security and nutrition	Food, nutrition and health research infrastructure	Software: nutritional tools for food consumption data collection, dietary intake assessment and nutrition planning	Capacity in nutrition and nutritional education for professionals	Food-based dietary guidelines	Food demand and food environment	Nutrition of targeted vulnerable group (children)	Sustainable, resilient food systems for healthy diets	
Albania	Available national strategic documents for nutrition	NO information system to provide data for food systems and nutrition policymaking	NO software for consumption and nutrient intake surveys	Available university-level education and training in food and nutrition	Available FBDG, but not implemented	Available food labeling regulations	Available policies and practices for nutrition of children, breastfeeding and complementary feeding	Available	
									strategies for SME development in the agrifood sector
	NO national coordination mechanism that addresses the country's food security and nutrition challenges	NO DRVs, FCDB		NO PhD in nutrition		Available policies for reducing TFA, SFA, S&S	Available legislation/regulations on International Code of Marketing of Breast-milk Substitutes		NO policies for diversification of agriculture, sustainable food production and natural resource management practice
	NO budget allocation for nutrition	NO responsible institution for FCDB or software				NO restrictions on advertising and marketing of HFSS foods to children	Available food and nutrition policies for kindergarten		
									NO policy on reduction of food loss and waste
	NO government SMART commitments						NO tax on HFSS foods	NO national nutrition standards for school meals, public procurements for schools at national level, mandatory nutrition education in schools	
							Available FF legislation, mandatory for iodine		Established effective national food control system with surveillance
	NO national nutrition committee								
									Available policies and programmes for AMR, implemented in practice
	Available anthropometric data for Ch&Ad								
NO monitoring and surveillance system- nutrition data collection									

Country	Governance, leadership and accountability for food security and nutrition	Food, nutrition and health research infrastructure	Software: nutritional tools for food consumption data collection, dietary intake assessment and nutrition planning	Capacity in nutrition and nutritional education for professionals	Food-based dietary guidelines	Food demand and food environment	Nutrition of targeted vulnerable group (children)	Sustainable, resilient food systems for healthy diets
Bosnia and Herzegovina	Available national strategic documents for nutrition	NO information system to provide data for food systems and nutrition policymaking	Available software for consumption and nutrient intake surveys	Available university-level education and training in food and nutrition, including PhD	Available FB DG,* but not implemented	Available food labelling regulations	Available policies and practices for nutrition of children, breastfeeding and complementary feeding*	Available strategies for SME development in the agrifood sector***
	NO national coordination mechanism that addresses the country's food security and nutrition challenges,	NO DRVs, FCDB**				Available policies for reducing salt	Available legislation/ regulations on International Code of Marketing of Breast-milk Substitutes	Available policies for the diversification of agriculture, sustainable food production and natural resource management practices*
	NO budget allocation for nutrition	Assigned institution responsible for FCDB or software				NO restrictions on advertising and marketing of HFSS foods to children	Available food and nutrition policies for kindergarten*	NO policy on the reduction of food loss and waste
	NO government SMART commitments						NO national nutrition standards for school meals, public procurements for schools at national level, mandatory nutrition education at schools*	Established effective national food control system with surveillance
	NO national nutrition committee						NO tax on HFSS foods	Available policies and programmes for AMR,* not implemented in practice
	Available anthropometric data for Ch&Ad*					Available FF legislation, mandatory for iodine, voluntary for iron, folic acid, vitamin D, A and others		
	Available monitoring and surveillance system- nutrition data collection							

* Only in Bosnia and Herzegovina, Federation of Bosnia and Herzegovina Entity

** Balkan regional FCDB in use

Country	Governance, leadership and accountability for food security and nutrition	Food, nutrition and health research infrastructure	Software: nutritional tools for food consumption data collection, dietary intake assessment and nutrition planning	Capacity in nutrition and nutritional education for professionals	Food-based dietary guidelines	Food demand and food environment	Nutrition of targeted vulnerable group (children)	Sustainable, resilient food systems for healthy diets
Bulgaria	Available national strategic documents for nutrition	Available information system to provide data for food systems and nutrition policymaking	Available software for consumption and nutrient intake surveys	Available university-level education and training in food and nutrition, including PhD	Available FB DG, implemented	Available food labeling regulations	Available policies and practices for nutrition of children, breastfeeding and complementary feeding	Available strategies for SME development in the agrifood sector
	Existent national nutrition committee	Available DRVs, FCDB				Available policies for reducing TFA, SFA, S&S	Available legislation/regulations on International Code of Marketing of Breast-milk Substitutes	NO policies for diversification of agriculture, sustainable food production and natural resource management practices
	National coordination mechanism that addresses the country's food security and nutrition challenges	Assigned institution responsible for FCDB or software				Existent restrictions on advertising and marketing of HFSS foods to children	Available food and nutrition policies for kindergarten and public procurement for schools, national nutrition standards for school meals, public procurements for schools at national level	NO policy on the reduction of food loss and waste
	Government SMART commitments					NO tax on HFSS foods	NO mandatory nutrition education at schools	Established effective national food control system with surveillance
	Available anthropometric data for Ch&Ad					Available FF legislation, mandatory for iodine		Available policies and programmes for AMR, distribution and use antimicrobials controlled, but surveillance not in place

Country	Governance, leadership and accountability for food security and nutrition	Food, nutrition and health research infrastructure	Software: nutritional tools for food consumption data collection, dietary intake assessment and nutrition planning	Capacity in nutrition and nutritional education for professionals	Food-based dietary guidelines	Food demand and food environment	Nutrition of targeted vulnerable group (children)	Sustainable, resilient food systems for healthy diets	
Czechia	NO budget allocation for nutrition	Available information system to provide data for food systems and nutrition policymaking	Available software for consumption and nutrient intake surveys	Available university-level education and training in food and nutrition	Available FB DG, implemented	Available food labelling regulations	Available policies and practices for nutrition of children, breastfeeding and complementary feeding	Available strategies for SME development in the agrifood sector,	
									policies for diversification of agriculture, sustainable food production and natural resource management practices
	Available national strategic documents for nutrition,	NO DRVs				Available food and nutrition policies for kindergarten and public procurement for schools, national nutrition standards for school meals, public procurements for schools at national level, mandatory nutrition education at schools			
							Available policy on reduction of food loss and waste		
	Existent national nutrition committee	Available FCDB				Existent restrictions on advertising and marketing of HFSS foods to children			
		Assigned institution responsible for FCDB or software					Established effective national food control system with surveillance		
	National coordination mechanism that addresses the country's food security and nutrition challenges					NO tax on HFSS foods			
							Available policies and programmes for AMR, distribution and use of antimicrobials controlled, but surveillance not in place		
	NO government SMART commitments					Available FF legislation, mandatory for iodine, voluntary for vitamin D			
	Available anthropometric data for Ch&Ad								

Country	Governance, leadership and accountability for food security and nutrition	Food, nutrition and health research infrastructure	Software: nutritional tools for food consumption data collection, dietary intake assessment and nutrition planning	Capacity in nutrition and nutritional education for professionals	Food-based dietary guidelines	Food demand and food environment	Nutrition of targeted vulnerable group (children)	Sustainable, resilient food systems for healthy diets
Estonia	NO budget allocation for nutrition	Available information system to provide data for food systems and nutrition policymaking	Available software for consumption and nutrient intake surveys	Available university-level education and training in food and nutrition, including PhD	Available FBDG, implemented	Available food labelling regulations	Available policies and practices for nutrition of children, breastfeeding and complementary feeding	Available strategies for SME development in the agrifood sector
	NO national nutrition committee	Available DRVs, FCDB				NO restrictions on advertising and marketing of HFSS foods to children	Available legislation/regulations on International Code of Marketing of Breast-milk Substitutes	Policies for diversification of agriculture, sustainable food production and natural resource management practices
	National coordination mechanism that addresses the country's food security and nutrition challenges	Assigned institution responsible for FCDB or software				NO tax on HFSS	Available public procurement for schools, national nutrition standards for school meals, mandatory nutrition education at schools	NO policy on reduction food loss and waste
	Available national strategic documents for nutrition					Available FF legislation, mandatory for iodine, voluntary for iron, folic acid, vitamin D, A, and others	NO food and nutrition policies for kindergarten and public procurements for schools at national level	Established effective national food control system with surveillance
	Government SMART commitments							Available policies and programmes for AMR, distribution and use antimicrobials controlled, but NO procedures and practice to monitor and evaluate the implementation of policies, strategies and programmes
	Available anthropometric data for Ch&Ad							

Country	Governance, leadership and accountability for food security and nutrition	Food, nutrition and health research infrastructure	Software: nutritional tools for food consumption data collection, dietary intake assessment and nutrition planning	Capacity in nutrition and nutritional education for professionals	Food-based dietary guidelines	Food demand and food environment	Nutrition of targeted vulnerable group (children)	Sustainable, resilient food systems for healthy diets
Hungary	NO budget allocation for nutrition	Available information system to provide data for food systems and nutrition policymaking	Available software for consumption and nutrient intake surveys	Available university-level education and training in food and nutrition, including PhD	Available FBDG, implemented	Available food labelling regulations	Available policies and practices for nutrition of children, breastfeeding and complementary feeding	Available strategies for SME development in the agrifood sector
	NO national nutrition committee	Available DRVs, FCDB				Available policies for reducing TFA, SFA, S&S	Available legislation/ regulations on International Code of Marketing of Breast-milk Substitutes	Available policy on reduction food loss and waste
								Established effective national food control system with surveillance
	Available national coordination mechanism that addresses the country's food security and nutrition challenges	Assigned institution responsible for FCDB or software				Existent restrictions on advertising and marketing of HFSS foods to children and tax on HFSS	Available food and nutrition policies for kindergarten, public procurements for schools at national level, national nutrition standards for school meals, mandatory nutrition education at schools	
								Available policies and programmes for AMR, distribution and use of antimicrobials controlled
	Available national strategic documents for nutrition					NO FF regulation		
								Existent procedures and practices to monitor and evaluate the implementation of policies, strategies and programmes
	Available national strategic documents for nutrition							
	NO government SMART commitments							
	Available anthropometric data for Ch&Ad							

Country	Governance, leadership and accountability for food security and nutrition	Food, nutrition and health research infrastructure	Software: nutritional tools for food consumption data collection, dietary intake assessment and nutrition planning	Capacity in nutrition and nutritional education for professionals	Food-based dietary guidelines	Food demand and food environment	Nutrition of targeted vulnerable group (children)	Sustainable, resilient food systems for healthy diets		
Latvia	NO budget allocation for nutrition	NO information system to provide data for food systems and nutrition policymaking	Available software for consumption and nutrient intake surveys	Available university-level education and training in food and nutrition, including PhD	Available FBDG, implemented	Available food labelling regulations	Available policies and practices for nutrition of children, breastfeeding and complementary feeding	Available strategies for SME development in the agrifood sector,		
										policies for diversification of agriculture, sustainable food production and natural resource management practices
	Existent national nutrition committee	Available DRVs, FCDB,						Available policies for reducing TFA, salt	Available legislation/ regulations on International Code of Marketing of Breastmilk Substitutes	
										Available policy on the reduction of food loss and waste
	Available national strategic documents for nutrition	Assigned institution responsible for FCDB or software						NO restrictions on advertising and marketing of HFSS foods to children and tax on HFSS	Available food and nutrition policies for kindergarten, public procurements for schools at national level, national nutrition standards for school meals	
										Established effective national food control system with surveillance
	Available national coordination mechanism that addresses the country's food security and nutrition challenges							Existent tax on HFSS		
										Available policies and programmes for AMR, distribution and use of antimicrobials controlled
	NO government SMART commitments							NO FF regulation		
										Existent procedures and practice to monitor and evaluate the implementation of policies, strategies and programmes
	Available anthropometric data for Ch&Ad									

Country	Governance, leadership and accountability for food security and nutrition	Food, nutrition and health research infrastructure	Software: nutritional tools for food consumption data collection, dietary intake assessment and nutrition planning	Capacity in nutrition and nutritional education for professionals	Food-based dietary guidelines	Food demand and food environment	Nutrition of targeted vulnerable group (children)	Sustainable, resilient food systems for healthy diets
Lithuania	Allocated budget for nutrition	Available information system to provide data for food systems and nutrition policymaking	Available software for consumption and nutrient intake surveys	Available university-level education and training in food and nutrition, including PhD	Available FBDG, implemented	Available food labelling regulations	Available policies and practices for nutrition of children, breastfeeding and complementary feeding	Available strategies for SME development in the agrifood sector
	NO national nutrition committee	Available DRVs, FCDB				Available policies for reducing TFA, SFA, S&S	Available legislation/regulations on International Code of Marketing of Breast-milk Substitutes	NO policies for diversification of agriculture, sustainable food production and natural resource management practices
	Available national strategic documents for nutrition	Assigned institution responsible for FCDB or software				Existing restrictions on advertising and marketing of HFSS foods to children	Available food and nutrition policies for kindergarten, public procurements for schools at national level, national nutrition standards for school meals, mandatory nutrition education at schools	Available policy on reduction food loss and waste
	NO national coordination mechanism that addresses the country's food security and nutrition challenges					NO tax on HFSS		Established effective national food control system with surveillance
	Available government SMART commitments					Available FF legislation, mandatory for iodine		Available policies and programmes for AMR, distribution and use of antimicrobials controlled
	Available anthropometric data for Ch&Ad							Existing procedures and practices to monitor and evaluate the implementation of policies, strategies and programmes
Republic of Moldova	Allocated budget for nutrition	NO information system to provide data for food systems and nutrition policymaking	NO software for consumption and nutrient intake surveys	Available university-level education and training in food and nutrition	Available FBDG, implemented	Available food labelling regulations	Available policies and practices for nutrition of children, breastfeeding and complementary feeding	Available strategies for SME development in the agrifood sector, policies for diversification of agriculture, sustainable food production and natural resource management practices
	Existing national nutrition committee	NO DRVs, FCDB				Available policies for reducing TFA, SFA, S&S	Available legislation/regulations on International Code of Marketing of Breast-milk Substitutes	Available policy on the reduction of food loss and waste
	Available national strategic documents for nutrition	Assigned institution responsible for FCDB or software				Existing restriction for advertising and marketing of HFSS foods to children	Available food and nutrition policies for kindergarten, public procurements for schools at national level, national nutrition standards for school meals, mandatory nutrition education at schools	Established effective national food control system with surveillance
	Available national coordination mechanism that addresses the country's food security and nutrition challenges					Available FF legislation, mandatory for iodine, voluntary for iron, folic acid		Available policies and programmes for AMR, distribution and use of antimicrobials controlled
	NO government SMART commitments							Existing procedures and practice to monitor and evaluate the implementation of policies
	Available anthropometric data for Ch&Ad							

Country	Governance, leadership and accountability for food security and nutrition	Food, nutrition and health research infrastructure	Software: nutritional tools for food consumption data collection, dietary intake assessment and nutrition planning	Capacity in nutrition and nutritional education for professionals	Food-based dietary guidelines	Food demand and food environment	Nutrition of targeted vulnerable group (children)	Sustainable, resilient food systems for healthy diets
Montenegro	NO budget allocation for nutrition	NO information system to provide data for food systems and nutrition policymaking	Available software for consumption and nutrient intake surveys	Available university-level education and training in food and nutrition	NO FBDG	Available food labelling regulations	Available policies and practices for nutrition of children, breastfeeding and complementary feeding	Available strategies for SME development in the agrifood sector, policies for diversification of agriculture, sustainable food production and natural resource management practices
	NO national nutrition committee	NO DRVs, FCDB**				Available policies for reducing salt	Available legislation/regulations on International Code of Marketing of Breast-milk Substitutes	NO policy on the reduction of food loss and waste
	Available national strategic documents for nutrition	Assigned institution responsible for FCDB or software				NO restrictions on advertising and marketing of HFSS foods to children	Available food and nutrition policies for kindergarten, mandatory nutrition education at schools, public procurements for schools at national level	Established effective national food control system with surveillance
	NO national coordination mechanism that addresses the country's food security and nutrition challenges					Existent tax on HFSS	NO national nutrition standards for school meals	Available policies and programmes for AMR, distribution and use of antimicrobials controlled
	NO government SMART commitments					Available FF legislation, mandatory for iodine		Existent procedures and practices to monitor and evaluate the implementation of policies
	Available anthropometric data for Ch&Ad							
North Macedonia	NO budget allocation for nutrition	NO information system to provide data for food systems and nutrition policymaking	Available software for consumption and nutrient intake surveys	Available university-level education and training in food and nutrition, including PhD	Available FBDG, implemented	Available food labelling regulations	Available policies and practices for nutrition of children, breastfeeding and complementary feeding	Available strategies for SME development in the agrifood sector, policies for diversification of agriculture, sustainable food production and natural resource management practices
	NO national nutrition committee	Available DRVs, FCDB				Available policies for reducing TFA, SFA, S&S	Available legislation/regulations on International Code of Marketing of Breast-milk Substitutes	NO policy on the reduction of food loss and waste
	NO national strategic documents for nutrition	Assigned institution responsible for FCDB or software				NO restrictions on advertising and marketing of HFSS foods to children or tax on HFSS	Available food and nutrition policies for kindergarten, national nutrition standards for school meals, mandatory nutrition education at schools, public procurements for schools at national level	Established effective national food control system with surveillance
	NO national coordination mechanism that addresses the country's food security and nutrition challenges					Available FF legislation, mandatory for iodine		Available policies and programmes for AMR, distribution and use of antimicrobials controlled
								NO procedures and practices to monitor and evaluate the implementation of policies
	NO government SMART commitments							
	Available anthropometric data for Ch&Ad							

Country	Governance, leadership and accountability for food security and nutrition	Food, nutrition and health research infrastructure	Software: nutritional tools for food consumption data collection, dietary intake assessment and nutrition planning	Capacity in nutrition and nutritional education for professionals	Food-based dietary guidelines	Food demand and food environment	Nutrition of targeted vulnerable group (children)	Sustainable, resilient food systems for healthy diets
Poland	Allocated budget for nutrition	NO information system to provide data for food systems and nutrition policymaking	Available software for consumption and nutrient intake surveys	Available university-level education and training in food and nutrition, including PhD	Available FBDG, implemented	NO food labelling regulations	Available policies and practices for nutrition of children, breastfeeding and complementary feeding	Available strategies for SME development in the agrifood sector, policies for diversification of agriculture, sustainable food production and natural resource management practices
	NO national nutrition committee	Available DRVs, FCDB				Available policies for reducing salt	NO legislation/regulations on International Code of Marketing of Breast-milk Substitutes	NO policy on the reduction of food loss and waste
	Available national strategic documents for nutrition	Assigned institution responsible for FCDB or software				Existing restrictions on advertising and marketing of HFSS foods to children	Available food and nutrition policies for kindergarten, national nutrition standards for school meals, mandatory nutrition education at schools, public procurements for schools at national level	Established effective national food control system with surveillance
	NO national coordination mechanism that addresses the country's food security and nutrition challenges					NO tax on HFSS		Available policies and programmes for AMR, distribution and use of antimicrobials controlled
	NO government SMART commitments					Available FF legislation, mandatory for iodine, folic acid, vitamin D, A		NO procedures and practices to monitor and evaluate the implementation of policies
	Available anthropometric data for Ch&Ad							
Romania	Allocated budget for nutrition	Available information system to provide data for food systems and nutrition policymaking	NO software for consumption and nutrient intake surveys	Available university-level education and training in food and nutrition, including PhD	Available FBDG, implemented	Available food labelling regulations	Available policies and practices for nutrition of children, breastfeeding and complementary feeding	Available strategies for SME development in the agrifood sector, policies for diversification of agriculture, sustainable food production and natural resource management practices
	Existing national nutrition committee	Available DRVs, FCDB				NO policies for reduction of TFA, SFA, S&S	Available legislation/regulations on International Code of Marketing of Breast-milk Substitutes	Available policy on the reduction of food loss and waste
	Available national strategic documents for nutrition	Assigned institution responsible for FCDB or software				Existing restrictions on advertising and marketing of HFSS foods to children	Available food and nutrition policies for kindergarten, national nutrition standards for school meals	Established effective national food control system with surveillance
	Available national coordination mechanism that addresses the country's food security and nutrition challenges					NO tax on HFSS	NO mandatory nutrition education at schools, public procurements for schools at national level	Available policies and programmes for AMR, distribution and use of antimicrobials controlled
	NO government SMART commitments					Available FF legislation, mandatory for iodine		Existing procedures and practices to monitor and evaluate the implementation of policies
	Available anthropometric data for Ch&Ad							

Country	Governance, leadership and accountability for food security and nutrition	Food, nutrition and health research infrastructure	Software: nutritional tools for food consumption data collection, dietary intake assessment and nutrition planning	Capacity in nutrition and nutritional education for professionals	Food-based dietary guidelines	Food demand and food environment	Nutrition of targeted vulnerable group (children)	Sustainable, resilient food systems for healthy diets
Serbia	NO budget allocation for nutrition	Available information system to provide data for food systems and nutrition policymaking	Available software for consumption and nutrient intake surveys	Available university-level education and training in food and nutrition, including PhD	NO FBDG	Available food labelling regulations	Available policies and practices for nutrition of children, breastfeeding and complementary feeding	Available strategies for SME development in the agrifood sector, policies for diversification of agriculture, sustainable food production and natural resource management practices
	NO national nutrition committee	NO DRVs				Available policies for reduction of TFA, SFA, S&S	Available legislation/regulations on International Code of Marketing of Breast-milk Substitutes	Available policy on the reduction of food loss and waste
	Available national strategic documents for nutrition	Available FCDB				NO restrictions on advertising and marketing of HFSS foods to children	Available food and nutrition policies for kindergarten, national nutrition standards for school meals	Established effective national food control system with surveillance
	Available national coordination mechanism that addresses the country's food security and nutrition challenges	Assigned institution responsible for FCDB or software				NO tax on HFSS	NO mandatory nutrition education at schools, public procurements for schools at national level	Available policies and programmes for AMR, distribution and use of antimicrobials controlled
	NO government SMART commitments					Available FF legislation, mandatory for iodine, voluntary on iron, folic acid, vitamin D, A		
	Available anthropometric data for Ch&Ad							
Slovenia	Allocated budget for nutrition	Available information system to provide data for food systems and nutrition policymaking	Available software for consumption and nutrient intake surveys	Available university-level education and training in food and nutrition, including PhD	Available FBDG, implemented	Available food Labelling Regulations	Available policies and practices for nutrition of children, breastfeeding and complementary feeding	Available strategies for SME development in the agrifood sector, policies for diversification of agriculture, sustainable food production and natural resource management practices
						Available Policies for reduction of TFA, SFA, S&S		
	Existent national nutrition committee	Available DRVs, FCDB				Exist restriction for advertising and marketing of HFSS foods to children	Available legislation/regulations on International Code of Marketing of Breast-milk Substitutes	Available policy on the reduction of food loss and waste
						NO tax on HFSS		
	Available national strategic documents for nutrition	Assigned institution responsible for FCDB or software				Available FF legislation, mandatory for iodine, voluntary for Folic acid, vitamin D, A	Available food and nutrition policies for kindergarten, national nutrition standards for school meals, mandatory nutrition education at schools, public procurements for schools at national level	Established effective national food control system with surveillance
	Available national coordination mechanism that addresses the country's food security and nutrition challenges							Available policies and programmes for AMR, distribution and use of antimicrobials controlled
	Available government SMART commitments							
Available anthropometric data for Ch&Ad								

Source: Data extracted from the survey conducted for this study in 2018

Abbreviations:

- | | | |
|--|--|---|
| Ch & Ad Children and Adults | TFA Trans fatty acids | F&N Food and nutrition |
| SMART specific, measurable, achievable, relevant and time-bound | SFA Saturated fatty acids | SME Small and medium enterprises |
| DRVs Dietary Recommended Values | S&S Salt and sugar | AMR Antimicrobial resistance |
| FCDB Food composition database | FF Food fortification | FLW Food loss and waste |
| FBDG Food based dietary guidelines | A&M Advertising and marketing | |
| | HFSS High fat, sugar and salt | |

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Chapter 2

Food safety in the context of accelerating global food supply and dynamic changes in agrifood systems

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Abstract

Unsafe food has high costs for social, economic and environmental dimensions of sustainability. Ensuring food safety in the context of dynamic changes in agrifood systems is a complex task that requires multisectoral collaboration at all levels – local, national, regional and global. This chapter highlights the polyvalent importance of food safety and the enhancements needed in three food safety-supportive areas that may help to face the ongoing accelerations in global megatrends and dynamic changes in food systems, namely: food safety governance, emergency response preparedness, and professional education of specialists for agrifood systems.

Keywords: *Food safety, agrifood systems, food safety governance, emergency response preparedness, professional education*

Introduction: recognizing essential connections

Achieving food security and adequate nutrition for all is the highest goal of agrifood systems and an integral part of the 2030 Agenda for Sustainable Development. The 2030 Agenda, with its 17 interrelated Sustainable Development Goals (SDGs), aims to stimulate action in areas of critical importance for people, planet and prosperity (UN, 2015). The SDGs call for major transformations in agriculture and food systems in order to “end hunger, achieve food security and improved nutrition, and promote sustainable agriculture” (SDG2). The intent of the SDGs is to stimulate effective policies and strategic partnerships, increase sustained investments and take appropriate action. To achieve the SDGs, it is critical to recognize essential interconnections among food security, food safety, nutrition and health, with due consideration of their relevance for the economic, social and environmental dimensions of sustainable development. While important for all SDGs, food safety is a critical contributor to achieving the commitments of Member Nations expressed in SDGs 1, 2, 3, 5, 6, 8, 12, 13 and 17.¹³ When people are facing food insecurity and hunger, food safety may receive less attention, with associated consequences for health. The objective of healthy diets can be achieved only when diverse, nutritious and safe foods are available, affordable and sourced from sustainable agrifood systems (FAO *et al.*, 2020). The essential connections among food security, food safety, nutrition and health need to be recognized to drive actionable policies. As an essential feature of healthy diets (FAO and WHO, 2019a), food safety needs to be incorporated into policies for agricultural and food systems development, food security, and improved nutrition. The global trends of increasing world population, increasing food demand and continuous depletion of natural resources place greater importance on food safety, due to its implications for food security and nutrition, public health and social cohesion, economic development and the environment. There is a growing understanding of food safety as an essential condition for sustainable development.

Food safety, if not properly addressed, will continue to have high social, economic and environmental costs. According to WHO estimates, every year more than 600 million people fall ill and 420 000 die from food-borne diseases related to the consumption of food contaminated with bacteria, parasites, toxins or chemicals. Globally, unsafe food is responsible for a cumulative 33 million lost years of healthy life – which is comparable to lost years of healthy life caused by infectious diseases such as HIV/AIDS, malaria and tuberculosis. The adverse impacts of unsafe food on nutrition and health are shown in Figure 2-1. While food-borne illnesses caused by pathogens are easier to trace to specific contaminated foods that have been consumed, the linkages to health impairments caused by chronic dietary exposure to food contaminated by chemical hazards are less obvious and more difficult to identify, unless monitoring of chemical hazards along the food chain is operated systematically and epidemiological surveillance data are collected and analysed together with the monitoring results of chemical hazards.

Food-borne diseases have an uneven impact on various parts of a population. The hardest impacts of unsafe food fall on the most vulnerable: an estimated 40 percent of food-borne diseases are associated with children younger than 5 years, amounting to 125 000 deaths each year. People in developing regions and poverty-stricken areas of the world account for more than 70 percent of the global burden of food-borne diseases (WHO, 2015). However, the occurrence of food safety hazards and the true

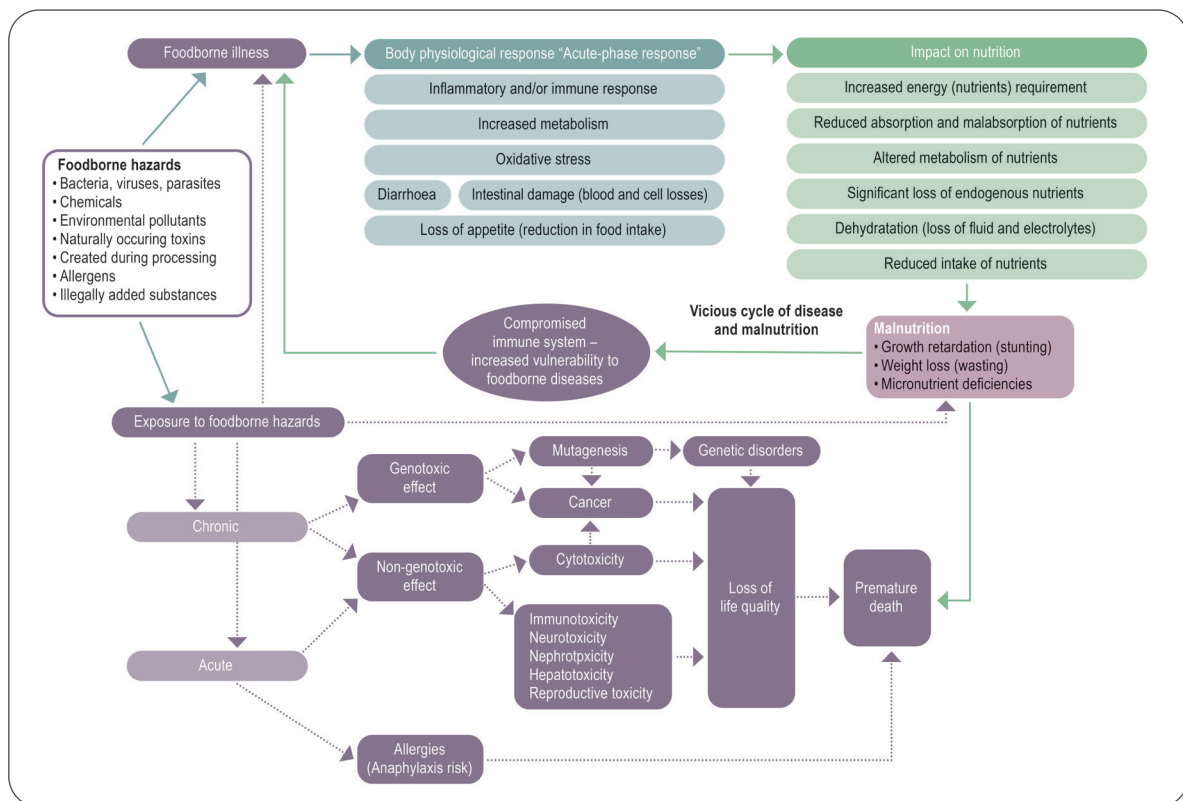
¹³ “End poverty in all its forms everywhere” (SDG 1), “End hunger, achieve food security and improved nutrition and promote sustainable agriculture” (SDG 2), “Ensure healthy lives and promote well-being for all at all ages” (SDG3), “Achieve gender equality and empower women and girls” (SDG 5); “Ensure availability and sustainable management of water and sanitation for all” (SDG 6); “Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all” (SDG8), “Ensure sustainable consumption and production patterns” (SDG12), “Take urgent action to combat climate change and its impacts” (SDG13), “Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development” (SDG17).

magnitude and cost of food-borne diseases are not always well known due to widespread unreported, uninvestigated and unrecognized cases.

Commensurate to the risks involved, food safety is not getting enough attention, policy and investment for capacity building and mitigation measures. To redress this situation, the capacity for surveillance – both laboratory-based and epidemiological – and the monitoring of food safety hazards along the entire food chain need to be reinforced to properly estimate the risks and the true burden of food-borne diseases, and the findings need to be communicated to policymakers for adequate resource mobilization toward strengthening national food control systems.

A recent World Bank Group study showed that the economic burden of unsafe food translates into more than USD 110 billion lost annually by low- and middle-income countries, including USD 90 billion in lost productivity, USD 15 billion in medical expenses, and USD 5 billion in lost trade. The study highlighted that the largest burden of food-borne disease originates from

Figure 2-1. Pathways of the impact of unsafe food on nutrition and health



Source: Adapted from: FAO. 2020. Strengthening Sector Policies for Better Food security and Nutrition Results: Food safety. Policy Guidance Note 14. Rome, FAO. <https://www.fao.org/documents/card/en/c/CA9476EN/>

unsafe food in domestic markets in low- and middle-income countries. The proposed concept of the food safety life cycle reveals variations in evolving food safety challenges dependent on levels of economic development (Jaffee *et al.*, 2019). The variation is linked to a multitude of factors, including economic advancement, modernizing and transitioning to postmodern agrifood value chains, demographics, dietary and environmental health, food safety risk management capacity in the public and private sectors, and incentives to agrifood value chain actors to comply with food safety requirements. These factors influence the occurrence of food safety hazards, potential consumer exposure, and the resultant burden of food-borne diseases. The economic impacts from unsafe food are highest in the transitioning and

modernizing economies of lower-middle-income countries. Traditional systems with little variety, predominant starchy foods, and close proximity between production and consumption sites offer fewer opportunities for contamination and thus a lower burden of food-borne diseases. Common causes of food-borne diseases are linked with poor food hygiene, close contact with animals, a shortage of clean water, and poor sanitation, facilitating the spread of pathogens and parasites.

Ensuring food safety has environmental costs associated with food production, transportation, storage, marketing and disposal. These costs are often overlooked. Impact factors include the transfer of antimicrobial resistance to the environment, energy-intensive processing and preservation technologies, uncontrolled use of agrochemicals, wide use of plastics associated with the bad management of used plastics and damage from the resulting micro-plastics to important agricultural resources, such as soil and water supplies and the produced food. Food loss and food waste, including unsafe food that has been recalled or confiscated and destroyed, is a source of greenhouse gas emissions.

To achieve the goals set out by the 2030 Agenda for Sustainable Development, food safety in agrifood systems must become a priority to consider and integrate in policies and practices. When policies fail to address food safety, there are social, health, economic and environmental repercussions that can be costly. The relevance of food safety to economic development and sustainable food systems needs to be better understood and relayed to policymakers and practitioners alike. Recognizing the essential linkages among food security, food safety, nutrition and health and aiming to strengthen commitments at the highest political levels to scale up food safety and identify key actions and strategies to address current and future challenges to food safety globally, FAO and the WHO, in collaboration with the World Trade Organization and the African Union, held two international food safety events in 2019.¹⁴ The first FAO/WHO/African Union International Food Safety Conference stressed that food safety requires multisectoral actions; increased investment into national food control systems; innovative partnerships among the public sector, private sector and academia; better engagement of consumers and civil society enabling better contributions to food safety decisions; and strengthened data and evidence as bases for food safety decisions. The International Forum on Food Safety and Trade highlighted the role and critical importance of the Codex Alimentarius within the constant evolution of food systems and trade practices. The forum also called on Members to continue to support the efforts of the FAO/WHO Project and Fund for Enhanced Participation in Codex (Codex Trust Fund). The potential of digital technologies for food safety through improvements to transparency, traceability and trade facilitation has been highlighted along with concerns on privacy, data ownership, disparities in access and capacities to use innovations, which have yet to be addressed. The forum also called for advancement on operationalizing the One Health approach as an essential condition of ensuring food safety (FAO and WHO, 2020a).

¹⁴ For information about the International Food Safety Conference, visit <https://www.who.int/news-room/events/international-food-safety-conference>.

Enhancements to face ongoing accelerations

The world is facing rapid changes in agrifood systems, with many impacts to food security, nutrition and food safety. Acceleration is seen in more pronounced and frequent extreme weather and climatic events, with associated induced emerging food-borne pathogens, contaminants and environmental degradation. Other rapid changes include population growth; changes in demographics; continuing increases in urbanization; rapidly expanding international food trade; technological changes; accelerated scientific innovations transforming the intensity of food production, management and governance; and advancements in the digital economy,¹⁵ with the facilitated interconnectivity of actors, stakeholders and sectors (FAO, 2017, 2018; FAO and WHO, 2020b). Stimulated by urbanization, rising incomes and increased consumer demand for a variety of out-of-season and year-round fresh produce and animal-sourced food – supported by improvements in production, postharvest technologies and cold chains – the international food trade has greatly expanded in the past two decades, making food safety an issue of increased significance and common concern for governments and consumers around the world. The increased globalization of the food supply and the reorganization of the markets have caused the safety of food to be highly dependent on policies and practices in many countries.

To meet sustainably growing needs for food security, adequate nutrition and food safety in front of the backdrop of ongoing accelerations with mixed potential for favourable and disruptive changes, the agrifood supply needs well-targeted enhancements and well-defined, actionable policies that tackle issues of sustainability and resilience to protect the agrifood supply chain from emerging challenges and shocks. The COVID-19 pandemic exposed specific areas that need prioritizing for strengthening and improving to become more resilient to external shocks in the future. While not a food-borne disease, COVID-19 rapidly led to a global economic and social crisis, indirectly affecting food supplies and food trade, deepening existing inequalities, rearranging social life, and raising new challenges to food security. The pandemic has revealed the need for the capability to ensure food safety in global crises that disrupt food supply chains.

In pursuit of global food system sustainability and resilience, current trends advocate for a coexistence between globalized, highly concentrated, large industrial agribusinesses and the development of complementary local and regional food chains, with a role for smallholders and family farming in supplying food to more localized and high-value niche markets. The key bottlenecks in the trade of high-value perishable food and crop commodities identified under the COVID-19 pandemic required unprecedented response measures. The pandemic highlighted the need for rethinking the effectiveness and resilience of food supply chains. Policies, investments and practical actions to accelerate and operationalize food trade facilitation through such tools as electronic certification, building digitalization into the food supply, developing electronic platforms to link smallholder producers to markets (national, regional, global) and enabling e-commerce with safe food need to be promoted. The pandemic also put a focus on the need to promote the One Health approach and to operationalize it, including through reshaping food safety governance and practices.

This chapter highlights three food safety policy areas – governance, preparedness for food safety emergency response and professional education – that would benefit from policy attention and funding for adequate enhancements in order to keep up with ongoing global accelerations and the rapid pace

¹⁵ The “digital economy” encompasses activities that use or are enhanced by digital inputs, such as digital technologies, infrastructure, services and data (OECD, 2020).

of change in current agrifood systems, providing support, contributing to positive transformations and transitioning towards efficient, inclusive, resilient and sustainable agrifood systems.

Food safety governance for sustainable agrifood systems

The prevention of food-borne diseases, food safety incidents and food loss due to non-compliance with food safety requirements requires multidisciplinary and multisectoral collaboration and effective action at local, national, regional and international levels. The importance of multisectoral action in food safety, intersectoral policy coherence, the delineation of roles and responsibilities, and the involvement of public and private actors and institutions cannot be overestimated (Global Panel, 2016). Countries should develop a set of capabilities to ensure food safety, including for the:

- generation of scientific evidence and the application of risk-based approaches for decision-making regarding the management of food safety risks;
- analytic capacities for monitoring food safety hazards along the food chain continuum, from farm to table;
- public health and veterinary health surveillance; and
- provision of support by public institutions to private actors in agrifood systems aiming to inform, prevent, anticipate, detect and manage food safety risks, integrate traceability in food supply chains, and prepare for response to potential food safety incidents, emergencies and crises.

Strengthening effectively these areas requires multidisciplinary expertise and multisectoral collaboration.

Food safety is a responsibility shared by all actors in the food chain in both public and private sectors, from governments to food business operators and consumers. “Food safety is everyone’s business”¹⁶ was the motto of World Food Safety Day 2019 and 2020. Governments take on leadership roles in ensuring food safety to protect the health of consumers and support safe trade and livelihoods by setting standards, providing updated food safety information for food business operators and the public, organizing enforcement activities, carrying out official controls to ensure that food safety and quality requirements are met, and engaging in global food safety governance. National food control systems are effective when they have a statutory legal basis, are mandatory with a clear description of duties and delineation of responsibilities, have operations based on risk analysis framework, and consult and collaborate with multiple stakeholders. Food control systems need to cover all foods produced, processed and marketed within a country, including imported foods. Critical contributions to agrifood systems’ resilience and sustainability include support for small and medium food businesses in improving their food safety knowledge and the capacity to apply good agricultural practices, good hygiene practices, and risk-based food safety management systems. The key elements of a national food control system include (FAO, 2006):

- food law, regulations, and standards;
- food control management at both national and enterprise levels;
- inspection services;
- laboratory services, including food safety hazards monitoring and epidemiological data collection; and
- information, education, communication and training.

¹⁶ <https://www.who.int/campaigns/world-food-safety-day/2020>

While these key elements are the cornerstone of national food control systems, the specific policies and capacities of each country and the institutional architecture of national food control management systems vary depending on socioeconomic, political and environmental contexts, policy priorities, and allocated resources. The focus of food governance differs among countries with different income levels. A bibliometric analysis of food safety governance research covering a 20-year period found that lower- and middle-income countries focused more on the food security aspect of food supply, while higher-income countries “cared more about food safety” and food-based nutrition (Shen, Wei and Sheng, 2020). An enabling environment is critical for a well-functioning national food control system, and effective governance is key in shaping the food safety enabling environment. Governance consists of “mechanisms, processes, and institutions through which citizens and groups articulate their interests, exercise their legal rights, meet their obligations, and mediate their differences” (United Nations, 2012). Governance influences the structure, operation and outcome of agrifood systems and has increased relevance where there is a need to address multisectoral, multistakeholder, and multilevel challenges (Gillespie, Bold and Hodge, 2019). In addition, leadership is needed to catalyse and secure political commitment and to build collaboration and alliances between sectors (Gillespie, Bold and Hodge, 2019). Effective food safety governance is exercised where there is legitimacy; economic, political and administrative authority; and the capacity to deliver the necessary food safety services. For food safety governance to be effective, it is critical that a right set of sectors, partners and stakeholders are involved and actively engaged. This should include representatives from agrifood, public health, nutrition, environment, trade, research (food science and digital science), education, labour, social protection, finance and other sectors. Each of these sectors contributes complementary and synergistic actions to achieving food safety objectives through processes and mechanisms for convening, consulting, coordinating, setting policies and norms, and regulating and overseeing the implementation of food law and food safety standards in the overall food chain, with adequate provision of accountability. Along with government authorities, other key stakeholders to engage for effective food safety governance include consumers, consumers’ associations, news media, producers’ and food manufacturers’ associations, third-party certification bodies, food trade, and representatives of research, academia and civil society. The active participation of consumers in food safety governance is conducive to policymakers’ understanding of food safety concerns from consumers’ perspective. Input from consumers is essential to improve the robustness of food safety governance (Devaney, 2016).

Entry points for participation in global food safety governance

Examples of effective food safety governance and outstanding governance practice are presented by, and not limited to, the FAO/WHO Codex Alimentarius Commission for food safety standards-setting and the international collaboration in addressing food safety incidents in international trade through the FAO/WHO International Food Safety Authorities Network (INFOSAN). The particularity of both Codex Alimentarius and INFOSAN is that these joint FAO/WHO programmes are membership-based and include representatives from all continents and from almost all countries.

Since 1962, the Codex Alimentarius Commission,¹⁷ an intergovernmental body, has been responsible for the implementation of the joint FAO/WHO Food Standards Programme. The elaborated Codex texts include standards for various commodities, guidelines, codes of practice, maximum residue limits and maximum levels for various contaminants. Codex Alimentarius hosts the online databases Pesticides

¹⁷ For more information about the Codex Alimentarius Commission, visit <http://www.fao.org/fao-who-codexalimentarius/en/>.

Residues in Food,¹⁸ Veterinary Drug Residue in Food¹⁹ and General Standard for Food Additives.²⁰ Codex standards, guidelines and codes of practice establish the basis for food safety risk management internationally, with the two-fold goal of protecting consumers' health and ensuring fair practices in food trade. The Codex Alimentarius Commission develops food safety and quality standards that many individual countries do not have the capacity or resources to develop on their own. The preeminence of Codex standards in food safety regulation is due to their two main features: their rigorous science-based content and their adoption by consensus among the 189 Codex Alimentarius Commission members (188 countries as of August 2022 and one member organization, the European Union). The Codex Alimentarius addresses food safety issues through the elaboration of food safety standards that have a global scope of applicability. FAO, in cooperation with the WHO, provides scientific advice on food safety and nutrition issues to the Codex Alimentarius Commission and to its Members as a basis for developing international and national food safety standards. Codex standards are recognized within the WTO Agreement on the Application of Sanitary and Phytosanitary Measures as the global reference for food safety in international trade. This fact increases the importance of countries adopting and applying Codex standards. Codex standards are voluntary, and countries are encouraged to apply them considering the fact that they are mandatory for internationally traded food and serve as benchmark in dispute settlement. It is important for governments to effectively participate in Codex work and contribute to standards elaboration with data and technical inputs; take advantage of and use the internationally developed Codex standards, guidelines, codes of practice and tools to enhance domestic food safety along the food chain and expand export opportunities; and harmonize national requirements with Codex standards, using them effectively to achieve objectives related to public health, food trade and development.

Member Nations are encouraged to harmonize national standards with Codex standards to facilitate regional and international trade and raise levels of food safety (FAO and WHO, 2019b). However, the mere existence of Codex food safety standards and guidance does not guarantee their application where countries lack adequate capacity to implement and comply with them. Support for eligible developing countries and countries with economies in transition in building capacity to participate effectively in international Codex food standard setting is provided by FAO and WHO through the FAO/WHO Codex Trust Fund.²¹ Since the fund became operational in 2003, the participation of developing economies in Codex activities has increased, opening perspectives for improved food trade for both domestic and international markets. FAO's capacity building activities aim to enhance the institutional capacities of countries to effectively participate in Codex work and to enable them to apply Codex standards as well as to develop policies and programmes to enhance the production of safe food, protect consumers' health, support and enhance the viability of the agro-processing sector, facilitate international food trade, and improve market access.

As international food trade expands, the projections are for the increased importance of and need for Codex standards. Emerging food safety issues point to the increasing necessity of the Codex global platform for the elaboration of globally applicable risk management options. New food standards are needed to account for changes in the environment due to climate change, new food technologies and new production methods, new food sources and emerging food safety contaminants.

¹⁸ The Pesticides Residues in Food database is available at <http://www.fao.org/fao-who-codexalimentarius/codex-texts/dbs/pestres/>.

¹⁹ The Veterinary Drug Residue in Food database is available at <http://www.fao.org/fao-who-codexalimentarius/codex-texts/dbs/vetdrugs/>.

²⁰ The General Standard for Food Additives database is available at <http://www.fao.org/fao-who-codexalimentarius/codex-texts/dbs/gsfafa/>.

²¹ The FAO/WHO Codex Trust Fund is available at <http://www.who.int/foodsafety/codex/trustfund/en>.

The INFOSAN network, established in 2004 and managed jointly by FAO and the WHO, deals with transboundary food safety issues, facilitating communication among over 600 members of the network from 188 out of 194 Members of FAO and WHO when unsafe food enters international markets (Savelli *et al.*, 2019). INFOSAN is critical for interregional communication in food safety emergencies. It operates as a virtual community of food safety professionals. Through INFOSAN, countries can share and exchange knowledge, experience and tested solutions, and develop better responses to international food safety incidents. INFOSAN provides technical assistance to countries in developing capacities for food safety risk communication, setting and operating food safety coordination mechanisms, and developing capabilities to respond to food safety emergencies. INFOSAN builds partnerships and collaborations with regional predictive and reactive alert and information systems for food and feed safety, joining efforts and contributing to consumer health protection, preventing further spread of food safety risks, and maintaining consumer confidence in the safety of food. One of the INFOSAN objectives, outlined in the Strategic Plan 2020–2025 (FAO and WHO, 2019a), is to further evolve as a “network of networks,” connecting the existent networks of food safety professionals across the world for an improved and accelerated response to food safety emergencies in global trade. Currently, developed countries are the predominantly active participants in INFOSAN. Participation in the work of INFOSAN is a way to strengthen global food safety governance. Prioritizing the effective participation in the work of the Codex Alimentarius and INFOSAN platforms provides opportunities to contribute, influence and benefit from the discussion, new knowledge and good practices exchanged on these platforms (FAO and WHO, 2019b).

One Health

The world we live in is highly interconnected, with the health of people, animals, plants and the environment interdependent and altogether linked to the overarching health of the planet. While each of these sectors has specific challenges and requires specific technical expertise to address them, the practice of searching for solutions “in silos” is not effective. A sector-based approach to problem solving may lead to a good outcome for the targeted sector while worsening the situation in other connected areas. One Health thinking is neither a new nor a stagnant concept. The One Health approach was first introduced in 1821 by Dr Rudolf Virchow, who recognized the link between human and animal diseases by identifying the connection between *Trichinella spiralis* in swine and human infections (Schultz, 2008). In recent years, the One Health approach has been increasingly adopted and enhanced: Virchow’s ideas were integrated into a single health model connecting human and animal health (Gyles, 2016). Today, the One Health approach continues to evolve, broadening its scope and foundations. With the emergence of system thinking, new evidence and knowledge about various realms’ interdependencies, the One Health approach is expanding to incorporate plant health, environmental health and broader planetary health aspects, linking in broader areas such as biodiversity, microbiomes, and the health conditions of water, soils and air. The systemic approach opens up innovative measures to mitigate the health risks for ecosystems and the constituents of agrifood systems. All areas for which the One Health approach is particularly relevant include complex issues that require close collaboration across sectors, stakeholders and countries. International efforts have been made to strengthen collaboration across sectors and disciplines under the One Health umbrella.

Improvements in health require that various sectors understand the value of the One Health approach and that they communicate, share information and collaborate. A tripartite agreement among FAO, OIE (currently WOAH) and WHO, in operation since 2018, encourages inter-sectoral cooperation to combat health risks at the interface of animals, humans and ecosystems in the context of the One Health approach and including antimicrobial resistance (FAO, WHO and OIE, 2018). It has been recently expanded into a quadripartite agreement, with UNEP joining the alliance. The inter-sectoral quadripartite (FAO, OIE, WHO

and UNEP) supports the “One Health” definition issued by the One Health High Level Expert Panel (OHHLEP) as “an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems. It recognizes the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and interdependent. The approach mobilizes multiple sectors, disciplines and communities at varying levels of society (government, private sector, non-governmental sector, civil society, academia, intergovernmental and international organizations) to work together to foster well-being and tackle threats to health and ecosystems, while addressing the collective need for clean water, energy and air, safe and nutritious food, taking action on climate change, and contributing to sustainable development.” (FAO, OIE, WHO and UNEP, 2021). The work of the quadripartite focuses on a One Health joint plan of action with six main action tracks, including enhancing countries’ capacity to strengthen health systems under a One Health approach; reducing the risks from emerging or resurfacing zoonotic epidemics and pandemics; controlling and eliminating endemic zoonotic, neglected tropical or vector-borne diseases; strengthening the assessment, management and communication of food safety risks; curbing the silent pandemic of antimicrobial resistance (AMR) and better integrating the environment into the One Health approach (UNEP, 2022). The integrated approach provides added value and is critical for achieving the SDGs. FAO is promoting systemically the One Health approach as one of the guiding principles of its work and an integral part of agrifood system transformation for the health of people, animals, plants and the environment, involving a range of actors, stakeholders and partners and spanning sustainable agriculture; animal, plant, forest and aquaculture health; food safety; AMR; food security; nutrition; and livelihoods. Adopting and applying a One Health approach is key “to anticipate, prevent, detect and control diseases that spread between animals and humans, tackle AMR, ensure food safety, prevent environment-related human and animal health threats, as well as combatting many other challenges.” (FAO, 2022). FAO encourages the sharing across sectors and borders of epidemiological data and laboratory information that is essential for effective and coordinated plans and responses to multiple threats stemming from zoonotic pathogens and environmental pollution and exacerbated by anthropogenic activities and climate change.

The One Health approach is increasingly critical to addressing health threats at the animal, human, plant and environmental interface, and the food safety aspect is part of this approach. Thus, “the sudden outbreak of major public health events, such as H1N1 in 2009, H7N9 in 2013, and MERS in 2015 had a certain influence on global food safety” (Shen, Wei and Sheng, 2020). “Between SARS-Cov, Ebola, and COVID-19, threats to human life and economic losses have increased multifold” (Aiyar and Pingali, 2020). The One Health approach is valuable in preventing, containing and addressing the risks caused by the spread of biological threats that may originate from animals (livestock and wildlife), aquaculture and plants, including zoonotic infections of pandemic potential and AMR (FAO, 2022). All these threats have the potential to affect food safety directly or indirectly and may disrupt the food supply chain. Mitigation of these threats can be achieved only through the concerted action and collaboration of multiple sectors. Aiyar and Pingali (2020) outlined a food safety approach for pre-emptive action against future pandemics that includes:

- market-based approaches for aligning One Health goals with food safety directives;
- sanitation and hygiene for greater food safety;
- integrated traceability technologies at local disease hotspots;
- depoliticized zoonotic disease emergence by focusing on local food safety as a key reconstruction goal; and
- conservation as a long-term food safety measure.

Conservation in this context refers to maintaining the genetic diversity of livestock through vaccination and improved biosecurity and veterinary services to reduce the vulnerability of livestock to zoonotic

diseases and the related use of antimicrobials. Afforestation and reduction in the demand of wildlife for food are potential ways to reduce exposure to species that may transmit high-risk but low-probability zoonotic diseases (Aiyar and Pingali, 2020). The authors argue that “investing in the development of local government capacity to track, trace, contain and prevent such diseases will help reduce global transmission. Pandemic control also requires coordination between the farming community, epidemiologists, animal science researchers, wet market traders, exporters, local food businesses and consumers. To prevent underinvestment at the national levels, coordination efforts must be facilitated by global actors. However, it is also safe to assume that without simultaneous investments in biodiversity conservation, many of these initiatives may fall in the short term. Hence a glocal²² long-term approach to food safety is imperative in preventing future pandemics and food systems disruptions. Food safety investments today will be extremely cost-effective reconstruction-related investments.”

Key to operationalizing One Health is intersectoral surveillance integration, including data collection, data analysis and interpretation, information dissemination and decision-making at global, national and local levels to efficiently manage hazards involving humans, animals and ecosystems (Aenishaenslin *et al.*, 2021; Bordier *et al.*, 2020). The challenges for applying integrated One Health surveillance in practice include sectors’ agreement for data sharing, “silo organization of public services, costs versus benefits, ethic and legal issues, and unclear responsibilities” (Stärk *et al.*, 2015). A solution for advancing the One Health agenda would be the adoption of integrated One Health governance models that would involve institutions, processes, actions and mechanisms in which food safety stakeholders have a role to play for positive outcomes in multisectoral responses to public health threats, such as addressing the emerging antimicrobial resistance pandemic and other threats originating through various pathways. Aiyar and Pingali offer additional ideas for advancing One Health: “Historical data on zoonotic diseases along with socioeconomic information on livestock production and consumption patterns at the disaggregated level can be integrated into data analytics software. These databases can be used for health monitoring and disease surveillance. Local food labs that test food quality should be equipped with surveillance technology and given access to data repositories to identify threats coming from food value chains. One Health researchers and food safety experts need to work alongside epidemiologists and local food-systems stakeholders to bolster surveillance efforts” (2020). Also essential for a comprehensive assessment of One Health are data on the occurrence of food-borne pathogens along the entire food chain, data on food-borne diseases, and knowledge on source attribution in food-borne outbreaks as well as in isolated food-borne diseases in humans. Understanding the interconnectedness of the broad One Health elements in agrifood systems and operationalizing good practices may significantly prevent food safety risks. Intersectoral food policy integration requires strong leadership and coordination among government agencies, along with technical support and guidance from intergovernmental organizations.

Preparedness for food safety emergency response

Food safety is a vulnerable issue that requires constant public health surveillance and monitoring of potential food safety hazards along the food chain, related risk assessment, risk communication, and adapted risk mitigation and risk management measures. With rapid population growth, urbanization, increasing food trade globalization, emerging new technologies, potential and unknown disruptors, the task to ensure food safety has become more complex. While not a food-borne disease, the COVID-19 pandemic highlighted the interconnections among systems and sectors, has displayed the crisis phenomenon and its disruptive effects on food supply, and triggered strong interest in developing national, regional and global capacities for better preparedness and response to emergencies.

²² The term “glocal” merges global trends and thinking with the local actions most appropriate for a particular context.

Despite improvements in food production technologies, in detection and analytical capacities, and food safety management systems at national scale and enterprise level, food safety incidents with international dimensions continue to occur (WHO and FAO, 2020). Food safety plays an important role in making agrifood systems more resilient and sustainable due to its associations with public health and with broader societal aspects, such as livelihoods and economic development, and with environmental health. Considering the polyvalent, multifaceted relevance of food safety for all dimensions of sustainability, it is essential to prioritize strengthening predictive capacity for emerging food safety issues and to develop a set of actions encompassing the anticipation, the design of national programmes for food safety incident prevention, and enhancements related to emergency response preparedness. Preparedness for food safety emergency response is a complex task that includes several important elements, such as:

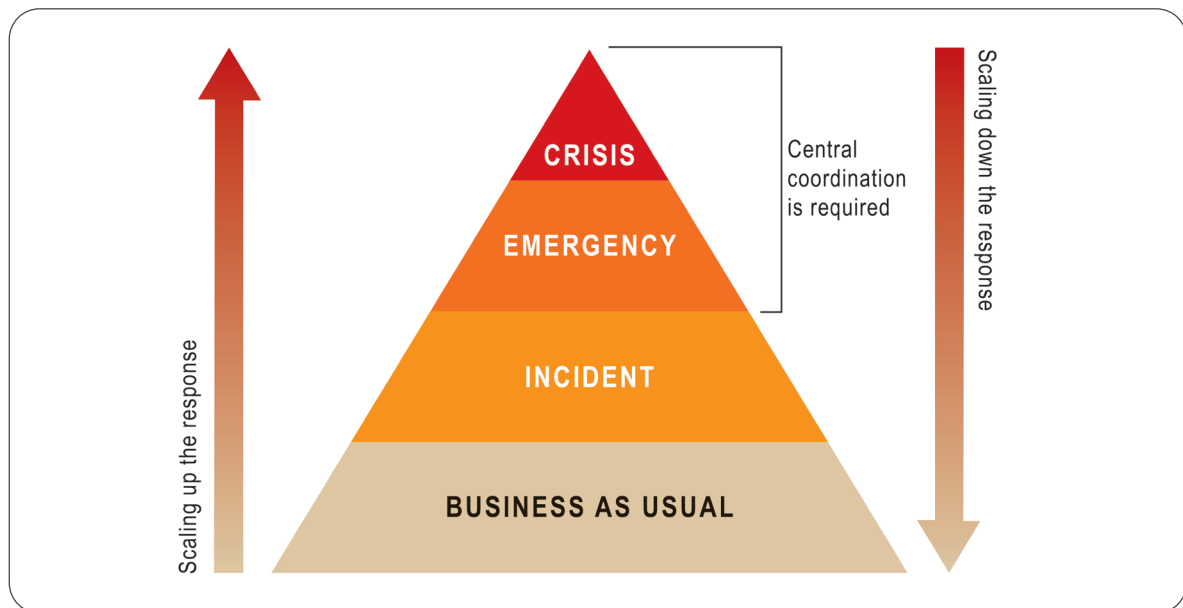
- defining and classifying various food safety hazardous situations and events according to their impact and magnitude;
- obtaining high-level support and identifying key partners for food safety information sharing and cooperation;
- establishing a multiagency planning group;
- establishing an operational multiagency emergency response coordination group;
- setting standard operation procedures and capacity development training.

The key elements of an emergency response plan include a description of essential background information, incident identification, incident management operations, post-incident review and evaluation, and communication (FAO and WHO, 2010). Countries are encouraged to use the FAO/WHO framework when developing their national food safety emergency response plans (FAO and WHO, 2010).

Depending on how a food safety event is categorized (food safety incident, emergency or crisis), it would elicit a different response, a different level of approval in the hierarchical chain of food safety risk management, a different set of stakeholders, partners involved and related pattern of coordination, and different communication strategies. Depending on its category, each food safety event may require different resources and may have different public health, economic and environmental impacts. For an appropriate response proportional to the risk from the food safety event, as well as for the accurate use of human and financial resources, the terms “food safety incident,” “food safety emergency” and “food safety crisis” should not be used interchangeably, as each entails a different degree of potential devastating impact. Developing and using appropriate terminology and defining multiple criteria and thresholds related to their impact on public health, food security, connection to food fraud, political sensitivity and consumer perception is essential for clear delineation among the types of food safety event, evoking the appropriate level and scale of response (Figure 2-2) and appropriate risk management decision-making.

Each country must define food safety events of various scales, using criteria and thresholds for launching and escalating adequate response with associated specific interventions, risk communication strategies and resources. Operational capacities of national food control systems imply country-based feasible and adjusted approaches to defining food safety events’ categories and features. There has been a good advancement in understanding and categorization of various food safety events. To support differentiating among various food safety events, general definitions are presented below that would apply to situations of varying degrees of risk and concern. A further challenge in this area is creating common definitions and harmonized approaches among countries and regions on different food safety event categories and their triggers and scales of response actions. Several existent definitions for various food safety events are presented below:

Figure 2-2. Scalability of response to food safety events



Source: FAO and WHO. 2010. FAO/WHO Framework for Developing National Food Safety Emergency Response Plans. Rome. <http://www.fao.org/3/i1686e/i1686e00.pdf>

Food safety incident: A situation in which there are concerns about the safety of a food product (or animal feed) and in which action may need to be taken to protect consumers. According to the European Commission (2019), an incident “means the detection of a biological, chemical or physical hazard in food, feed or humans which might result in or indicate a possible public health risk with the exposure of more than one person to the same hazard, or a situation in which the number of human cases or detections of a hazard exceed the expected number and where cases are linked or probably linked, to the same food or feed source.”

Food Safety Emergency: A situation, whether accidental or intentional, that is identified by a competent authority as constituting a serious and as yet uncontrolled food-borne risk to public health that requires urgent action (Codex definition, CAC/GL 19-1995, Rev.1-2004).

Food Safety Emergency Response: A process of assessing the risk, making risk management decisions, and communicating risks in the face of time constraints and possible incomplete data and knowledge (CAC/GL 19-1995, Rev.1-2004).

Food Safety Crisis: A situation that poses a high risk to public health, such as severe illness or death, and is associated with uncertainties; has a large scale or is likely to become large in terms of the number of affected products, people or countries; has high actual or potential level of media interest or public concern; may have extraordinary pressure/demand on traditional structures; requires unusual problem-solving methods; and indicates the need for a change (Adapted from European Food Safety Authority, 2016; Milašinović and Kešetović, 2008).

Elliott (2014) stressed that “mechanisms must be in place to deal effectively with any serious food safety incident. The government should ensure that all incidents are regarded as a risk to public health until there is evidence to the contrary.” The chart in Figure 2-3 captures a typology and some features of various food safety events based on public health impact criterion.

Figure 2-3. Typology and features of various food safety events

Business as usual: day-to-day food safety promotion	Food safety incident	Food safety emergency	Food safety crisis
Risks under control and managed	(Low risk/ concern)	(Medium and high risk/concern)	(High or unknown risk/concern)
Preparation of tools for food safety event response: – Risk categorization of food and enterprises – Prepare risk management options for various food safety issues, checklists, templates, decision trees, set protocols, standard operating procedures	– Minor to mild adverse health effect, may require hospital care	– Severe/serious adverse health effects	– Severe illness or death – Uncertainties – Large scale (or likely to become so) in terms of the number of affected products, people or countries
Set multiagency coordination group and communication lines	– Hazard, its source and the contaminated food are identified	– Food-hazard combination identified	– A high, actual or potential level of media interest or public concern – May have extraordinary pressure/demand on traditional structures
– Plan food distribution centres, mass feeding and critical supplies, infrastructure, logistics – Plan target audiences and information distribution lists – Test risk communication messages – Provide training to key personnel and stakeholders	– Localized event, under control – Low risk perception – Limited attention of media	– Wide distribution of contaminated food and related food-borne illness	– Requires unusual problem-solving methods – Indicates the need for change <u>Examples:</u> Zoonotic pandemics; radiologic, chemical contamination; terrorist acts targeting food or water supply

Source: Author’s elaboration with adaptations from (FAO and WHO, 2011; EFSA, 2016; Milašinović and Kešetović, 2008).

The need to find unusual risk management options and the need for a change following the lessons learned after a food safety event are particular characteristics of food safety crises. Below are examples of food safety crises that have triggered important changes in food control systems:

- Bovine spongiform encephalopathy, colloquially known as mad cow disease, has triggered the farm to fork approach to ensure food safety along the entire food supply chain, including feed, and a request for traceability in the food chain.
- Melamine in milk and powdered infant products has drawn attention to economically motivated food adulteration and has enhanced regulatory action to prevent food fraud.
- The horsemeat scandal, managed as a food crisis, has shifted consumers’ shopping patterns and preferences towards organic as an indication of integrity and quality and towards less processed meat, favouring small-scale local suppliers and traceable short supply chains. This crisis has led to actions on strengthening public–private collaboration for food chain intelligence gathering and sharing, developing central databases and setting central bodies in charge to promote food defence (Elliott, 2014).

The typology of food safety events shown in Figure 2-3 may be used to distinguish one food safety event from another and may guide the level of required risk communication, keeping in mind that food safety risk communication is different from crisis communication. Distinguishing between risk communication (information on something that may happen and how to reduce the probability) and crisis communication (communicating on an event that already happened or is happening) implies close collaboration among communication officers in competent authorities during the non-emergency/preparation phase. Crises may have a high-profile food safety/human health impact component, but not always; the horsemeat scandal, which gained high media attention, had a significant socioeconomic impact, and countries applied crisis communication to address the issue.

Aiyar and Pingali noted the importance of transparency and collaboration: “Disease spread can be controlled only if there is transparency in sharing information and if local actors are empowered with resources to act on disease threats” (2020). Ensuring food safety requires collaboration and information sharing at both subnational, national, regional and international levels.

The level of risk communication should be determined in consultation with experts responsible for scientific risk assessment. In the case of a food safety event, the competent authority needs to clarify:

- What hazard caused the issue?
- What is known about the related risk?
- Has a scientific risk assessment already been performed at the country level?
- If so, who performed the risk assessment?
- If not, is there an available risk assessment on the issue in trusted international references?
- Has anyone already issued a communication on this hazard?
- Who should be informed and involved in risk communication: industry associations, consumer interest groups, research organizations, health professional organizations, civil society organizations or others?
- What risk mitigation measures need to be applied by consumers and other stakeholders?

Food safety crises must be distinguished from non-food safety crises, such as extreme climatic and weather events, pandemics, etc. For example, the COVID-19 pandemic, while a health crisis with dramatic implications for economies and societies, is not a food safety crisis. However, it has implications on food control systems due to restrictions on movement and physical distancing, which implied adjustments in the implementation of food safety inspection plans. The COVID-19 pandemic brought into the spotlight the need for changes in food systems, such as broader use of digital technologies, including for food safety inspections and audits, vending machines, robotics in foodservice, self-payment posts in supermarkets, broader use of e-commerce, etc. The internet was crucial for connectivity, keeping many businesses ongoing through remote work and telework. Further opportunities must be identified to accelerate the digital economy support for food safety. At the onset of the first lockdown, FAO and the WHO issued guides that were of great support to food safety authorities and food business operators in finding adapted solutions to keep the flow of safe food supplies uninterrupted during the pandemic (FAO and WHO, 2020a, 2020c).

One Health and the need for professional education

The agrifood sector is quickly developing and continuously adopting new production technologies; new value chain tools and operations; new methods of processing, packaging and distribution; and advanced food safety analysis methods. Workforce training needs to respond to the changing demands

of the labour market brought about by new technologies, new food sources, innovation and challenges related to global trends. For new technologies to be effectively applied, the needs of future professional education and training must be identified for adequate curriculum reform and programme development. Professional education programmes must keep pace with transformations in agrifood systems, technologies and food safety requirements, with changes in society and in job markets associated with updated job profiles. Continuously updating, modernizing and investing in professional education and training is a priority for building resilient, inclusive and sustainable agrifood systems. In agrifood systems, the COVID-19 pandemic brought to the fore the need to accelerate the application of digital technologies – such as blockchain, internet of things and the use of artificial intelligence in production, packaging, foodservice and machine learning – that enable and facilitate innovative food business processes and enhance their performance. Digital technologies enabled the new business models – such as remote and telework – that were needed in response to physical distancing in the workplace. These technologies also enabled the testing of video inspection in food processing enterprises and the growth of online trading. The introduction of new technologies and business models has raised the demand for new professional skill requirements in the agrifood systems' workforce.

Bridging the gaps between science and food policy, policy and education, education and changing agrifood systems are key for positive developments in food safety practice and for the implementation of the One Health approach. The education of policymakers and decision-makers and of employees in all sectors along the food chain, from production to retail, impacts the quality of services, influences the resilience of agrifood systems, and enhances participation in food safety governance. The continual supply of safe food depends on the robustness of food safety management processes and on the behaviour of food business operators.

In this realm, Shen *et al.* (2020) have noted the importance of education and training: "Technical assistance from professionals, the education level of employees, and the implementation of public training programmes are believed to have an important impact on food safety." Operationalizing the One Health approach requires the integrated interdisciplinary work of professionals from multiple domains, such as public health surveillance, veterinary health surveillance and food chain monitoring. Horizontal and vertical cooperation among all relevant institutions with roles in One Health is essential, and this can be supported by the inclusion of One Health approach in professional education and continuous training in various disciplines. "A combination of different skills and ways of thinking results in synergism" that will enhance capacities to cope with existing and new challenges (Hristovski *et al.*, 2010). Scholars suggest that in addition to hard skills, such as technical expertise and the knowledge needed to fulfil a job, the new generation of food professionals needs to master certain soft competencies that would help in intersectoral cooperation and would give them a competitive advantage (Robles, 2012). Robles has identified ten important soft competencies of employees, including "flexibility, integrity, communication skills, politeness, teamwork, responsibility, professionalism, positive attitude, work ethic and interpersonal skills." These skills already are solicited from professional graduates by business employers. Enhanced research and data generation also will be a key tool for the work of academics, policymakers and practitioners. In this respect, research and analytical laboratory staff need to keep up to date with legal regulations and new requirements for food processing, and they must master good laboratory practices and know customer expectations (Dziuba *et al.*, 2019).

Meeting evolving global challenges, protecting the health of consumers, and ensuring food and nutrition security and safe food for everyone in a world of rapid transformations and emerging new risks requires the collaboration of professionals from many disciplines, such as agronomic science, agricultural economics, food technology and nutrition, food science, food toxicology, public health, veterinary medicine, human medicine, environmental protection, wildlife and more. Reducing the skill

mismatch between the current workforce and new job requirements is necessary to adequately manage what Akyazi *et al.* call “the big industrial revolution challenge” (2020). A thorough analysis of the needed knowledge, competencies, skills and qualifications would inform the development of updated, upgraded, targeted and tailored continuous training programmes of employees in agrifood chains. Akyazi *et al.* (2020) have presented an analysis of the essential and optional future skills required for employees of food industry 4.0. Creating centres of excellence for education and training in specific areas relevant for One Health, increasing professional opportunities, and gaining scientific knowledge to create innovative educational programmes are essential in preparing agrifood workers for the future (Hristovski *et al.*, 2010). Programmes for public education and training are needed as well. These would increase and generalize the attention to food safety, improving consumer awareness and knowledge and enabling consumer demand for safer food.

Conclusions

- Food safety is an integral part of and a pre-condition for food security, healthy diets and adequate nutrition for all. It also is a feature of sustainable, efficient, inclusive and resilient agrifood systems and a contributor to the 2030 Agenda for Sustainable Development and its SDGs.
- An operationalized and consistently practiced comprehensive One Health approach provides the grounds for inclusive, collaborative and effective food safety governance and practice.
- New food standards are needed that take into consideration changes in the environment, new food technologies and food sources, and emerging food safety risks. Participation in global food safety governance through the FAO/WHO Codex Alimentarius and the FAO/WHO INFOSAN provides opportunities both to contribute to the elaboration of new food safety standards that protect consumers by ensuring the safe flow of food in international food trade, and to better use the valuable international resources in strengthening national food control systems.
- The One Health approach recognizes the interdependencies among the health of humans, animals, plants and ecosystems. Understanding this interconnectedness in agrifood systems and operationalizing good practices of intersectoral collaboration and integrated intersectoral surveillance may significantly prevent food safety risks and protect public health.
- Insights on differentiating various food safety events is evolving. Defining and classifying hazardous food safety situations according to their severity and magnitude is an essential step in emergency response preparedness, including a clear delineation of the roles, responsibilities and leadership by designated competent authorities and stakeholders.
- The modernization of education and training programmes is essential to impart high-level competencies, skills and knowledge to the future generation of food safety professionals to prepare them and assist them in coping with various potential disruptive challenges and threats to agrifood systems.
- Strengthened food safety education with the One Health approach would also equip the new generation of professionals with the multidisciplinary hard and soft skills needed for robust food safety governance and practice.

Disclaimer: The views expressed in this paper are those of the author and do not necessarily reflect the views or policies of the Food and Agriculture Organization of the United Nations.

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Chapter 3

Mycotoxin incidence in southeastern European countries: implications for the food supply chain

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Abstract

Mycotoxins are chemical hazards of microbiological origin, produced mainly by filamentous fungi such as secondary metabolites. Fungal and mycotoxin food contamination results in lower product quality and nutritional losses and can significantly compromise food safety, especially in low- and middle-income countries. Analyses of food and feed carried out in southeastern European countries in recent decades have revealed the presence of mycotoxins, such as aflatoxins (AFs), ochratoxin A (OTA), fumonisins (FUMs), type A trichothecenes (TCTs), T-2 and HT-2 toxin (T-2/HT-2), type B TCTs, deoxynivalenol (DON), patulin (PAT) and *Alternaria* toxins, with varying distribution patterns and in variable concentrations, dependent on the affected region and agricultural season. Thus, mycotoxin contamination of food and feed has a considerable impact on food safety, regional and international trade, national economies and public health. The role of mycotoxins has been recognized in the etiological background of several diseases, particularly non-communicable ones, including malignancies. Furthermore, mycotoxin contamination directly reduces food availability and increases its costs, contributing to hunger, malnutrition and growth impairment. Due to its negative impacts on public health and economy, mycotoxin contamination will continue to be a large public health challenge that must be addressed by producers, regulatory agencies, the research community and consumers. This review aims to provide an up-to-date overview of the prevalence of mycotoxins in food and feed in the countries of southeastern Europe and to discuss their impacts on food supply chains and food system sustainability in these countries.

Keywords: *mycotoxins, southeastern European countries, prevalence, public health, sustainable food systems*

Introduction

Food safety assurance, as a prerequisite for the prevention of hunger and malnutrition, is one of the major issues that still needs to be addressed to protect human health and ensure global economic development. According to data released by the World Health Organization (WHO), the number of undernourished people reached 821 million in 2017, and the rate of undernourished people continues to be exacerbated, particularly in the Global South (WHO, 2011). Undernourished adults and children may contract multiple acute or chronic diseases, such as developmental disorders, unmet genetic potential, overall poor health and shorter life expectancy as a result of poor dietary quality and low nutrient intake. Therefore, food safety was declared as the key policy objective of the 2030 Agenda for Sustainable Development (Sustainable Development Goal 2) adopted by the United Nations in 2015 (Dupouy and Gurinović, 2020). The problem of food and feed contamination by food-borne fungi and the hazard of consuming contaminated foods has been recorded worldwide throughout the history of humankind. Based on data provided by numerous food safety authorities, mycotoxin contamination of food and feed is more common in low- and middle-income countries and has a considerable impact on food safety systems, regional and international trade, and the global economy (Milićević and Nedeljković-Trailović, 2021). Mycotoxins are defined as a structurally heterogeneous group of secondary metabolites produced by a high number of filamentous fungal genera of microscopic size, which can contaminate staple foods and feeds during growth, after harvesting, during storage, during transportation, and during processing. Their common low-level co-occurrence in food and feed jeopardizes human and animal health and causes major economic losses, which can be felt by the likes of farmers, the food industry, international supply chains and society as a whole. On top of the most important mycotoxins, such as aflatoxins (AFs), ochratoxin A (OTA), trichothecenes (TCTs) of type A and B, including T-2 and HT-2 toxins (T-2/HT-2), fumonisins (FUMs), zearalenone (ZEA), deoxynivalenol (DON), patulin (PAT), and *Alternaria* toxins (AT), some other mycotoxin groups, such as “modified,” “masked” and newly emerging mycotoxins (moniliformin, enniatins, beauvericin and fusaproliferin) have also attracted a lot of attention from the research community (Jajić *et al.*, 2019). The term “modified mycotoxins” refers to any mycotoxin whose structure has been changed during the chemical/biochemical reaction taking place in herbal or animal fungi or during food processing (Rychlik *et al.*, 2014). “Masked mycotoxins” are a group of mycotoxins produced during detoxication reactions run by plants in an attempt to neutralize native mycotoxins (Khaneghah *et al.*, 2018). Given that modified mycotoxins are usually undetectable by commonly used analytical methods, only limited data on their occurrence in crops is available. Thus, their impact on food safety may be even more relevant than current research suggests. It is also important to point out that most mycotoxins are relatively stable during conventional food processing, such as cooking, baking, frying, roasting, etc. and thus remain in the final product (Carballo *et al.*, 2019; Udovički *et al.*, 2018). Exposure to mycotoxins primarily comes from ingestion, either directly via the consumption of contaminated foods or indirectly (*carryover*) through the consumption of mycotoxins and/or their metabolites residing in animal tissues, milk and eggs (Milićević *et al.*, 2009; Pleadin *et al.*, 2015a; Vasiljević, M., Marinković and Milićević, 2021). Nevertheless, other routes of exposure, such as dermal and inhalation routes, cannot be dismissed either. Ingestion of mycotoxin-contaminated food/feed induces, subclinically, a disease known as mycotoxicosis. Depending on the toxicity of the culprit mycotoxin(s), the concentrations in foods, the duration of exposure and the age and nutritional status of the affected individual, the health risks can range from acute to chronic (mutagenic, teratogenic, and carcinogenic) in both humans and animals (Datsugwai *et al.*, 2013; Milićević, Škrinjar and Baltić, 2010). Based on the data presented by the Rapid Alert System on Food and Feed (RASFF), in the last ten years, mycotoxins, particularly aflatoxins, represent the most frequently reported type of food safety hazard. The data show that 93 percent of the overall mycotoxin notifications contain aflatoxins (EC Directorate

General for Health and Consumers, 2019). Due to the high risk of mycotoxin exposure, especially for infants and children, and their significant impact on food quality and safety, mycotoxins-focused research and preventive activities have been declared a high priority by the Food and Agriculture Organization of the United Nations and the WHO (FAO *et al.*, 2018). It is encouraged that competent authoritative bodies establish an effective food safety system that includes integrated and well-coordinated longitudinal “field-to-table” monitoring (Gurinović *et al.*, 2016). In 1993, the International Agency for Research on Cancer (IARC) evaluated the carcinogenic potential of AFs, OTA, TCTs, ZEA and FUMs. The IARC re-evaluated the AFM1 carcinogenicity in 2012 (IARC, 2012; Ostry *et al.*, 2017). Naturally occurring aflatoxins (AFB1, B2, G1, G2, M1) were classified as human carcinogens (Group 1), while OTA and FUMs were classified as potential carcinogens (Group 2B). TCTs, ZEA, and PAT, however, were not classified as human carcinogens (Group 3) (Table A4- 1). Currently, there are no regulations governing the presence of *Alternaria* toxins in food and feed in Europe. The European Food Safety Authority (EFSA) is currently investigating the relative hazard posed by mycotoxins produced by *Alternaria* species across the European Union to obtain information on the levels of *Alternaria* toxins in different food products. Although based on limited data, the results show that vegetarians seem to have a higher dietary exposure to *Alternaria* toxins than the general population (EFSA, 2016). Recently, several papers have assessed the impact and consequences of climate change on food safety, food production and availability, the levels of mycotoxin contamination, and the levels of exposure of humans and animals consuming mycotoxin-contaminated food and feed (Milićević, Nastasijevic and Petrovic, 2016; Paterson and Lima, 2011). These data clearly show that mycotoxin contamination is becoming a more severe problem because of its hazards to public health, affecting feed and food safety, food security and international trade, especially in low- and middle-income countries. The EFSA has investigated the potential impact of climate change in Europe and has suggested that effects will be regional and detrimental or advantageous depending on geographical region (Battilani *et al.*, 2012). In southern and southeastern Europe (i.e. Portugal, Spain, southern France, Italy, Slovenia, Greece, Malta, Cyprus, Bulgaria and southern Romania), temperature increases of 4–5 °C and reduced water availability during the summer months are predicted. If these predictions come to fruition, they could decrease agricultural yields by 10–30 percent in many regions, sustain droughts, cause heat waves, catalyse soil and ecosystem degradation, and initiate desertification.

In this overview, we aim to review and discuss the prevalence of mycotoxins in southeastern European countries, review the key aspects of the impacts of mycotoxin contamination on the food supply chain, understand the effects of mycotoxins on human and animal health and the applicable regulations governing the subject matter, analyse the latest trends in mycotoxin reduction activities and forecasts of their success, and discuss necessary support measures for sustainable food systems. The Scopus and the Medline electronic databases were searched to identify articles reporting on mycotoxin contamination of food or feed in the countries of southeastern Europe.

Background of toxicogenic moulds and major mycotoxins

Fungi belong to natural microflora and may be found across the entire food production chain: before harvesting, between harvesting and drying, and during storage. The production of secondary metabolites is not essential for normal fungal growth, but it allows moulds to rapidly colonize, compete with other organisms or inhibit competitor growth and reproduction, thus giving them a “head start” within complex ecosystems (Raffa and Keller, 2019). Mycotoxins are synthesized from biochemically simple interim products of the primary metabolism, such as acetates, malonates, mevalonates, and certain amino acids, through a chain of enzyme-catalysed reactions. The major reactions implicated in mycotoxin biosynthesis are condensation, oxidation/reduction, alkylation and halogenation, through which a unique range of secondary compounds is formed (Bennett and Klich, 2003). The major pathways included into their synthesis are polyketone (aflatoxins), terpene (trichothecenes), amino acidic (gliotoxins) and tricarbone acid pathways (rubratoxins). Some of the mycotoxins (e.g., cyclopiazonic acid) are synthesized through two or more major pathways detailed above.

Mycotoxins embrace a variety of forms, spanning from simple C₄ compounds (e.g., moniliformin) to complex substances such as tremorgenic mycotoxins or phomopsins (Brase *et al.*, 2009). The growth conditions of a fungal species may be different in the field as compared to postharvest stages, but various factors operate interdependently to affect fungal colonization and/or the production of secondary metabolites, such as mycotoxins. Toxicogenic moulds, known as mycotoxin producers, grow on substrates of plant and animal origin in areas of constant high relative humidity and moderate to high temperatures and can be divided into three groups (Fleurat-Lessard, 2017):

1. moulds in natural habitats growing on cereal grains in the field before harvest, mainly species of the *Alternaria*, *Fusarium*, *Rhizopus* and *Cladosporium* genera;
2. moulds growing on stored cereals during postharvest storage, mainly species of the *Penicillium*, *Aspergillus* and *Mucor* genera; and
3. advanced spoilage moulds growing on grains damaged by other microorganisms, mainly species of the *Fusarium* and *Chaetomium* genera.

Although moulds dangerous to human health mostly belong to the group of postharvest colonizers predominately found in storage facilities, some biologically active mould metabolites that have formed in natural habitats also have been shown to be toxic to humans and animals. Toxicogenic moulds present in food and feed do not necessarily imply the presence of mycotoxins, but it should be noted that the absence of visible mould from biological material does not vouch for the absence of mycotoxins (Milićević *et al.*, 2010b). Since natural substrates almost never contain pure but rather mixed mould cultures and given that mixed cultures are often more biochemically active than pure ones, the problem of biosynthesis of various metabolites during mixed cultures' mould growth becomes even more significant. The main mycotoxin-producing mould genera include the *Aspergillus*, *Penicillium*, *Fusarium*, *Claviceps*, *Alternaria*, *Pithomyces*, *Phoma*, *Stachybotrys* and *Diplodia* genera, with the most common among them being those of the *Aspergillus*, *Penicillium* and *Fusarium* genera (Bennett and Klich, 2003; Marin *et al.*, 2013).

Although 400 toxicogenic secondary metabolites of the above kind have been discovered, only about 50 of them have been studied in detail due to their important role in jeopardizing food safety. From the standpoint of agricultural economics and public health, the most important classes of mycotoxins are AFs (produced by *Aspergillus flavi* species), OTA (*Aspergillus circumdati* species, *Aspergillus nigri* species,

Penicillium nordicum, *P. verrucosum*), FUMs (*Fusarium verticillioides*, *F. sporotrichioides*), T-2/HT-2 (*F. langsethiae*, *F. sporotrichioides*), DON (*F. graminearum* and related species), PAT (*P. expansum*), and *Alternaria* toxins and ergot toxins (Liew and Mohd-Redzwan, 2018; Rai, Das and Tripathi, 2019). Some of the classes may produce more than one mycotoxin, and some mycotoxins are produced by more than one fungal species. Such a contamination may affect different types of cereals, widely used as raw materials in the production of food and feed. The most important mycotoxin-producing moulds and the mycotoxins they produce are shown in Table A4-1.

Given that the presence of mycotoxins produced by both preharvest (plant-pathogenic) and storage-associated (saprophytic) fungi depends on the climate, climate change and increased climate variability will lead to a slight shift from traditional occurrence areas of the *Aspergillus* and *Fusarium* species to areas offering the optimum climatic conditions these species require for their growth, distribution and mycotoxin production. For example, in Serbia, the co-occurrence of high air temperatures (up to 40 °C) and heavy rainfall with high relative humidity (up to 80 percent) within the same year presents a novel weather pattern for this country. Under volatile conditions, the presence of toxigenic fungi and consequent mycotoxin co-contamination has become a rising issue. It is important to note that Serbia's economy relies heavily on its agricultural sector, and thus mycotoxin contamination of agricultural products has had an adverse impact on Serbian trade, especially on the European Union markets. Due to the long-reaching effects on global trade and food systems, it is extremely important to determine trends in the occurrence of toxicogenic moulds and mycotoxins depending on differing climate conditions. The control of mycotoxins in food and feed samples can be adjusted appropriately for different regional contexts.

Table A4-1. Toxicological aspects of the main mycotoxins

Mycotoxins	Most susceptible crops	Producing fungi	Primary mechanism of action/Health effects	IARC (Group)	Health guidance value	Reference
Afs	Tree nuts, ground nuts, dried fruits, spices, maize	<i>Aspergillus flavus</i> , <i>A. parasiticus</i> , <i>A. section Flavi</i>	Binds to guanine (DNA adduct)/carcinogenic, mutagenic, teratogenic, hepatotoxic, nephrotoxic, immunosuppressive	1	(ALARA principle) BMDL ₁₀ 0.4 µg kg ⁻¹ bw day ⁻¹	EFSA, 2020b, IARC, 2012
OTA	Cereal grains, coffee, beer, wine, dried fruits, spices, meat products	<i>A. ochraceus</i> , <i>P. verrucosum</i> , <i>A. niger</i> <i>A. carbonarius</i>	Blocks protein synthesis/ mutagenic, teratogenic, neurotoxic, hepatotoxic, nephrotoxic, immunotoxic	2B	BMDL ₁₀ 14.5 µg kg ⁻¹ bw day ⁻¹	IARC, 1993; Schrenk <i>et al.</i> , 2020b
FUMs	Maize, maize-Based food	<i>Fusarium proliferatum</i> , <i>F. verticillioides</i>	Inhibit ceramide synthase/ esophageal and liver carcinogens, neurotoxic, neural tube defects, genotoxic	2B	TDI= 1 µg kg ⁻¹ bw day ⁻¹	IARC, 1993, 2002; EFSA, 2018
STG	Coffee beans, spices, nuts and beer	<i>A. versicolor</i> , <i>A. flavus</i> , <i>A. parasiticus</i> , <i>A. nidulans</i>	Genotoxicity, carcinogenicity, liver and kidneys	2B	PTWI is not established	IARC, 1987, EFSA, 2013
DON and sum 3-Ac-DON, 15-Ac-DON, DON-3-glucoside	Cereal crops, processed grains	<i>F. graminearum</i> , <i>F. culmorum</i>	Inhibition of protein synthesis/gastrointestinal haemorrhagiae, immuno-suppression, dermatosis	3	TDI = 1 µg kg ⁻¹ bw day ⁻¹	IARC, 1993; EFSA, 2014a
T-2/HT-2 toxin	Cereal crops, processed grains	<i>F. sporotrichioides</i> , <i>F. Poae</i> , <i>F. langsethiae</i>	DNA damage/Immun depressants mutagenic gastrointestinal haemorrhaging, neurotoxic	3	TDI (T-2+HT-2) = 0.1 µg kg ⁻¹ bw day ⁻¹	IARC, 1993; EFSA, 2014b

Mycotoxins	Most susceptible crops	Producing fungi	Primary mechanism of action/Health effects	IARC (Group)	Health guidance value	Reference
NIV	Cereal crops, processed grains	<i>F. graminearum</i> , <i>F. crookwellense</i> , <i>F. nivale</i>	Inhibition of protein and DNA synthesis, immunosuppressive	3	TDI = 1.2 µg kg ⁻¹ bw day ⁻¹	IARC, 1993; EFSA, 2014b
ZEA	Maize, cereal crops	<i>F. graminearum</i> , <i>F. culmorum</i> , <i>F. equiseti</i> , <i>F. cerealis</i> , <i>F. verticillioides</i>	Binds to mammalian estrogen receptor/hyperestrogenism, reproductive disorders, infertility, early pubertal changes	3	TDI = 0.25 µg kg ⁻¹ bw day ⁻¹	IARC, 1993; EFSA, 2014a
PAT	Apples and apple-derived foods	<i>Penicillium expansum</i> , <i>Bysochlamis nivea</i> , <i>A. clavatus</i>	DNA and RNA synthesis inhibition/ gastrointestinal symptoms, neurotoxic, immunosuppressive, mutagenic	3	TDI = 0.4 µg kg ⁻¹ bw day ⁻¹	IARC, 1993; EC, 2006

Source: Data extracted from reviewed publications

AFs – Aflatoxins (B1, B2, G1, G2, M1); DON – deoxynivalenol; FUMs – Fumonisin (B1, B2); NIV – nivalenol; OTA – Ochratoxin A; PAT – Patulin; STG – Sterigmatocystin; ZEA – Zearalenone

Group 1 – carcinogenic to humans;

Group 2A – probably carcinogenic to humans;

Group 2B – possibly carcinogenic to humans;

Group 3 – Not classifiable as to its carcinogenicity to humans;

ALARA principle – As low as reasonably achievable;

TDI – tolerable daily intake;

PTWI – provisional tolerable weekly intake

Toxic effects of mycotoxins on humans and animals

The toxic effects of mycotoxins on humans and animals are summarized under the term “mycotoxicoses.” Mycotoxicoses are defined as food- or feed-related, non-transferable, non-immunogenic diseases and are untraceable to microorganisms other than fungi (Zain, 2011). Clinical symptoms usually subside on removal of contaminated food or feed. Symptoms depend on the type of mycotoxin; the level and duration of exposure; the age, health status, sex and genetic characteristics of the host; and the synergistic effects of mycotoxins and/or other toxins to which the organism has been exposed (Bennett and Klich, 2003). If mycotoxicosis occurs in combination with malnutrition, vitamin deficiency, excessive alcohol consumption and/or infectious diseases, the health consequences may be severe. Mycotoxicosis can make the host more susceptible to other diseases and intensify toxic effects. The direct effects of mycotoxins on humans and animals are slowed growth, weakened immunity and proneness to infections. In cases with high levels of exposure to mycotoxins, the outcome might even be fatal. In animals, decreased egg and milk production can be witnessed. On top of acute toxicity, chronic diseases, including tumours seen after prolonged exposure to small amounts of mycotoxins, can be developed (Council for Agricultural Science and Technology, 2003). A report compiled by the WHO’s Food-borne Diseases Burden Epidemiology Reference Group used global estimates of incidence to calculate illnesses, deaths and disability-adjusted life years lost (DALYs) to reveal the highest global DALYs to be attributable to liver cancer (Gibb *et al.*, 2015). The chemical associated with the greatest number of DALYs was reported to be aflatoxin (636 869). Aflatoxins have been identified as highly toxic substances (IARC, 1993) that exhibit teratogenic, mutagenic, carcinogenic, and immunosuppressive properties. The clinical symptoms of aflatoxicosis include fever, vomiting, anorexia, tachycardia and oedema. The most common route of intake of almost all aflatoxins is the ingestion of contaminated foodstuffs, while dermal exposure results in slow and insignificant absorption. However, the most toxic representative of this group, aflatoxin B1 (AFB1), can also enter the body through the skin or via inhalation of contaminated dust. Inhalational exposure in humans has not been studied because of its irrelevance for food toxicology (Fung and Clark, 2004). Other types of aflatoxins are several times less toxic than AFB1 (Lee *et al.*, 2014) and rarely present health hazards. *In vitro* metabolism studies have shown AFB1 to undergo the following metabolic pathway: reduction resulting in the nascence of aflatoxicol (AFL), hydroxylation resulting in the nascence of aflatoxin M1 (AFM1), hydration resulting in the nascence of AFB2a, and epoxidation resulting in the nascence of AFB1-2,3-epoxide. The latter epoxide is the most reactive metabolite and is thought to be responsible for both acute and chronic toxic (carcinogenic) effects of AFB1, especially in the liver (WHO, 2011).

Although AFB1 is more toxic than AFG1, if metabolic activation of AFG1 occurs through epoxy formation, the toxicity of these two is almost equal, while AFB2 and AFG2 are far less toxic because of their inability to produce epoxides. AFM1 is a hydroxylated metabolic product of AFB1, formed during oxidation in the body after the ingestion of contaminated food, while AFM2 is a hydroxylated metabolic product of AFB2 that is formed during oxidation in the milk of mammals that received contaminated food. Both fall into the group of less toxic mycotoxins (Council for Agricultural Science and Technology, 2003). The average conversion was found to be 2.5 percent, although a direct relationship between the carryover rate and the milk yield, with a maximal 6.2 percent carryover rate, was found (Walte *et al.*, 2016). AFB1 is the most predominant and most potent hepatocarcinogen and has been classified as Group 1 of proven human carcinogens (IARC, 1993). Therefore, no tolerable daily intake can be defined for this type of carcinogen, and a different approach is needed to evaluate the risk of this carcinogenic mycotoxin. The EFSA recommended using the margin of exposure (MoE) approach, concluding that MoE values

higher than 10 000 (based on the $BMDL_{10}$ from animal studies) are of low concern from the point of view of public health (Schrenk *et al.*, 2020a). In other words, only a zero level of exposure will result in no risk.

OTA, as the most important representative of the ochratoxin group, shows nephrotoxicity, carcinogenicity, teratogenicity, hepatotoxicity, and neurotoxicity, and, to a lesser extent, it acts as a mutagen and an immunosuppressant (Doi and Uetsuka, 2011). It is easily absorbed through the gastrointestinal tract, mainly through the duodenum and the jejunum. There have not been enough studies done on skin or inhalation absorption. When absorbed, OTA has a high binding affinity for plasma protein. It can be found in decreasing order of concentrations in the kidneys, liver, fat, and muscle tissue (Milićević *et al.*, 2008; Pleadin *et al.*, 2016a). In humans, it is excreted in two phases, the first being the rapid excretion phase and the second being the purification phase, which determines the rate of final elimination of the compound. OTA toxicity involves several mechanisms. It inhibits protein synthesis by competing with the phenylalanine aminoacylation reaction catalysed by Phe-tRNA synthetase. This results in the inhibition of protein, DNA and RNA synthesis. OTA also disrupts hepatic microsomal calcium homeostasis by impairing the endoplasmic reticulum via lipid peroxidation. The main target affected by OTA is the kidney; OTA can cause endemic nephropathy associated with urothelial cancer, known as Balkan endemic nephropathy and witnessed in some endemic areas in Bulgaria, the former Yugoslavia and Romania (Pavlović, 2013; Peraica, Lucić and Pavlović, 1999). The first signs and symptoms of the disease are fatigue, headache and pale skin, while after prolonged exposure, symptoms of low molecular weight proteinuria develop, without concomitant hypertension but in combination with aplastic or normochromic anaemia. Historically, the consumption of pork has been a significant source of human exposure to OTA in these regions. Unlike other monitored mycotoxins, OTA has the potential to bioaccumulate in the organism and resides in edible tissues, particularly in the kidneys and liver, often used by the meat industry (Milićević *et al.*, 2014). Due to high OTA-induced health risks, OTA toxicity has been studied more often and more in depth than that of other mycotoxins encountered in the southeastern Europe region. OTA is classified as a possible human carcinogen (Group 2B) by the IARC (1993) based on sufficient evidence of carcinogenicity in animal models but insufficient evidence from human studies. Based on the last assessment of the Scientific Committee on Food (SCF), the tolerable weekly intake (TWI) of 120 ng per kg of body weight established by the CONTAM Panel in 2006 (EFSA, 2006) is no longer valid. Following EFSA guidance for substances that are both genotoxic and carcinogenic, an MoE of 10 000 or higher between the reference point and the estimated dietary exposure would be of low health concern. However, in the absence of elucidated modes of action for the genotoxicity/carcinogenicity of OTA, the panel concluded that an MoE of 10 000 needs to be applied to the $BMDL_{10}$ of 14.5 μg per kg of body weight per day for neoplastic effects (kidney tumours) in rats (Schrenk *et al.*, 2020b).

The co-occurrence of nephrotoxic mycotoxins OTA and citrinin (CTN) is commonly reported in grains grown in moderate climatic regions (Pleadin *et al.*, 2018). Studies have shown that citrinin exposure increases liver and kidney weight, while prolonged exposures lead to the formation of smaller adenomas (Wen, Mu and Deng, 2016). It is thought that the increase in kidney weight should probably be attributed to the accumulation of toxins within the renal tissue after their transport to the proximal renal tubules. In addition, CTN has been found to significantly affect the mitochondrial respiratory chain, as it leads to changes in calcium ion fluxes through the cell membrane and alters its permeability, thereby disrupting the electron transfer chain. This mycotoxin has been associated with “yellow rice syndrome,” but there has been no systematic investigation into the actual mycotoxin or agent responsible for this poorly defined illness. Other possible toxic effects of CTN exposure include decreased cytokine production, inhibition of DNA and RNA synthesis and decreased gene expression, induction of oxidative stress, and activation of cell apoptosis (Rašić *et al.*, 2018; Sugiyama *et al.*, 2013).

Trichothecenes are classified into four groups. Group A includes T-2 toxin and diacetoxyscirpenol (DAS), and Group B includes 4-deoxynivalenol (DON) and nivalenol (NIV). Many *Fusarium* species produce Group A and Group B trichothecenes. The plant species *Baccharis megapotamica* produces the Group C trichothecene baccharin that is the least common of them all. Group D mycotoxins include roridins produced by *Mycothecium roridum*, verrucarins produced by *M. verrucaria*, and satratoxins produced by *Stachybotrys atra*. It is important to point out that more common and more potent trichothecenes are produced by the *Fusarium* species. In animals, DON causes severe nausea, vomiting and diarrhoea, resulting in food rejection (Valenta and Dänicke, 2005). The direct toxicity of DON is catered by the epoxy part of its structure and results in impaired immunity. It manifests itself in the superegulation of mRNAs, thus modulating the expression of several cytokines, chemokines, and immune-related proteins (Pestka *et al.*, 2008). Other important negative impacts are those on immunoregulatory processes responsible for cell proliferation, differentiation, and apoptosis (Bae and Pestka, 2008; Rocha, Ansari and Doohan, 2005). Other trichothecenes, such as T-2 toxin and diacetoxyscirpenol, also show immunosuppressive effects. In addition, they are cytotoxic, resulting in an increased susceptibility to infectious microbes. In humans, these two trichothecenes cause toxic alimentary aleukaemia, the early symptoms of which are skin inflammation, vomiting and hematopoietic tissue damage. In the acute phase, necrosis of the oral cavity and profuse bleeding from the nose, mouth and vagina occur, and neurological disorders have been observed. Since T-2 toxin has an epoxy ring and side chains containing several acetyl and hydroxyl substituents, it is characterized by high biotoxicity manifested in the form of inhibition of DNA and RNA synthesis and consequent induction of apoptosis. T-2 toxin is rapidly metabolized to HT-2 toxin, which is its major metabolite (Wu *et al.*, 2014). In 2003, the IARC added DON, NIV, T-2 and HT-2 toxins to Group 3 of non-classifiable human carcinogens due to inadequate evidence of animal carcinogenicity and a lack of human studies. Tolerable daily intakes of 1 µg per kg⁻¹ of body weight per day⁻¹ and 1.2 µg per kg⁻¹ of body weight per day⁻¹ were established for DON and NIV, respectively (EFSA, 2014a, 2014b). Recently, the SCF concluded that the full tolerable daily intake of 0.1 µg per kg⁻¹ of body weight per day⁻¹ for the sum of T-2 and HT-2 toxins could be established (EFSA, 2014b). In domestic animals, the toxic effects of ZEA can lead to infertility, low offspring birth weight and hypoestrogenism. In addition, research has shown that in humans, ZEA disrupts hormonal balance, decreasing male fertility due to xenoestrogen accumulation and causing gynecomastia (Kowalska, Habrowska-Górczyńska and Piastowska-Ciesielska, 2016). The reason for this is that this compound acts as a competitive substrate for hydroxysteroid dehydrogenase (HSD), an enzyme involved in steroid synthesis and metabolism. HSD works by reducing the 6-keto group of ZEA to a hydroxyl group to form α-zearalenol and β-zearalenol. Of these two metabolites, zearalenone is a potentially active α-form that exhibits enhanced oestrogenic activity (Fink-Gremmels and Malekinejad, 2007; Minervini and Dell'Aquila, 2008). After conjugation with glucuronic acid and sulfonation reactions, both enol metabolites form adducts (Guerre, 2015). Other important zearalenone derivatives are zearalanaol and zearalanon, which have been associated with immunotoxicity. Zearalanaol is used as a growth promoter for fattening cattle and has an anabolic effect in the body. In humans, changes in different immune responses can occur, resulting in the dysfunction of lymphoid organs, thymic atrophy, changes in the phenotype of lymphocytes produced by the spleen, and decreased peroxidase production (Hueza *et al.*, 2014). The IARC found limited evidence of ZEA carcinogenicity in animal models, classifying it together with DON into Group 3. In 2000, the SCF established a tolerable daily intake of 0.2 µg per kg⁻¹ of body weight per day⁻¹ for ZEA. However, in 2011, the SCF concluded that a tolerable daily intake of 0.25 µg per kg⁻¹ of body weight per day⁻¹ should be established based on recent data gathered across the most sensitive animal species (EFSA, 2014a).

The primary biological activity of FUMs mirrors in the initial stages of sphingolipid synthesis because of the inhibition of ceramide synthetase (sphingosine N-acetyltransferase). Other signalling pathways regulating the production of early sphingolipid products, such as ceramides, sphingoid bases and phosphorylated

sphingosine-1-phosphate, are disrupted as well (Stockmann-Juvala and Savolainen, 2008; Wen, Mu and Deng, 2016). Apoptosis caused by the disturbance of cellular balance and mitosis leads to carcinogenesis. In animals, FUM toxicity has been linked to diseases such as equine leukoencephalomalacia, which was recently recorded in Serbia (Jovanovic *et al.*, 2015), and porcine pulmonary oedema syndrome. Given that some studies have linked human oesophageal cancer with high levels of FUMs ingested through a corn-based diet, it was thought that in developing countries whose residents mostly consume corn as a staple of the diet, the risk of cancer would be higher than in the rest of the world. However, further research has refuted this by proving that there is no statistically significant correlation between serum sphingolipid levels and cancer risk (Sydenham *et al.*, 1991). The consumption of food contaminated with FUMs during pregnancy is considered to be the key factor responsible for the occurrence of neural tube defects (anencephaly and *spina bifida*) attributed to sphingolipid deficiency. This deficiency damages folate receptors and reduces folate (Vitamin B9) levels. The latter vitamin is the main nutrient used to create new cells and synthesize DNA and RNA (Imbard, Benoist and Blom, 2013). Hence, FB1 is listed as a Group 2B carcinogen (IARC, 1993), while recent evaluation by the EFSA (2018) established a group tolerable daily intake of 1 µg per kg⁻¹ of body weight per day⁻¹ based on the increased incidence of megalocytic hepatocytes found in a chronic mice exposure study.

PAT is a mycotoxin produced by a wide range of fungal species of the *Penicillium*, *Aspergillus* and *Byssoschlamys* genera (Frisvad, 2018). Due to the high affinity of PAT for sulfhydryl groups, this toxin can inhibit enzymes, resulting in acute toxic effects such as gastrointestinal symptoms, neurotoxic effects, pulmonary symptoms, ulceration and oedema. Other toxic effects include teratogenicity, genotoxicity and carcinogenicity (Vidal *et al.*, 2019; Wen, Mu and Deng, 2016). On top of the above, PAT has a mutagenic effect and is classified as clastogenic, as well as immunotoxic in terms of reducing cytokine production and increasing the production of neutrophils and T-lymphocytes in the spleen (Puel, Galtier and Oswald, 2010). Regarding its carcinogenicity to humans, the IARC included PAT in Group 3 of non-classifiable compounds. The Joint FAO/WHO Expert Committee on Food Additives (JECFA) established a provisional maximum tolerable daily intake for PAT of 0.4 µg per kg⁻¹ of body weight per day⁻¹ (JECFA, 1995).

Emerging mycotoxins are defined as mycotoxins that are neither routinely determined nor legislatively regulated. However, the evidence of their incidence is rapidly increasing (Gruber-Dorninger *et al.*, 2017). The most relevant and frequently occurring emerging mycotoxins are *Fusarium* toxins. *Fusarium*-generated mycotoxins include enniatins (ENNs), beauvericin (BEA), moniliformin (MON) and fusaproliferin (FUS). Emerging fusariotoxins were mostly investigated in the Mediterranean countries. Moreover, their presence was recently reported in maize from Serbia (Jajić *et al.*, 2019; Janić Hajnal *et al.*, 2020). The authors found that MON, BEA and FUS had the highest presence of all emerging mycotoxins and were present in all the investigated regions. Emerging mycotoxins also include citreoviridin, gliotoxin, griseofulvin, mycophenolic acid, b- nitropropionic acid, kojic acid, tremorgenic mycotoxins (penitrems, janthitrems, lolitrems and paspalitrems), penicillic acid, viomellein, vioxantin, xan-thomegnin and walleminols. They are not classifiable as to their carcinogenicity to humans by the IARC. Due to the lack of research showing direct human and animal health effects, no regulations governing their presence in food or feed have been enacted.

In grazing livestock, such as sheep, cattle, poultry and pigs, the risk of toxic effects evoked by ergot alkaloids is high. Common clinical symptoms of ergotism are hypersensitivity, convulsions, gangrene, muscle contractions, abortion and ataxia (Bennett and Klich, 2003; Bennett and Bentley, 1999). The convulsive form manifests itself in epileptic seizures, diarrhoea, paraesthesia, itching, nausea and effects on mental health, such as psychosis, headaches and drowsiness. The effect on the central nervous system is manifested after gastrointestinal symptoms. Dry gangrene usually occurs as the result

of vasoconstriction caused by the ergot alkaloids (ergovaline, ergotamine, ergocryptine, ergocristine, ergonovine, ergocornine, and lysergic acid). The main target tissues are those less perfused (fingers and toes). Symptoms include desquamation, loss of peripheral sensation, oedema and, ultimately, the death of target tissues (Eadie, 2003; Tudzynski, Correia and Keller, 2001). In medicine, ergot alkaloids are used in low concentrations to reduce menstrual bleeding or miscarriage, to stimulate placental abruption after childbirth due to uterine wall muscle contractions, and to treat acute migraines, Parkinson's disease, cerebrovascular insufficiency, and prolactin-Ca⁺² inhibition (Bennett and Bentley, 1999).

The occurrence and the significance of mycotoxins in southeastern Europe

Data on the occurrence of mycotoxins are extremely important to determine the risk to both humans and animals. This report is a valuable risk assessment input that contributes to the enforcement of new and effective regulations, the upscaling of laboratory facilities, etc., particularly in vulnerable countries prone to mycotoxin contamination, such as the countries of southeastern Europe. Dietary habits observed by the southeastern Europe countries differ depending on the region (Mediterranean or continental), religion (Christianity, Judaism, or Islam), and socioeconomic and cultural factors. When it comes to mycotoxins, the riskiest foodstuffs are wheat, maize, rice, beans, coffee, grapevines, wine, fruits, nuts, spices, dried food and animal products, such as meat and eggs. Various groups of toxigenic moulds and related mycotoxins have been reported to be associated with the contamination of these commodities. From 2010 to 2020, the ingestion of mycotoxin metabolites through dairy products also has been observed. However, the highest level of contamination is still that of cereals, especially maize, since the nutritional composition of this cereal is particularly conducive to mould development and mycotoxin production (Chulze, 2010). It is important to point out that consumers also can be exposed to mycotoxins through foods whose spoilage has not been recognized, i.e. mouldy foods. While the data released by FAO in 1999 indicate that 25 percent of cereals were contaminated with mycotoxins, new data show a significantly higher level of contamination (Eskola *et al.*, 2019). The authors point out that global mycotoxin prevalence in food crops varies largely and is dependent on many factors, such as the mycotoxin of concern and the analytical and reporting methods used, but, nevertheless, it appears that the correct percentage is as high as 60 to 80 percent. Additionally, an extensive, multiyear research project on cereals and animal feed, which included data from nearly 100 countries around the world collected between 2008 and 2017, proved a strong association between mycotoxin occurrence and certain climatic conditions. Mycotoxins were detected in most of the samples, with 88 percent of the samples containing at least one mycotoxin and 64 percent of the samples containing at least two mycotoxins (Gruber-Dorninger, Jenkins and Schatzmayr, 2019). Data provided by this study for the countries of southeastern Europe (separately for countries of southern and eastern Europe) show a high incidence of *Fusarium* contamination, primarily with FUMs (74.9 and 33.6 percent, respectively), ZEA (36.3 and 42.5 percent, respectively) and DON (52.9 and 59.9 percent, respectively), but also an increased incidence of AFB1 presence, especially in southern Europe (28.9 percent). Mycotoxin representation in agricultural crops and foods evident for some countries of southeastern Europe through individual research is shown in Table A4-2. Significant advances have been made in the past few decades in the development of methods for the detection and qualification of mycotoxins. The most frequently used was the semi-quantitative screening, called the enzyme-linked immunosorbent assay (ELISA), a rapid and sensitive assay suitable for mycotoxin determination. Other methods of mycotoxin quantification that require sophisticated laboratory equipment include high-performance liquid chromatography (HPLC), gas chromatography (GC), liquid chromatography/mass spectrometry (LC/MS), and gas chromatography/mass spectrometry (GC/MS) (Rahmani, Jinap and Soleimany, 2009).

Reports on mycotoxin contamination of these staple foods in countries of southeastern Europe have mainly focused on the *Fusarium*, *Aspergillus* and *Penicillium* mycotoxins, such as AFs, OTA, ZEA, DON, T-2, FUM and PAT. Authors from Serbia and Romania were the first to provide the mycotoxin profile of wheat and maize with respect to newly emerging mycotoxins (moniliformin, enniatins, beauvericin and fusaproliferin) (Jajić *et al.*, 2019; Stanciu *et al.*, 2017). Data concerning mycotoxin levels in staple foods from Albania, Bulgaria, Bosna and Herzegovina, Montenegro, Kosovo²³ and North Macedonia is sparse. Given that re-

²³ All references to Kosovo should be understood to be in the context of United Nations Security Council resolution 1244 (1999).

cent decades have seen an increasing occurrence of extreme weather, a high level of AFs was detected in maize followed by a high incidence of AFM1 in milk coming from the southeastern European countries. Therefore, several Rapid Alert System for Food and Feed (RASFF) notifications related to AF levels above the maximum levels found in maize delivered by the southeastern European countries were issued at the end of 2012 and the first months of 2013 (EC Directorate General for Health and Consumers, 2013).

A recent report on the occurrence of mycotoxins in maize harvested in northern Serbia in seasons with an extreme drought (2012), hot and dry conditions (2013 and 2015), and extreme precipitation (2014) revealed significant differences in the incidence of AFs, OTA, ZEA and FUMs among the sampling seasons. The results showed that in each study year, the samples were fumonisins-positive in high numbers (from 76 percent to 100 percent). AFB1 was detected in 94 percent and 90 percent of maize samples sampled in 2012 and 2015, respectively, while in 2014, DON, ZEA and their derivatives were detected in 100 percent of the samples. The study revealed OTA to be the most predominant contaminant of the 2012 samples (25 percent positive samples). Weather conditions recorded throughout the four-year study period had a significant influence on the occurrence of the above mycotoxins in maize (Kos *et al.*, 2020).

In the past decade, data from Croatia indicate a high incidence of cereal and animal feed contamination, primarily with DON (up to 85 percent in cereals and 97 percent in feed), ZEA (up to 88 percent in cereals and 93 percent in feed), and FUMs (up to 90 percent in cereals and 88 percent in feed) (Pleadin *et al.*, 2012a, 2012b, 2012c, 2013). The contamination of feed also resulted in a high incidence of ZEA contamination of cow milk (94 percent) (Pleadin *et al.*, 2017a). High AFB1 contamination of maize was observed during 2013 due to the tropical and subtropical climatic conditions seen in 2012 during maize cultivation (Pleadin *et al.*, 2014, 2015b), although earlier Croatian research indicated more frequent contamination of maize and other cereals with *Fusarium* mycotoxins. The contamination of maize and feed with AFB1 resulted in higher incidence and higher concentrations of AFM1 in cow milk (Bilandžić *et al.*, 2014). Studies also show that mycotoxins can be present in dry-cured meat products overgrown by surface moulds during ripening, as well as consequent to a carryover effect or the use of contaminated spices (Markov *et al.*, 2013; Pleadin *et al.*, 2015a; Pleadin, Kovačević and Perši, 2015).

Table A4-2. Occurrence of mycotoxins in food and feed commodities in in Southeaster European countries

Country/Region	Mycotoxin	Food commodity	Method of analysis	Incidence (%)	Range ($\mu\text{g kg}^{-1}$)	Reference	
Albania	AM	Maize	LC-MS/MS	7.1-45.2	up to 1.283	Topi <i>et al.</i> , 2019	
		Wheat		82.9-86.1	up tp 175.7		
Bosna and Herzegovina	AFM1	UHT milk	ELISA		2.45-21.4	Bilandzic <i>et al.</i> , 2016	
	CTN	Cereals	ELISA	73-76	15-429	Pleadin <i>et al.</i> , 2016b	
		Feed		62-70	16-63		
	T-2/HT-2		Unprocessed cereals	ELISA	31.6-71.4	20.5-235.6	Pleadin <i>et al.</i> , 2017b
			Cereal-based food		28.6-33.3	19.2-84.9	
			Feed components		21.4-94.1	28.7-477.1	
Feed products			50.0-66.7		25.6-118.1		
Bulgaria	OTA	Pig serum	HPLC	90	up to 28.8	Stoiev <i>et al.</i> , 2010	
	OTA	Feed	TLC, HPLC	100	376.4 ^a		
	CTN			96	120.5 ^a		
	FB1			92	3254.5 ^a		
	DON			100	51.4 ^a		
	ZEA			92	108.2 ^a		
	ZEA	Wheat	VICAM	55	84-1600	Beev <i>et al.</i> , 2013	

Country/ Region	Mycotoxin	Food commodity	Method of analysis	Incidence (%)	Range ($\mu\text{g kg}^{-1}$)	Reference
Croatia	DON	Maize	ELISA, TLC, HPLC	85.0	15-17.920	<i>Pleadin et al., 2012a</i>
	ZEA			87.5	2.0-5.110	
	AFB ₁	Pig's feed	ELISA	13.3	0.92-1.53	<i>Pleadin et al., 2012b</i>
	OTA			26.7	0.97-2.79	
	ZEA			93.3	8.93-866	
	DON			96.7	156-1864	
	T-2			46.7	21.0-78.8	
	FUM			80.0	30.0-1043	
	T-2			24	10.5-210	
	FUM	67	31-25200			
	DON	Unprocessed cereals	ELISA	21-71	34-2942	<i>Pleadin et al., 2013</i>
	ZEA			28642	4-611	
	FUM			33025	25-4438	
	T-2			18-57	15462	
	OTA	Fermented meat products	ELISA, HPLC	64.44	1.23-7.83	<i>Markov et al., 2013</i>
	CTN			4.44	1.0-1.3	
	AFB ₁			10	1.0-3.0	
	AFB ₁	Maize	LC-MS/MS	38.1	1.1-2.07	<i>Pleadin et al., 2014</i>
	AFB ₁	Grains	ELISA	12.5	up to 2072	<i>Pleadin et al., 2015b</i>
		Grain mixtures		26.2	up to 252.3	
		Feed		22.2	up to 304.6	
	AFB ₁	Traditional meat products	ELISA	up to 11.1	up to 1.69	<i>Pleadin et al., 2015a</i>
	OTA			up to 20.0	up to 9.95	
	CTN	Cereals	ELISA	50-61	16-374	<i>Pleadin et al., 2016b</i>
		Feed		67-75	15-55	
	AFM1	Cow, goat sheep and donkey milk	ELISA	15.2	up to 162.3	<i>Bilandžić et al., 2014</i>
	T-2/HT-2	Unprocessed cereals	ELISA	28.6-66.7	11.6-304.2	<i>Pleadin et al., 2017c</i>
		Cereal-based food		15.1-34.5	23.6-53.1	
		Feed components		28.6-79.0	30.2-521.0	
		Feed products		53.3-53.9	24.7-129.3	
	DON	Silage	ELISA	81	38.3-13407	<i>Pleadin et al., 2017a</i>
		Dairy cattle feed		72	24.1-10120	
Feedstuffs		77		24.1-13407		
Cow milk		14.3		5.4-67.3		
ZEA	Silage	ELISA	74	9.2-11,424		
	Dairy cattle feed		58	2298.07.05		
	Feedstuffs		66	5.7-11424		
	Cow milk		94.3	0.3-88.6		
FUM	Silage	ELISA	88	49.3-6300		
	Dairy cattle feed		71	33.1-1854		
	Feedstuffs		80	33.1-6300		
DON	Unprocessed cereals and soybean	ELISA	55-78	24-9560	<i>Pleadin et al., 2017c</i>	
ZEA			43-56	5-7,874		
CTN	Unprocessed cereals	ELISA	49	4.5-374	<i>Pleadin et al., 2018</i>	
OTA			6.5	1.0-7.0		
AFB1	Traditional meat products	ELISA	8	up to 1.92	<i>Zadravec et al., 2020</i>	
OTA			14	up to 6.86		
OTA	Dry-fermented sausages	LC-MS/MS	14.8	up to 0.48	<i>Kudumija et al., 2020</i>	

Country/ Region	Mycotoxin	Food commodity	Method of analysis	Incidence (%)	Range ($\mu\text{g kg}^{-1}$)	Reference
Greece	OTA	Dry wines	HPLC	66.7	n.d.–1.51	<i>Labrinea et al., 2011</i>
		Dessert wines		81.5	n.d.–2.00	
	AFB ₁	Wheat grains		22-25	1.05-14.21	<i>Irakli et al., 2017</i>
	DON			100	102.4-2446	
	OTA			5-12	1.20–1.35	
	ZEA			22-31	20.4-30.1	
AFM ₁	Cow milk	ELISA	46.5	8.6–11.4	<i>Tsakiris et al., 2013</i>	
Kosovo	AFM ₁	Raw cow milk	LC-MS/MS	38	up to 0.082	<i>Camaj et al., 2018</i>
Macedonia	AFM ₁	Raw milk	HPLC	42.4	0.006–0.408	<i>Dimitrieska-Stojković et al., 2016</i>
	AFM ₁	Dairy Products	ELISA, HPLC	67.8-93.8	0.03-0.049	<i>Ilievska et al., 2022</i>
Romania	EM	Wheat	LC-MS/MS	26-100	up to 814.6	<i>Stanciu et al., 2017a</i>
	DON			26	110-1787	
	ZEA			13	327-1135	
	ENs	Wheat flour		19-61.0	3-510	<i>Stanciu et al., 2017b</i>
	DON			3	190.0	
	ZEA			6	51-73	
	ENs		9-80	3-60		
	OTA	Wheat grains	ELISA	34.62- 92.31	2.67–25.70	<i>Alexa et al., 2013</i>
	DON			19.23-73.08	254–3390	
	ZEA			69.23- 76.92	28.22–105.64	
	FUM		15.38	960–1180	<i>Stanciu et al., 2019</i>	
	DON		60	1.1–955		
	3AcDON		5	2.7–12		
	15AcDON	5	8.9–30			
	NIV	3	40–64.3			
	HT-2	11	24.7–98.5			
	ZEA	16	11.7–300			
	DON	Raw, processed and cereal-based food	ELISA	42.9	18.5-1269.9	<i>Gagiu et al., 2018</i>
	AFs			45.4	1.75-82.94	
	OTA			6.8	2.50-6.72	
ZEA	7.1			1.75-7.05		

Country/ Region	Mycotoxin	Food commodity	Method of analysis	Incidence (%)	Range ($\mu\text{g kg}^{-1}$)	Reference
Serbia	AFs	Maize	HPLC-FLD	57.2	1.3–91.4	Janić Hajnal et al., 2017
			ELISA	68.5	1.01-86.1	Kos et al., 2013
		Corn flours	HPLC UV	48.2	max. 9.14	Torović et al., 2018a
	AFM1	Raw cow's milk	ELISA	80.7	0.005-1.26	Milicevic et al., 2017a
				81.0	0.055- 0.074	Milicevic et al., 2019
	TeA	Wheat	HPLC	68.5	0.75- 48.9	Janić Hajnal et al., 2015
	AOH			12.0	0.49–70.2	
	AME			6.5%	2676.05.02	
	FUM	Maize	ELISA	100	520–5800	Kos et al., 2014
				75.7	830-10790	Udovicki et al., 2019
				34.4	930-10860	
				93.9	1050-3790	
				100	890-34480	
		Corn flour	HPLC-UV	96.4	max. 1468.5	Torović et al., 2018b
	Corn flakes	73.3		max. 579.4		
	TCT	Maize	ELISA	52.0	25.3–200	Janić Hajnal et al., 2013
				Corn flakes	40	878.6
		Corn flour	HPLC-UV	42.9	max. 931.8	
				66.1	max. 242.1	
	ZEA	Corn flakes		86.7	max. 121.6	
OTA	Corn flours	HPLC	37.5	max.7.16	Torović et al., 2018a	
	Pig's kidney		14.74	0.10 - 3.97	Polovinski Horvatovic et al., 2019	
PAT	Apple-based food	HPLC	28.1	max. 8.3	Torović, 2017	

Source: Data extracted from reviewed publications

^a concentration of mycotoxin is given as mean value

AF ζ s – Aflatoxins (B1, B2, G1, G2, M1); AM – Alternaria mycotoxins; AME – Alternariol monomethyl ether; AOH – Alternariol; CTN – Citrinin; DON - deoxynivalenol; EM – Emerging mycotoxins; FUM ζ s – Fumonisin (B1, B2); NIV – nivalenol; OTA – Ochratoxin A; PAT – Patulin; TCT – Trichothecenes; TeA – Tenuazonic acid; ZEA – Zearalenone
 ELISA – Enzyme-linked immunosorbent assay; HPLC – High-performance liquid chromatography; LC-MS/MS – Liquid chromatography tandem mass spectrometry; TLC – Thin-layer chromatography

The impact of climate change on mycotoxin incidence and food safety

Research shows that environmental stress has a significant impact on the occurrence of mycotoxins (Medina *et al.*, 2015; Medina, Rodríguez and Magan, 2015). Although moulds are mainly resistant to elevated carbon dioxide concentrations, combined with other factors (drought, plant damage by insects and changes in crop phenology, such as changes in flowering time and grain ripening), this gas can have a pronounced indirect effect on mycotoxin production (Medina *et al.*, 2017; Van der Fels-Klerx, Liu and Battilani, 2016). Recent findings suggest that a two- or threefold increase in atmospheric carbon dioxide concentration, from 350–400 to 800–1200 ppm, and temperature increases of 2–5 °C, followed by dry periods, can be expected in the coming decades (Bebber and Gurr, 2015; Bebber, Holmes and Gurr, 2014; Gregory *et al.*, 2009; Medina *et al.*, 2017; Medina, Rodríguez and Magan, 2014).

Increased levels of contamination of food and feed may be caused by the presence of the existing mycotoxins or their “relocation” to new, still-unaffected or only mildly affected geographical regions. Stress caused by climate change can result in the emergence of new mycotoxins, and their occurrence can seriously impair the availability of food and feed, especially in developing countries (Miraglia *et al.*, 2009). It is believed that AFs produced by the moulds of the *Aspergillus* genus, present in areas with hot and humid climates that became even hotter and more humid due to climate change, caused an increased contamination in the early 2000s across Europe. In southern Europe, extremely hot summers already have resulted in changes in maize growing ecosystems, leading to changes in the occurrence patterns common to *Fusarium* species and *Fusarium* mycotoxins. This has led to a more frequent occurrence of *A. flavus* and contamination with highly toxic AFB1 (Milićević *et al.*, 2019a). During the year, temperatures have been above the annual average (more than 35 °C). Nevertheless, drought has been the factor causing the greatest damage, especially to maize. In comparison to 2016, the total 2017 maize production decreased by 45.5 percent. The next two years (2018 and 2019), particularly 2019, were the hottest years in recorded Serbian meteorological history. According to the report of the Republic Hydrometeorological Service of Serbia, 13 of the 15 hottest years on record have occurred after 2000 (Republic Hydrometeorological Service of Serbia, 2020). Due to the severity of maize contamination, elevated concentrations of AFM1 have been found in milk countrywide, with 31 percent of milk samples non-compliant to the European Union maximum levels (0.05 µg kg⁻¹) (Milićević *et al.*, 2019b).

Research conducted in Croatia indicated high contamination of maize with aflatoxins during 2013, influenced by tropical and subtropical climatic conditions witnessed during maize cultivation in 2012 (Pleadin *et al.*, 2014, 2015b). It is important to point out that previous research in this part of Europe indicated a more frequent contamination of maize and other cereals with *Fusarium* mycotoxins and puts Croatia among countries for which *Fusarium* contamination is now considered characteristic (Binder *et al.*, 2007; Pleadin *et al.*, 2012a, 2012b, 2012c, 2013).

Globally, recent research has focused on studying the impact of a number of environmental variables, such as temperature, pest attack and nutrient availability, on mycotoxin production and their occurrence in food (Paterson and Lima, 2011). Research on predictive models is important in order to identify geographical regions in which interactive climatic factors may have the highest impact on toxicogenic mould infection and consequent mycotoxin contamination. It is important to point out that mycotoxins often occur together and have synergistic effects in the body, and that, therefore, intensive research is being conducted to develop models for risk assessment in case of contamination with multiple

mycotoxins. The findings from these various research projects have been linked to food chains and the impact on food availability in the future. The EFSA predicts that the effects of climate change on the occurrence of mycotoxins will be regional and mostly detrimental, but possibly also beneficial for a particular geographical area (Battilani *et al.*, 2012; EFSA *et al.*, 2020). Climate change is also expected to affect global changes in the occurrence and geographical distribution of insects (Bebber and Gurr, 2015; Bebber, Holmes and Gurr, 2014; Medina, Rodríguez and Magan, 2015), which are known to have a significant impact on crop infection caused by toxicogenic moulds. Research shows that climate change may be responsible for one-third of the variability of basic food yields globally and that it negatively affects the nutritional value of food (EFSA *et al.*, 2020; Ramos, 1998).

Climate change and predictions of mycotoxin contamination

In the last century, temperatures have risen by 0.7 °C globally and by 1 °C in Europe. The amount of precipitation during the same period has increased by 10–40 percent in northern Europe and decreased in southern Europe. The frequency of droughts, heat waves and extreme rainfall in Europe has increased, while the occurrence of cold extremes has decreased. Projections show that in the next century, the increase in annual average global temperature could be between 1.4 °C and 5.8 °C, and between 2.0 °C and 6.3 °C in Europe. It is projected that cold winters will almost completely disappear by the end of the century, while warm summers will be even more frequent. It can be expected that climate change will have a strong impact on mycotoxin contamination of various cereals. Changes in the production of mycotoxins, as a consequence of temperature increases by 3 °C and 5 °C under different water activity conditions, are shown in Table A4-3.

Table A4-3. Changes in mycotoxin production consequent to temperature increase of 3 and 5 °C at different water activity (aw)

Mycotoxin	Mould	aw	τ max range/T	τ+3	τ+5
AFB1	<i>Aspergillus flavus</i>	0.95	3082-2278/37	102-138	6.1-n.p.
		0.90	449-332/37	1-n.p.	n.p.
	<i>Aspergillus carbonarius</i>	0.95	2000-1500/20	1000-500	500-n.p.
		0.90	1000-500/20	500-n.p.	500-n.p.
OTA	<i>Aspergillus westerdijikiae</i>	0.95	1066-1015/30	719-685	489-465
		0.90	54-52/30	52-49	50-48
		0.95	> 50/20	> 50	50-30
	<i>Penicillium verrucosum</i>	0.90	50-30/20	50-30	50-30
		0.95	n.d.	n.d.	n.d.
PAT	<i>Penicillium expansum</i>	0.90	n.d.	n.d.	n.d.
		0.95	n.d.	n.d.	n.d.
DON	<i>Fusarium graminearum</i>	0.95	1-0.1/20	1-0.1	0.1-0.01
		0.93a	n.p.	n.p.	n.p.
		0.95	1-0.25/20	0.25-0.1	0.1-0.01
FUM	<i>Fusarium culmorum</i>	0.93 ^a	0.25-0.01/20	n.p.	n.p.
		0.95	10000-1000/20	10000-1000	1000-100
		0.93a	10/15	50-10	50-10
		0.95	> 1000/20	1000-100	100-50
	<i>Fusarium proliferatum</i>	0.93a	50-10/15	50-10	50-10

Source: Magan, N., Medina, A. & Aldred, D. 2011. Possible climate change effects on mycotoxin contamination of food crops pre- and post-harvest. *Plant Pathology*. 60, 150-163. <https://doi:10.1111/j.1365-3059.2010.02412.x>

Due to increased contamination with aflatoxicogenic moulds, their most toxic representative AFB1 will become a significant food safety threat in the next century, primarily in eastern Europe, the Balkans and the Mediterranean (Battilani *et al.*, 2012; Milićević *et al.*, 2020). Literature shows that the southern part of Europe will be particularly affected by climate change in terms of increased carbon dioxide in the atmosphere, rising temperatures, and the occurrence of extreme precipitation and drought. Similar impacts are expected in parts of North America, South America, Africa and Asia (Paterson and Lima, 2011). Predictive models suggest that northern Europe could benefit from these changes, while the Mediterranean region could be the “hot spot” in which numerous extreme climatic changes could

take place. The maturation of crop cultures in southern and central Europe is expected to arrival much earlier than usual. In some countries in southern and southeastern Europe, the temperature is expected to rise by 4 °C to 5 °C, followed by reduced water availability, especially in summer. Western and Atlantic European countries can expect temperatures to rise by 2.5 °C to 3.5 °C, with drier and warmer summers (Paterson and Lima, 2011). Due to higher amounts of precipitation, strong storms and floods are predicted to be more frequent, especially in winter.

Perspectives for risk management and controlling strategies

Due to the considerable impacts on food safety, regional and international trade, the economy and public health, mycotoxin contamination remains a significant challenge for the food industry, regulatory agencies, researchers and consumers. Past food crises, such as AFs contamination, have confirmed the importance of rapid identification and disposal of unsafe foodstuffs prior to consumption. Therefore, several food standards, guidelines and codes of practices have been developed by the Codex Alimentarius to prevent harmful effects of mycotoxins throughout the food chain (CAC, 2003). Likewise, many studies are focused on different processes and strategies for the reduction of mycotoxins in food and feed, giving detailed information about implementable decontamination approaches (Cheli, 2020). These recommendations are divided into two parts: preharvest practices adopted based on good agricultural practices (GAP), postharvest practices such as good manufacturing practices (GMP), and good hygiene practices (GHP) implemented in the hazard analysis and critical control points (HACCP) systems. However, GAP coupled with prediction models that integrate the most important field parameters and weather input are the best options to prevent fungal colonization and mycotoxin production in the field.

Storage conditions are crucial for the postharvest prevention of mycotoxin contamination. Among many factors within the storage ecosystem, temperature and humidity are critical for fungal infection and mycotoxin contamination. Improved storage management, especially at the farmer and the small trader level, will prevent fungal growth and mycotoxin contamination in stockpiled commodities (Milićević *et al.*, 2019b). An organization dealing with food production and grain storage will develop a formal Food Safety Management System (FSMS) to ensure that food is safe for consumption. Furthermore, organizations need to establish and implement control measures appropriate for specific hazards and the risks they pose to the final consumer.

If mycotoxin contamination has occurred, contaminated feed and food must be managed through postharvest decontamination or detoxifying treatment to convert mycotoxins into non-toxic or less toxic products. Traditional detoxifying methods include physical, chemical, and biological methods (Wan, Chen and Rao, 2020).

It is important to protect the consumer from the effects of a mycotoxin detected within the food supply chain, assuming the risk assessment indicates a level of exposure to be unacceptable. This study highlights that the population of the southeastern Europe countries could be exposed to mycotoxin-contaminated food, particularly due to the consumption of food staples, such as cereals, dried fruits and animal products, including meat and dairy. The presence and range of concentrations of mycotoxins are correlated with the location of production and seasonal weather. Because this southeastern Europe subregion is more susceptible to climate change than northern Europe, further research and implementation of new monitoring principles is required. The challenges to be addressed include:

- Development and implementation of new national strategies for monitoring and prediction of agroclimatic changes that could affect fungi development and mycotoxin production in specific foods/feeds in given geographic regions.
- Designing of a map of mycotoxin incidence in correlation with climatic conditions.
- Identification of high-risk commodities, and the periodic surveillance and risk assessment of those commodities.
- Strengthening and improvement of analytical capacities, investment into targeted research, and sharing of results to reduce economic and health-related costs.

- Wider education on GAP and GMP practices, upgrading of GAP and GMP facilities oriented towards farmers and small-scale industries, and integration of these practices into mycotoxin management systems that can readily be adopted at critical points along the entire food chain, from producer to final consumer (Logrieco *et al.*, 2018).
- The use of information and communications technology (ICT), artificial and business intelligence, cloud systems, sensors and algorithms for the generation, storage, interpretation and distribution of all data relevant for mycotoxin management.

The results presented in this report should be seen as the first step in the establishment of a regional mycotoxin risk assessment centre in charge of the appropriate dissemination of available information (Milićević *et al.*, 2020), among other responsibilities. Since it is impossible to fully eliminate the presence of undesirable substances and contaminants from food and feed, the applicable legislation is a persistent pending issue. Many countries have stipulated the maximum levels or given recommendations for mycotoxin content in food and feed, depending on the intended use of food or feed in question. These limits and recommendations are guided by food-regulating bodies, such as FAO, the WHO and the European Union. Factors influencing mycotoxin-related regulations include the availability of toxicity data, the availability of data on mycotoxin occurrence in different commodities, analytical data, methods of sampling and analysis, and economical and political factors, such as the commercial interests of each country (Van Egmond, Schothorst and Jonker, 2007). The strictest standards are those laid down under the European Union legislation. Most of the non-European Union countries in the southeastern Europe region have harmonized regulations for sampling protocols, analytical performance criteria, and the MLs according to European Union guidance. However, countries with mycotoxin problems might not always be able to adopt these regulations due to capacity and capability issues.

In Serbia, the MLs of 11 food mycotoxins have been stipulated in accordance with the European Union regulation, as follows: AFB1 and AFM1 alone, as well as the sum of AFs (AFB1, B2, G1, and G2), FUMs (FB1, FB), OTA, patulin, DON, ZEA, and ergot sclerotia (Serbian Regulation, 2019). In comparison with the European Union legislation, which applies to the southeastern Europe European Union Member Nations, some MLs remain high or are not enacted (as is the case with AFM1, FUMs, and TCTs), which calls for the amendments of the existent laws and regulations. Surprisingly, the Serbian regulatory authorities failed to establish the MLs for FUMs in feed despite their widespread occurrence and their animal health hazards (Serbian Regulation, 2016).

Monitoring and control systems are an integral component of the food safety system that have been established to obtain reliable information about the real exposure of human populations to mycotoxins and consequential public health risks. Official food control laboratories in the countries of southeastern Europe are mostly accredited by national accreditation bodies according to ISO 17025 and participate in interlaboratory proficiency testing schemes. Given the often-restricted budgets, national programmes of monitoring, prevention and control of mycotoxin contamination in food and feed do not entirely serve their purpose, calling for evidence-based reinforcement and upscaling.

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Chapter 4

Analysis of nutrition transition in Central Asia from food systems perspectives

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Abstract

This paper provides an overview of the changing nature of food and nutrition security in the countries of Central Asia. A food systems framework was used for understanding the dynamic transitions in diets, food affordability and food environments experienced in Central Asia. Data was collected through Food and Agricultural Organization of the United Nations (FAO) food security databases, including FAOSTAT and Food Price Monitoring and Analysis, and recently conducted surveys. It was notable that the availability of sugar for human consumption has sharply increased in Central Asia, and changes in food consumption patterns are associated with certain trends in the region, including increased disposable incomes, remittances from labour migrants, price volatilities of basic food items, rapid urbanization, and the increased variety of food available in urban areas. As the transition of nutrition observed in Central Asia has been occurring simultaneously with significant shifts in demography, economy and food security, it is important to respond with an interdisciplinary approach that includes inputs from multiple sectors, including agriculture, education, urban planning and public health. The evolution of these trends and how they associate with changes in diets and nutrition will be the key to moving towards ending all forms of malnutrition.

Keywords: *Central Asia; nutrition transition; healthy diets; food systems*

Introduction

The region of Central Asia has five countries that were included in this analysis: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. According to standard World Bank lending classifications in 2020, Tajikistan was classified as a low-income country, Kyrgyzstan and Uzbekistan as lower-middle-income countries, and Kazakhstan and Turkmenistan as upper-middle-income countries.

Governments in Central Asian countries have been taking various steps to implement the 2030 Agenda for Sustainable Development. In line with Goal 2 of the Sustainable Development Goals (SDGs), which calls for eradicating hunger, achieving food security and eliminating all forms of malnutrition, Central Asian countries are building on the progress made in the region that began in 1990. Between 1990 and 2015, almost all of the Central Asian countries succeeded in reducing the prevalence of undernourishment by half, thereby achieving Millennium Development Goal 1c. In most countries of the Central Asia region, national governments continue to recognize food and nutrition security as one of the key priorities in their national development strategies and policies.

Food and nutrition security is still a significant issue for the region. This paper argues that the nature of food and nutrition security has been changing gradually as countries of the region have experienced dynamic changes in the areas of food systems, particularly food supply chains, food environments, individual factors and consumer behaviour. The changes in the pattern of food consumption have been driven by an increased variety of food available in markets, rapid urbanization and increased disposable incomes, particularly in the countries where economic growth has been faster. FAO's food balance sheet data show that the availability of macronutrients, particularly proteins and fats, has sharply increased, in line with economic growth (FAO, 2017a). This transition indicates a rise of new types of challenges to food and nutrition security in the region.

Issues regarding diet and nutrition have largely been left to the health sector. National strategies were developed separately for food security and nutrition in most countries in Central Asia. Nutrition strategies and policies tend to disregard the roles of agriculture and food-related sectors in addressing malnutrition, while food availability and food self-sufficiency are priorities in national food security policies. This is largely due to the lack of systematic analysis at both regional and national levels to enable the understanding of the relationships among food supply, food environments, consumer behaviours, changing dietary patterns and nutritional outcomes. There is limited understanding and knowledge on the role that diets and food systems can have in obesity prevention. It is now important to bridge the divide between research and food-related policies for better understanding of country-level drivers.

The change in the character of food and nutrition security that has been observed in the region is referred to in this paper as the "transition of food and nutrition insecurity." According to empirical research (Popkin, 2003, 2008), the nutrition transition is preceded, or occurs simultaneously, with significant shifts in demographic changes, such as high mortality to low mortality, and an epidemiological shift from a population characterized by a high prevalence of infectious disease to one characterized by a high prevalence of NCDs. Popkin describes five broad nutrition patterns (Popkin, 2003, 2008). The first pattern is associated with Paleolithic man and hunter-gatherer populations and is not relevant today. The second is primitive agriculture and is associated with periodic famine and various nutritional deficiencies. The trajectory of most developing countries falls within the third pattern, namely receding famine but continuing nutritional deficiencies. Populations of high- and middle-income societies (and segments of low-income societies as well) fall into the stage 4 nutrition pattern. In stages 4 and 5,

populations enjoy longer and healthier life expectancy, and their diets change to include higher levels of total fat, cholesterol, sugar and other refined carbohydrates and lower levels of fibre. This consumption is often accompanied by a more sedentary lifestyle, leading to an increased prevalence of overweight and obesity that cause NCDs such as diabetes, heart disease and cancer. The final nutrition pattern (stage 5) is characterized by changes in diet aimed at preventing or delaying degenerative diseases and prolonging health. It may also be accompanied by behavioural changes to increase activity levels. These changes may lead to significant changes in body composition and increased life expectancy (Popkin, 2003, 2008).

Complex changes in the supply and demand sides of food systems have been driving the changes in food consumption patterns. While all countries in Central Asia have had their own unique changes over the past two decades, there are lots of similarities in the changed consumption patterns. The patterns of change in Central Asia follow macro trends found globally: increased consumption of meat, fat, sugar and processed foods. These changes in consumption behaviour are considered to be one of the major causes of the rapid increase in obesity among adults in the region. Obesity is related to the risk of diet-related NCDs, such as diabetes, hypertension and cardiovascular diseases (Guh *et al.*, 2009).

The analysis in the following section specifies how changes in food systems in Central Asian countries are playing out in food and nutrition security outcomes, particularly in undernourishment and all forms of malnutrition, which are two of the major parameters for measuring the progress of SDG 2.

Methods and data sources

Several sources of data are used to describe the food and nutrition security transition in the countries of Central Asia and to analyse the issues of food systems transitions in various dimensions. All data were obtained from FAOSTAT, national statistics authorities, and other studies conducted in relevant areas. Changes in food and nutrition outcomes were analysed using SDG 2 indicators, such as the prevalence of undernourishment, anthropometric indicators, and micronutrient deficiencies. Modifications in food consumption patterns were estimated using national-level data of food availability as a benchmark. Changes in consumer behaviour and food environment were described using income-related indicators, food imports, and the results of various surveys conducted in relevant areas.

Results

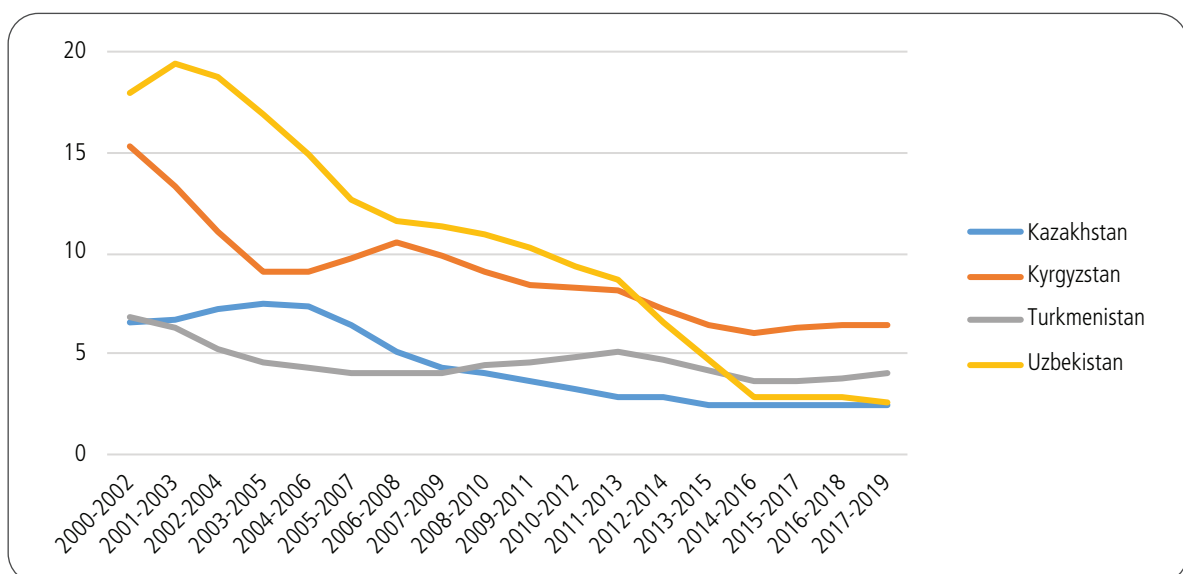
Evolution of food and nutrition security in Central Asia

SDG Target 2.1 aims to “end hunger by 2030 and ensure access by all people, in particular the poor and people in vulnerable population groups, including infants, to safe, nutritious and sufficient food all year round.” At the global level, the evolution of progress towards Zero Hunger is monitored by the use of SDG Indicator 2.1.1, the prevalence of undernourishment (PoU), and indicator 2.1.2, the severity of food insecurity. This paper will use the PoU for analysing progress towards SDG Target 2.1, as the indicator has been estimated for all countries in Central Asia, while indicator 2.1.2 is available for Kazakhstan, Kyrgyzstan and Uzbekistan and only in the past five years. The PoU measures the prevalence of the undernourished population, defined as the proportion of undernourished people relative to the total population. It approximates the degree of inadequate energy intake of a person in relation to the required energy intake (FAO *et al.*, 2020).

Figure 4-1 shows that all five countries in Central Asia successfully reduced the PoU over the period 2000–2019. The reduction occurred more rapidly than the global average.

Kyrgyzstan and Uzbekistan significantly reduced the prevalence of undernourishment, by approximately 2 percent per year in the early 2000s. Undernourishment was the lowest in Kazakhstan and Turkmenistan at the beginning of the century, and the prevalence was estimated to be below 2.5 percent in 2019. In recent years, stagnation in the reduction of the PoU is evident in all countries for which data are available. There has been a slight upward trend of undernourishment in Kyrgyzstan and Turkmenistan starting around 2017.

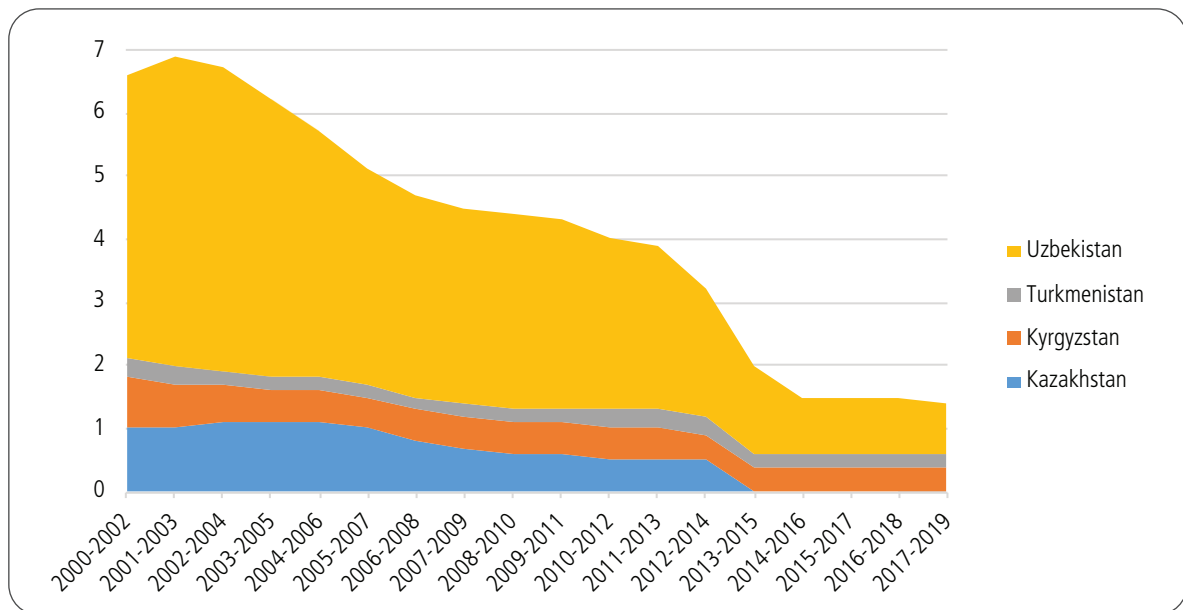
Figure 4-1. Prevalence of undernourishment (%) in four countries of Central Asia, 2000–2019



Source: Food and Agriculture Organization of the United Nations. 2020. Prevalence of undernourishment. FAOSTAT. Rome, FAO. <http://www.fao.org/faostat/en/#home>

It is important to assess trends in both prevalence and absolute numbers, as the number of undernourished people may increase while its prevalence decreases due to relatively high population growth in Central Asia. As **Figure 4-2** shows, the number of undernourished people has dropped sharply in the early- to mid-2000s in all countries. Data from the past three years shows an overall stagnation and an upward trend in undernourishment.

Figure 4-2. Number of undernourished people (millions) in four countries of Centra Asia, 2000–2019



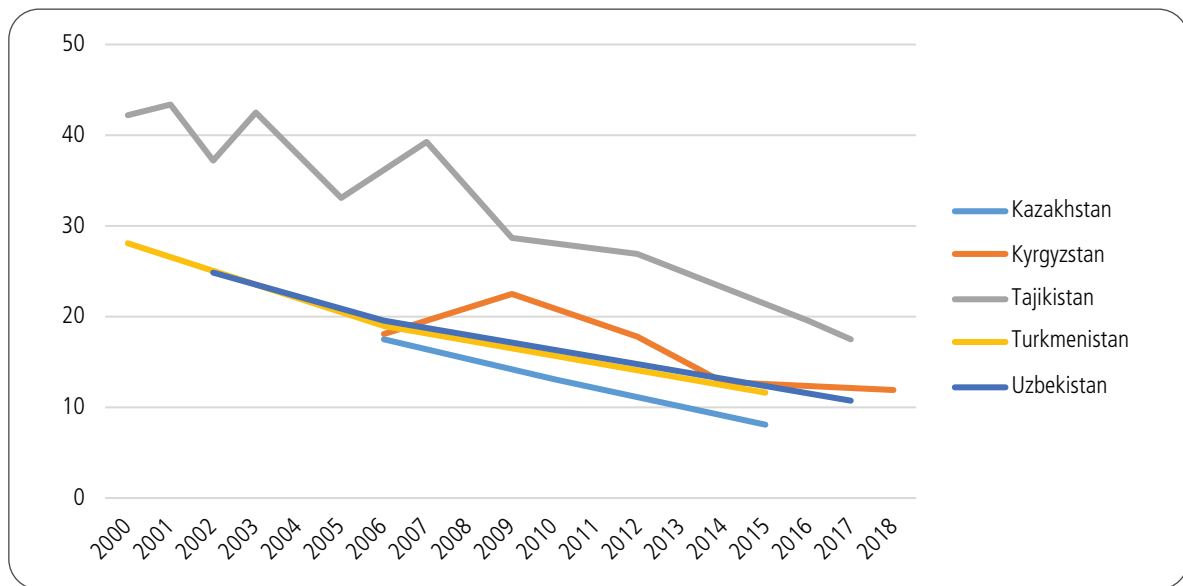
Source: Food and Agriculture Organization of the United Nations. 2020. Number of undernourished people. FAOSTAT. Rome, FAO. <http://www.fao.org/faostat/en/#home>

SDG Target 2.2 aims to “end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under five years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons.” During the period 2000–2019, all countries in Central Asia achieved significant reductions in stunting among children younger than 5. Stunting is defined as a low height-to-age ratio and serves as a basic indicator of chronic malnutrition (**Figure 4-3**). The prevalence, which was around 20–40 percent in the early 2000s, has gradually reduced to 10–20 percent in the past three years. The current stunting rates are below the world average, but achieving the internationally agreed target of a 40 percent reduction by 2025 still presents a challenge.

A similar trend is observed for the prevalence of wasting, which is low weight-to-height ratio and serves as a key indicator for acute malnutrition among children younger than 5. As in the case for stunting, the prevalence has reduced in all countries for the past two decades. Kazakhstan, Kyrgyzstan, Turkmenistan and Uzbekistan reached the global target to reduce the prevalence to below 5 percent by 2025, and the latest data from Tajikistan indicate that that country is close to meeting the goal (**Figure 4-4**).

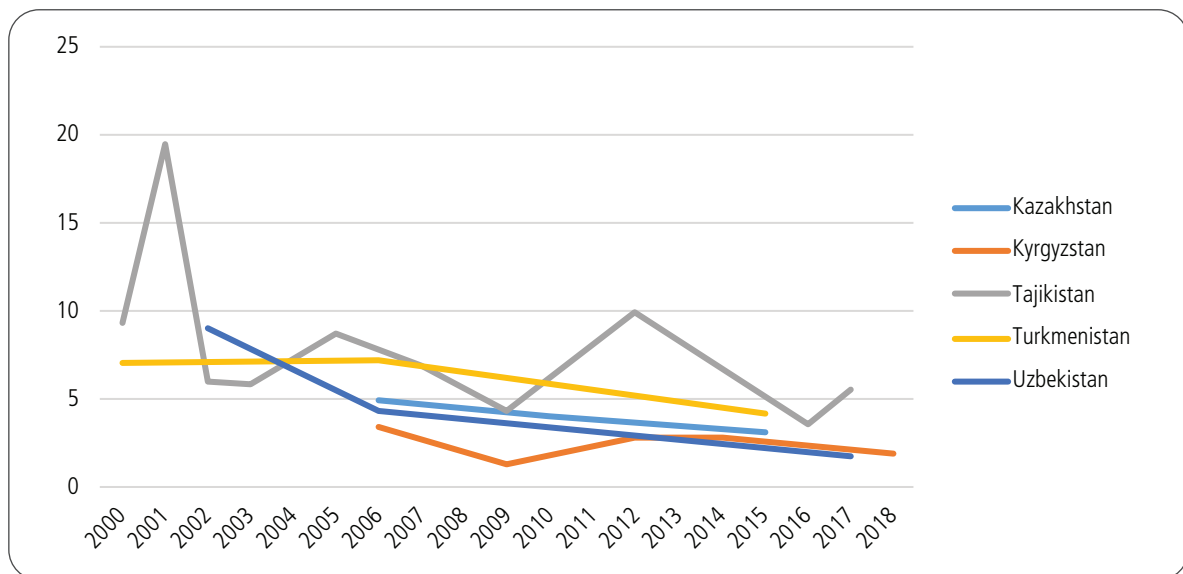
Micronutrient deficiencies refer to a lack of key vitamins and minerals, such as iodine, vitamin A and iron. Micronutrient deficiencies present major threats to people’s health, particularly among women and children. One of the most commonly used indicators to monitor micronutrient deficiencies is the prevalence of anaemia, which is mainly caused by inadequate intake of essential micronutrients – particularly iron, vitamin A and folate. Anaemia is closely linked to health-related SDG targets such as SDG Target 3.1, which aims to reduce the global maternal mortality ratio to less than 70 per 100 000 live

Figure 4-3. Prevalence of stunting among children younger than 5 (%) in countries of Central Asia, 2000–2018



Source: Food and Agriculture Organization of the United Nations. 2020. Prevalence of stunting among children younger than 5. FAOSTAT. Rome, FAO. <http://www.fao.org/faostat/en/#home>

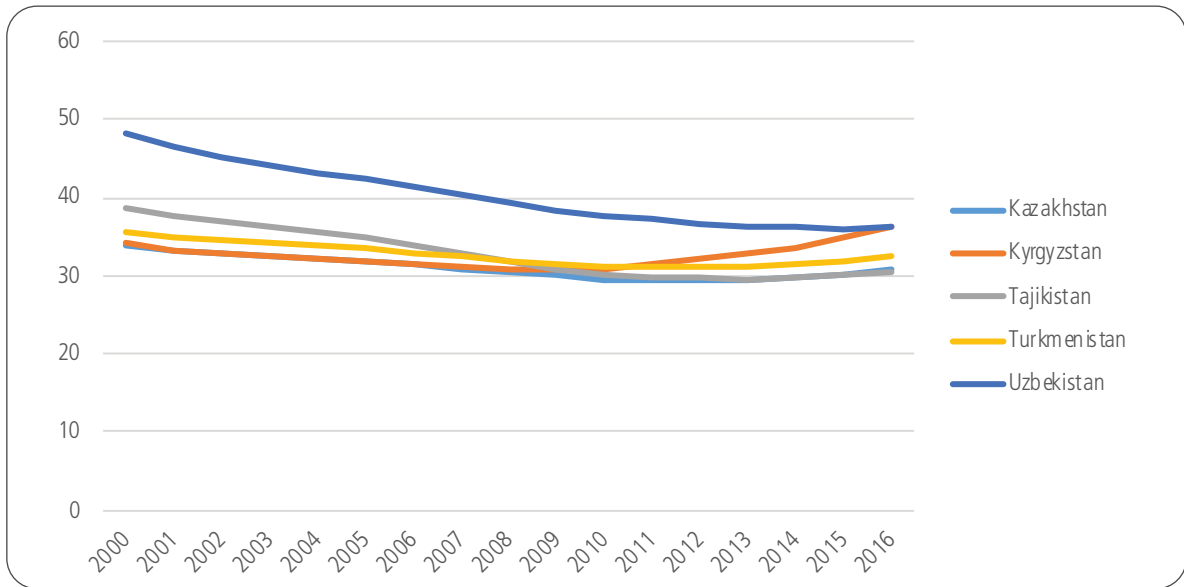
Figure 4-4. Prevalence of wasting among children younger than 5 (%) in countries of Central Asia, 2000–2018



Source: Food and Agriculture Organization of the United Nations. 2020. Prevalence of wasting among children younger than 5. FAOSTAT. Rome, FAO. <http://www.fao.org/faostat/en/#home>

births by 2030. Lowering rates of anaemia will help reduce maternal mortality. Anaemia is most prevalent in women who are of reproductive age, 15–49. Anaemia rates declined steadily in all countries in Central Asia between 2000 and 2010. The decline slowed and the trend turned to a slight increase in the past five years (**Figure 4-5**). The latest rates of anaemia are between 30 and 40 percent, indicating that micronutrient deficiencies remain a major concern in food and nutrition security in the region.

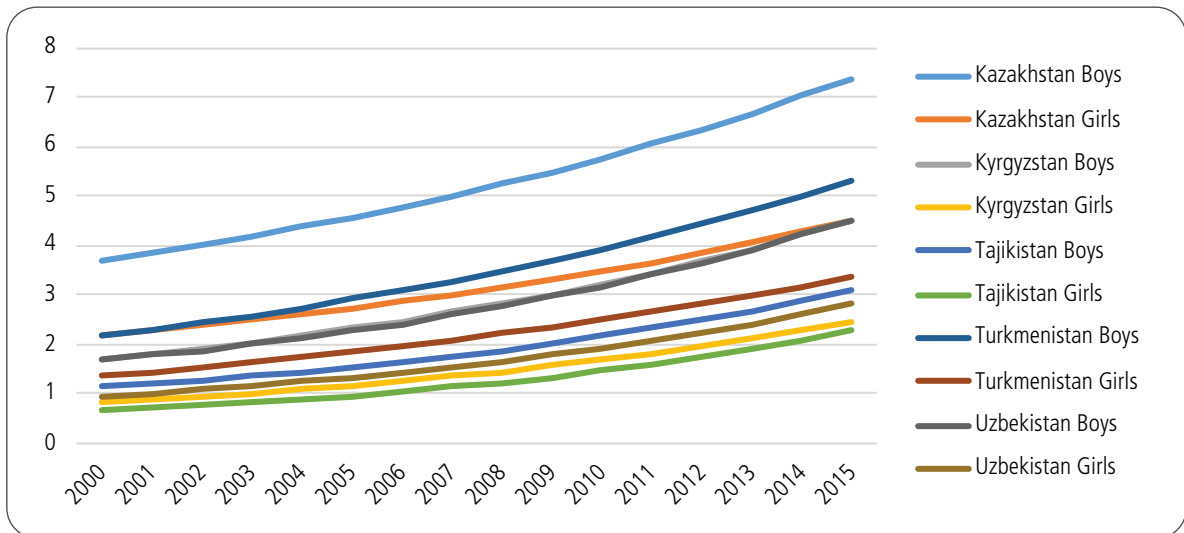
Figure 4-5. Prevalence of anaemia among women of reproductive age (%) in countries of Central Asia, 2000–2016



Source: Food and Agriculture Organization of the United Nations. 2020. Prevalence of anaemia among women of reproductive age. FAOSTAT. Rome, FAO. <http://www.fao.org/faostat/en/#home>

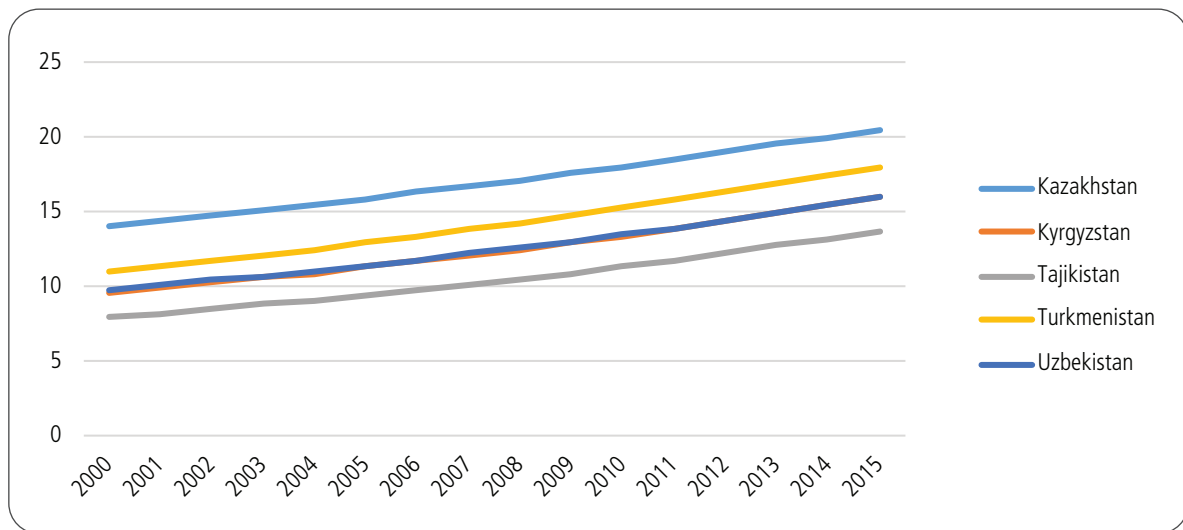
In contrast to the progress observed in reducing hunger, micronutrient deficiencies, and chronic and acute undernutrition in children, the prevalence of obesity has been increasing in all countries, both in adolescents and adults (**Figure 4-6** and **Figure 4-7**). The rates of obesity are above the world average in almost all countries. The increasing rates of obesity has accelerated over the past ten years, starting in 2010. The prevalence of obesity is particularly high in Kazakhstan and Turkmenistan.

Figure 4-6. Prevalence of obesity among adolescents, aged 5–19 (%) in countries of Central Asia, 2000–2015



Source: Development Initiatives. 2020. Global Nutrition Report: Action on equity to end malnutrition. Bristol, United Kingdom of Great Britain and Northern Ireland, Development Initiatives. <https://globalnutritionreport.org/reports/2020-global-nutrition-report/>

Figure 4-7. Prevalence of obesity among adults (%) in the world and in countries of Central Asia, 2000–2016



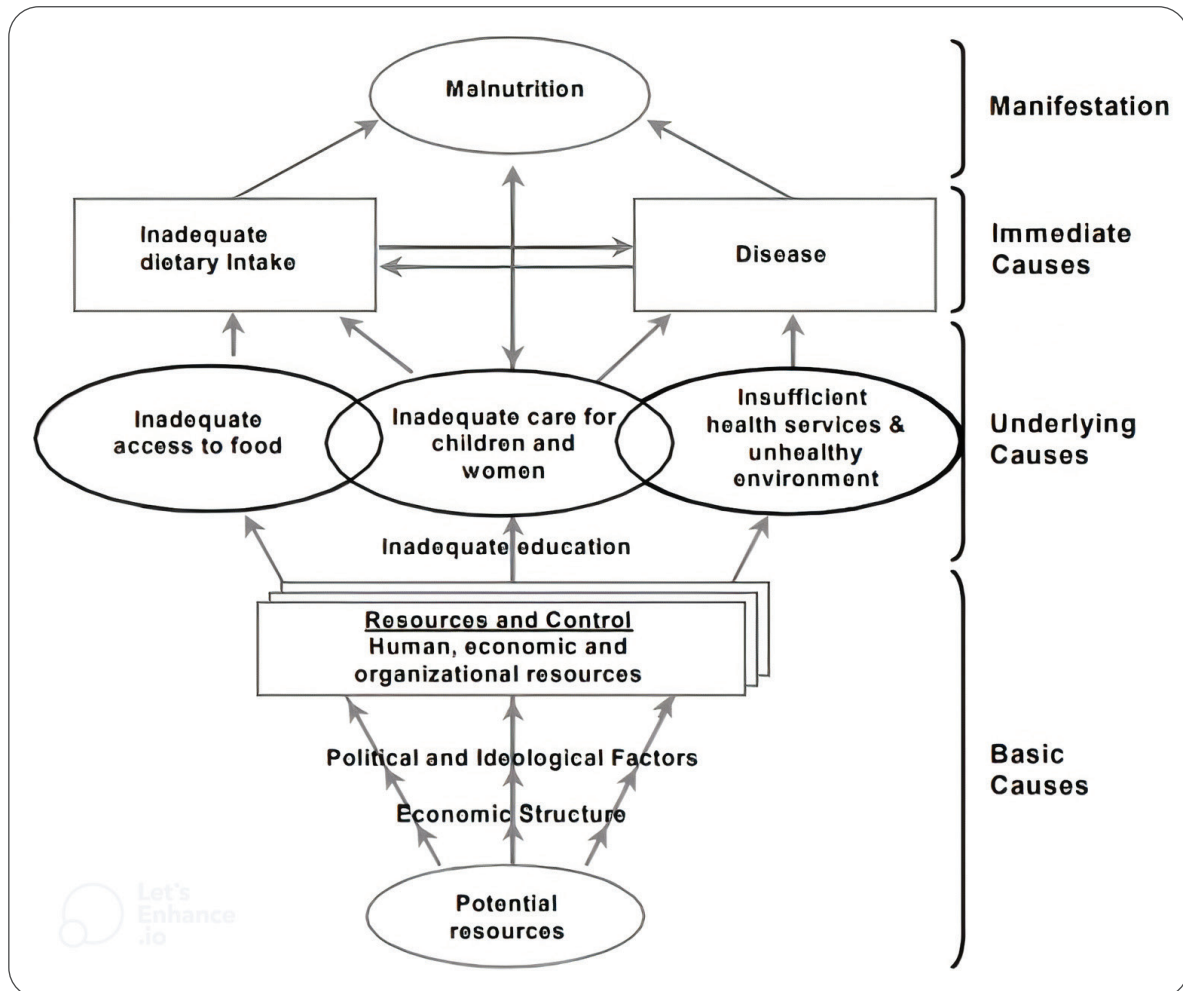
Source: Food and Agriculture Organization of the United Nations. 2020. Prevalence of obesity among adults. FAOSTAT. Rome, FAO. <http://www.fao.org/faostat/en/#home>

A slow reduction of undernutrition, persistent micronutrient deficiencies, and rising trends of obesity demonstrate that the populations of these Central Asian countries are affected by the multiple burden of malnutrition. A high prevalence of undernutrition, which was the dominant nutrition problem until the 2000s, has been compounded by rising overweight and obesity rates in both adults and children. Such a rapid transition of consumption patterns calls for better understanding of the causes behind the shift in behaviour.

Food systems framework for understanding the dynamics behind the nutrition transition

The UNICEF conceptual framework shown in **Figure 4-8** (United Nations Children’s Fund, 1991) is widely used conceptual tool for analysing the causes and consequences of malnutrition and their relationship with multiple factors such as diet, sanitation and livelihoods. The framework suggests several key issues to understand potential causes of nutritional problems from three different levels: immediate, underlying and basic causes. The immediate causes include diet and diseases, while broader social and economic issues such as household access to food, livelihood assets and activities, access to health services, and feeding practices are considered to be underlying and basic causes of malnutrition. The framework has been widely accepted among the international nutrition community and used as a conceptual framework for a wide range of nutritional assessments and analyses.

Figure 4-8. The UNICEF conceptual framework

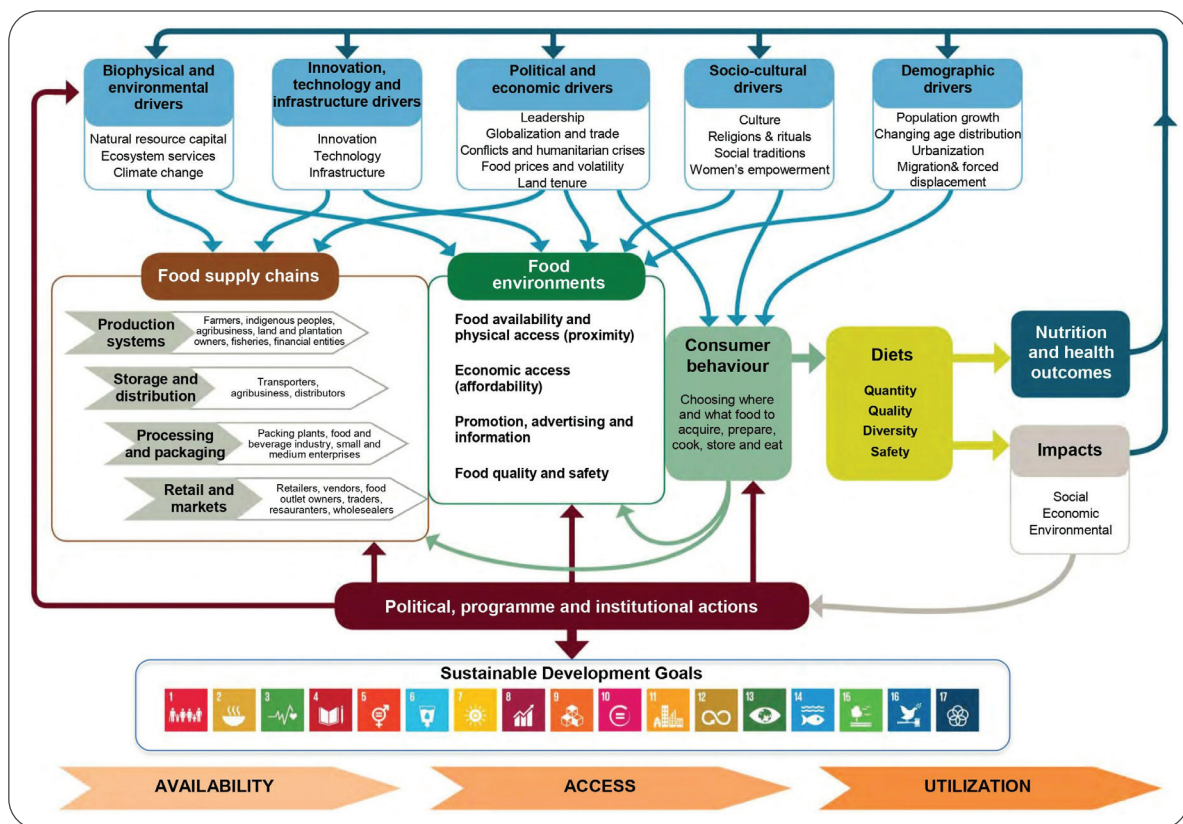


Source: United Nations Children’s Fund. 1991. Strategy for improved nutrition of children and women in developing countries. *The Indian Journal of Pediatrics*, 58(1): 13–24. <https://doi.org/10.1007/BF02810402>

There are gaps in the UNICEF conceptual framework regarding the causes of malnutrition, particularly the interaction with food production, supply and the environment. It is important to account for the causal pathways between agriculture and nutrition in analysing rapid changes in the nature of malnutrition in the region.

Food systems have been increasingly recognized in recent years as a driver of nutritional change, especially after the Second International Conference on Nutrition (ICN2), an intergovernmental meeting on nutrition jointly organized by FAO and the WHO in 2014. Food systems encompass the entire range of actors involved in the production, aggregation, processing, distribution, consumption and disposal of food products that originate from agriculture, forestry, fisheries and parts of the broader economic, societal and natural environments in which they are embedded (FAO, 2018). The conceptual framework from the High-Level Panel of Experts on Food Security and Nutrition (HLPE) illustrates that food systems influence consumer choices and diets, thus impacting nutrition and health (HLPE, 2014). The framework unpacks food systems into three key elements: food supply chains, food environments and consumer behaviour. The framework is presented in **Figure 4-9**. The food systems lens enables simultaneous analysis of food supply and food demand within an integrated analytical framework.

Figure 4-9. Food systems conceptual framework



Source: HLPE. 2017. Nutrition and food systems. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security. Rome, HLPE. <https://www.fao.org/3/i7846e/i7846e.pdf>

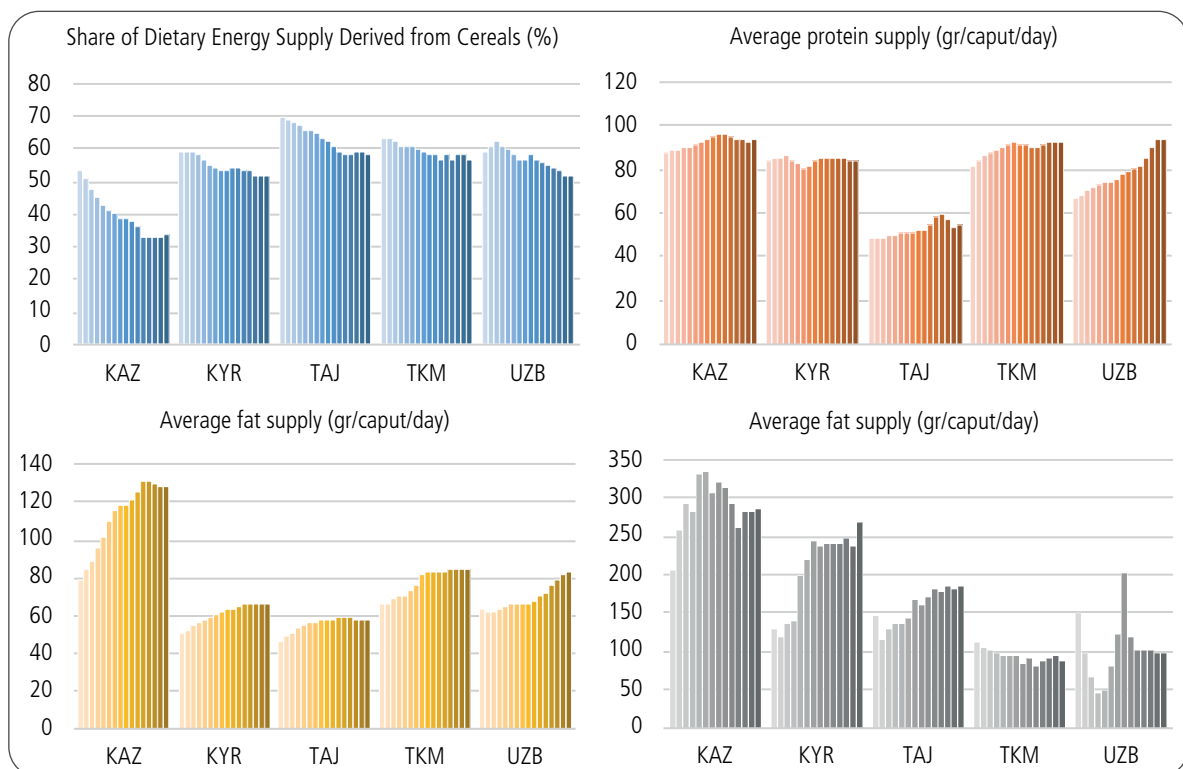
Changes in dietary patterns in Central Asia

Poor-quality diets are a major and immediate cause of malnutrition, as illustrated by the UNICEF conceptual framework and the food systems framework. Poor-quality diets limit the intake of nutrients, particularly micronutrients, such as vitamins and minerals. Data on dietary quality and diversity are often made available through household- or individual-level surveys such as national household budget surveys (HBS), demographic and health surveys (DHS), and multi-indicator cluster surveys (MICS). These surveys are not done frequently in Central Asian countries, and there are limited data available in some countries in the region. The FAO Food Balance Sheet data are widely used as a baseline for consumption, as they

provide information on estimated food availability for human consumption at the country level, taking into account domestic production, import, export, food losses and non-consumption use. The volume of available food in the country, separated by food group, is considered a benchmark for the overall quality of diet in the country.

The availability for consumption of the four food groups – cereals, protein foods, fats and sugars – characterize dietary quality in Central Asian countries. Changes in food availability in all four food groups have been significant in the past two decades (**Figure 4-10**). Overall, the availability of protein, fats and sugars has increased, and the availability of cereals remains unchanged. This indicates that people's consumption patterns have gradually changed towards more high-calorie foods and the demand for staple foods such as wheat has unchanged. It is notable that the availability of sugar has sharply increased in Kyrgyzstan and Tajikistan, two lower-income countries in the region.

Figure 4-10. Food availability for consumption in countries of Central Asia, 2000–2017



Source: Food and Agriculture Organization of the United Nations. 2020. Food availability. FAOSTAT. Rome, FAO. <http://www.fao.org/faostat/en/#home>

Income, purchasing power and consumer behaviour

Food affordability

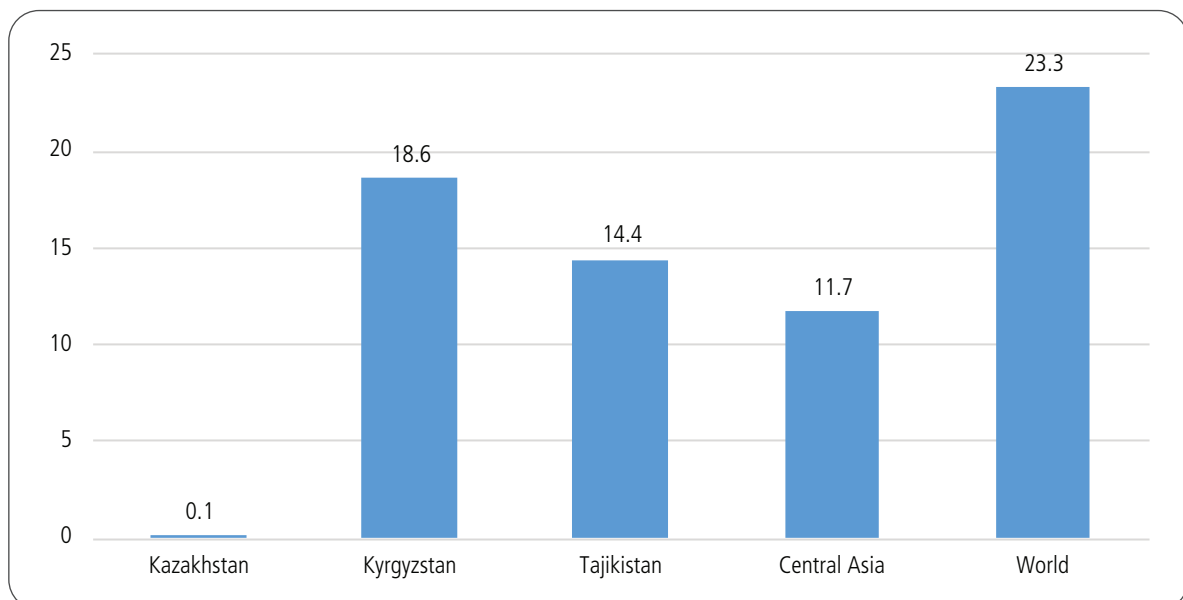
Food affordability directly affects people's dietary choices. Food affordability is influenced by two factors: household income and the market prices of food. When food is not affordable for a household due to low household income or high market prices, the household tends to reduce the quality or quantity of food, both of which result in reduced nutrient intake. Households tend to adapt more monotonous dietary patterns, with reduced consumption of nutrient-rich products such as vegetables, fruits, meat and dairy products, and maintain or increase the consumption of processed foods, which provide cost-

efficient dietary calories. Sugars, grains and oils are generally cheaper than vegetables, fruits and dairy products per serving. This means that an increase in household income leads to an increase in overall food consumption and a possible change in dietary choices.

Household incomes have substantially increased in all countries in Central Asia over the past two decades. The level of GDP per capita has grown at average of 147 percent in Central Asia between 2000 and 2019. Turkmenistan has seen the largest increase, while other countries in the region have experienced less sizable but still significant growth. It is important to note that poverty has decreased during the same period, raising the GDP per capita. All countries in Central Asia reduced the proportion of the population living below national poverty lines, and the rate of reduction varied across countries. The most remarkable reduction was observed in Kazakhstan and Turkmenistan. Overall, the decline in hunger and the prevalence of undernutrition and the increased consumption of meat, fats and sugars are consistent with the improvement in household income during the same period.

The latest analysis on the cost of diets in the *State of Food Security and Nutrition in the World* (FAO *et al.*, 2020) provides insights into whether a nutrient-adequate diet is affordable for the poorest. It estimated the cost of a nutrient-adequate diet in each country in comparison to average household food expenditures. As stated previously, almost all populations in the countries of Central Asia can afford an energy-sufficient diet; however, a nutrient-adequate diet is much more expensive than an energy-sufficient diet and is therefore less affordable for households with low income. According to the analysis provided by FAO (FAO *et al.*, 2020), 11 percent of the population in Central Asia cannot afford a nutrient-dense diet. This was higher in Kyrgyzstan (18 percent) and Tajikistan (14 percent) (**Figure 4-11**), indicating that the affordability of a nutritionally adequate diet is still a challenge in Central Asian countries, and particularly among low-income households.

Figure 4-11. Population unable to afford a healthy diet in 2017 (millions) in Central Asia and the world

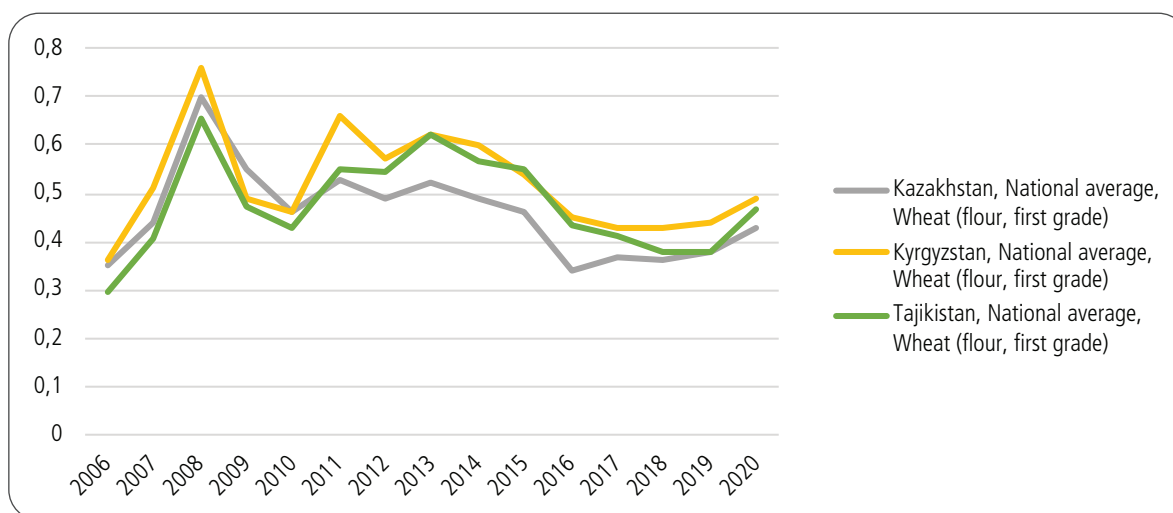


Source: FAO, IFAD, UNICEF, WFP, & WHO. 2020. *The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets.* Rome, FAO. <https://doi.org/10.4060/ca9692en>

Increases in food prices reduce the purchasing power of consumers by depressing real incomes, especially when the prices of basic food items increase over a short period of time. Experiences from the global food and fuel crises in 2007–2008 demonstrate that retail food prices in Central Asian countries are

highly vulnerable to volatility in international markets. As shown in **Figure 4-12**, the prices of wheat, which is a staple for most of the Central Asian population, sharply increased in 2007–2008 and again in 2011, following the trend of international prices. In the past three to five years, the prices went up sharply in Kyrgyzstan and Tajikistan, when Kazakhstan and Russian Federation, which are major exporters of wheat in the region, restricted wheat exports due to the COVID-19 pandemic.

Figure 4-12. Retail prices of wheat flour (nominal price in USD/kg) in Kazakhstan, Kyrgyzstan and Tajikistan (2006–2020)



Source: Food and Agriculture Organization of the United Nations. 2020. Retail prices of wheat flour. Food Price Monitoring and Analysis. Rome, FAO. <https://www.fao.org/giews/food-prices/tool>

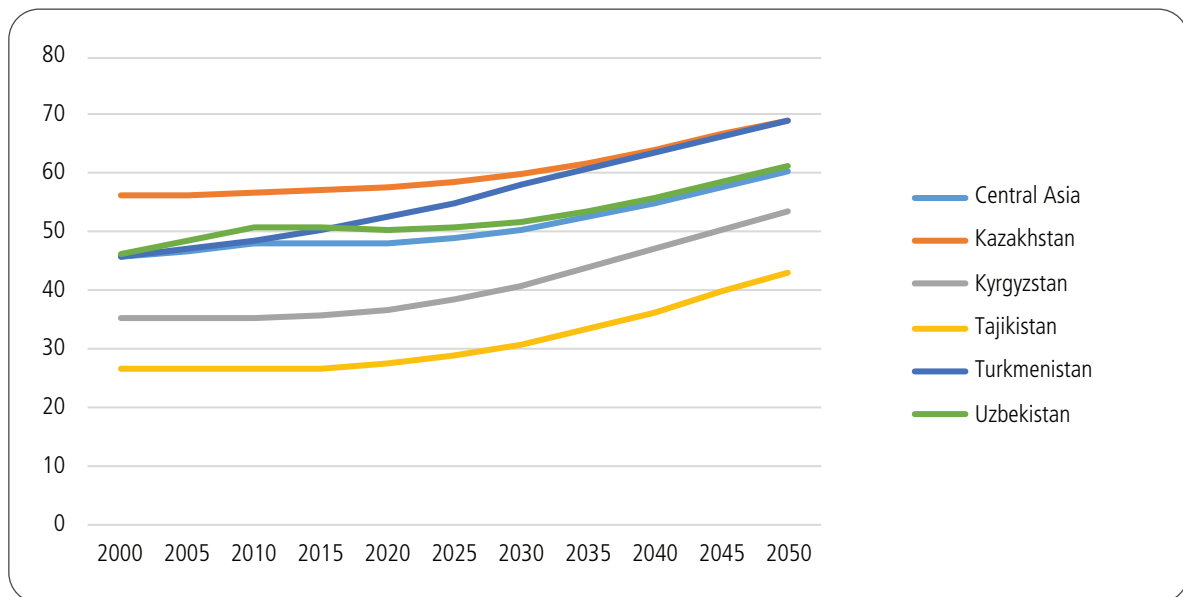
Consumer behaviour

Consumer behaviour reflects all the choices and decisions made by consumers on what food to acquire, store, prepare, cook, eat and share among household members (HLPE, 2014). Consumer behaviour is influenced by a wide range of factors (Committee on World Food Security, 2019), including demographics, lifestyle, values, food marketing, social environment and traditions. Including all these factors is beyond the scope and capacity of this analysis; only two major factors – urbanization and migration, which are considered to have considerable effects on food-related consumer behaviour – are presented in this section. Food environments in urban areas are characterized by supermarkets, food vendors and restaurants and facilitate physical and economic access to cheap and high-calorie foods. This leads to higher consumption of animal-sourced foods, sugars, fats, refined grains and processed foods. Urbanization is widely known as a one of the major contributing factors to changes in consumer behaviour and nutrition (FAO, 2017b).

Central Asia's population is steadily urbanizing. In 2000, 45 percent of the population in Central Asia was living in urban areas, and this is estimated to have increased to 48 percent in 2020 (United Nations Department of Economic and Social Affairs, 2019). According to the latest projections made by the United Nations Department of Economic and Social Affairs (UNDESA), the rate will continue to grow to around 60 percent in 2050 (United Nations Department of Economic and Social Affairs, 2019).

The growth has been faster in Uzbekistan, which is home to Tashkent, the largest city in Central Asia, and has seen the rise of new urban centres, such as Almalyk and Navoi. Kyrgyzstan and Tajikistan, two of the least urbanized countries in the region, also are experiencing rapid rural-to-urban migration, particularly in the last decade (**Figure 4-13**).

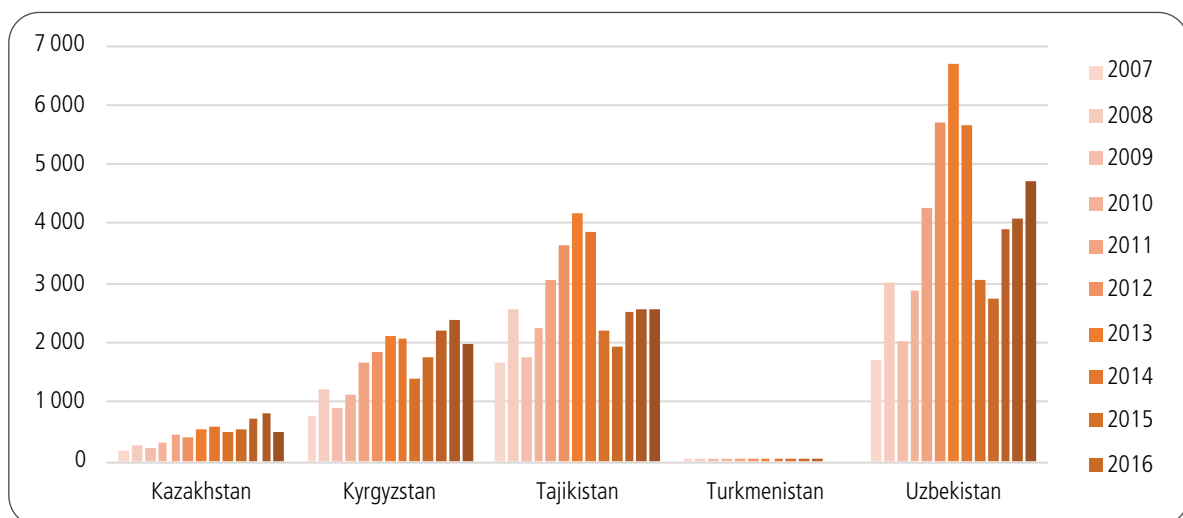
Figure 4-13. Annual percentage of population at mid-year residing in urban areas in countries of Central Asia, 2000–2050



Source: United Nations Department of Economic and Social Affairs. 2019. World Urbanization Prospects: The 2019 Revision. New York, UNDESA. <https://population.un.org/wup/>

Countries in Central Asia have been experiencing high levels of labour migration – not only from rural to urban areas but also between countries in the region, predominantly composed of seasonal labour migration from Kyrgyzstan, Tajikistan and Uzbekistan to the Russian Federation. Labour migration has become a major livelihood strategy for households in rural communities where agriculture alone cannot provide sufficient employment opportunities. The livelihoods of rural families have become heavily dependent on the remittances of labour migrants. In 2019, it was estimated that the remittances from labour migrants equalled around a quarter of the GDP in Kyrgyzstan and Tajikistan. Remittances have continued to grow since the mid-2000s, with a slight decrease during the Russian financial crisis in 2014–16 (**Figure 4-14**).

Figure 4-14. Remittances from the Russian Federation (current millions USD)



Source: The Central Bank of the Russian Federation. 2020. Cross-border Transfers of Individuals. Moscow, The Central Bank of the Russian Federation. <http://www.cbr.ru/eng/statistics/>

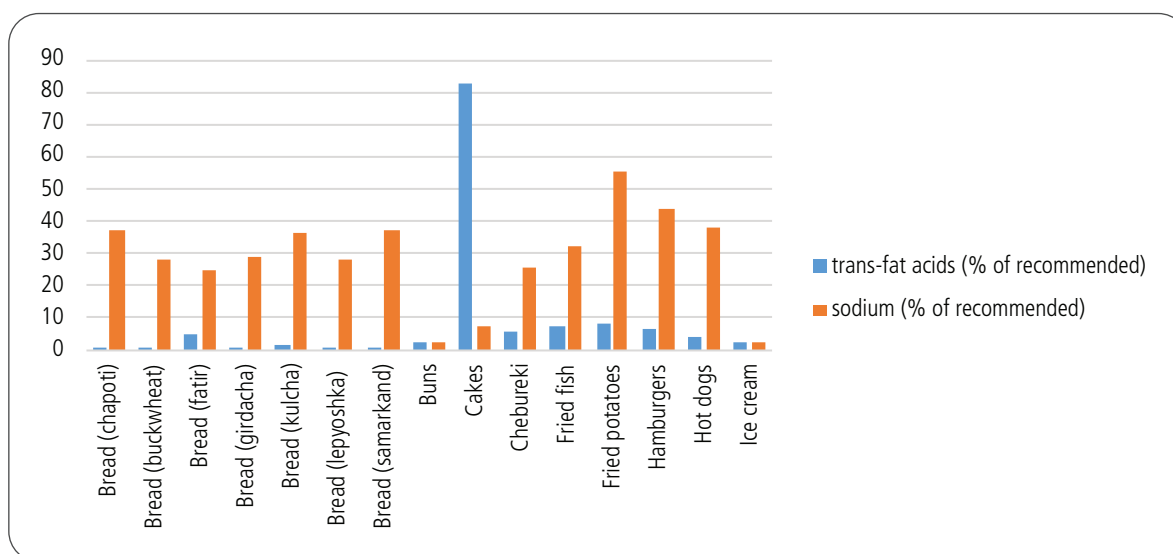
Various studies in the Central Asia region have shown that remittances from labour migrants are used for the acquisition of assets and consumer goods, such as houses, property and automobiles, and for meeting the daily needs, including food, of households in the home country. It is highly likely that remittances from labour migration positively affect food and nutrition security for families left behind. The effects of remittances also may change food habits, but not necessarily positively. If a nutrient-rich diet is not financially feasible without remittances, the increased disposable income may result in an increase in diets reliant on cheap and high-calorie foods, based on as cereals, fats and sugar.

Urban food environments

Rapid urbanization and income growth in Central Asia have been changing physical and economic surroundings, creating new food environments and thus influencing people's dietary choices. In urban areas, the number of supermarkets, convenience stores and fast food restaurants is growing, and people are increasingly exposed to the marketing of various types of food through traditional and digital media. Tools to assess the changes in food environment are currently lacking. Related data are missing in Central Asian countries, such as the diversity of foods accessible in urban areas and the nutritional value of foods commonly accessible from urban street vendors.

A series of recent studies undertaken by the WHO Regional Office for Europe as a part of the "FEEDCities" project provides insights into the urban food environments of cities in Central Asia. Two surveys of food and beverage marketing for children conducted in Kazakhstan and Kyrgyzstan revealed that unhealthy food products, such as sugar confectionery and beverages, were the most frequently advertised food products in both countries (WHO, 2019a, 2019b). These results suggest that children and adolescents have lots of exposure to advertisements that market food high in fat, sugar and salt. A similar study in Tajikistan analysed the characteristics of food available in Dushanbe, the capital of Tajikistan. On the positive side, fresh fruit was widely available as street food. Sugar-based soft drinks, sugary confectionery and salty bread with high sodium levels also were widely available. Many of the commonly accessible foods in the streets of Dushanbe had high levels of trans-fatty acids and sodium, and some of the foods available would provide close to the daily recommend amount of trans-fatty acids or sodium in just one serving (Figure 4-15).

Figure 4-15. Nutritional composition of street food samples in Dushanbe, Tajikistan



Source: WHO. 2017. FEEDCities Project: The food environment description in cities in Eastern Europe and Central Asia: Tajikistan. WHO. Regional Office for Europe. <https://apps.who.int/iris/handle/10665/359725>

Summary and conclusions

Central Asian countries face the multiple burden of malnutrition. Undernutrition, which was the dominant nutrition problem in Central Asia until the beginning of the 2000s, has been compounded by rising overweight and obesity rates, among both adults and children. Overall, the review of developments in food and nutrition security in the Central Asia region indicates that significant progress has been made in reducing hunger and undernutrition. Most countries successfully reduced the prevalence of undernourishment by half during the period 1990–2015, thereby achieving Millennium Development Goal 1c. The prevalence of child malnutrition and micronutrient deficiencies also has been reduced during the same period. A rapid reduction of hunger and undernutrition occurred in the first decade of the 2000s, along with income growth and poverty reduction. However, decreasing rates of hunger and undernutrition have stagnated in all five countries over the mid-2010s, with some countries developing an increasing rate of undernutrition and hunger. Overweight and obesity rates have become more common in adult and adolescent populations, and the rate of increase has accelerated over the past three to five years. Such a rapid transition of nutrition patterns calls for better understanding of the underlying dynamics behind the shift to accelerate the progress towards SDG 2, which includes the “end of all forms of malnutrition.”

This paper has analysed data and study results to paint a picture of evolving food and nutrition security, as countries in Central Asia experience dynamic transitions in various dimensions of food systems – particularly in diets, food affordability and food environments. The analysis of the availability for consumption indicates gradual but significant changes in dietary diversity and quality over the past two decades. It is notable that the availability of sugar for human consumption has sharply increased in Kyrgyzstan and Tajikistan. These changes in the pattern of food consumption are associated with increased disposable incomes, remittances, market prices of nutritious diet, volatilities of the prices of basic food items, rapid urbanization, and an increase in the variety of food available in markets, particularly in urban areas. As the transition of nutrition observed in Central Asia has occurred simultaneously with significant shifts in demographics, the economy and food security, it is important to respond from a range of sectors, including agriculture, education, urban planning and public health.

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Part III

COUNTRY CASE STUDIES

Chapter 5

Review of agrifood systems and malnutrition in Armenia

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Abstract

Armenia is an upper-middle income, landlocked, net food-importer country. The country is still recovering from many externalities that have hindered its development. However, with proposed sustainable solutions and economic security, Armenia is continuing to address its hunger and food insecurity problems. Certain improvements in malnutrition over the past decade have been reported; however, a considerable part of the population in Armenia is still nutrient-deprived and vulnerable. High levels of poverty and unemployment, as well as low and instable incomes, have caused remarkable differences in food security and nutrition among the population living in various regions of Armenia. This review summarizes the available information on dynamic changes in malnutrition, food systems and diet, and the major drivers of these changes in Armenia.

This review highlights that food insecurity and malnutrition are key concerns for the country. There is a double burden of child malnutrition. Moreover, two forms of malnutrition – obesity and anaemia – were reported as significant in the Armenian population.

Keywords: *food security, food systems, diet, malnutrition, agriculture.*

Introduction and background of malnutrition

Introduction and background

Armenia is an upper-middle-income (World Bank, 2019), landlocked, net-food-importer country (**Figure 5-1**). It is one of the most shock-prone countries in the Central Asia and Caucasus region (United Nations and WFP, 2018). The territory of Armenia is composed of ten marzes (regions) and the capital city of Yerevan.

Figure 5-1. Map of Armenia



Source: ARMSTAT. 2023. <https://www.armstat.am/en/?nid=111>

The most vulnerable areas of Armenia are revealed by examining the distribution of key socioeconomic indicators, in addition to levels of food insecurity and malnutrition. In **Table 5-1**, values in red are above the national average, while these in green are below it.

Table 5-1. Key indicators by regions (marzes) of Armenia

2014	Food insecurity ²⁴	Stunting	Overweight	Poverty	Unemployment
Armenia	14.6 percent	19.4 percent	14.8 percent	30.0 percent	17.6 percent
Yerevan	18.4 percent	15.2 percent	14.7 percent	25.2 percent	26.9 percent
Aragatsotn	4.7 percent	12.5 percent	8.8 percent	18.7 percent	5.1 percent
Ararat	14.1 percent	19.8 percent	16.2 percent	28.5 percent	7.5 percent
Armavir	13.8 percent	19.0 percent	10.6 percent	29.0 percent	7.4 percent
Gegharkunik	5.6 percent	26.2 percent	15.8 percent	32.3 percent	5.8 percent
Lori	16.6 percent	30.6 percent	19.0 percent	36.4 percent	16.9 percent
Kotayk	14.4 percent	18.0 percent	13.3 percent	37.2 percent	22.8 percent
Shirak	17.4 percent	28.4 percent	23.4 percent	44.2 percent	20.8 percent
Syunik	6.8 percent	22.4 percent	22.6 percent	24.2 percent	18.3 percent
Vayots Dzor	2.4 percent	10.8 percent	4.8 percent	18.2 percent	13.0 percent
Tavush	15.8 percent	13.7 percent	9.6 percent	30.6 percent	10.9 percent

Source: WFP. 2016. Armenia Comprehensive Food Security, Vulnerability and Nutrition Analysis.
<https://docs.wfp.org/api/documents/WFP-0000020456/download/>

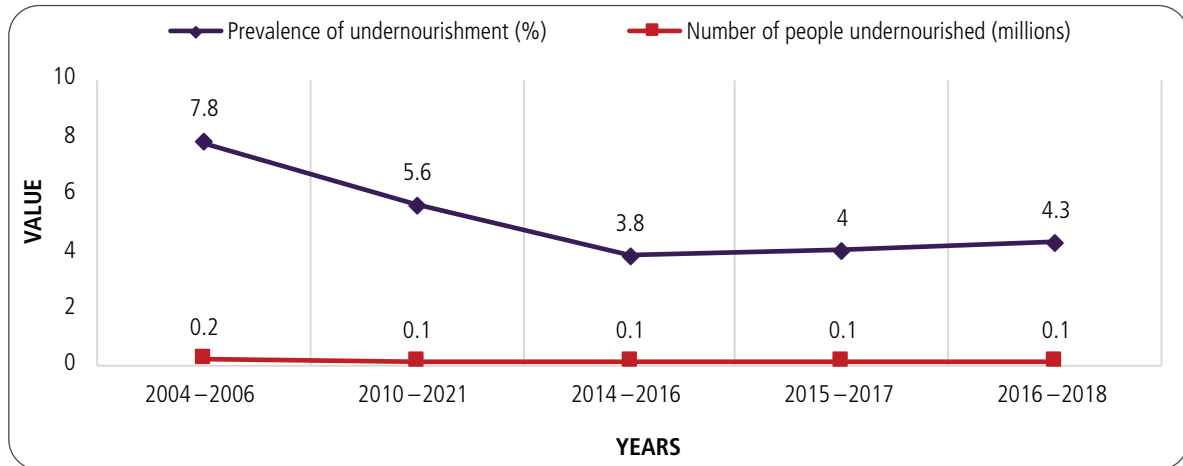
The marzes of Shirak, Lori, Gegharkunik, Ararat and Syunik face high rates of stunting and overweight prevalence (**Table 5-1**). Moreover, in Lori and Shirak, these indicators are combined with a high proportion of food-insecure households (greater than 15 percent).

To determine the nutrition status in Armenia, the Armenian Demographic and Health Survey (ADHS) is conducted every five years (National Statistical Service, Ministry of Health, and ICF, 2017). Compared to data from 2000 and 2005 surveys, the percentage of non-pregnant women ages 15–49 who are underweight (with a body mass index, or BMI, lower than 18.5) has not changed, remaining stable at around 4 percent. The percentage of women who are overweight or obese (BMI greater than or equal to 25.0) increased to 45 percent in 2015–2016. The 2015–2016 ADHS reported that women in their teens or 20s are more likely than women in older age groups to be thin or undernourished. In contrast, the proportion of women who are overweight increases with age: among women aged 40–49, 45 percent are overweight and 35 percent are obese. Differences by urban–rural residence are small; women in rural areas (46 percent) are almost as likely as urban women (44 percent) to be overweight or obese. By region, the proportion of undernourished women does not vary considerably (1–7 percent).

²⁴ Food insecure households are those that are food energy deficient and have a high consumption of staples. A household is also classified as food insecure if it is either food energy deficient or has a high consumption of staples combined with unsustainable income and wealth (CFSVNA, 2016).

Armenia's economic growth and growth in food availability, leading to a healthier energy supply, have created a decline in the prevalence of undernourishment. The prevalence of undernourishment has dropped nearly 1.8 times between 2004 and 2018 (Figure 5-2).

Figure 5-2. Prevalence of undernourishment (%) and number of people undernourished (millions) in Armenia, 2004–2018



Source: FAO. 2019. Establishment of the Armenian Soil Information System. In: Global Soil Partnership. <http://www.fao.org/global-soil-partnership/resources/highlights/detail/en/c/1236483/>

According to the Global Nutrition Report (GNR, 2018), Armenia is on course to meet global targets for overweight among children younger than 5, stunting among children younger than 5, wasting among children younger than 5, and exclusive infant breastfeeding. Armenia also is set to reach targets for anaemia in women of reproductive age, diabetes, and obesity in both male and female populations. Even though malnutrition indicators among children aged 0–5 have shown some improvements, there is a double burden of child malnutrition (stunting and overweight) in the country (WFP, 2018a).

Obese children and adolescents are likely to suffer from both short- and long-term health consequences, including non-communicable diseases (NCDs). According to the Armenia Comprehensive Food Security, Vulnerability and Nutrition Analysis (CFSVNA), public health in Armenia is dominated by a very high prevalence of NCDs. According to the 2015–2016 ADHS, the balance between communicable and non-communicable diseases has changed, and NCDs are now the primary cause of mortality (National Statistical Service, Ministry of Health, and ICF, 2017). It is estimated that over 90 percent of all deaths in the country are attributable to NCDs, while the probability of dying prematurely (before the age of 70) from one of the four major NCDs for a person living in Armenia was 22 percent in 2016 (United Nations Armenia, 2019). NCDs such as cancers, cardiovascular diseases, diabetes and chronic respiratory diseases and NCD risk factors (e.g. unhealthy diets) are increasing public health issues and challenges in Armenia (WFP, 2016).

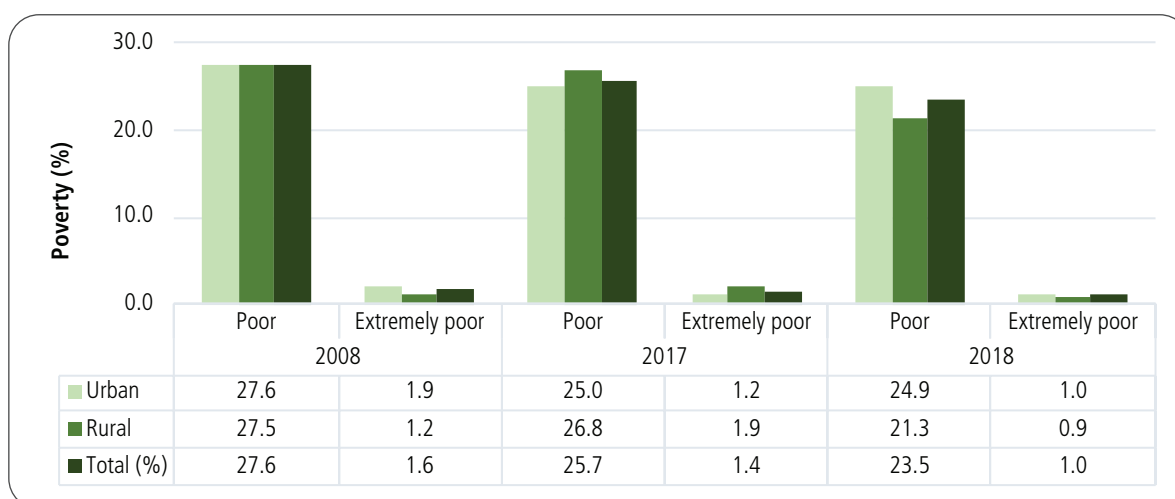
Background of agriculture and poverty in Armenia

According to the Armenia Development Strategy for 2014–2025, agriculture and rural development is among the cornerstones of the broader sustainability agenda in Armenia. Currently, agriculture is one of the most vital sectors of the Armenian economy, in terms of the country's GDP, sustainable rural development and, most importantly, food security (WTO, 2018). The share of the sector in GDP was 13.7 percent in 2018 (ARMSTAT, 2019). As of 2019, the sector employs about 33.2 percent of the working population.

Armenia is characterized by widening disparities in wealth and income that have led to serious socioeconomic differences among regions. Urban and rural communities have very different vulnerability profiles. Generally, rural areas and urban areas outside of the capital city of Yerevan are vulnerable. According to the Social Snapshot and Poverty in Armenia report, the underdeveloped condition of both physical infrastructures and financial opportunities are key obstacles for rural development. The poverty rate is higher among households deprived of land or that own only a small piece of land, have limited access to irrigation, have limited financial sources, or lack steady access to agricultural machinery or production capacities. The rural population living in the regions less favourable for agricultural activity tend to be poorer than in the more fertile marzes (ARMSTAT, 2019).

From 2008 to 2018, the poverty rate decreased countrywide (**Figure 5-3**). According to the Statistical Committee of the Republic of Armenia, in 2018, the poverty rate was 23.5 percent, constituting a fall of 2.2 percentage points from 2017 (indicating that each fourth person in Armenia was below the upper poverty line of AMD 42 621), and of 4.1 percentage points from 2008 (27.6 percent) (ARMSTAT, 2019). That means that in 2018, there were 700 000 people under the poverty line and 30 000 living in extreme poverty.

Figure 5-3. Poverty indicators for Armenia in urban and rural areas in 2008, 2017 and 2018



Source: ARMSTAT. 2019. Social Snapshot and Poverty in Armenia, 2019.
<https://www.armstat.am/en/?nid=82&id=2217>

State of food security and nutrition

Food insecurity has been a problem faced by the Armenian population since the first year of independence in 1991. Food insecurity is closely related to poverty, as people who live under the poverty line tend to be the most food insecure. Poor and extremely poor households are most sensitive to fluctuations in food prices.

According to the CFSVNA, the global economic crisis caused food insecurity in Armenia to grow sharply. Despite economic growth, the level of food-insecure households remained high at 16 percent in 2015, double the level in 2008 (WFP, 2017). Households that are able to cultivate land generally have better access to food than the urban population, especially those living below the poverty line.

The National Strategic Review of Food Security and Nutrition in Armenia (WFP, 2018a) states that poverty is highly correlated with food insecurity and malnutrition. The expenditures on food make up 59 percent

of the total consumer expenditures for those living below the poverty line. High levels of inequality are reflected in food security and nutrition indicators. The wealthiest 20 percent of population has more than double the national average food energy consumption of the poorest 20 percent. Given that many people who are food insecure are also impoverished, they tend to purchase food based on quantity over quality. This results in the intake of less-nutritious foods in low-income areas. Food consumption patterns among the poorest quintile of the population rely predominantly on staple foods, such as bakery goods and potatoes (56 percent), which, in addition to vegetables, consist of 73 percent of their diet. The food consumption pattern of the wealthiest quintile contains 1.3 times fewer staple foods, twice the amount of fruit, and 1.9 times more meat, fish and eggs. Even though poorer people spend more of their budgets on food than do wealthier people, the nutritional quality of food they consume is lower (WFP, 2018a).

Overall, poverty, structural inequalities, limited labour market opportunities, limited access to healthy diets, low education levels of the population, individual and household dietary habits, and low awareness of healthy lifestyle have led to food insecurity and malnutrition in Armenia.

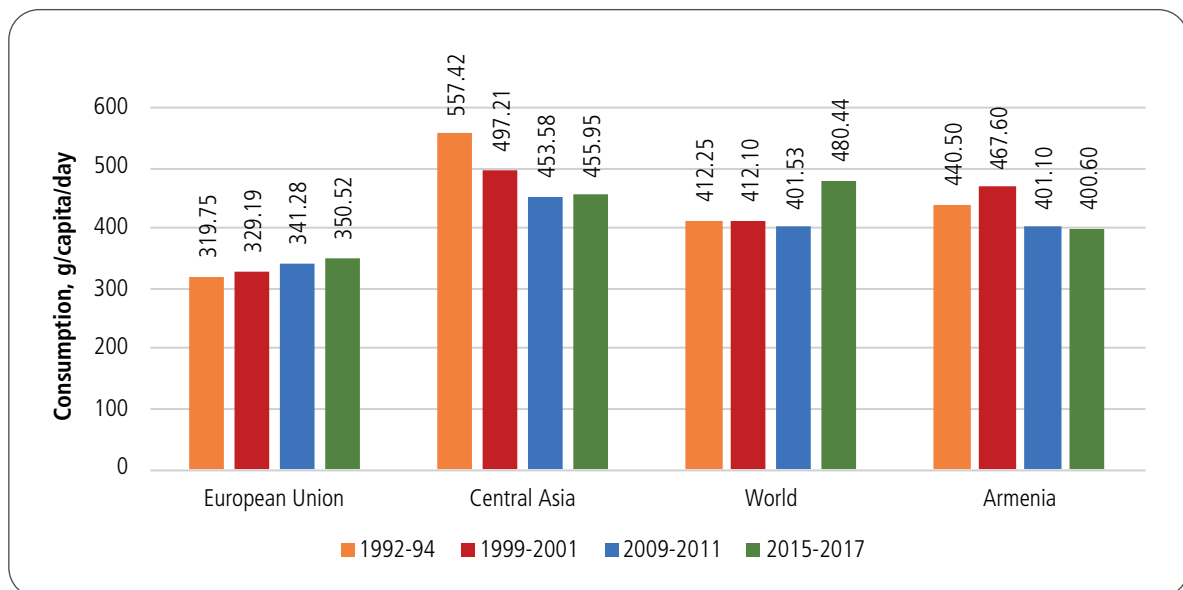
Transformation of dietary change and food systems

Trends of food consumption based on the FAO country food balance sheets (1992–2017)

Based on food balanced sheets, per capita consumption of vegetables, fruits, red meat, poultry, milk, fish, vegetable oil, sugar and other sweeteners have increased over the period from 1992 to 2017 (**Figure 5-5, Figure 5-6, Figure 5-8, Figure 5-9, Figure 5-10, Figure 5-11, Figure 5-12**). In contrast, the consumption of cereals (**Figure 5.4**) and pulses (**Figure 5-7**) have slightly decreased over the same period. During the same period, the consumption of vegetables, fruits, pulses, sugar and other sweeteners was higher than the average consumption of these products in the European Union and Central Asia.

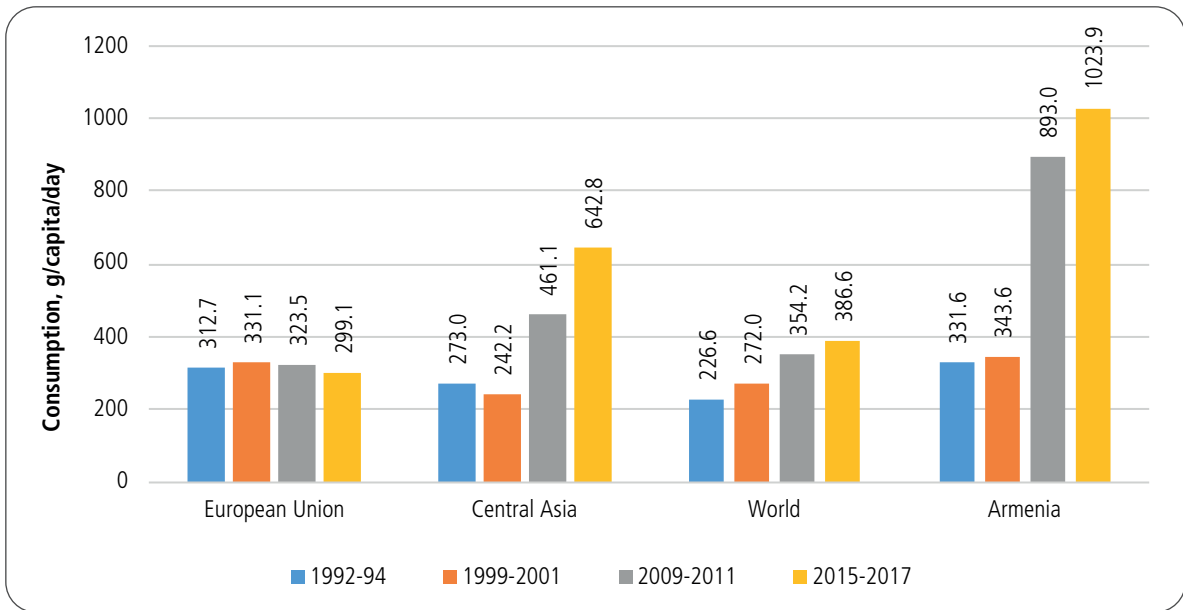
It should be noted that among the mentioned food products, the lowest consumption was reported for fish (30.5 g per capita per day as of 2017) (**Figure 5-11**). This can be considered a negative aspect from the point of a nutritionally balanced diet. Besides, the increased consumption (from 61.6 g per capita per day to 144.4 g per capita per day) of sugar and sweeteners (**Figure 5-13**) also can be mentioned as a negative factor.

Figure 5-4. Availability for consumption of cereals



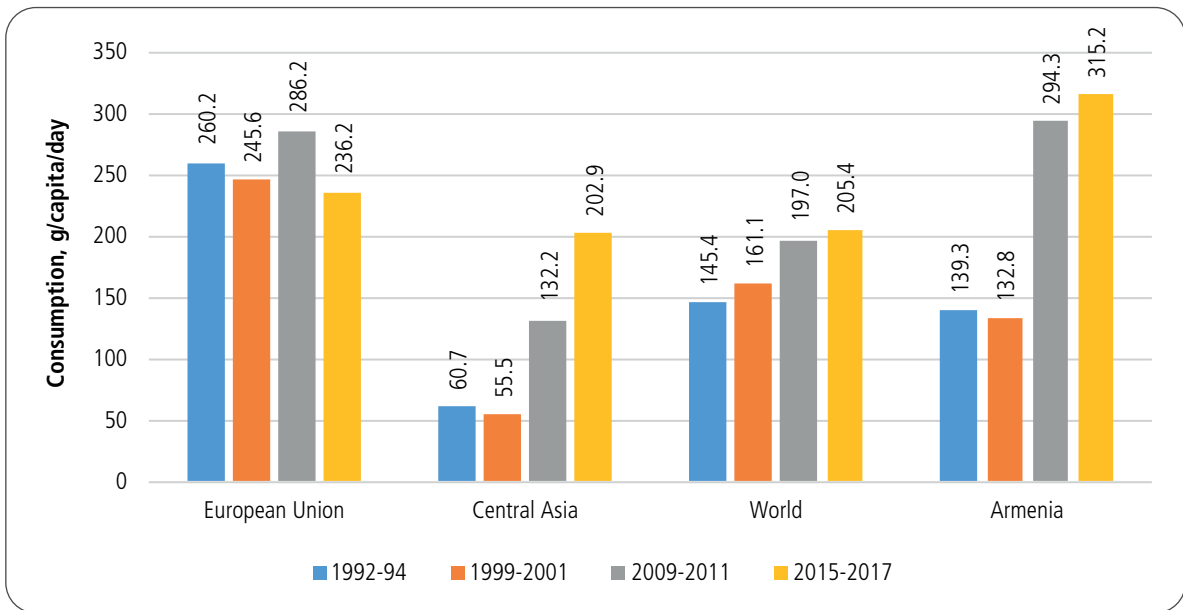
Source: based on FAO Food Balance data, created by the authors

Figure 5-5. Availability for consumption of vegetables



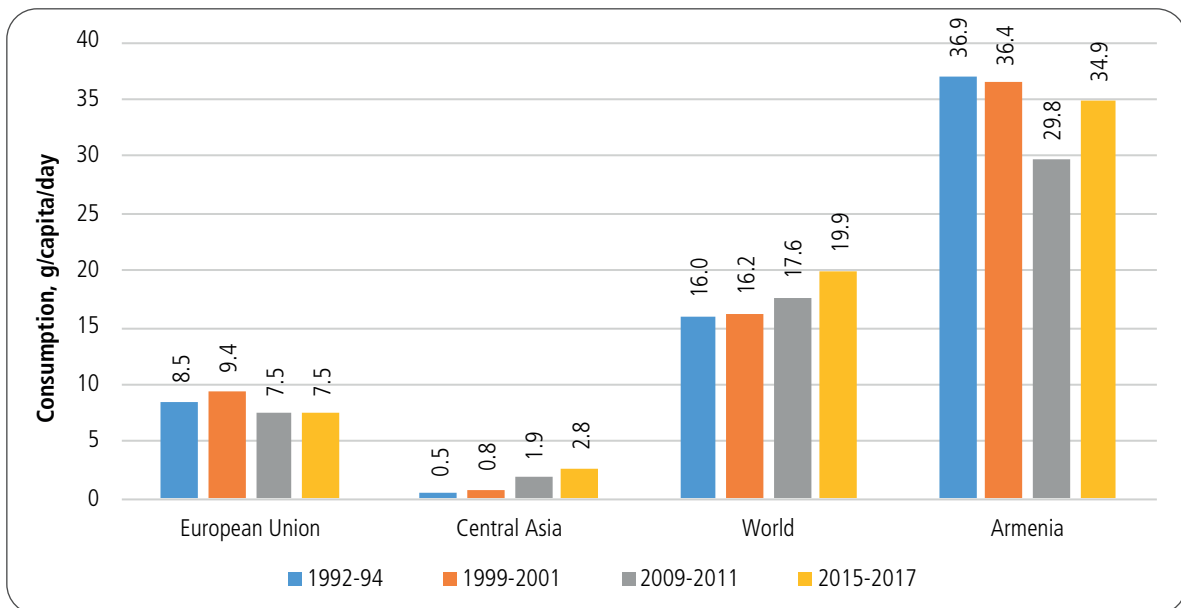
Source: based on FAO Food Balance data, created by the authors

Figure 5-6. Availability for consumption of fruits



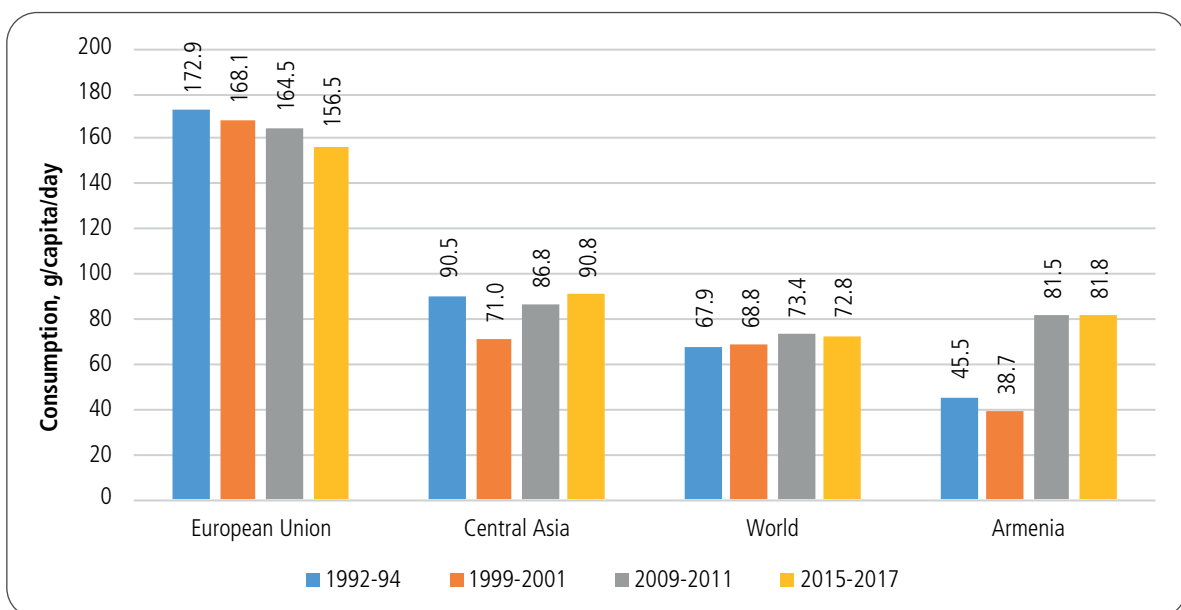
Source: based on FAO Food Balance data, created by the authors

Figure 5-7. Availability for consumption of pulses



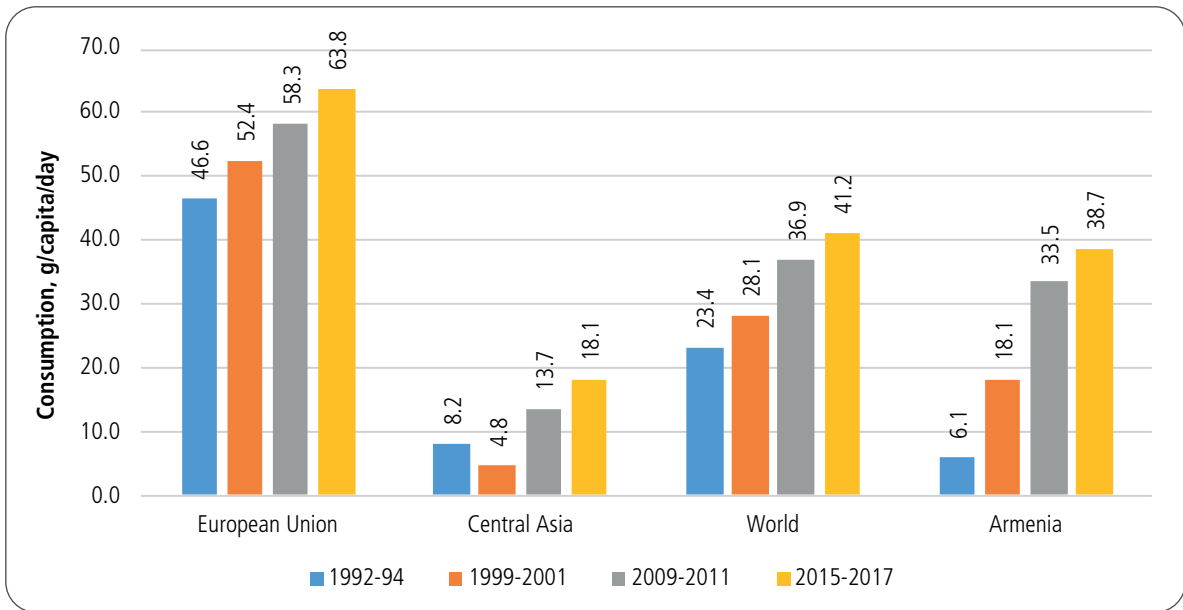
Source: based on FAO Food Balance data, created by the authors

Figure 5-8. Availability for consumption of red meat



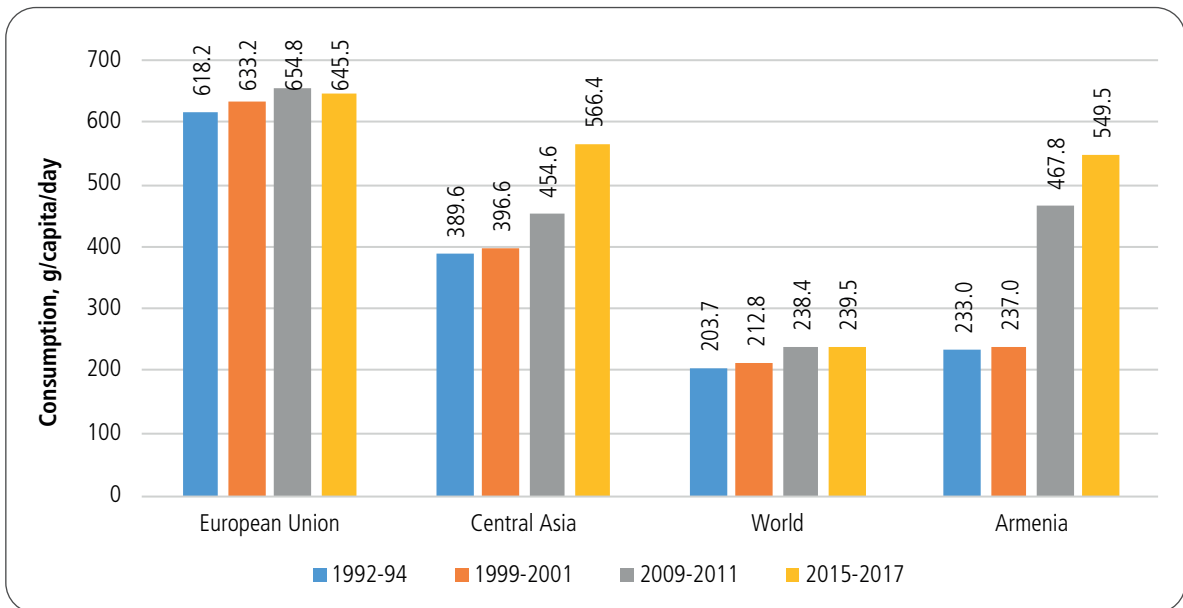
Source: based on FAO Food Balance data, created by the authors

Figure 5-9. Availability for consumption of poultry



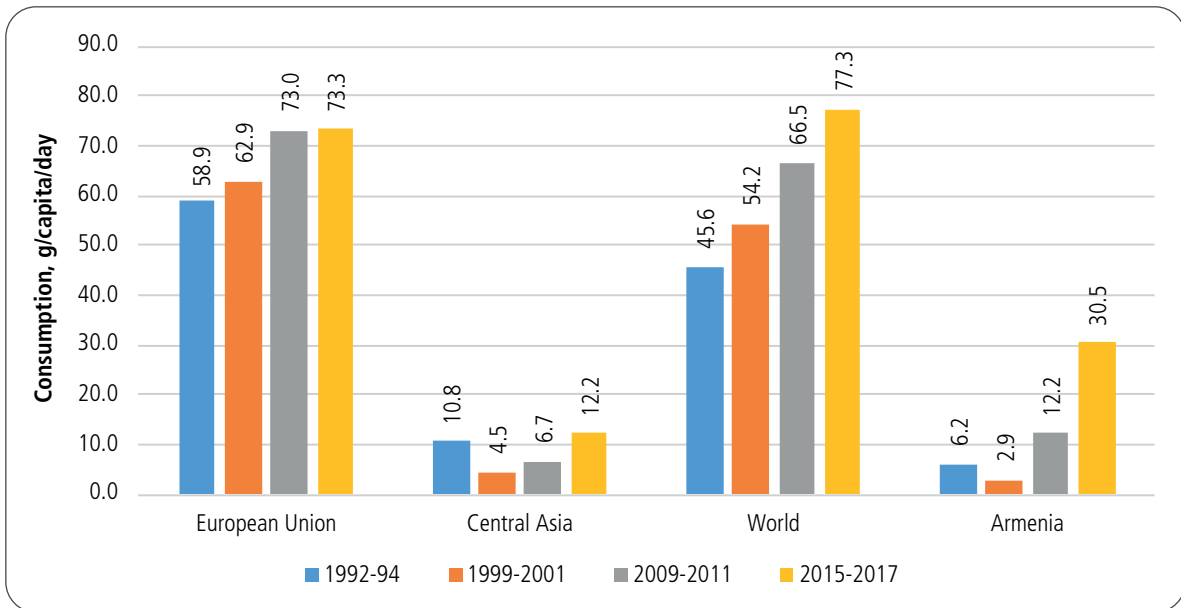
Source: based on FAO Food Balance data, created by the authors

Figure 5-10. Availability for consumption of milk



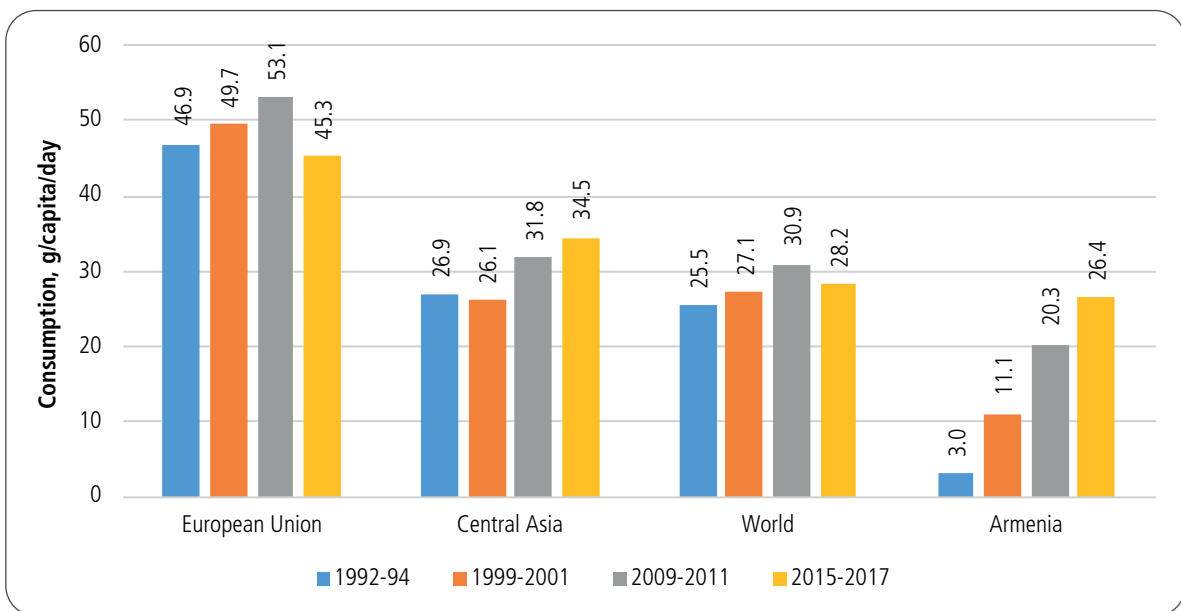
Source: based on FAO Food Balance data, created by the authors

Figure 5-11. Availability for consumption of fish



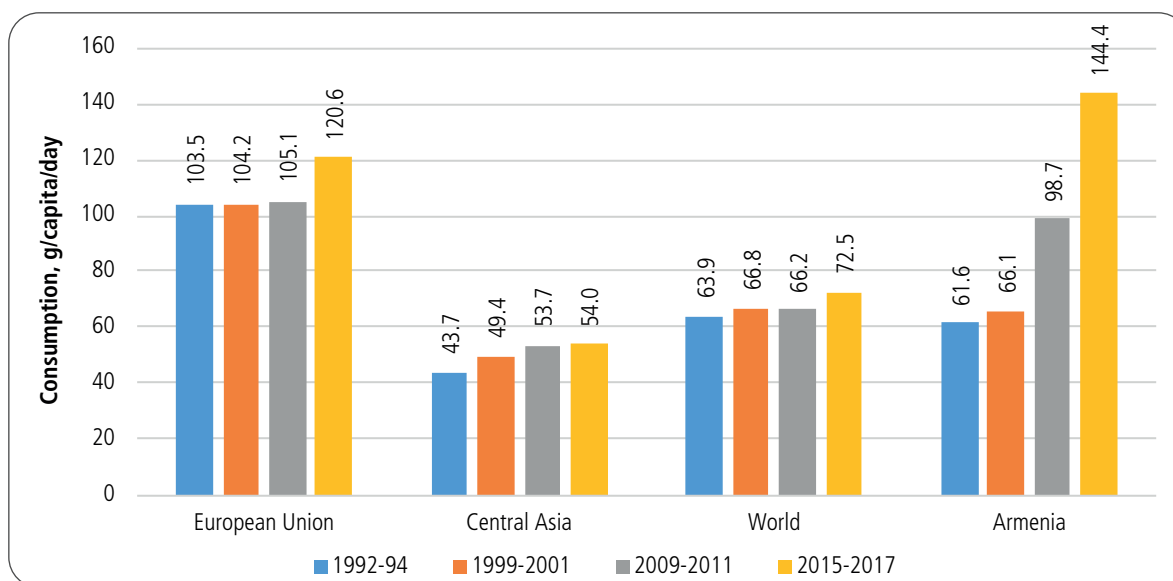
Source: based on FAO Food Balance data, created by the authors

Figure 5-12. Availability for consumption of vegetable oils



Source: based on FAO Food Balance data, created by the authors

Figure 5-13. Availability for consumption of sugar and sweeteners



Source: based on FAO Food Balance data, created by the authors

Trends of food consumption based on the household budget survey data

Food consumption is one of the many indicators used to understand the conditions of a household. The term “consumed food” refers to food products purchased, produced in households or received as a donation. Food consumption includes food consumed at home, outside the home, in-kind food consumption such as own food home production, food gifts, transfers in-kind, and humanitarian food aid (ARMSTAT, 2019). **Table 5-2** presents the composition of food consumption for various population deciles. The second, third and fourth consumption deciles were considered per adult equivalent, as a reference population for the establishment of the minimum food basket. The choice of reference population for the minimum food basket has been guided by the need to adequately represent the population of households near the poverty line, reflecting a minimum food basket that is not “too” poor and not too rich (ARMSTAT, 2019).

Table 5-2. Composition of food consumption for various reference population (%)

Food groups	All population	Deciles 1-2	Deciles 2-4	Deciles 4-6	Deciles 1-5	Deciles 6-10
Bread and cereals	28.7	33.3	33.6	31.8	33.3	25.5
Meat	16.1	9.2	11.4	13.6	11.4	19.3
Fish	1.1	0.5	0.7	1.0	0.7	1.4
Milk, cheese and eggs	14.3	19.0	16.6	14.2	16.5	12.8
Oils and fats	7.2	8.2	7.6	7.2	7.6	6.9
Fruits	8.1	3.7	5.2	7.3	5.3	10.0
Vegetables	15.3	17.9	16.5	15.9	16.7	14.3
Sugar, jam, honey, chocolate, confectionery	4.6	3.5	3.8	4.3	3.8	5.2
Food products n.e.c.	1.0	1.1	1.1	1.1	1.1	1.0
Coffee, tea and cocoa	3.0	3.3	3.1	3.1	3.2	2.8
Non-alcoholic drinks	0.7	0.3	0.4	0.5	0.4	0.9
Total	100	100	100	100	100	100

Source: ARMSTAT. 2019. Social Snapshot and Poverty in Armenia, 2019. <https://www.armstat.am/en/?nid=82&id=2217>

Data provided by the Statistical Committee of Armenia indicated that the national average food expenditure share has decreased from 56.1 percent in 2004 to 40.4 percent in 2018 (Table 5-3). In 2018, the consumption of almost all types of food decreased, as a reflection of an increasing consumer price index from the previous year. The share of expenses on food was still a relatively large part of total consumption expenditures in rural households compared to urban households. The share of expenses on food in rural communities decreased from 62.5 percent in 2004 to 43.8 percent in 2018 (Table 5-4). Per capita monthly expenditure on food consumed out of home is presented in Table 5-5. Based on the data (Table 5-5), the highest per capita monthly expenditure is reported for food consumed in the canteen or buffet at the workplace or educational institution.

Table 5-3. Structure of household nominal consumption expenditures in Armenia, 2004, 2008, 2016–2018

Expenditure items	Average monthly per capita expenditures									
	AMD					percent				
	2004	2008	2016	2017	2018	2004	2008	2016	2017	2018
Consumption expenditures	19 251	28 878	43 867	44 413	45 788	100	100	100	100	100
<i>Including</i>										
Food products	10 797	14 984	18 520	18 446	18 496	56.1	51.9	42.1	41.5	40.4
<i>of which food consumed away from home</i>	227	449	896	481	424	1.2	1.6	2.0	1.1	0.9
Alcoholic beverages	163	227	244	321	322	0.8	0.8	0.6	0.7	0.7

Source: ARMSTAT. 2019. Social Snapshot and Poverty in Armenia, 2019.
<https://www.armstat.am/en/?nid=82&id=2217>

Table 5-4. Expenditure (nominal) and structure of household consumption (monthly per capita) by urban and rural communities, 2004 and 2018

Expenditure item	Urban area				Rural area			
	AMD		percent		AMD		percent	
	2014	2018	2014	2018	2014	2018	2014	2018
Consumption expenditures	20 933	47 535	100	100	16 458	42 905	100	100
<i>Including</i>								
Food products	11 109	18 314	53.1	38.5	10 281	18 793	62.5	43.8
<i>of which food consumed away from home</i>	321	565	1.5	1.2	72	193	0.4	0.5
Alcoholic beverages	173	306	0.8	0.7	146	350	0.9	0.8

Source: ARMSTAT. 2019. Social Snapshot and Poverty in Armenia, 2019.
<https://www.armstat.am/en/?nid=82&id=2217>

Table 5-5. Per capita monthly food expenditure away from home, in drams (as of 2018)

Place out of home	Per capita monthly expenditure on food out of home, in drams (AMD)
Restaurants	61.76
Other public catering places (café, bistro)	106.79
Canteen or buffet at the workplace or educational institution	201.48
Store	31.16
Street	23.29

Source: ARMSTAT. 2022. Microdata. Online: <https://armstat.am/en/?nid=15>

There are some differences between the food consumption patterns of rural and urban households. Urban households consumed meat, poultry and fish more frequently than did rural households. Rural households consumed dairy products, eggs, legumes and fresh vegetables more frequently than did urban households. Among vulnerable communities, the main source of food is self-produced produce, milk and other dairy products.

Gaps and challenges of dietary changes

Despite the growth in food availability between 2008 and 2015, food consumption patterns neither created more diversified diets nor increased the consumption of more nutritious food items (WFP, 2018a). It was reported that diets were mostly based on carbohydrate-rich foods, and while the consumption of fruits and vegetables was substantial, it was not sufficient, according to daily dietary recommendations. The consumption of micronutrient-rich animal foods also remained low, with the exception of milk and dairy products.

The Arabkir Joint Medical Centre and Institute of Child and Adolescent Health found in their 2013–2014 National Study on Health Behaviour of School-Age Children (Arabkir MC-ICAH, 2016) that Armenian adolescents consume excessive amounts of foods that are high in sugar. The consumption of sweets is widespread among Armenian teenagers. On average, 50 percent of Armenian adolescents eat sweets every day, and 65 percent of girls aged 15 to 17 eat sweets a couple of times a day.

Even though the use of sugar-based carbonated drinks had decreased in comparison to 2009–2010 data, it remains high. The Study on Health Behaviour of School-Age Children revealed that the habit of not eating breakfast is quite prevalent among schoolchildren and adolescents, which contributes to the development of premature fatigue and affects academic excellence (Arabkir MC-ICAH, 2016).

Most Armenian adults use more salt than recommended through the consumption of traditional Armenian dishes, such as salty cheese, sausages, pickled vegetables, and other canned food, including meats, fish, etc. Ready-to-eat and canned foods have high sodium levels, even if the food does not taste particularly salty (HSPA, 2016).

The Armenian diet is high in fat. There are no national policies that limit or eliminate industrially produced trans fats. There is no evidence that the intake of trans fats has been reduced. One WHO report scored interventions in this area as “limited,” whereas another report, from the WHO Regional Office for Europe in 2017, scored them as “not achieved.” As of 1 January 2018, a new standard for the content of industrial trans-fatty acids in oil and fat products came into force in countries of the Eurasian Economic Union (*TR CU 024/2011- Technical regulations for oil and fat products, approved by the decision of the Customs Union Commission of 09.12.2011, No. 883*). The industrial trans-fatty acid content in hard margarines, soft and liquid margarines, milk fat substitutes, and fats for special purposes must not exceed 2 percent of the total fat content of the food product. It is not clear to what extent this has been implemented in Armenia, as there are no officially published data on trans-fatty acid content in food.

Structure and changes of food trade

International trade and trade agreement

The 2008 global economic crisis had a significant impact on Armenia, and there is a long road ahead to continue and sustain national development (WFP, 2016). The economy went into steep decline in 2009, with the GDP falling by 14.4 percent to USD 16.25 billion, in comparison to 2008. According to an FAO paper published in 2012, the economy had recovered to pre-2009 levels, reaching USD 18.17 billion, with an official unemployment rate of 6.2 percent. In 2011, economic growth increased by 4.6 percent. Industry contributes more than half of the growth, especially the mining sector and, to a lesser extent, agri-industry (FAO, 2012).

The main export articles of Armenia are mining products, processed food (such as beverages, spirits, processed fruits and vegetables), chocolate, dairy products, precious and semiprecious stones, and precious metals. The export of prepared food increased four-fold in 2017 in comparison to 2010, becoming the second largest export category, after mining products. The Russian Federation is the top trade partner of Armenia, followed by China, Switzerland, Germany and Bulgaria. Exports to the Russian Federation constituted 24.1 percent of total exports in 2017, in comparison to just 13.3 percent of total exports in 2010. According to a trade policy review published by WTO, the Russian Federation constitutes 20.7 percent of Armenian imports. This share has recorded a slight decline of around 2 percentage points compared to 2010. In 2010–2017, 57 percent growth in imports from Georgia was registered, which constituted 8.4 percent of imports in 2017. Armenia's other important trade partners include the United Arab Emirates, Switzerland, China and Iran, each of which have about a 4–5 percent share of total imports (WTO, 2018).

Since the first years of independence, Armenia has become a member of more than 40 international organizations and has a number of trade agreements, including tax, tariff and trade treaties:

CIS

Since 1991, Armenia has been a member of the Commonwealth of Independent States (CIS). Under Armenia's free trade agreements with some CIS countries, all imports are duty free, with no implementation period.

WTO

Armenia's accession to the WTO in 2003 consolidated a process of trade liberalization and institutional reforms. Since the accession, reforms have continued. In the sanitary and phytosanitary area, a number of measures have been taken to reduce barriers in the field, improve and modernize the legislation for food safety system and standards, increase consumers' awareness, and promote investments in the field.

EAEU

In 2015, Armenia became a member of the Eurasian Economic Union (EAEU), allowing for the free movement of goods, capital, services and labour. Armenia was temporarily exempt from the higher customs duties set by the EAEU for around 800 types of imported goods. These goods represent the major share of Armenia's imports. Armenia adheres to the Customs

Code of the Eurasian Economic Union, since it entered force on 1 January 2018. At the same time, the customs tariff and non-tariff regulation is being implemented on the unified base. However, there are some specifics that are being implemented at a national level, in particular, the Law “On Customs Regulation,” which entered into force on 2 January 2015.

Ultimately, EAEU membership will force a more protectionist trade policy in Armenia, once its tariffs are introduced in 2022. In the short run, Armenia is likely to benefit from lower import energy prices, higher customs revenues, and possibly larger investments from the Russian Federation. For example, the Russian Federation’s removal of a 30 percent tariff on precious stone imports may open up new opportunities for the Armenian jewellery industry. Longer-term implications on the Armenian economy and trade relations – with commitments under the WTO – foreign investments and market reforms remain unclear.

Armenia continues to apply most favoured nation tariffs to all WTO members. As a member of the Eurasian Economic Union, Armenia applies common tariff rates based on the Harmonized Commodity Description and Coding System, with the exception of the 800 goods for which decreased tariff rates are applied. Seasonal tariffs are applied to certain potatoes, fresh or chilled tomatoes, fresh or chilled cucumbers, sweet peppers, fresh apples, certain varieties of pears, beet sugar, and certain kinds of white sugar (WTO, 2018).

It should be noted that accession to the EAEU has an enormous impact on the Armenian economic landscape. Nevertheless, there is still some confusion over norms and standardization of regulations in the EAEU, as some of these regulations contradict European Union norms.

European Union

Armenia and the European Union are in the process of deepening their cooperation, which has been enhanced by Armenia’s participation in the Eastern Partnership programme. Currently, European Union–Armenia relations in economic, investment, trade, legislative and other areas are regulated by the European Union–Armenia Comprehensive and Enhanced Partnership Agreement (CEPA). The CEPA was signed on 24 November 2017 in the frame of the Sixth Eastern Partnership Summit in Brussels, Belgium. The trade part of the CEPA aims to foster sustainable growth, improve investment, business environments, and promote the trade of goods and services among parties.

Despite not signing the Deep and Comprehensive Free Trade Agreement (DCFTA) with the European Union, which would have offered an important opportunity to overcome Armenia’s geographic blockade and closed borders, Armenia benefits from the European Union’s General Scheme of Preferences plus (GSP+) arrangement. GSP+ (the European Union’s Special Incentive Arrangement for Sustainable Development and Good Governance) offers Armenian exports broad access to the European Union market, allowing complete duty suspension across approximately 66 percent of all European Union tariff lines. In 2018, Armenia’s utilization of GSP+ preferences was high, at around 91 percent. The main European Union imports from Armenia benefiting from GSP+ trade preferences in 2018 have included base metals (90 percent), apparel and clothing (3 percent), and prepared foodstuffs (2.7 percent) (European Commission, 2021).

Domestic retail and wholesale food markets

According to data from 2004–2008, the share of food and agricultural raw materials in the commodities structure of external trade consists of 14.4 percent of total exports and 17.1 percent of total imports. According to 2008 data, the value of imports is 4.1 times higher than that of exports. The value of imports from food and raw farm materials is 3.6 times higher than the value of exports of the same group. Moreover, cognac alone accounted for over 64 percent of exports in this group of products, pointing to a need to diversify exports. The improvement of the trade balance is an issue of strategic importance (FAO, 2012).

Armenia’s relatively strong agricultural performance has resulted in a substantial increase in self-sufficiency, resulting in high levels of staple food products and overall better food availability. However, the availability of food in Armenia is highly dependent on food imports (**Table 5-6**). Armenia is a net food importer of wheat, vegetable oil and other key foodstuffs. Domestic agriculture cannot entirely satisfy the demand for a range of items, such as meat, poultry, sugar, flour, soft drinks, wine, rice, vegetable oils and other high-value food products. This reflects the vulnerability of the country’s population to foreign food markets and food price fluctuations (WFP, 2018a).

Table 5-6. Self-sufficiency (%) of some food commodities in Armenia

Food commodity	Year		
	2017	2018	2019
Wheat	33.2	31.5	25.9
Barley	83.8	85.3	70.3
Oats	87.9	85.6	83.4
Maize	17.6	9.8	6.5
Rice	0	0	0
Potatoes	102.6	102.6	101.1
Vegetables and melons	102.5	104.7	102.4
Fruit and berry (except grapes)	109.7	108.9	104
Grapes	106.4	104.8	103.6
Legumes	49.7	38.6	38.2
Vegetable oil	4.3	2.2	1.5
Sugar	65.2	68.6	73
Eggs	98.2	99.5	100
Milk	91.2	86.8	84.3
Beef	91.5	89.2	90.4
Pork	58	53.3	55.5
Mutton and goat meat	138.9	128.6	113.8
Poultry	22.5	26.6	21.7
Fish	101.8	109	113.1

Source: ARMSTAT. 2021. RA National Food Balances by food commodity groups/food commodity, indicator and year. Online: https://statbank.armstat.am/pxweb/en/ArmStatBank/ArmStatBank__7%20Food%20Security/FS-1-2021.px/?rxid=9ba7b0d1-2ff8-40fa-a309-fae01ea885bb

Agricultural and food production systems structure and changes

Structural changes

Since its independence, the closed borders with neighbouring Türkiye and Azerbaijan have constrained the country's economic development.

As with most of the Eastern Partnership countries, Armenia's rural population is reliant, to some extent, on small, divided land plots and communal or state-owned pasturelands. These small landholders often have very limited resources, with finite growth potential. The products from these lands are for subsistence purposes only. The selling of any surplus is made difficult by limited links to organized markets and access to, or lack of, processing, storing, handling, packing and distribution facilities (FAO, 2012).

Even though the agricultural potential of Armenia is high, there are a number of obstacles to reaching its full potential. Agriculture development is facing a number of major constraints, such as small and fragmented farms, mountainous terrain, inadequate irrigation systems, and lack of farm support services. Currently, the farm structure in Armenia is dominated by a large number of small-scale farms with fragmented land holdings. According to 2014 census data, there are 317 346 family farms, comprising 99.86 percent of all active agricultural holdings. Forty-five percent of the farms have three or more land plots, and 20 percent of farms have five or more plots. Small²⁵ landholders constitute the vast majority of farms in the country, representing around 95 percent of all farms that produce the majority of gross agricultural product, around 97 percent (FAO, 2018a).

Policies and drivers for change

Policies and action plans for food security and nutrition tend to focus primarily on food availability, via agriculture and self-sufficiency improvement. Meanwhile, food accessibility and utilization issues are major gaps at both policy and implementation levels (United Nations and WFP, 2018).

The Strategy of Agricultural and Rural Sustainable Development for 2010–2020

The major goals of the strategy are:

1. overcoming the consequences of the financial crisis and investing in anti-epidemic mechanisms;
2. deepening agrarian reforms and developing agricultural cooperation;
3. increasing food safety levels and establishing minimum levels of food security and agrifood self-sufficiency;
4. increasing the competitiveness of domestic agricultural products, substituting import-oriented agrifood policy and developing of export-oriented agriculture;
5. zonal specialization and rational distribution of production;

²⁵ Currently in Armenia, there is no formal definition of "smallholder" or "family farm," and it is generally accepted that all farms belonging to physical (natural) persons are family farms. In most cases, family farms also can be considered smallholder farms, given the size of owned/cultivated land, which is smaller than 3 ha for around 89 percent of household farms in Armenia (FAO, 2020).

6. provision of food security;
7. increasing the productivity of land utilization;
8. developing organic agriculture practices and infrastructure;
9. developing better crop production;
10. developing the livestock sector;
11. processing agricultural raw materials;
12. developing industrial-technical services for agriculture and increasing the saturation of industrial equipment;
13. developing the social infrastructures in Armenia;
14. mitigating agricultural risks;
15. improving the provision of credit in the agrarian sector;
16. improving the educational system in the agrarian sector; and
17. improving accounting and consultancy systems in the agrarian sector.

Policies to promote organic and agroecology approaches

The first attempts to develop an organic agriculture sector in Armenia have been initiated through various international projects and with the active involvement of local NGOs (e.g. SHEN, Ecoglobe, Nature and Biodiversity Conservation Union, Green Lane, CARD, etc.). The discussion of organic agriculture among stakeholders started in 2002, coordinated by the United States Department of Agriculture (USDA). These activities have continued under FAO and the United States Agency for International Development/DAI Armenia Small and Medium-Sized Enterprises Market Development (ASME) project. Several farmers' associations have included organic agriculture on their agendas, and some of their members have started to produce organically (Darbinyan, 2011).

Organic legislation became part of the official agenda of the Armenian Government through a partnership programme with the European Union. The 2008 Law of the Republic of Armenia on Organic Agriculture entered into force in May 2009. This law describes the principles for the management of organic agriculture, defining practices that are harmonious with agro-ecological systems and are implemented in compliance with the requirements of the relevant technical regulations. The importance of the organic industry is highlighted in the 2010–2020 Sustainable Strategy Programme for Agricultural and Rural Development, approved in 2010 by the Armenian Government.

Food processing and marketing structure changes

Structural changes

The food processing sector has a historical significance in Armenia. Armenia was a primary supplier for agro-processed goods for the entire Soviet Union. After independence, the government shifted to a market-based economy.

The agro-processing sector is one of the most important branches of country's economy, particularly in terms of rural employment and income generation. This promotes food and economic security as well as the formation of an agricultural food market.

In the first stage (1991–1993) of land reforms following the onset of economic reforms, Armenia appeared in the economic blockade, causing most of the agro-processing companies to halt their activities. In those years, household-scale processing operations started to grow, because the volume of raw product supplies had increased and prices had decreased. Consequently, farmers had no other choice than to process products on their own, in homestead conditions, to avoid spoilage of the products (Avetisyan, 2010). Nevertheless, starting from 1998, additional investments from the private sector and support from international organizations resulted in significant improvement of the situation in the agro-processing industry.

The food processing industry is mainly focused on exports. The largest share of exports is made up of beverages, spirits, fresh and processed fruits and vegetables, chocolate, and dairy products. Alcoholic beverages and spirits make up the largest share of Armenian prepared foods exports, accounting for approximately 35.9 percent in 2017 (WTO, 2018).

Policies and drivers for change

Currently, food processing is one of the most-developed value chains in the country, connecting primary agriculture to local retailers and export markets.

The Government of Armenia has adopted an export-oriented industrial policy. Protocol Decision N 49 of the Government, as of 15 December 2011, approved the strategy of the export-oriented industrial policy. Within the frame of this policy, the industrial committee session held in 2012 approved actions plans for cognac and wine production industries for 2012–2015, ensuring the implementation of development strategies in the two sectors. The adoption of the Government of Armenia resolution draft on “Approval of the Strategy for Development of Agricultural Products’ Processing Industry and the Schedule of Strategy Implementation Actions” aimed to promote the sustainable development of the processing industry for agricultural products and increase export quantities.

The most important products in this industry are canned foods and alcoholic beverages, especially wine and brandy made from locally grown grapes. In addition, the country exports fish, cheese and mineral water. Some exporters ship frozen fruits and vegetables.

Companies engaged in agricultural food processing are gradually adapting to the emerging market economy. These companies have undertaken activities to raise work efficiency and product diversification to increase the competitiveness of their products. Developing companies are successfully competing both in domestic, CIS country and international food markets, making investments for further development in production.

Marketing, including advertising practices

In 1996, Armenia adopted the Law on Advertising, which sets advertising standards and principles, including a mandate that makes Armenian the official language of advertising.

The Ministry of Health's permission is necessary for advertising pharmaceuticals, medical equipment or treatment methods. The law prohibits advertisements promoting the stimulating or relaxing effects of alcohol and cigarettes. Unfair or inaccurate advertising is prohibited, and the Civil Code allows for civil action for legal entities or people whose rights have been violated as a result of unfair or false advertising.

Radio, television, internet and print media are widely available for advertisers, and creative businesses have adopted more modern means, such as painting the sides of public buses. Glass stands with oscillating posters and billboards have become a common method of advertising. Advertising can be arranged via local advertising agencies or directly with TV, radio or other media outlets. Telemarketing also is common. Cable and satellite television are expanding their reach and offer another advertising medium. Internet advertising has grown remarkably over the past few years, since the number of internet users in the country has increased. A lot of companies specialize in designing web pages and advertising (Export.gov, 2019).

Food additives and food fortification

Since Armenia is a member of the Eurasian Economic Union (EAEU), the application of food additives is regulated according to the Technical Regulations of the Customs Union (TR CU 029/2012) "Safety requirements of food additives, flavourings and processing aids." The objects of the TR CU 029/2012 technical regulation are:

- dietary supplements, nutritional supplements complex
- flavourings
- processing aids
- food products, in terms of its content of dietary supplements, biologically active substances of flavours, residual amounts of processing aids
- processes of production, storage, transportation, sale and disposal of food additives, flavourings and processing aids.

TR CU 029/2012 sets the following requirements for the safety purposes of food additives, flavourings, and processing aids in the production of food and the prevention of actions misleading purchasers (consumers):

1. The use of food additives, flavourings and processing aids should not increase the risk of possible adverse effects of food on human health.
2. The content of food additives, residual amounts of processing aids and biologically active substances contained in the flavours, flavouring preparations and/or natural sources of flavourings must comply with the requirements of technical regulation.
3. Food additives, flavourings and processing aids should be used only in cases where there is a need to improve the technology, as well as the need to improve consumer properties of food products to increase their shelf life, which is not possible through another method.
4. The use of food additives and flavourings should not mislead the customer about the real properties of food products.
5. The use of food additives, flavourings and processing aids must not cause deterioration of the organoleptic characteristics of food products.

6. Nutritional supplements, flavourings and processing aids should be used in the manufacture of food products in the minimum amount necessary to achieve the technological effect.
7. Never use food additives and flavourings to hide corruption and poor quality of raw materials or finished food products and/or falsification, and/or with the intent to mislead purchasers (consumers).
8. Food additives, flavourings and processing aids produced with the use of genetically modified organisms and other biotechnologies must comply with the Technical Regulation of the Customs Union "On food safety."

In Armenia, the government developed and adopted national laws to prevent and reduce the prevalence of iodine deficiency among its citizens through universal salt iodization. Salt use is the most common vehicle for iodine fortification to prevent the public health concerns of iodine deficiency disorders (Global Fortification Data Exchange, 2017).

Taxation on unhealthy food and price policies for promoting healthy diets

Food price policies for promoting healthy diets

Alongside current health systems and financing reforms, the Government of Armenia is already taking steps to reduce the burden of NCDs (WHO, 2019). In particular, taxes on sugar-based carbonated beverages and regulations on salt to introduce maximum limits in certain foods are being considered. Nevertheless, no other actions, such as food price policies, have been adopted to promote healthy diets.

The Armenian consumer is quite price sensitive. Food prices in Armenia are rather volatile, which hampers the stability of food security. The retail price indexes of the main food products are presented in **Table 5-7**.

Table 5-7. Retail food price indexes of selected food products in Armenia (previous year=100)

	2014	2015	2016	2017	2018
Food products	101.7	103.0	97.0	104.0	102.5
bread and cereals	101.2	106.2	96.5	98.6	99.3
meat	100.1	103.1	95.9	104.1	110.4
fish and seafood	105.9	89.5	94.5	120.5	109.5
milk, cheese and eggs	108.2	105.0	95.6	100.4	102.3
<i>of which – eggs</i>	99.7	94.4	94.6	102.8	93.8
oil and fats	96.9	98.5	96.8	105.9	111.2
fruits	99.6	104.3	91.7	110.6	99.7
vegetables (<i>including potatoes</i>)	105.1	94.6	100.5	114.8	94.7
sugar	90.8	101.8	100.7	109.2	87.7
coffee, tea, cocoa	102.1	112.5	99.9	100.2	100.7
confectionery	105.2	114.7	100.3	97.0	95.6
other food	103.8	103.5	100.8	98.8	99.9
non-alcoholic drinks	103.5	103.8	104.2	102.7	101.1

Source: ARMSTAT. 2019. Prices and Prices Indexes in the Republic of Armenia.

Online: <https://armstat.am/en/?nid=82&id=2183>

Food labelling/information

Since Armenia is a member of the EAEU, food labelling is regulated according to the Technical Regulation of the Customs Union “Food products in terms of their labelling” (TR CU 022/2011). It should be mentioned that the law of Armenia on food safety also defines general requirements for food labelling (Article 9). Additional requirements for the labelling of packaged food products that do not contradict the requirements of TR CU 022/2011 can be found in the Technical Regulations of the Customs Union for certain types of food products – for example, Technical Regulation on Milk and Milk Products (TR CU 033/2013), Technical Regulation on Meat and Meat Product Safety (TR CU 034/2013), etc.

According to TR CU 022/2011, the labelling of packaged food products must contain the following information:

- the name of the food products
- the number of food products
- the date of manufacture of food products
- the shelf life of food products
- the composition of food products
 - the composition of food products not required to specify in respect of 1) fresh fruits (including berries) and vegetables (including potatoes), which are not peeled, cut or processed in a similar manner; 2) vinegar obtained from one kind of raw food (without the addition of other components); 3) the food product, consisting of a single component, with the proviso that the food product name allows to establish the presence of this component
- nutritional value of food products
- the conditions for storage of food products that are installed by the manufacturer or provided in the Technical Regulations of the Customs Union for certain types of food products (a food product’s quality and safety are altered after a package is open, and the package, which protects the product from damage, must indicate the storage conditions after opening)
- the name and address of the manufacturer of food products or surname, name and location of the individual entrepreneur-manufacturer of food products, as well as in the cases established by the Technical Regulations of the Customs Union, the name and location manufacturer authorized person, the name and location of the company importing or surname, the name and location of the individual entrepreneur importing
- recommendations and/or restrictions on the use, including the preparation, of food if its use without these guidelines or limitations is difficult or may cause harm to the health of consumers, their property or may lead to a reduction or loss of taste properties of food products
- information about the presence of food ingredients derived from genetically modified organisms (GMOs)
- single sign-treatment products on the market states – members of the Customs Union.

The nutritional value of food products, reflected in its labelling, includes the following indicators:

- energy value (caloric)
- the number of proteins, fats and carbohydrates
- the amount of vitamins and minerals

The nutritional value of flavouring agents, chewing gum, coffee, natural mineral water, bottled drinking water, food additives, raw food products – mushrooms, products of farm animals, fish, vegetables (including potatoes), fruits (including berries) – salt, spices, vinegar and tea cannot be specified unless otherwise provided by the Technical Regulations of the Customs Union for these types of food products. The nutritional value of other types of food cannot be specified in the cases stipulated by the Technical Regulations of the Customs Union for certain types of food products.

The quantities of vitamins and minerals in food products should be indicated if the vitamins and minerals are added to the food product during its production. In other cases, the amounts of vitamins and minerals in food products may be specified as an amount per 100 ml, per 100 g or per serving of food. The average daily needs of a grown-up person in proteins, fats, hydrocarbons and energy, vitamins, minerals and other substances are presented in **Table 5-8**.

Components (including food additives and flavourings) and dietary supplements that may cause allergic reactions or that are contraindicated for certain diseases shall be specified in the composition of food products, regardless of their number, according to the regulation.

Table 5-8. Recommended daily requirements of essential nutrients and energy for the labelling of food products

Key nutrient	The recommended level of daily consumption
Energy value kJ / kcal*	10 467 / 2 500
Proteins, g	75
Fat, g <i>including polyunsaturated fatty acids, g</i>	83 11
Digestible carbohydrates, g <i>including sugar (sucrose), g</i>	365 65
Dietary fibres, g	30
Minerals:	
Calcium, mg	1 000
Phosphorus, mg	800
Iron, mg	14
Magnesium, mg	400
Zinc, mg	15
Iodine, ug	150
Potassium, mg	3 500
Selenium, mg	0.07
Vitamins:	
Vitamin A, mcg	800
Vitamin D, g	5
<i>5 g of cholecalciferol – 200 ME vitamin D</i>	
Vitamin E, mg	10
Vitamin C, mg	60
Thiamine, mg	1.4
Riboflavin, mg	1.6
Niacin, mg	18
Vitamin B, mg	2
Folacin, ug	200
Vitamin B, g	1
Biotin, mg	0.05
Pantothenic acid, mg	6

* **Note:** When referring to the energy value in joules used to recalculate the ratio 1 kcal equals 4.1868 J.

Source: TR CU 022/2011. Technical Regulation of the Customs Union "Food products in terms of their labeling".

Online: <https://docs.cntd.ru/document/902320347>

Consumer demand, awareness, education and social protection

Food-based dietary guidelines

There are no adopted food-based national guidelines for the country. However, there are some data on minimum dietary energy requirements. The average caloric requirement for Armenia was calculated by the Statistical Committee of Armenia, with the technical assistance of the World Bank, in 2004, using information on caloric requirements from different demographic groups. The average caloric requirement was calculated according to the WHO's (1985) standards and information on population shares of these demographic groups. The average caloric requirement for Armenia was estimated at 2 232 calories per day per capita.

According to national food balance data, 2 846 kilocalories of daily dietary energy can be consumed from the available food for an average Armenian. Cereals, such as wheat, provide about 52 percent of the calories available for consumption, while livestock products, including meat, milk, eggs and fish, provide 20 percent. A considerable percentage of the dietary energy per person is available from domestic production (WFP, 2018a).

School food and nutrition

In 2002, the World Food Programme (WFP) began its support of school meals in Armenia. From 2002 to 2008, the WFP implemented school meal projects as part of a larger WFP operation aimed at improving the food security of vulnerable populations in four marzes: Gegharkunik, Lori, Tavush and Shirak (GCNF, 2016). In 2010, in partnership with the WFP and with financial support from the Russian Federation, the Government of Armenia was able to initiate the project Development of Sustainable School Feeding in Armenia. The project has two main objectives to support:

the food security and education of children through school meals; and
developing and implementing a sustainable, cost-effective and nutrition-sensitive national school meal programme.

The Concept for Sustainable School Feeding was developed and adopted by the Government of Armenia in 2012, and the Sustainable School Feeding Programme (SFP) Strategy action plan was developed and adopted in 2013, with technical and financial support from the WFP. In late 2016, the Government of Armenia established the Sustainable School Feeding Foundation to ensure the continued implementation of the programme. Currently, the programme is carried out in seven marzes through support from the WFP foundation and in three marzes funded through the state and receiving technical support from a branch of the Nutrition Institute of the Russian Federation. It should be noted that the National Schools Meals Programme is not carried out in Yerevan, where there are only a few private schools that provide meals for students.

It is worth mentioning that the school feeding programme is an important and good practice that contributes not only to the promotion of child health but also to the formation of correct nutrition behaviour. Besides, through the programme, schools have become a place where vulnerable families can receive support and have the possibility of equal access to nutrition. Regarding the reported achievements

of the school feeding programme, the WFP and partners planned to expand the programme and create innovative and sustainable nutrition-sensitive food value chains.

Another important initiative was the opening of greenhouses in some rural schools in Armenia's Ararat region. The goal of this initiative was to increase schoolchildren's dietary diversity and improve their nutrition. Three types of greenhouses were built: a small greenhouse to supply the school with additional food supplies, a medium-sized greenhouse that also allows for the production of surplus for market, and a large greenhouse that can be used to produce food for neighbouring schools and to sell surplus to the local market. All three greenhouses – in the public schools of Vedi, Verin Artashat and Surenavan – are equipped with modern heating, ventilation and drip irrigation systems. This initiative is part of a major project aimed at strengthening food security and nutrition in selected countries of the Caucasus and Central Asia, funded by the Russian Federation and implemented by FAO, in technical partnership with the Russian Social and Industrial Foodservice Institute. The FAO pilot programme will serve as a model that can be replicated in other parts of the country to ensure the viability and sustainability of the national school feeding programme in Armenia (FAO, 2018b).

Nutrition-sensitive social protection

According to the WFP Regional Synthesis Report 2018 (WFP, 2018b), Armenia has a well-developed social protection system. The biggest social assistance programme in Armenia is the Family Living Standards Enhancement Benefits (FLSEB) programme. The state's social funds, especially pensions, have a significant impact on reducing poverty and food insecurity in the country. There is a high dependency among the poorest in the population on social funds, including pensions and various types of state benefits. Remittances from migrant workers also play a role as informal safety nets (United Nations and WFP, 2018).

WFP reported that the Government of Armenia identifies social protection as a tool for pro-poor growth, securing livelihoods, and providing decent living standards for the population. Generally, the system is comprehensive, but some issues and gaps remain. Nutrition-sensitive social protection is among the noted gaps (WFP, 2018b). Moreover, another ongoing issue is that government-run programmes don't involve nutrition-sensitive or nutrition-specific elements, except for the school feeding programme.

The 2020 *State of Food Security and Nutrition in the World* report provides recommendations for helping governments make healthy diets affordable for everyone (FAO *et al.*, 2020). From this perspective, the importance of nutrition-sensitive social protection policies is particularly highlighted. These policies should be undertaken towards an increase in purchasing power and affordability of healthy diets by the most vulnerable populations. Based on the data on within-country variation in unaffordability of a nutrient-adequate diet, in Armenia, a wide variation was reported, with the unaffordability of a nutrient-adequate diet ranging from 28 percent to 74 percent (FAO *et al.*, 2020). In general, policies and actions should promote healthy diets becoming affordable for all, across the country's regions and income groups.

Nutrition education and behaviour change communication

There are several instruments of public awareness and nutrition education present in healthcare and education policies. Nevertheless, data show that dietary habits and preferences need more systematic improvement. Public awareness on healthy nutrition should be increased through behavioural change

and through the regulation of unhealthy food sales, especially in and near educational institutions (United Nations and WFP, 2018). One solution from the National Strategic Review of Food Safety and Nutrition is to raise public awareness on healthy nutrition and provide ways for people to make better decisions about food choices. These public awareness and education campaigns would take place in remote communities where food education is not prevalent. The education campaign also would serve as a preventive measure against malnutrition and undernourishment by focusing on sustainable food choices. The solution to hunger and food insecurity in Armenia may be in the creation and adoption of policies that would protect underserved populations. Part of this solution would include food vouchers to the unemployed, social assistance programmes aimed at children 3–5 years of age, and monetary and non-monetary plans to ensure nutritious food intake to the beneficiary families of assistance programmes.

Cross-cutting issues

Soil degradation: Armenia is a land-poor country in which soil degradation challenges are among the most pressing issues. Almost all soils in the country exhibit varying degrees of erosion. One of the major causes of soil degradation is heavy grazing, particularly on pastures near villages. There also is poor utilization of remote pastures further from village centres. This has an adverse impact on socioeconomic and nature protection spheres.

In 2010, 735 000 inhabitants were living on degraded agricultural land in Armenia. This is a 30 percent increase since the beginning of the decade, bringing the share of rural residents who inhabit degraded agricultural land up to 68 percent of the total rural population. Land degradation can severely influence populations' livelihood by restricting people from vital ecosystem services, increasing the risk of poverty. Between 2000 and 2010, the number of people residing in remote degraded agricultural areas with limited market access increased by 15 percent, reaching 155 000 inhabitants. Populations in remote areas have restricted options for managing land and accessing other benefits of economic development (UNCCD, n.d.).

The Government of Armenia intends to prevent soil degradation. Within the Framework of the Global Soil Information System (GLOSIS), the Global Soil Partnership (GSP) secretariat has visited Armenian institutions to facilitate the establishment of the Armenian Soil Information System (ArSIS). The development of ArSIS was requested by the Ministry of Economy of Armenia due to the necessity of soil resource assessments for improving agricultural policy, facilitating land market and addressing land degradation (FAO, 2019).

Soil pollution: There are several studies reporting on heavy metal contaminations in agricultural production areas of Kajaran, Alaverdi, Akhtala and Agarak. Common contamination sources include dust and waste coming from mining activities (Pipoyan *et al.*, 2019b). Pipoyan *et al.* stated that excessive accumulation of some essential trace elements (e.g. Zn, Cu, Ni) or low concentration of toxic elements (e.g. Cd, Pb, Hg, As) in agricultural soils will not only have adverse environmental impacts, but will also affect food quality and safety, as these trace elements can enter the food chain, posing carcinogenic and non-carcinogenic risks to human health (Pipoyan *et al.*, 2019a).

Pesticide application and food safety: In Armenia, like in other developing countries, there are problems regarding the use of pesticides, derived from a lack of education about these substances. This leads to the inefficient and incorrect application of pesticides, increasing the risk of pollution. Currently, the country imports virtually all of its fertilizers and pesticides, and only registered pesticides and fertilizers can be sold. However, low-quality and outdated pesticides easily can be found on the domestic market due to inefficient market control and enforcement mechanisms. There is also a danger of agro-chemical misuse by uninformed or untrained farmers due to the use of expired pesticides and an underdeveloped agriculture extension service (UNEP, 2018).

Since 2003, the production and use of some pesticides in Armenia have been limited due to the signing of the Stockholm Convention. After the Soviet Union collapsed, numerous former pesticide storehouses distributed throughout Armenia have remained unmanaged and abandoned. In the 1990s, some of the former pesticide storehouses and their related territories were privatized and used for other purposes. Various studies show that obsolete pesticides and their semi-collapsed and former pesticide storehouses are potential sources of environmental pollution (Tepanosyan *et al.*, 2020).

According to the report “Practices on use and application of pesticides in Armenia,” in agricultural regions such as Ararat and Oktemberian, the most persistent agrochemicals are still found in soil, water and food. The illegal import and use of unauthorized pesticides might be a problem in Armenia (University of Wageningen, 2005). This problem could be addressed with stronger policy regarding the important and distribution of pesticides.

From 2014 to 2018, the Centre for Ecological-Noosphere Studies (CENS) of the National Academy of Sciences of Armenia carried out the project “Monitoring of pesticide residues in food produced in the Republic of Armenia.” A study was conducted on residual pesticides in soils, irrigation waters of agricultural lands, farm produce, and soils from former pesticide storage facilities in Armenia. The samples were analysed for 17 forbidden pesticides, but only DDT was detected in 15.1 percent of soil samples. No pesticides were identified in waters, vegetables or fruits (Beglaryan *et al.*, 2016). Organochlorine pesticides and organophosphorus pesticides contents were studied, and pesticide-induced health risk was assessed. The study suggested that special attention should be given to rural communities at high risk; risk reduction measures are needed to reduce or eliminate observed carcinogenic health effects (Tepanosyan *et al.*, 2020).

Conclusions and key messages

Based on the review of the available information on malnutrition, food security and systems in Armenia, the following general conclusions can be drawn:

Food security has improved substantially over the past two decades in Armenia. However, new evidence points to a stagnation of the decreasing trend in food insecurity in recent years. The country is affected by triple burden of malnutrition (undernutrition, overnutrition and micronutrient deficiencies). There have been some improvements in malnutrition in recent years, but a significant part of the population in Armenia is still nutrient-deprived and vulnerable. There are significant differences in food security, undernourishment and nutritional indicators among population groups in various regions of Armenia. Obese children and adolescents are likely to suffer from both short- and long-term health consequences, including non-communicable diseases.

Based on food balance sheets, per capita availability for consumption of vegetables, fruits, red meat, poultry, milk, fish, vegetable oil, sugar and other sweeteners have increased significantly over the past three decades. The consumption of vegetables, fruits, pulses, sugar and other sweeteners was higher than the average consumption of these products in the European Union and Central Asia. The lowest availability is fish, while the increased consumption of sugar and sweeteners is also a negative factor from the point of view of a nutritionally balanced diet in the country.

Despite the growth in food availability, food consumption patterns have not created more diversified diets, nor have they increased the consumption of more nutritious food items. While the consumption of fruits and vegetables has been substantial, it is not sufficient to meet daily dietary recommendations. The consumption of micronutrient-rich animal foods also remains low, with the exception of milk and dairy products. There are some differences between the food consumption patterns of rural and urban households. Urban households consume meat, poultry and fish more frequently than rural households.

Poverty has sizable effects on food security and malnutrition in the country. Particularly, the food consumption patterns of the poorest quintile of the population rely on predominantly staple foods such as bakery goods and potatoes. Moreover, the food consumption patterns of the wealthiest quintile contain fewer staple foods and more fruit, meat, fish and eggs.

One of the ongoing issues is that government-run programmes don't involve nutrition-sensitive or nutrition-specific elements, except for the school feeding programme.

In 2002, with the support of the WFP, the programme of school meals started in Armenia. In late 2016, the Government of Armenia established the Sustainable School Feeding Foundation. Currently, the programme is carried out in seven marzes through support from the WFP and with technical support from a branch of the Nutrition Institute of the Russian Federation. The school feeding programme has become an important and good practice that contributes not only to the promotion of child health but also to the formation of correct nutrition behaviour in Armenia.

Another important initiative in Armenia has been the opening of greenhouses in some rural schools in Armenia's Ararat region. The goal of this initiative was to increase schoolchildren's dietary diversity and improve their nutrition. With the reported achievements of the school feeding programme, the

Government and its partners have planned to expand the programme and create innovative and sustainable nutrition-sensitive food value chains.

The availability for consumption of foods (cereals, meat, etc.) highly depends on food imports in Armenia. Over the past decade, an increase in the self-sufficiency levels of some main food products has been reported. Even though there is high agricultural potential in Armenia, there are a number of obstacles to reaching the country's full potential. The major constraints include small and fragmented farms, mountainous terrain, inadequate irrigation systems, and a lack of farm support services. Currently, the farm structure in Armenia is dominated by a large number of small-scale farms with fragmented land holdings.

Targeted policies and actions are needed to improve food availability, information about healthy diets and public awareness. This is important especially for the reduction of the burden of NCDs in the country. Actions such as taxes on sugar-based carbonated beverages and regulations on salt to introduce maximum limits in certain foods must be considered.

Actions such as food price policies have not been adopted to promote healthy diets. Moreover, there are no adopted food-based national guidelines for the country.

Taking into consideration the main conclusions, the following recommendations are provided:

- Continuously collect, analyse and update the information on the nutrition situation for the whole population.
- Both governmental and non-governmental net safety programmes should prioritize the support and protection of the most vulnerable groups of population by implementing tailored nutrition-sensitive social protection programmes.
- Dietary diversification and healthy dietary practices need development and assistance, which can decrease the risk of NCDs.
- Raise public awareness and promote nutritional education. Information related to healthy diets (e.g. balanced diets, nutrient-dense foods, food storage and preparation, etc.) should be simple and clearly presented through various platforms via social and mass media by relevant stakeholders. In summary, awareness on healthy nutrition should be increased through public behavioural change communication.

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Chapter 6

The role of food systems in the transition of diets and prevention of malnutrition in Kyrgyzstan

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Abstract

Kyrgyzstan has experienced moderate development of its national economy over the past 20 years. The standard of living has been steadily improving, with poverty rates having declined from 77.3 percent in 2000 to 15.5 percent in 2018 and with rates of extreme poverty having been below 1 percent since 2014. People's nutrition is improving but remains sensitive to external shocks, such as food price shocks or national currency depreciation. Stunting and wasting rates among children have declined, while overweight and obesity rates have increased among adults. Cereal, root and tuber consumption have slowly declined, while consumption of meat and other animal-based products has increased. The consumption of processed foods remains high, while fruit and vegetable consumption is low but incrementally improving. These trends are not universal across the country; there have been notable increased rates of consumption of unhealthy foods in the northern provinces of Kyrgyzstan.

Kyrgyzstan's membership in the Eurasian Economic Union (EAEU) has led to an increase in import tariff rates. Trade flows with Kazakhstan and the Russian Federation play an essential role in the country's food systems. Agricultural reforms have allowed for an uptick in smallholder family farms and substantial growth of the livestock industry over the past decade. National financing of agriculture is minimal, accounting for only 1.5–2.3 percent of the federal budget. The development of the domestic food processing industry is primarily a response to local demand trends. The dairy industry in Kyrgyzstan demonstrates the largest potential for exports into international markets. Some sectors in the food industry are experiencing a flooded market due to imported products from the EAEU. Nutrition improvement policies, which are mostly implemented via school food programmes, are mainly funded by donors. Generally, development organizations' agendas and support drives agricultural and nutrition policies in Kyrgyzstan.

Keywords: *Kyrgyzstan, nutrition, food systems, food availability, EAEU*

Introduction and background of malnutrition in Kyrgyzstan

- Kyrgyzstan is a lower-middle-income country in Central Asia with a transitioning economy.
- Agriculture has become a less pertinent part of Kyrgyzstan's economy, with a decline of agriculture share in the GDP from 34 percent to 12 percent over the past two decades.
- Poverty (USD 3.20 per person per day) declined to 15.5 percent, with most poverty concentrated in rural areas. The poverty level is sensitive to food price growth and currency depreciation. Extreme poverty has been eliminated in Kyrgyzstan.
- Stunting and wasting rates among children 5 years and younger declined from 2006 to 2018, but overweight and obesity rates have increased among adults over the past five years.

Introduction and background of malnutrition

Kyrgyzstan is a mountainous, landlocked lower-middle-income country in Central Asia with a multi-ethnic population of 6.6 million people but with a prevalence of ethnic Kyrgyz (70 percent). Kyrgyzstan is in Central Asia, bordered by Kazakhstan, China, Uzbekistan and Tajikistan. Kyrgyzstan is among the poorest countries in the Europe and Central Asia region, with a gross national income (GNI) per capita of USD 1249 in 2019 (Atlas method). After joining the Eurasian Economic Union (EAEU) in 2015, outmigration levels remained high, presumptively with improved labour markets and working conditions of migrants. Migrant remittances generate almost one-third of the gross domestic product (GDP), contributing to economic growth and helping to eradicate poverty.

The structure of Kyrgyzstan's GDP has changed substantially since joining the EAEU. The share of agriculture declined from 34 percent in 2000 to 12 percent in 2019, and manufacturing declined from 18 percent in 2000 to 14 percent in 2019. Declining sectors in the economy also include communication, energy, gas, and water (National Statistical Committee, 2021). During the same period, the trade and services sector increased from 12 percent in 2000 to 18 percent in 2019. Growing sectors in the economy also include construction and transport.

There has been an increasing amount of political instability since 2020. New parliamentary elections in fall 2020 exposed high levels of public dissatisfaction, which led to the resignation of the country's president, Jeenbekov. The current president, Sadyr Japarov, was elected in January 2021 after acting as interim president following Jeenbekov's resignation.

The recent and ongoing COVID-19 pandemic has affected Kyrgyzstan and its population significantly, resulting in the reduction of foreign remittances, migrant returns, a drop of supplies from China, job losses, and losses in the trade, construction, consumer services and tourism sectors. Tourism is of vital importance to Kyrgyzstan, especially the Issyk-Kul region in summer months. Only a few regions, such as the cities of Bishkek and Osh, experienced full lockdowns. These lockdowns negatively affected micro, small, and medium-sized enterprises (MSMEs). The population has experienced increased prices for some products, such as wheat, and reduced production, although vulnerable groups were provided with food aid. The overall situation led to the country's GDP declining by 8.6 percent and considerable depreciation of the Kyrgyz som. The health sector experienced shocks given the shortage of medical drugs and equipment, resulting in high death rates and population stress. Overall, political instability and the shocks associated with the ongoing COVID-19 pandemic have considerably impacted the country's population and economic situation, having an adverse effect on efforts to improve the socioeconomic

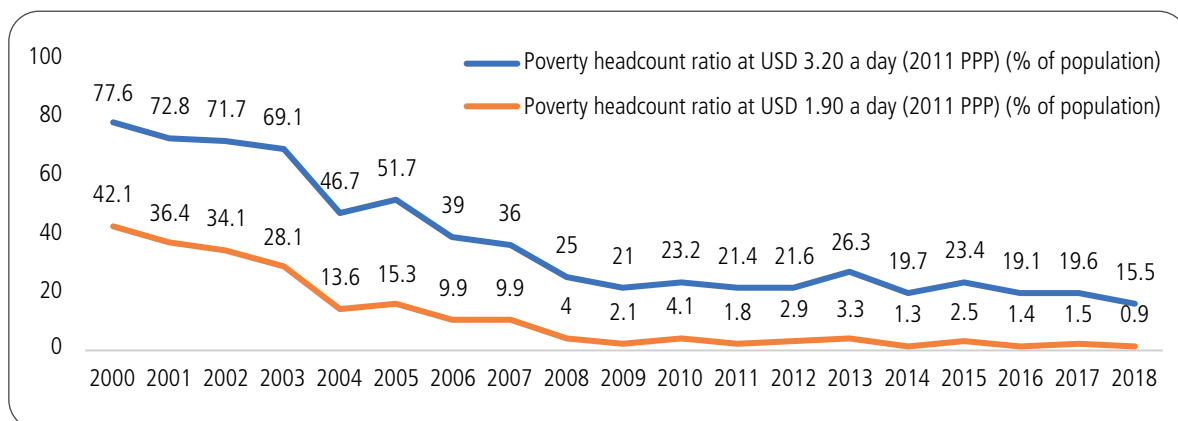
status of Kyrgyzstan’s population. The full impacts of the ongoing pandemic and political instability cannot be fully understood, as they are still unfolding.

Background of the agricultural and poverty situation in Kyrgyzstan

Agriculture as a share of total GDP has been gradually declining over the past two decades. This is also reflected in the decrease in agricultural employment, from 53 percent in 2000 to 18 percent in 2019 (NSC 2021a). As of 2019, 66 percent of the population in the country lives in rural areas. The share of the population residing in rural areas has remained stable over the past two decades.

The poverty headcount ratio,²⁶ USD 3.20 per person per day, for Kyrgyzstan demonstrated a decline in the poverty rate from 77.6 percent in 2000 to 15.5 percent in 2018 (World Bank, 2021). Estimations from 2018 found that extreme poverty, below USD 1.90 per person per day,²⁷ declined from 42.1 percent to 0.9 percent of the population (**Figure 6-1**). During that period, the country’s economy grew due to increased agricultural productivity, an increase in the service sector (mainly trade), and an increase in remittances from labour migrants in the Russian Federation.

Figure 6-1. Poverty rates (%) by international measurements in Kyrgyzstan, 2000–2018



Note: The poverty lines are USD 3.20 per person per day and USD 1.90 per person per day in 2011 purchasing power parity.

Source: The World Bank. 2020. Poverty headcount ratio. The World Bank.
<https://databank.worldbank.org/source/world-development-indicators>

According to the national poverty assessment from 2019, 20.1 percent of the population lived below the national poverty line (Figure 6-2). Poverty is lower in urban areas (14.7 percent) and higher in rural areas (23.2 percent) (National Statistical Committee, 2020). Over the last decade, the gap between rural and urban poverty declined. This decline is because rural households are simultaneously food producers and consumers. Rural households are more resilient to external shocks than are urban households, which is demonstrated by the increase in urban food prices in 2009–2010 and 2015 (Tilekeyev, 2019).

Poverty is also unevenly distributed across Kyrgyzstan’s seven regions. Two of the three southern provinces, Batken and Jalal-Abad, have a high poverty incidence, a large percentage of the rural population, lower access to agricultural land, and small local labour markets. The third region, Naryn, is

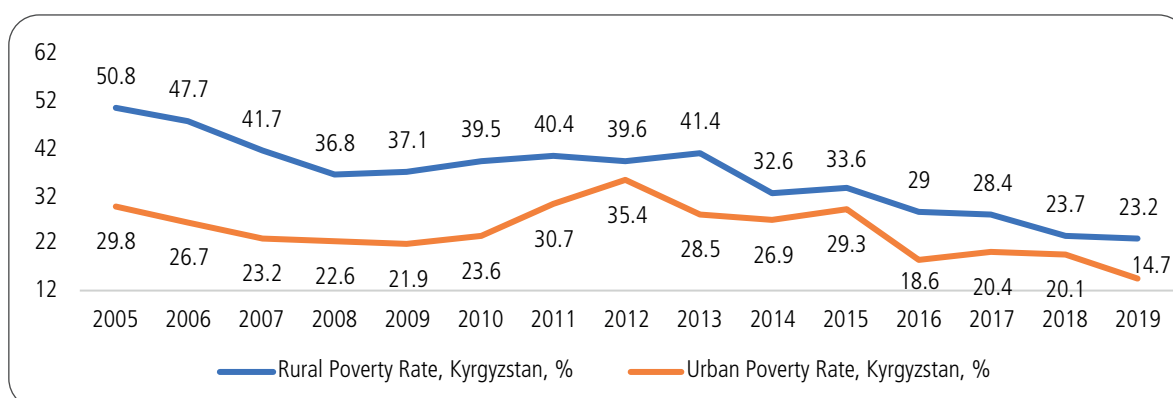
²⁶ Calculated in 2011 purchasing power parity (PPP) USD.

²⁷ This line is also known in the literature as the “extreme poverty line” or the “food poverty line.” It is calculated in 2011 PPP USD.

one of the mountainous areas of the country, with a complex landscape, harsh climate conditions, and a predominantly rural population.

There has been an expected increase in poverty due to the COVID-19 pandemic and the political instability sweeping the country in 2020. The predicted decrease in incomes comes from job loss in the service sector and a decline of remittances from labour migrants. In addition to job loss and less money coming to Kyrgyzstan from abroad, there has been an increase in food item prices and national currency depreciation that occurred in 2020.

Figure 6-2. Rural and urban poverty rates (%) by national measurements in Kyrgyzstan, 2005–2019



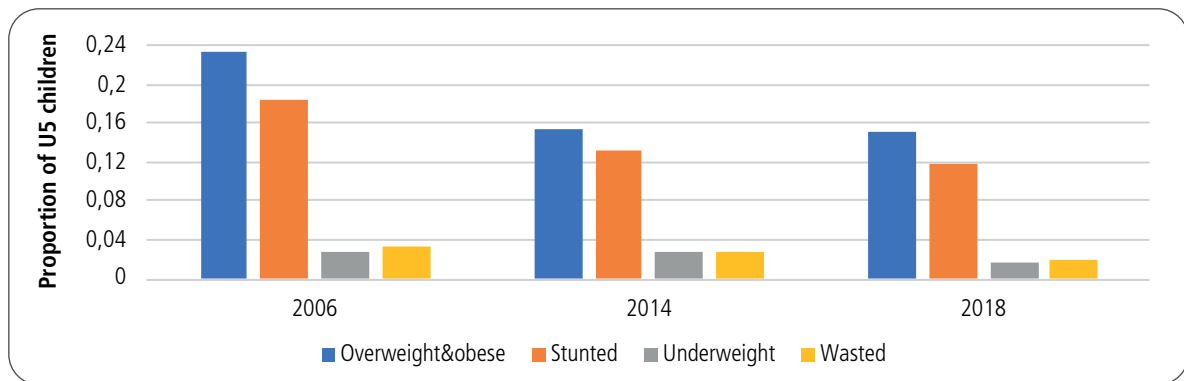
Source: National Statistical Committee (NSC) of Kyrgyz Republic. 2020. Poverty in the Kyrgyz Republic. Annual report. Bishkek, Kyrgyzstan. NSC. <http://stat.kg/ru/publications/uroven-bednosti-v-kyrgyzskoj-respublike/>

State of food security and nutrition

Trends in nutrition status for children younger than 5 (2006–2018)

The percentage of stunted children younger than 5 declined from 18.4 percent in 2006 to 13.3 percent in 2014 and to 11.8 percent in 2018 (**Figure 6-3**). Wasting declined gradually, from 3.3 percent in 2006 to 2.8 percent in 2014 and to 2 percent in 2018. The percent of underweight children younger than 5 declined from 2.7 percent in 2006 and 2014 to 1.8 percent in 2018. The percentage of overweight children younger than 5 declined from 10.6 percent in 2006 to 7.2 percent in 2014 and then remained at 7.2 percent in 2018. Obesity rates for children younger than 5 declined from 12.8 percent in 2006 to 8.2 percent in 2014 and to 8 percent in 2018.

Figure 6-3. Anthropometric nutrition status among children younger than 5, 2006–2018

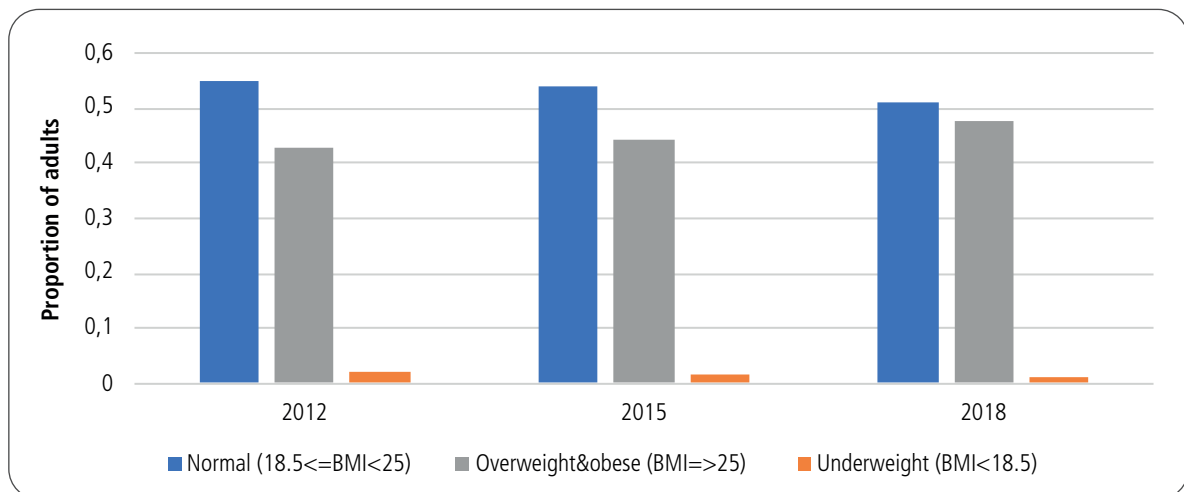


Source: National Statistical Committee of the Kyrgyz Republic and UNICEF. 2019. Kyrgyzstan Multiple Indicator Cluster Survey, Snapshots of Key Findings. Bishkek, Kyrgyzstan. NSC and UNICEF. 2019. <http://stat.kg/media/files/c50def33-f18c-44d3-aecb-1f45786034dd.pdf>

Trends in anthropometric nutrition status for adults (2012–2018)

Adults (anyone older than 18) saw a decline in normal body mass index (BMI), from 54.8 percent in 2012 to 54 percent in 2015 and to 51.2 percent in 2018 (**Figure 6-4**). According to the BMI, the rate of underweight adults declined from 2.3 percent in 2012 to 1.8 percent in 2015 and to 1.3 percent in 2018. However, the rate of overweight/obese adults increased from 42.9 percent in 2012 to 44.2 percent in 2015 and to 47.5 percent in 2018.

Figure 6-4. Anthropometric nutrition status among adults, 2012–2018



Source: National Statistical Committee of the Kyrgyz Republic and UNICEF. 2019. 2018. Kyrgyzstan Multiple Indicator Cluster Survey, Snapshots of Key Findings. Bishkek, Kyrgyzstan. NSC and UNICEF. 2019. <http://stat.kg/media/files/c50def33-f18c-44d3-aecb-1f45786034dd.pdf>

Transformation of dietary change and food systems

- Food consumption has improved in Kyrgyzstan over the past three decades. There has been an expansion of primary foods groups in comparison with the region and world, but some data demonstrate the contrary.
- National household data show shifts in food consumption patterns. From 2012 to 2018, there was a slow decline in the consumption of cereals, grains, roots and tubers. During the same period, there was an increase in the consumption of meat and other animal-based products.
- High-calorie food groups are the primary food source for the population of Kyrgyzstan. Fruits, vegetables and animal-based products are secondary and tertiary food sources. Processed food consumption remains high.
- Regional disparities in food consumption exist between the northern and southern regions. Those in the northern regions eat more meat, processed foods and sugars, while those in the southern regions consume more fruits and vegetables.

Trends of food consumption based on the FAO country food balance sheets

The food balance sheets prepared by FAO are used to assess the national availability of food and understand food consumption patterns and dietary habits compared to the average values for the Central Asian region and the world (FAO, 2022). The data used here present the consumption of products in grams per capita per day in Kyrgyzstan and show the trends of food consumption from 1992 to 2017 (**Figure 6-5a** and **6-5b**).

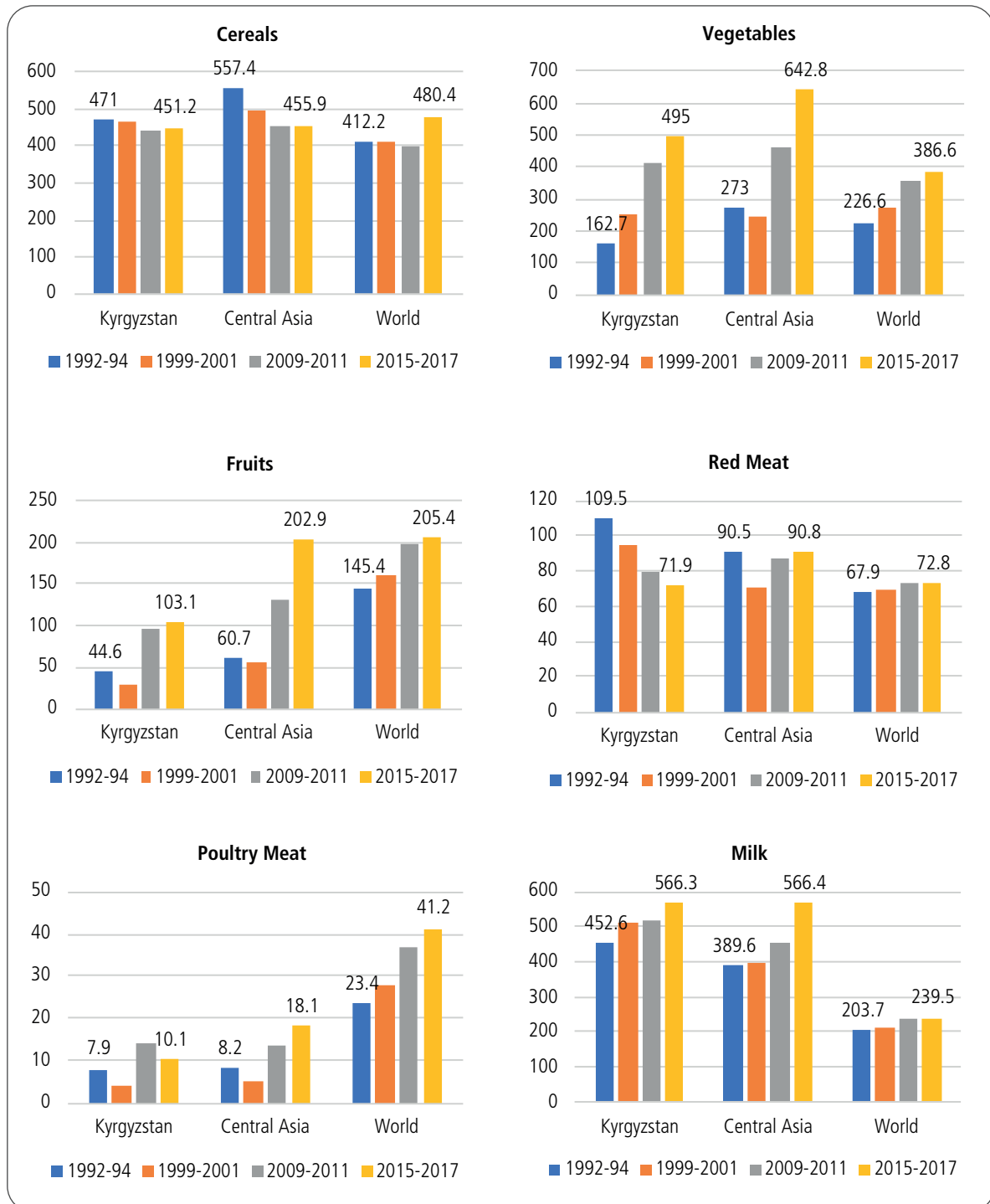
The consumption of cereals in Kyrgyzstan slightly declined by 4.2 percent between 1992–1994 and 2015–2017 and is on par with the average consumption of cereals for Central Asia between 2015–2017, which is 451 g per person per day. The regional decline of cereal consumption was substantially higher, at 18.2 percent during the same time period. At the same time, global consumption of cereals increased from 412 to 480 g per person per day during the same period. The consumption of poultry, fish and fruits in Kyrgyzstan was significantly lower than the average rates of consumption in Central Asia and the rest of the world between 1992 and 2017. The consumption trends for poultry, fish and fruits are positive, but the gap remains.

The consumption of vegetable oils demonstrates a significant gap compared to Central Asia and the global average from 1992 to 2017. Vegetable oil consumption in Kyrgyzstan saw a decline between 1992 and 1999, from 16.5 to 10.3 g per person per day, while its consumption varies in Central Asia and the world level between 25 and 27 g per person per day. Vegetable oil consumption recovered, approached 1999 levels (approximately 16 g per person per day) in 2009–2011 and remained stable until 2017. At the same time, Central Asian and global vegetable oil consumption increased to 27–30 g per person per day in the region and 30–35 g per person per day on the worldwide level in 2009–2017. There are no indications that Kyrgyzstan will close the gap between its consumption and the Central Asian and global consumption rates of vegetable oil, given that the Central Asian and global rates also are on the rise.

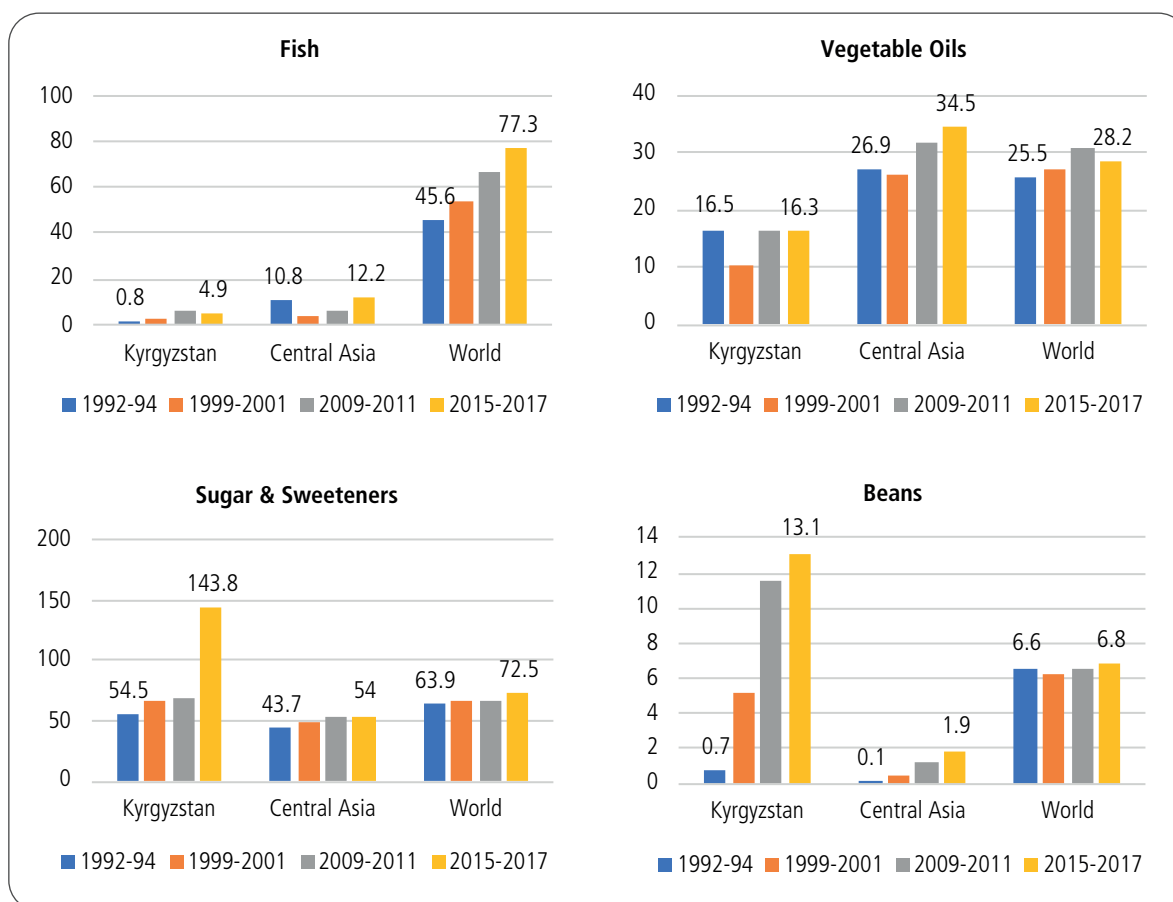
Vegetable consumption in Kyrgyzstan saw significant improvement from 1992 to 2017, increasing almost threefold, from 162 to 495 g per person per day. Some regions in Kyrgyzstan even surpassed the average world level by 66 percent between 2015 and 2017. There is less consumption of red meat

in Kyrgyzstan than in the Central Asia and the world, with a decrease from 110 to 72 g per person per day between 1992 and 2017. Milk consumption was on the rise between 1992 and 2017, from 452 to 566 g per person per day. This rate is comparable to milk consumption rates in Central Asia and more than double the world average.

Figure 6-5a. Evolution of the availability for consumption of prominent food subgroups in Kyrgyzstan, Central Asia, and the world, 1992–2017 (g per capita per day)



Source: FAO. 2020. Food consumption for different foods in Kyrgyz Republic. FAOSTAT database.

Figure 6-5b. Evolution of the availability for consumption of prominent food subgroups in Kyrgyzstan, Central Asia, and the world, 1992–2017 (g per capita per day)

Source: FAO. 2020. Food consumption for different foods in Kyrgyz Republic. FAOSTAT database.

Bean consumption skyrocketed between 1992 and 2017, starting at 0.7 g per person per day and reaching 13 g per person per day by 2017. The rate of bean consumption is double the world average and six times the rate of the Central Asia region. There was an increase in the consumption of sugar and other sweeteners between 1992 and 2017, exceeding Central Asian and global averages. The dataset shows incredible growth between 2015 and 2017, with consumption rates reaching 143.8 g per person per day, more than twice the regional and world averages. The consistency of the calculations used to make these estimations must be reanalysed for better results.

Trends of food consumption based on household budget survey data

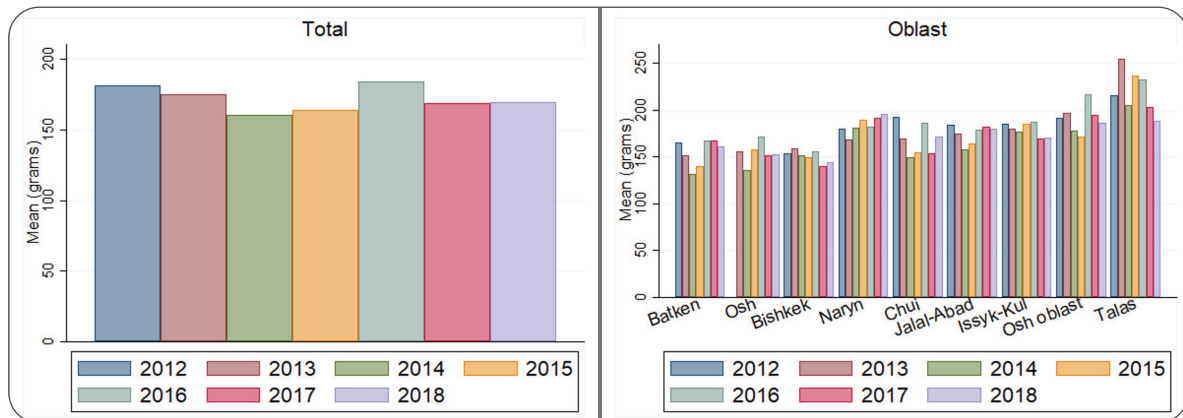
Food consumption data was extracted from the Kyrgyzstan Integrated Household Surveys from 2012 to 2018. The data allow for the analysis of primary food group consumption in Kyrgyzstan, which is presented in this chapter.

Trends in the quantity of food items consumption per capita

The daily per capita consumption of cereals and grains declined by 20 g between 2012 and 2018, from 180 g to 160 g (**Figure 6-6**). The Batken and Osh regions recorded the lowest daily per capita consumption at about 150 g. The Talas region has the highest consumption rates of cereals, despite

the observed decline in per capita daily consumption of 250 g in 2013 to 175 g in 2018. Rural residents consume more cereals and grains than do urban residents. There was a decline in rural per capita cereal consumption from 195 g in 2012 to 175 g in 2018. During that same period, urban residents consumed 160 g in 2012 and 150 g in 2018. In addition to the rural/urban divide, there also is an economic divide, with the top 20 percent of earners consuming 70 g per capita more daily than the lowest 20 percent of earners.

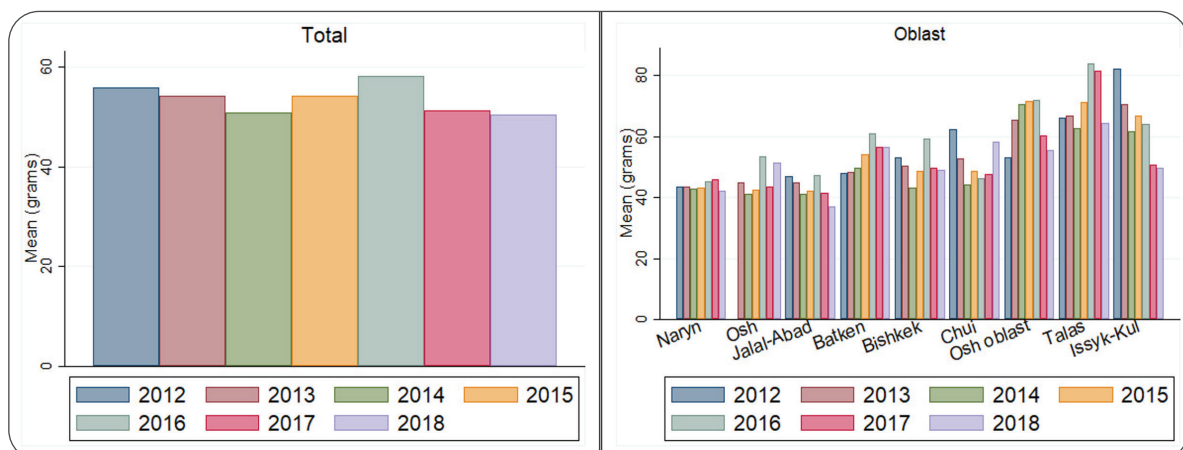
Figure 6-6. Consumption of cereals (g per capita per day), national average and by oblast, 2012–2018



Source: National Statistical Committee of the Kyrgyz Republic. 2019. Kyrgyz Integrated Household Survey (KIHS) 2012-2018. NSC database. Bishkek, Kyrgyzstan. NSC.

The daily per capita consumption of roots and tubers saw a marginal decline from 58 g in 2012 to 55 g in 2018 (Figure 6-7). Between 2012 and 2018, Osh city and the Naryn and Jalal-Abad regions consumed the lowest number of roots and tubers, approximately 43 g per capita per day. The Talas and Issyk-Kul regions consumed the highest number of roots and tubers, about 56–60 g per day. Root and tuber consumption declined significantly in the regions, from 60 g per day in 2012 to about 40 g per day in 2018. Rural residents consumed about 10 g more roots and tubers daily than did urban households, with a marginal decline between 2012 and 2018. The top 20 percent of earners consumed about 30 g more roots and tubers per capita than did the bottom 20 percent of earners in Kyrgyzstan.

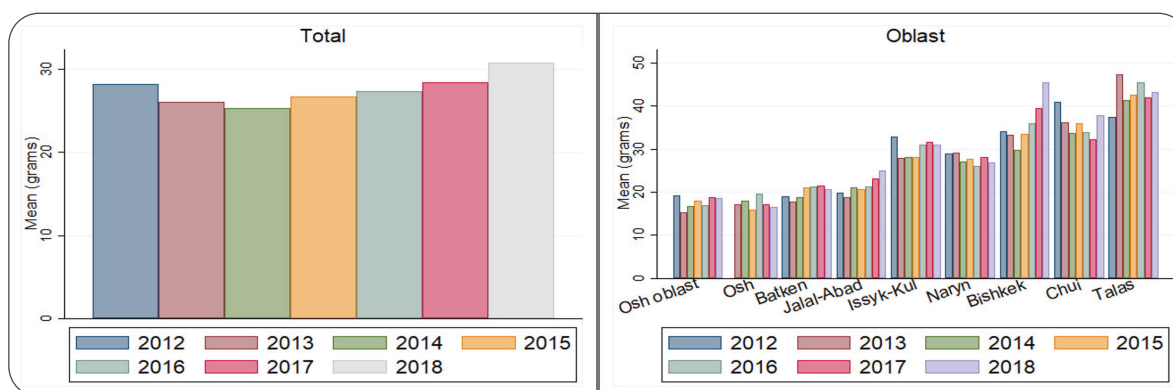
Figure 6-7. Consumption of roots and tubers (g per capita per day), national average and by oblast, 2012–2018



Source: National Statistical Committee of the Kyrgyz Republic. 2019. Kyrgyz Integrated Household Survey (KIHS) 2012-2018. NSC database. Bishkek, Kyrgyzstan. NSC.

The daily quantity of meat and meat products consumed per capita increased by about 5 g, from 28 g in 2012 to 33 g in 2018 (Figure 6-8). Osh region and Osh city recorded the lowest per capita daily consumption of meat and meat products, at about 15–20 g. Bishkek, Chui and Talas recorded the highest per capita consumption quantities, and quantities consumed increased from about 33–40 g in 2012 to about 44–48 g in 2018. While rural residents consumed more meat and meat products between 2012 and 2015, urban residents consumed more by 2018. Households with the highest consumption expenditure quintile consumed 40 g more meat and meat products per capita than those in the lowest quintile.

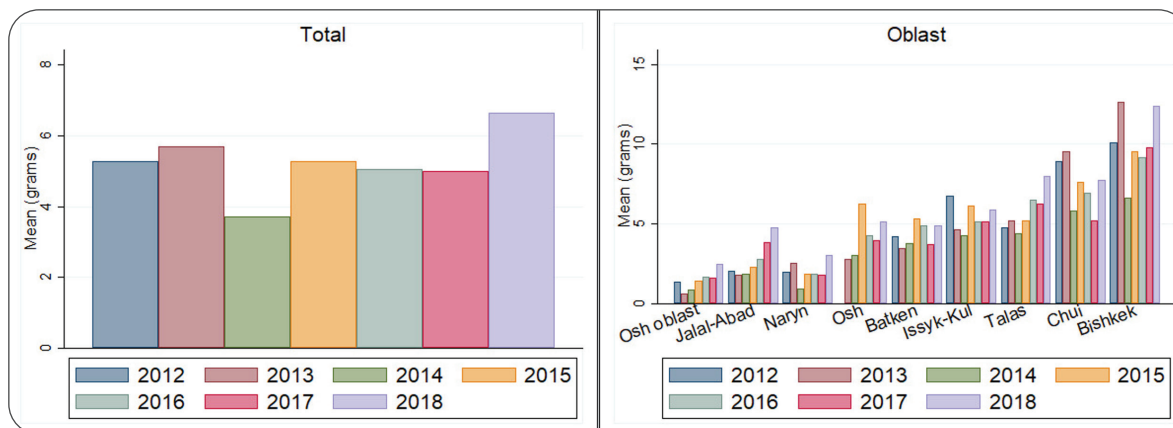
Figure 6-8. Consumption of meat and meat products (g per capita per day), national average and by oblast, 2012–2018



Source: National Statistical Committee of the Kyrgyz Republic. 2019. Kyrgyz Integrated Household Survey (KIHS) 2012-2018. NSC database. Bishkek, Kyrgyzstan. NSC.

The consumption of other animal-based products increased from 5.5 g per capita per day in 2012 to 6.2 g per capita per day in 2018 (Figure 6-9). The Osh, Jalal-Abad and Naryn regions recorded the lowest per capita daily consumption of about 1–3 g, and the Chui, Bishkek and Talas regions recorded the highest per capita consumption, about 6–12 g, in 2018. Urban residents consumed about 4–5 g more between 2012 and 2018 than did rural residents. By 2018, households with the top 20 percent of earners consumed about 8 g more of other animal-based products per capita per day than did the bottom 20 percent.

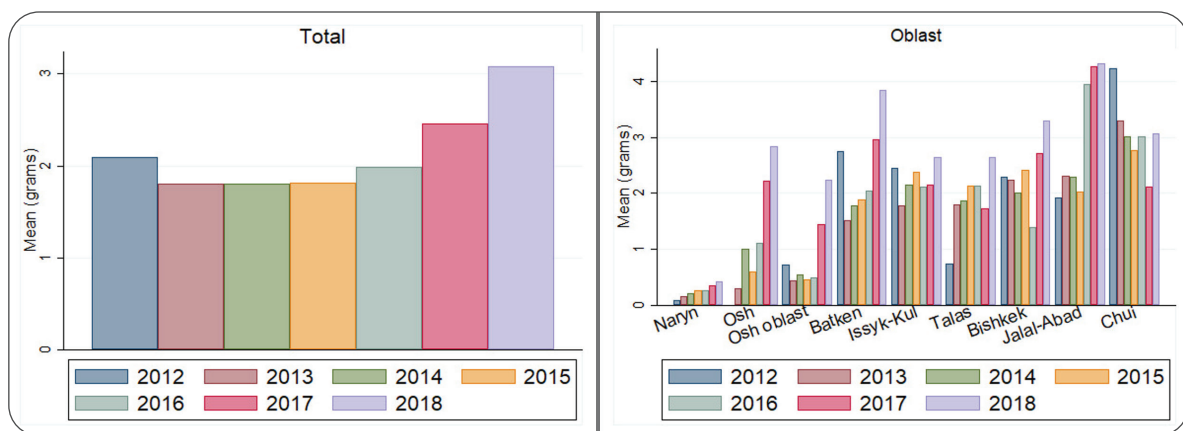
Figure 6-9. Consumption of other animal-based products (g per capita per day), national average and by oblast, 2012–2018



Source: National Statistical Committee of the Kyrgyz Republic. 2019. Kyrgyz Integrated Household Survey (KIHS) 2012-2018. NSC database. Bishkek, Kyrgyzstan. NSC.

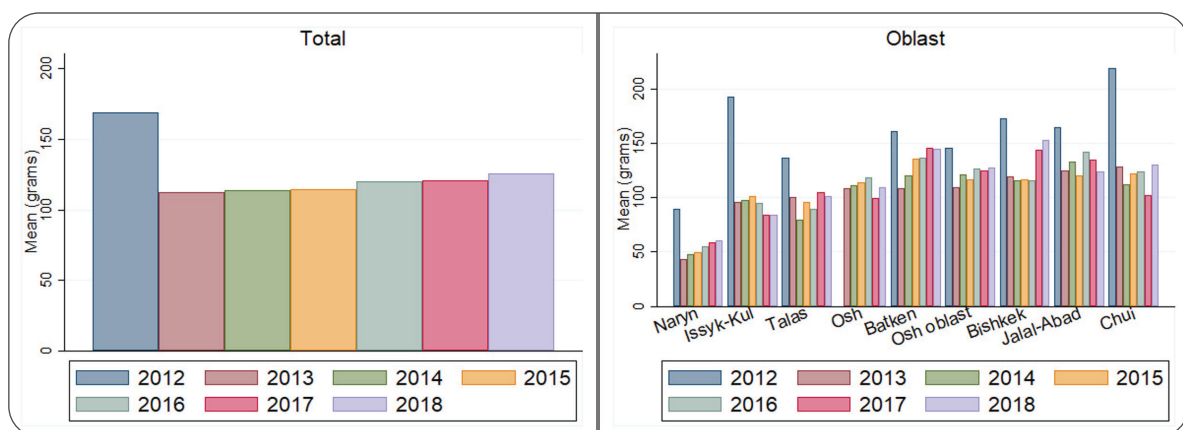
The consumption of legumes per capita per day increased from 2 g in 2012 to 3.2 g in 2018 (Figure 6-10). The Naryn region recorded the lowest per capita daily consumption, less than 1 g, between 2012 and 2018, whereas the Jalal-Abad and Chui regions recorded the highest per capita consumption between 2012 and 2018. In the Jalal-Abad region, consumption of legumes per capita per day doubled, from about 2 g in 2012 to 4 g in 2018. Interestingly, legume consumption declined from about 4 g in 2012 to 3 g in 2018 in Chui region during the same period, but it remains high. Urban residents saw an increase in legume consumption, from 2.3 g in 2012 to 3.2 g in 2018, and rural residents saw a more moderate, but still noteworthy, increase in legume consumption, from 2 g in 2012 to 2.8 g in 2018. By 2018, the top 20 percent of earners consumed about 2 g more legumes per capita daily in comparison to the bottom 20 percent.

Figure 6-10. Consumption of legumes and pulses (g per capita per day), national average and by oblast, 2012–2018



Source: National Statistical Committee of the Kyrgyz Republic. 2019. Kyrgyz Integrated Household Survey (KIHS) 2012-2018. NSC database. Bishkek, Kyrgyzstan. NSC.

Figure 6-11. Consumption of fruits and vegetables (g per capita per day), national average and by oblast, 2012–2018

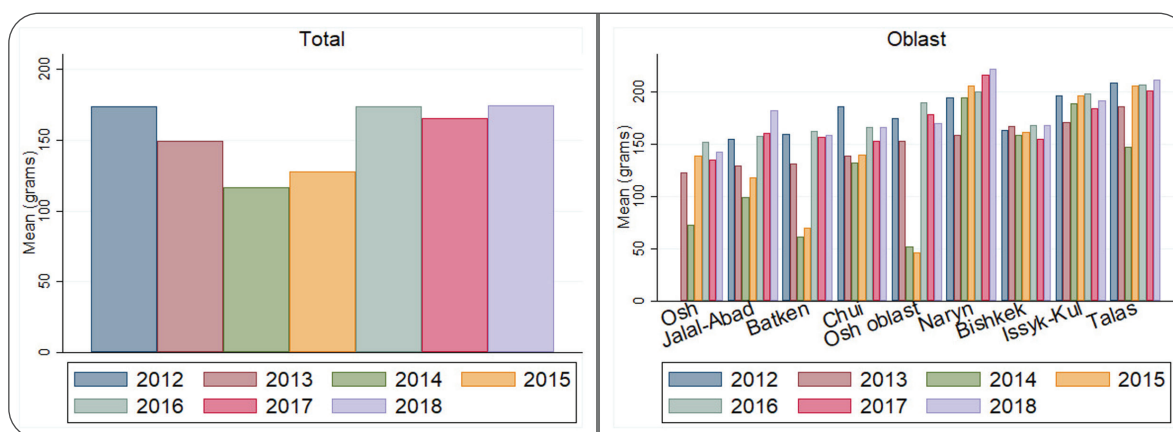


Source: National Statistical Committee of the Kyrgyz Republic. 2019. Kyrgyz Integrated Household Survey (KIHS) 2012-2018. NSC database. Bishkek, Kyrgyzstan. NSC.

Consumption of fruits and vegetables per capita per day declined significantly, from 170 g in 2012 to 110 g in 2013. However, there was a moderate increase to 120 g by 2018 (Figure 6-11). The Naryn region recorded the lowest per capita daily consumption, averaging 47–52 grams between 2012 and 2018. The Chui region recorded the highest per capita consumption, at an average of about 110 g,

between 2012 and 2018. Urban residents consumed more fruits and vegetables per day, with a daily per capita consumption rate of 110 g in 2012 and 135 g in 2018. Rural residents consumed about 100 g in 2012 and 110 g in 2018. Between 2012 and 2018, the top 20 percent of earners consumed about 150 g fruits and vegetables per capita per day, and the bottom 20 percent of earners consumed about 80 g per capita per day.

Figure 6-12. Consumption of processed foods (g per capita per day), national average and by oblast, 2012–2018

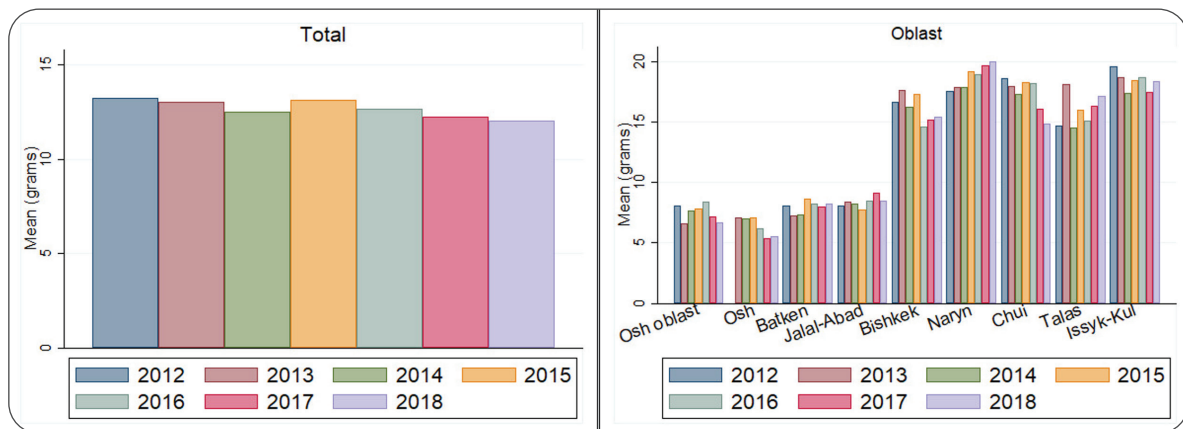


Source: National Statistical Committee of the Kyrgyz Republic. 2019. Kyrgyz Integrated Household Survey (KIHS) 2012–2018. NSC database. Bishkek, Kyrgyzstan. NSC.

The consumption of processed foods per capita per day remained at about 170 g between 2012 and 2018 (**Figure 6-12**). There are no significant differences in processed food consumption across the Kyrgyzstani regions, although Osh city recorded the lowest consumption rates at 125 g in 2012 and 147 g in 2018. The Talas region recorded the highest consumption rates, at approximately 200 g between 2012 and 2018. Urban residents have seen a slight increase in consumption, from 152 g in 2012 to 155 g in 2018. Rural residents have had fluctuating rates of consumption of processed food, starting at 170 g in 2012, decreasing to 100 g in 2014 and jumping back up to 170 g in 2018. Between 2012 and 2018, the top 20 percent of earners consumed about 60 g more processed foods per capita per day than did those in the lowest quintile.

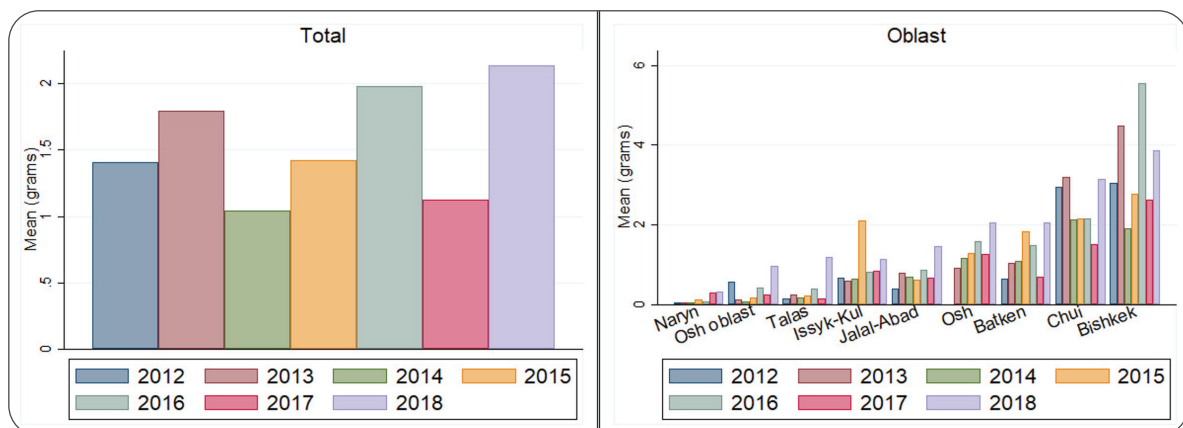
The consumption of sugary foods and beverages remained steady at 14 g per capita per day between 2012 and 2018 (**Figure 6-13**). The Osh, Batken and Jalal-Abad regions recorded the lowest quantities of sugary foods and beverages consumed, at about 8 g per capita per day, between 2012 and 2018. The Bishkek, Talas, Naryn, Chui and Issyk-Kul regions recorded consumption rates ranging between 16 and 20 g per capita per day between 2012 and 2018. Urban residents had a slightly higher sugary food and beverage consumption rate per capita per day than did rural residents, by about 3 g. Between 2012 and 2018, the top 20 percent of earners consumed 18 g of sugary foods and beverages per capita per day, and those in the bottom 20 percent consumed about 8 g per capita per day.

Figure 6-13. Consumption of sugary foods and beverages (g per capita per day), national average and by oblast, 2012–2018



Source: National Statistical Committee of the Kyrgyz Republic. 2019. Kyrgyz Integrated Household Survey (KIHS) 2012-2018. NSC database. Bishkek, Kyrgyzstan. NSC.

Figure 6-14. Consumption of fermented food (g per capita per day), national average and by oblast, 2012–2018

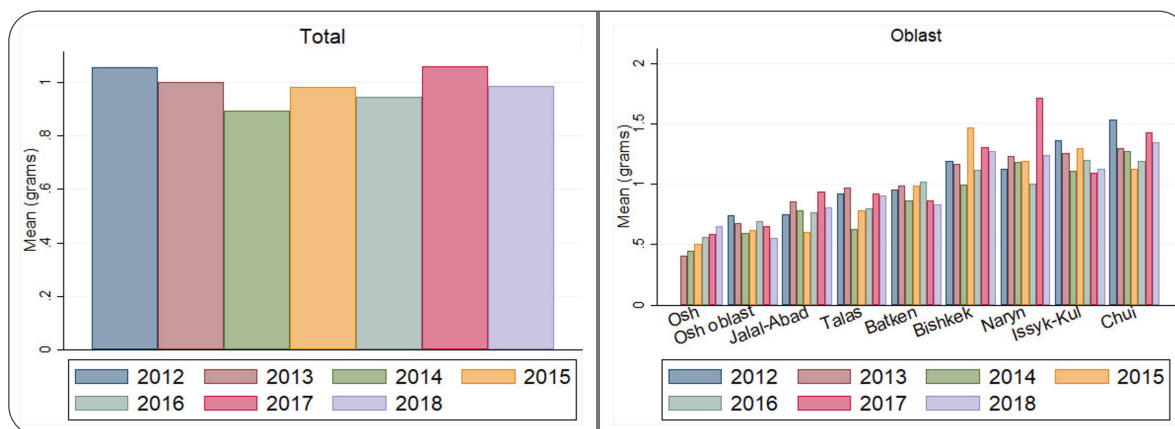


Source: National Statistical Committee of the Kyrgyz Republic. 2019. Kyrgyz Integrated Household Survey (KIHS) 2012-2018. NSC database. Bishkek, Kyrgyzstan. NSC.

Consumption of fermented foods per capita per day in Kyrgyzstan increased from about 1.5 grams in 2012 to about 2.2 grams in 2018 (Figure 6-14). The regions of Chui and Bishkek had the highest consumption rates, about 2–6 g per day, and the Naryn, Osh and Talas regions reported less than 1 g. The consumption of fermented foods was higher among urban residents, at about 2–3.5 g per capita per day, while rural residents consumed about 0.8–1 g per capita per day. Between 2012 and 2018, the bottom 20 percent of earners in Kyrgyzstan doubled their consumption of fermented foods, from 0.5 g to 1 g per capita per day. The consumption of fermented foods also increased among the top 20 percent of earners, from 3.5 g in 2012 to 4 g in 2018.

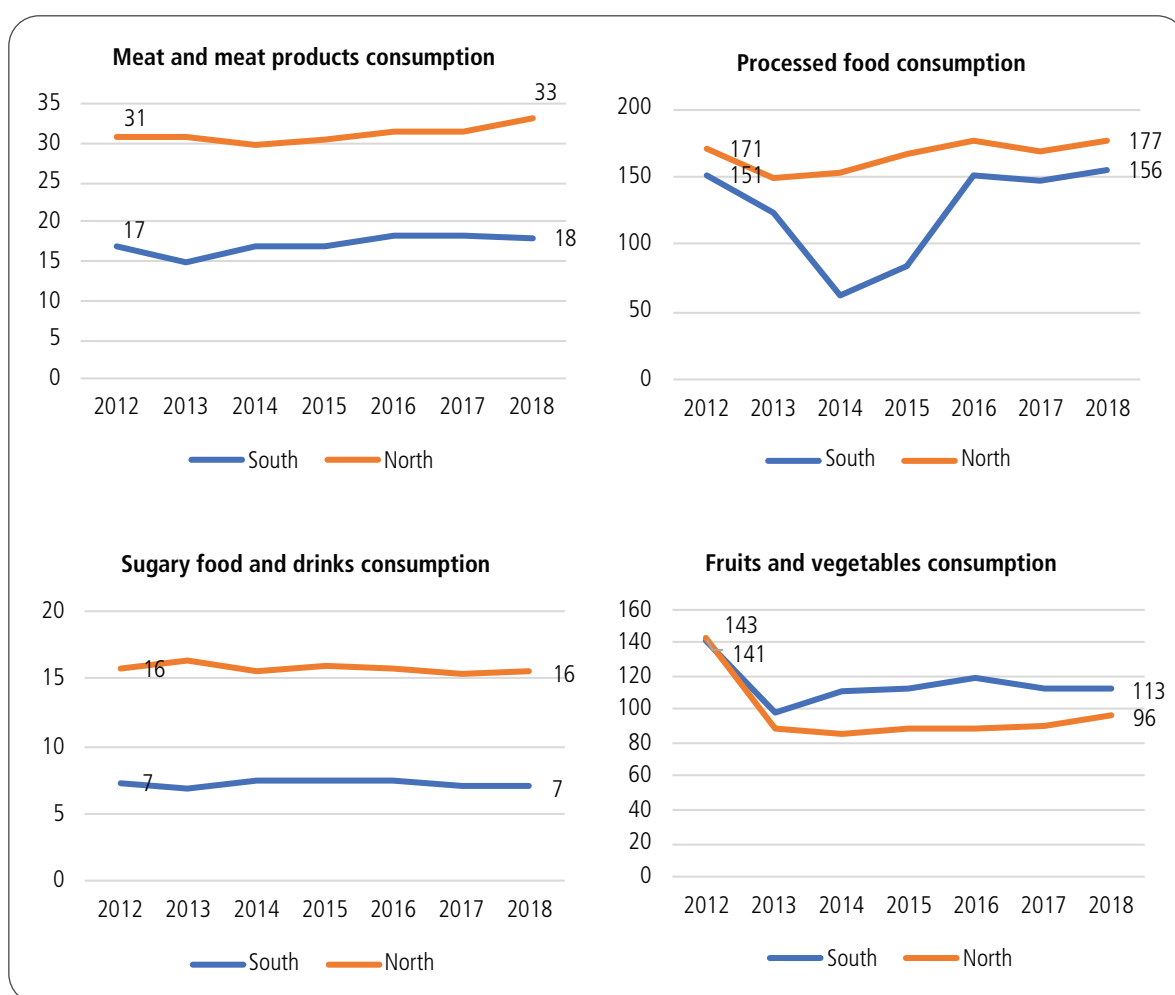
Tea and coffee consumption per capita per day remained at the same level between 2012 and 2018, at around 1 g (Figure 6-15). Osh city and the Osh region recorded the lowest per capita daily consumption, about 0.6 g, between 2012 and 2018. The Issyk-Kul and Chui regions had the highest levels of consumption, 1.2–1.5 g per capita per day, between 2012 and 2018. The consumption of tea and coffee per capita was at 0.7 g among households in the bottom 20 percent of earners between 2012 and 2018. Those in the top 20 percent of earners averaged about 1.8 g per capita per day between 2012 and 2018.

Figure 6-15. Consumption of tea and coffee (high in polyphenol) (g per capita per day), national average and by oblast, 2012–2018



Source: National Statistical Committee of the Kyrgyz Republic. 2019. Kyrgyz Integrated Household Survey (KIHS) 2012-2018. NSC database. Bishkek, Kyrgyzstan. NSC.

Figure 6-16. Regional differences in food consumption rates (g per capita per day), 2012–2018



Source: National Statistical Committee of the Kyrgyz Republic. 2019. Kyrgyz Integrated Household Survey (KIHS) 2012-2018. NSC database. Bishkek, Kyrgyzstan. NSC.

Regional differences in nutrition practices

Nutrition practices in the country's northern regions (Chui, Talas, Issyk-Kul and Naryn) and southern regions (Jalal-Abad, Osh and Batken) are affected by cultural differences, neighbouring influences, and the availability of food products. Disaggregating national data on the consumption of basic food groups allows these regional differences to be recognized and analysed. Residents in the northern regions consume more meat and meat products, processed foods, and sugary foods and beverages than those in the southern regions, where fruit and vegetable consumption is higher (**Figure 7-16**). There was a higher consumption of processed foods in the northern regions, 171–177 g per capita per day, from 2012 to 2018 than in the southern regions, where the consumption of processed foods stayed around 151–156 g per capita per day between 2012 and 2018. Sugary foods and beverage consumption remained relatively stable between 2012 and 2018, but there remains a distinction between northern and southern regions, with northern regions consuming 16 g per capita per day and southern regions consuming 7 g per capita per day. Households in the northern region saw a sharp decline in fruit and vegetable consumption, from 143 g to 96 g per person per day, from 2012 to 2018. Southern households saw more steady consumption rates of fruits and vegetables, ranging from 113–141 g per capita per day between 2012 and 2018.

Food consumption findings

Examining the per capita per day consumption rates of basic food groups shows interesting trends across food groups, regions, urban and rural communities, and socioeconomic classes. The consumption of cereals and grains, roots and tubers declined during the observed period. Simultaneously, the consumption of meat and meat products and other animal products increased. The consumption of legumes, fermented products, tea and coffee is minute, and even growing consumption rates are not substantial enough to change the structure of the Kyrgyzstani diet, especially with increases in the consumption of processed foods and sugary food and beverages.

Energy-rich food groups, such as cereals and grains and roots and tubers, are the primary food sources for households in Kyrgyzstan, which consume a total of 215 g per capita per day. The second largest food group is fruits and vegetables, with averages of 20 g per capita per day. Kyrgyzstanis consumed about 10 g of animal-based products and protein-rich foods, and the consumption of legumes remained nominal, at about 3 g per capita per day. While the consumption of energy-rich food items declined during 2012–2018, the consumption of protein-rich and vitamin-rich foods increased.

Although the consumption of energy-rich foods remains high across all regions, consumption was higher in the Osh, Talas and Issyk-Kul regions. Three regions (Bishkek, Chui and Talas) had the highest rates of consumption of animal-based products and protein-rich foods.

Across all food groups, the consumption of processed foods remained high and consistent between 2012 and 2018. These foods are high in sugar, saturated fat, salt and sodium and have reduced nutritional value. The consumption of these foods is consistent across all regions, populations densities and socioeconomic statuses.

Analysis of the regional disparity between the southern and northern regions demonstrates that those in the southern regions have generally healthier diets than do their northern counterparts.

Structure and changes of food trade

- Kyrgyzstan operates in a complicated trade environment, being a member of both the WTO and the EAEU. Entrance into the EAEU increased Kyrgyzstan's import duties from 5 percent in 2012 to 8.4 percent in 2020.
- Kyrgyzstan is a net importer.
- Kyrgyzstan imports foods from the primary food groups, mostly from Kazakhstan and the Russian Federation. Agricultural exports are primarily for EAEU markets.
- Domestic trade networks are developing gradually, with green markets serving as a pivotal part of network development.

International trade and trade agreement

Kyrgyzstan has been a member of the World Trade Organization (WTO) since 1998, and in 2015, Kyrgyzstan has been a member of the Eurasian Economic Union (EAEU), along with Armenia, Belarus, Kazakhstan and the Russian Federation (Eurasian Economic Union, 2015). The EAEU provides free movement of goods, services, capital and labour and coordinates policies in many sectors. EAEU member countries have harmonized their agricultural national policies, particularly addressing market access, domestic support to agriculture, and sanitary and phytosanitary (SPS) regulations. Since 2015, the EAEU has signed a range of free trade agreements:

- Free trade agreement with Viet Nam
- Interim agreement leading to the formation of a free trade zone between the Eurasian Economic Union and its member states and the Islamic Republic of Iran
- Agreement on trade and economic cooperation between the Eurasian Economic Union and its member states and China
- Free trade zone agreement with Singapore
- Free trade zone agreement with Serbia

Kyrgyzstan is also a member of the Commonwealth of Independent States Free Trade Area (CIS FTA), which entered into force in 2012. Whereas import tariffs generally do not apply within the CIS FTA, some members have reserved the right to apply import tariffs for specific agrifood products, such as sugar, imported from all or some other CIS FTA members. Since January 2016, a preferential trade regime for Kyrgyzstan's trade with the European Union (GSP+) has allowed some agrifood products to be exported to the European Union with zero or reduced tariff rates. Kyrgyzstan is a member of the Economic Cooperation Organization (ECO), along with Armenia, Afghanistan, Iran, Kazakhstan, Pakistan, Tajikistan, Türkiye, Turkmenistan and Uzbekistan. The Economic Cooperation Organization Trade Agreement (ECOTA) aims to establish a free trade regime among ECO members, but it has been signed only by Tajikistan.

Table 6-1. Trade dynamics in Kyrgyzstan, 2003–2020 (millions USD)

	2003–2005	2010–2012	2017–2019	2020
Import	922	4285	4922.7	3387
Export	657	1717	1859.6	1864
Balance	–264	–2569	–3063.0	–1523
Import coverage by export (%)	71 percent	40 percent	38 percent	55 percent

Source: United Nations Statistics Division, UN COMTRADE. 2021. International Merchandise Trade Statistics. New York. UNSD. <http://comtrade.un.org/>

During the past two decades, imports to Kyrgyzstan have always surpassed the country's exports (**Table 6-1**). Volumes of trade have been rising quickly; imports multiplied by five between 2003 and 2019, and export has only tripled during the same period, leading the coverage of imports by exports to decline from 71 percent to 38 percent. During 2020, exports remained constant while imports decreased from USD 4.9 billion to USD 3.4 billion.

Kyrgyzstan exports consist of gold (50.5 percent of total export), ore (7.5 percent), apparel and clothing (5 percent), copper (4 percent), cotton (2 percent), and agrifood stuff. The main export destinations are the United Kingdom of Great Britain and Northern Ireland, Russian Federation, Kazakhstan, Uzbekistan and Türkiye. Key export markets for Kyrgyz agrifood products are Kazakhstan, Russian Federation and Türkiye. Kyrgyzstan imports apparel and clothing accessories, raw cotton, mineral fuels, footwear, pharmaceutical products, and agrifood stuff. The leading importers are China, Russian Federation, Kazakhstan and Türkiye. The primary import sources of agrifood products are Kazakhstan, China, Russian Federation and Ukraine.

Table 6-2. Agrifood trade (current millions USD) in Kyrgyzstan, 2003–2020

	2003–2005	2010–2012	2017–2019	2020
Total food and agriculture goods (commodity codes 01–20)				
Import	89.7	538.0	453.7	391.7
Export	51.5	182.5	192.4	221.8
Balance	–38.2	–355.5	–261.3	–169.9
Import coverage by export (%)	57 percent	34 percent	42 percent	57 percent

Source: United Nations Statistics Division, UN COMTRADE. 2021. International Merchandise Trade Statistics. New York. UNSD. <http://comtrade.un.org/>

The trade dynamics of agricultural and food items develop in tandem with the general growth of trade volumes (**Table 6-2**). Following the same trade patterns, Kyrgyzstan is a net importer of agricultural and food goods. Kyrgyzstan's dependence on agrifood imports has gradually declined over the past decade. Import coverage by export has improved, from 42 percent in 2010–2012 to 34 percent in 2017–2019. The top trading producers and trade partners of agrifood items are Russian Federation and Kazakhstan. These two countries import wheat, flour, finished wheat products, sugar, vegetable oil and confectioneries. Those two countries are also the top destinations for exported agrifood products, such as dairy products, fruits and vegetables, and other products.

In 2020, exports of agrifood products increased. The source of export growth is livestock exports, mainly cattle and sheep, to Uzbekistan and Tajikistan. Additionally, the overall volume of agrifood imports decreased in 2020. Kyrgyzstan saw a 12 percent decrease in poultry imports from 2019 to 2020, a 36 percent decrease in fruits and nuts, a 28 percent decrease in sugar, an 18 percent decrease in cereals, and a 10 percent decrease in oils and fats. These import decreases were primarily from the Russian Federation and Kazakhstan. The protectionist positions of the other EAEU members during global humanitarian and economic crises calls into question the role and position of Kyrgyzstan in the trade union.

Domestic retail and wholesale food markets

Consumers in Kyrgyzstan have three primary market channels through which they obtain their goods: wholesale trade, retail trade and other trade.²⁸ The volume of trade and services has increased rapidly, growing by more than a quarter (27 percent) between 2015 and 2019 (**Table 6-3**). The share of retail trade declined from 53 percent in 2015 to 51.4 percent in 2019. The share of wholesale trade slowly increased, from 31.3 percent in 2015 to 34.8 percent in 2019.

Retail trade is both sales made through shops and through traditional retail markets (bazaars). The share of shops trade as a share of total retail trade has been increasing, from 53 percent in 2015 to 58 percent in 2019. As a result, trade through bazaars has declined, but their significance as places of trade has not, especially in rural areas. The share of food items²⁹ in the retail trade is stable, account for 53–55 percent of total volume of retail trade between 2015 and 2019.

Table 6-3. Consumer market (in value and by channel) in Kyrgyzstan, 2015–2019

	2015	2016	2017	2018	2019
Consumer market, in millions (current USD)	6683	6529	7460	8101	8529
<i>Including:</i>					
Retail trade, percent	53.0	53.7	52.4	51.6	51.4
Wholesale trade, percent	31.3	32.2	33.9	34.2	34.8
Other trade, percent	15.7	14.1	13.7	14.2	13.9
Retail trade, including sales through café and restaurants, in millions (USD)	4816	4641	5172	5587	5841
<i>Including:</i>					
Trading enterprises, percent	53	54	56	57	58
Retail markets (bazaars), percent	47	46	44	43	42

Source: NSC. 2020. The consumer market of Kyrgyz Republic. 2015-2019. Annual report. Bishkek, Kyrgyzstan. NSC. <http://stat.kg/ru/publications/sbornik-potrebitelskij-rynok-kyrgyzskoj-respubliki-2008-2012/>

Wheats and grains accounted for 23–24 percent of total food sales from 2015 to 2019 (**Table 6-4**), followed by meat and meat products, accounting for 12 percent. The third-largest group in food sales is alcoholic beverages, with its share gradually decreasing from 11 percent in 2015 to 7 percent in 2019. In fourth place, at 4 percent of total food sales, is milk and other dairy products. The share of food groups in retail food trade mirror the dietary patterns of Kyrgyzstan, taking into account food produced by rural households for their own consumption and food distributed in other social structures, such as family sharing or other communities.

²⁸ “Other trade” in statistics from Kyrgyzstan includes trade by automobiles, sales of petroleum, and automobile services, i.e. car repairs and other automobile services.

²⁹ This includes alcoholic drinks.

Table 6-4. Retail food sales (millions USD) through all market channels, including café and restaurants, in Kyrgyzstan, 2015–2019

	2015	2016	2017	2018	2019
Food sales, total	2541	2460	2798	3034	3201
Meat and meat products	313	290	329	369	397
Fish and fish products	8	9	10	11	12
Animal oil	39	37	41	43	43
Vegetable oil	67	68	73	79	83
Milk and dairy products	102	98	107	116	125
Eggs and egg products	26	26	29	32	33
Sugar	85	86	96	98	108
Confectionery	92	87	95	101	106
Flour, bread, and other bakery products	601	579	659	709	757
Potatoes	51	52	59	59	60
Vegetables	55	53	62	57	60
Fruits, berries, grapes	82	79	90	92	97
Alcoholic beverages	278	242	246	242	227

Source: NSC. 2020. The consumer market of Kyrgyz Republic. 2015-2019. Annual report. Bishkek, Kyrgyzstan.
NSC. <http://stat.kg/ru/publications/sbornik-potrebitelskij-rynok-kyrgyzskoj-respubliki-2008-2012/>

Agricultural and food production systems structure and changes

- Agricultural reform has focused on empowering small-scale farmers, i.e. peasant farms and rural households, in Kyrgyzstan. Smallholders produce 98 percent of total agricultural production.
- The principal crops in the country are cereals, perennial greases (alfalfa and lucerne), potatoes and vegetables. Livestock primarily focuses on cattle, sheep and horses. Livestock herds declined in the 1990s, but after 2005, they demonstrated an increase of 28–40 percent. Smallholder farmers steered the makeup of crops in the 1990s, however, the increase in livestock upped the demand for domestically grown fodder.
- Policies aimed at peasant farms and rural households created frameworks for operating producers, state bodies and other stakeholders, leaving the state with the primary role of regulation.
- Agriculture accounts for 1.5–2.3 percent of the total federal budget.

Structural changes

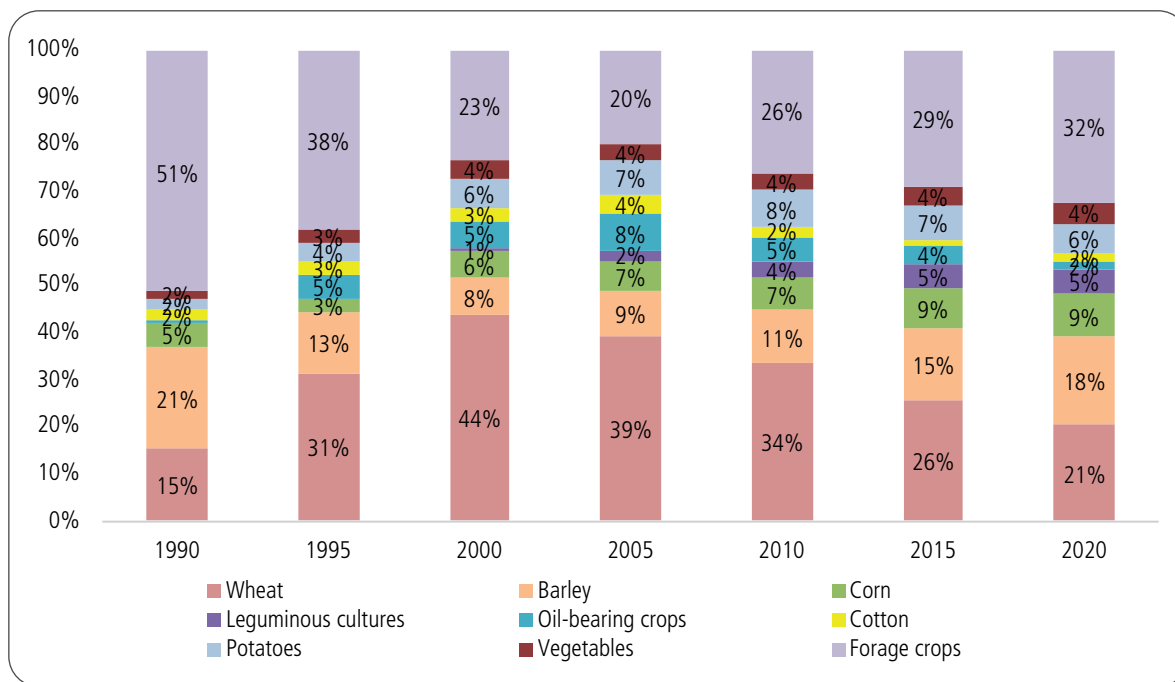
Kyrgyzstan is approximately 10.5 million hectares (ha), of which 9 million ha are pasture. Roughly 12 percent of the total land is arable, which is used for crop and fodder production. Land reform in Kyrgyzstan was implemented in the late 1990s, transitioning from a socialist agricultural structure to smallholder agriculture. Prior to the transition, 80 percent of the arable land in the country was distributed among rural households during private land reform between 1996 and 1999. As a result of the land reforms, the number of small peasant farms increased from 20 000 in 1994 to 323 000 in 2016 (FAO, 2020).

The arable land in Kyrgyzstan is divided among state farms, collective farms, peasant farms and rural households. As of 2015, peasant farms accounted for 87.4 percent of arable land, kitchen gardens used by rural households accounted for 8.3 percent, and state and collective farms accounted for 4.3 percent. The overall trend in agricultural land use focuses on empowering individual farmers and rural households. The average size of a land plot is around 2.9–3.1 ha per farm. The gap in land size between the northern and southern provinces is substantial, at 1.4–1.7 ha per farm in southern provinces and 2.3–5.1 ha per farm in the northern provinces (FAO, 2020).

Almost all arable land and livestock belong to small farmers, either peasant farms or rural households, meaning that most agricultural products are produced by smallholders. Smallholder production accounted for 98.1 percent of total agricultural output in 2015, with 61.9 percent of production attributed to peasant farms and 36.3 percent to rural households (FAO, 2020).

During the Soviet rule of Kyrgyzstan, livestock was an industry owned and facilitated by the state. After the fall of the Soviet Union, livestock were distributed to rural residents, who initially lacked the necessary livestock experience and expertise. Since 2005, livestock have started to recover in all regions of the country. Between 2005 and 2015, the number of primary livestock (sheep, cattle and horses) increased by 28–40 percent. The increase in the number of animals caused overgrazing of pastureland, leading to some land degradation. Additionally, the increase in animals created a larger demand for fodder.

Figure 6-17. Production structure of the main crops in Kyrgyzstan, 1990–2020, %



Source: NSC. 2021. Agriculture of Kyrgyz Republic. 1990-2020. Annual report. Bishkek, Kyrgyzstan. NSC. <http://stat.kg/ru/publications/sbornik-selskoe-hozyajstvo-kyrgyzskoj-respubliki/>

During the 1990s land reform, there was a shift in crop selection (Figure 6-17), often at the farmers' discretion. In the 1990s, there was a shift from the fodder-focused production of the planned Soviet economy. Before the transition, more than half of arable land was perennial grasses that were used for grazing, and barley production was also a high priority. During the 1990s land reform, farmers were more interested in growing crops for human consumption. Wheat production increased from 15 percent of total agricultural output in 1990 to 44 percent in 2000. This change is not entirely a result of the 1990s land reform but also was a response to the growth of poverty experienced in Kyrgyzstan, with poverty rates peaking at the end of the 1990s. Potato production also increased as a result of rising poverty rates, from 2 percent of total agricultural output in 1990 to 7 percent in 2000. Potatoes became one of the first commercial crops supported by domestic demand. Vegetable production also increased, from 2 percent in 1990 to 4 percent in 2000, and has remained around 4 percent for the past two decades.

Leguminous crops, such as kidney beans, are an example of commercial, export-oriented crops that were cultivated in Talas Province starting at the end of the 1990s. Since 2005, this crop has become the number one agricultural export product. Between 60 000 and 70 000 tonnes of beans are exported annually, mainly to Türkiye and other Balkan countries. These exports amount to USD 50–60 million. However, domestic legume consumption is low because of national dietary preferences.

The increase in livestock has stimulated the production of fodder over the past decade. Perennial grasses have gradually recovered, from 20 percent of land coverage in 2005 to 32 percent in 2020. An increase of barley and corn production also shows a shift back towards livestock-oriented crop production. The revival of fodder-oriented agriculture in Kyrgyzstan is partially due to the increase in livestock and partially due to the difficulties in production and unstable demand for other crops, including such commodities as canola, rapeseed, tobacco and cotton.

Policies and drivers for change

The Government of Kyrgyzstan has adopted numerous programmes and policies aimed to develop different agricultural sectors over the past 20 years. The main stakeholders in this policy development are the Government of Kyrgyzstan, the Ministry of Agriculture, the World Bank, the Asian Development Bank, FAO and the International Fund for Agricultural Development (IFAD).

The Government of Kyrgyzstan spends relatively moderate sums on agriculture. In 2015, the state spent 1.5 percent of its total federal budget on agriculture (Mogilevskii, 2017). The agricultural sector saw limited support from the state between 2000 and 2019. The state support that is available is concentrated on subsidized credits (92 percent), maintaining on-farm reclamation networks (5 percent), and assisting seeds production (3 percent). The federal government spent KGS 2.5 billion (USD 36 million) on agriculture in 2018. In 2019, funding increased to KGS 3.7 billion (USD 53 million), or 2.3 percent of the country's budget (World Trade Organization, 2021).

Livestock production

The Programme on the Development of Beef Cattle Breeding in the Chui region (2000–2005)³⁰ was aimed at increasing production and improving the quality of beef in the Chui region through the development of specialized beef cattle breeding, progressive technology of growing, fattening livestock on mountain pastures, and feeding on succulent fodder. The main goal was to conduct experimental research in the Chui region on crossing low-productivity breeding stock of Alatau and black-spotted cattle with bulls of meat breeds (Sharolese, Aberdeen-Angus, Kian and others) to create a new, highly productive Kyrgyz meat breed. There is no information about the financial sources for this project or the status of the project.

The Package of Measures for the Development of Animal Husbandry in the Kyrgyz Republic until 2010, as part of the “Comprehensive development of the rural areas until 2010” National Strategy of the Kyrgyz Republic was accepted by the Kyrgyz Government. The primary goals were to provide the population's meat demands with domestic meat and provide the food processing industry raw materials domestically. The cost of the programme was assessed at KGS 1.2 million (USD 2.9 million).³¹ Only 0.1 percent of anticipated funds would be provided by the state and the remaining 99.9 percent from rural entrepreneurs and international financial organizations. This programme included plans to expand the growth of leading livestock products (meat, milk, eggs, wool) with an improved regulatory legal framework for the development of cattle breeding, the reform of livestock management systems through the creation of an institutional structure, the creation of auxiliary services for farm animal treatment, and the improvement of commodities production, including financial and technical support.

The State Programme on the Development of Horse Breeding in the Kyrgyz Republic (2003–2010) was set to develop horse breeding in the country. This programme should have helped increase the production of horse breeding and increased production of horse products such as kumis, meat and sports horses. Measures included land allocation, lengthy loan agreements, grants for the development of state breeding farms, funding for scientific research, and introducing new scientists and breeders in order to improve existing and create new, highly productive breeds of horses. All these programmes

³⁰ The texts of state programmes and laws were obtained from the database of the Ministry of Justice of the Kyrgyz Republic: <http://cbd.minjust.gov.kg/ru-ru/npakr/search>.

³¹ Based on a 2005 exchange rate of USD 1 = KGS 41.01. Source: <http://stat.kg>.

were supposed to be financed by the state budget and horse owners. The document outlining the programme expired in 2016 (Government of the Kyrgyz Republic, 2003).

The Law on Livestock Breeding in the Kyrgyz Republic (2009–present) establishes the legal, economic and organizational framework for the breeding of pedigree animals, the production and use of pedigree products, preserving and increasing the gene pool of pedigree animals, and reproducing and improving their productive qualities. The main stakeholders mentioned in the law are breeding farms and the state body authorized to manage pedigree work. The financing source is the federal government (Government of the Kyrgyz Republic, 2009a).

The Law on the Identification of Animals and Products of Animal Origin (2013–present) regulates the identification, registration and traceability of animals and animal-based products and determines the organizational, legal and financial foundations of animal identification. Implementation of the law may support a better framework for safer animal-based products originating from Kyrgyzstan. The State Register of Identified Animals was organized by the State Inspectorate for Veterinary and Phytosanitary Safety. The federal government is responsible for funding this regulating body. These verifications are necessary to limit barriers to exporting processed milk and meat (Government of the Kyrgyz Republic, 2013).

The milk and meat demand in Kyrgyzstan is satisfied with domestic supply. This reflects a shift from crop production to livestock as a result of price fluctuation rather than a change in policy. However, joining the EAEU led to higher investments in the food safety systems and improvement of the legal and information system (Law on the Identification of Animals and Products of Animal Origin), leading to an increase of milk products export to EAEU markets (Yamano *et al.*, 2019).

Fish production

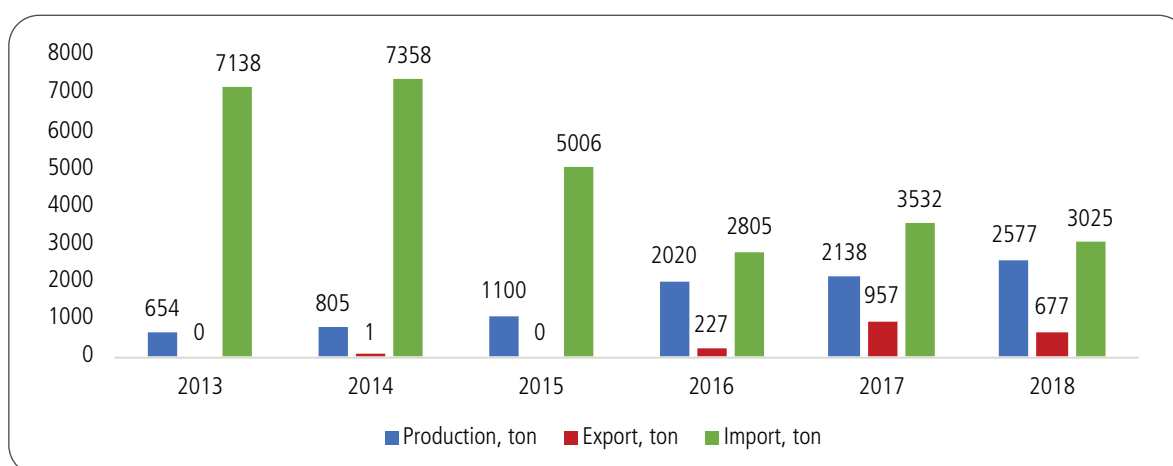
The Law on Fish Farming (1997–present) has steered the development of domestic fisheries since 1997. The law regulates the legal, economic and organizational bodies for the fisheries in Kyrgyzstan. The law also includes a description of the transfer process of reservoirs and their sections for use, protection of fish stocks and their habitats, and restrictions on the use of fish stocks (Government of the Kyrgyz Republic, 1997).

The Fishery Development Programme of the Kyrgyz Republic for 2008–2012 was accepted in 2008 and terminated in 2016. The programme aimed to improve the management of fisheries, reservoirs and fish resources, the regulation of fishing activities, the organization and development of recreational fishing and aquaculture improvement of control measures for the protection of fish stocks and their preservation and provide additional funding for fishery research and education for fishing industry specialists. The programme was funded by collected fees (40 percent), donors (predominately FAO), and private investors (60 percent). The leading state authority responsible for regulating fishery farms is the Department of Pastures, Livestock and Fisheries of the Ministry of Agriculture, Food Industry, and Melioration of the Kyrgyz Republic, established in 2016 (Government of the Kyrgyz Republic, 2008).

The new Programme for the Development of Fisheries and Aquaculture in the Kyrgyz Republic for 2019–2023 was accepted in 2019. The tasks for further development of the sector include stimulating the development of pasture fish farming, support for small-scale fisheries, improving the regulation of recreational and sport fishing, supporting the production of fish seed, supporting small-scale aquaculture fisheries, raising awareness of aquaculture actors, adapting cage culture technologies to local conditions,

reorganizing the authorized state fisheries management, developing measures focused on specific goals for the development of the fisheries sector based on the principles of sustainability and complexity, providing technical support to fisheries associations, improving legislation, and coordinating anti-poaching and development challenges (Government of the Kyrgyz Republic, 2019a). Continuous efforts to improve the industry in Kyrgyzstan have seen some positive results. Domestic fish production is small, at a few hundred tonnes a year. It gradually increased and covered the decline of imported fish from 2014 to 2018. **Figure 6-18** shows the export potential and how increases in fish production can improve food security in the future.

Figure 6-18. Dynamics of fish production and trade (import and export) in Kyrgyzstan, 2013–2018, tonnes



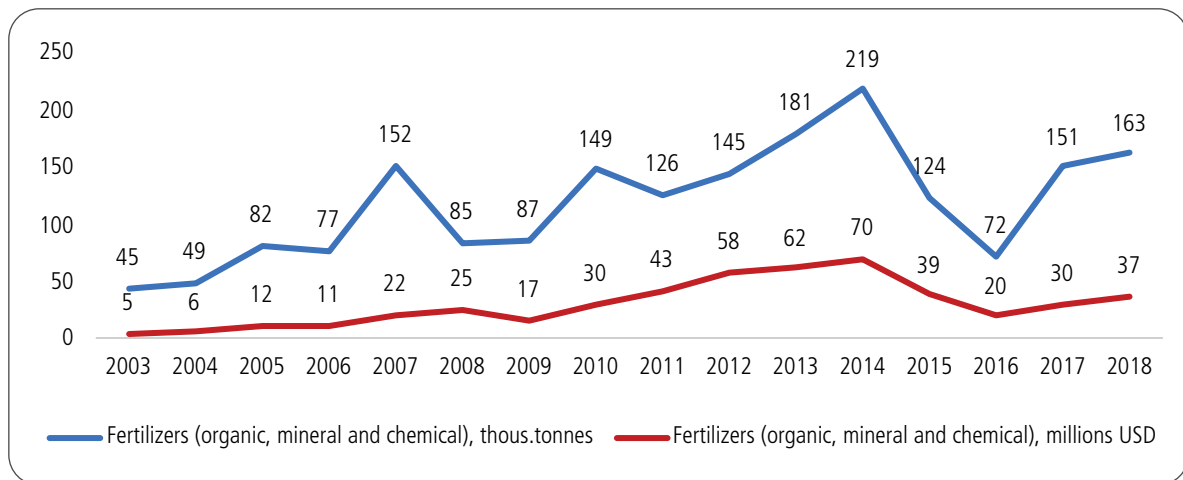
Source: United Nations Statistics Division, UN COMTRADE. 2021. International Merchandise Trade Statistics. New York. UNSD. <http://comtrade.un.org/>

Crop production policies

The Law on Chemicalization and Plant Protection (1999–present) was written and implemented to create the legal, economic, ecological, social and organizational structures to address chemicalization and plant protection in order to protect the health of people, plants and animals. The use of pesticides and agrochemicals not included in the state catalogue of pesticides and agrochemicals permitted for use in the territory of Kyrgyzstan is prohibited. Importers accredited by state authorities carry out registration tests of pesticides and agrochemicals. The registration of pesticides and agrochemicals includes an evaluation and determination of the effectiveness of the pesticides and agrochemicals, the development of regulations for their use, the assessment of the danger posed to human health and hygienic standards, sanitary norms and rules, and an environmental assessment. The law prohibits the use of the words “safe,” “harmless,” “non-toxic,” “environmentally friendly” and other similar concepts when advertising pesticides and agrochemicals. The transportation, storage and application of pesticides and agrochemicals should be done with specialized equipment. Only citizens with special professional training should be administering the application of pesticides, with the necessary permits from an authorized executive body (Government of the Kyrgyz Republic, 1999).

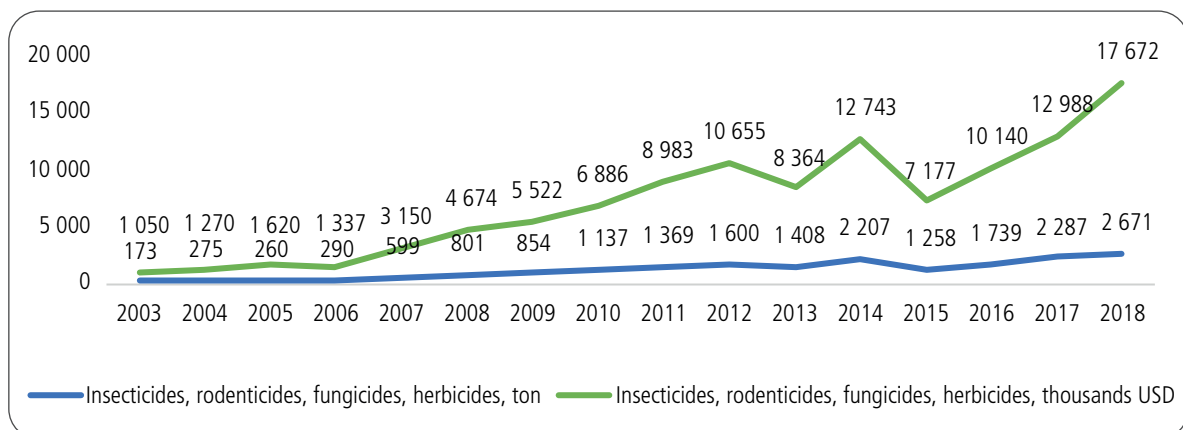
Crop producers are obligated to participate in an inspection, participate in diagnostic studies of land and crops for preventive treatments, and comply with the State Service for Chemicalization and Plant Protection instructions for the use of pesticides and agrochemicals.

Figure 6-19. Fertilizer imports in Kyrgyzstan, 2013–2018, thousand tonnes and millions USD



Source: United Nations Statistics Division, UN COMTRADE. 2021. International Merchandise Trade Statistics. New York. UNSD. <http://comtrade.un.org/>

Figure 6-20. Plant protection substance imports in Kyrgyzstan, 2013–2018, tonnes and thousands USD



Source: United Nations Statistics Division, UN COMTRADE. 2021. International Merchandise Trade Statistics. New York. UNSD. <http://comtrade.un.org/>

The volume of imported fertilizers increased until 2014 and then declined, stabilizing at approximately 160 000 tonnes by 2018 (**Figure 6-19**). Plant protection substance imports have been increasing since 2003, with a sharp decline from 2014 to 2015 and continual growth from 2015 onwards (**Figure 6-20**). The decline may be attributed to Kyrgyzstan’s entrance into the EAEU and national currency depreciation in those years, but the overall trend of increased use of plant protection substances may signal a larger issues of plant diseases in the country.

Food processing and marketing structure changes

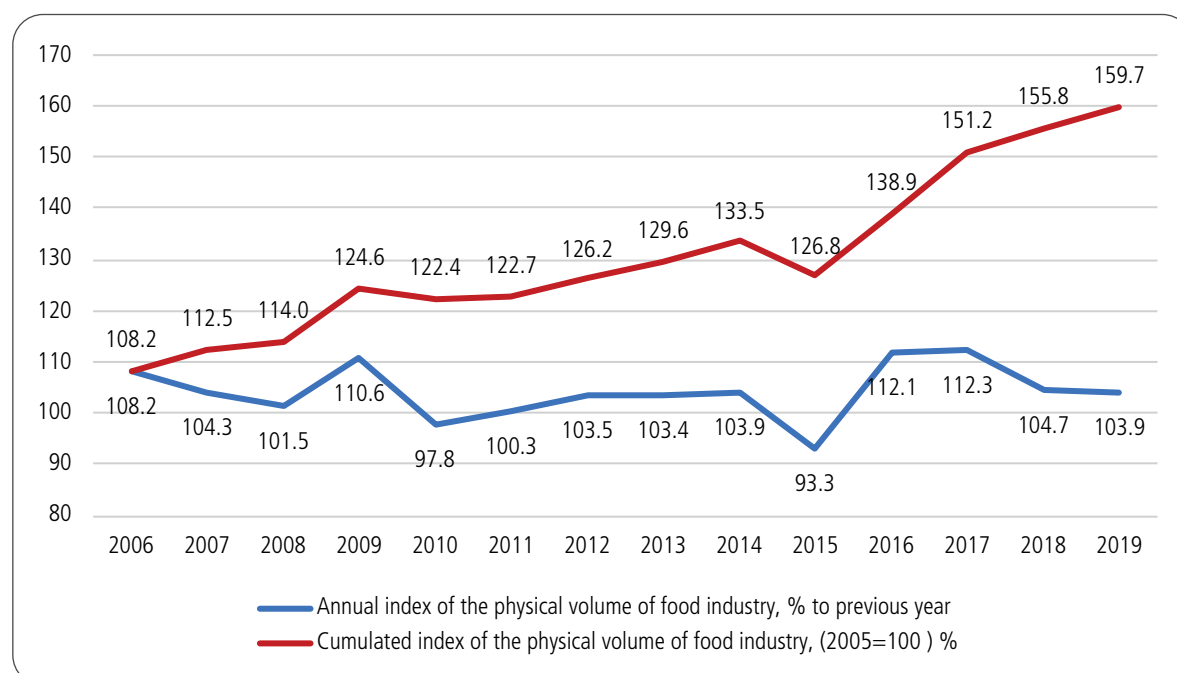
- Food processing production gradually increased in Kyrgyzstan, declining during political and economic shocks in 2010 and 2015.
- The number of food processing enterprises declined while employment rates in the sector remains stable.
- Processed dairy products, such as cheese, butter, canned milk and processed liquid milk, are the only type of agrifood products that have seen success in export markets.
- Kyrgyzstani processed food production is competing with imported food from the EAEU, such as cereals flour and vegetable oil. The increase in local consumption of processed foods has bolstered the domestic processed food sector.

State policies, programmes and regulations support sector development and integration to EAEU markets. Some policies aim to improve people's health, e.g. salt iodization and flour fortification requirements. Other policies might be harmful in the long run.

Structural changes

The food processing sector has developed gradually in Kyrgyzstan over the past two decades. Between 2006 and 2019, processed food production grew on average by 4.3 percent (Figure 6-21). The decline of processed food production observed in 2010 and 2015 can be attributed to the political regime change in 2010 and economic shocks after entering the EAEU and Kyrgyz currency depreciation in 2014–2015. The cumulative index shows the increase in volume of production over the past 14 years.

Figure 6-21. Food processing industry indexes in physical volume in Kyrgyzstan, 2006–2019, %



Source: NSC. 2020. Industrial production in Kyrgyz Republic. 2006-2019. Annual report. Bishkek, Kyrgyzstan. NSC. <http://stat.kg/ru/publications/sbornik-promyshlennost-kyrgyzskoj-respubliki-2008-2012g/>

During the last decade, the food industry saw a decline in the number of enterprises, decreasing by 34 percent between 2009 and 2019 (**Table 6-5**). However, the number of people working in the food products industry remained stable, at 20 000 employees, during the same period. The monetary value of the processed food industry increased between 2009 and 2014. There was a slight dip in 2015–2016, but 2017–2019 saw recovery and growth. From 2009 to 2019, the value of processed food doubled.

Table 6-5. Food processing industry indicators in Kyrgyzstan, 2009–2019

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Number of food processing enterprises	412	392	372	354	340	290	279	286	285	284	273
Food processing enterprises personnel, thousands	20.4	20.4	21.2	20.7	20.5	19.9	20.4	20.1	20.2	20.2	20.0
Food processing production, millions USD	357	373	413	449	461	463	359	371	461	462	484

Source: NSC. 2020. Industrial production in Kyrgyz Republic. 2009-2019. Annual report. Bishkek, Kyrgyzstan. NSC. <http://stat.kg/ru/publications/sbornik-promyshlennost-kyrgyzskoj-respubliki-2008-2012g/>

Animal-based processed foods, meaning both meat and milk products, have seen overall positive growth. The growth of the livestock industry in Kyrgyzstan explains that phenomenon (Table 6-5).

Other processed foods that are produced domestically are also starting to become competitive with imported goods. Domestically produced vegetable oil competes with imported vegetable oil, mostly sunflower oil, from the Russian Federation. Vegetable oil production volumes declined twice between 2009 and 2019 due to lower global prices of vegetable oil. Wheat flour is produced domestically from local and imported grain, which mostly comes from Kazakhstan. After Kyrgyzstan entered the EAEU, domestic flour production decreased by 300 percent in comparison to pre-EAEU flour production. The decline of domestic production was not remunerated by an increase in grain and flour imports. One of the potential explanations for this particular situation is the smuggling of wheat flour to Kyrgyzstan through informal trade channels.

Domestic sugar production increased significantly after investments were made in the Chui Province in 2016. A significant number of farmers were contracted to cultivate sugar beets simultaneously. The impacts of this investment were already visible in 2016, with sugar production reaching 68 000 tonnes by the end of the year. Between 2017 and 2019, domestic sugar production reached 100 000 to 120 000 tonnes (**Table 6-6**).

Domestic ethanol and vodka production declined from 2009 to 2019, while beer and wine production increased during the same period. One explanation offered is the increase in excise tariffs on alcohol in Kyrgyzstan. Tariffs on spirits like vodka and brandy were more expensive than the tariffs on wine and beer.

From processed food products, only dairy-based processed products demonstrate export potential. Other processed food product groups are growing, but only due to the development of domestic demand. The food processing industry needs to develop in a way that focuses on exports, and it needs to consider the regional comparative advantages.

Table 6-6. Production of processed food items in Kyrgyzstan, 2009–2019

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Meat and edible offal, thousand tonnes	5.7	6.7	6.5	7.2	8.1	8.3	10.7	12.4	13.8	13.3	13.6
Sausage products, thousand tonnes	2.3	2.4	2.9	2.9	3.6	3.3	3.0	3.3	3.9	5.6	7.5
Fish, processed fish products, thousand tonnes	0.8	1.2	1.3	2.0	1.1	0.9	1.0	1.5	1.0	1.6	1.0
Vegetable oil, thousand tonnes	20.6	18.1	15.1	13.9	14.1	13.9	13.8	11.5	11.3	11.7	9.4
Processed liquid milk, thousand tonnes	22.1	27.0	19.6	13.0	21.0	30.7	31.6	36.6	31.4	38.4	40.5
Canned milk (milk powder, condensed milk, etc.), thousand tonnes	1.3	3.2	3.0	2.2	2.0	2.3	1.8	2.4	4.2	4.0	6.0
Butter of all kinds, thousand tonnes	11.0	4.2	2.0	2.2	2.0	2.2	2.1	3.1	4.6	4.4	5.6
Cheese, thousand tonnes	2.6	3.6	3.7	3.0	3.3	3.2	3.6	4.1	3.9	4.1	3.6
Ice cream and frozen products, thousand tonnes	3.6	3.5	4.8	4.7	4.6	3.5	3.2	3.8	4.5	5.5	5.1
Cereal flour, thousand tonnes	513	479	440	447	433	445	273	269	271	188	154
Groats, thousand tonnes	0.8	0.5	0.4	0.5	0.6	0.5	0.8	1.1	1.2	1.6	2.2
Fresh bread, thousand tonnes	109	112	109	109	95	107	101	96	98	106	108
Confectionery, thousand tonnes	9.1	10.2	10.1	10.0	11.5	12.1	10.4	11.7	14.2	13.5	14.4
Sugar, thousand tonnes	5.8	14.1	17.0	13.2	25.2	20.4	24.4	67.7	100.4	122.5	99.7
Pasta, thousand tonnes	6.9	11.9	11.5	9.8	10.0	17.2	15.9	10.6	11.6	7.1	15.3
Packaged tea, thousand tonnes	3.0	3.3	3.3	3.2	3.2	3.2	3.1	2.8	1.7	2.3	2.4
Ethanol, million litres	6.2	8.4	7.0	7.7	8.0	6.4	5.4	4.8	3.1	4.2	4.1
Vodka, million litres	13.6	12.0	15.6	15.5	16.0	12.9	8.9	7.4	5.0	4.5	4.1
Brandy, million litres	0.6	0.6	0.7	0.9	0.9	1.0	0.6	0.7	0.9	1.3	0.9
Wine, million litres	1.4	1.6	1.4	0.5	1.8	0.6	1.0	2.4	2.8	3.0	2.3
Other fruit wines, million litres	0.2	0.2	0.3	0.2	0.7	0.2	0.6	1.2	1.0	2.6	1.5
Beer, million litres	15.2	18.0	21.2	21.9	23.9	27.1	26.3	24.0	25.1	28.5	29.0
Mineral and carbonated waters, million litres	20.7	19.6	22.3	26.6	35.8	46.7	36.8	32.7	34.8	44.4	44.3
Non-alcoholic drinks, million litres	48.7	54.4	79.0	85.1	196.0	102.2	101.9	108.2	118.9	126.8	128.3
Fermented tobacco, thousand tonnes	7.3	8.3	7.5	4.4	5.8	5.7	2.0	0.3	0.1	0.9	0.3
Cigarettes, billion pieces	3.6	3.6	2.4	1.7	0.9	0.5	0.0	0.0	0.0	0.0	0.0

Source: NSC. 2020. Industrial production in Kyrgyz Republic. 2009-2019. Annual report. Bishkek, Kyrgyzstan. NSC. <http://stat.kg/ru/publications/sbornik-promyshlennost-kyrgyzskoj-respubliki-2008-2012g/>

Policies and drivers for change

The Government of Kyrgyzstan developed a Programme for the Development of the Food and Processing Industry of the Kyrgyz Republic for 2017–2021 that aimed to develop the food processing industry, increase export potential, set standards and norms for food consumption that meet the requirements of a healthy diet, and develop an agro-industrial complex. The programme aimed to increase food production 1.3 times by 2021. The targeted sectors for this programme included sugar, dairy products, flour-grinding, baking, confectionery, meat, oil, and alcoholic and non-alcoholic beverages. Funding for the programme was partially provided by the private sector and banks (Government of the Kyrgyz Republic, 2017).

Possible risks and threats of the programme included unpredictable weather and climatic events, macroeconomic external shocks, institutional risks stemming from a weak legal framework, and micro-risks at the level of individual producers. The programme aimed to increase export potential, increase agricultural production, increase income for the rural population, decrease the poverty rate, and expand the labour market in rural areas. The Ministry of Agriculture, Food Industry and Melioration was the state agency responsible for programme implementation.

Marketing, including advertising practices

The Law on Advertising (1998–present) regulated advertising in Kyrgyzstan, defining the requirements and conditions for any advert published in the country. The State Antimonopoly Regulation Agency is responsible for the monitoring and control of advertising. Limitations for advertisements promoting alcohol include no outdoor advertising; limitations in newspapers and magazines; no distribution in educational organizations, public transport, cultural locations and organizations; no free distribution; no discount or sale for alcoholic products advertised in public spaces, etc. There are similar limitations applied for the advertisement of tobacco products (GKR, 1997).

There is a separate law on protecting the health of citizens of Kyrgyzstan from the harmful effects of tobacco and its consumption (2006–present) that provides additional regulations on the marketing and sale of tobacco products. The sale of tobacco products to juveniles is prohibited. Under this law, the following activities are prohibited: free distribution of tobacco products; discount programmes; sponsorship of public cultural, health and sports events; organization of events to promote tobacco product consumption, etc. There are also regulations for the packaging of tobacco products that require 40 percent of the package to be covered by a medical advisory (GKR, 2006).

Food additives and food fortification

The law on the prevention of iodine deficiency, passed in 2000, lays the foundations for the state agency responsible for the prevention of iodine deficiency and related diseases. Among the main measures approved for limiting iodine deficiency is the iodization of salt. The quality, safety, methods of iodization, and control over the content of iodine must comply with the standards set up in this law. It is illegal to import salt into the territory of Kyrgyzstan for nutritional and fodder needs without providing certificates of conformity issued or recognized by the state certification body (Government of the Kyrgyz Republic, 2000). Support was provided by development organizations, such as the Asian Development Bank, UNICEF, USAID and Mercy Corps. Surveys and reviews in the country indicate progress in preventing and controlling anaemia in women and young children.

The Law on the Fortification of Baking Flour from 2009 was not as successful as the law on the iodization of salt (UNICEF, 2017). This law required fortification of flour with vitamins and minerals to reduce the prevalence of iron and other micronutrient deficiencies. The law and technical regulations were applicable to the production, storage, transportation, sale and disposal of wheat flour. The proposal suggested that wheat flour would be fortified with B1, B2, B3, Folic acid, Iron and Zinc (Government of the Kyrgyz Republic, 2009b). Enriched flour is not produced domestically in Kyrgyzstan and is purchased in large quantities, requiring a large up-front investment.

One of the most ambiguous technical regulations of the EAEU is Technical Regulations for Fat and Oil Products. According to the latest safety requirements for fat and oil products, the content of trans isomers of fatty acids in confectionery and bakery products should not exceed 2 percent of the total fat content in the product (Eurasian Economic Union, 2013). Trans isomers are forms of fatty acids considered potentially harmful to humans and are a by-product of hydrogenating oils to convert them into solid fats. However, butter contains 8 percent natural trans isomers, making its use impossible under the new requirements of the technical regulations. As an alternative to butter, confectioners have turned to other oils, the most affordable being palm oil, which contains 1.5 percent trans isomers after processing.

Taxation on unhealthy food and price policies for promoting healthy diets

Taxation on unhealthy foods has not yet reached Kyrgyzstan. Curbing the consumption of unhealthy food by consumers is proposed in the second **Food Security and Nutrition Programme for 2019–2023**. Under Goal 3, improving the nutritional status of the population, there is a list of desired outcomes:

- creation of a regulatory framework to prohibit or significantly restrict the advertising of high-calorie foods with high levels of saturated fats, trans fats and sugars.
- implementation of specific measures to improve nutrition among children younger than 5 and women of reproductive age (Government of the Kyrgyz Republic, 2019b).

Food labelling/information

As a part of EAEU membership, technical regulations need to be put into place in the newly inaugurated country. After joining the EAEU in 2016, Kyrgyzstan implemented 48 technical regulations. All technical regulations and standards contain norms governing the processes of manufacture, sale, storage, transportation and disposal of a specific type of product. The Law of the Kyrgyz Republic Technical Regulation on Food Labelling was no longer applicable after Kyrgyzstan was admitted into the EAEU.

Consumer demand, awareness, education and social protection

- School nutrition programmes were initiated in 1999, and national programmes were implemented in 2006. Financing of the programme is limited and supported by development organizations.
- The school food programme only covered two-thirds of schools in the country.
- Social protection programmes have been criticized for their lack of adequate financial support.
- Nutrition education is provided on the elementary level for students in public education institutions. There is no educational programme for children after elementary school or for adults.

School food and nutrition

The first law dedicated to school nutrition was the Law on the Organization of Nutrition for Pupils in Secondary Schools of the Kyrgyz Republic (2002–2019) (Government of the Kyrgyz Republic, 2002). The National School Nutrition Programme was established in 2006. The programme provided funds to feed schoolchildren breakfast. The nutritional value of the meal was modest, usually consisting of 200 g of milk with a baked roll. The amount of money per student per meal was not equal across Kyrgyzstan's seven regions. Amounts ranged from KGS 7 (USD 0.17) to KGS 14 (USD 0.25) in 2006.

The Law on the Organization of Nutrition for Pupils in General Education Organizations came into force on 4 December 2019. The law required public education organizations to provide their pupils with meals that appropriately fulfilled their nutritional needs based on their age (Government of the Kyrgyz Republic, 2019c). This programme is primarily funded by the federal government. Additional sources of funding come from the parents of students enrolled in public schools and large international organizations, such as the WFP and Mercy Co. Currently, this programme is implemented in just 1 485 of 2 265 schools, around 66 percent.³²

Nutrition-sensitive social protection

The Law on State Benefits (1991–present) regulates social protections in Kyrgyzstan. The law established state benefits and regulates the distribution of state benefits. The objective was to reduce poverty among families, families taking care of children with disabilities, and the elderly. Two different benefits were provided: the universal monthly benefit (UMB) and the monthly social benefit (MSB). The UMB was introduced in 1991, and the MSB was established in 1998, after some amendments were adopted. The purpose of the UMB was to act as a safety net for impoverished families with children. The MSB is a cash income replacement programme that targets disadvantaged groups. The country spends a relatively high amount of money on social protection, with 7.4 percent of the GDP in 2015 spent on social insurance (OECD, 2018). The MSB has received criticism because it is not enough money to lift its recipients out of poverty.

³² For more information about this school nutrition programme, see <http://tamakash.edu.gov.kg/>.

Nutrition education and behaviour change communication

Students enrolled in public education institutions receive nutrition education in Kyrgyzstan only during their first years of study. Students are taught basic knowledge about a balanced healthy diet, such as consuming proportional amounts of proteins, oils and carbs. There is no massive information campaign to teach adults the same basic knowledge on healthy nutrition.

Conclusions and key messages

Kyrgyzstan has seen improvements in its economic and social development since it declared independence from Moscow in 1991. Due to external shocks, political instability and structural problems, the country is experiencing various bouts of food insecurity and stagnation of nutrition indicators. Poverty has declined, with the most substantial improvement seen between 2002 and 2008. Poverty dynamics in 2008–2019 show high sensitivity to food inflation and currency depreciation caused by the dependency on food imports. Health indicators among children improved from 2006 to 2014, but there are obstacles to continued improvement. Adults' health indicators show an increase in overweight and obesity rates.

Food consumption statistics (FAO database) show an increase in living standards and nutrient intake, with some figures higher than expected. A more detailed analysis of household consumption from 2012 to 2018 shows changes on the micro level: an increased prevalence of cereals, roots and tubers in the national diet, an increase in processed food consumption, and a low level of fruit and vegetable consumption. The national diet is not considered healthy, and the prevalence of non-communicable diseases due to unhealthy diets and poor nutrient intake practices will continue to plague Kyrgyzstan and impede further social and economic growth and development.

Trade flows are influenced by Kyrgyzstan's membership in the WTO and the EAEU. Joining the WTO sparked an intensive growth in trade from 2000 to 2012. Entering the EAEU in 2015 led to high import tariff rates, increased migration and more money flow from remittances. Food imports primarily come from other EAEU countries: Kazakhstan and the Russian Federation. Most agricultural exports go to EAEU markets. Processed milk products – such as cheese, butter, canned milk and processed liquid milk – are the main group of agricultural products that have had success in international markets.

The share of agriculture in the total GDP declined due to the prevalence of smallholder farms. Smallholder farmers produce 98 percent of the total agricultural output. The prevalence of smallholders in the sector led to slower development in agriculture than in other sectors due to lower investment capacities, knowledge gaps, limited economies of scale and other issues related to small-size production.

The role of the state in agricultural development is minimal, with just 1.5–2.3 percent of the state budget allocated to agricultural activities and development. The role of development organizations in terms of investments, capacity building, and technical expertise remains significant. Food processing developed gradually and demonstrated stability in terms of employment potential. Processed foods are competing with imported food from the EAEU, such as cereals, flour and vegetable oil, stifling domestic production. The domestic demand for processed foods has been the impetus for the sector's growth in Kyrgyzstan. Dairy products are Kyrgyzstan's star export.

Nutrition education is taught to students only in their first years of elementary school. School food programmes need to expand and be implemented in the remaining one-third of schools that do not have hot meal programmes. Social protection programmes have been criticized for their lack of adequate financial support.

The overall nutrition situation in Kyrgyzstan has been gradually improving. Current patterns show high prevalence of cereals and processed food and a lack of fruits and vegetables. Changing what people eat and encouraging healthier choices requires developing an approach to nutrition education for both children and adults. Nutrition in Kyrgyzstan is still vulnerable to external shocks, such as supply changes,

fluctuating food prices, remittance declines, and national currency depreciation. The improvement of agricultural productivity among smallholders needs to be addressed by federal agricultural policy. The food processing industry needs additional funding and support to compete with foreign agrifood imports. Kyrgyzstan's membership in the EAEU provides positive and negative consequences that need to be analysed and understood so that national policy can best be used to take advantage of new economic opportunities.

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Chapter 7

The role of food systems in the transition of diets and the prevention of malnutrition in Ukraine

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Abstract

The chapter addresses main nutrition trends in Ukraine, including dietary indicators, prevalence of diet-related diseases, food insecurity, and undernourishment and their correlation with agricultural and food policy, agricultural trade and general socioeconomic indicators. Due to policies targeting technology development, food safety improvement, food diversity and the promotion of healthy nutrition choices, positive changes in the diets of the Ukrainian population have been observed during the past five years. However, differences among regions, age groups and income levels remain significant. Affordability of healthy food, information campaigns, food assistance programmes and general improvement in the quality of locally produced foods remain the main issues to be addressed at state and local levels. A high share of agricultural production, especially stockbreeding, is concentrated in households and family farms. Organic production and fortification are not developed. As a result, significant efforts from the government, local authorities, communities, producers and households are required to improve the nutrition of the population of Ukraine.

Keywords: *food insecurity, agriculture, food systems, nutrition.*

Introduction and background of malnutrition

Prevalence of malnutrition in Ukraine

According to a survey conducted in 2018–2019 by the Public Health Centre of the Ministry of Health in Ukraine (Prozdorove, 2019), daily consumption of necessary nutrients and healthy foods in Ukraine is significantly below the recommended values. In particular, the average consumption of fruits and vegetables by the adult population in Ukraine is less than 50 percent of the recommended level. Furthermore, potatoes comprise almost 50 percent of total vegetable consumption. The consumption of fruits and vegetables by children younger than 14 is closer to the recommended amount, but the share of potatoes in the consumption of vegetables is higher than that of adults.

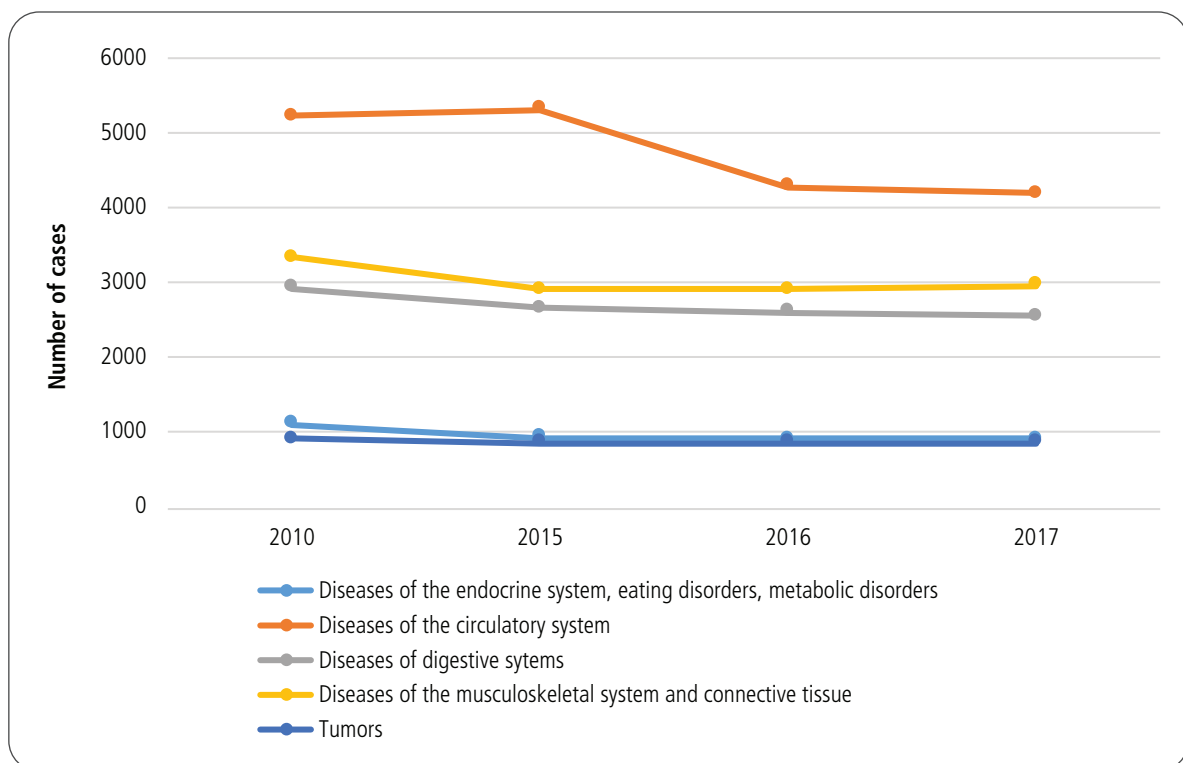
Traditionally, the consumption of nuts, seeds and beans in Ukraine has been low. In 2019, adults in Ukraine consumed just 12 percent of the recommended amount of beans and 25 percent of the recommended servings of nuts and seeds (State Statistics Committee of Ukraine, 2019). High levels of consumption of bread, bread products, animal fat and sugar (including sugar in processed food) contribute to negative impacts of dietary habits. Energy intake and food accessibility are not prevalent problems in Ukraine. Poor food choices, low affordability of healthy food, low share of locally produced fresh foods, and lack of information and education on healthy eating habits need to be addressed by the Government of Ukraine, the public sector, producers and international organizations.

According to World Bank development indicators, undernourishment of the population has intensified during the past five years. In 2000–2010, the rate of undernourished people in Ukraine decreased from 5 percent to 2.5 percent. However, in 2015, partially because of military conflict in eastern Ukraine, the rate increased to 3 percent by the end of 2015, 3.3 percent in 2016 and 3.5 percent in 2017. Between 2014 and 2019, 1.8–1.9 percent of the population experienced severe food insecurity. As of 2016, 55.5 percent of adult women and 61.4 percent of adult men in Ukraine were overweight, and 25.7 percent and 22.0 percent, respectively, were considered obese. The prevalence of anaemia in women of reproductive age (18–55 years) grew from 20.9 percent in 2010 to 23.5 percent in 2016. The share of underweight children and adolescents (aged 5–19) decreased from 19.1 percent for girls and 16.9 percent for boys in 2000 to 16.2 percent and 13.5 percent, respectively, in 2016. The prevalence of obesity in the population aged 5–19 almost doubled in 16 years, from 2.7 percent in 2000 to 4.7 percent in 2016 for girls and from 4.3 percent in 2000 to 8.9 percent in 2016 for boys. In 2016, almost 20 percent of males aged 5–19, or one in five, were overweight, as well as 18.1 percent of females of the same age (World Bank, 2020).

Prevalence of diet-related non-communicable diseases

Starting from 2010, the number of first-time recorded cases of the most widespread diet-related, non-communicable diseases (NCDs) per 100 000 people has been decreasing. Women were diagnosed more often than men. The number of first-time diagnoses of diseases per 100 000 people was below the average level for age groups 0–17 years, women aged 55 or older and men aged 60 or older. The number of first-time diagnosed cases of diet-related NCDs in 2010–2017 is presented in **Figure 7-1**.

Figure 7-1. Number of first-time diagnosed cases of diet-related NCDs per 100 000 people in Ukraine, 2010–2017



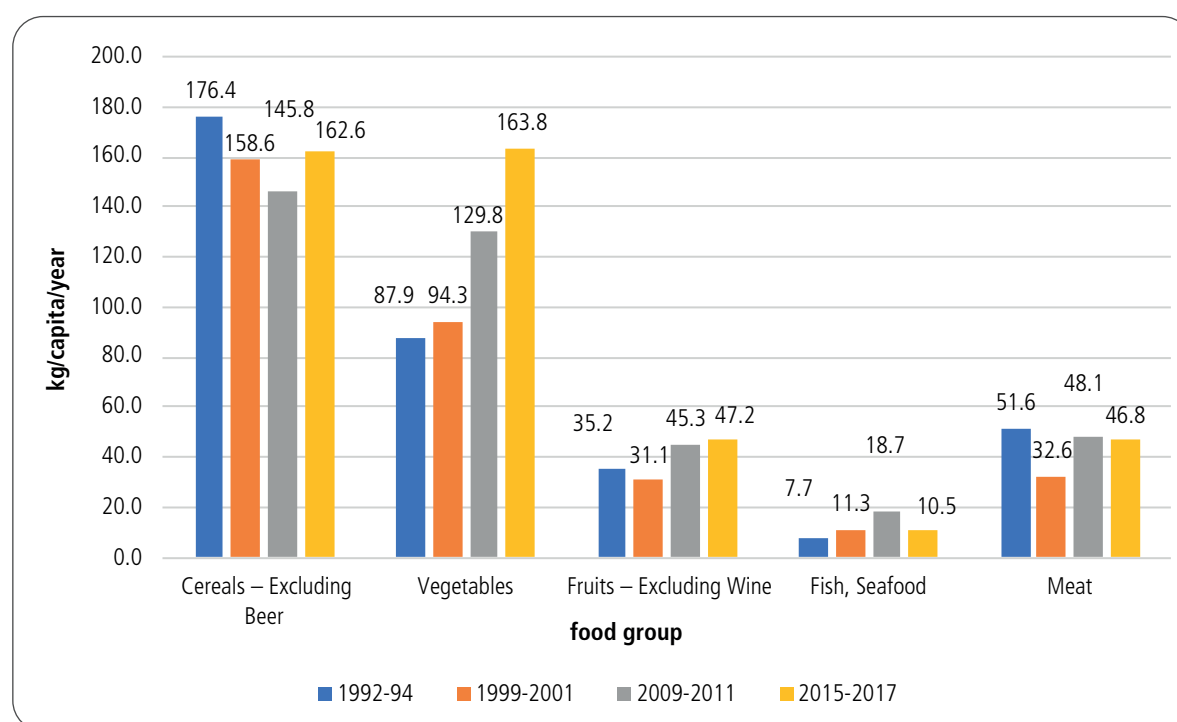
Source: The Government of Ukraine. 2021. Statistical Information. The State Statistics Committee of Ukraine. www.ukstat.gov.ua

Transformation of dietary change and food systems

Trends of food consumption based on FAO/Ukraine food balance sheets

The consumption of plant-based foods with high nutritional value increased between 2015 and 2017. The highest increase is observed in the availability of vegetables for consumption. Between 2015 and 2017, consumption was 163.8 kg per capita per year, which was a 26 percent increase from the period 2009–2011. On the other hand, consumption of fish and seafood between 2015 and 2017 decreased by 44 percent, starting with the period 2009–2011. Meat consumption also has decreased (FAO, 2020). Some positive trends in vegetable consumption can be partially attributed to the stable economy. There was a sharp decrease in healthy food consumption between 1999 and 2001 caused by economic and social factors that were a result of the transition to the market economy (Figure 7-2).

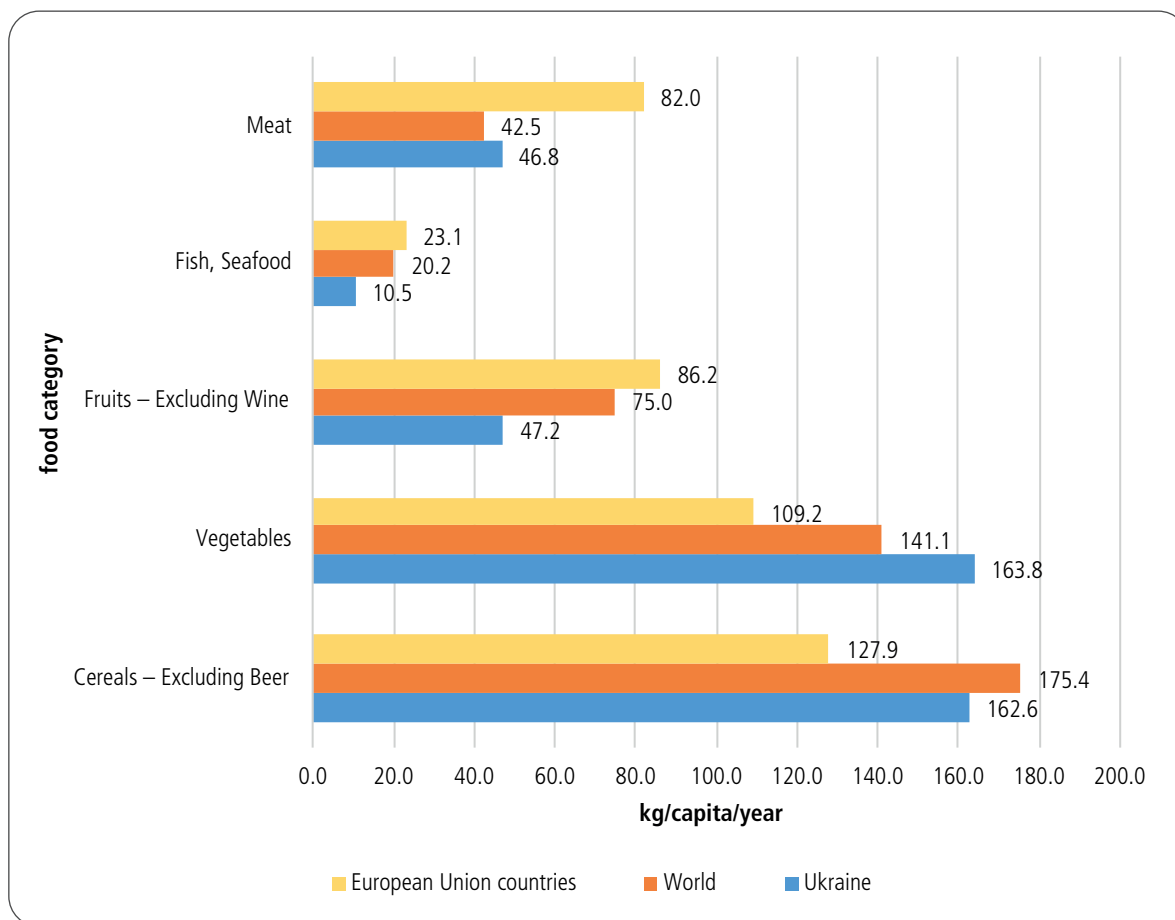
Figure 7-2. The availability for consumption of main food groups in Ukraine, 1997–2017, kg per capita per year



Source: FAO. 2020. New Food Balances. FAOSTAT. <http://www.fao.org/faostat/en/#data/FBS>

In 2015–2017, the consumption of fruits, fish and seafood in Ukraine was significantly lower than in European Union countries. Differences in the consumption of cereals and meat were less critical and could be mitigated by policies targeted at increasing the affordability of locally produced food. The consumption of vegetables in Ukraine was higher than in European Union countries, but this was caused by high levels of consumption of potatoes and other starchy vegetables (Figure 7-3).

Figure 7-3. Availability for consumption of food groups in Ukraine, European Union countries and the world, 2015–2017, kg per capita per year



Source: FAO. 2020. New Food Balances. FAOSTAT. <http://www.fao.org/faostat/en/#data/FBS>

The consumption of sugar and sweeteners in Ukraine in 2015–2017 was at the level of 62.8 kg per capita per year, 24 percent higher than the consumption of sugar and sweeteners in 2009–2011 and 62 percent higher the period 1999–2001. Furthermore, per capita consumption of sugar and sweeteners in Ukraine from 1999 to 2017 was higher than in developed countries in the European Union and in other parts of world. Per capita consumption of red meat in Ukraine remained at the same level from 2009 to 2017, while consumption of poultry increased 4.3 times during the same period. Per capita consumption of poultry in Ukraine in 2020 is slightly lower than in European Union countries, while the consumption of red meat is 2.4 times lower (FAO, 2020). Although the decline of red meat consumption is a positive trend, the decrease in total consumption of meat and fish, as well as the quality of poultry and the share of processed meat in meat consumption, should be addressed.

The consumption of milk (excluding butter) in Ukraine decreased by 10 percent from 1999 to 2017, and in 2015–2017 it was 60 percent lower than in European Union countries. The consumption of vegetable oil increased significantly from 2009 to 2011; this rise was compensated by the decrease in 2015–2017. Sunflower oil is a part of traditional Ukrainian cuisine. Despite this, per capita consumption of vegetable oil in Ukraine is 53 percent lower than in European Union countries. A critical situation regarding the consumption of nuts was observed between 1994 and 2017, with insignificant fluctuations. The per capita consumption of nuts in Ukraine from 2015 to 2017 was three times lower than in European Union countries and 65 percent lower than in the rest of the world (FAO, 2020).

Trends of food consumption based on household budget survey data

Between 2010 and 2019, negative dietary changes were observed in Ukraine, with a small rebound in 2018–2019. Between 2010 and 2018, monthly consumption of meat and meat products declined by 4.0 percent, from 5.1 kg to 4.9 kg per capita. In 2019, the consumption of meat was back at 2010 consumption levels. The monthly consumption of milk and dairy products in 2019 was 19.0 kg per capita, which is only 1.1 percent lower than 2010 consumption rates. There was a significant increase in consumption between 2010 and 2019, despite a decline in consumption observed between 2013 and 2014. The consumption of eggs fluctuated between 19 and 20 eggs per capita per month during the past decade. The consumption of fish and fish products declined significantly; in 2015–2016, the monthly level of consumption was 33.3 percent lower than in 2010, and in 2019 the monthly level of consumption increased to 1.5 kg per capita, remaining 16 percent lower than 2010 consumption rates. However, the upward trend is stable (Government of Ukraine, 2020).

The consumption of vegetables decreased from 9.5 kg per person per month in 2010 to 8.8 kg per person per month in 2019, while the consumption of fruits, berries and nuts increased by 9 percent in the same period and in 2019 was at the level of 4.0 kg per person per month. There are no observed long-term regional differences regarding the consumption of vegetables. Detailed data on monthly consumption of selected types of food per capita is presented in **Table 7-1**.

Table 7-1. Consumption of food high in protein, fruits and vegetables in Ukraine, monthly kg per person, 2010–2019

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2019/2010, %
Meat and meat products	5.1	5.1	5.0	5.1	4.9	4.6	4.7	4.7	4.9	5.1	100.0
Milk and dairy	19.2	19.1	19.6	20.3	20.3	19.8	19.6	19.3	19.1	19.0	98.6
Eggs (items)	20.0	20.0	20.0	20.0	20.0	19.0	19.0	20.0	19.0	20.0	100.0
Fish and fish products	1.8	1.7	1.7	1.8	1.6	1.2	1.2	1.3	1.4	1.5	83.3
Vegetables	9.5	9.9	10.1	9.4	9.0	8.8	9.2	8.5	8.9	8.8	92.6
Fruits, berries, nuts	3.7	3.7	3.7	4.1	3.7	3.1	3.3	3.7	3.8	4.0	108.1

Source: The Government of Ukraine. 2021. Statistical Information. The State Statistics Committee of Ukraine. www.ukstat.gov.ua

The consumption of foods that have high levels of sugar, vegetable oil and starch declined between 2010 and 2019, contributing to improved diets across the nation. In 2010, sugar consumption was 2.6 kg per capita per month. The monthly consumption of sugar decreased by 13 percent over the course of ten years. In the same period, the consumption of sunflower and other vegetable oils decreased by 22 percent (**Table 7-2**).

Table 7-2. Consumption of some types of unhealthy food in Ukraine, 2010–2019, monthly kg per person

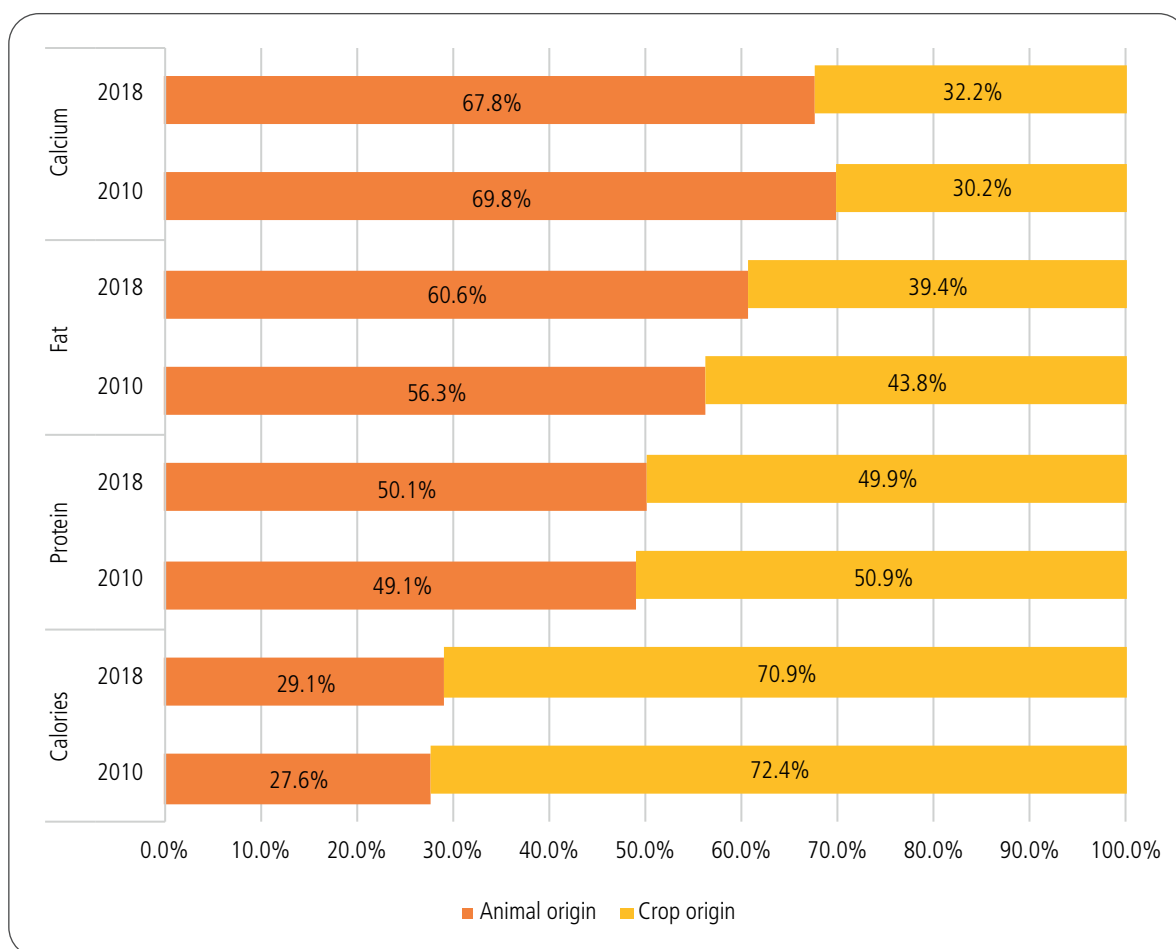
Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2019/2010, %
Sugar	3.0	3.2	3.1	3.0	3.0	2.8	2.7	2.8	2.7	2.6	81.3
Sunflower and other vegetable oils	1.8	1.8	1.8	1.7	1.7	1.6	1.5	1.5	1.5	1.4	77.8
Potatoes	7.7	7.9	7.8	7.1	6.9	6.6	6.7	6.4	6.3	6.2	78.5
Bread and bread products	9.3	9.2	9.1	9.0	9.0	8.5	8.3	8.4	8.3	8.1	88.0

Source: The Government of Ukraine. 2021. Statistical Information. The State Statistics Committee of Ukraine. www.ukstat.gov.ua

In 2018, the total daily energy intake per capita in Ukraine was 2 706 kcal, which was 8.5 percent lower than in 2010. The decline in energy intake was primarily caused by the decline in the consumption of fat, more so than by the decline in protein consumption. The consumption of calcium decreased between 2010 and 2018 by 2.4 percent, and the consumption of iron decreased by 0.5 percent.

The share of calories that came from cereals, fruits and vegetables decreased from 72.4 percent in 2010 to 70.9 percent in 2018. The percentage of animal fat that contributed to daily fat consumption increased significantly, from 56.3 percent to 60.6 percent, during the same period. Between 2010 and 2018, there was a shift in sources of calcium. In 2010, calcium from plant-based sources made up 30.2 percent of total calcium sources, while in 2018, it made up 32.2 percent (Figure 7-4).

Figure 7-4. Shares of food of animal and crop origin in daily nutritional value per capita, 2010 and 2018



Source: The Government of Ukraine. 2021. Statistical Information. The State Statistics Committee of Ukraine. www.ukstat.gov.ua

In 2016, per capita daily consumption of salt in Ukraine was 4.0 g, which is two times higher than the recommended daily amount. In the same year, per capita daily consumption of beverages with sugar was 106 g, which is 42 times higher than the recommended daily amount. These two factors could be considered a threat to public health that needs to be addressed with policy instruments in the nearest future.

According to a household budget survey conducted by State Statistics Service of Ukraine, in 2017–2018, a household, on average, spent 1.7 percent of its total expenditures on eating out. The share of food

consumed outside the home, as a percentage of total expenditures of households, was 2.8 percent in large cities, 1.5 percent in small towns, and 1.2 percent in rural areas. Households with per capita monthly income below UAH 8 000 spent, on average, 1.8 percent of their budget on eating out and 3.1 percent of expenditures on food and beverages, while households with per capita income above UAH 8 000 spent 3.4 percent and 8.9 percent, respectively. Households in western Ukraine, Kyiv and Kyiv region spent a larger share of their budget on eating out than households in eastern, southern and central Ukraine (State Statistics Committee of Ukraine, 2019).

Gaps and challenges of dietary changes

The consumption of cereals, vegetable oil, poultry and fruits show positive trends and are close to the recommended levels of consumption. The consumption of starchy vegetables and potatoes is above the recommended level, while the consumption of green and other non-starchy vegetables needs to be addressed and promoted. The daily intake of salt should be decreased, starting with sodium that comes from processed meat.

The consumption of sugary beverages is far above the recommended values and is increasing, as is the consumption of plain sugar and sugar-based confectionery. Furthermore, education on healthy nutrition choices has had no significant success with this dietary challenge.

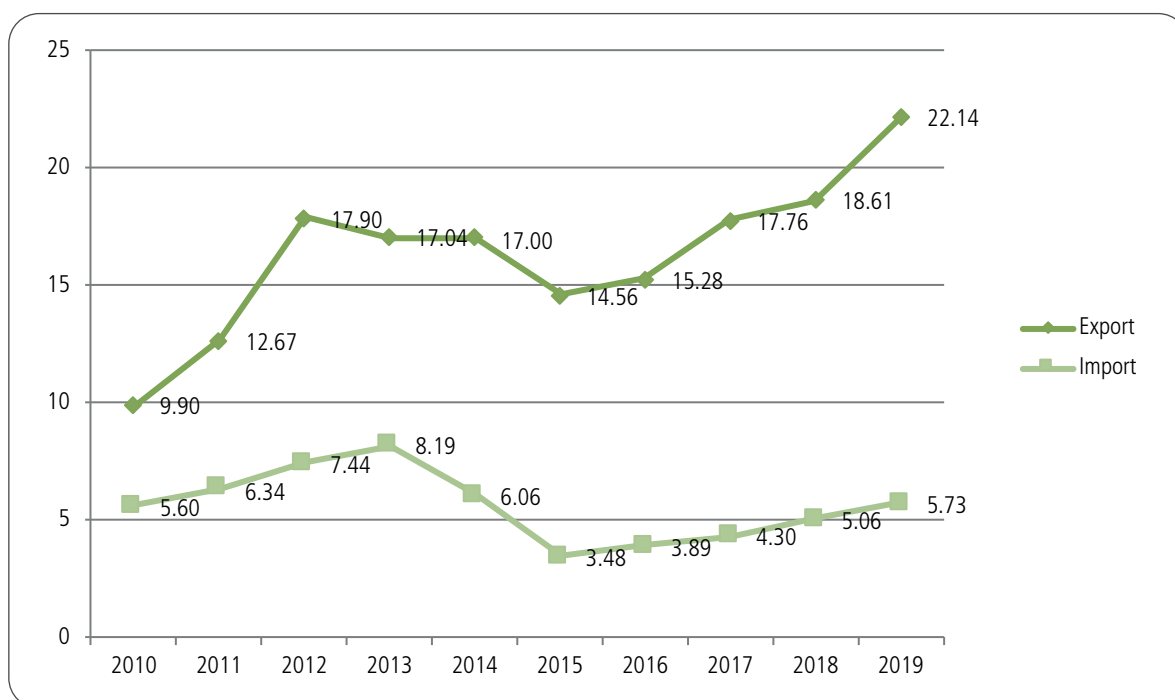
Although meat consumption shows positive trends, the structure of meat consumption should be analysed, with emphasis on processed meat and red meat. The consumption of fish, seafood and nuts remains low, with no observable positive trends, but this dietary gap is caused more by the level of income of the population than by a lack of education on healthy nutrition. Price regulation and price support policies targeted at making fish, seafood and nuts more affordable for people with lower incomes are not discussed.

Structure and changes of food trade

International trade and trade agreements

Ukraine has a positive balance of trade in agricultural commodities. In 2019, the export of agricultural commodities was 3.86 times higher than the import of these commodities. The share of agriculture export in commodity exports from Ukraine is significant. Between 2014 and 2019, it increased from 31.0 percent to 44.2 percent. After reaching a maximum of USD 17.9 billion in 2012, agricultural exports in 2013–2015 from Ukraine began to decline. In 2014, exports were 16.8 percent lower than in 2012. This sharp decrease in 2014 was mainly caused by an internal crisis and loss of export markets in the Russian Federation as well as some loss in newly independent states. In 2016, export markets started to grow, reaching USD 22.14 billion in 2019. The import of agricultural commodities stopped its growth in 2014 due to an internal crisis and subsequent devaluation of the Ukrainian hryvnia against other world currencies. In 2015, the import of agricultural commodities started to increase again. However, in 2019, imports of agricultural commodities were equal to 69.9 percent of their level in 2013. The trends of export and import of agricultural commodities are presented in **Figure 7-5**.

Figure 7-5. Export and import of agricultural commodities in Ukraine, 2010–2018, nominal billions USD



Source: The Government of Ukraine. 2021. Statistical Information. The State Statistics Committee of Ukraine. www.ukstat.gov.ua

The share of sunflowers from Ukraine is the largest, at 22 percent of the total export of agricultural goods/commodities. Over the past four years, the volume of trade in sunflower oil was equivalent to USD 4.1 billion, making Ukraine the largest producer and exporter of sunflower oil in the world. However, raw agricultural goods still prevail in agricultural exports: the share of corn makes up 19 percent of total agricultural exports, wheat makes up 16 percent, rapeseed 5 percent, and barley 4 percent. The top ten goods constitute 81 percent of total agricultural exports from Ukraine.

Agricultural imports to Ukraine are more diversified than are agricultural exports. Imports of the top ten imported agricultural goods constitute only 53 percent of total agricultural imports to Ukraine, while the share of each individual product is no higher than 7 percent of the total imports. The share of frozen fish in agricultural imports is 7 percent, tobacco 5 percent, sunflower seeds 5 percent, and bananas and other citrus fruits, which are not produced in Ukraine, below 4 percent.

Following accession to the World Trade Organization (WTO) on 16 May 2008, Ukraine reformed its trade regime in accordance with the guidelines to enter the WTO. All of Ukraine's tariff lines are bound. The simple average bound rate for agricultural products is 11.1 percent. Ukraine's applied most favoured nation (MFN) rates for agricultural products were slightly below the bound levels, at 9.26 percent, in 2018. Obligations to reduce import tariff rates were completely fulfilled by Ukraine in accordance with the tariff reduction schedule adopted. Ukraine has a tariff quota for the import of raw cane sugar at the level of 267 800 tonnes, with an import duty rate of 2 percent within the quota, which has been practically unused since 2012 due to high carryover stocks. In Ukraine, the import duty rate applied to imports of white and cane sugar is one the highest in the world, reaching 50 percent; this import duty is imposed to protect the local producers of sugar and farmers who grow sugar beets, as sugar and sugar beets are considered critical goods for some rural regions in Ukraine.

In February 2015, Ukraine took advantage of General Agreement on Tariffs and Trade (GATT) provisions, authorizing special measures to stabilize the balance of payments. Ukraine has fulfilled its obligations to the WTO to reduce export duties on oilseeds, livestock and animal hides. In 2019, tariffs for flax, sunflower and camelina seeds were set at 10 percent, live cattle at 10 percent, and animal hides at 20 percent, in accordance with the commitments defined by WTO agreements (Government of Ukraine, 1996).

An automatic value-added tax (VAT) refund system launched in Ukraine on 1 April 2017. On 22 May 2018, amendments were made to the Tax Code of Ukraine that provided for the abolition of VAT refunds on soybean exports from 1 September 2018 to 31 December 2021 and on rapeseed from 1 January 2020 to 31 December 2021 (Tax Code of Ukraine, 2011). These changes were adopted with the purpose of creating incentives to construct new oilseed processing facilities, ensuring that the value added remains in Ukraine. The cancellation of the VAT refund does not apply to export operations carried out by agricultural enterprises producing soybeans and rapeseeds on their own or leased lands or on lands in permanent use.

Following the country's accession to the WTO, the Government of Ukraine is actively pursuing bilateral negotiations with WTO member countries to increase the openness of these countries' markets to Ukrainian exports under free trade agreements. Currently, Ukraine has 12 free trade agreements in force: with the European Union, the European Free Trade Association (Switzerland, Norway, Iceland and Liechtenstein), the CIS (member countries are Ukraine, Azerbaijan, Belarus, Armenia, Kazakhstan, Kyrgyzstan, Republic of Moldova, Russian Federation, Tajikistan, Turkmenistan, Uzbekistan; some of the partners have also valid bilateral free trade agreements with Ukraine), as well as Azerbaijan, Canada, Georgia, Israel, Montenegro, North Macedonia, Tajikistan, Turkmenistan and Uzbekistan.

Although the full implementation of the Association Agreement between Ukraine and the European Union began on 1 September 2017, the free trade agreement with the European Union has been functioning bilaterally since 1 January 2016. The European Union and Ukraine have agreed to establish a free trade area over a period of a maximum of ten years. Import duties on agricultural products are either eliminated immediately, gradually (over ten years) or traded with the use of tariff quotas. For most agricultural products, the European Union Members' import duty for goods originating in Ukraine was eliminated as of 1 January 2016, in accordance with the framework of the Association Agreement. Within its annual tariff quotas, the European Union has allocated certain volumes of the zero tariff import of meat products, some dairy products, raw grains, grain-derived products, sugar, honey, garlic, juices, tomato paste and other products to Ukraine. In 2016–2017, the Government of Ukraine negotiated an increase in tariff quota volumes, which were fully used by domestic exporters during the period of the European Union autonomous preferences regime. From 1 October 2017 until 31 January 2018, eight additional quotas for duty-free exports to the European Union of honey, cereals, flour, processed tomatoes, grape and apple juice and cereals (oats, wheat, maize and barley) were applied with the basic quotas. Ukraine will terminate its export duties in trade with the European Union by 1 January 2024 (European Union, 2014).

On 1 August 2017, a bilateral free trade agreement between Ukraine and Canada entered into force with a seven-year transition period. Since 2017, there has been a complete liberalization of the markets of fish, seafood, cereals, oilseeds, fruits, chocolate, baked goods, confectioneries, fruit juices, mineral water, beer, wine and other various goods (Government of Ukraine, 2017a).

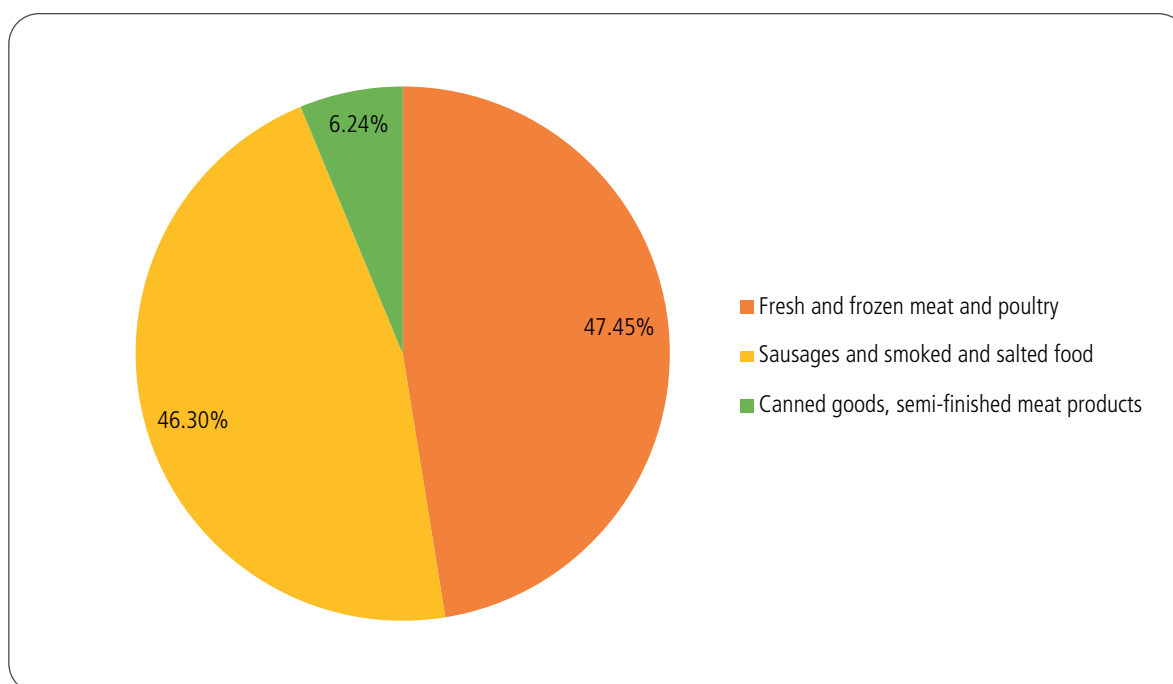
Ukraine and Israel signed a free trade agreement on 21 January 2019. Even though Israel's share in agricultural exports from Ukraine is only 1.81 percent, Ukrainian exporters are interested in Israel's markets of frozen boneless beef, wheat, corn, soybeans and sugar (WTO, 2018). The agreement opens opportunities for the export of high-value-added products – meat products, dairy products, fruits, juices, vegetables and canned meats – from small and medium-sized enterprises.

Challenges in trade in agricultural commodities with the Russian Federation began long before the signing of the Association Agreement with the European Union. During the period of preparation for the signing and ratification of the agreement, these issues became concretized in the agreement and led to the further loss of Russian export markets. In accordance with the Decree of the President of the Russian Federation "On the Suspension of the Free Trade Area in relation to Ukraine," No. 628, published on 16 December 2015, the Russian Federation suspended the agreement on the free trade area signed on 18 October 2011. Because of the adoption of Decree No. 628, a most favoured nation regime for goods originating in Ukraine was introduced by the Russian Federation instead of the preferential regime that was in force until 31 December 2015 (i.e. the standard customs duties of the Eurasian Common Customs Tariff for the Eurasian Customs Tariff groups are applied to goods from Ukraine instead of the zero rates applied previously).

Domestic retail and wholesale food markets

The supply of meat and meat products in the Ukrainian market consists mainly of domestically produced goods. The share of domestically produced meat and meat products market was 93.7 percent in 2017 and 94.6 percent in 2018. However, despite the prevalence of locally produced goods, the share of fresh and frozen meat and poultry in retail trade remains low: only 47.3 percent in 2017 and 43.9 percent in 2018. **Figure 7-6** shows the structure of meat and meat products market in 2018.

Figure 7-6. Market structure of meat and meat products in Ukraine, 2018.



Source: The Government of Ukraine. 2021. Statistical Information. The State Statistics Committee of Ukraine. www.ukstat.gov.ua

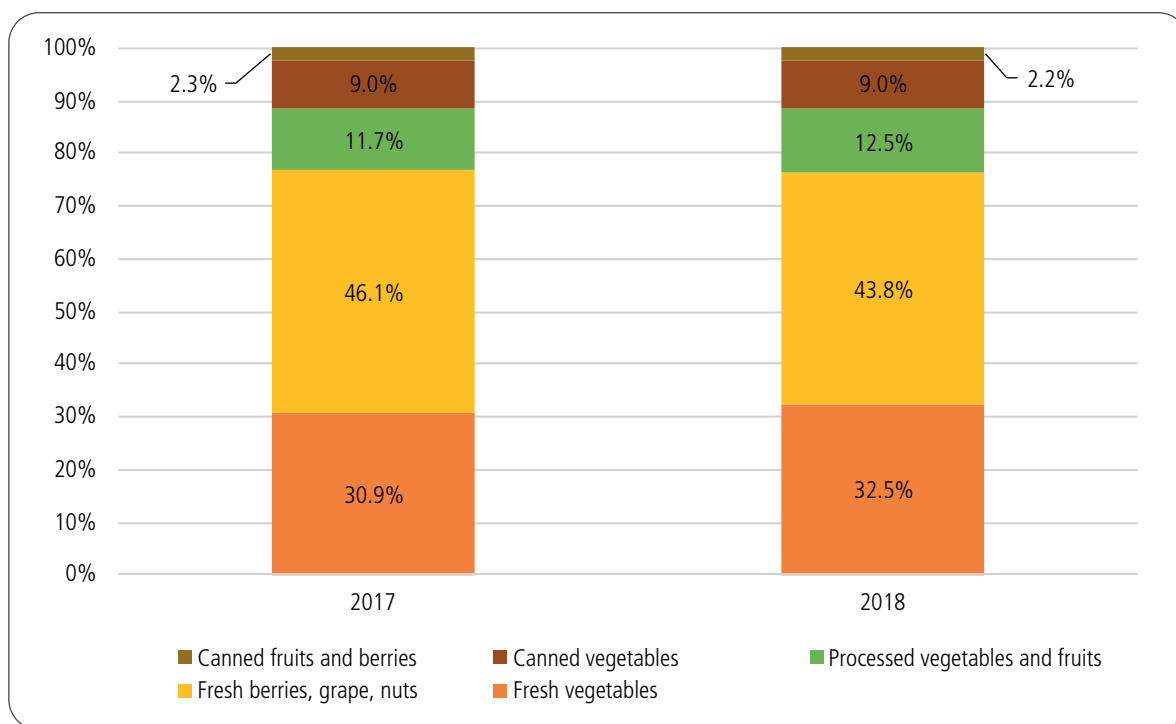
In the first half of 2019, the share of fresh meat and poultry in the supply of meat and meat products decreased to 40.5 percent. These changes are not considered seasonal because in the first half of 2018, the share was at 49.1 percent. The amount of money spent on fresh meat and poultry in the first half of 2019 was UAH 75.4 billion, which is UAH 0.1 billion higher than in the first half of 2018. Meanwhile, the cost of meat products supplied in the first half of 2019 was UAH 3.3 billion higher than in the first half of 2018 (Government of Ukraine, 2020). Therefore, the structure of meat and meat products market shows negative dynamics as the share of the processed goods increases. However, the positions of domestically produced goods remain strong.

The share of domestically produced goods in the milk and dairy products market is lower than in meat and meat products. The share of domestically produced milk and dairy products was 91.3 percent in 2017 and 90.8 percent in 2018. The share of imported goods of rennet, processed and sour milk cheese is relatively high, making up 16.3 percent of the market in 2018. The share of milk and dairy products in the market decreased from 53.03 percent in 2017 to 49.5 percent in the first half of 2019. The share of rennet, processed and sour milk cheese increased from 35.0 percent in 2017 to 38.2 percent in first half of 2019. The share of butter and other dairy spreads fluctuates insignificantly (Government of Ukraine, 2020).

The consumption of fish and fish products per capita decreased from 13.4 kg per person per year in 2017 to 11.9 kg per person per year in 2018. Traditionally, the share of domestically produced goods is low in this particular market. The share of fish and seafood in fish and fish products market increased in 2018 and reached 65.1 percent, while the share of canned fish and seafood and semi-prepared products decreased to 34.9 percent.

The consumption of vegetables in Ukraine fluctuated insignificantly during 2014–2018. In 2018, vegetable consumption reached 163.9 kg per person, and fruit consumption reached 57.8 kg per person, a 10.5 percent increase in comparison to 2014. The supply of fruits and vegetables increased in 2018 to 32.5 percent due to an increase in the supply of non-starchy fruits. The share of potatoes in the fresh vegetable supply decreased from 12.9 percent in 2017 to 11.7 percent in 2018. The share of fresh fruits, berries and nuts decreased from 46.1 percent in 2017 to 43.8 percent in 2018, while the share of canned vegetables, fruits and berries has not changed (7).

Figure 7-7. Market structure of fruits and vegetables in Ukraine, 2017–2018



Source: The Government of Ukraine. 2021. Statistical Information. The State Statistics Committee of Ukraine. www.ukstat.gov.ua

Significant changes in the supply of fruits and vegetables were observed in the first half of 2019. The share of fresh vegetables increased from 33.6 percent to 55.9 percent. During the first half of 2019, the share of fresh berries, grapes and nuts decreased from 44.7 percent to 25.0 percent, and the share of canned fruits and vegetables declined from 21.8 percent to 19.1 percent during the same period. However, the price trends are the opposite of the demand trends; prices for fresh vegetables were 41 percent higher in first half of 2019 than in the same period in 2018, and for fresh fruits prices were 17.2 percent lower between the first half of 2018 and the first half of 2019. These positive trends are not long-term and were caused by climatic factors, as well as a shift in agricultural production and international trade.

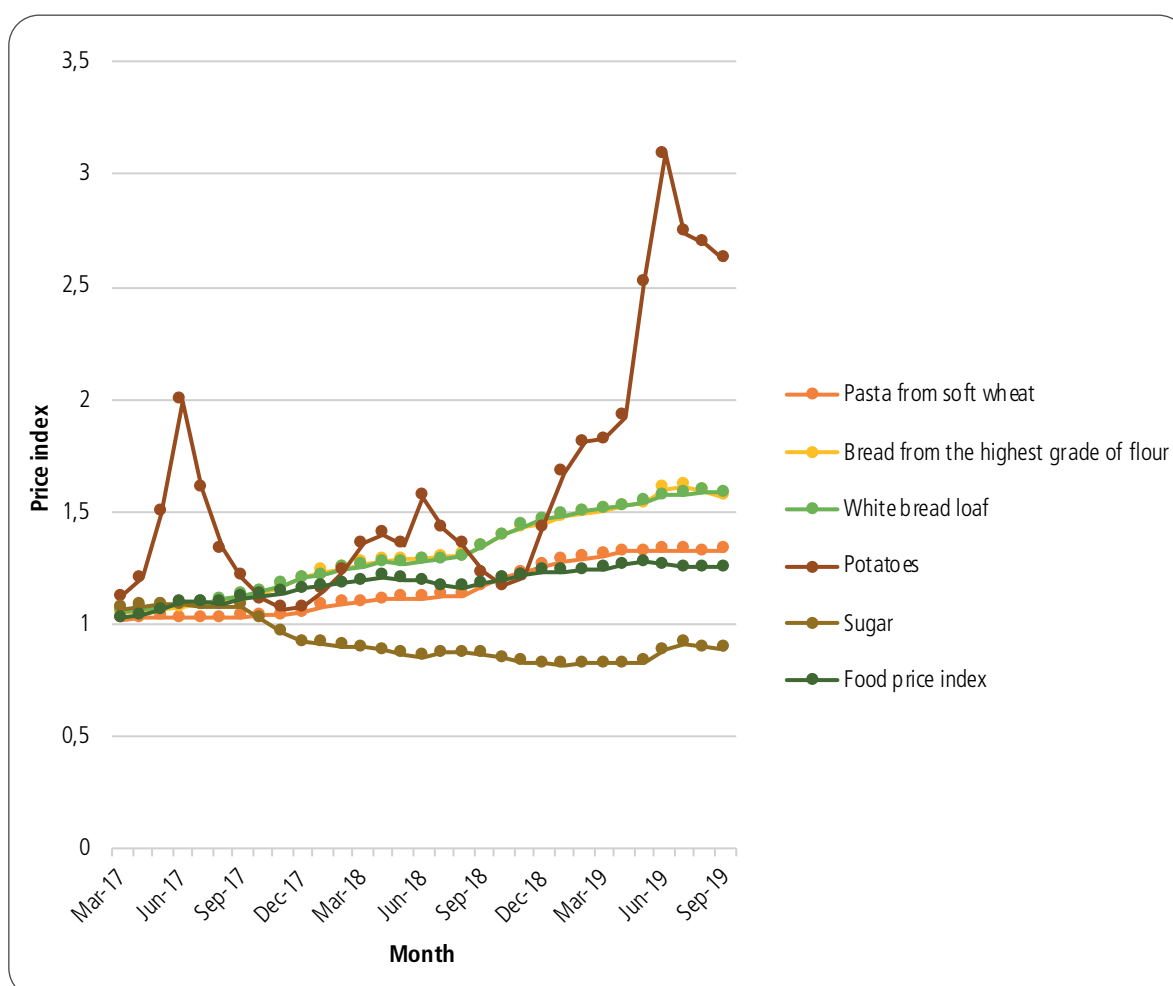
The share of domestically produced goods in the bread, macaroni products and flour confectionery market did not change significantly between 2017 and 2018. Bread and flour confectionery maintained

relatively stable levels, at 97.4 percent and 93.5 percent, respectively. The share of domestically produced macaroni products declined from 74.9 percent in 2017 to 72.9 percent in 2018. The share of domestically produced eggs in the egg market increased during slightly from 2017 to 2018, reaching 99.2 percent. In the first half of 2019, the volume of trade in eggs declined by 9.8 percent compared to the same period in 2018. The share of domestically produced sugar confectionery was 85.1 percent in 2018, and the volume of trade in sugar confectionery in the first half of 2019 increased by 25.1 percent compared to the first half of 2018 (Government of Ukraine, 2020).

Food price trends

From 2017 to 2019, prices for food high in simple carbs, sugar and starchy foods in Ukraine mostly increased – and more significantly than the average food price index, except for prices for sugar (see **Figure 7-8**).

Figure 7-8. Price indexes for foods high in sugar, simple carbs, and starchy foods, 2017–2019

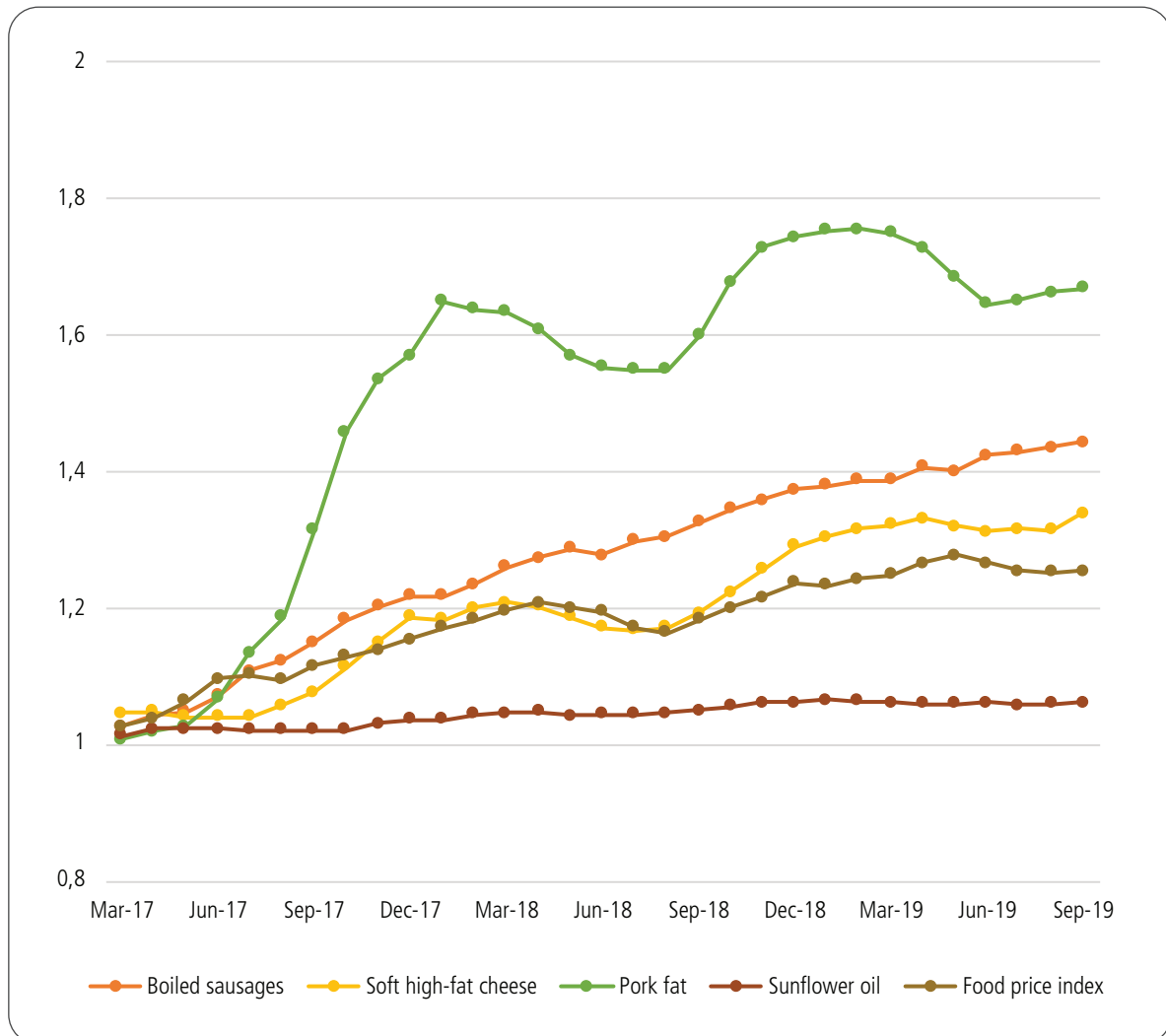


Source: The Government of Ukraine. 2021. Statistical Information. The State Statistics Committee of Ukraine. www.ukstat.gov.ua

The comparison of average food price indexes and price trends of foods high in fat and salt (**Figure 7-8**) demonstrate that most of these foods became less affordable, except for sugar and sunflower oil. However, regional differences in prices are significant, and although prices for foods high in salt, fat

and sugar are generally lower in the western and southern regions, there is no correlation between the average level of income per region and price trends. Thus, the question of affordability remains open and should be discussed within a regional context.

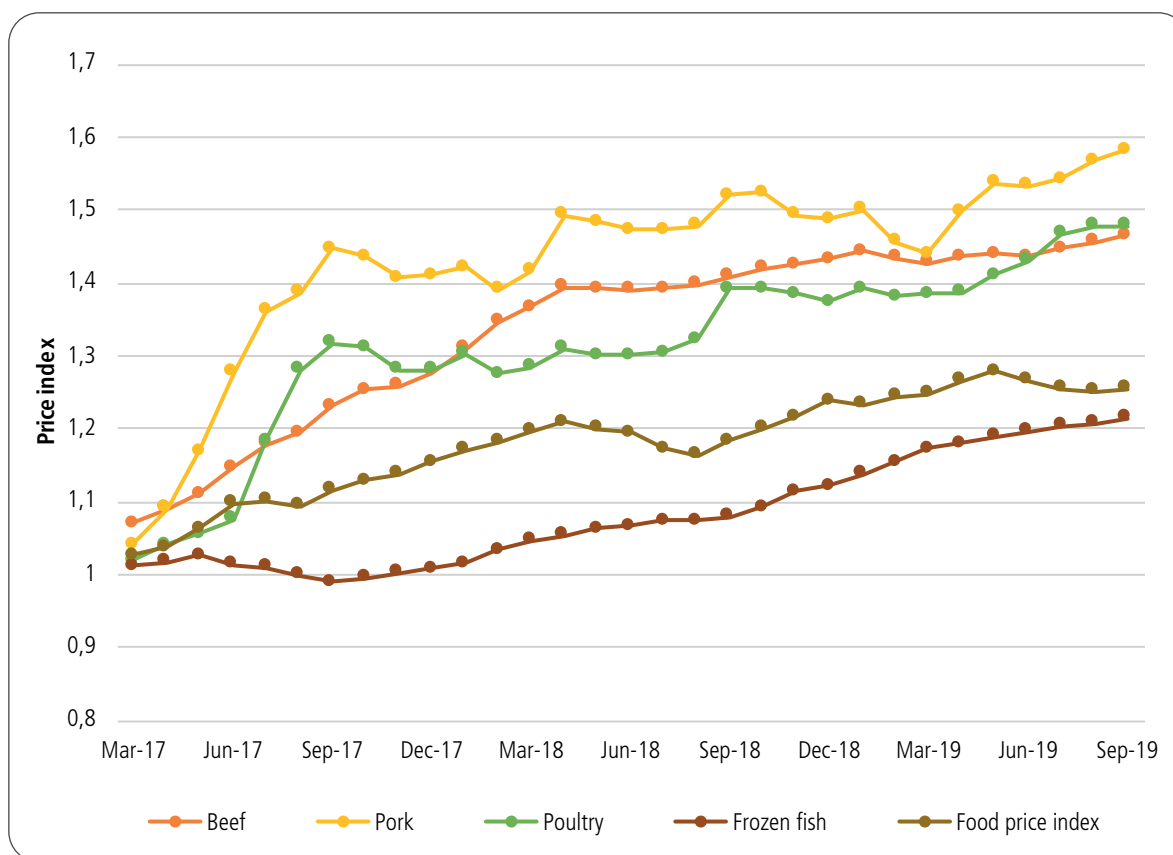
Figure 7-9. Prices for food high in fat or salt, 2017–2019



Source: The Government of Ukraine. 2021. Statistical Information. The State Statistics Committee of Ukraine. www.ukstat.gov.ua

Market prices for meat increased from 2017 to 2019 more rapidly than did the average food price index, with the price for pork having the highest increase, rising 58 percent between March 2017 and September 2019. In the same period, the prices of beef and poultry increased by 46.5 percent and 47.8 percent, respectively. (10). The growth of prices for frozen fish was less significant than average food price index growth, but the share of fish in daily consumption of the Ukrainian population is much lower than the share of meat; therefore, it can be ascertained that foods high in animal protein became less affordable over the course of the past three years. Price changes for fresh and frozen fish do not have a significant impact on the consumption of fish, as affordability in this category is historically low and more complex mechanisms are required to increase food consumption, such as increasing accessibility to locally sourced fish, support for domestic fish producers, and research and development in the sector.

Figure 7-10. Price indexes for meat and fish, 2017–2019



Source: The Government of Ukraine. 2021. Statistical Information. The State Statistics Committee of Ukraine. www.ukstat.gov.ua

Seasonal fluctuations were observed for fruit and vegetable prices, but they are still growing faster than the average food price index. The prices of apples increased by 40 percent from March 2017 to September 2019, while the price of carrots increased by 76 percent and the price of cabbage by 95 percent. There are no structured regional differences in the prices of vegetables and fruits, as seasonal fluctuations are not simultaneous in different regions. However, prices of majority of vegetables are higher in the Zakarpattya, Kyiv and Donetsk regions. Overall, fruits and vegetables became less affordable between 2017 and 2019 in Ukraine (Government of Ukraine, 2020).

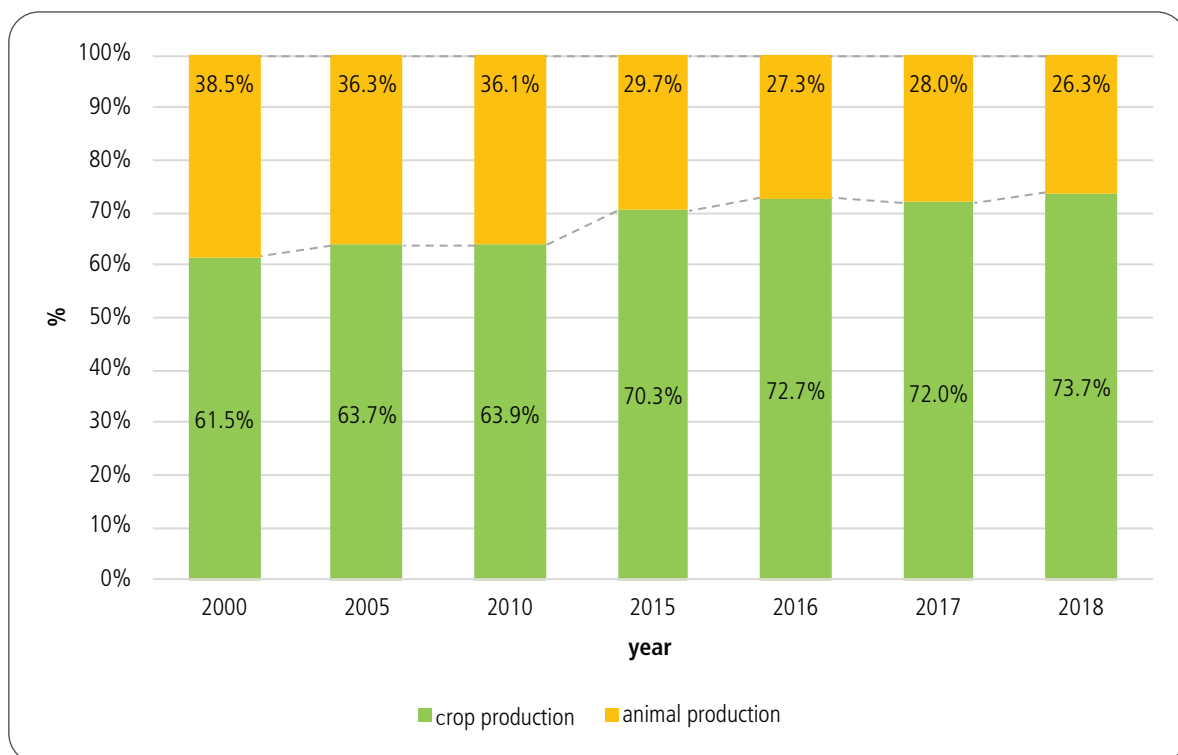
Agricultural and food production systems structure and changes

Structural changes

The total area of agricultural land in Ukraine as of 1 January 2019 was 41.3 million ha, including 32.7 million ha of arable land. The state owned 10.4 million ha of agricultural land, which constitutes 25 percent of all agricultural land in Ukraine. Decree of Government of Ukraine No.60-r of 31 January 2018 initiated the process of transferring state agricultural land outside limits of settlements to communal property of the united territorial communities. As of October 2019, 883 united territorial communities had been created in Ukraine.

The industrial structure of agriculture in Ukraine is characterized by the disproportion between crop and livestock production. In 2018, the share of crop production in agricultural output was 73.7 percent, compared to 61.5 percent in 2000. The share of animal production decreased from 28.8 percent in 2000 to 26.3 percent in 2018 (Figure 7-11).

Figure 7-11. Crop and animal production (in 2010 prices; percentage to total) in Ukraine, 2000–2018

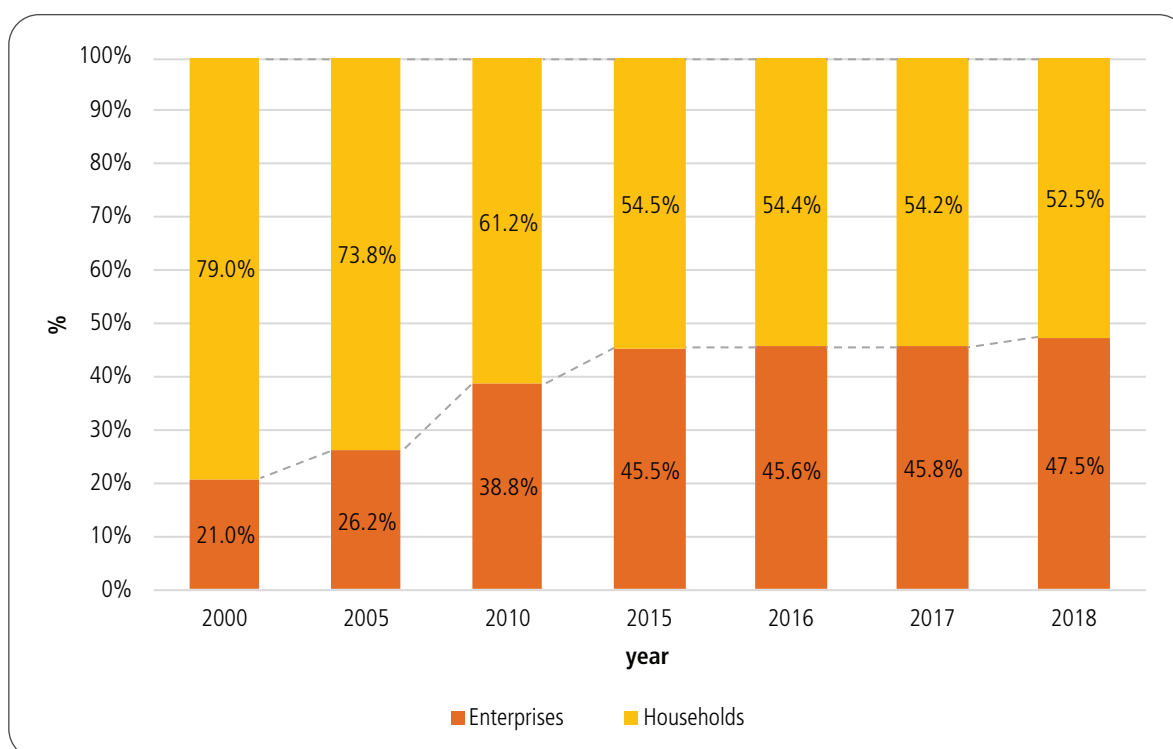


Source: The Government of Ukraine. 2021. Statistical Information. The State Statistics Committee of Ukraine. www.ukstat.gov.ua

A significant share of goods is still produced in rural households; however, this share is decreasing. According to Ukrainian legislation, rural households can produce and sell goods without registering as a farm or enterprise. Obviously, the quality and safety of food produced and the level of technology are compromised in rural households in comparison with farms and enterprises; therefore, agricultural support policy incorporates mechanisms targeted at switching production to farms and enterprises.

In 2000, household production accounted for 61.8 percent of all agricultural production (in actual prices), while in 2018, it accounted for just 37.2 percent. To incorporate household producers into the agricultural sector more effectively, ensure the safety of food processing and the quality of produced goods, and provide social guarantees to rural populations, the Government of Ukraine is taking steps to transform household producers into family farms. In 2010, households produced 79 percent of all livestock production in Ukraine; this declined to 52.5 percent in 2018 (Figure 7-12). In 2018, 65.9 percent of all livestock were kept by household producers, including 75.6 percent of cows, 43.6 percent of pigs, 85.6 percent of sheep and goats, and 43.9 percent of poultry. In the same year, households produced 72.6 percent of milk, 34.9 percent of meat (in slaughter weight) and 44.8 percent of eggs.

Figure 7-12. Livestock production by type of agricultural holdings (in 2010 prices; percentage of total livestock production) in Ukraine, 2000–2018



Source: The Government of Ukraine. 2021. Statistical Information. The State Statistics Committee of Ukraine. www.ukstat.gov.ua

Policies and drivers for change

Section 2 of the Law of Ukraine No.1877-IV “On the State Support for Agriculture in Ukraine,” the most recent version from 15 August 2018, named “State regulation of prices of certain types of agricultural good and Agricultural Fund,” allows the state to execute regulation on wholesale prices by means of establishing minimum and maximum intervention prices (Government of Ukraine, 2018). The law emphasizes that the state does not execute price regulation outside organized agricultural market (stock trading).

The Budget Code of Ukraine states that some of the funds allocated for the support of agriculture should be spent on the purchase of agricultural equipment and machinery from local producers (from 10 percent in 2017 to 20 percent in 2020). In 2019, partial compensation of special hopper cars for the transportation of grain, as well as equipment for the production of bioethanol and electricity

from biomass, were included in this initiative. The budget programme for stock breeding support was implemented in 2017. This programme provides partial compensation of the cost of building and reconstructing livestock farms and complexes, partial reimbursement of breeding animals purchased for further reproduction, and partial compensation for building and reconstructing facilities for grain storage and processing.

The budget programme to support private farmers launched in 2018, providing partial compensation for locally produced agricultural crops, including seeds, agricultural consulting services and locally produced agricultural equipment and machinery, etc. The programme also provides support mechanisms for agricultural service cooperatives.

Food processing and marketing structure changes

Structural changes

The Decree of the Cabinet of Ministers of Ukraine No.394 dated 7 June 2017 cancelled the state regulation of retail food prices starting from 1 July 2017. The state regulation of food prices was executed according to decrees of the government from 1996 and 2007, which prohibited trade margins above 15 percent for socially significant food products (flour, bread, locally produced macaroni products, cereals, sugar, beef, pork with bones, poultry in carcasses, sausages, milk with 2.5 percent milk fat, sour milk with 20 percent milk fat, butter with 72 percent milk fat, cottage cheese with 9 percent milk fat, eggs and sunflower oil).

Policies and drivers for change

The Decree of the Cabinet of Ministers of Ukraine No. 980 "Some Issues of Defining Medium-Term Priority Areas of Industry-Level Innovation Activity for 2017-2021," adopted on 18 October 2017, defines core directions of research and development in agriculture. The decree provides measures for the development and implementation of technologies for production, storage and processing of high-quality crops, including the creation of energy-saving, resource-saving technologies for growing crops with elements of precision farming. In addition, there are measures for adaptive energy-saving green technologies for growing vegetables and for the development of technologies for cultivating and processing bioenergy crops and rice. These steps could have positive effects on the affordability of food products for the population. However, few of these measures influence the quality of food. State support for research and development in agriculture is constantly increasing in absolute value; however, its share in total agriculture support is declining. In 2016, this share was equal to 4.5 percent, while in 2019, it was 0.7 percent.

In 2011, there was an attempt to make biofortification a permanent direction of research and development in agriculture. The projects were under development from 2012 to 2016 and were approved but never implemented.

Organic agriculture and agroecology

The organic agriculture sector in Ukraine is growing dynamically. In 2017, 304 organic agricultural producers used 289 000 ha of arable area, or 0.7 percent of total agricultural lands in Ukraine, for organic production (International federation of organic agriculture movements and Forschungsinstitut für biologischen Landbau, 2019). Organic agriculture in Ukraine is export-oriented, with organic products being exported to more than 40 countries, mainly European Union Member States. The list of top exported organic goods includes sunflower seeds, soybeans, grains, feeding crops high in protein, processed fruits and berries as ingredients of food products, walnuts, medicinal herbs, aromatic plants and honey.

The domestic demand for organic products in Ukraine is expanding through major supermarket chains, which are gradually developing an attractive image of organic product lines. The organic food price margin is much higher than with non-organic goods. The demand for organic products in Ukraine is

limited by purchasing power; in 2017, it was estimated to be EUR 29.4 million, meaning that the average yearly consumption per capita was EUR 0.68 (Ministry for the Development of Economy, Trade and Agriculture of Ukraine, 2020).

The Law of Ukraine No. 2496-VIII “On basic principles and requirements to organic production, circulation and labelling of organic goods,” adopted on 10 July 2018 and enforced on 2 August 2018, determined the main principles and requirements for organic production, trade and labelling of organic goods, framework for legal regulation of organic production, circulation of organic goods, functioning of the market of organic products, legal basis for activity of the central bodies of executive authority, agents of the organic goods market, and directions of the state policy in the above-mentioned spheres (Government of Ukraine, 2018).

Food safety policies

After WTO accession in 2008, reforms were implemented of technical regulations systems and distribution of responsibilities in the food safety sphere between controlling and monitoring institutions. After the Association Agreement between Ukraine and the European Union was signed, the speed of reforms in food safety and product quality control increased.

A large-scale reform of Ukraine’s sanitary and phytosanitary legislation began in 2015 in order to harmonize it with European Union regulations. A new version of the Law of Ukraine “On Food Safety and Quality” No. 771/97-BP of 23 December 1997, named “On Basic Principles and Requirements for Food Safety and Quality,” was adopted (Government of Ukraine, 1997). The new version was based on European Union regulations and requirements for food safety, and the updated version entered into force on 20 September 2015. The provisions of the new law put the core responsibilities for safe production of foods on manufacturers and introduced requirements for the development, implementation and application of permanent procedures based on the principles of the Hazard Analysis and Critical Control Point (HACCP) system. Market operators are required to implement traceability systems that ensure the availability of information both one step backwards and one step forward at any point in the supply chain.

The new version of the law abolished the requirement for importers to receive hygiene certificates for the import of food and raw materials for processing (Article 53 of the Law). Animal products were exempted from this. From 20 September 2015 onwards, the import of such products must be accompanied by an international certificate or other document issued by the competent authority from the country of origin. Imports of meat and meat products are also executed based on the international veterinary certificate or other relevant document issued by the competent authority from the country of origin. Due to deregulation, the requirements for obtaining the importer’s veterinary authorization to import meat, meat products and live animals were abolished (Government of Ukraine, 1997).

On 24 February 2016, the Government of Ukraine approved the Strategy for Implementation of Legislation in the Sphere of Sanitary and Phytosanitary Measures, which contains a step-by-step plan for the preparation and implementation of basic European Union legislation in the fields of food safety, food labelling and information, measures for products of animal origin, animal health, animal identification and registration, standards of stockbreeding and animal welfare, feed and nutritional supplements, and phytosanitary measures, to be achieved by 2021.

The Law of Ukraine “On Feed Safety and Hygiene” No. 2264-VIII, adopted on 21 December 2017 and enforced on 19 January 2020, defines the legal and organizational basis for ensuring the safety of feed in the process of production, handling and use. It determines requirements for hygiene and the marking and packaging of feed, and it regulates cooperation between market operators and state authorities. The Law of Ukraine No. 2501-VIII “On Amendments to Certain Legislative Acts of Ukraine Concerning the Regulation of Some Phytosanitary Procedures,” adopted on 10 July 2018, allows for the conducting of phytosanitary examination with the purpose of commodity export by private phytosanitary laboratories.

Policies to promote production diversification

In 2016, the Ministry of Agrarian Policy and Food of Ukraine put the development of niche crops on the list of its priority activities. The programme for private farms support provides financial assistance to agricultural service cooperatives for producers of fruits, berries and vegetables. Funding also is available for the harvest and processing of honey and honey by-products, berries, mushrooms and live plants. The programme aids in the purchasing of locally produced equipment for the production, harvesting, storage, processing, quality determination, sorting and packaging of agricultural products, and transportation vehicles. There are additional resources for farmers involved with hops, vineyards, new fruit and berry orchards. Farmers engaged in horticulture can receive interest-free loans from the Ukrainian State Farm Support Fund.

Between 2014 and 2019, the Ministry of Agrarian Policy and Food of Ukraine actively cooperated with international organizations to assist small and medium-scaled agricultural businesses in the cultivation and export of niche crops. In the framework of the joint FAO–EBRD project “Improving access of Ukrainian agribusiness to export markets,” a detailed study of the potential of the fruit and vegetable sectors was conducted, and the top ten niche crops for export were identified. These crops included vegetables, fruits and berries – in particular, yams, asparagus, pumpkins, red and black currants, wild cherries, pears, bell peppers, Napa cabbage, cauliflower and broccoli. As part of the FAO project “Technical Assistance to the Ministry of Agrarian Policy and Food of Ukraine in the Policy of Supporting Agriculture, Export of Horticultural Products and Land Consolidation,” manuals on the export of fresh and frozen fruits and berries to the European Union were developed. Assistance to Ukrainian producers in the cultivation of niche crops is provided by the IFC “Agrarian Receipts in Ukraine” Project, the EU4Business European Union Initiatives, and other international donors.

The product diversification policy is implemented in the livestock sector. Since 2019, the state budget support programme for animal husbandry finances, most notably, partial compensation of the interest rate on bank loans with costs related to the activities of sheep and goat breeding, beekeeping, animal husbandry, rabbit breeding, sericulture and aquaculture.

Policies to support fruit and vegetables, fish, dairy products, etc.

Several budget programmes for Ukrainian agriculture are aimed directly at supporting the producers of vegetables, fruits, fish and dairy products. In 2017, a new programme of financial support for agricultural producers was launched in the State Budget of Ukraine, with an allocation of UAH 4.77 billion (USD 170.97 million) for its implementation. According to the Decree of the Cabinet of Ministers of Ukraine on 8 February 2017, the allocated funds should be used for subsidies for the development of agricultural producers and partial compensation of the cost of domestically produced agricultural equipment.

Chapter VI “State support for producers of certain types of agricultural products,” which aids agricultural producers for the development of agriculture in the form of budget subsidies in the period from 2017 to 2022, was annexed to the Law No. 1877-IV. The budget subsidy is transferred to the registered producers monthly in proportion to the amount of VAT paid by the producers, within the limits of the monthly payments. Producers of vegetables, grapes, fruits, berries and livestock goods have a right to receive a budget subsidy in accordance with Article 161, paragraph 16-1.3 of the act.

In 2017, for the first time after a three-year hiatus, the state programme for establishing and growing orchards, vineyards and berry plantations was renewed. In 2019, farmers and household producers were able to compensate with the mechanisms of this programme up to 80 percent of the cost spent on planting material for fruits, berries, grapes and hops. In addition, compensation was provided for the construction of refrigerators with a regulated gas environment with a capacity above 500 tonnes, facilities for freezing fruit and berry products, the purchase of lines for the commercial processing of fruits, and equipment for the freeze-drying of fruits.

Since 2018, the livestock support programme has become the priority state programme with the largest amount of funding. The programme provides funding for partial reimbursement of costs relating to the construction and reconstruction of livestock farms and complexes, special subsidies for milk cows, meat cows and milk-meat cows, special budget transfer for the growing of young cattle to certain age, and partial reimbursement of the value of the animals purchased for further reproduction. In 2019, both farmers and household producers were entitled to a subsidy of UAH 1 500 per cow. In 2020, this subsidy was temporarily cancelled (Ministry for the Development of Economy, Trade and Agriculture of Ukraine, 2018). Support of fisheries was introduced in 2019 in the form of partial compensation for the interest rate on bank loans initiated to cover the costs associated with aquaculture activities. The private farm support programmes also provide financial support for agricultural service cooperatives for dairy, meat, fruit, berry and vegetable producers and cooperatives for the production and processing of beekeeping, berries, mushrooms and plants.

Food labelling/information

The Law of Ukraine No. 2639-VIII “On information about food for consumers,” adopted on 6 December 2018, provides requirements for nutrition labelling and information required on food packaging, which serves as the basis for advertising legislation. This law incorporates European Union regulations on food labelling, as is required by Chapter IV (Sanitary and Phytosanitary Measures) of Section IV, Trade and Trade-Related Matters, of the Association Agreement between Ukraine and the European Union. According to provisions of the law, mandatory nutritional information on foodstuffs should include information on energy value and the content of fats, saturated fats, carbohydrates, sugars, proteins and salt. In order to avoid misleading information, additional voluntary information should not be unclear or confusing for the consumer and, when appropriate, should be based on relevant scientific data. The word “natural” should be used only according to the strict requirements of the law. Although the law is based on the European Union regulations and provides mechanisms for the state to control nutrition labelling, there is currently no information on how labelling has impacted the market or the health of the Ukrainian population, as the law was implemented in 2019.

Consumer demand, awareness, education and social protection

Public information campaigns

At the end of 2017, the Ministry of Health of Ukraine, together with the Centre for Public Health and nutrition experts, presented national recommendations on healthy nutrition and identified the most important food categories to be included in the daily diet (Ministry of Health of Ukraine, 2017). The first recommendations on healthy nutrition in Ukrainian history, in the form of a healthy nutrition plate, have become the basis for a national pro-healthy lifestyle information platform.³³ It was developed in cooperation with health authorities and the Danone group. The platform provides the following information: (1) analysis of the nutrition levels of adults and children in Ukraine; (2) salt, sugar and fat consumption and its impact; (3) information on diet-related diseases; (4) recommendations on meal schedules and nutrition value; (5) recommendations for healthy food choices and information on how to better understand nutrition labelling; and (6) healthy recipes. In 2019, the Ukrainian Ministry of Health launched an information campaign called “To school” that provides information about the acceptable levels of nutrition for children.

Nutrition education (formal and informal)

Basic nutrition education for school-age kids is a part of the course “Fundamentals of Health”. For elementary school students, the nutrition curriculum “Alphabet of nutrition” was developed through a Nestlé initiative in Ukraine. The main purpose of the programme is to teach children about the principles of proper nutrition and to cultivate habits that act upon these principles. NGOs and food companies participate in the development and implementation of local nutrition education programmes. Nutrition education for adults is in the form of a free online course on the national education platform.³⁴ This is the main educational resource on this topic.

Policies changing the market environment

The main policy aimed at changing the market environment was food price regulation mechanisms at national and regional levels between 2000 and 2017. In 2016, following the discussion on the low efficiency of price interventions, a pilot project abolishing price regulations was implemented. Data were collected and analyzed. As a result, on 7 June 2017, the Cabinet of Ministers of Ukraine abolished government regulation of prices for food and services in the markets (Government of Ukraine, 2017b). Currently, there are no price regulations applied to the food market and trade services, and support of agricultural production is the main instrument to ensure the affordability of food to the population. Abolishing the price regulation instruments had a positive impact on agriculture in general, and as a result, on food quality, diversity and affordability.

³³ This platform is available at <http://www.prozdorove.com.ua/>.

³⁴ This platform is available at <https://prometheus.org.ua/>.

Food assistance programmes

An average household spends about 42.5 percent of its total income on food, beverages and eating out. For households that fall below the average per capita income, this amount is higher, reaching almost 48 percent (Government of Ukraine, 2020). There are no food assistance programmes implemented by state or local authorities. The Law of Ukraine No. 1768-III “On State Social Assistance to Low-Income Families,” adopted on 1 June 2000, provides that low-income families are entitled only to direct payments, while all in-kind assistance is no longer provided (Government of Ukraine, 2000). The arguments behind this decision included inefficiency of food assistance programmes, corruption at all levels, and complicated bureaucratic procedures for recipients.

School food programmes

The goal of the school food programme in Ukraine is to provide each public school student with at least one fresh, hot meal during the school day. In some local communities, these hot meals are partially or completely paid for from local budgets. The menu is based on the approved nutrition requirements for students of different ages. However, students have access to snack bars and vending machines with food high in sugar, salt and fats. The list of food allowed in schools must be revised according to nutrition requirements, but this process is currently being blocked by food providers.

Nutrition-sensitive social protection programmes

During the past five years, no state nutrition-sensitive social protection programmes have been implemented. However, special nutrition is provided to vulnerable groups by local communities. Food with higher nutritional value is provided to children with special needs, disabled people, elderly people, patients in hospitals, and care facilities of all types.

Conclusions and key messages

Conclusions

1. The food security situation had been improved since 2000, and the rate of undernourished people decreased from 5 percent to below 2.5 percent from 2000 to 2010. However, the rate increased to 3.5 percent in 2017, partially because of military conflict in eastern Ukraine, and worsened recently as a result of ongoing war between Ukraine and the Russian Federation. The country is suffering from various forms of malnutrition. In particular, the rates of overweight and obesity are steadily rising across all demographic groups of the Ukrainian population. There is also a reported increase of Ukrainians with diabetes and other NCDs.
2. The main nutritional problems include high consumption levels of salt, sugar, sugar-based beverages, animal fat and starchy products. This is compounded by low intakes of calcium, iron and other nutrients because of low vegetable, fruit, legume and nut consumption. The consumption of unhealthy food has been declining in the past five years, and the structure of daily calorie intake is improving, as the share of calories coming from protein is increasing.
3. Trade policy in Ukraine is mainly targeted at developing the market of exported agricultural commodities. As the trade data show, food affordability and accessibility are not compromised by the changes in trade regimes. However, continuing to develop the export of commodities could contribute to food quality and investments in research and development of agricultural methods and techniques, resulting in an improved quality of food in the domestic market.
4. The consumption of processed meat products per capita increased between 2018 and 2019 compared to fresh meat. On the contrary, fresh fish and seafood consumption increased in comparison to canned products. The main cause of these shifts in consumption was price trends. The output of vegetable and fruit and, consequently, consumption, are fluctuating given climatic variation, international trade trends and agricultural production shifts. No sustainable changes in vegetable and fruit prices that can improve consumption trends are currently observed.
5. Households in Ukraine produce a significant share of agricultural outputs, and they are mainly targeted at the domestic market. The reorganization of households into family farms and the development of infrastructure to make their production more accessible to consumers will improve both the nutritional intake of the population and the development of rural areas.
6. No market price support policies nor policies changing the market environment are currently in place, including food products for people with special dietary requirements, socially significant goods, and food for vulnerable populations.
7. Research and development policies for agriculture focus mostly on increasing productivity and implementing green technologies for production. These policies do not address issues concerning food quality.
8. Organic agriculture in Ukraine is under development. All necessary regulations have been established; however, the domestic demand remains low due to purchasing power and is not forecasted to grow significantly in the next five years.
9. Policies in the sphere of food safety, labelling, advertising, etc. have been drafted to be harmonious with current European Union regulations, by-laws, and other documents. These policies are in the process of development and adoption.
10. Agriculture sector support is one of the main components of the Ukrainian economic development strategy. Its aim is to increase productivity, profitability, food safety, food diversification, export growth, technology development, and the social and economic development of rural areas. These initiatives indirectly contribute to the affordability, diversity and quality of food.

11. There are no food assistance or nutrition-sensitive social protection programmes implemented by state or local authorities. Local authorities have not been required to finance school food programmes since 2016; thus, in most regions, these programmes are only partially implemented or not implemented at all.

Recommendations

1. Nationwide information campaigns and school educational programmes on healthy eating have contributed to the improvement of the daily diets of Ukrainians. As the influence of information and educational campaigns has been beneficial, these programmes should continue to be implemented and developed to reach large portions of the population, across all demographics. Additionally, it is important to finalize the revision of approved food for schools and other institutions.
2. The share of products, such as fresh meat or sausages, in the meat or meat products market depends on relative prices and price indexes. This situation can be partially attributed to the lack of education on healthy food choices, as consumers consider fresh meat and processed meat to be nutritional substitutes. Policies targeting the affordability of a “good choice from the group” and an information campaign could improve consumers’ choice.
3. There are prevalent issues relating to the accessibility of food produced by households and family farms to the final consumers, including the availability of processing, storage and transportation capacities for farmers and the development of trade infrastructure, which will allow for shortening supply chains. These should be addressed with the purpose of increasing both the share of fresh locally produced foods in daily diets and the economic development of rural areas.
4. The abolishment of market-support policies had positive economic effects; however, policies regarding niche products and products with special nutritional value (including products for people with diabetes, coeliac disease, etc.) should be revisited. Measures aimed at increasing the affordability and accessibility of such products should be developed and implemented.
5. Measures and projects targeted at increasing the quality of food, including biofortification, should be included in research and development policy in agriculture.
6. Food assistance programmes, including nutrition-sensitive social programmes, should aim to increase nutrient intake among vulnerable groups and the overall population.

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Chapter 8

The role of food systems in the transition of diets and the prevention of malnutrition in North Macedonia

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Abstract

This analysis examines the agricultural, food and trade systems in North Macedonia and the links to various forms of malnutrition. Agriculture is a key sector in the economy of North Macedonia, providing employment for a large portion of the population, mostly in rural areas. Productivity shortcomings continue in the sector, which makes addressing rural poverty, food insecurity and malnutrition more challenging. Agricultural development can contribute to poverty reduction, not only in terms of income, but also by stimulating off-farm economic development and offering better employment opportunities in both rural and urban areas. Increased productivity in agriculture can raise farm income and also have an effect on surging food supply, with more affordable food prices. The sectoral policy framework targets competitiveness, food safety and environment concerns but also should INCREASINGLY focus on rural development and structural measures, as well as social protection and risk management. While poverty levels in the country are slowly decreasing, overweight and obesity rates are on the rise. Food availability in the country has increased in recent decades, but limited incomes and unemployment affect food consumption patterns, food processing and marketing channels. Consumer awareness and education regarding food and nutrition continuously need to be addressed. The findings highlighted in this case study can serve as a basis for multistakeholder engagement and intersectoral dialogue.

Keywords: *North Macedonia, agrifood system, poverty, food availability, nutrition*

Introduction and background of malnutrition

- North Macedonia is an upper-middle income country transitioning to a functional and inclusive market economy.
- Agriculture is an important sector in North Macedonia's economy. The agrifood complex accounts for about 12–15 percent of the GDP and 16 percent of employment.
- Poverty levels are slowly but steadily decreasing, with a 21.9 percent at-risk-of-poverty rate in 2018. The young population is most vulnerable to poverty, as well as households of two adults with three or more dependent children.

In North Macedonia, malnutrition and food consumption changes are driven by increasing urbanization, trade liberalization, market integration of food chains, modifications in food culture, and consumer preferences. The roles of agriculture and the rural sector remain unclear largely due to a limited understanding of the impacts of food systems on nutrition. A multisectoral approach is useful for exploring the complexity of these changes. This chapter focuses on data related to agriculture, food systems, trade and trade policies in North Macedonia in order to better understand the role of these factors in diet transitions to curb malnutrition in the country. The methods for research are a literature review based on available and relevant sources on the country's food system, nutrition, health, community economic development, demographics, specific nutritional challenges, education and agriculture. When available, national sources were used along with references to international databases and reports. These findings can support the evidence-based approach for addressing nutrition-related challenges from an agricultural and food systems perspective.

Introduction and background of malnutrition

North Macedonia is an upper-middle-income country (World Bank, 2019). In the past two decades, due to stable economic growth, annual income doubled to USD 6 100 per capita in 2018. North Macedonia is a small and landlocked country, but it has a strategic geographic location, at the crossroads of the Balkan Peninsula. The latest population estimate is 2.08 million, with an average population density of 80.8 inhabitants per sq. km (SSO, 2020).

Following the breakup of the former Yugoslavia, the country has tried to shape its economy using liberal market principles, yet it remains one of Europe's poorest countries. In 2020, North Macedonia joined the North Atlantic Treaty Organization (NATO) and has been a European Union candidate country since 2005. North Macedonia is reliant on the European Union accession process to complete its transition to a well-functioning and inclusive market economy, to strengthen its institutions, and to enhance its infrastructure.

Nevertheless, a few major obstacles continue to pose serious structural challenges, including low productivity, still-weak state institutions, competition issues, investment policy, business regulation, environmental threats, unequal access to economic opportunities, and educational shortcomings limiting the availability of skills to meet evolving demands (World Bank, 2019).

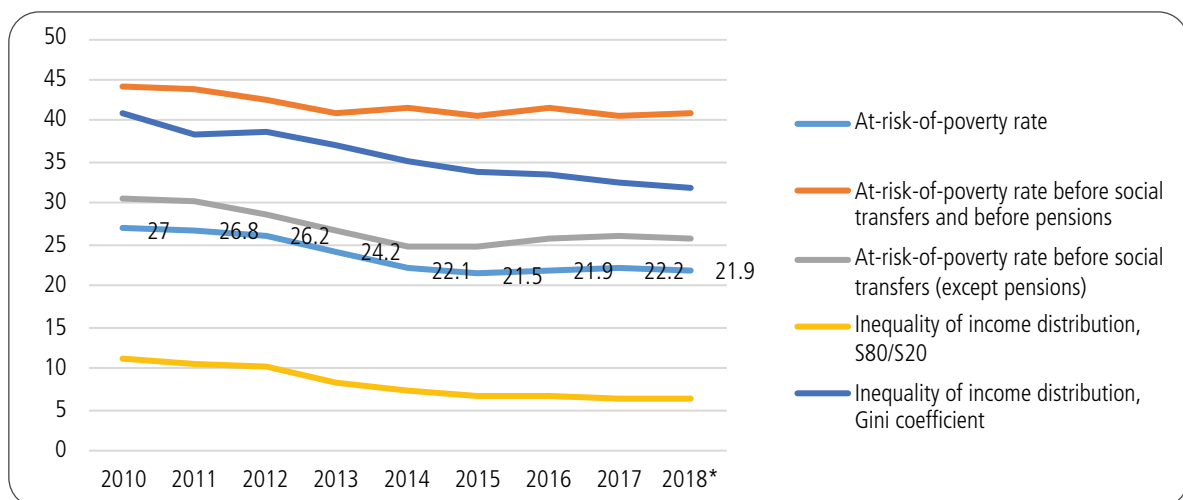
Background of agriculture and poverty in North Macedonia

Agriculture is one of the key sectors of North Macedonia's economy. It is the core activity in rural areas, where half of the country's population lives. The sector contributes to less than one-tenth of the country's economy, with a decreasing trend both in terms of the share and value in the national GDP over the past decade. Coupled with the food industry, the share of the agrifood complex is estimated at 12–15 percent of the national GDP. The share of labour in agriculture, together with forestry and fishery, is around 16 percent, or 120 300 people out of the total 740 600 people employed in the country. That labour engagement in agriculture is greater than the sector's GDP contribution indicates low income and low productivity in the sector.

Modernization and development in the agrifood sector aims to improve conditions in rural areas, contributing to job creation and economic growth. The sector still suffers from inefficient market structures and limited access to knowledge, information, innovations and new technologies. Rural areas in North Macedonia face many structural and socioeconomic challenges. Most of the rural areas are experiencing outmigration, and available resources are often unutilized or underutilized, leading to negative economic, social and environmental consequences. Agriculture remains the core employer in rural areas, as other employment opportunities are very limited.

The poverty situation in the country has seen gradual improvement throughout the years (**Figure 8-1**). The at-risk-of-poverty rate decreased from 27 percent in 2010 to just under 22 percent in 2018 (SSO, 2019). Although poverty levels are subsiding, around 400 000 citizens still suffer from poverty, with scarce incomes and poor living conditions. If social transfers and pensions are excluded from the total household disposable income, the at-risk-of-poverty rate rises to about 44 percent in 2010 and 41 percent in 2018.

Figure 8-1. Poverty and income inequality in North Macedonia, 2010–2018



Source: State Statistical Office of the Republic of North Macedonia. 2020. MakStat database. Skopje, SSO. <http://makstat.stat.gov.mk/PXWeb/pxweb/en/MakStat>

The Gini coefficient, a measure of inequality in income distribution, was estimated at 41 percent in 2010 and 32 percent in 2018, demonstrating the gradual improvement of parity on the concentration of income in the population. This indicates that there is a lower likelihood of food insecurity, as increases in household income are correlated with a reduction in severe food insecurity (FAO, 2019). Undernutrition is also related to income and wealth inequalities. This is made evident through data from North Macedonia, where undernourishment has fallen from 6.1 percent to 3.2 percent between the periods of 2004–2006 and 2016–2018.

The risk of poverty decreases with age, as indicated through the at-risk-of-poverty rate, reflecting the percentage of persons with an equivalized disposable income below the at-risk-of-poverty threshold (Table 8-1). The most vulnerable for poverty are minors, defined as people younger than 17 who are financial dependents. The second most vulnerable group is the working age population, and the least vulnerable is the group of persons 65 and older. There is no significant difference between males and females regarding vulnerability in different age groups.

The poverty rate among the employed population was 8.8 percent in 2018, and the poverty rate among pensioners was 7.9 percent. The highest poverty rates are seen in the unemployed category, considerably higher for the unemployed male population. Unemployment rates in the country are decreasing, from 32.0 percent in 2010 to 20.7 percent in 2018. Unemployment rates are decreasing at a faster pace than poverty rates, indicating that there is insufficient income from employment.

Table 8-1. At-risk-of-poverty rate by gender, age and most frequent activity status in North Macedonia, 2016–2018

	2016			2017			2018*		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
Total	21.9	22.1	21.6	22.2	22.4	22.0	21.9	21.8	22.0
Age 0-17	28.6	29.3	27.8	29.9	30.2	29.6	29.3	28.7	29.8
Age 18-64	21.3	21.3	21.2	21.1	21.0	21.2	21.2	21.0	21.5
Age 65 and older	14.5	14.1	14.9	16.1	17.1	15.4	14.6	15.0	14.3
Employed	9.0	10.7	6.5	9.0	10.8	6.2	8.8	10.6	6.0
Unemployed	41.1	46.2	33.8	38.7	44.0	31.6	41.9	46.5	35.2
Retired	7.1	9.9	2.2	7.7	11.5	1.6	7.9	11.5	2.1
Other inactive population	29.4	27.7	29.8	32.1	33.7	31.7	31.1	30.8	31.2

*preliminary data; **Source:** State Statistical Office of the Republic of North Macedonia. 2020. MakStat database. Skopje, SSO. <http://makstat.stat.gov.mk/PXWeb/pxweb/en/MakStat>

Household structure and size also affect poverty levels. Households comprised of two adults with two dependent children below the poverty threshold accounted for 22.0 percent of the total poverty rate in 2018. The most vulnerable are households composed of two adults with three or more dependent children, accounting for 50.2 percent of the total poverty rate in 2018. Single-person households are the least vulnerable to poverty.

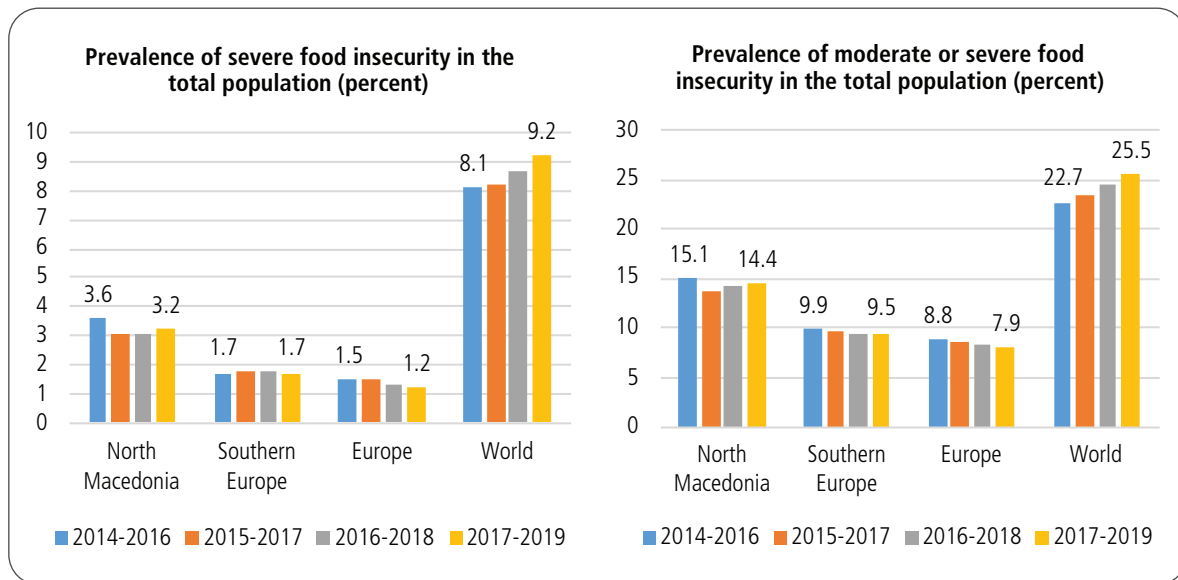
State of food security and nutrition

Eastern European countries, North Macedonia included, have had relatively good performance in reducing poverty in the global comparison framework (Sachs *et al.*, 2020). The Sustainable Development Goals (SDGs), linked to nutrition, food production and food security have improved moderately and remain a significant challenge for the country and the region.

North Macedonia has seen some decline in food insecurity and selected forms of malnutrition. Although the situation is substantially better than the global average, the levels are higher than those in neighbouring countries and across the region. The estimates from 2018 show that 3.1 percent of the country population, or approximately 60 000 people, are experiencing severe forms of food shortages, while 14.4 percent, or around 300 000 people, are concerned with moderate or severe food insecurity.

This means that a significant portion of the population eat diets that lack necessary nutrients or eat a reduced quantity of food (**Figure 8-2**).

Figure 8-2. Prevalence of food insecurity in North Macedonia, selected regions and the world, 2014–2019



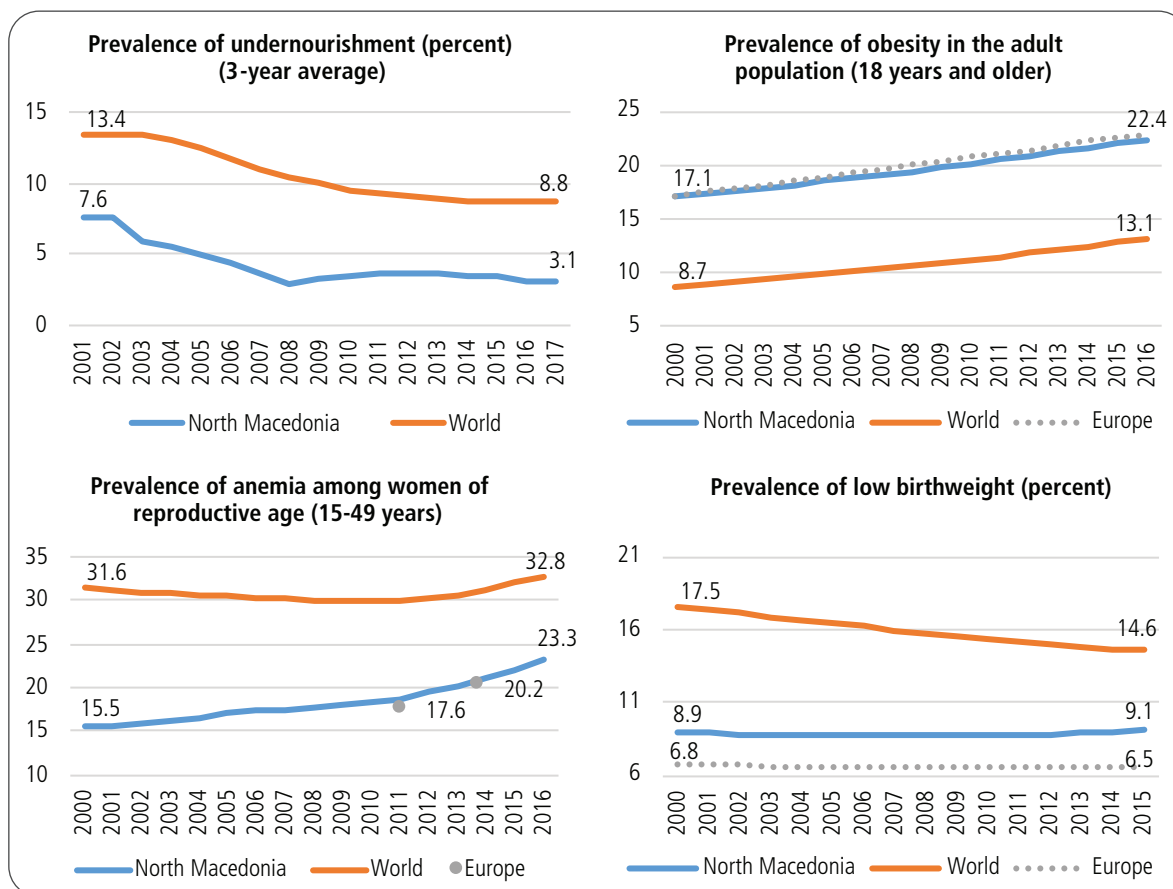
Source: Food and Agriculture Organization of the United Nations. 2020. FAOSTAT statistical database. SDG Indicators. Rome, FAO. <https://www.fao.org/faostat/en/#data/SDGB>

The prevalence of undernourishment has been decreasing over the past two decades and is far below the world average (**Figure 8-3**). While undernourishment is becoming less of an issue, the country has been experiencing other forms of malnutrition, such as increasing obesity rates among children, adolescents, and adults, increasing cases of anaemia among women of reproductive age, and prevalence of low birthweights, in comparison to the European average.

Poor nutrition and limited physical activity are the most important factors contributing to the increased body weight and obesity in North Macedonia. National data show that 62.7 percent of men and 48.4 percent of women older than 18 are overweight, and 19.6 percent and 17.2 percent of them are obese, respectively (IPH, 2017). A national survey found the prevalence of overweight and obesity to be higher in rural women and also to be increasing with age (IPH, 2012). The State Statistical Office estimates the overall obesity rate at 10.5 percent in 2017 (SSO, 2020).

Anaemia is a common health problem and is considered a moderate public health concern in children 6–59 months of age and in women 15–49 years of age in North Macedonia. The prevalence of anaemia in children has shown some decline, with a 25.7 percent prevalence in children in 1999 and 21.8 percent in 2011 (IPH, 2012). This 2011 rate is still higher than the European average. National data show an increase in anaemia from 12.2 percent in 1999 to 19.2 percent in 2011 for women of reproductive age (IPH, 2012), which also is higher than the European average. Although the rates of severe anaemia are low, both mild and moderate anaemia still have negative effects on health. Health specialists in the country estimate that 90 percent of anaemia is due to iron deficiency through poor diet (IPH, 2012).

Figure 8-3. Selected indicators of food security and nutrition in North Macedonia, Europe and the world, 2000–2017



Source: Food and Agriculture Organization of the United Nations. 2020. FAOSTAT statistical database. SDG Indicators. Rome, FAO. <https://www.fao.org/faostat/en/#data/SDGB>

Life expectancy in North Macedonia is 75.95 years, with women having longer life spans (77.9 years) than men (74.0 years). In terms of age structure, the population is growing older. In the period from 2007 to 2017, the share of the young population (0–14 years) decreased from 18.5 percent to 16.5 percent, and the share of elderly population (65 and older) increased from 11.4 percent to 13.7 percent. In 2018, the average age in North Macedonia was 39.2 years – 38.4 years for men and 40.1 years for women (SSO, 2019).

The larger older population, both in North Macedonia and across the globe, has resulted in an increasing number of diseases. North Macedonia saw a 3.2 percent increase in the number of deaths from 2010 to 2018. Circulatory diseases were responsible for approximately 57 percent of all deaths during that same period. Neoplasms accounted for 19 percent of deaths. Endocrine, nutritional and metabolic diseases accounted for 4.4 percent, and respiratory system diseases accounted for 3.9 percent (SSO, 2020). Mortality from heart disease is significantly higher in the population 65 and older than in younger age groups. The most common non-genetically related risk factors for cardiovascular diseases are tobacco use, physical inactivity, unhealthy eating, and alcohol overuse. These activities are leading to four key metabolic/physiological changes: elevated blood pressure, overweight/obesity, elevated blood sugar levels, and elevated cholesterol (IPH, 2018). A recent survey in North Macedonia found that 55 percent of respondents aged 15–64 used tobacco during their lifetime (IPH, 2018).

Transformation of dietary change and food systems

- Food availability in the country has increased from the early 1990s to the present. The availability of most food groups is larger than the world average, but some categories lag behind the regional and European levels (e.g. meat and fish, vegetable fats and oils).
- Food and beverages take up to 40 percent of total household expenditures in North Macedonia.
- Consumption patterns have been shifting. Health and wellness concerns have led to limited consumption of processed foods for a portion of the population, while the trend of convenience or fast food has had the opposite effect.

Trends of food consumption based on the FAO/country food balance sheets

The food balance sheets compiled by FAO are used to assess the national availability of food, providing a valuable insight into food consumption patterns and dietary habits. The typical diet in North Macedonia consists of a wide variety of individual food items from various food groups. The food intake composition is influenced by the availability and affordability of different foods but is heavily influenced by traditional dietary habits and individual preferences.

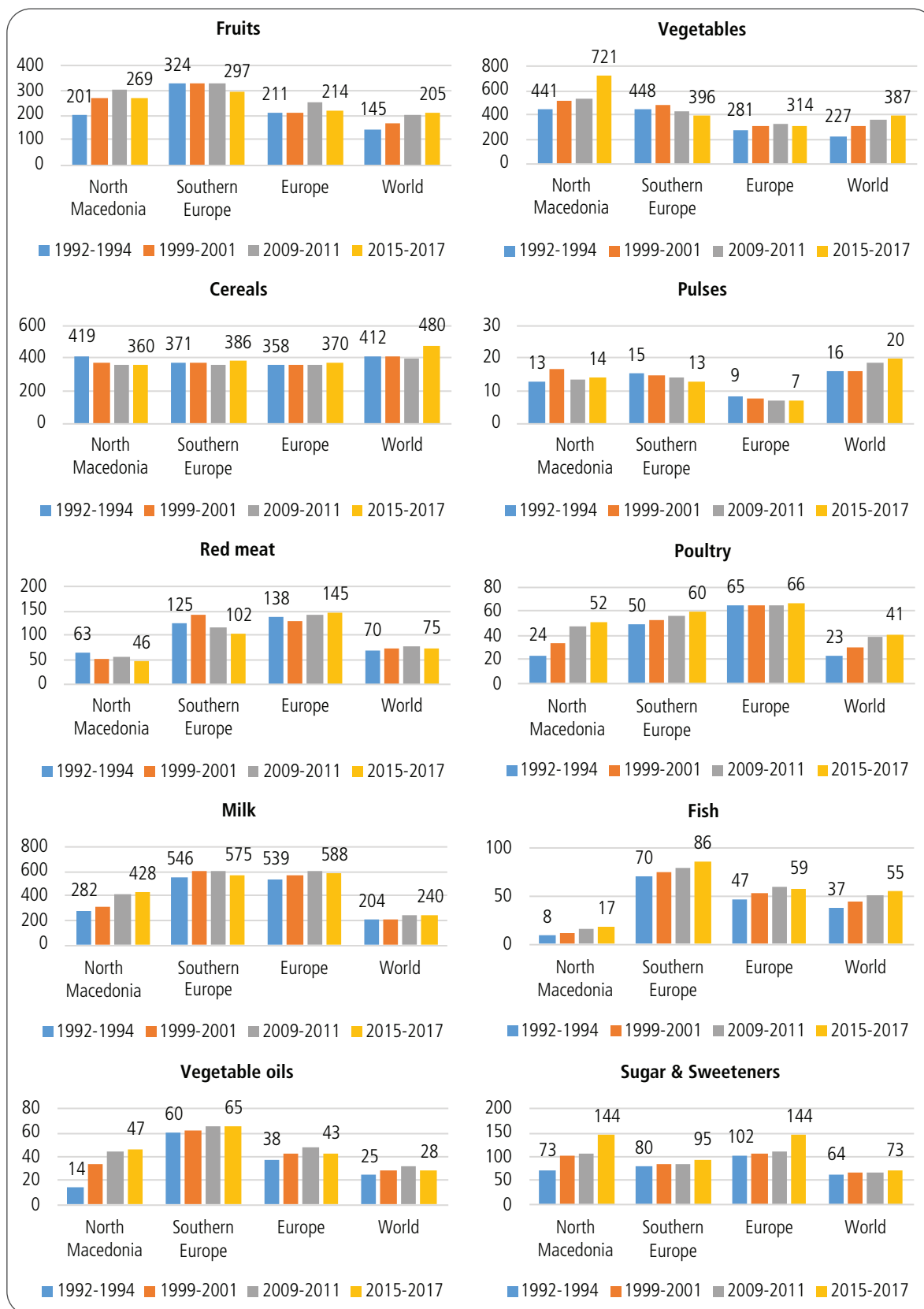
As a country's prosperity grows over time, the daily supply of calories, protein and fat all tend to increase, especially in low to upper-middle income ranges (Roser and Ritchie, 2019). The supply of food in North Macedonia increased from 2 455 to 3 000 kcal per capita per day from 1993 to 2017, though it has stagnated in the past few years (FAO, 2020). Cereals and cereal products contribute the highest share in energy from food, approximately 30 percent, with a slowly declining importance over the past three decades. Vegetable and animal oils make up for that difference, with an increasing share of 10 percent to 18 percent in the calories structure during the same period. Sugar is the third most important source of energy (FAO, 2020).

The changes over the past three decades can be seen through the availability for consumption of the ten prominent food items or subgroups in terms of healthy diets: fruits, vegetables, cereals, pulses, red meat, poultry, milk, fish, vegetable oils, confectioneries and sweeteners. **Figure 8-4** illustrates the average availability levels in grams per capita for the periods 1992–94, 1999–2001, 2009–11 and the latest available new food balance data for 2015–2017. Nevertheless, future analysis should clarify the actual nutrient intake in relation to food availability levels (FAO, 2019).

North Macedonia produces fruits and vegetables, which are an important part of a balanced, nutrient-rich diet. The availability of fruits and vegetables has improved in recent last decades, most notably for vegetables from 2015 to 2017. Fruit and vegetable consumption exceeds the minimum target intake of a combined 500 g per day (MOH, 2014). The availability of both fruits and vegetables surpasses the world average, with fruits lagging behind regional levels and vegetables being significantly more available in comparison to countries in the region.

Cereal availability, according to the FAO's food balance sheets, is on par with the regional average and is somewhat lower than its availability on the global level. The situation with pulses is similar.

Figure 8-4. Availability for consumption of prominent food subgroups in North Macedonia, southern Europe, Europe and the world (g per capita per day), 1992–2017



Source: Food and Agriculture Organization of the United Nations. 2020. FAOSTAT statistical database. Food balances. Rome, FAO. <https://www.fao.org/faostat/en/#data/FBS>

Red meat availability in North Macedonia has gradually decreased. Poultry availability has doubled in the past three decades. The overall meat availability is consistent with regional trends.

North Macedonia's milk availability for human consumption is relatively high and increasing when compared to global availability. North Macedonia still lags behind the countries in the region and the rest of Europe. The current availability levels, assumed to reflect the actual intake, are within the range of the recommended dietary guidelines.

The availability of confectioneries and sweeteners has doubled in the past three decades, reaching the European average. The levels of sugar intake in North Macedonia in the early 1990s are equal to the current world levels.

The share of funds used for food and beverages is around 40 percent of household expenditures in North Macedonia, though this has been slowly decreasing recently. This is significantly higher than the European Union average of 12.2 percent (Eurostat, 2019). It is an indication of the lower parity prices of some food items, but it is mostly an indication of the modest funds available in absolute terms, around USD 7 000 per household/per annum. Eating outside of the house, including restaurants and hotels, ranged around 4 percent of total household expenditures for 2002–2018. Income spent on health services is around 3 percent of total household expenditures (SSO, 2020).

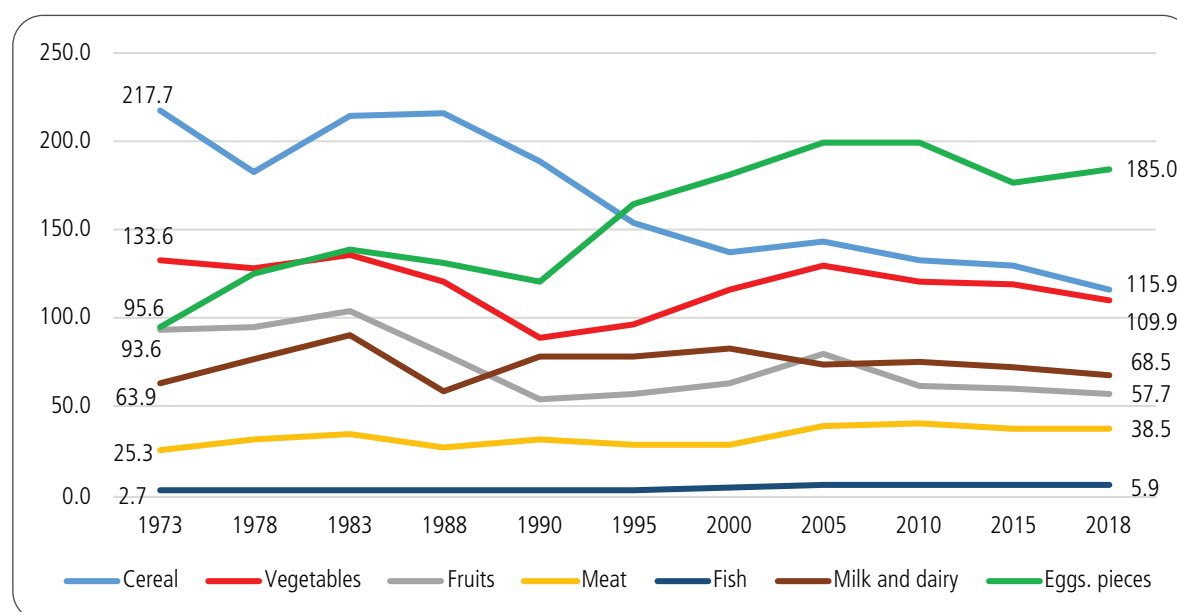
According to the national data on quantity consumed by households, cereals constitute the most-consumed food group, though this number has declined over the past four decades. In 1973, 217.7 kg of cereal were consumed per household member in North Macedonia and in 2018, the average consumption of cereals was 115.9 kg per household member (SSO, 2020). Both vegetable and fruit consumption are declining as well (**Table 8-2** and **Figure 8-5**), which indicates a change in food habits, lifestyle and urbanization. Meat and eggs consumption is rising, which is due to better availability and affordability of these protein sources. Cigarette consumption is slowly declining, which is due to more pronounced health warnings and increased taxes (**Figure 8-6**).

Looking at the composition of meat consumption over the years, fresh meat shows small increases, from 22.2 kg per household member per year in 1973 to 27.4 kg in 2018, but processed meat, which can include canned meat, sausages, salami, and smoked meat products rose almost four times in the last twenty-five years, from 3.1 kg per household member per year in 1973 to 11.1 kg in 2018. Poultry is the most common choice of meat, followed by pork and beef. In the case of milk and dairy, fresh milk consumption is declining from 57.0 litres per household member per year in 1973 to 34.1 litres in 2018, while the inclusion of processed dairy products, such as yogurt, sour milk, and cheese is on the rise (from 7.0 kg per household member per year in 1973 to 34.4 kg in 2018).

Table 8-2. Average consumption of major food and beverages items (kg per household member), North Macedonia

	Three years average			Changes in percent		
	2002-04	2009-11	2016-18	2010/2003	2017/2010	2017/2003
Cereals	158.4	137.4	120.2	86.7	87.5	75.9
Vegetables	133.2	126.9	113.6	95.3	89.5	85.3
Fruits	76.9	66.5	55.9	86.5	84.1	72.7
Meat	40.3	40.8	38.0	101.2	93.0	94.1
<i>Fresh meat and offal</i>	29.6	28.1	27.4	94.8	97.4	92.4
<i>Processed meat</i>	10.7	12.7	10.6	119.0	83.2	99.1
Fish	5.8	5.8	6.1	100.6	104.0	104.6
Milk and dairy	85.2	74.8	69.3	87.8	92.6	81.3
<i>Milk</i>	57.1	41.6	34.9	72.9	83.8	61.1
<i>Dairy products</i>	28.1	33.2	34.4	117.9	103.7	122.3
Eggs, pieces	215.3	196.0	181.0	91.0	92.3	84.1
Fats and oils	22.9	20.0	16.7	87.2	83.5	72.8
Coffee, tea and cocoa	3.6	3.3	3.0	92.6	89.0	82.4
Sugar	25.9	19.6	15.5	75.9	79.1	60.1
Non-alcoholic beverages	69.7	70.8	55.8	101.6	78.7	80.0
Alcoholic beverages	20.0	15.0	12.4	75.0	82.9	62.1
Tobacco	73.0	50.0	39.7	68.5	79.3	54.3

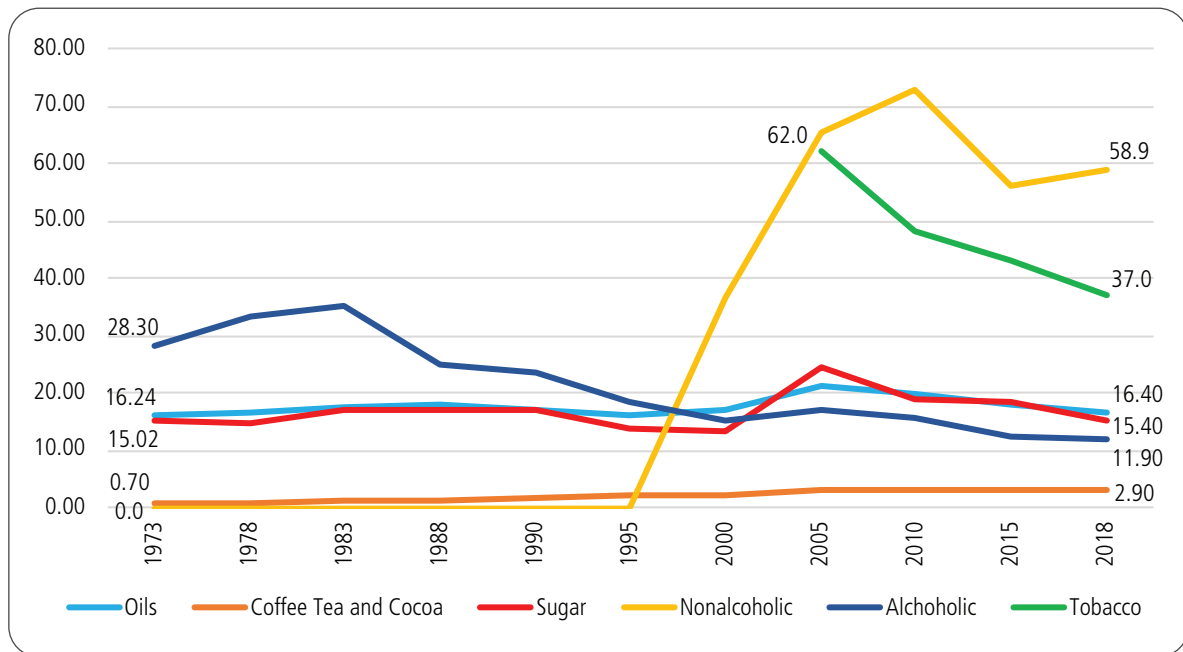
Source: State Statistical Office of the Republic of North Macedonia. 2021. Statistical Yearbook of the Republic of North Macedonia. Skopje, SSO. https://www.stat.gov.mk/PublikaciiPoOblast_en.aspx?id=34&rbrObl=37

Figure 8-5. Per capita food and beverage consumption, major items (kg per household member), North Macedonia, 1973–2018

Source: State Statistical Office of the Republic of North Macedonia. 2021. Statistical Yearbook of the Republic of North Macedonia. Skopje, SSO. https://www.stat.gov.mk/PublikaciiPoOblast_en.aspx?id=34&rbrObl=37

The consumption of oils and sugar remained relatively stable from 1973 to 2017 (Figure 8-6). There is increased consumption of fish, coffee, tea, and cocoa. The consumption of alcoholic beverages is declining, mostly due to the fall in brandy and wine consumption. These figures do not represent alcohol consumption rates in North Macedonia, as brandy and wine are often home produced and not officially registered.

Figure 8-6. Per capita food and beverage consumption of other items (kg per household member), North Macedonia, 1973–2018



Source: State Statistical Office of the Republic of North Macedonia. 2021. Statistical Yearbook of the Republic of North Macedonia. Skopje, SSO. https://www.stat.gov.mk/PublikaciiPoOblast_en.aspx?id=34&rbrObl=37

National data indicate differences in household food consumption among agricultural households, predominantly in rural areas, and non-agricultural households, predominantly in urban areas.³⁵ In the cereals group, the quantities of consumed white bread are higher in non-agricultural households, from 63.7 kg per household member per year in 2016 to 71.6 kg in 2018. The use of flour is declining in both agricultural and non-agricultural households, though the rates of flour use remains more than double in agricultural households than in non-agricultural households. In agricultural households, more vegetables and fruits are consumed than in non-agricultural households. The consumption of poultry meat is similar in both types of households, but pork meat is consumed at a higher rate in agricultural households. Beef, veal and lamb are more expensive than other meat types and have declining rates of consumption in both agricultural and non-agricultural households, with steeper declines in non-agricultural households. Milk consumption is declining in both types of households, and, to some extent, substitutions have been made with yogurt and sour milk, while the traditional white cheese is partially substituted by other kinds of cheese. The consumption of both non-alcoholic and alcoholic beverages is higher in agricultural households, though both households have seen decreases over the past 45 years.

³⁵ The State Statistical Office defines an agricultural household as a household with its own agricultural holding with all its members who are able to work engaged on the holding as agricultural workers. Non-agricultural households are households that do not possess their own agricultural holdings and that have one or more members permanently employed in the public or private sectors or performing certain non-agricultural services, or who are pensioners or receiving income (SSO, 2020).

Gaps and challenges of the dietary changes

In general, consumption patterns are shifting as the availability of most food groups grows. Some traditional habits, such as the home preparation of “winter” preserves, including pepper pastes, mixed vegetables in brine, home-made jams, and fruit preserves are diminishing, due to the lack of time and effort to produce them at home. In parallel, there is increased availability of commercial brands that provide good value-for-money off-the-shelf products all year long. Frozen fruit and vegetables have seen a rapid expansion in the past few years in terms of new products and brands (Euromonitor, 2018).

Limited disposable incomes, high unemployment, and particularly youth unemployment are affecting consumption. The majority of people have low- to middle-level incomes. Pay levels are relatively flat, and real incomes are deteriorating.

Food consumption is shaped by two trends: health and wellness concerns and the emergence of convenience culture. The former has a portion of the population limiting their consumption of processed foods and shifting consumers toward fresh produce. The latter trend has the opposite effect. The health and wellness trend and the convenience trend both have effects on the consumption of foods from key food groups and how people in North Macedonia shop for ingredients, cook and think about meals. Health concerns, mostly in the large urban centres, influence the growth in extracurricular activities for kids due to the limitations of school offerings.

High youth unemployment results in low spending power. Increasingly, consumers have started shopping online, especially due to the COVID-19 pandemic. With consumers spending more time online, they have a higher susceptibility to social media, which exposes them to the adverse effects of advertising and international influence, and culminates in changed daily diets (Euromonitor, 2014).

Structure and changes of food trade

- North Macedonia has an open economy and is integrated in international trade, with European Union and Central European Free Trade Agreement (CEFTA) countries serving as major trade partners.
- The trade structure is traditionally in deficit, but the volume of imports/exports is increasing over time. The country is a net importer of agrifood products. Agrifood exports need to be diversified towards higher-value products.
- Domestic trade is highly fragmented, with many independent sellers and individually owned grocery stores still constituting the majority of grocery retailers. The share of supermarket chains is slowly growing. Local farmers' markets and grocery stores supply the population with significant quantities of fruits and vegetables.

International trade and trade agreement

North Macedonia's strategic goal is to join the European Union and the European common market. In 2001, the country signed a Stabilization and Association Agreement with the European Union and acquired free access to its market, which includes a preferential trade arrangement that allows products from North Macedonia to enter the European Union duty free. The agreement provides for a gradual reduction of duty rates for European Union products entering North Macedonia.

In 2003, the country became a member of the World Trade Organization (WTO). WTO membership imposed further liberalization of the trade policy and implementation of numerous reforms related to the rules of trade conduct. A list of goods in customs quota under the Protocol of Accession to the WTO is published in the Official Gazette once a year (Customs Office of North Macedonia, 2019).

In addition to the efforts made by the WTO for trade integration, bilateral or regional free trade agreements (e.g. with Türkiye and Ukraine) were signed in order to promote relationships with important and potential trade partners. Since 2006, North Macedonia has been a member of the Central European Free Trade Agreement (CEFTA), a free trade zone of the countries of Central and East Europe, including Albania, Bosnia and Herzegovina, Kosovo,³⁶ Republic of Moldova, Montenegro and Serbia. Croatia joined the European Union in 2013 and left the CEFTA.

Customs duties generally apply to most products imported into North Macedonia. Preferential tariffs apply to countries with which North Macedonia has signed bilateral free trade agreements, as well as to countries participating in multilateral trade agreements, such as the European Union Stabilization and Association Agreement, the European Free Trade Agreement (EFTA), and CEFTA. In 2018, customs tariffs ranged from 0 to 45 percent. The simple average applied tariff on agricultural products was 17.6 percent in 2019, while that on non-agricultural products is 5.8 percent (WTO, 2019). Customs tariffs are revised and amended on an annual basis, in accordance with the amendments of the Combined Nomenclature of the European Union. Amendments refer to the system of designations of the goods, system of numeric marking, unit prices, and notes concerning particular sections and chapters.

³⁶ All references to Kosovo should be understood to be in the context of United Nations Security Council resolution 1244 (1999).

There are no tariffs applied to most raw materials. Excise duties are determined by the type and quantity of the product and are levied in addition to the customs tariff, such as excise duties applied to alcohol, cigarettes, mineral oils, and tobacco. Due to the various agreements, there are no duties for industrial products originating from European Union, EFTA, CEFTA countries, Türkiye or Ukraine.

The Macedonian denar is stable and is pegged to the Euro. Overall, the macroeconomic fundamentals are sound, with very low inflation rates and established monetary and fiscal policies. There is an openness and stimulation of foreign direct investment and trade. The largest sources of foreign direct investment are Austria (13.6 percent), the United Kingdom of Great Britain and Northern Ireland (11.3 percent), Greece (10.1 percent) and Slovenia (6.9 percent).

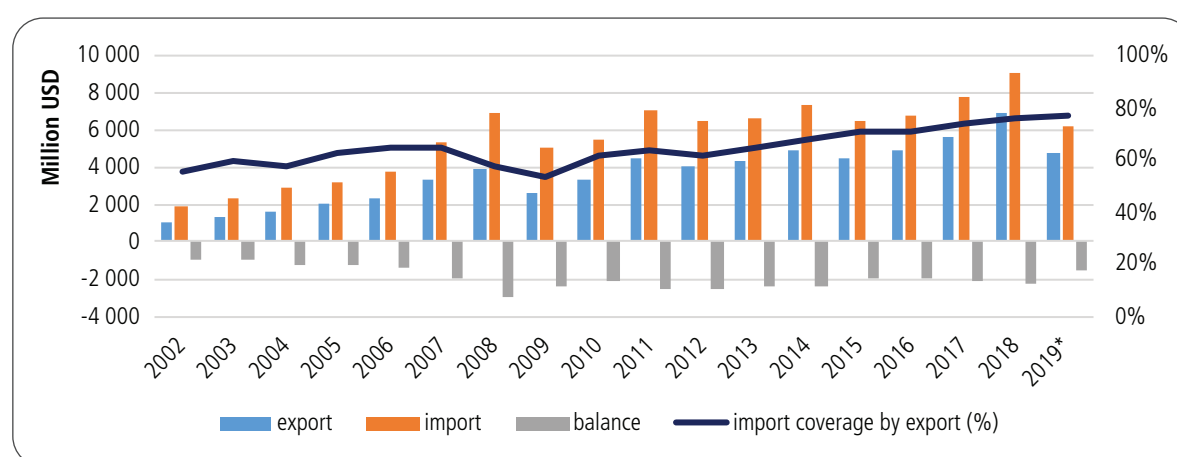
Overall, North Macedonia is a net-importing country. The trade deficit has doubled in monetary terms, from USD 1 billion in 2003 to USD 2.1 billion in 2017, but in relative terms, the volume of trade has increased significantly, with a four-fold increase of exports and a threefold increase of imports in the past 15 years. The total 2018 trade, imports plus exports, reached almost USD 16 billion (**Table 8-3**), or 126.1 percent of North Macedonia's GDP.

Table 8-3. Total trade (value in thousands USD), North Macedonia

	Three years average			Changes in percent		
	2002-04	2009-11	2016-18	2010/2003	2017/2010	2017/2003
Export	1.385.334	3.512.743	5.815.545	253.6	165.6	419.8
Import	2.401.648	5.858.156	7.872.356	243.9	134.4	327.8
Balance	(1.016.314)	(2.345.413)	(2.056.812)	230.8	87.7	202.4
Import coverage by export (percent)	57.6	59.4	73.6	103.2	123.8	127.8

Source: State Statistical Office of the Republic of North Macedonia. 2020. MakStat database. Skopje, SSO. <http://makstat.stat.gov.mk/PXWeb/pxweb/en/MakStat>

Figure 8-7. Total trade indicators in real prices of North Macedonia, 2002–2018



Source: State Statistical Office of the Republic of North Macedonia. 2020. MakStat database. Skopje, SSO. <http://makstat.stat.gov.mk/PXWeb/pxweb/en/MakStat>

The country is a net importer of agrifood products. Although the volume of trade is increasing, there remains a trade deficit in absolute terms that is rising (**Table 8-4** and **Figure 8-7**). The sector's importance in terms of its share of total country trade has been decreasing, from 17 percent in total exports and

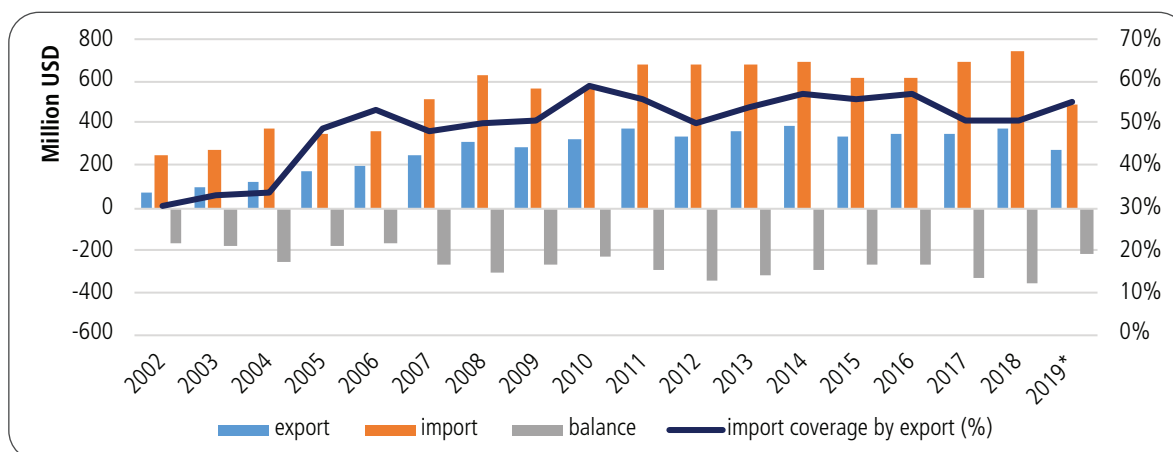
13 percent in total imports in 2003 to around 10 percent in both exports and imports in 2017 – including beverages and tobacco, which constitute about one-third of total exports (SSO, 2020).

Table 8-4. Total trade and food and live animals trade (value in thousands USD), North Macedonia

	Three years average			Changes in percent		
	2002-04	2009-11	2016-18	2010/2003	2017/2010	2017/2003
TOTAL FOOD AND LIVE ANIMALS TRADE						
Export	97.452	328.562	357.770	337.2	108.9	367.1
Import	300.382	596.810	679.570	198.7	113.9	226.2
Balance	(202.931)	(268.248)	(321.800)	132.2	120.0	158.6
Import coverage by export (percent)	32.3	55.0	52.8	170.5	96.0	163.8
TOTAL FOOD AND LIVE ANIMALS TRADE WITH BEVERAGES AND TOBACCO						
Export	227.383	540.110	574.492	237.5	106.4	252.7
Import	323.770	656.218	766.955	202.7	116.9	236.9
Balance	(96.388)	(116.108)	(192.463)	120.5	165.8	199.7
Import coverage by export (percent)	71.3	82.3	75.1	115.4	91.2	105.3

Source: State Statistical Office of the Republic of North Macedonia. 2020. MakStat database. Skopje, SSO. <http://makstat.stat.gov.mk/PXWeb/pxweb/en/MakStat>

Figure 8-8. Total food and live animals trade, North Macedonia, 2002–2018



Source: State Statistical Office of the Republic of North Macedonia. 2020. MakStat database. Skopje, SSO. <http://makstat.stat.gov.mk/PXWeb/pxweb/en/MakStat>

The main export products from North Macedonia are tobacco, lamb meat, fresh and processed vegetables and fruits, wine and confectionery products. The main imports are meat (including poultry, beef and pork), chocolates, confectionery, cheese, processed foods and grains (**Figure 8-8**).

Food and beverage processing are significant industries in North Macedonia, especially processed fruits and vegetables. Processed fruits and vegetables foods include semi-finished products, such as frozen foods, dried foods, or concentrates and finished products, such as canned foods or preserves. Almost 80 percent of the production of the fruits and vegetables processing industry in 2018 was exported, at a value of EUR 59 million, mainly to the European Union and neighbouring countries.

Processed vegetable products dominate the total exports, accounting for 79 percent of the total quantity and 83 percent of the total export value in 2018 (MAP, 2019). The top markets for agriculture and food products are the European Union, which accounts for around half of total exports – with Greece at 14.6 percent, Germany at 14.4 percent, Bulgaria at 13.2 percent and Croatia at 12 percent – and CEFTA countries (33.9 percent).

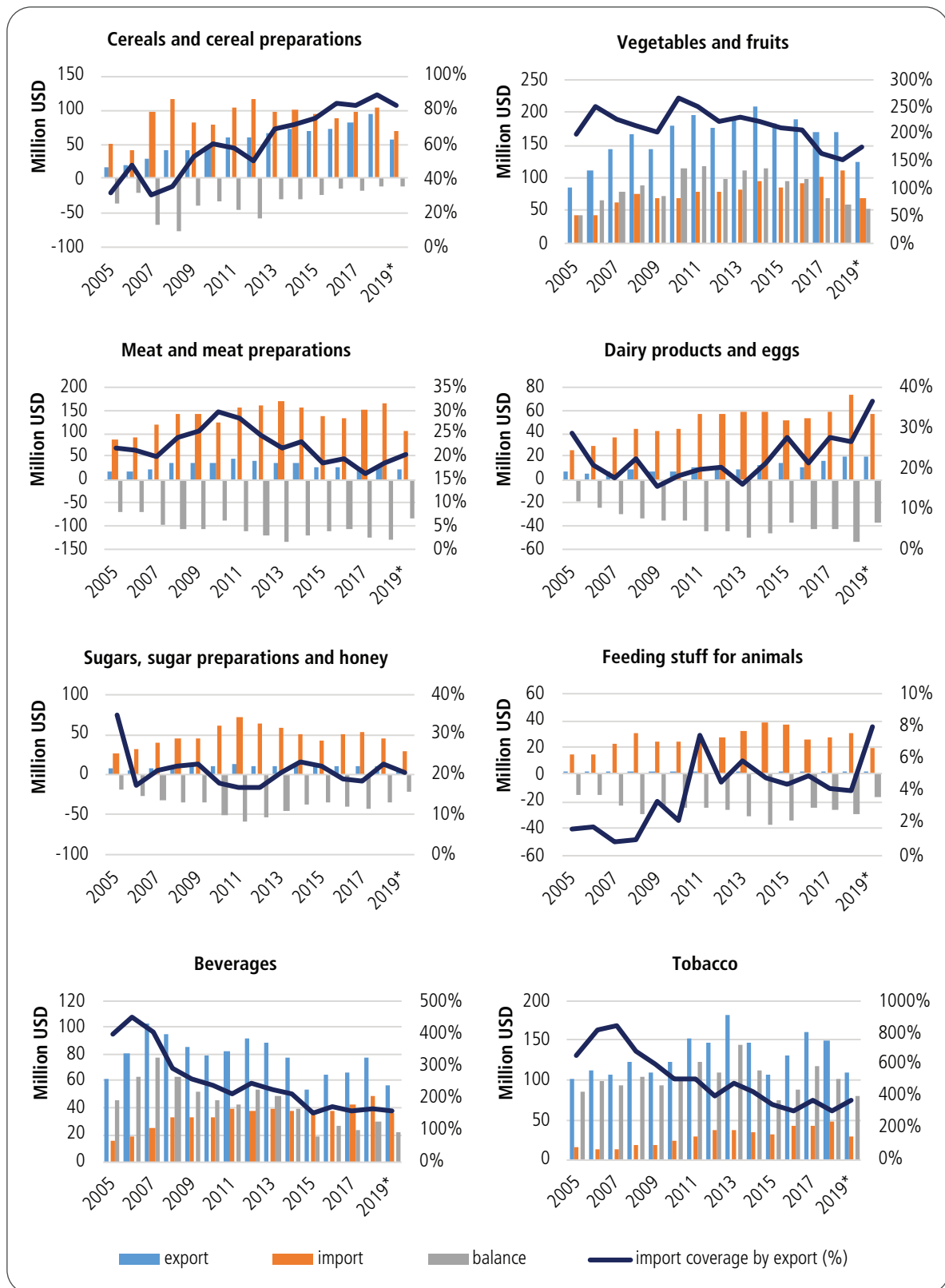
Domestic retail and wholesale food markets

Fresh produce is easily available in North Macedonia, which is agriculture- and farming-oriented. Domestic trade channels vary depending on the product type. Fresh produce is typically sold via intermediaries to wholesale markets and then sold to retail outlets. The post-distribution and management system for fresh produce is still underdeveloped, and produce quality suffers from the lack of an appropriate infrastructure.

The consumption of fresh produce is important as local farmers' markets (locally called "green markets") and grocery stores supply the local population with significant quantities. Consumers in North Macedonia still largely rely on farmers' markets for their supply of fruit and vegetables. Skopje, the capital of North Macedonia and other major cities have permanent farmers' markets, while smaller towns have weekly or twice weekly farmers' markets. The trend of buying fruits and vegetables in supermarkets and other retail shops is steadily growing, given the convenience of "one-stop" shopping. The situation is similar with meat, which is traditionally purchased at butchers or other speciality shops but has seen increased consumption in supermarkets and one-stop shops.

The retail market is characterized by many independent grocery stores, which still constitute the most important retail channel. Food and beverage retailing in North Macedonia continues to lag behind that in neighbouring countries in terms of foreign direct investments and acquisitions by large international chains.

Figure 8-9. Trade of the most important agrifood products, North Macedonia



Source: State Statistical Office of the Republic of North Macedonia. 2020. MakStat database. Skopje, SSO.
<http://makstat.stat.gov.mk/PXWeb/pxweb/en/MakStat>

Agricultural and food production systems structure and changes

- The agriculture sector in North Macedonia is based predominantly on small-scale family farms. Major agricultural production sub-sectors are cereals, tobacco, vegetables, fruits, grapes, milk, and meat, predominantly cattle and lamb.
- The agricultural and rural development policy in North Macedonia follows the overall concept of the European Union's CAP framework. Key priorities of the policy are strengthening the agriculture sector to compete in the European Union and other markets and promoting the sustainable development of rural areas.
- Direct payments to producers constitute the largest part of the budgetary transfers, followed by rural development measures.
- Tailored policy measures should address various cross-cutting challenges in order to foster food security resilience, improve market functionality, enable risk mitigation and strengthen coping strategies.

Structural changes

The agriculture sector in North Macedonia is based predominantly on small-scale family farming. There are around 178 000 farms in the country, of which only 280 are companies. Half of the farms have less than EUR 2 000 annual output value. Small farms, with an output range of EUR 2 000 to EUR 8 000 annually, account for 36 percent of total farms. The remaining are medium-large farms, with output greater than EUR 8 000.

Agriculture employs 442 000 people, or 243 000 full-time labour equivalents. The small area of agricultural land per holding, 1.8 ha on average, and its excessive fragmentation are the biggest structural problems with direct negative impacts on sector competitiveness. Around 61 percent of producers operate on farms that are smaller than 1 ha, and less than 2 percent of producers use more than 10 ha. Most of the business entities belong to the latter group. Individual land parcels, ranging between 0.2 ha and 0.6 ha, are often poorly equipped without irrigation and drainage and lack adequate road infrastructure. The structure of fragmented, poorly equipped land plots results in a lower volume of production, increased fuel costs for transport, and an inability to apply modern technology, limiting the overall revenue from agriculture and impeding rapid development.

Farmers seldom organize into formal producer associations or organizations. The agricultural cooperatives segment in the country is not sufficiently developed due to the altered role of cooperatives since the departure from the socialist system and due to the lack of adequate policies to support cooperatives since North Macedonia's independence.

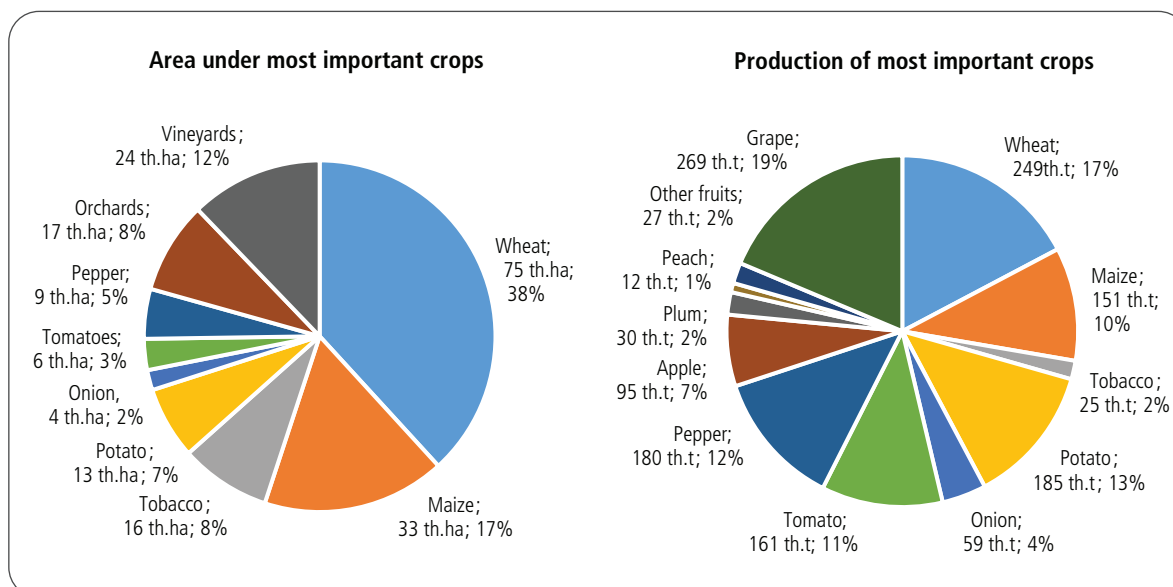
The total agricultural area amounts to 1.266 million ha, or around half of the country's total territory. Almost 59 percent of this agricultural area is for pasture grazing. The arable land has slowly declined in the past 15 years, comprising one-third of the total agricultural area.

Major agricultural production sub-sectors are cereals, including wheat and rice, tobacco, vegetables, fruits, grapes, milk and meat (Figure 8-10). North Macedonia produces around 250 000 tonnes of wheat

and 150 000 tonnes of maize annually. The area in which wheat is grown has fallen by 20 percent over the past 15 years, but during the same period, from 2003 to 2017, the land productivity has slowly increased, from 2.7 tonnes per ha to 3.3 tonnes per ha. North Macedonia is a net importer of grain. Increased domestic production of grain for livestock feed, in particular on-farm production, is a prerequisite for a competitive livestock sector. With the current market prices and yields among the lowest in the region – and more than two times lower than the European average – wheat production satisfies only around 60 percent of the domestic demand.

Around 850 000–900 000 tonnes of vegetables and 200 000–250 000 tonnes of fruit are produced annually. Over 75 percent of vegetable production is in open fields and 20 percent in polytunnels (structures made with steel hoops and polyethylene). The remainder is grown in glass greenhouses. Yields differ significantly according to the chosen growing method. Fruit and vegetable production comprises 46 percent of agriculture output in the country and is export oriented. North Macedonia produces approximately 1 million hectolitres of wine annually. The vineyard structure needs to be renewed to maintain quantitative and qualitative production potentials.

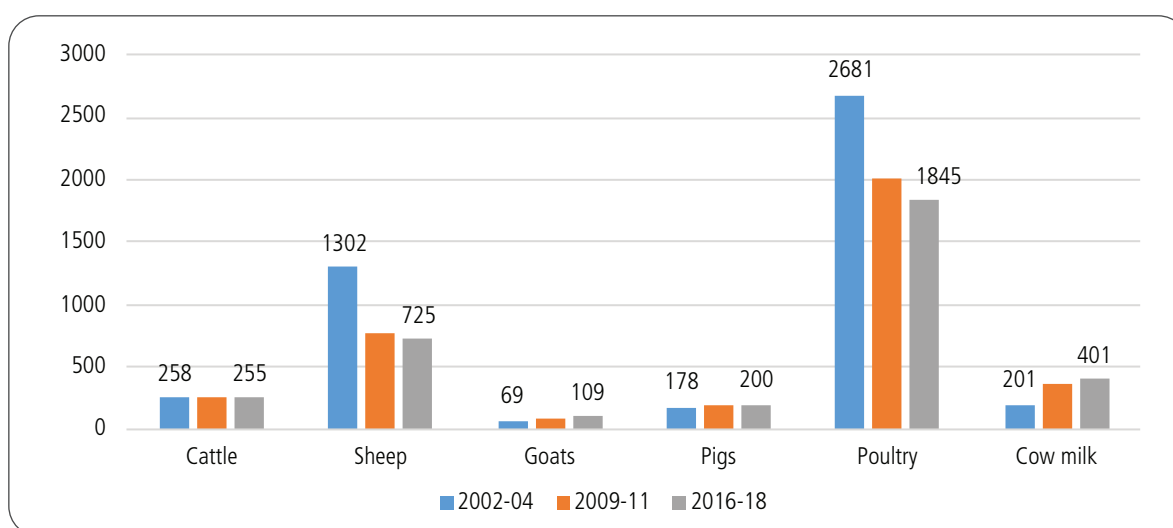
Figure 8-10. Composition of crop area and production in North Macedonia, 2016–2018



Source: State Statistical Office of the Republic of North Macedonia. 2020. MakStat database. Skopje, SSO. <http://makstat.stat.gov.mk/PXWeb/pxweb/en/MakStat>

North Macedonia is a net importer of meat, with more than 50 percent coming from imports. There is an insufficient domestic meat supply and decreasing number of livestock (**Figure 8-11**). There also is a significant lack of beef, as most of the cattle in the country are dairy cows. The poultry industry is focused on egg production; broiler chicken production is almost non-existent. The domestic pork industry satisfies almost 90 percent of the market for fresh meat, while demand for processed meat is covered by imports. Lamb meat is the only net exported livestock product from the country.

Cow milk is dominant and is used both as fresh product and for processing. Sheep milk is processed into cheese. Over 95 percent of milk production is produced by individual agricultural holdings.

Figure 8-11. Livestock numbers and cow milk production in North Macedonia

Source: State Statistical Office of the Republic of North Macedonia. 2020. MakStat database. Skopje, SSO. <http://makstat.stat.gov.mk/PXWeb/pxweb/en/MakStat>

Policies and drivers for change in agriculture

The agricultural and rural development policy in North Macedonia follows the overall concept of the European Union's CAP framework. The cornerstone document for the national policy is the Law on Agriculture and Rural Development (LARS), which regulates the sector and defines the key policy objectives, such as providing stable production of good-quality, affordable food, providing the population with enough food, increasing sector competitiveness, providing stable incomes for agricultural holdings, and ensuring the sustainable development of rural areas and the optimal use of natural resources. These objectives are actualized by measures and instruments in the area of organization and support of agricultural markets, direct payments and rural development.

The National Strategy for Agriculture and Rural Development (NARDS) for 2014–2020 is the main long-term strategic document setting the goals, policies, and measures for the development of agriculture and rural areas in North Macedonia (MAFWE, 2014). It aims to strengthen the ability of the agricultural sector to compete in the European Union and other markets and to promote the sustainable development of rural areas. The need to tackle structural deficiencies is recognized as vital for increasing competitiveness, along with creating functional institutional, legal and policy tools. Other NARDS objectives are intended to increase competitiveness through the improved marketing of agricultural products and quality standards.

The 2014–2020 framework allows for substantial funds allocated to agricultural and rural development policies, with annual increases. The national budget for agriculture increased from USD 112 million in 2010 to USD 154 million in 2017 (Kotevska *et al.*, 2019). The agriculture budget accounts for around 4.5 percent of the total national budget. Following the CAP intervention logic, the national policy is delivered through market and direct producer support measures and structural and rural development measures. The current agricultural policy is still connected to the production structure of agricultural holdings. Direct payments are still the most common policy, calculated using various criteria: per unit of agricultural land, per livestock head, or per output. In terms of rural development support, measures targeted at improving competitiveness have prevailed, but in recent years, a portion of the funds also have been allocated to measures that curb negative environmental externalities of agriculture, such as organic agricultural practices and subsidies to stimulate rural economies.

Arable crops take the highest share of subsidies, with tobacco as the most subsidized single commodity, at 23.9 percent of the total subsidy budget in 2017. Permanent crops such as orchards and vineyards receive 15 percent, with half of this amount allotted to grapes. Vegetables receive the least amount of subsidies at 7 percent in 2017. For livestock, sheep and goats receive the most subsidy support, around 14 percent of the total subsidy budget, and subsidies for milk are around 8 percent (Kotevska *et al.*, 2019).

The legal framework links agricultural policy to the promotion of healthy food consumption. LARS includes the possibility for increased availability of fresh fruit and vegetables to people 18 years or younger and people who are most vulnerable to poverty and health risks. Such measures include free distribution of domestic fresh produce. Although the legal framework is present, no such programme for promoting fresh fruit and vegetables consumption has been established. Adjusting to the European Union Common Market Organisation policy includes a comparable possibility for grade schools to have similar programmes, promoting fruits, vegetables and dairy. The possibilities of this can be explored in future policy measures.

One of the policies that supports short value chain development is the recently adopted legislation for direct sales. These by-laws regulate the marketing of small quantities of products manufactured by farmers without compromising or jeopardizing food safety and consumer health protection.

In 2007, North Macedonia adopted the National Strategy on Organic Agricultural Production for 2008–2011 and established the grounds to introduce and develop organic agricultural production across the country (MAFWE, 2007). This strategy was followed by the National Plan for Organic Production for 2013–2020, as the instrument determining the policy's directions, activities, and measures needed in order to develop the organic production sector. Besides regular direct support, additional direct payments are available for organic production, if certified or equivalent. The payments generally include an extra 30 percent to 50 percent in addition to the direct farmer support.

Climate change impact as a cross-cutting issue

Several recent studies (Sutton *et al.*, 2013; MOEPP, 2014) suggest that the country is expected to experience an overall increase in temperature and more weather extremities, such as heatwaves and floods. Increases are anticipated in heat-related mortality, changes in the distribution of infectious diseases, risk of appearance of tropical infectious diseases, and food-borne disease outbreaks. Although the country is small, there are notable regional differences due to the geographic features and several climatic zones (continental, sub-Mediterranean and mountain). The increased vulnerability to climate change poses additional challenges to the agricultural sector, with crop production being the most vulnerable. The downside risks for the agricultural sector outweigh the potential benefits, such as a longer growing season.

With a considerable proportion of the rural population dependent on agriculture for their livelihoods, rural communities are particularly vulnerable to risks that may occur as a result of climate change. This is further intensified by the country's relatively low productivity associated with a lack of adaptive capacity; imperfections in agricultural output and input markets, agricultural education, extension, research and market information systems; delays in farm restructuring; undeveloped agricultural land markets; lack of access to financial resources; unsustainable soil management; insufficient irrigation; and high vulnerability to natural hazards such as droughts, floods, frosts and severe storms (MAFWE, 2014; IPARD, 2015). The most significant impacts agriculture has on the environment are associated with soil degradation and erosion and poor water management. All these increase the vulnerability of agricultural systems and rural livelihoods to the adverse effects of climate change.

Food processing and marketing structure changes

- The production of food products in the country generally marks an upward trend. Low levels of processing and the production of value-added products remain a challenge. North Macedonia is exporting unprocessed or semi-processed food products and importing finished food products.
- The regulatory framework in the area of food quality and food safety is well established. A comprehensive set of laws and by-laws regulates the markets of agricultural products, including quality standards, classifications, food additives use, labelling, marketing, and advertising of food products.
- Food products are subject to a preferential value-added rate of 5 percent.

Structural changes

One of the major issues in the agricultural sector is the low level of food processing. North Macedonia is exporting unprocessed or semi-processed food products and importing finished food products (Ministry of Economy, 2018).

Food product production in North Macedonia has shown upward trends in terms of volume produced from 2012 to 2018. This increase in production is particularly noticeable in the frozen vegetables sector, from 2 000 tonnes produced in 2012 to almost 5 000 tonnes in 2018, approximately a 90 percent increase. Milk and fermented milk products saw an increase of 60 000 tonnes produced in 2012 to 79 000 tonnes in 2018, around a 30 percent increase. Pork meat product saw a more modest increase, from 7 900 tonnes produced in 2012 to 9 100 tonnes in 2018, an increase of 16 percent) A decline in production is seen in animal feed, cheese and cheese products, and fresh bread. In the beverage sector, there is an evident rise in the production of bottled wine and a decrease in bulk wine. Most wine is still sold in bulk, though this ratio is continually changing.

An underlying issue of the food processing industry is the low level of utilization of production capacities, mainly due to the seasonal nature of the raw material supply. Other contributing factors include lack of access to favourable finances; lack of contractual agreements with suppliers of raw materials, such as agricultural producers; lack of skilled workers; lack of adequate storage facilities; and low investment in the development of new value-added products, innovation, joint marketing, and distribution (MAFWE, 2014).

Policies and drivers for change

There is a well-established regulatory framework in the food quality and food safety segment. The Law on Food Safety was adopted in 2010, in alignment with European Union regulations, followed by a number of accompanying by-laws. This law regulates the basic principles of food and feed safety, general and specific food hygiene requirements, organizational structures of the food safety system, and official controls on food and feed. The purpose of the law is to ensure a high level of protection of human health and consumer interests in relation to food, in particular considering the diversity of the food supply, including foods with traditional characteristics, and ensuring the efficient functioning of the internal market.

Another important legislative act is the Law on Quality of Agricultural Products (2010). This law regulates markets of agricultural products, quality standards, classification, quality labelling and information systems, and protection of agricultural and food products with geographical identifications and traditional specialties. In addition, the law sets the measures and activities that must be performed by the quality assurance authorities and corresponding institutions to assess quality control in the agricultural sector.

The implementation of activities within the national system for food safety control in North Macedonia is carried out by authorized institutions: the Institute of Public Health and ten regional Centres for Public Health, in cooperation with the Inspection Services and Food and Veterinary Agency.

Marketing, including advertising practices

All forms of advertising are available to food producers in North Macedonia. Restrictions for media advertising apply foremost to tobacco and tobacco products and are prohibited by the Law on Broadcasting and the Law on Protection from Smoking. Advertising and teleshopping (selling via television programmes) are also prohibited in the case of alcohol and alcoholic beverages other than wine and beer.

Food additives and food fortification

The food-related legislation regulates standards related to food additives. It includes activities related to surveillance, sampling and laboratory analysis of samples at the level of import, domestic production, and trade in foodstuffs. Relevant parameters are tested for additives in foodstuffs, such as quality, clear indications of additives, residues of pesticides and heavy metals, mycotoxins, antibiotics, and microbiological correctness.

Adding supplements to food and food fortification is regulated by the Law on Food Safety and its by-laws. Vitamins and minerals, in a formulation that is biologically applicable to the human body, can be added to foods in North Macedonia, whether they are usually contained in food. Food operators may produce fortified foods or foods containing added vitamins and minerals that meet specific safety, composition and labelling requirements only after a review and approval has been issued by the Food and Veterinary Authority.

An example of food fortification in the context of North Macedonia is iodized salt. The salt that is put into circulation should meet the prescribed iodine levels, which are no less than 20 mg of iodine per 1 kg of salt and no more than 30 mg of iodine per 1 kg of salt. This intervention aims to reduce or eliminate the occurrence of iodine deficiency diseases.

There was an initiative to fortify flour with iron in North Macedonia. However, this practice was not adopted due to related health concerns regarding iron levels for certain parts of the population. Vitamin D fortification of certain foods also offers an alternative way to enhance nutrient intake, though no programmes have materialized.

Taxation on unhealthy food and price policies for promoting healthy diets

The taxation system in North Macedonia is competitive, meaning that companies pay a 10 percent corporate income tax on realized profits. A value-added tax (VAT) of 18 percent applies to most products and services. Raw materials and machinery for agriculture production, solar energy systems, refined and unrefined oils for industrial use, and foodstuffs for human consumption are taxed at preferential rate of 5 percent. For imports to North Macedonia, VAT is assessed on the customs value of the goods plus the customs duty and excises.

All foodstuffs are subject to the preferential rate of 5 percent. Tobacco products taxation includes 18 percent VAT and additional excise taxes.

Food labelling/information

The labelling of food products in North Macedonia is regulated by the Law on Food Safety and additional by-laws. It is obligatory to label the product name in a way that is clear and visible to the consumer and to include a nutritional table, composition, net weight and shelf life. The product may contain voluntary information including nutritional claims, such as certain vitamin or mineral levels and health claims associated with the product. The regulations aim to provide greater protection from the potential health concerns related to eating food that has been fortified or contains additives.

Consumer demand, awareness, education and social protection

- Food-based dietary guidelines have been available since 2008 and were extended in 2014. They contain dietary recommendations that would contribute to the health benefits of the population. Key messages promote eating a balanced and nutritious diet based on diverse food groups, maintaining healthy eating habits, and restricting highly processed foods with high levels of sodium, sugar and fat.
- Nutrition standards for meal composition are available for school-aged children and young adults. Studies show that the intake of whole grains, fish, eggs and fresh vegetables and fruits should be increased.
- Awareness, education and communication about nutrient needs and dietary habits need to be continually addressed.

Food-based dietary guidelines

North Macedonia published its first set of food-based dietary guidelines (FBDGs) in the form of a short pamphlet in 2008. An extended electronic version of the FBDGs was published in May 2014, developed by the Institute of Public Health and endorsed by the Ministry of Health (MOH, 2014).

The guidelines include recommendations for nutrient-rich diets that would contribute to the health and well-being of the population. They contain evidence-based recommendations from research in nutrition, physical activity and medicine. The purpose of the guidelines is to improve the health of the general population in the country and of future generations by promoting healthy eating habits and physical activities. The guidelines provide guidance to parts of the population with increased health risks and chronic non-communicable diseases.

The key messages in this document relate to eating a nutritious diet based on diverse food groups and maintaining healthy eating habits, such as regular mealtimes.

School food and nutrition

Nutrition standards for kindergartens were included in the by-law for standards and norms for childcare institutions adopted in 2014 by the Ministry of Labour and Social Policy, in cooperation with the Ministry of Health. Kindergarten staff and managers are required to be trained on children's nutrition and to promote healthy food choices in classrooms. Kindergartens should be equipped with staff and facilities that will enable them to pay close attention to children's nutrition in order to introduce healthy habits at a young age to reduce the risk of diet-related illnesses in the future.

Nutrition standards, which food operators are obligated to adhere to, were adopted in 2018 in the form of a Rulebook on Food Standards and Meals in Primary Schools. In supplying schoolchildren with food and staff in school kitchens, food operators must apply the healthy eating recommended nutrition standards for this age group. The Ministry of Education and Science, in cooperation with the Ministry of Health and local government units, should regulate the distribution of unhealthy food in school premises

and in the immediate vicinity of these facilities. In 2016, the Ministry of Education adopted a rulebook on the quality of meals in student dormitories. Additional development is needed, including guidelines on how to facilitate and enforce this policy.

A recent national survey concluded that the diets of preschool children do not fully meet the recommendations for food intake (IPH, 2018). Macronutrients are properly balanced, but the quality of the food sources of these macronutrients should be improved. Calcium intake should be increased, and sodium intake reduced. According to the study, the intake of whole grains, fish, eggs, and fresh vegetables and fruits should be increased. Elementary school children have similar issues; the intake of fruits and vegetables is below the recommended quantities while the intake of sugar concentrates, sweetened soft drinks, and carbonated or non-carbonated drinks with added sugar is excessive (IPH, 2018).

Nutrition-sensitive social protection

Social protection should guarantee adequate living standards. Investing in social protection contributes to more cohesive societies, more resilient communities and stronger economies (UNICEF, 2018).

In relation to child social protection, current legislation restricts child allowances to people who are currently working or receiving unemployment benefits, hindering an important share of the population – particularly those most impoverished – from receiving extra support. However, the monetary value of the benefits currently available is too low to have a sustained impact on child and family poverty levels.

The system and society should ensure that the minimum standards for proper food intake on a daily basis are taken care of through childcare facilities and schools.

Nutrition education and behaviour change communication

Several institutions are active in the areas of nutrition education and communication. The ministries of Health, Labour and Social Protection, Agriculture, Forestry and Water Economy, and Education and Science constitute the main responsible bodies in the governmental framework. The Institute of Public Health and Food and Veterinary Agency are active in the area of nutritional coverage, safety and education. The Organisation of Consumers of North Macedonia and donor programmes such as FAO, UNICEF, the World Bank and UNDP also contribute to these policy arenas.

The Public Health Institute implements the Childhood Obesity Surveillance Initiative (COSI) in North Macedonia, a research initiative sponsored by the World Health Organization, to explore the trends in weight gain and obesity among schoolchildren. The country joined COSI for the first time in 2009, collecting relevant data on weight gain and obesity in children, as well as raising the awareness on these issues.

In 2014, a public campaign under the slogan “Health is the Choice! Healthy food and a healthy lifestyle mean a long life!” promoted healthy food and keeping a healthy lifestyle. The campaign was aimed at the entire population of North Macedonia. There is no measurable outcome about the success of the campaign.

Nevertheless, there is still awareness among young people about the need for healthy lifestyles. Schools are sporadically act on their own initiative, with peer-to-peer education through student projects and presentations. Some civil society organizations occasionally support such activities.

Nutrition-sensitive value chains

Interventions that use tools such as nutrition-sensitive supply chain incentives, targeted subsidies and taxes are yet implemented in North Macedonia. Such targeted interventions alter food prices and can improve the availability of healthy nutrition while discouraging purchases of potentially nutrient-poor foodstuffs. A WHO study suggests that appropriately designed taxes on sweetened beverages would result in proportional reductions in consumption and that subsidies for fresh fruits and vegetables that reduce prices are effective in increasing fruit and vegetable consumption (WHO, 2016).

Such interventions should take into account the overall impact on vulnerable groups and the intervention's effects on food accessibility. The Nutrition Study in North Macedonia (2009) showed fat and saturated fat intake above the recommended level in populations with lower socioeconomic status. The situation was similar for sugars and trans fats. Salt intake is above the recommendations for the entire population in the country. In 2016, a government proposal suggested an additional tax on fatty foods to dissuade people from buying these food items started a debate, but this initiative was then abandoned.

Conclusions and key messages

This analysis provides an overview of the agricultural and food systems in North Macedonia and their role as drivers of various forms of malnutrition. A comprehensive approach is needed as a basis for planning effective policy responses. The results could serve as a basis for multistakeholder engagement and intersectoral dialogue.

While food security is less of an issue, the country is suffering from various forms of malnutrition. The prevalence of undernourishment has been decreasing in the past two decades and is far below the world average. However, overweight and obesity are becoming an increasing health concern.

The transition to a well-functioning and inclusive market economy is not yet complete. Major obstacles include low productivity, weak state institutions, insufficient educational achievement, and limited skills to meet evolving demands, which creates unequal access to economic opportunities. The share of employment in agriculture as compared to the sector's contribution to the national economy is almost double. This indicates that although the sector is a key income buffer for a large portion of the population, productivity shortcomings persist in the sector, making addressing rural poverty, food insecurity, and malnutrition more challenging. Agricultural development can contribute to poverty reduction – not only in income terms, but also by stimulating off-farm economic development and better employment opportunities in both rural and urban areas – and generating growth through the multiplier effect. Increased productivity in agriculture can contribute to improved farm incomes and also create a larger food supply with more affordable food prices.

Socioeconomic disparities, especially in rural areas, need to be considered in terms of consumption and spending patterns. Issues of limited income and high unemployment persist. Food and beverage expenditures take around 40 percent of household funds. Price sensitivity is a key issue, given the limited purchasing power of local consumers.

Food availability in the country increased in the past three decades, both through certain increases in domestic production and imports, which were facilitated by free trade agreements with the European Union and CEFTA countries. The availability of prominent food items is higher than the world average and, in most cases, close to regional and European levels. The North Macedonia food basket includes satisfactory levels of fruits, vegetables, cereals and meat. The availability of poultry and pulses is increasing. Fish availability is lower than regional and global levels. The availability of confectioneries and sweeteners has doubled over the course of the past three decades.

Diversity and dietary habits are changing over time, and the **food processing and marketing channels** that affect consumption patterns are changing in tandem. **Consumer awareness and education** regarding food and nutrition needs to be continuously addressed.

North Macedonia is not self-sufficient in most agrifood products, as the country is a **net importer** of agrifood products. Increasing trade levels are a result of better integration in international trade, yet the trade gap is on a continuous rise. The main imports are meat, chocolates, confectioneries, animal or vegetable fats and oils, cheeses, processed foods and grains. The main agrifood export products are tobacco, lamb meat, fresh and processed vegetables and fruits, wine, and confectionery products. The main markets for agriculture and food products are the European Union and the countries in the

Balkan region. The country is exporting raw or semi-processed products and importing finalized processed products. North Macedonia needs to further develop the export potential in its agriculture sector.

Agriculture and food production systems face many challenges. Traditional small-scale farming, with small quantities of unstandardized products, is the dominant feature of the sector. Additional factors contributing to the unfavourable position of agricultural producers are a lack of producer organizations; undeveloped cooperatives; and limited access to knowledge, innovation, technology and information. European Union integration has been the main driving force for the legal, institutional and economic reforms in the sector, and in that respect, the national agricultural policy tends to align with the CAP. The current policy framework in the country provides increased producer support, mostly in the form of direct payments, and rural development support targeting competitiveness, food safety and environment are key priorities.

The food quality and safety framework is well regulated. Dietary guidelines published in 2014 include recommendations for promoting physical activity and improving the health of the general population and future generations.

Climate and environmental threats require urgent attention. People living in poverty are particularly exposed to risks related to climate change and environment degradation, adding to their vulnerability. In that respect, the issues requiring the most imminent policy attention are climate adaptation and mitigation and biodiversity protection. The current policy includes supporting measures for crop insurance, irrigation systems, alternative energy systems and other means to respond to climate and environmental threats, but the implementation of these policy measures needs to be addressed.

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Chapter 9

The role of food systems in the transition of diets and the prevention of malnutrition in Poland

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Abstract

After introducing radical reforms in the 1990s, joining the European Union in 2004, and adopting European Union institutions such as the CAP, Poland developed a modern food market. Despite many changes in the food supply chain and consumer behaviours, the current food environment does not fully support healthy food choices, especially of the country's most vulnerable population groups, including households with children. The prevalence of severe food insecurity based on the Food Insecurity Experience Scale (FIES) decreased to 0.5 percent in 2017-2019, and prevalence of obesity levels in adults reached 23.5 percent in 2016. However, growing overweight and obesity trends are alarming, especially among children and adolescents. Increased awareness among Polish consumers on the impacts of their food-related behaviours on health, climate change and the environment is crucial to making a transition to a more sustainable food system possible. This food system will require more comprehensive food policy tools that foster a people-oriented approach. **The European Union Farm to Fork Strategy, the cornerstone of the European Green Deal, and the United Nations Food Systems Summit will hopefully deliver** additional momentum to this process.

Keywords: *Poland, sustainable food system, diet transition, malnutrition, obesity, European Union*

Introduction and background of malnutrition

Agricultural and poverty situation in Poland

Poland became a Member of the European Union in May 2004, after 15 years of a pre-accession period that started in December 1994 with the confirmation of the country's application by all Member Nations. During this time, the country underwent enormous socioeconomical changes that led to an economy with market allocation of resources and largely private ownership. Despite the fact that Polish agriculture had retained, to a remarkable degree, its autonomy under central planning (1945–1989), an expectation of government-controlled market prices and capital remained strong among farmers. Tensions increased when Polish food producers faced the challenges of selling their goods in the market (Majewski and Dalton, 2000), as a result of rigorous anti-inflationary measures and the decline of gross income for the whole population in the early 1990s for the first time in post-WWII history. A report published by the European Bank for Reconstruction and Development (EBRD) showed that in most post-communist countries, only the top 27 percent of the total population experienced average or above-average income growth. In other words, the populations in these countries were not privy to average growth rates (EBRD, 2016).

Currently, physical and economic access to food in Poland is not a significant challenge, except among the poorest segments of the population (HLPE, 2017). Although the country has been classified by the World Bank Group as “high income” since 2009, almost one-fifth (19.5 percent) of the population is at risk of poverty or social exclusion. This ratio is slightly lower, according to the European Union Statistics on Income and Living Conditions data, than the estimated EU-28 average of 22.4 percent. The highest risk in Poland is observed in single adult households with dependent children (47.3 percent). In rural areas, the number of inhabitants who are at risk of poverty or social exclusion is estimated at 3.8 million; in towns and suburbs, that number is 1.4 million, and it is 1.7 million in cities (Statistics Poland, 2019).

State of food security and nutrition

Chronic hunger, which is when a person lacks adequate energy for a healthy and active life, measured with the prevalence of undernourishment (PoU) indicator (SDG Indicator 2.1.1), is hardly an issue in most parts of the Europe and Central Asia region. In Poland, the PoU, as in all European Union Member Nations, is below 2.5 percent. According to Food and Agricultural Organization of the United Nations (FAO) data, the second indicator for monitoring SDG Target 2.1, the prevalence of severe food insecurity based on the FIES, decreased in Poland from 1.8 percent in 2014–2016 (national three-year average) to below 0.5 percent in 2017–2019. The prevalence of moderate or severe food insecurity ($FI_{\text{mod-sev}}$) in the population dropped, from 8.9 percent (average 2014–2016) to 4.3 percent (2017–2019). The number of severely food-insecure people in Poland decreased during this time from 0.7 million to 0.2 million, and the number of moderately or severely food-insecure people decreased from 3.4 million to 1.6 million (FAO *et al.*, 2020).

The improvement of Poland's state of food security is affirmed by the Global Food Security Index (GFSI), which takes affordability, availability, quality and safety of food into account across 113 countries. Poland was ranked No. 26 in the 2018 overall GFSIs score (No. 29 in 2016) and No. 22 in the overall GFSIs, adjusted by the Natural Resources & Resilience score. Within the analysed factors of the GFSI, Poland achieved the highest possible results in ranking because of farmers' steady access to funding, the

presence of food security systems and food standards, and the low percentage of the population living below global poverty thresholds (Van der Hoek and Kowalczevska, 2018).

Although food insecurity is generally associated with developing countries, it also occurs in developed countries, especially among socially vulnerable groups. Food insecurity was measured with the Household Food Insecurity Access Scale (HFIAS) in 710 small-scale farms in Poland. The study found that about 43 percent of the respondents were exposed to food insecurity, including almost 9 percent who were severely food insecure (Poczta-Wajda *et al.*, 2020).

Currently, Poland will not meet the global nutrition targets for anaemia in women of reproductive age. The prevalence of deficiency anaemia (IDA) among women aged 15–49 increased from 23.5 percent in 2010 to 25.7 percent in 2016 (FAO *et al.*, 2020). The country is on course to meet the stunting target for children younger than 5, as the national prevalence dropped to 2.6 percent in 2019 from 2.9 percent in 2012 (FAO *et al.*, 2020). There are insufficient data to assess Poland's progress on the rates of children younger than 5 who are overweight or wasting or on the exclusive breastfeeding of infants (Development Initiatives, 2020).

Monitoring overweight and obesity

For many years, data on overweight and obesity rates in Poland were limited, and the studies conducted did a poor job of representing the whole population. One of the first comprehensive projects, the Food Consumption and Anthropometric Survey (2000), which was funded by FAO, demonstrated that 15.7 percent of Polish men and 19.9 percent of Polish women were obese in 2000. The rate of obesity of children aged 1–18, for both females and males, was 4.6 percent. Rates of overweight children were at 7.2 percent for females and 8.0 percent for males. The survey also was an important source of information about the content of an average Polish diet, including vitamin and mineral intake (Szponar *et al.*, 2003). The study concluded that in most cases, intake did not meet daily recommendations.

Excessive intake of vitamin A, sodium, potassium and phosphorus was found frequently, while insufficient intake of niacin, calcium, zinc, copper, B₁ and iron, especially in the female population, were reported. Additionally, there was high variability of vitamin C intake, which can be tied to the consumption of fortified foodstuffs. Excessive sodium intake was shown in 99 percent of reported diets. The average sodium intake in daily diets in the studied population was 4 170 mg, slightly higher in males at 5 183 mg, and highest in men between the ages of 19 and 25, at 6 472 mg. Daily dietary sodium intake was marginally lower in urban populations compared to Poles living in rural areas – 4 119 mg and 4 252 mg, respectively.

The Multicenter Polish Health Status Population Survey (WOBASZ) conducted in 2003–2005 demonstrated that 21.2 percent of men and 22.4 percent of women aged 20–74 were obese and 40 percent of men and 28 percent of women in Poland were overweight (Webber *et al.*, 2014). WOBASZ II (2013–2014) showed that between 2013 and 2014, the age-standardized prevalence of obesity was 24.4 percent in men and 25 percent in women. The prevalence of overweight (those with a BMI between 25.0 and 29.9) was 43.2 percent in men and 30.5 percent in women. Abdominal obesity (waist circumference greater than or equal to 102 cm in men or 88 cm in women) was noted in 32.2 percent of men and 45.7 percent of women (Stepaniak *et al.*, 2016).

Currently, obesity among adults is the most challenging form of malnutrition in the country. In 2016, obesity exceeded 23.1 percent, as the growth rate from 2010–2016 rose 2.2 percent per year (FAO,

2019). In 2016, the number of obese Poles aged 18 years and older reached 7.2 million, compared to 6.7 million in 2012. The chances of Poland meeting the United Nations adult obesity target for 2025 of “no increase in obesity prevalence by 2025” are very poor; the probability of meeting this target is 1 percent for men and 8 percent for women (World Obesity, 2020). Poland is not on track to meet SDG targets on adult obesity in either 2025 or 2030.

Although the BMI ratios can be calculated the same way for both children and adults, the criteria used to interpret them for children and adolescents should be age and sex specific. This is because the amount of body fat changes with age and differs between the sexes. Methodological challenges connected to defining cut-off points for BMI for overweight and obesity in children continue to be up for debate. BMI values are usually compared with reference values that are generally age and sex specific. These are then translated into a Z-score, or a percentile relative to some specific distribution of BMI, for age. According to the World Obesity Foundation, obesity refers to a BMI at least two standard deviations above the mean. Based on the World Health Organization (WHO)’s growth standards and reference tables, around 8 percent of females and 16.8 percent of males aged 5–9 years in Poland are obese. In older children, aged 10–19, the prevalence of obesity is lower, at 3.5 percent in females and 10.4 percent in males. The predicted prevalence of obesity in Poland among children aged 5–9 in 2030 is 20.3 percent, and among children 10–19, it is 13.9 percent.

In the 2017–2018 Health Behaviour in School-aged Children (HBSC) study, carried out in Poland among a representative group of adolescents, the WHO’s 2007 age and gender-specific growth reference charts (WHOREF) for school-age children and adolescents and the International Obesity Task Force (IOTF) standards were used. The data on weight and height indicated that 21.3 percent of adolescents had excess body weight, with significantly more of them males, at 29.3 percent in comparison to females at 13.7 percent. Circa 4.7 percent of these adolescents were obese: 7.0 percent of males and 2.6 percent of females. When the IOTF standards were applied, the calculated prevalence ratios were lower, with 16.5 percent of the adolescents having excess body weight, and only 2.3 percent of total adolescents being obese. Still, the obesity rate in males (3.1 percent) was almost double the rate of females (1.6 percent) in this age group (Mazur and Małkowska-Szcutnik, 2018).

Transformation of dietary change and food systems

Trends of food consumption based on the FAO country food balance sheets

In Poland, the availability of food for consumption, also called apparent consumption, has evolved dynamically since the 1990s. This is due to changes in food supply, including the development of the food industry, imports, and food companies' effective marketing strategies. The observed trends are determined by economic factors, such as price, income, availability and marketing, as well as by demographic, geo-biological, socio-psychological and cultural aspects.

The food consumption structure in Poland is traditionally dominated by three groups of vegetable-derived products: cereals, potatoes and vegetables. The consumption of all of them shows downward trends (**Table 9-1**). The consumption of meat has increased, especially poultry, which more than tripled. Fruit and fish consumption has increased but remains among the lowest in the European Union. According to food balance sheet (FBS) data, the availability of pulses in Poland is low and has not changed significantly since the 1990s. The trend in the availability of vegetable oils is one of the most interesting to observe. Before the transformation of Poland's economic system, the supply of vegetable oils was relatively low, at 6.6 kg per capita per year, as small production and low import volumes resulted in shortages in market supply. The biggest increase in vegetable oil availability was noted between 1990 and 1995. This can be linked to the rapid growth of production potential and marketing activities of foreign investors, doubling from 6.6 kg to almost 12.1 kg.

Table 9-1. Food available for consumption in Poland (kg per capita per year)

	1992–1994	1999–2001	2009–2011	2015–2017
Cereals – excluding beer	153.6	151.9	150.2	142.4
Vegetables	123.8	134.8	122.1	117
Fruits – excluding wine	40.7	48.1	51.7	61.1
Potatoes	142.8	132.2	114.9	100
Meat	72.7	69.2	74.5	86.7
Red meat	62.7	55.7	54.5	57.5
Poultry meat	9.7	13.3	19.9	29.1
Milk – excluding butter	208.1	198.1	166.8	175.5
Fish total	10.2	11.1	15.1	12.7
Fish, seafood	8.8	9.8	11.4	10.7
Freshwater fish	1.4	1.3	3.7	2.0
Vegetable oils	10.2	12.3	12	7.0
Sugar and sweeteners	42.5	43.6	43.1	43.7
Pulses	1.9	2.5	1.9	1.9
Peas	1.3	1.4	0.9	1.2
Nuts and products	0.3	0.5	1.6	0.9
Beans	0.6	0.9	0.9	0.8
Pulses, other and products	0.01	0.06	0.04	0.05

Source: FAO. 1992-2017. Food Balance sheets. FAOSTAT.

Analyses of FAO FBS data confirm that despite fluctuations, food inadequacy (shortages) at the national level has never been an issue in the country. The daily energy supply (DES) per capita in Poland increased from 3 300 kcal in 1992 to 3 525 kcal in 2017.

The consumption of selected food groups in Poland, based on country balance sheet data, show multidirectional trends since the 1990s. The consumption of beef, potatoes, animal fats, milk and eggs have shown the biggest decreases, while poultry, vegetable oils and fruits show the biggest increases (**Table 9-2**).

Table 9-2. Consumption of food groups in Poland based on country FBS data

	1995	2000	2005	2010	2015	2017
Cereals	120	120	119	108	103	102
Potatoes	135	134	126	110	100	96
Vegetables	120	121	110	106	105	105
Fruits	41	52	54	44	53	53
Meat and edible offal	63	66	71	74	75	75
Meat (total) incl.:	59	62	67	70	71	70
– beef	8.7	7.1	3.9	2.4	1.2	3.2
– pork	39.1	39	39	42.2	41.4	38.2
– poultry	10.2	14.7	23.4	24.6	27.1	27.6
Fish	6.5	12.5	11.3	13.1	12.5	12.5
Edible fats incl. :	25	29	31	32	34	35
– animal	7.2	6.7	6.6	6.3	5.8	6.5
– vegetable	14.4	17.8	19.8	21.5	23.4	24.1
– butter	3.7	4.2	4.2	4.3	4.5	4.5
Cows' milk (l)	195	193	173	189	213	218
Eggs (units)	154	188	215	202	144	139
Sugar	41.9	41.6	40.1	39.9	40.5	44.5

Source: Statistics Poland. 2021. Annual editions of Statistical Yearbooks of the Republic of Poland, 1996-2018. Warsaw <https://stat.gov.pl>

Trends of food consumption based on household budget survey data

Polish household budget surveys, conducted every year, are an important source of information about food consumption. The methodology allows for the generalization of results regarding household expenditures, consumption and incomes to the whole population. In order to maintain the relation between the structure of the surveyed population and the socio-demographic structure of the total population, data are weighted with the structure of households by number of persons and class of locality coming from the Population and Housing Census. Households are classified according to the five basic socioeconomic groups, based on source of maintenance: employees, farmers, self-employed, retirees and pensioners, and households living on unearned sources. Overall, households of retirees and pensioners and farmers have the highest levels of in-house food consumption, while the self-employed, who have the highest income levels, have the lowest levels of in-house food consumption.

The survey data regarding in-home consumption of most food groups shows decreasing trends (**Table 9-3**). The consumption of meat is stable, oscillating between 62 and 65 kg per year.

The HBS data on quantitative consumption of food and beverages does not include catering services, such as food consumed at canteens, bars, restaurants, etc. The COVID-19 pandemic and the closure of many restaurants may have influenced consumption patterns in 2020, but this rate will not be the same across different types of households, depending on income and expenditure levels. The average monthly income and expenditure per capita dispersion across various socioeconomic groups remain relatively high. The average monthly available income per capita is traditionally highest in the households of self-employed people and in households of married couples without dependent children, around 30 percent above the national average (Central Statistical Office, 2006).

Table 9-3. Consumption of selected food groups in 2005, 2010, 2015 and 2018 (kg per person per year) in Poland

	2005	2010	2015	2018
Bread and cereals	93.7	84.1	72.7	65.8
Vegetables and products	68.9	61.4	57.5	59.4
Potatoes	80.2	58.0	44.3	35.6
Fruits and products	44.6	41.2	43.1	45.0
Meat	65.7	66.8	63.2	62.4
Fish and seafood	5.0	3.4	3.96	3.36
Milk	53.2	42.1	37.8	35.3
Eggs (in units)	181	153	141	133
Animal fats	6.2	5.0	4.1	3.9
Vegetable oils	12.0	11.2	9.7	9.0
Sugar	18.4	15.6	13.1	11.2

Source: Statistics Poland. 2021. Annual editions of Household Budget Surveys, 2006 ... 2018. Warsaw <https://stat.gov.pl>

Gaps and challenges of dietary changes

Analysing the cost and availability of healthy diets shows that only 0.8 percent of Poland's population cannot afford a healthy diet, 0.5 percent cannot afford a nutrient-adequate diet, and 0.1 percent cannot afford an energy-sufficient diet (FAO *et al.*, 2020). However, country data show that many low-income and small (one-person) households are food insecure and either cannot buy the food they need or choose cheap, low-quality products.

Studies have shown that there are several ways to slow, and possibly reverse, the projected increases of non-communicable diseases (NCDs) and adverse environmental impacts. Among these are transitioning to diets that contain smaller proportions of calories from animal-source foods, particularly ruminant meat (cows, goats and sheep). Reducing meat consumption can reduce greenhouse gas (GHG) emissions while retaining nutritionally adequate diets by substituting fruits and vegetables for meats in order to fulfil caloric requirements (Willet, 2019). The biggest challenges in Poland are increasing the consumption of plant-based foods, especially fruits, pulses and nuts, whose consumption rates are very low compared to other countries in the European Union.

Another challenge in fostering dietary changes is linked to conventional food classifications that have different effects on health and disease. For example, cereals and cereal products often are grouped under "whole grains." This food group also contains sugary breakfast cereals and cookies. In Europe, the NOVA classification system has been used to describe population dietary patterns and to study the

relationship between household food consumption patterns and relative prices of ultra-processed and all other food items to estimate the potential for the reduction of cardiovascular disease by reducing the consumption of ultra-processed products (Monteiro *et al.*, 2018).

Structure and changes of food trade

International trade and trade agreements

Poland became a member of the General Agreement on Tariffs and Trade (GATT) in October 1967 and a member of the World Trade Organization (WTO) in July 1995. Since 2003, the country has been a net exporter of agrifood products. In 2018, almost 45 percent of the country's food industry's sale value was from export transactions, compared to 14 percent before European Union enlargement. Poland is one of the European Union leaders in food exports. It is ranked first in poultry exports and is one of the leading suppliers of apples, dairy and confectionery products. The trade of non-food commodities generates a deficit, but the trade of agrifood products reduces the size of this deficit (Łopaciuk, 2019). The share of agrifood products in Poland's total export in 2019 was 10.7 percent, while the share in total import was 7.2 percent.

The main trading partners in both exports and imports of Polish agrifood products are European Union countries, mainly Germany. The European Union accounts for 82 percent of Poland's total exports and is responsible for 69 percent of Poland's imports. The highest profits were generated primarily by the export of meat (poultry, beef, pork), cigarettes, dairy products, chocolate, other products containing cocoa, bakery and confectionery products, sugar syrups, animal feed, fish (fresh and processed), processed meat, fruit juices (mainly apple juice), wheat, and frozen fruits. By value, the share of these goods in the total export of agrifood products amounted to over 60 percent. The biggest expenditures were incurred for imports of pork, fish, soybean cakes, chocolate, other products containing cocoa, animal feed, sugar syrups, unprocessed tobacco, fish fillets, live pigs, citrus fruits, bakery and confectionery products, cheeses, flour, bananas, wine, meat, meat preserves, oilseeds, vegetable fats, coffee, tea and cocoa. The share of import of these goods in the total value of imports of agrifood products amounted to nearly 50 percent.

Domestic retail market

The Polish retail market is dominated by small conventional outlets that coexist with large surface stores with more than 400 sq. m of trading surface. In 1993, the number of shops selling food in Poland was estimated at 139 100, which includes 1 100 supermarkets and discount stores. The first hypermarket with more than 2 500 sq. m of trading surface opened in Warsaw in 1993. According to Central Statistics Office data, in the past 25 years, the total number of grocery stores decreased to around 108 000, of which 6 000 are supermarkets and hypermarkets. In 2018, the calculated number of inhabitants per hypermarket or supermarket store was 4 668. The most popular form of large self-service outlets in Poland are discount stores, which, due to their low prices, are extremely competitive players. Poles prefer to buy food in discount shops situated along the route from home to work, in grocery stores with traditional service, and in convenience shops. According to the 2015 AC Nielsen Shopper Trends Report, Poles purchase foods much more frequently than do all other Europeans (Maciejewski, 2018).

In 2019, in order to prevent local retailers from trashing unsold food that was still fit for consumption, a new law was introduced (the Parliament Act of 19 July 2019 on Counteracting Food Loss and Waste) that requires the owners of retail outlets with a total surface of greater than 250 sq. m to donate such food to charity organizations, with the disposal of edible food punishable by financial penalties.

Agricultural and food production systems structure and changes

Structural changes

There is a gap between two key structural transformation indicators: the agriculture share in GDP (value-added share) and employment, also called the “sectoral Gini coefficient.” This indicates that there is an inequality of incomes between those engaged in agriculture and the rest of the economy. In Poland, this figure reached a difference of 8.4 percent in 2015–2017. Both indicators have been decreasing in recent years. However, only five other countries among the 30 total European Union and EFTA countries – Croatia, Greece, Lithuania, Portugal and Romania – had a larger gap (FAO, 2019).

The farm structure in most regions of Poland is fragmented, historically determined, and dominated by small family holdings. The estimated number of farms, characterized by a falling trend, currently rests at around 1.4 million farms. The fragmentation of Polish agriculture strongly inhibited the process of vertical integration in the supply chain. Establishing effective grading systems at the farm level or quality assurance schemes was seen as the next step in reducing transaction costs in the sector. Due to the hegemony of buyers in setting transaction terms, many producers saw the necessity to cooperate in order to strengthen their bargaining position on the market and lower transaction costs. In mid-2004, when Poland joined the European Union, there were 22 registered farming producer organizations in Poland. The number of farmers in these groups was around 800. In 2018, the number of producer organizations surpassed 800. The benefits of horizontal integration in Polish agriculture include higher prices received by cooperating farmers, and also significant revenue advantages compared to average procurement prices. This demonstrates the relatively higher market power of affiliated holdings, and from this point of view, public support directed at improving horizontal integration is justified (Bajan and Czubak, 2018).

Policies and drivers for change

Before 1989, due to regulated prices and guaranteed purchases of basic products, agricultural production for the majority of farms was remunerative. The costs of the basic means of production and food were subsidized, and all agricultural and processing outputs could be sold, regardless of their quality and cost of production (Józwiak, 2000). During the transformation and restructuring processes, many policy measures were introduced, including custom tariffs to prevent excessive import, subsidies to agricultural loans and fuel, and preferential credit lines. However, it was the European Union integration process that had the main impact on the sector’s transformation and modernization process.

In 2004, Polish agriculture became a beneficiary of European Union funds under the CAP, including EUR 23.4 billion in direct payments to farmers in the 2014–2020 budget framework. A simplified system

of payments, known as the single area payment scheme, links the amount of basic income support for Polish farmers to the area of land declared by each farmer. This means of payment is simpler than the main direct payment scheme applicable in most European Union countries. The Polish authorities earmarked 15 percent of their direct payments for voluntary coupled support, i.e. linking payments not only to hectares but to specific products or processes, such as beef, veal, flax, fruits, vegetables, hemp, hops, milk, milk products, protein crops, sheep meat, goat meat, starch potatoes and sugar beets.

The European Strategy on Nutrition, Overweight and Obesity adopted in May 2007 recognized that the CAP may play a role in shaping the European diets and counteracting trends in obesity and overweight by ensuring the availability of the foods. In 2009, the European Union fruit scheme was launched, and in 2017, it merged with the school milk scheme, which has been operating in schools since the 1980s.

The amount of the European Union community aid allocated annually for the school fruit scheme in Poland surpassed EUR 9 million, about 10 percent of the total European Union budget for all participating countries, while the school milk scheme has a budget of EUR 14 million, or about 19 percent of the total European Union budget for the programme. Both schemes receive additional funding from the national budget. In the case of the milk programme, dairy products distributed in preschools and secondary schools were also subsidized by the milk industry. The current European Union school scheme, developed in 2017, supports the distribution of fruit, vegetables and milk to schools across the European Union as a part of a wider educational programme about European agriculture and the benefits of healthy eating in school settings. This has the potential to improve dietary patterns in Poland. The scheme is administered by the National Support Centre for Agriculture (KOWR), which reported 1.8 million child participants in the first two years of the programme.

Food processing and marketing structure change

Structural changes

Since 2004, the Polish food and beverage industry has operated on the European Union single market and plays an important role in the European Union's largest manufacturing sector. More than 99 percent of companies in the region are small and medium-sized enterprises (SMEs), generating around 50 percent of the total production turnover and providing two-thirds of jobs in the industry. The many challenges that SMEs and smallholders have faced in recent decades can be linked to high competition and transaction costs, including for negotiations, information and monitoring of the changing market. Institutional changes were introduced to reduce these costs and counteract hold-up problems (Gellynck, Halicka and Viaene, 2002). The changes brought by the market system and the restructuring of the Polish economy resulted in a rapid inflow of foreign capital to the country in the 1990s. Direct foreign investments with a single value greater than USD 1.1 million in the food industry between 1990 and 2004 was estimated at USD 7 billion, and 75 percent of these investments were made by global corporations (Kowrygo, 2008). The decisions made by global agrifood companies to invest in Poland were driven by the cheap labour force and the possibility of taking over companies for relatively low prices. These companies became the source of modern technologies, marketing, management and organizational know-how, slowly taking control over the industry. According to national statistical data from 1997 and 2006, the number of employees dropped in large and medium-sized companies from 1995 (356 000) to 2005 (297 500). However, work efficiency increased during time. Due to the observed concentration process, the number of food processing companies decreased in the past decade, from 21 000 in 2006 to 15 100 in 2017 (Statistics Poland, 2022).

Out of the total 294 000 food processing companies currently operating in the European Union, approximately 15 100 are in Poland, and these companies employ roughly 460 000 of the total 4.72 million people employed by the food and beverage sector in the European Union. Poland is ranked No. 5 in the European Union in the number of people employed in this sector. In 2017, it had the sixth highest annual turnover, estimated at EUR 62.4 billion, compared to EUR 1.2 trillion among all EU-28 countries at the time (FoodDrinkEurope, 2019).

Policies and drivers for change

Several food safety emergencies, including the bovine spongiform encephalopathy crisis in the mid-1990s, heralded a transition from market-oriented food laws in European Union Member Nations to food safety laws. The goal of the new legislation was to restore and maintain consumer confidence. A new and independent Food Safety Authority was established with a number of key tasks, embracing independent scientific advice on all elements of legislation related to food safety, operation of rapid alert systems, communication with consumers, and networking with national agencies and scientific bodies.

The abundance of food available on the market and the increased consumption of so-called ultra-processed foods high in fats, sugars and sodium is linked to poor health outcomes and is associated with an increased risk of overweight, obesity and NCDs. According to many experts, including the FAO High-Level Panel of Experts on Food Security and Nutrition, policies should aim at limiting the consumption of highly processed and nutrient-poor foods by targeting consumers and the industries that produce these foods (HLPE, 2017). Although policies can influence food availability and content by making some

ingredients cheaper than others, by regulating food markets and firms, by providing information to consumers and by researching investments that introduce new food content or processing, such changes can occur without consumer awareness.

Many European Union institutions, including the European Commission's Health and Food Safety Department (Directorate General SANTE), have taken steps to engage the food industry in the process of changing the diets of European consumers. The Commission's High-Level Group on Nutrition and Physical Activity enhances contact among governments in order to create relevant collaborations within the food industry and among the food industry, health-oriented NGOs and policymakers. In order to coordinate and promote the fight against diet-related diseases in European Union countries, a Platform for Diet, Physical Activity and Health was created in 2005. Platform members commit to undertaking activities aimed at preventing obesity and overweight. Since 2015, more than 300 commitments involving stakeholders at local, regional, national and European level have been made, with 166 of them covering Poland. One of the ongoing commitments aimed at children and adolescents is the "Keep Fit!" educational programme, which is based on a partnership between the state administration and private sector organizations and is supported by the Ministry of Health, the Ministry of Sports, the Ministry of Education and the Ministry of Agriculture and Rural Development in Poland.

Marketing and advertising practices

European Union countries implement policy tools that address the marketing of food and alcohol-free beverages in specific settings, such as primary and secondary schools, in order to limit the effects of food marketing to children and adolescents. These tools range from legally binding obligations to industry self-regulation and stakeholder cooperation platforms. In Poland, the issue is approached through both comprehensive and stepwise policy measures, including legal regulations for limiting the sale, advertisement, and promotion of foods, based on a list of food categories, in schools. Advertising and promoting foods that do not meet nutrition standards in preschools and primary and secondary schools has been banned since 2015.

Restricting the marketing of foods high in fat, sugar and salt and non-alcoholic beverages to children in Poland is based on voluntary and self-regulatory measures proposed by the industry. Initially, European Union Pledge member companies committed to not advertise products to children younger than 12, except for products that fulfil specific nutrition criteria. They defined "advertising to children under twelve years" as advertising to media audiences with a minimum of 50 percent of children younger than 12. The companies then enhanced this commitment by lowering the audience threshold to 35 percent of children younger than 12. Regarding online media, the European Union Pledge originally applied only to third-party internet advertising. Since January 2012, member companies also have applied this commitment to company-owned websites.

The marketing of food products for infants (people younger than 12 months old) and young children (people between 1 and 3 years of age) is subject to provisions of the International Code of Marketing of Breast-milk Substitutes, which was adopted in 1981 by the World Health Assembly (WHA). The goal of this policy was to promote safe and adequate nutrition for infants by protecting and promoting breastfeeding and by ensuring the proper use of breast milk substitutes when these are necessary. The ICMBMS is followed by many WHA resolutions that take into consideration the development of markets, scientific knowledge, and changes in consumer awareness. Resolutions have the same status as the ICMBMS and constitute significant restrictions in the marketing of formula and baby foods.

They also are accountable for education about infant and adolescent nutrition for health workers, health systems and governments.

For European Union Members, limitations on the labelling, presentation and marketing of formula milk and foods for infants are included in Regulation (EU) No. 609/2013 of the European Parliament and of the Council of 12 June 2013 on food intended for infants and young children, food for special medical purposes, and total diet replacement for weight control. However, the regulations only partially implement the ICMBMS and WHA resolutions. Market research conducted in Poland has shown that manufacturers of food products for infants and young children have been predominantly transnational corporations with tremendous marketing power, often pursuing other means of targeting potential consumers (particularly pregnant women) as early as possible (Jackowska, Rejman and Halicka, 2018).

Food additives and food fortification

Currently, all issues related to food fortification in European Union Member Nations are covered by Regulation (EC) No. 1925/2006 of the European Parliament and of the Council of 20 December 2006 on the addition of vitamins and minerals and of certain other substances to foods.

In Poland, in accordance with the decree of the Minister of Health of 16 September 2010, producers are obliged to add vitamins A and D to spreadable fats, excluding butter, and iodine to salt for human consumption, which has been mandatory since the 1980s. Products that can be voluntarily fortified are juices, non-alcoholic beverages, cereal products and confectioneries. Manufacturers can decide on the amounts of vitamins or minerals they add, but in accordance with European Union regulations, only vitamins and minerals normally found in and consumed as part of the diet and that are considered essential nutrients should be allowed to be added to food, meaning that manufacturers should not add new vitamins and minerals but rather enhance the ones already found in the food product. The labelling, presentation and advertising of foods to which vitamins and minerals have been added must omit statements implying that a balanced and varied diet can be achieved through the consumption of added vitamins and minerals. It also is prohibited to add vitamins and minerals to unprocessed foods, including fruits, vegetables, meat, poultry, fish and beverages containing more than 1.2 percent alcohol.

Taxation on unhealthy food

A sugar tax was introduced under the Act of 14 February 2020, in effect since 1 January 2021, in order to reduce the consumption of beverages with added sugar (so-called sugar-sweetened beverages). The fee covers food, drinks and syrups containing sugar or sweetener and those with the addition of caffeine or taurine. It does not cover medical devices, food for special medical purposes, dietary supplements, infant formulas, excise goods, dairy products, isotonic drinks and drinks containing at least 20 percent fruit, vegetable or fruit and vegetable juice. The legislation implies that 96.5 percent of the proceeds from the fee constitute the income of the National Health Fund and 3.5 percent the income of the state budget.

Food labelling/information

Regulation (EU) No. 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers came into effect in the Polish food market in December

2014. According to this regulation, information should not mislead the consumer or be ambiguous or confusing. In addition, where appropriate, information should be based on relevant scientific data.

Voluntary quality assurance schemes (such as protected designation of origin, protected geographical indication and traditional speciality guaranteed designations and other eco-labels) have been gradually introduced to products by producers seeking a competitive advantage. By the end of 2019, there were 42 Polish foodstuffs registered in the European Union with additional eco-labels. National voluntary business-to-consumer labelling schemes, including the PDZ (Poznaj Dobrą Żywność) certificate, administered by the Ministry of Agriculture and Rural Development, also are implemented by local producers to gain market share and loyal customers.

Consumer demand, awareness, education and social protection

Food-based dietary guidelines

One of the keys to developing effective methods to transform diets is raising awareness among consumers about the consequences of their behaviours related to food, including purchasing decisions, food preparation, and food waste. Dietary guidelines for the Polish population were introduced by the Institute of Food and Nutrition (IŻŻ) in 1995 and later modified in 2009, 2016 and 2019. In October 2020, new recommendations were developed and endorsed by the National Institute of Public Health National Institute of Hygiene in collaboration with the Ministry of Health. Polish consumers are encouraged to eat a variety of foods every day and consume more full-grain cereals, vegetables, fruits, pulses, fish, low-fat milk products and nuts. Lowering the intake of salt, red meat, sugar, sweetened beverages and processed products is recommended (**Figure 9-1**). Healthier food options and steps to achieve change include choosing fish, poultry, eggs and pulses rather than red meat and choosing water instead of sweetened beverages. Daily energy food intake should not exceed individual daily requirements related to age and physical activity level.

Figure 9-1. Healthy eating recommendations, 2020



Source: Wolnicka K. ed. 2021. *Wiem, że dobrze jem. Talerz Zdrowego Żywienia w praktyce*. Warsaw. Narodowy Instytut Zdrowia Publicznego PZH – Państwowy Instytut Badawczy e-book-Talerz-Zdrowego-Zywienia.pdf (pzh.gov.pl)

School food and nutrition

Since September 2015, legislation has come into effect regulating the availability of foods sold in schools, banning the sale of products that do not fulfil the requirements for specific age groups according to the current recommended dietary allowances for the Polish population. According to these guidelines, children should eat foods from various food groups, and their daily diets should include cereal products or potatoes, vegetables, fruits, milk or other dairy products, meat, fish, eggs, nuts, pulses and edible fats. Soups, sauces and other dishes sold in schools must be prepared without the use of concentrates, with the exception of natural concentrates. Pupils can buy milk-based (or milk-alternative) cocktails with fruits or vegetables, mineral or spring water, and drinks prepared on site (e.g. tea, compotes, cocoa-based drinks and coffee) under the condition that these beverages contain no more than 10 g of sugar per 250 g of product. Schoolchildren also can buy drinks with no added sugars or sweeteners. School shops can sell sugar-free gums and dark chocolate with a minimum 70 percent of cocoa. The list of products available in school shops was slightly modified after protests from children and their parents, with an updated list published in August 2016. School cafeterias cannot serve more than two fried meals each week, and the oil used for frying should be plant-based and contain more than 50 percent of monounsaturated fatty acids and less than 40 percent of polyunsaturated fatty acids.

The European Union school scheme is a CAP initiative aimed at promoting healthy diets among schoolchildren. In Poland, free of charge, children who participate in the programme receive portions of fresh fruit, vegetables, juices and milk products at least three times a week for 12 weeks. In the school year 2019–2020, the scheme's budget totalled PLN 238.15 million (around EUR 54 million), of which PLN 110.05 million was contributed by the European Union budget and the remainder by the national budget. Around 1.725 million children, constituting 94.2 percent of the targeted group, took part in the fruit and vegetable component in the first semester of 2019/2020, and 1.721 million children (94 percent of the target group) took part in the milk component (Program dla szkół, 2022). Regular monitoring is needed to evaluate the impact of this programme, especially during the COVID-19 pandemic, which led to many months of school closures.

Nutrition education covering topics related to health and diet is included in the curriculum for various school levels. Due to the rising prevalence of obesity among school-aged children, standards and recipes for school meals were published by the Food and Nutrition Institute in 2012.

Nutrition-sensitive social protection

After joining the European Union, Poland implemented the European Food Aid programme for the most deprived people. The programme was established in 1987 under the CAP to distribute food among the European Union's neediest inhabitants. The value of support through this programme in Poland reached EUR 622 million between 2004 and 2014. In 2015, the programme was replaced by the Fund for European Aid to the Most Deprived (FEAD), and once again, Poland was among the biggest beneficiaries. The fund is aimed at providing non-financial assistance to materially deprived people and at helping them take their first steps out of poverty. It is financed from structural funds allocated to the European Social Fund. European Union countries contribute at least 15 percent of the total budget in co-financing their national programmes. In Poland, FEAD supports disadvantaged households by providing food aid in packages or meals. Accompanying measures and common initiatives for local communities include workshops focused on cooking/food products, healthy eating, preventing food waste, and managing household budgets. These actions are aimed at strengthening end recipients' autonomy and skills in managing their households. The programme's total budget for 2014–2020 was EUR 3.8 billion,

with Poland allocated EUR 420 million. NGOs, including the Federation of Food Banks, Caritas, and the Polish Red Cross, play key roles in managing the projects supported by the FEAD.

In accordance with Article 12 of the Treaty on the Functioning of the European Union (TFEU), consumer protection requirements must be taken into account in defining and implementing other European Union policies and activities. Article 38 of the Charter of Fundamental Rights of the European Union reinforces consumer protection by stating that European Union policies must ensure a high level of consumer protection.

Another population group in need of protection in Poland in the context of food security and nutrition is school-aged children. With progressive economic system transformation, undernutrition among families with young children has become a persistent issue. Not all families have been receiving the needed support due to shortages of funds. In September 2015, the Council of Ministers implemented a programme for supporting communities in the years 2014–2020. The budget of the programme was established at PLN 3.85 million (approximately EUR 0.9 million). Its strategic goal was to decrease undernutrition among children and adolescents from low-income families or in difficult life situations, including students from areas of high unemployment or from rural communities. The target demographics also included the elderly, adults living alone, and those who are sick and/or disabled.

Nutrition education and behaviour change communication

In recent years, measures have been implemented in many European Union countries aimed at raising awareness of nutrient deficiencies, increased consumption of fruits and vegetables, and improvement of school lunches and dietary education. Information policy, such as those regarding labelling regulations and nutrition information, can raise consumer awareness and stimulate demand for products recommended for better health and environmental sustainability. The main objective of the European Union Consumer Policy Strategy, as described in the Commission “Consumer Empowerment in the EU” working paper, is to empower European Union consumers through choice, information and awareness of their rights.

In 2017, the National Centre for Nutritional Education was established in Poland, financed by the National Health Programme. A big role in educating the population also is played by the hundreds of NGOs with motivated and competent management but that do not have sustained funds to fulfil their goals. However, there is an overall lack of cooperation mechanisms among NGOs in various regions of the country.

Cross-cutting issues

In 2016, the European Economic and Social Committee (EESC) called on the European Commission and Member States to develop a clear European Union policy and implementation plan for building a sustainable, resilient, healthy, fair and climate-friendly food system that encourages cooperation and mutual understanding among all stakeholders along the food supply chain. Better coherence and integration of food-related policy objectives and instruments are necessary to cohesively address the three pillars of sustainability (social, economic and environmental).

In 2019, a policy reform and realignment needed to build sustainable food systems in Europe was adopted by the International Panel of Experts on Sustainable Food Systems (IPES-Food, 2019), presenting the environmental and social impacts of the CAP in Europe and containing a blueprint of a revised CAP aimed at aligning European Union policies currently handled by separate departments – so-called directorates general – in the European Commission and various committees in the European Parliament to shape sustainable food systems. The report recognizes the gaps between policies developed at national and European Union levels and states that a shift towards the relocalization and reterritorialization of food systems must be seen not as a threat but rather as an opportunity for fairer and more sustainable food systems. According to the report, the European Union “can enable such transitions, accelerate collective learning, support networks of local actors, and ensure that the best innovations are more widely shared” (IPES-Food, 2019). The European Economic and Social Committee made a demand to establish a European Union Food Policy Council.

The European Union Farm to Fork Strategy, the cornerstone of the European Green Deal, aims to accelerate the process of making regional food systems more sustainable. Additional financing has been provided for research and innovation in rural agricultural communities. Increased public awareness and demand for healthier and more sustainable food not only should help mitigate climate change but also ensure that everyone has access to sufficient, safe, nutritious and sustainable food. By 2023, a legislative framework will be developed to establish common general principles and requirements for sustainable food systems and products. To empower consumers, the Strategy also announced the Commission’s intent to propose a European Union sustainable food labelling framework that would integrate nutritional, environmental and social aspects of the food supply chain by 2024.

Conclusions and key messages

The rapid development of the food supply in Poland over the past three decades went hand in hand with changes in demand. This transition did not effectively support a shift to healthier diets, especially among the country's most vulnerable population groups. Currently, the most challenging form of malnutrition in Poland is obesity. This has led to a growing prevalence of diet-related diseases.

After joining the European Union in 2004 and adjusting to the single internal market institutions, including the CAP, a modern food market with European Union standards developed in Poland. Despite the introduced policy tools, including laws and self-regulation measures at both European Union and country levels, overweight and obesity rates have increased.

During the structural changes to national and European Union policies, mechanisms linked to food security and nutrition were implemented, including the European Union school scheme (a merger of the milk, fruit and vegetable schemes), the Fund for European Aid to the Most Deprived and regulations on the provision of food information to consumers. Many types of measures are implemented in European Union countries to limit the effects of food marketing to children and adolescents. In Poland, legal regulations limit the sale, advertising and promotion of foods that do not meet the nutrition standards for canteens.

Although the availability of many product groups has improved, the determinants of food choices in the population have to be further explored. According to research in urban populations, the desire to improve health by decreasing body weight was the main driver for consumer food choices, while prices remained the main limitation (Rejman *et al.*, 2018). More studies should be conducted in rural areas and among vulnerable groups, especially women and youth.

Due to the environmental, economic and social consequences of food waste, the Act on Counteracting Food Waste was adopted in July 2019. National food-based dietary guidelines, first introduced in 1995, were updated in 2020. Due to rising obesity levels, a "sugar tax" came into effect in January 2021. However, there are currently no food price policies aimed at promoting healthy diets, except for the European Union school scheme.

The process of transitioning to a sustainable and nutrition-sensitive food system requires developing a comprehensive food policy that fosters a more people-oriented approach. Changes in consumer behaviour as well as multisectoral, trust-based cooperation among entities from the agriculture, food processing, trade, health, research and education sectors are needed. Local stakeholder engagement, dialogues and participatory decision-making can increase the effectiveness of this process.

Disseminating clear messages on the importance of adopting healthy, sustainable and low-waste diets for Poland's population and continued monitoring of all the food system's stakeholders is crucial. It is hoped that the European Green Deal, which will further develop legislative and self-regulatory tools, including a sustainable food labelling scheme, can enable food systems to evolve in a more sustainable manner.

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Chapter 10

Sustainable and nutrition-sensitive food systems for healthy diets and prevention of malnutrition – Case studies in Western Europe

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Abstract

This study aims to provide an overview of the nutritional approach of countries of less concern to mitigate the predominant nutritional problem in some high income countries of the Europe and Central Asia (ECA) region. The transition of diets has resulted in high and rising rates of overweight and obesity among children and adults in the region. Therefore, it is crucial to design food and agricultural policies and assistance programmes to deal with this particular malnutrition problem. This report analyses successful nutritional policies and programmes to reflect on good practices for the future that can be applied to other countries. Among the less concerned group, Finland was selected regarding school food and nutrition education, Denmark and Austria for public food procurement, and France and the Kingdom of the Netherlands for urban food systems. The case of Rome was chosen for an in-depth analysis of integrated nutritional policy.

Keywords: *School food and nutrition education, Public food procurement, Urban food system, Value chain*

Introduction

Severe hunger has been less of an issue in the countries of Europe and Central Asia during the past two decades. However, moderate food insecurity (understood as irregular access to nutritious and sufficient food) and malnutrition affect most of the countries of the ECA region, though it affects each country differently, depending on its level of income (FAO, 2016).

Overnutrition continues to be a growing problem, challenging the region's capability to achieve global hunger and malnutrition goals. The prevalence of overweight and obesity for both children and adults are alarmingly high in most of the countries. Additionally, the region is strongly affected by challenges imposed by overconsumption of foods high in salt, fat and sugar and low consumption of fruits and vegetables, calling for structural changes in food production and food consumption within the current food systems.

There are large variations in the cost and affordability of nutritious diets by country and by segment of the population within households in a country. Addressing malnutrition in a sustainable manner must take a life-cycle approach. It must include a range of context-specific, targeted interventions that engage stakeholders across multiple sectors, including food production, food processing and social protection.

The Europe and Central Asia region is heterogeneous in terms of the composition of countries and their economic structures, climate conditions, rates of economic growth and transition, and other socio-demographic features. The nutritional status of the ECA region is categorized into four groups based on a ranking of synthetic indicators: the degree of undernutrition, micronutrient deficiencies and overnutrition (FAO, 2016).

- Undernutrition: Undernutrition and micronutrient deficiencies – 7 percent of the total population of the region.
- Triple burden: All three problems (undernutrition, micronutrient deficiencies and overnutrition) – 13 percent of the population of the region.
- Overnutrition: Overweight or obesity – 57 percent of the population of the region.
- Countries where nutrition problems are of lower concern – 23 percent of the population of the region.

Countries comprising the less concerned group in the ECA region are Austria, Belgium, Denmark, Estonia, Finland, France, Greece, Iceland, Italy, the Kingdom of the Netherlands, Norway, Sweden and Switzerland. These countries have shown relatively low numbers compared to other groups regarding the triple burden of all three problems (undernutrition, micronutrient deficiencies and overnutrition).

Despite that the less concerned group has fewer nutritional problems to address, overweight and obesity remain a critical issue even in this group. Recent WHO data show that the prevalence of overweight among children aged 6–9 has been severe, with nearly every second boy overweight and every fifth boy obese (FAO *et al.*, 2020). The countries in this group have a prevalence of adult obesity above 20 percent, which is relatively lower in Western Europe but is well above the global prevalence (FAO, 2021).

It is essential to identify methodological approaches to tackle nutritional concerns. The objective of this report is to guide the adaptation of nutritional policy for health. Particularly, this report focuses on national nutrition assistance programmes in school food and nutrition education, public food procurement, and urban food systems in the cases of **Finland, Denmark, Austria, France, the Kingdom of the Netherlands and Italy.**

School food and nutrition education

Promoting better diets and nutrition through schools can increase the health and well-being of students and their families. School-based food and nutrition education (SFNE) helps schoolchildren, adolescents and their communities advance their diets and food choices and build their capacity to change. It includes educational strategies and learning activities supported by a healthy food environment (FAO, 2019a).

Schools give a unique opportunity to support good nutrition and the development of schoolchildren. Their structured learning settings influence children's food perceptions, practices and habit interaction, enabling students to autonomously make choices and decisions about their food consumption. SFNE capitalizes on this and creates learning opportunities for shaping healthier food patterns combined with a healthy food environment (FAO, 2019a).

For these reasons, FAO values the importance of schools and cooperation with governments to maximize schools' potential through programmes and policies, supporting SFNE in school systems (FAO, 2019a).

Finland: National innovation – free school meals

Background

Finland was the first country to implement a free school meals programme, called *Kouluruokailu*. At the beginning of the twentieth century, Finland was considered to be a poor country, relying predominantly on agriculture due to its war with the Soviet Union. The country experienced great challenges, including ubiquitous malnutrition. Although its economic and political status was unstable, a law in 1943 decreed that schools must offer a free meal for all pupils. After five years of transition, all schools started to offer a free daily meal of porridge or soup. As time passed, school meals became diversified and developed into the school meal system in place today. The objective of the programme is to present a free of cost, multipurpose, well-balanced, and structured meal every school day for all children enrolled in pre-primary, basic, and upper secondary education (Finnish National Agency Education, 2019).

Stakeholders and partners

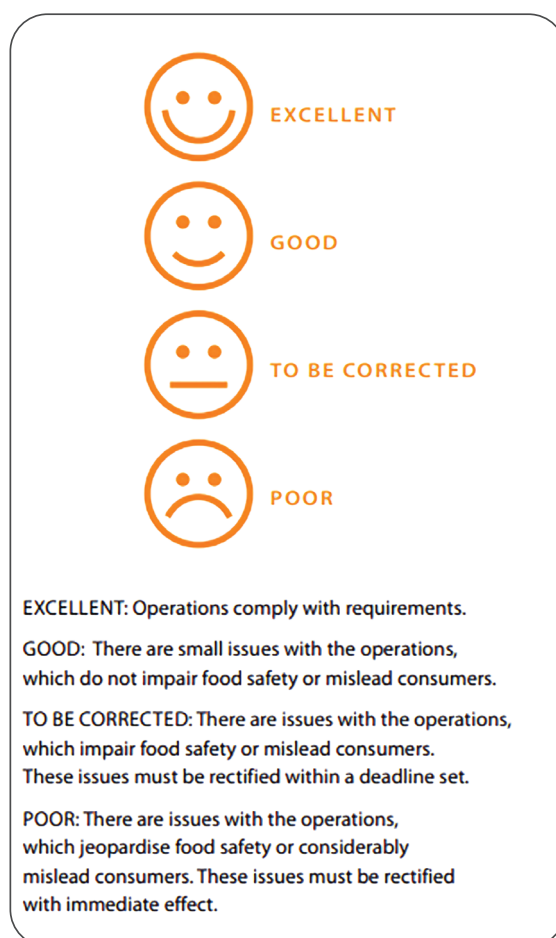
- **Beneficiaries:** The free school meals programme covers the demand for pre-primary, basic, and upper secondary education students. Food service providers for those institutions are required to provide all children and students with a meal in accordance with the federal legislation and local curricula. The Finnish school meal programme is organized regionally, meaning that municipalities and other education providers are responsible for planning and organizing statutory education, including school meals. The school meal programme also covers kindergarten students, where meals are included in the day care fee paid by parents. In higher education, a meal subsidy is offered for students to provide a reasonable and well-balanced meal daily.
- **Stakeholders:** For the programme, several governmental bodies collaborate, each with its own responsibilities. The Ministry of Education and the Finnish National Agency for Education coordinate for the academic application of the school meals programme on a national level. The Ministry of Social Affairs and Health and the National Institute for Health and Welfare

monitors the nutritional content of the meals and general welfare in school. The Ministry of Agriculture and Forestry coordinates food policy, while the Finnish Food Authority manages food safety. The National Nutrition Council develops the implementation of the nutritional guidance of school meals (Finnish National Agency Education, 2019).

Methodological approach

- Modalities, food basket, and nutritional norms:** School meals usually consist of typical Finnish cuisine. The portion size of school meals is differentiated according to age groups. A balanced school meal includes a hot dish such as potato, rice, or pasta with fish, white or red meat, vegetarian protein sources, eggs, or a vegetable side dish with salad dressing or oil. Each municipality is responsible for procuring ingredients that meet federal requirements. A food service provider, invited to tender by a municipality, plans school menus and is overseen by the Finnish Nutrition Council for food pricing and managing the food service provider's ingredient demands (Figure 10-1). In addition, the Finnish Nutrition Council examines the proportions of energy nutrients, the quality of the carbohydrates and fats, and the amount of salt. Schools are encouraged to serve a vegetarian meal once a week and have two alternative meal options alongside the main meal.

Figure 10-1. Evaluation of food safety in school catering – Oiva system (Finnish National Agency for Education, 2019)



Source: Finnish National Agency Education. 2019. School Meals for All. Helsinki, Finland, Finnish National Agency for Education. <https://www.oph.fi/en/statistics-and-publications/publications/school-meals-all>

- Food procurement and preparation
 - **Food service procurement:** Either the municipality or a catering company can produce the catering services. The procurement process should abide by the law of the European Community directives on public procurement.³⁷ The European Union suggested the method for public procurement of school meals through a guideline called Public Procurement of Food for Health: Technical Report on the School Setting. If the quality of the food or the service was insufficient, parents or school staff could raise their concerns to a school authority. If the dispute continues, the Regional State Administrative Agency could intervene.
 - **Links with local communities and local production:** In terms of tendering, it aimed to secure the economical sustainability of food service. Municipalities can decide to align with their municipal plans of public procurement. For example, the municipality of Kiuruvesi has committed to supporting local and organic foods in its public procurement since the 1990s. The City of Parainen provides locally produced food, and local farmers procure food items such as bread, potatoes, apples, and tomatoes for the city.
 - **Food preparation:** Foods are prepared depending on the requirements of the region. The methods for preparation are determined by price and labour efficiency, floor area, storage capacity and, most importantly, the needs of a school. The Finnish school tends to adapt effective central kitchen systems that deliver foods to schools after preparation and cooking (Table 10-1). The cooking procedure and the amount of food are the key factors in planning for kitchen equipment.

Table 10-1. The food preparation and transport method of central kitchen

Kitchen type	Food preparation and transport
Central kitchen	<ul style="list-style-type: none"> • Planning recipes and pre-preparation for multiple institutions • Transport food hot, cold, or chilled to be heated or served at kitchens and service points • Distribute pre-prepared foods to local canteens every day

Source: Finnish National Agency Education. 2019. School Meals for All. Helsinki, Finland, Finnish National Agency for Education. <https://www.oph.fi/en/statistics-and-publications/publications/school-meals-all>

- Policy and legal frameworks
 - **Legislation:** Legislation, national and local curricula and national recommendations regulate the school meals programme. Under the Finnish Constitution, the duties of municipalities are defined as well as the fundamental rights protected by public authorities. As Finnish municipalities have huge power in their communities, they provide citizens with basic services, such as social welfare and health, education and cultural administration, and environment and technical infrastructure.
 - **Recommendations:** The National Nutrition Council provides educational and informational guidance in order to implement recommendations to the food service sector and the education system based on the Nordic Nutrition recommendations (Finnish National Agency Education, 2019), which provide national dietary reference values and food-based dietary guidelines throughout the Nordic and Baltic countries (Christensen *et al.*, 2020).
 - **Education and curricula:** The national core curriculum is the basis for the local curricula, which prescribes standards of school meals. Municipalities and schools establish the guidelines for school meals and educational goals annually.

³⁷ Act on Public Procurement and Concession Contracts, 1397/2016 and 6 Section, <http://www.fao.org/faolex/results/details/en/c/LEX-FAOC180634>

- **Funding and budgeting:** The national budget for school meals is not specified but is circumscribed under the general funding for education. Therefore, each municipality allocates the funds for education. In 2017, the national average price for a single school meal in basic education was EUR 2.80. This price includes the costs of the food, labour, facilities, transfer and additional meals from other sources.
 - **Monitoring and evaluation:** Local and national authorities monitor school feeding. Data are collected regarding food waste, pupils' participation in school meals, and costs at the local level. Food service providers also monitor nutrient intake when planning menus. National data on food safety and pupil participation in mealtimes is collected by schools. The National Institute for Health and Welfare has evaluated pupil participation in mealtimes at school, including the timing and role of school meals, local monitoring cooperation among administrators, and the involvement of pupils and their parents.
- **Community participation:** Teachers and school staff lead pupils during mealtimes, while parents are involved in the aim and coordination of the school meals programme. The principal and teaching staff cooperate with food service providers to improve the programme. In some schools, the principal of the school forms school food committees with the teaching staff, pupils, school health care employees, and the food service provider. They meet at least twice a year to resolve problems through collaborative discussion and planning (Finnish National Agency Education, 2019).

Contribution

The serving of balanced meals at school ensures parents that their children are well nourished during the day. The school meal programme reaches all students aged 7–15, and a large proportion of young people studying in upper secondary education. The school meal programme has developed and now guarantees each student at least one balanced, warm meal a day. Since its inception, this programme has alleviated nutrition concerns and there is virtually no undernutrition in Finland. In addition, the country started to stabilize its childhood obesity rate by providing mandatory health education, physical education, and nutrition and cooking courses (World Health Organization, 2015) to tackle child obesity. Food-related education plays a key role in the fight against obesity and malnutrition, and the school mealtime has been a valuable opportunity for adopting healthy diet habits since its inception in 2011.

Like many other countries, Finland has not performed an impact evaluation of the programme. The link between modern school meal programmes and education has proven to be a challenging subject for research. However, it is recognized that school meal programmes and their links to education have certain benefits. The school meal programme is a part of a Finnish basic education system that has provided excellent academic results.

The lessons learned through the programme are the following:

- **Health and welfare:** The programme provides nutritious, delicious, and free meals to pupils, ensuring their ability to focus during the school day. The programme also teaches proper nutrition and helps students maintain their health.
- **Support for learning:** The mealtime offers a great opportunity not only for nutrition and relaxation, but also for learning-by-doing food education.
- **National guidance – local implementation:** The school meal programme is directed by national legislation, instructions, and recommendations, but its establishment is decentralized. Through decentralization, local operators have the autonomy to implement the school meal

programme in their region. Foods provided by school meal programmes are mainly made of Finnish or local ingredients, which supports local food production and teaches local food culture.

- **Horizontal institutional cooperation:** To maintain sustainable practices, it is essential to develop long-term commitments and cooperation among various institutions and actors throughout the supply chain. All collaborators should work towards a common goal, avoiding political alignments to reduce any disruptions of school meal programmes (Finnish National Agency Education, 2019).

Public food procurement

Public food procurement indicates “initiatives that aim to provide a market channel to smallholder farmers by removing key barriers to entry in public food procurement markets” (Miranda, 2018). Public food procurement can encourage agricultural development by directing government food demand to domestic suppliers, particularly smallholder farmers (Miranda, 2018). In developing countries, most rural households are smallholder farmers who engage in agriculture (Miranda, 2018). They often are susceptible to poverty, food insecurity and malnutrition and have constraints in market accessibility (Miranda, 2018). Therefore, strengthening the role of smallholder farms and farmers in public food procurement is crucial to reducing poverty and developing rural agriculture (Miranda, 2018). Public food procurement can provide an accessible market channel for improving incomes, food security, and nutrition as well as fostering positive effects in rural communities (Miranda, 2018).

Denmark and Austria have implemented public food procurement initiatives that aim to strengthen rural livelihoods and promote food security and nutrition goals. Denmark has been running an ambitious project to provide 90 percent organic foods to the public canteen, while Austria built a national framework for green dairy products. These good practices will provide a stepwise approach to guide the design and implementation of public food procurement programmes (Miranda, 2018).

Copenhagen, Denmark: Procurement of 90 percent organic, seasonal food

Background

Since the 1990s, Denmark has established national plans for sustainable food procurement and organic farming (Soldi, 2018). The Danish government has been running a green procurement program, “Grønne Indkøb,” that promotes the transition to sourcing organic products for the kitchens of public canteens by building catering units’ staff capacities via the training programme “EkoLogika” (Soldi, 2018). These programmes are based on public organic procurement policies, including food service worker training, procurement procedures and supply chain development (Soldi, 2018).

Within this structure, the City of Copenhagen declared that its food should be 90 percent organic by the end of 2015 (Soldi, 2018). In 2007, 51 percent of procured foods were organic (Soldi, 2018). In 2013, the City of Copenhagen published a public tender to provide 100 percent organic and seasonal fruits and vegetables (European Union, 2014). The objective was to provide organic foods to 80 large public kitchens in the city with a budget of around EUR 70 000 annually, serving approximately 20 000 meals per day (European Union, 2014). In 2016, the proportion of organic food procurement reached 88 percent (Soldi, 2018). Most of the public canteens reached the benchmark of 90 percent organic food, especially in nurseries and kindergartens, with assistance from the large production kitchen set up within the Copenhagen Healthy School Meals project, KØSS (Soldi, 2018).

Stakeholders and partners

- **Beneficiaries:** The organic conversion policy and the target of going from 45 to 90 percent over the course of nine years was instituted by the City Council as a part of Copenhagen’s sustainability strategy. The goal was to strengthen the market for organic and sustainable food

through the capital city's yearly spending on food, including securing clean drinking water for the citizens of Copenhagen. The 90 percent organic strategy has been a dual effort for training kitchen staff and restructuring the methods of procurement to ensure the supply of quality organic ingredients (FAO, 2018a).

- **Stakeholders:** The Municipality of Copenhagen cooperated with the Copenhagen House of Food established by the municipality in 2007. Its objective was to increase the quality of meals offered by the Municipality of Copenhagen to its citizens and to create a healthy, happy and sustainable public food culture. The House of Food has run several projects, including the Organic Conversion Project, the Assessment and Development of Quality in Public Meals Project (The Kitchen Pledge), the EAT Organic School Food Project, and the Organic Meals in Preschools and Day-cares Project (European Union, 2014).

Methodological approach

In 2018, about 89 percent of food served in Copenhagen's public canteens came from organic ingredients. The municipality achieved the ratio without increasing the budget. In order to do so, the municipality trained kitchen staff and supported the improvement of organic supply chains.

- **A city focused on sustainability:** Denmark has the second highest per capita consumption of organic food in the world. The average Dane spends EUR 227 per year on organic food, and in Copenhagen, organic produce has been mainstreamed. Organic food makes up 24 percent of total food sales in Copenhagen, whereas 89 percent of the food consumed in the City of Copenhagen's public kitchens and consumed at locales such as day care centres, nursing homes and schools is organic. This transition not only has reshaped the meals served to Copenhagen residents but also has reshaped the public food system.
- **The decision to use green procurement to promote sustainable diets:** The remarkable rise of organic food in public institutions has come about through a combination of forward-looking green procurement policies and a determination to transform food culture. The Municipality of Copenhagen has pursued an organic agenda since 2001 (Organic Without Boundaries, 2018). Consequently, the city achieved the national government goal of reaching 60 percent organic in all public canteens in 2016 (FAO, 2018a). The City of Copenhagen also won public financing for conversion and education in public kitchens and facilitated an intensive collaboration among organic farmers, food companies and wholesalers to expand organic supply to public canteens (Organic Without Boundaries, 2018).
- **Going organic within the same budget:** To achieve the 90 percent goal, the city authority trained kitchen staff and restructured procurement approaches to ensure a sufficient supply of quality organic ingredients. Municipal departments have undertaken the organic conversion of 900 kitchens across the city. No kitchen has been awarded an increased budget to achieve the goal of 90 percent organic, as the task has been to convert within existing budgets. The main idea behind the strategy is to train kitchen staff in cooking techniques so that they can plan and cook their food and meals sustainably. They also teach other techniques to maximize the value of public food spending budgets, resulting in more nutritious, climate-friendly, and appealing meals. For instance, kitchen staff received training on incorporating seasonal vegetables, using less meat, baking, preserving, fermenting, and reducing food waste.
- **Professional organic supply chains:** The Municipality of Copenhagen has made an effort to ensure that quality organic procurement and tenders support the organic transition in the kitchens. Consequently, there has been a professionalization of the organic supply lines into the canteens, schools, hospitals and nursing homes, where it is possible to get a wide range

of organic products in catering sizes, organic meat and a diverse range of seasonal fruits and vegetables. Until 2012, none of the Danish wholesalers offered fresh organic meat, and only a small range of frozen organic meat was available. This changed after the municipality published a tender specifying a wide assortment of fresh and organic meat. After this tender, these products soon became available through several wholesalers.

Contribution

Residents of Copenhagen have meals that are up to 90 percent organic, as most of the municipality's public kitchens use 90 percent organic food. Some canteens supply a higher proportion of organic food, mainly crèches, kindergartens and the EAT Kitchen, which provide 5 000 to 7 000 healthy and fresh meals to students every day. In general, 88 percent of the food from public kitchens in Copenhagen is organic (FAO, 2018a; The City of Copenhagen, 2018), meaning that approximately 141.8 kg of organic food is served weekly, with a total yearly budget of EUR 40.3 million (FAO, 2018a). As a result, Copenhagen is the largest municipal organic kitchen in Denmark (The City of Copenhagen, 2018).

The impact on sustainability is hard to quantify, but the municipality's annual consumption of organic milk shows a saving of approximately 370.82 million litres of ground water from being contaminated with pesticides. The environmental impacts that the Organic Conversion Programme has had on the Danish foodservice market cannot be evaluated. However, the organic food service market has expanded rapidly, which has resulted in a tripling of growth since 2009 (FAO, 2018a).

This approach to public food procurement reveals the innovative aspect of organic food policy in Copenhagen. The process of raising the skill level and status of public kitchen staff across the city has taken many years and has required the assistance of several external consultants and extended determination among the city's employees. The programme also has benefited from the involvement of thousands of stakeholders; the entire approach in Copenhagen, from diet changes and meal culture to changes in procurement, depends entirely on inclusion (FAO, 2018a). Although the prices of organic food tend to be higher than for non-organic food, the Municipality of Copenhagen ensured that the tender for organic food did not cost more than a tender for non-organic food by using less meat and more vegetables (European Union, 2014).

Austria: A national framework contract for green dairy products

Background

Austria started its sustainable procurement action plan in 2010 to implement sustainable public procurement criteria for 16 product groups within tenders. Most of the criteria within the food product group were based on the European Union green public procurement criteria for food and catering services. Some organizations bought through the current dairy framework contract, such as the federal ministries of education and culture, agriculture and forestry, defence, justice and the interior, health and social care facilities, welfare associations, state bodies, and municipalities. The country's Federal Procurement Agency (BBG) began procuring food for other public bodies in 2002. Since then, it has gradually incorporated requirements including organic quality, non-genetically modified produce and fairtrade ethics into their framework contracts.

BBG conducted an open tender procedure to set up a national framework contract for dairy products starting in October 2012, aiming to supply approximately 350 public kitchens with organic dairy products. Principle procurement objectives included: the consideration of organic and non-genetically modified products, the inclusion of smaller dairy producers from the region, deliveries within one working day, and better value for money. Specifications aimed to encourage food production methods that are less harmful to the environment, and the national contract was divided into eight regions to facilitate the participation of small and medium-sized enterprises (SMEs). Before each tender, the BBG forms a group to discuss and decided upon a strategy. A thorough analysis of the market was conducted before tendering, and the BBG set up working groups to decide upon the food criteria. Early market engagement activities included the BBG working groups holding discussions with dairy producers and relevant associations to determine what the market was able to deliver (European Union, 2019a).

Stakeholders and partners

- **Beneficiaries:** The objective of the national framework contract for green dairy products is to enhance the sustainable production of food by procuring organic and non-genetically modified products, including regional SMEs, transporting foods within one working day, and guaranteeing better value for money. Thus, it is expected to benefit not only SMEs but also patrons of public canteens.
- **Stakeholders:** There are some organizations that bought food products through the current dairy framework contract, including the federal ministries of education and culture, agriculture and forestry, defence and justice and the interior; health and social care facilities; welfare associations; state bodies and municipalities. Since 2002, BBG has procured food for other public institutions and gradually incorporated requirements including organic quality, non-genetically modified produce and fair trade ethics into their framework contracts.

Methodological approach

To make price comparisons possible and to illustrate priority items for ecological criteria, the tender contained a core list of 135 most used dairy products, with a subgroup of 16 basic products, including milk and butter. The product list was based on empirical knowledge from previous contracts as well as on anticipated future trends. The subgroup was identified as a range of products for which green criteria were of even higher importance.

- **The subject matter of the contract:** Supply and delivery of dairy products in Austria
- Technical specifications:
 - 21 items (15 percent) of the core product list must be of organic origin and labelled as such, as specified in EU Directive 834/2007.
 - The 16 most basic products listed must comply with the criteria set out in Austria's action plan on sustainable procurement.
 - Verification: Products with certification from AgrarMarkt Austria (AMA), a market regulation company of Austria, are automatically deemed to comply.
- Award criteria:
 - The award criteria consisted of four factors, totalling 100 percent. The authority measured the importance of each criterium differently, as follows:
 - 87 percent: price

- 10 percent: Quantity of non-genetically modified products (must be verified by a label with the GMO-free statement)
- 2 percent: Price of the products
- 1 percent: Delivery days offered outside of standard working days
- **Contract performance clauses:** To ensure safety, quality and legality in the production of dairy products, the contractor must have and maintain an Instrument for Stability (IFS) certification, or equivalent, for the duration of the contract. The whole chain of custody must be certified, meaning that suppliers are only allowed to use products from equivalently certified producers. All users of the framework contract should be allowed to conduct spot checks to verify this certification.
- **Monitoring:** The monitoring system used involves quarterly reporting and evaluation meetings with suppliers and includes a comprehensive complaint resolution process. External specialists verify quality (European Union, 2019a).

Contribution

- **Results:**

All bidders were able to comply with the criteria outlined by the framework contract for green dairy products. Because of the award criteria, 90 percent of the products in the core list do not contain genetically modified organisms (GMOs). The contract was awarded to two companies, and the value of the contract is approximately EUR 3.8 million, including VAT.
- **Environmental impact:**

As a result of the distance of contractual delivery stops having decreased, CO₂ emissions were reduced. The effect of reduced CO₂ emissions can be scaled up, considering the thousands of deliveries made each year in the public sector. Organic agriculture has a less severe environmental footprint than industrial farming methods. Organic farming avoids the use of pesticides and herbicides on crops, which pose a risk to humans and the ecosystem. Soil degradation and the loss of biodiversity associated with intensive farming methods also are reduced when organic methods are practised. The contract aimed to encourage less environmentally harmful dairy production by specifying organic dairy methods and encouraging the use of non-genetically modified products.
- **Difficulties:**

Although the contract was divided into lots, smaller dairy producers were still not able to offer competitive prices to compete with larger dairy producers. Those larger companies are usually able to produce all items from the core list, which gives them the advantage of offering lower prices (EASME, 2019; European Union, 2019a). In addition, it has been difficult to obtain milk-based products that are non-genetically modified, as additional ingredients, such as sugar, fruit purée, stabilizers and aromas, often contain GMO residues. It would be less restrictive and easier to obtain these products in the future if the milk component were required to be non-genetically modified solely (European Union, 2019a).

Urban food system

The world is experiencing extraordinary urban growth. Over half of the globe's population lives in urban areas, and by 2050, an additional 2.5 billion people will have moved to cities (European Union, 2019b). Attention to urban food security and intra- and peri-urban agriculture has increased considerably over the last couple of decades. Various cities have designed innovative food and urban agriculture policies and are implementing programmes to strengthen the urban food system and stimulate local food production and multifunctional land use in the cities and surrounding regions. Urban agriculture contributes to a wide variety of urban issues and has been better integrated into urban land use planning and urban sector programmes, such as social inclusion and poverty alleviation, local economic development, environmental management, and climate change strategies, among others. Urban food systems have been used as a tool in sustainable city development (RUAF, 2022).

FAO recognizes the importance of addressing urban food systems and has developed a framework to support the Urban Food Agenda, underpinning the complex interconnected social, economic, environmental, political, and cultural dynamics. FAO aims to support decision-makers at global, national, territorial, and urban levels to identify the role of cities and subnational governments as key strategic sites and actors to address the complex socioeconomic and ecological issues that constrain food security and nutrition (FAO, 2019b).

Paris, France: The Paris Health Nutrition Programme

Background

The Paris Health Nutrition (Paris Santé Nutrition; PSN) programme aims to alter the environments where children's eating and activity habits are formed, in both family and educational settings, by ensuring a coherent approach to addressing adolescent overweight and obesity rates among city departments. The programme builds awareness of balanced diets among institutions that provide food services; helps professionals develop projects, tools and events aimed at young people who are overweight; and conducts studies of nutrition and health status at the household level (Halliday, Platenkamp and Nicolarea, 2019).

The programme was necessary because of the high rate of overweight children across Paris. In 2009, the regional health observatory found that almost one in six children (15.6 percent) aged 8–9 was overweight. The programme began in 2009 in three pilot districts in Paris with high rates of food insecurity (the 13th, 15th and 19th). Its initial targets were parents, teachers and childcare professions, but it later oscillated towards institutional actors. In 2013, the programme was launched in three more districts (the 10th, 18th and 20th) (Halliday, Platenkamp and Nicolarea, 2019).

Stakeholders and partners

- Beneficiaries:** The PSN programme was launched in 2009 under the leadership of the deputy mayor of Paris in charge of public health and relations with the Parisian hospital system. The programme was organized by the Department of Social Action, Childhood and Health (DASES) in partnership with the funds of schools and district town halls. The main objective of the programme was to prevent overweight and obesity in young people and vulnerable populations. The programme was based on three aims:
 - Establish an inventory of districts: study with the families in furnished hotels, etc.
 - Bring awareness to the components of a balanced, nutritious diet and lifestyle and to steer institutions and social structures towards interventions that focus on food and physical activity.
 - Establish tools and set up events to raise awareness about nutrition and motivate overweight young people to practice and adapt physical activity with the attending physician from the Parisian hospital system (La Caisse des écoles du 20^e arrondissement, 2019).
- Stakeholders:** The deputy mayor managing public health and relations with the Parisian hospital system started the programme. It is directed by the city's directorate for DASES with the Caisses des Écoles, the public institutions encouraging school participation, such as town halls. The project is supervised by both citywide coordinators and project managers in each district. Other partners participate in specific projects (Halliday, Platenkamp and Nicolarea, 2019).

Methodological approach

- Translating policies to fight obesity according to Parisian territories
 The programme combined nutrition education, prevention and physical activity promotion and is regarded as a strong political statement in combatting rising overweight and obesity rates. It has a sustainable administrative organization in the form of a district mission, whose management is entrusted to nutrition expertise. In volunteer district town halls, the PSN mission is led by a local project manager in collaboration with the elected municipal official in charge of health issues and relies on the central coordination based at DASES.

In the districts affiliated with the PSN, the actions and projects are carried out with the catchphrase "Eat better, move more." It is taken from the official slogan "*Manger Bouger* (Eat and Move)³⁸" of the Programme National Nutrition Health (PNNS), a governmental exercise programme. As the notions of "Eat well" and "Move well" are clearly defined by the PNNS, PSN reassured its objectives and the public aims. "Eat well" for the PNNS means adopting a varied and balanced diet. This consists of favouring foods that are beneficial to children's health and limiting the consumption of sweets, salty snacks and fats. For the PSN, this incentive has been translated into a booklet for children from 8 to 9 years old with the evocative title "History of eating well" (**Figure 10-2**). Likewise, "Move well" encourages moving or exercising more often. In the same vein, a booklet titled "History of moving well" conveys this message (**Figure 10-3**).

³⁸ Manger Bouger, <https://www.mangerbouger.fr/>

Figure 10-2.
The cover of 'History of eating well'



Source: La Caisse des écoles du 20e arrondissement. 2019. Paris Santé Nutrition – Présentation.
In: La Caisse Des Écoles Du 20e Arrondissement.
<http://www.caissedesecoles20.com/paris-sante-nutrition-presentation/>

Figure 10-3.
The cover of 'History of moving well'



Source: La Caisse des écoles du 20e arrondissement. 2019. Paris Santé Nutrition – Présentation.
In: La Caisse Des Écoles Du 20e Arrondissement.
<http://www.caissedesecoles20.com/paris-sante-nutrition-presentation/>

These translations of the PNNS recommendations by PSN highlight the importance of nutrition education and physical activity. The goal is to reduce the prevalence of obesity and decrease the sedentariness of all age groups.

The PSN is structured around three themes: Know, Prevent and Manage. By “Know,” the PSN intends to evaluate the mission by conducting studies with families or professionals in contact with the target populations. It is a matter of understanding the facets of nutritional problems by locale. By “Prevent,” the PSN raises awareness through local communication actions about a balanced diet. It guides children and adults to adopt appropriate eating habits, described in educational booklets distributed through municipal and associative institutions. By “Manage,” the PSN supports young people who qualify as overweight or obese with adapted physical activity workshops. The support aims to provide expertise to organizations working with the PSN, such as social centres, recreation and associations to promote projects and events, such as nutrition workshops, physical activities and training families via social workers.

- Action based on networks and proximity
The PSN does not tackle the treatment of overweight and obesity but supports and strengthens the networking of professionals and actors in the field. The development of a network around nutrition is one of the PSN’s stated objectives. It is done at the local and departmental level and encourages multidisciplinary collaborations among professionals with various areas of expertise in the same region or locale.

Through the proximity of the working area, the PSN network collaborates with other health networks already in operation. The Ile-de-France RéPOP, the city-hospital network, and its Paris cell are partnering with PSN around a joint action: adapted physical activity workshops. The adapted physical activity workshops are proof of the operationalization of network practice. They have attempted to improve the physical condition of children and help build self-esteem. Recently, the PSN and RéPOP launched a workshop at the House of Teens Robert Debré Hospital in the 19th district. Committed to the fight against obesity as a member of the Integrated North Francilian Centre for Adult and Childhood Obesity (CINFO), the hospital already had collaborated with the RéPOP through its practitioners involved in this network. The collaboration with the PSN provides access to its adapted physical activity workshops for obese children recruited by the hospital.

The PSN network aims to involve the environment of children directly into the prevention and awareness-raising process. In this network, the associative framework, such as social or leisure centres, are provided on a daily basis.

This network methodology reflects one of the functions of the PSN organization for the city of Paris. In addition to being a credible interlocutor for the problem of rising overweight and obesity rates, the PSN serves as a platform for people who are difficult to reach and offers tools for the management of overweight and obesity. Moreover, two orientation circuits have emerged through these synergies. The first circuit combines the obesity consultation of a hospital as a detection element, leading to the integration of adapted physical activity workshops in the 19th district. The second circuit is based on school health and identification, made during check-ups of children during kindergarten. In the case of severe obesity, parents and an attending physician coordinate in the monitoring of a child by registering for adapted physical activity workshops. Consequently, the PSN could improve the effectiveness of management of obesity by forming direct relationships among the participants and the support team (Laupeze, 2016).

Contribution

Unfortunately, it is challenging to quantify the effect of the programme regarding the number of children who no longer were overweight or obese after participation in the PNS. The PNS programme has encouraged behaviour change in some children and parents, and the number of children who have joined activities has increased steadily. Some parents have shown increased interest in teaching healthy eating habits for their children (Halliday, Platenkamp and Nicolarea, 2019).

Utrecht, The Kingdom of the Netherlands: Food as a means of reducing inequalities

Background

The Utrecht region, in the centre of the Kingdom of the Netherlands, consists of ten municipalities, including the City of Utrecht and nine neighbouring cities (RUAF and FAO, 2018). Agriculture in the Utrecht region provides 5 percent of foods consumed within the region and is mostly dedicated to dairy farming, with only a few farms producing fruits and vegetables. It is relatively small-scale and faced with an ageing farmer population. In the cities of Utrecht and Zeist, also in the Utrecht region, there are a large variety of urban and peri-urban agriculture activities, such as allotments, school gardens, semi-governmental urban farms, and income-generating farms. These initiatives provide an important range of social and educational services to the Utrecht region (RUAF and FAO, 2018).

In 2014, according to the Utrecht Public Health Monitor, the citizens of Utrecht had good levels of health. However, a close examination revealed that there were major health inequalities throughout the city. Regarding food consumption patterns, this issue required a concerted action involving the municipality, residents, civil society associations and other local actors. With these stakeholders, the City of Utrecht developed a plan to disrupt this trend and prevent health inequalities from increasing by recognizing the key roles of players in the field of food and nutrition. Consequently, several initiatives promoting healthy food and the reduction of inequalities have been supported (FAO, 2018b).

Stakeholders and partners

- **Beneficiaries:** In 2016, 33 percent of the population in the City of Utrecht was classified as overweight. Among them, 21 percent were classified as having low education and were diagnosed with Type II diabetes. Figures were similar or higher for other municipalities in Utrecht. Also, with urban population growth and increasing awareness of the relationship between food consumption and health, demand for healthy and sustainable food has increased. Therefore, in 2015, the City of Utrecht has adopted “healthy urban living” as a key policy framework. This framework provides the basis for its food policy and various food-related policy actions. Its vision is “Healthy and sustainable food for the whole of Utrecht.” For this to happen, working at the city–region scale is crucial to ensure the preservation and protection of agricultural areas and the production and processing of locally grown food (Haenen *et al.*, 2018).
- **Stakeholders:** Several initiatives supported by the Utrecht municipality, such as *Eetbaar Utrecht* (Edible Utrecht) and *Lekker Utrechts* (Tasty from Utrecht), integrated regional food on the agenda from 2009 to 2014. The policy focuses on promoting “healthy urban living” to improve public health with healthy and sustainable local foods. However, relationships with other relevant actors for food policies at the level of the Utrecht region are less developed, although policies state that “the municipality will connect with regional food developments and take up a facilitating and stimulating role” (RUF and FAO, 2018).

Methodological approach

- Food consumption
 - The City of Utrecht has implemented several activities aiming to increase the consumption of sustainable and healthy food in disadvantaged neighbourhoods. These have included the creation of educational vegetable gardens and the promotion of urban agriculture. Gardens foster social cohesion and support local food production, providing all citizens with green and pleasant environments. Local restaurants are encouraged to offer healthy food choices, provide jobs and training places for long-unemployed young people, and offer daytime activities for the elderly and disabled. This initiative is complemented by more innovative actions to explore the link between food and health in the Kingdom of the Netherlands, such as a food bank initiative created to store food supplies for people in need.
 - The resulting innovations and start-ups are prioritized for Overvecht, a region with high rates of health conditions in Utrecht. Other activities target local production and support for the consumption of locally grown food, not only at the household level but also within the public sector. The University Medical Centre of Utrecht leads the initiative, providing local healthy food to its patients and employees. The city encourages sustainable purchasing, sustainable consumption, and the prevention of food waste. Examples of the networks

behind this movement are such alliances as the National City Network on Urban Agriculture, the Green Deal, efforts to reduce waste at all academic medical centres, and the creation of a food court on the Uithof campus. In addition, there are events such as the Future Food meeting in the botanical gardens, public open days, and harvest festivals (FAO, 2018b).

- Food policy support in Utrecht
 - Through initiatives such as *Eetbaar Utrecht* and *Lekker Utrechts*, regional food was featured on the policy agenda in 2009–2014, with support of a one-time financial support programme, which lasted from 2010–2014, to stimulate urban and local agricultural initiatives. After 2014, this temporary financial support was included in other programmes.
 - Since then, local governments have been cooperating with the civil society, building partner-to-partner or partner-to-facilitator relationships. This is seen as responsive governance to join energy and urgency in a society to facilitate and strengthen developments instead of taking a directive role. Consequently, the roles of regional food distributors, such as Willem & Drees and Local2Local, have become more visible in the regional food landscape.
 - Another example is the outsourcing of environment and nature education from the Municipality of Utrecht to semi-governmental institutes, such as *Utrecht Natuurlijk*. Food and nutrition information is a part of the educational package. The Municipality of Utrecht, mainly through its “food team” in the Department of Public Health, has been re-identifying its role in developing food policy and food-related processes (Haenen *et al.*, 2018).

Contribution

Social restaurants and urban gardens have hired young residents, raised incomes, and helped young people develop skills to increase their chances of future employment. These places enhance the inclusion of marginalized actors, providing a meeting point where people of all ages can work together or share a meal. In addition, urban agriculture reduces stress levels and educates urban gardeners about sustainable food production and consumption. All these benefits contribute directly and indirectly to diminishing health inequalities across the city.

What we can learn from this is that the connection between food and health is a key element to consider when building sustainable food systems. It is crucial to invest in food for reducing inequalities in the urban context, which often presents major differences across neighbourhoods (FAO, 2018b).

Integration of nutritional policies

This section describes how the city of Rome, Italy, managed to combine nutritional policies in the fields of food/nutrition education, sustainable value chain and public food procurement.

Rome, Italy: Sustainable food procurement for schools

Background

Approximately one million organic meals are served in Italian schools, accounting for a quarter of the total number of school meals served annually. In Rome, the All for Quality food programme has been in place since 2001. In January 2010, the Council of Rome adopted a decision on green public procurement for food and canteens. More than 144 000 meals are served daily in 550 nurseries, primary and secondary schools, with 92 percent of the meals prepared on-site and 69 percent of them including organic ingredients. Many nutritionists and dietitians advise and monitor the service.

The objective behind Rome's approach is to support organic agriculture and organic food chains, ensure food safety and nutritional balance, and encourage the good environmental performance of current and potential suppliers through its school meal service. Since 2001, the city has employed an incremental approach to designing its food and catering tenders and its food service, gradually making these systems more sustainable and innovative (European Union, 2019b).

Stakeholders and partners

- **Beneficiaries:** In Rome, approximately 150 000 meals are served daily (190 days per year) in a total of 700 nurseries, primary, and secondary schools. Each school has a canteen and 92 percent of the institutions that serve meals house kitchens on-site. Essentially, the city has been steadily increasing the standard of food and catering while maintaining the same budget (Soldi, 2018).

Stakeholders: In Italy, each municipality is responsible for public school meals, which are mostly provided through the catering services. Families and municipalities cover the costs for school meals.

Methodological approach

The latest tender published for Rome's school catering service – covering preparation, cooking, serving meals, cleaning and waste separation – included the following sustainability and quality criteria:

- Separate non-food and food waste for collection.
- Use detergents and sanitizers with a low environmental impact.
- Single-use materials (e.g. napkins) must be biodegradable and recyclable.
- Materials must include ceramic (plates and tableware), stainless steel (cutlery) and glass.
- Food stemming from organic agriculture according to Regulation (EC) No 834/2007 for bread, legumes, cereals, olive oil, pasta, rice, cheese, fruits, and vegetables.
- No genetically modified food may be used by catering services or for animal feed.

- A “guaranteed freshness” criterion should be used for fruits and vegetables, with no more than three days allowed between harvest and consumption. Products are required to be marked with information about the harvest, including the date of harvest and the site of the food processing centre.
- Red and white meats must be delivered in vacuum-sealed packs within four days of packaging. Protected denomination of origin or protected geographical indication should be introduced for meat (beef, pork, lamb, cold meats) and some cheeses, following Council Regulation (EC) No 510/2006 of 20 March 2006.
- Seasonal produce in and around Rome is the basis for designing and planning menus. Winter and summer menus are designed based on nine-week cycles, using 160 recipes. Meat is served twice per week, at most, to reduce the environmental impacts of the foodservice. The basic price is EUR 5.28 per meal (European Union, 2019b).

Contracts were awarded based on the most economically advantageous tender, with 51 points allocated according to the economic offer (the price of the meal) and 49 points for the technical offer (adaptation and improvement of kitchens and canteens, staff training, provision of products from social cooperatives, working to preserve “freshness guaranteed” criterion, etc.).

Food produced according to fair trade principles (as defined by the European Parliament Resolution on Fair Trade and Development A6-0207/2006 approved 6 July 2006), such as bananas, chocolate, and biscuits, also are influential in deciding Rome’s menus. The framework of the contract divides Rome’s municipal territory into 11 lots to encourage SMEs to tender (European Union, 2019b).

Contribution

- Result:
 - Organic food accounts for 69 percent of the food served in schools, apart from meat, fish and cold cuts. The transition to organic has raised the average cost of a meal by 8 percent, or EUR 0.40. However, this approach has improved the sustainability and quality of the meals and surrounding food system. Companies face strict compliance with all the requirements specified in tenders. Therefore, they take the bidding process seriously and are encouraged to improve their performance. Suppliers should be able to meet the criteria and standards in the tendering process. The evaluation of bids was complex, and support was needed from experts, but good results eventually were achieved.
- Environmental impacts:
 - Industrial farming and food production have a massive adverse environmental impact. Meat and meat products have the greatest environmental impact, accounting for 4–12 percent of anthropocentric greenhouse gases, followed by dairy products. According to a life-cycle analysis of various types of meat, Rome estimates that 1 kg of meat served in schools accounts for 14 kg of CO₂ equivalent. Based on the amount of meat served in Roman schools, at a maximum of twice a week, there has been a savings of approximately 8887 tonnes of CO₂ equivalent annually. The savings in water consumption associated with the reduced consumption of meat is estimated at 5783 cu. m annually. Plastic plates and other serving utensils were replaced with earthenware and other reusable materials, resulting in an estimated savings of 1800 tonnes of plastic annually.

- Lessons learned:
 - Municipal dietitians check the quality of foods every day to ensure that companies constantly abide by the terms of their contracts. Moreover, another contract was made for monitoring in schools, delegated to two private laboratories that analyse about 15 samples of food and foodstuffs daily. Extending the school food practice to other public canteens in Rome is under consideration. The principles on which the latest contract is based will be applied to future contracts (European Union, 2019b).

Conclusion

In brief, the above-mentioned practices have accomplished the following:

- School food and nutrition education
 - Finland: All pupils can have a nutritious free meal, and this has resulted in high levels of school attendance and virtually no undernutrition in Finland.
- Public food procurement
 - Copenhagen, Denmark: Without raising budgets, the public kitchens of the municipality offer meals that consist of 90 percent organic food.
 - Austria: The distribution of organic and non-genetically modified dairy products is ensured. In addition, decreased delivery distances reduce the impact on the environment.
- Urban food system
 - Paris, France: Both children and parents have shown behavioural changes needed to reduce overweight and obesity among children.
 - Utrecht, The Kingdom of the Netherlands: By employing young residents in urban agriculture, the problem of ageing farmers has been mitigated, and there has been an increase in the incomes of employed farmers, etc.
- Integration of public food procurement, value chain and school food and nutrition education
 - Rome, Italy: About 69 percent of foods served at schools are organic, achieved with the cooperation of schools, producers, tenders and the local government.

Given that each country has different social and economic capacities to cope with problems specific to their food systems, it might seem difficult to generalize or scale up the above-mentioned nutritional policies. As these policies have been successful, their widespread implementation would be an efficient and cost-effective method to improve resilience and livelihoods, especially for vulnerable populations. It is important to note that most of these practices also consider sustainable development by attempting to address the environmental footprint of agriculture and livestock. Beyond the impact on the food system, the future adoption of policies should ensure environmentally sustainable development.

Since there were no established evaluation processes, it was hard to measure the impact of these actions. Thus, the development of tools to evaluate methods and the results of nutritional policies is necessary, in order to justify further actions and improvements for future implementations. As this report collected and analysed the good examples of nutritional policies for sustainable food systems, it is expected to contribute to the development of such tools.

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