FOOD LITERACY

HANDBOOK

Food Literacy Handbook

Ankara, 2025

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1.1. PROJECT OBJECTIVE

The aims of the Food Literacy project are to create sustainable and freely accessible digital information and inquiry tools to help individuals adopt healthy, conscious, and sustainable eating habits. Through the project's educational activities and intellectual outputs, the goal is to raise food awareness among target audiences, support consumers in accurately reading nutrition labels on food packaging to question the content, origin, and nutritional value of food, inform them about healthy nutrition, and develop their critical thinking skills in response to misinformation about nutrition spreading on social media.

1.2. PROJECT ACTIVITIES

The food literacy-themed project is carried out over a 24-month period and includes transnational management meetings, international youth trainings, development of intellectual outputs, field studies in three countries, and multiplier events. Through these activities, broader awareness of food literacy is created among the general public.

1.3. PROJECT OUTPUTS

Within the scope of the project, the following outputs have been produced in four languages (Turkish, English, German, and French):

1. Food Literacy Handbook
2. Training Module and Website
3. Mobile Application (Foodapp)

1.4. PROJECT PARTNERS

1. METU Alumni Association Foundation
2. Association for Education and Career Planning
3. Mardin Artuklu University
4. Ministry of Agriculture and Forestry – Department of Training and Publication
5. COMPASS GmbH (Austria)
6. Euroactiva (Belgium)

2.1. WHAT IS FOOD LITERACY?

Food literacy is the process of acquiring the knowledge, skills, and attitudes necessary to enable people to make informed decisions about food. It involves understanding the journey of food from its source to the table, developing healthier eating habits, and supporting sustainable food systems.

Food literacy is not only about knowing what we eat, but also includes understanding how food is produced, processed, distributed, and how our consumption habits affect the environment, economy, and society.

2.1.1. The Importance of Food Literacy

1. **Healthy Eating and Well-being:** Food literacy helps individuals create a healthy and balanced diet. The ability to read nutritional content, which is vital in preventing health problems such as obesity, diabetes, and heart disease, also includes the ability to make informed choices between fresh and processed foods.
2. **Environmental Sustainability:** Food literacy supports individuals and communities in reducing food waste and promoting sustainable farming and production methods. Consuming local and seasonal food helps reduce the carbon footprint and protects the environment.
3. **Economic Awareness:** Food literacy enables people to shop within their budget and waste less. It also encourages support for local producers, thereby contributing to the local economy.
4. **Social Benefit:** Food literacy raises awareness on issues such as food safety and justice. This awareness contributes to the development of a more equitable and healthier food system.
5. **Global Impact:** Food literacy helps individuals learn more about international food policies and systems. This awareness encourages both individual and global efforts to fight hunger and malnutrition around the world.

2.1.2. Recommendations for Improving Food Literacy

- **Education and Awareness:** Food literacy education and activities should be included in school curricula.
- **Label Reading Habits:** It is important to examine food labels, understand

the ingredients, nutritional values, and expiration dates.
- **Supporting Local Products:** Priority should be given to local and seasonal products.
- **Preventing Food Waste:** Planned shopping and better use of leftovers can help reduce waste.

Food literacy enables individuals to act more consciously not only for themselves, but also for society and the environment. Therefore, for a healthier future and a sustainable world, food literacy should be a priority skill for everyone.

2.1.3. International Efforts in the Field of Food Literacy

2.1.3.1. United Nations World Food Programme (WFP)

The UN World Food Programme (WFP), in line with the recommendations of other UN bodies and the Food and Agriculture Organization (FAO), provides food assistance to countries in need, supports economic and social development, and responds to food needs arising from emergencies and crises, in accordance with the 2030 Sustainable Development Goals.

Member Countries: WFP was established by the UN General Assembly and FAO. Therefore, countries that are members of these organizations, as well as other UN specialized agencies, can participate in WFP's activities. However, only 36 countries, which serve on a rotational basis, have voting rights through their membership in the Executive Board. Türkiye participates in WFP Executive Board activities as an observer. As a UN agency, the World Food Programme works globally to ensure food security and combat hunger. WFP is particularly active in providing emergency food assistance, distributing food to regions affected by famine and natural disasters, and developing long-term food security strategies.

The main responsibilities of WFP include:

- **Emergency Assistance:** WFP provides food aid to regions affected by wars, natural disasters, or other crises, fighting hunger through hot meals, food packages, or cash assistance.
- **Food Security and Nutrition:** WFP implements long-term plans to ensure food security and runs nutrition support programs, particularly for vulnerable groups such as pregnant women and children.
- **Sustainable Agriculture and Food Systems:** WFP supports local agricultural systems in developing countries to increase food production capacity among rural populations and to build sustainable food systems.
- **Fighting Hunger:** Globally, WFP combats malnutrition and hunger, intervening in global food crises while seeking long-term solutions.
- **Education and Future Projects:** WFP implements education and capacity-building projects to empower communities and find sustainable solutions in the fight against hunger.

WFP is one of the largest humanitarian organizations providing aid to regions affected by conflict and natural disasters. Additionally, during the COVID-19 pandemic in 2020, WFP provided food assistance to millions of people around the world who were in need.[1]

2.1.3.2. Food and Agriculture Organization of the UN (FAO)

The Food and Agriculture Organization of the United Nations (FAO) is a specialized agency operating under the UN that works in the areas of global food security, agriculture, forestry, fisheries, and rural development. FAO's mission is to combat hunger and malnutrition worldwide, increase agricultural production, support sustainable food systems, and assist in the conservation of natural resources. The main responsibilities of FAO include:

- **Food Security and Nutrition:** FAO combats hunger and malnutrition and offers recommendations to improve the efficiency of food systems.
- **Agriculture and Rural Development:** FAO develops projects to increase agricultural production, improve living conditions in rural areas, and provide farmers with education and technical assistance.
- **Conservation of Natural Resources:** FAO is responsible for ensuring the sustainable use of fisheries, water, soil, forests, and other natural resources.
- **Research and Data Provision:** FAO collects and analyzes global food and agriculture data and provides policy recommendations to countries.
- **International Cooperation and Advocacy:** FAO promotes collaboration among countries on food and agriculture policies and invites both public

1 https://www.mfa.gov.tr/birlesmis-milletler-dunya-gida-programi-_wfp_-.tr.mfa

and private sectors to cooperate. It also develops global projects and policies aimed at improving agricultural methods, biodiversity, and environmental sustainability.

2.1.3.3. 2021 United Nations Food Systems Summit

The United Nations created a roadmap to make global food systems more sustainable. The summit focused on sustainability in agriculture, reducing food waste, and increasing the resilience of food supply chains. It emphasized global cooperation and reinforced the Sustainable Development Goals, including "Zero Hunger."[2]

2.1.3.4. EAT-Lancet Commission

Established in 2015, the EAT-Lancet Commission is a global initiative that integrates research across food, health, and environmental fields to explore sustainable food systems. The Commission aims to develop a comprehensive approach for promoting healthy eating habits and sustainable global food production systems. One of its key goals is to create and promote a "Planetary Health Diet," which simultaneously protects both human and planetary health. This diet is designed to improve human health while supporting environmental sustainability.

2 https://yesilgazete.org/2022-raporu-gida-guvencesizligi-kapida/

Key Goals and Activities of the EAT-Lancet Commission:

- **Designing Healthy and Sustainable Diets:** Based on scientific evidence, the Commission sets standards for diets that ensure sufficient nutrients while minimizing environmental impacts. The goal is to strike a balance between health and sustainability.
- **Transforming Food Production Systems:** EAT-Lancet proposes systems that reduce the environmental impact of food production and use natural resources like water and energy more efficiently. It emphasizes reducing the consumption of foods with high environmental footprints, such as meat and dairy products.
- **Ensuring Food Security:** The Commission develops sustainable solutions to provide equal access to healthy food and combat global hunger. This includes strategies aimed at enhancing food security, especially in low-income countries.
- **Protecting Planetary Health:** The Commission focuses on creating food systems that protect water, soil, and biodiversity. It advocates for minimizing environmental problems such as soil degradation, biodiversity loss, and climate change caused by food production.
- **Promoting Policy and Social Change:** EAT-Lancet offers policy recommendations for individuals, governments, and the private sector worldwide. These proposals aim to influence decision-makers in the areas of food production and consumption.

2019 EAT-Lancet Report

In 2019, the Commission published a comprehensive report outlining a sustainable and healthy diet model. Known as the "Planetary Health Diet," this model addresses how to meet human nutritional needs without exceeding the planet's ecological limits. The report recommended reducing sugar and meat consumption while increasing the intake of vegetables and whole grains. The EAT-Lancet Commission continues to raise awareness and advocate for policy changes to encourage the global adoption of sustainable and healthy food production systems.

2.1.3.5. Global Food Crisis Report

The Global Food Crisis Report is an annual report on worldwide food security published by the United Nations World Food Programme (WFP) and other international organizations. This report analyzes the causes, impacts, and proposed solutions to the global food crisis, focusing especially on regions suffering from hunger and food insecurity.

The report compiles information on the increasing hunger, food insecurity, and malnutrition worldwide, aiming to identify the scope, causes, and effects of these issues. It also sheds light on policies and strategies to address the crisis.

Content and Focus Areas of the Global Food Crisis Report

- **Food Insecurity and Hunger:** The report includes statistics on the number of people suffering from hunger, regions affected by food insecurity, and the main issues involved. These issues include displacement, economic crises, conflicts, natural disasters, and climate change.
- **Causes of the Crisis:** The causes of the global food crisis are categorized into economic, social, and environmental factors. The report highlights fluctuations in food prices, losses in agricultural production, effects of natural disasters and climate change, and the destructive impact of local conflicts on food production.
- **Proposed Solutions and Intervention Strategies:** The report outlines short-, medium-, and long-term action plans to combat food insecurity and hunger. These strategies include emergency food aid, sustainable agricultural practices, strengthening local food systems, infrastructure investments, education, and policy reforms.
- **Conflicts and Climate Change:** Food security is significantly affected by conflicts. The report discusses regions in the Middle East, Africa, and Asia where conflicts have caused food crises. It also addresses the adverse impacts of climate change on agriculture, such as droughts, floods, and other disasters.
- **Displacement and Food Security:** The report draws attention to the nutritional and food security challenges faced by displaced populations due to wars and natural disasters, especially those living in refugee or internally displaced persons camps.

Importance of the Global Food Crisis Report

- **Emergency Aid:** The report helps guide urgent humanitarian responses by identifying where aid is most needed and which regions should be prioritized.
- **Policy and Strategy Development:** Data and analyses in the report provide governments, international organizations, and aid agencies with better tools to develop effective policies. This includes sustainable food security solutions and improved crisis response methods.
- **Awareness and Education:** The report raises global awareness about the food crisis and promotes education and awareness campaigns to address food security issues at societal, governmental, and international levels.

The Global Food Crisis Report is a crucial tool for shaping policies to address food insecurity and hunger affecting millions worldwide. It identifies necessary urgent and long-term interventions to reduce the impacts of food crises and ensure people's basic food needs are met.

2.2. CONCRETE EXAMPLES FROM OTHER COUNTRIES ON FOOD LITERACY

2.2.1. Australia – "Food Literacy Program"

In Australia, the initiative called Stephanie Alexander Kitchen Garden Foundation offers training that combines agricultural and culinary skills to help primary school children develop food literacy. Students grow vegetables in school gardens and learn to prepare healthy meals using these products. The program helps children understand where food comes from and make healthy food choices.[3]

2.1.2. United States – "Food Literacy Center"

The Food Literacy Center in California, United States, works to teach children—especially those living in socioeconomically disadvantaged areas—about healthy eating and sustainable food habits. The program educates children on the importance of seasonal and fresh produce while improving their food literacy.[4]

The U.S. Food and Drug Administration (FDA) also revised the definition of the term "healthy food" for the first time in nearly thirty years. According to the new regulations, foods labeled as "healthy" must meet limits on saturated fat, sodium, and added sugars and include certain food groups. For example, sugary fruit snacks and breakfast cereals are no longer classified as "healthy."[5]

2.2.3. United Kingdom – "Healthy Schools London Program"

The Healthy Schools London program in London provides students with education on reading food labels correctly, making healthy food choices, and reducing food waste. By promoting food literacy in schools, the program helps both families and children become more aware of food safety.[6]

2.2.4. Japan – "Shokuiku Education Program"

In Japan, the educational system known as Shokuiku aims to instill an awareness of balanced and healthy eating habits in students from an early age. Supported by the Japanese government, the program addresses food choices through the lens of cultural values and sustainability, helping young people develop lifelong healthy habits.[7]

3 https://www.kitchengardenfoundation.org.au/
4 https://www.foodliteracycenter.org/

5 https://tr.mashable.com/saglik-zindelik/15304/abd-30-yil-sonra-saglikli-gidalar-listesini-guncele-di-hangi-gidalar-cikti-hangileri-girdi?utm_source
6 https://www.london.gov.uk/what-we-do/health/healthy-schools-london/awards/home
7 https://www.maff.go.jp/e/policies/tech_res/attach/pdf/shokuiku-21.pdf

2.1.5. Sweden – "School Meals and Food Education"

State-supported schools in Sweden teach students food literacy by providing free and healthy meals. Through these meals, students receive education on recognizing food groups, selecting sustainable agricultural products, and preventing food waste.[8]

2.1.6. Canada – "Farm to School Canada" Program

In Canada, the Farm to School program allows students to practice farming in school gardens and directly interact with local farmers. The program teaches children about sustainable food systems while emphasizing the importance of consuming local and healthy foods.[9]

2.1.7. Italy – "Food Smart Schools" Project

The Food Smart Schools program, implemented in Italian schools, aims to educate young people about the sustainability of agricultural production and food safety. Hands-on activities such as farm visits and community gardening are part of the program.

- In countries like **Australia** and **the United States**, school programs for children are common.
- In **Japan**, cultural food education (Shokuiku) is emphasized.
- **Sweden** and **the United Kingdom** support food literacy by integrating healthy eating into school curricula.
- **Canada** combines local agriculture and sustainability with food education.

These examples show how food literacy is shaped according to cultural and regional needs. Such education-focused projects play a critical role in enabling younger generations to make healthy and sustainable food choices.

8 https://sweden.se
9 https://www.farmtocafeteriacanada.ca

2.3. CURRENT INITIATIVES IN TÜRKİYE

2.3.1. Food Literacy in Türkiye

One of the fundamental conditions for people to lead a healthy life is proper nutrition. Managing dietary habits correctly, being informed about food production and consumption, and having sufficient knowledge, skills, and awareness regarding food choices constitute the most important aspects of this process. At this point, it is crucial for individuals to be food literate, both for their own well-being and for a sustainable food system (Yılmaz, 2020).

Food and nutrition literacy involves understanding various types of information about food and nutrition, evaluating them critically, and applying this knowledge to make proper food choices and consumption decisions (Aktaş & Özdoğan, 2016). Due to technological advancements, social changes, economic problems, irregular population growth, and environmental pollution, access to safe and healthy food is becoming increasingly challenging (Bahar & Yılmaz, 2021). Therefore, it is essential for people to be conscious about the foods they consume, and efforts in this area are being made worldwide.

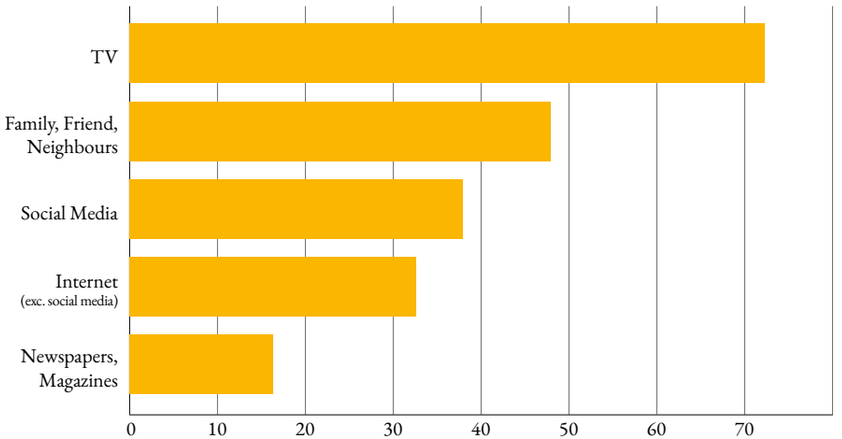
Numerous academic and policy studies on food literacy are also being conducted in Türkiye, all contributing to food literacy at both global and local levels.

The FAO conducted a comprehensive study on the state of food literacy in Türkiye, using 56 academic papers and 161 media reports. According to the resulting report, the main sources of information regarding nutrition and food are friends, family, social media, television, healthcare professionals, and celebrities. While these sources vary, family, friends, and television were found to have the most significant influence on food purchasing behaviors.

The study also found that university students with lower food literacy levels tend to rely more on their families, while those with higher knowledge levels place greater trust in doctors and healthcare professionals. Additionally, between 2018 and 2021, when searching for terms related to food literacy in media sources, it was found that 49% of the national press coverage was about nutrition literacy, 36% about food literacy, 11% about nutrition awareness, and 7% about food awareness (FAO, 2023).

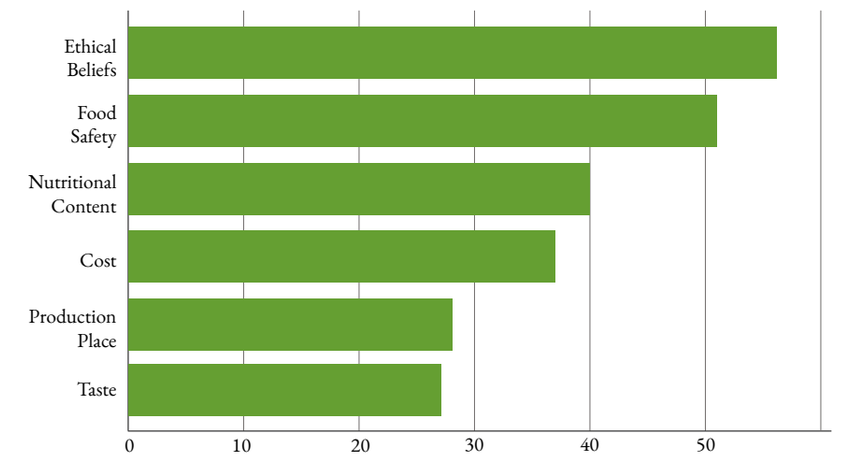
According to the EU Food Safety Barometer Survey (EFSA-2019):

- Among individuals aged 15 and over in Turkish society, the 'Primary Sources of Food Safety Information' are as follows:



Primary Sources of Food Safety Information - Percentage (%)

- Important Factors for Consumers in Food Purchase (FAO, 2023):



Priorities in FoodPurchase - Percentage (%)

Similarly, a study conducted on the factors influencing consumers' food label reading behaviors in Türkiye revealed notable findings. According to the study, the frequency of label reading varies depending on individuals' socio-demographic characteristics, their level of knowledge, education level, income level, and age. For instance, people with higher education and income levels tend to read food labels more frequently and understand them better. The most commonly read labels are typically the production and expiration dates, the brand, the product name, and the list of ingredients. However, there is also a significant portion of people who rarely or never read labels. Some of the reasons for not reading food labels include the information being written in very small print, labels fading quickly, the absence of translations on imported foods, the color of the packaging, lack of time, and difficulty in understanding the information. The study also found gender-based differences. Women were found to be more knowledgeable than men about reading food labels. While 71% of men read food labels primarily to check the price of food products, 79% of women read them to learn about the energy value of the foods. The most frequently read nutrition claims by both men and women were whether the product contains trans fats and whether it is fat-free or low-fat (Cebeci & Güneş, 2017).

Food and nutrition literacy also varies according to individuals' developmental stages. From a young age, people gain certain experiences related to food shopping and consumption. One of the most critical stages in this regard is adolescence, during which significant physical, social, and psychological changes and developments occur. Since developing conscious and balanced eating habits during this period influences individuals' later lives, food literacy during adolescence is considered particularly important (Can & Şahin-Kaya, 2022). In a study conducted with 614 high school students in Kahramanmaraş on their nutrition literacy, it was found that adolescents commonly skipped meals, consumed excessive amounts of carbonated beverages, had a high prevalence of fast-food dietary habits, consumed insufficient amounts of water, and had limited knowledge about food literacy. Nutrition literacy rates were found to be relatively higher among female students, non-smokers, individuals who read labels, and those with a history of dieting (Kayaalp, 2020). Similarly, a 2019 study conducted with 307 students in a vocational high school in Çorum examined food literacy and the use of food labels. According to the findings, food literacy varies based on adolescents' socio-demographic characteristics and health behaviors. Results showed that food literacy was higher among 17-19-year-olds, female students, those whose mothers had a high school education or higher, and those who engaged in regular physical activity (Yılmazel & Bozdoğan, 2019).

Studies conducted among university students reveal certain differences. For example, a study conducted with 276 students in Istanbul aimed to measure the relationship between food literacy and dietary habits among university students. According to the study, female students had higher levels of food literacy than male students, and individuals with higher food literacy levels also displayed healthier dietary habits. On the other hand, it was found that some students skipped meals or only ate two meals a day, frequently consumed snacks throughout the day, and had high consumption levels of foods such as tea, coffee, and chocolate (Kalkan, 2019). Another university study was conducted with 224 students from a Faculty of Health Sciences. According to the results, 50.9% of the students had previously heard of the concept of food literacy, while 64.3% correctly understood the term. Regarding their consumption habits, 15.6% of the students stated that they always read the label information when purchasing packaged products, whereas 21.4% found the information on labels insufficient. Finally, the aspects students paid attention to while shopping for food were mainly expiration date, freshness, quality, and food safety. Hygiene conditions, absence of tears on packaging, storage conditions, and usage instructions were also important considerations. Despite these findings, 32.1% of the students described themselves as conscious consumers, 55.4% as partially conscious, and 12.5% as unconscious consumers (Palamutoğlu et al., 2021).

Lastly, another study revealed a different perspective on food literacy. Among 750 adults aged 20–65, 67.3% reported having healthy eating habits, 83.7% were found to have an adequate level of food literacy, and 16.3% were at a borderline level. While 82.7% of participants had sufficient general food and nutrition knowledge, 47.2% were found to be at a borderline level when it came to reading food labels. Unlike other studies, this research revealed that individuals who frequently used social media during the day and accessed nutrition-related information from social media had higher levels of food literacy (Özenoğlu et al., 2019).

As shown in the study above, social media is also a source from which individuals in Türkiye gain knowledge about food and nutrition literacy. In 2020, a study examined the impact of social media on food literacy and nutrition. According to the study, followers of an account with 664,000 followers, which shares content on food and nutrition, were surveyed to assess their food and nutrition literacy. The findings showed that after following the account, followers demonstrated improvements in nutrition awareness, label reading, food safety and food fraud. Additionally, they expressed that they shared the information they learned from the account with people around them, experienced changes in their purchasing behaviors, and became more willing to improve their food and nutrition literacy. Based on these findings, it can be said that when used correctly, social media can contribute to raising public awareness about food and nutrition literacy (Kobak, 2020).

2.3.2. Current Policies and Actions on Food Literacy in Türkiye

Tijen COŞKUN[10]

2.3.2.1. Communication Plan for Capacity Development in Food Literacy and the National Food Literacy Strategy and Action Plan

In Türkiye, various institutions are carrying out different initiatives related to food literacy. Among these, one of the most comprehensive efforts is the "Communication Plan for Capacity Development in Food Literacy," jointly developed by the Ministry of Agriculture and Forestry and the FAO in 2021. This plan aims to enhance the knowledge, skills, and capacities of all actors within the food systems and to raise awareness about food literacy. At its core, the plan seeks to educate consumers on topics such as food choices, food safety, sustainability, nutrition, and food literacy. In addition, a "National Food Literacy Strategy and Action Plan" covering the years 2022–2028 has been prepared under the scope of this initiative. Some of the global objectives of the plan include promoting awareness of food literacy, contributing to the sustainability of global food systems, and ensuring a balance between consumption and production. Another key mission is to encourage Turkish consumers to access safe food and to adopt adequate and balanced nutrition. Strategic objectives of the plan include enhancing food literacy knowledge, providing accurate and up-to-date information on nutrition and food safety, preventing the spread of misinformation, raising awareness about food systems, and reducing food loss and waste. The strategic action plan outlines short-, medium-, and long-term activities. Planned actions in areas such as public knowledge on food literacy, policies, institutions, schools, various sectors, food labeling, and social media use will be implemented under the responsibility and cooperation of multiple organizations.[11]

10 Food Engineer, Head of Food Businesses and Codex Department

11 https://cdniys.tarimorman.gov.tr/api/File/GetGaleriFile/470/DosyaGaleri/3295/gida_okuryazarligi_eylem_plani.pdf

2.3.2.2. National Strategy Document and Action Plan for the Prevention, Reduction, and Management of Food Loss and Waste in Türkiye: "Protect Your Food, Preserve Your Table" Campaign

According to the Waste Report published by the Ministry of Trade, 5.4% of consumers in Türkiye throw away leftover food. Moreover, consumers discard 23% of the food they purchase. The "Protect Your Food, Preserve Your Table" campaign was launched in 2020 by the FAO and the Ministry of Agriculture and Forestry to reduce food loss and waste and to transform Türkiye into a country that utilizes sustainable food systems from both production and consumption perspectives. As part of this campaign, the "National Strategy Document and Action Plan for the Prevention, Reduction, and Management of Food Loss and Waste in Türkiye" was prepared. Goal 1.9 of the plan explicitly states: "To prevent and reduce food waste at the consumer level by increasing food literacy across all age groups." Actions have been planned to achieve this goal, and certain initiatives were implemented in Türkiye by the end of 2023. These actions included measuring and evaluating food loss and waste, raising awareness, educating consumers, building capacity, improving efficiency in the food supply chain, optimizing packaging, facilitating cold chain logistics, finding alternative uses for unused food products, and promoting recycling.[12]

2.3.2.3. Türkiye's National Roadmap Report Toward Sustainable Food Systems

Türkiye actively participates at the local, national, and global levels in the UN Food Systems Summit, which aims to contribute to the 2030 Agenda and the Sustainable Development Goals (SDGs). The summit's action areas include transitioning to healthy and sustainable consumption models and building resilience against vulnerabilities, shocks, and stresses. In line with these goals, the Ministry of Agriculture and Forestry prepared a local sustainable food systems report in 2019 by consulting with public institutions, private sector organizations, universities, NGOs, and disadvantaged groups. Subsequently, the Ministry published the "National Roadmap Report Toward Sustainable Food Systems in Türkiye" in 2021. The main objectives of this report are to ensure consumer access to safe and nutritious food, promote sustainable consumption and production, and build resilience against gaps in food security.

12 https://openknowledge.fao.org/items/ac75f5b4-928d-4d54-bdaa-7b6dd3eece8f

The report also includes targeted actions related to food and food literacy.[13]

2.3.2.4. Turkish Food Codex Regulation on Food Labeling and Consumer Information

In Türkiye, food labeling is governed by the "Turkish Food Codex Regulation on Food Labeling and Consumer Information," which is harmonized with the European Parliament and Council Regulation (EU) No. 1169/2011. This regulation, which came into force in 2017 following its publication in the Official Gazette, aims to establish fundamental principles and responsibilities for providing food information and labeling, while also informing consumers.

The regulation defines rules for identifying food products, mandates nutrition declarations, and includes a guideline for implementation. Accordingly, producers are obligated to avoid misleading information on food labels and must present all relevant details transparently. This makes it easier for consumers to access accurate information and make informed food choices.[14]

2.3.2.5. The Eleventh Development Plan of the Republic of Türkiye

The Eleventh Development Plan, prepared by the Presidency of Strategy and Budget of the Republic of Türkiye and covering the years 2019–2023, includes provisions that support food literacy. Article 411 emphasizes "ensuring food safety, reducing losses in the supply chain, and preventing waste," while Article 411.3 states that "consumer awareness will be raised to prevent food loss and waste."[15]

2.3.2.6. The 3rd Agriculture and Forestry Council of the Republic of Türkiye

Türkiye's 3rd Agriculture and Forestry Council was held in 2019, during which decisions were made concerning food and nutrition literacy. Article 49 proposed the creation of legal regulations to address misinformation about food and to impose penalties on those who disseminate false information. Article 50 focused

13 https://www.tarimorman.gov.tr/ABDGM/Belgeler/Uluslararası%20Kuruluşlar/Türkiye'nin%20Ulusal%20Yol%20Haritası_BOOKLET_4%20Subat%20(1).pdf
14 https://www.resmigazete.gov.tr/eskiler/2017/01/20170126M1-6.htm
15 https://www.sbb.gov.tr/wp-content/uploads/2022/07/On_Birinci_Kalkinma_Plani-2019-2023.pdf

on increasing food literacy.[16]

Food literacy is an essential concept for countries developing their dietary guidelines. Over 100 countries around the world have prepared nutrition guides tailored to their habits, cultures, and sustainability goals. Türkiye also has its own nutrition guide, which is regularly updated in line with developments. The most recent guide was created in 2022 using data from the 2017 Türkiye Nutrition and Health Survey (TNHS). The general aims of the nutrition guide are to raise public awareness about food and nutrition, prevent malnutrition-related problems, and provide clear, concise, and scientific messages to promote public health.[17]

2.3.2.7. Project to Enhance Adult Food Literacy Skills: "FOODTR"

FOODTR is a KA204 Strategic Partnership Project in Adult Education led by the Bursa Food and Feed Control Central Research Institute and funded by the European Union. In addition to national partners such as the General Directorate of Agricultural Research and Policies (TAGEM), Bursa Metropolitan Municipality (TARIM A.Ş.), Bursa Provincial Directorate of Agriculture and Forestry (BURSA İl Tarım), and Bursa Technical University (BTU), the project also involves international stakeholders like the National Technological Centre for Canning and Food (CTC) from Spain, Széchenyi István University (SZE) from Hungary, and the Centre of Food and Fermentation Technologies (TFTAK) from Estonia. The main objectives of the project include improving food literacy skills among adults, teaching people how to read food labels, promoting sustainable food systems, raising awareness about food safety, reducing foodborne illnesses, spreading knowledge on ideal packaging and storage methods, and creating accessible guides and digital training materials for public use. As part of the project, seminars, presentations, school programs, and participation in food fairs are being conducted across partner institutions and countries to achieve these goals.[18]

16 https://cdniys.tarimorman.gov.tr/api/File/GetGaleriFile/330/DosyaGaleri/958/iii_tarim_orman_sura-si__sura_kitabi.pdf
17 https://hsgm.saglik.gov.tr/depo/birimler/saglikli-beslenme-ve-hareketli-hayat-db/Dokumanlar/Rehberler/Turkiye_Beslenme_Rehber_TUBER_2022_min.pdf
18 https://www.foodtr.org

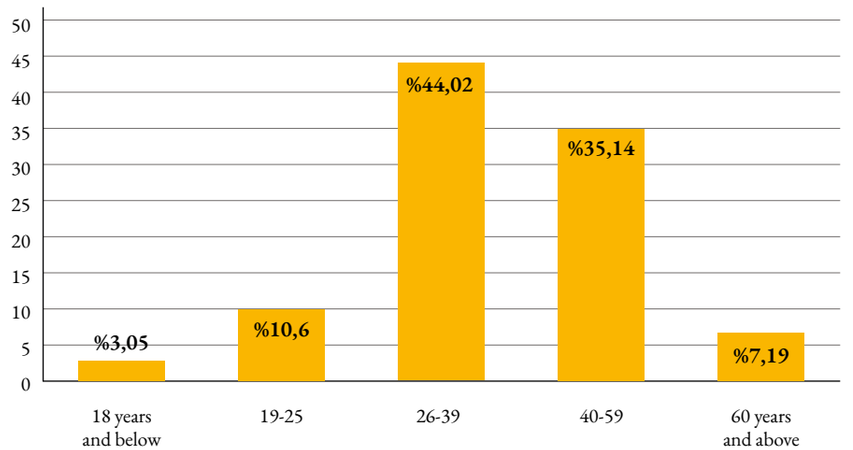
2.4. FOOD LITERACY FIELD STUDY IN TÜRKIYE

This study[19] was conducted within the scope of the "Food Literacy" project, supported by the Turkish National Agency and the European Commission's Erasmus+ Program. The project was carried out by the METU Alumni Association Foundation, the Training and Publication Department of the Ministry of Agriculture of the Republic of Türkiye, and the Association for Education and Career Planning. As part of the Food Literacy project, a survey was conducted between October 2024 and January 2025 across all 81 provinces and 922 districts of Türkiye, reaching a total of 9,293 participants. As a result of the research, data was obtained regarding the level of knowledge about "Food Literacy" in Türkiye. The study aims to increase awareness of food health, improve knowledge of food literacy, and raise public awareness about reading food labels in Türkiye. The project consortium is responsible for the content of the study. The funding authorities Turkish National Agency and European Commission are not responsible for the content.

19 2024

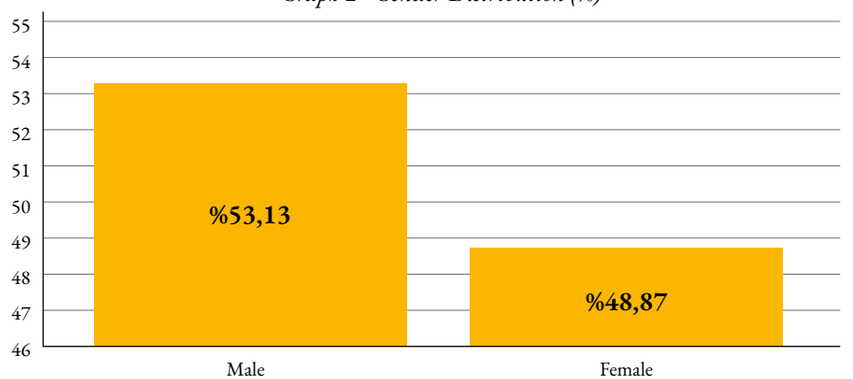
2.4.1. Demographic Information

Graph 1 - Ages of the participants (%)



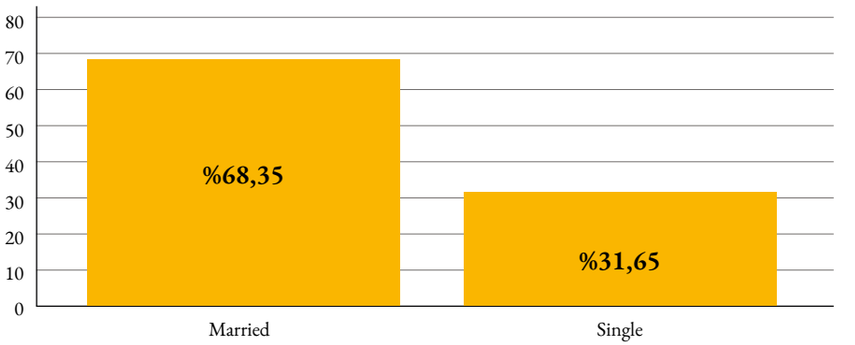
According to Graph 1, 3.1% of the participants are under the age of 18, 10.5% are between the ages of 19–25, 44.1% are between 26–39, 35.1% are between 40–59, and 7.2% are aged 60 and above. Based on the graph data, the highest participation in the food literacy survey comes from the 26–39 age group, while the lowest participation is from those under 18.

Graph 2 - Gender Distribution (%)



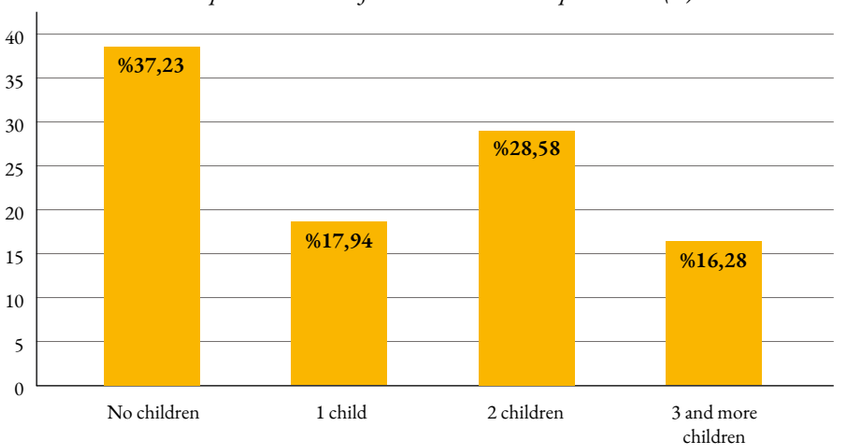
According to the data in Graph 2, 53.13% of the participants in the study are male, while 43.87% are female. Based on the graph information, the highest participation in the food literacy survey comes from male respondents.

Graph 3 - Marital Status Distribution (%)



According to the data in Graph 3, 31.65% of the participants are single, while 68.35% are married. Based on the graph information, the highest participation in the food literacy survey comes from married individuals.

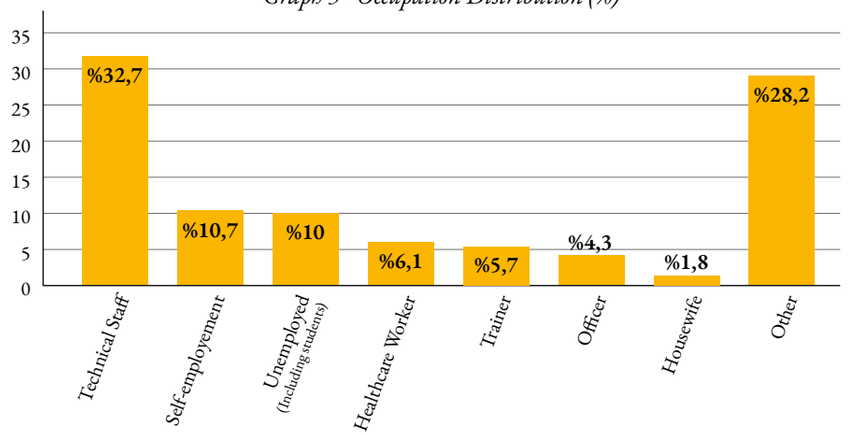
Graph 4 - Number of Children the Participants have (%)



According to the data in Graph 4, 37.23% of the participants have no children, 17.94% have one child, 28.58% have two children, and 16.25% have three or

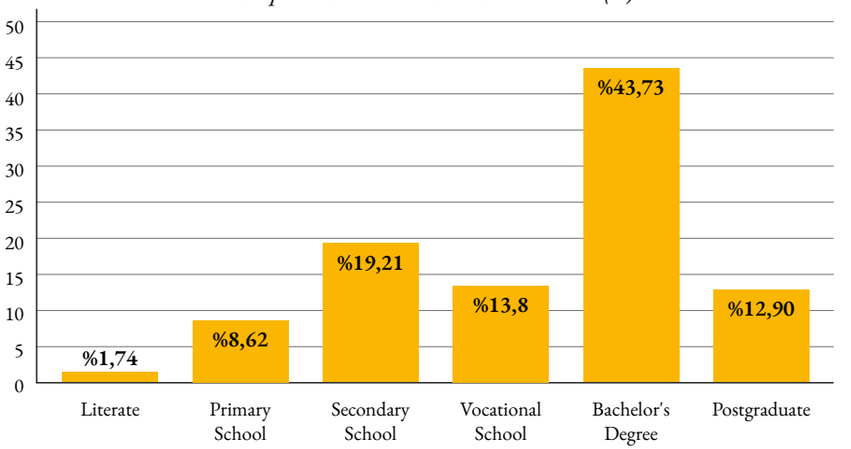
more children. Based on the graph information, the highest participation in the food literacy survey comes from individuals without children, while the lowest participation is from individuals with three or more children.

Graph 5 - Occupation Distribution (%)



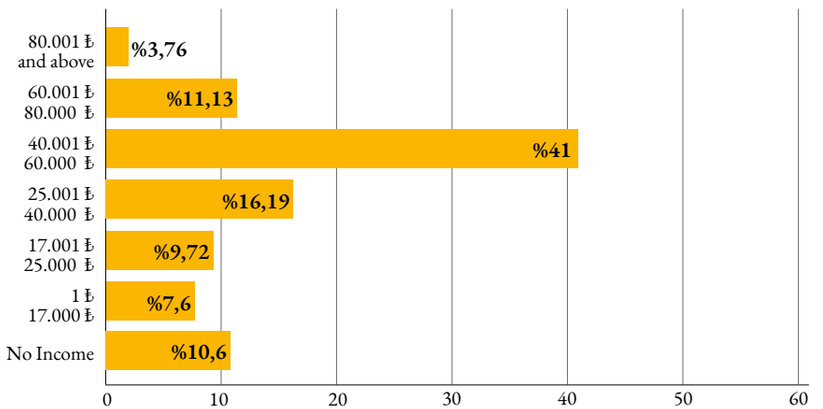
According to the data in Graph 5, 32.7% of the participants are technical staff, 10.7% are self-employed, 10% are unemployed or students, 6.1% are healthcare workers, 5.7% are educators, 4.3% are civil servants, 1.8% are housewives, and 28.2% belong to other occupational groups. Based on the graph information, the highest participation in the food literacy survey comes from technical personnel, while the lowest participation is from housewives.

Graph 6 - Education Level Distribution (%)



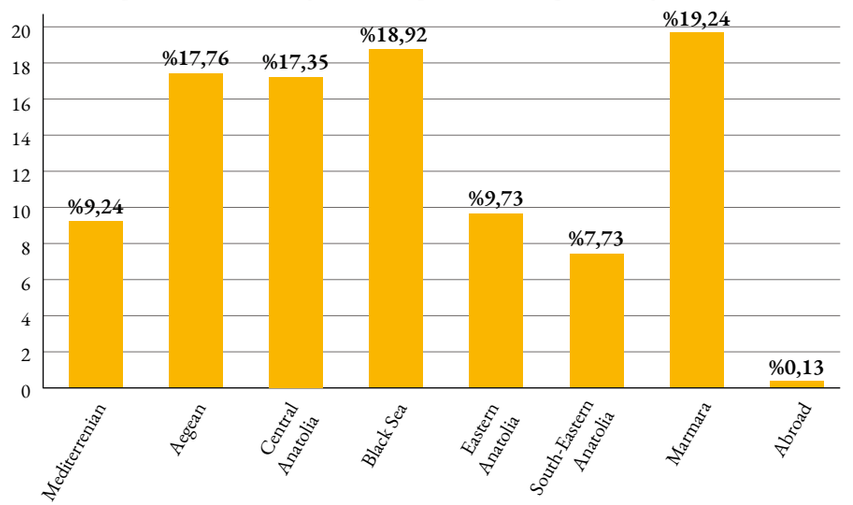
According to the data in Graph 6, 1.74% of the participants are literate without formal education, 8.62% have a primary education, 19.21% have a secondary education, 13.80% have an associate degree, 43.73% hold a bachelor's degree, and 12.90% have a postgraduate education level. Based on the graph information, the highest participation in the food literacy survey comes from individuals with a bachelor's degree, while the lowest participation is from those who are only literate.

Graph 7 - Distribution of the Participants According to their Monthly Income (%)



According to the data in Graph 7, 10.60% of the participants have no income. Among the participants, 7.60% have an income between 1,000–17,000₺[20], 9.72% between 17,001–25,000₺, 16.19% between 25,001–40,000₺, 41% between 40,001–60,000₺, 11.13% between 60,001–80,000₺, and 3.76% have an income of 80,000₺ or more. Based on the graph information, the highest participation in the food literacy survey comes from individuals in the 40,000–60,000₺ income range, while the lowest participation is from those with an income of 80,000₺ or more.

Graph 8 - Distribution of the Participants according to Place of Residence (%)

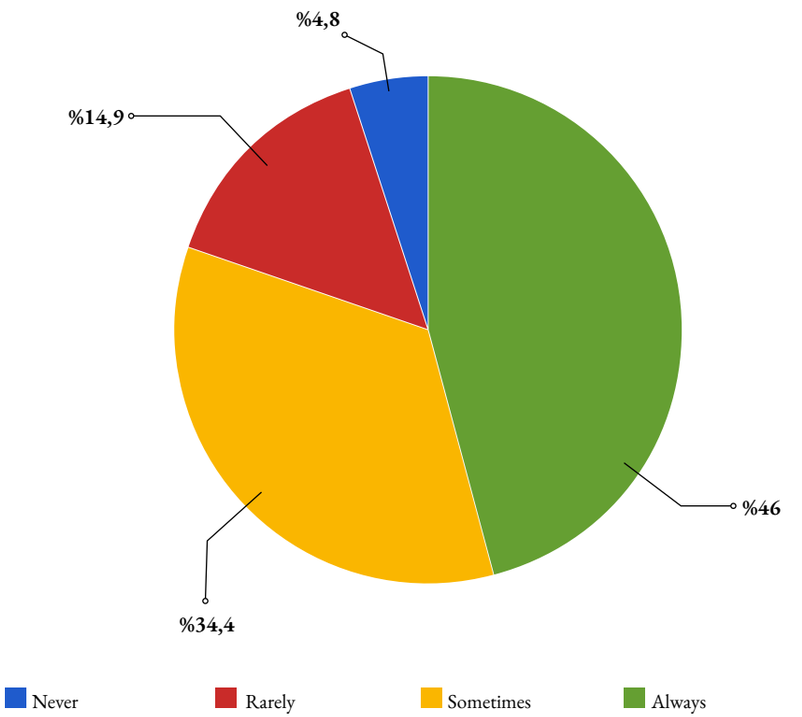


According to the data in Graph 8, 9.24% of the participants are from the Mediterranean Region, 17.76% from the Aegean Region, 17.35% from the Central Anatolia Region, 18.92% from the Black Sea Region, 9.73% from the Eastern Anatolia Region, 7.73% from the Southeastern Anatolia Region, 19.24% from the Marmara Region, and 0.13% live abroad. Based on the graph information, the highest participation in the food literacy survey comes from the Marmara Region, while the lowest participation comes from the Southeastern Anatolia Region and participants living abroad.

20 The data from the survey conducted in 2024 can be interpreted based on the minimum wage in effect for the year 2025.

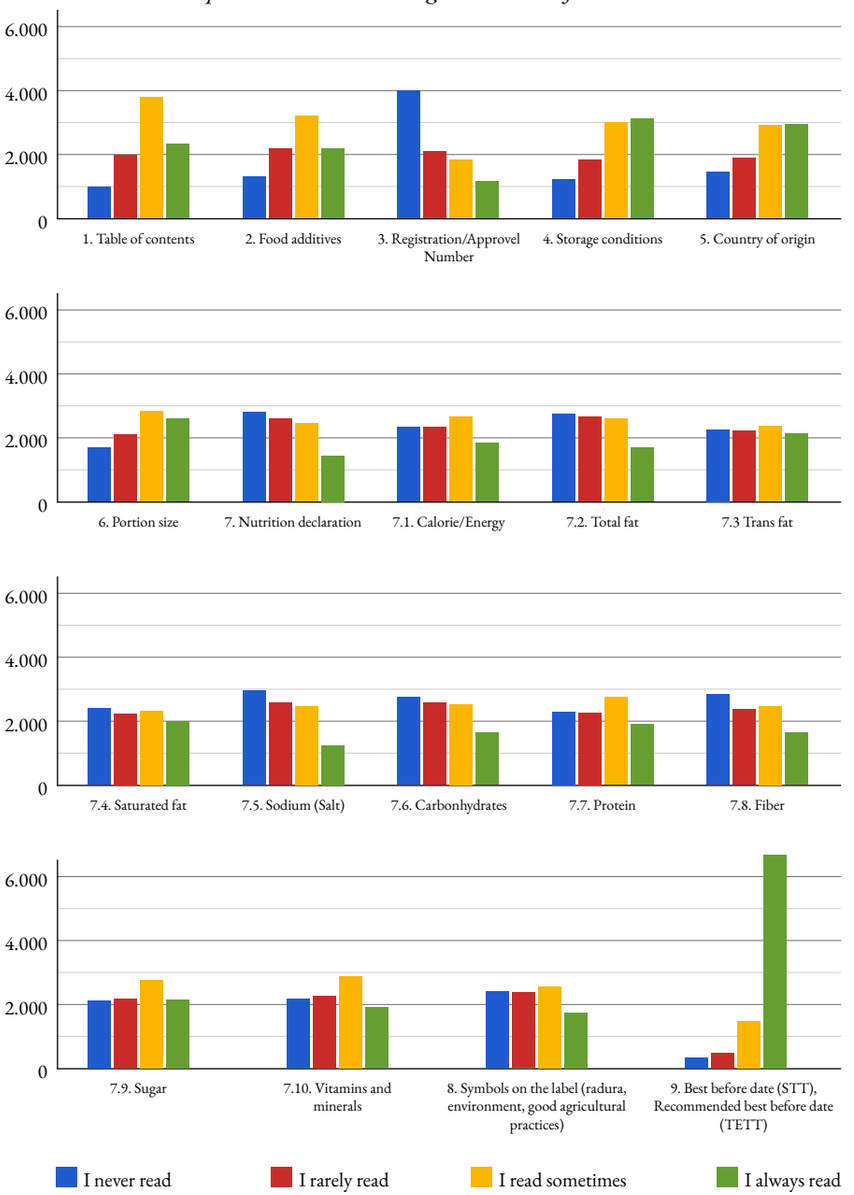
2.4.2. Level of Food Literacy

Graph 9 - How often do you read the labels when buying food?



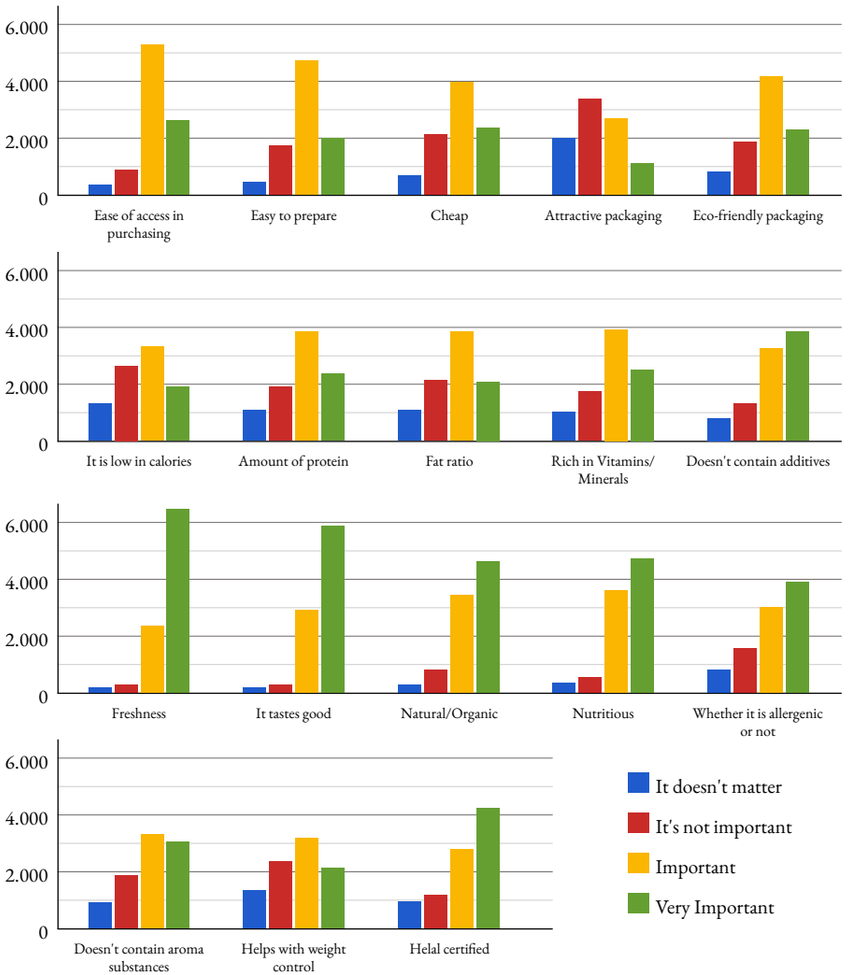
According to the data in Graph 9, 46% of the participants stated that they always read food labels, 34.3% said they sometimes do, 14.9% said they rarely do, and 4.8% reported that they never read food labels.

Graph 10 - I look at the things below on the food labels



According to the data in Graph 10, it was found that participants most frequently check the expiration or recommended consumption date. However, they do not consistently look at other label contents such as symbols, vitamins and minerals, fiber, salt, protein, carbohydrates, saturated fat, and sugar.

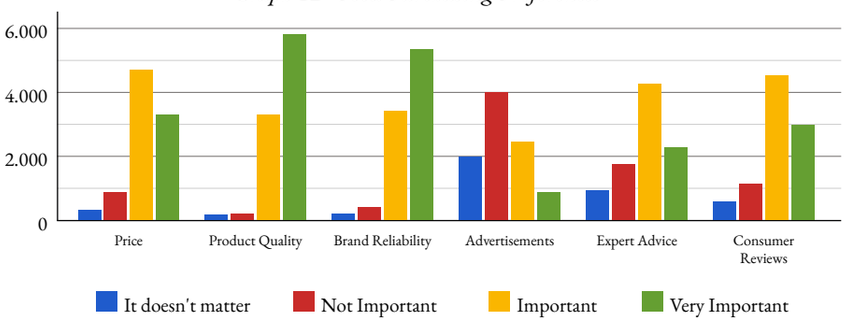
Graph 11 - I consider the following when consuming food



According to the data in Graph 11, it was determined that participants consider

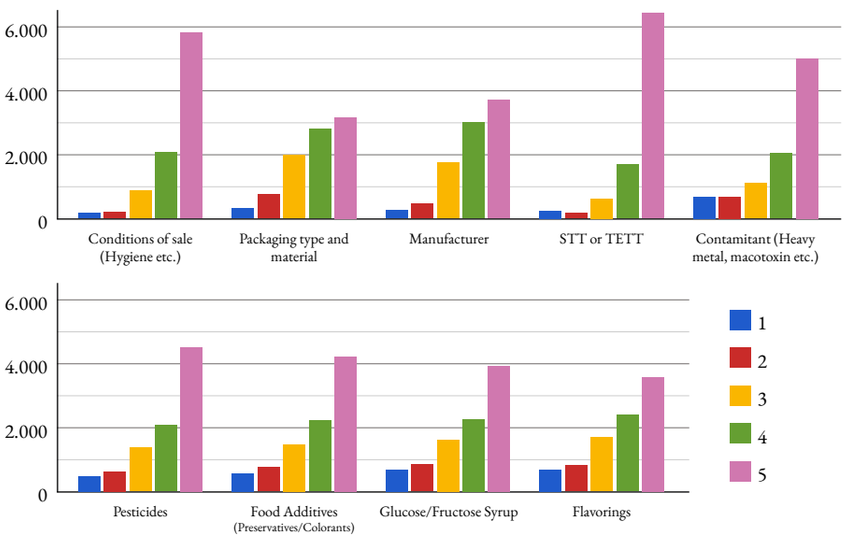
taste, freshness, naturalness, and nutritional value in food to be very important. They also find accessibility important when purchasing food, while they consider attractive packaging to be not important at all.

Graph 12 - Food Purchasing Preferences



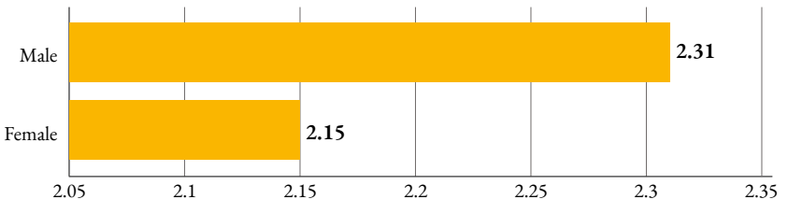
According to the data in Graph 12, it was determined that participants consider product quality and brand reliability as very important criteria when purchasing food. They also view price and consumer reviews as important, while they regard advertisements as not important at all.

Graph 13 - Elements that you are anxious about when purchasing food



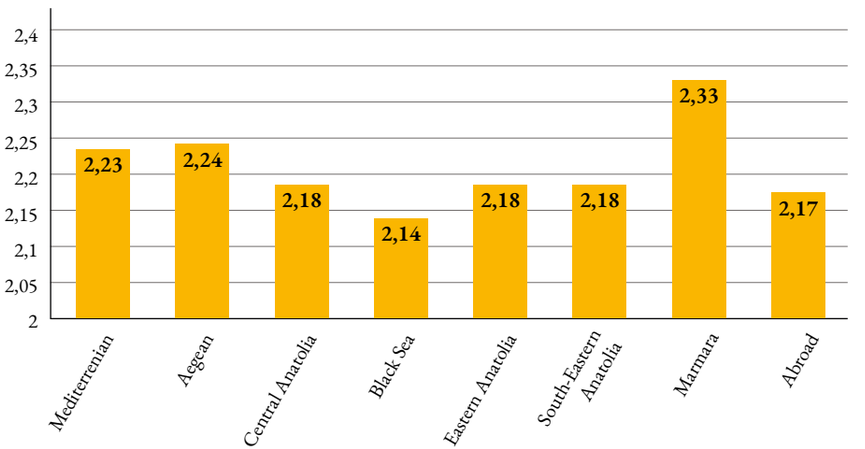
According to the data in Graph 13, the top concerns of participants when purchasing food are the expiration date and recommended consumption date, as well as the sales conditions. It is observed that participants find all the criteria very important.

Graph 14 - How often do you read the food labels when purchasing food?



According to the independent samples t-test analysis results in Graph 14, the frequency of reading food labels while purchasing food was compared between women and men. The results showed that the average score for men's frequency of reading food labels (M = 2.31, SD = 0.801) was higher and significant compared to women (M = 2.15, SD = 0.908) ($p < 0.001$). These results indicate that men tend to read food labels more frequently than women.

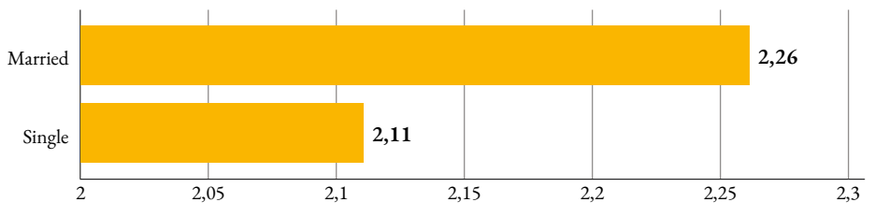
Graph 15 - Average difference between regions in reading the food labels



According to the Games-Howell test results in Graph 15, the frequency of reading food labels among individuals in the Marmara region (M = 2.33, SD = 0.80, p < 0.001) was found to be significantly higher compared to those in the Central Anatolia (M = 2.18, SD = 0.86, p < 0.001), Black Sea (M = 2.14, SD = 0.90, p < 0.001), Eastern Anatolia (M = 2.18, SD = 0.90, p < 0.001), and Southeastern Anatolia (M = 2.18, SD = 0.91, p < 0.001) regions. The frequency of reading food labels in the Mediterranean region and abroad did not differ significantly from other regions. Additionally, a significant difference was observed between the Aegean (M = 2.24, SD = 0.86, p < 0.001) and Black Sea regions (M = 2.14, SD = 0.90, p = 0.015), with the Aegean region having a higher mean.

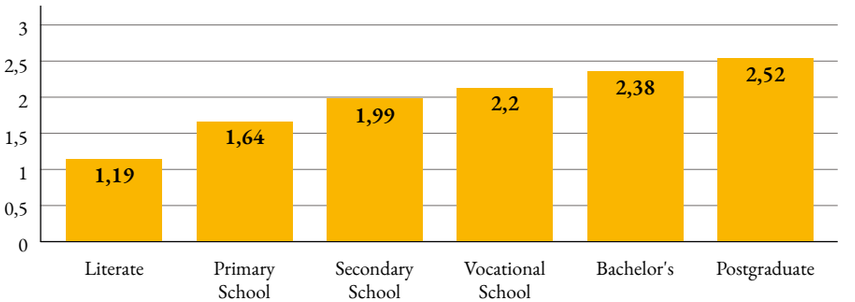
The Marmara Region has a significantly higher average frequency of reading food labels compared to many other regions. The Central Anatolia, Eastern Anatolia, and Southeastern Anatolia regions have lower averages compared to Marmara. These results indicate that, except for abroad and the Mediterranean region, the differences in the frequency of reading food labels among other regions are statistically significant.

Graph 16 - The frequency of reading food labels according to the marital status



According to the independent samples t-test results in Graph 16, the frequency of reading food labels among married individuals (M = 2.26, SD = 0.856) was found to be significantly higher than that of single individuals (M = 2.11, SD = 0.885), t (9239) = -8.050, p < 0.001.

Graph 17 - Frequency of reading food labels according to the level of education

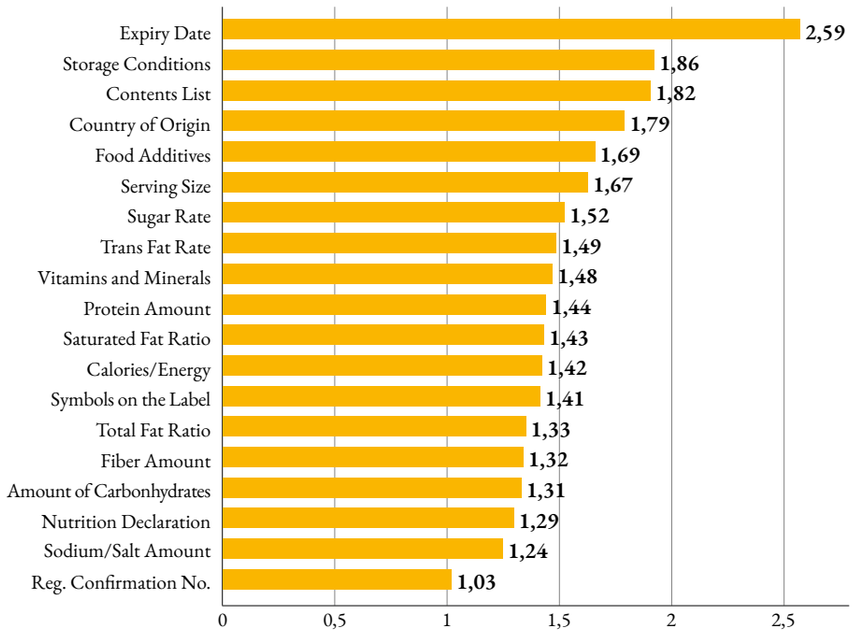


Graph 17 shows the average differences in the frequency of reading food labels according to education levels. Starting from the literate level, as the education level increases, the frequency of reading food labels also increases. According to the Games-Howell multiple comparison test results based on education levels, the average frequencies of reading food labels were found to be significantly different among all education levels, and a significant increase in food label reading frequency was observed as education level increased (Literate: M = 1.19, SD = 1.01, p < 0.001; Primary education: M = 1.64, SD = 1.01, p < 0.001; Secondary education: M = 1.99, SD = 0.92, p < 0.001; Vocational school: M = 2.20, SD = 0.83, p < 0.001; Bachelor's degree: M = 2.38, SD = 0.74, p < 0.001; Graduate degree: M = 2.52, SD = 0.69, p < 0.001). These results indicate that as education level rises, individuals read food labels more frequently. (f = 221.755, p < 0.001)

General Conclusion

- A significant increase in the average frequency of reading food labels was observed as education level increased.
- Individuals with graduate-level education (doctorate and above) have the highest average compared to all other groups.
- Literate individuals have a significantly lower average compared to all other education groups.

Graph 18 - The level of importance in food preferences

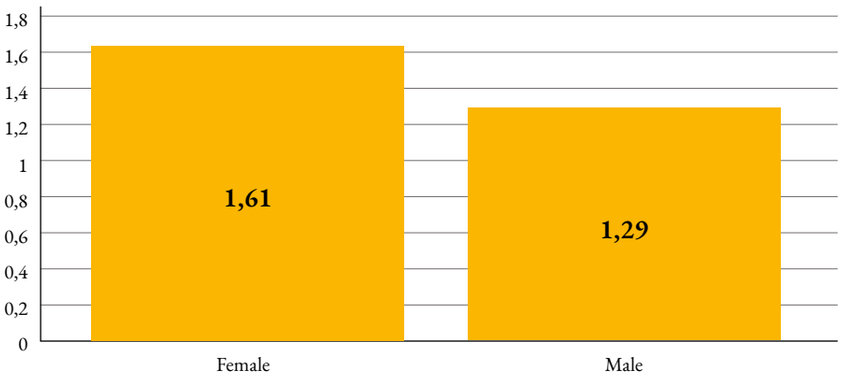


According to the data in Graph 18, the criteria that individuals consider in their food preferences within the scope of this study are ranked according to their average level of importance. According to the findings, the most considered criterion by individuals is the product's expiration date (M = 2.59), which ranks first. This is followed by storage conditions (M = 1.86) and the ingredients list (M = 1.82). Country of origin (M = 1.79) and food additives (M = 1.69) are also important criteria for consumers. Portion size (M = 1.67) and sugar content (M = 1.52) are among the factors considered.

From a nutritional and health perspective, consumers pay attention to nutrient components such as trans-fat content (M = 1.49), vitamins and minerals (M = 1.48), protein content (M = 1.44), and saturated fat content (M = 1.43). Additionally, information like calories/energy (M = 1.42) and symbols on the label (M = 1.41) are also evaluated by consumers.

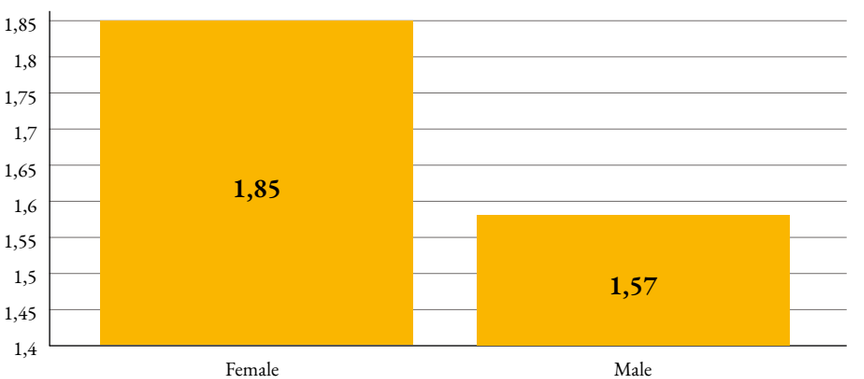
Furthermore, macronutrients such as total fat content (M = 1.33), fiber content (M = 1.32), carbohydrate content (M = 1.31), and nutritional claims (M = 1.29) are among the criteria consumers consider. Sodium/salt content (M = 1.24) is observed to be a relatively less important factor, while the registration approval number (M = 1.03) is among the least considered factors by consumers.

Graph 19 - Level of person's checking calories/energy data according to gender



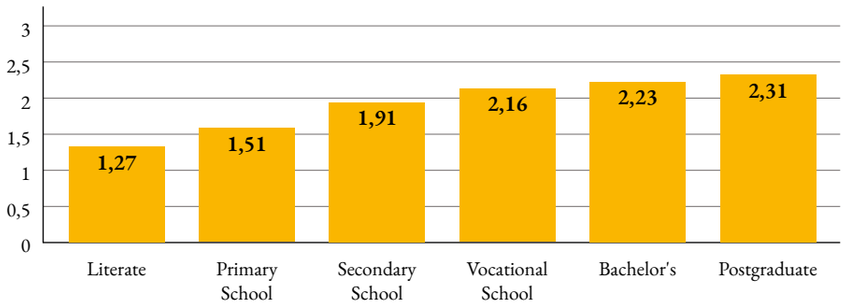
According to the independent samples t-test results in Graph 19, the level at which women pay attention to calorie/energy information on food labels (M = 1.61, SD = 1.054) was found to be significantly higher than that of men (M = 1.29, SD = 1.067), $t(9190) = -13.951$, $p < 0.001$. These results indicate that women place more importance on calorie/energy information on food labels compared to men.

Graph 20 - Level of persons checking food additives in food labels according to gender



According to the independent samples t-test results in Graph 20, the level at which women check food additives on food labels (M = 1.85, SD = 0.965) was found to be significantly higher than that of men (M = 1.57, SD = 1.033), t(9,190) = -13.309, p < 0.001, MD = -0.281, 95% CI [-0.322, -0.239]. These results indicate that women pay more attention to food additives than men. The difference in mean values shows that women have a higher level of sensitivity on this issue.

Graph 21 - Level of persons checking food additives in food labels according to the level of education

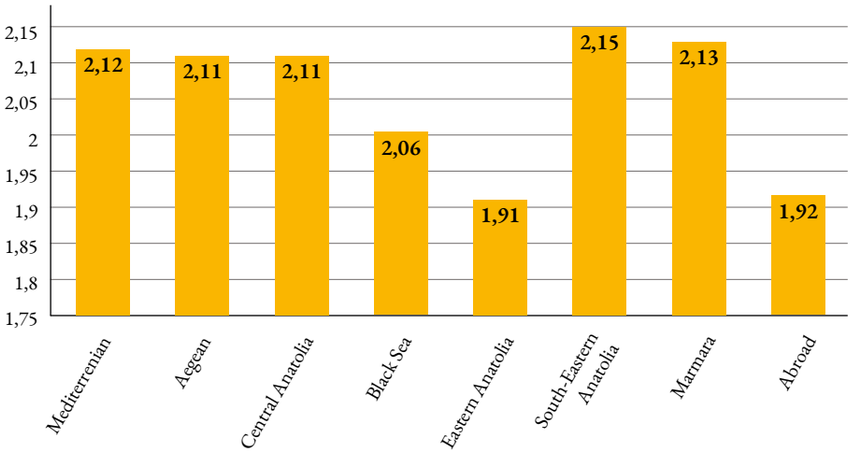


According to the Games-Howell test results in Graph 21, education level has a significant effect on the extent to which individuals check food additives on food labels. The average score of literate individuals (M = 1.27, SD = 1.08, p < 0.001) is significantly lower than those with an associate degree (M = 2.16, SD = 0.92, p < 0.001), a bachelor's degree (M = 2.23, SD = 0.83, p < 0.001), and a postgraduate degree (M = 2.30, SD = 0.82, p < 0.001).

The elementary education level, except for the literate group, was found to have a significantly lower level of attention to food additives compared to all other education levels. Individuals with secondary education showed significantly different levels of attention to food additives compared to all other education levels. The sensitivity of individuals with an associate degree to food additives was not significantly different from those with bachelor's and postgraduate degrees but was significantly different from those with secondary education or lower.

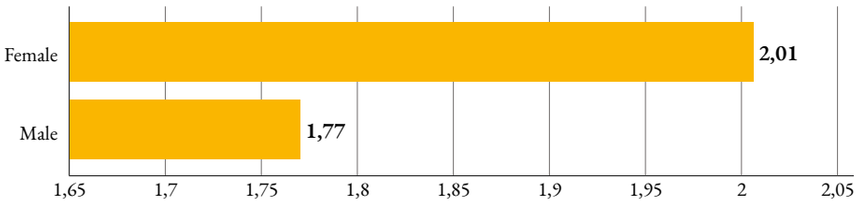
The average sensitivity of individuals with a bachelor's degree was significantly higher than all other education levels, except for associate and postgraduate degrees. These findings indicate that as the education level increases, the level of attention paid to food additives also increases. Individuals with postgraduate education have the highest average attention to food additives. Literate individuals have the lowest average, significantly lower than all other groups.

Graph 22 - Level of checking food additives in food labels according to regions



According to the Games-Howell test results in Graph 22, the region of residence has a significant effect on the level of attention paid to food additives on food labels. Individuals living in the Mediterranean region (M = 2.12, SD = 0.93, p < 0.001) show significantly greater sensitivity to food additives than those living in the Eastern Anatolia region (M = 1.90, SD = 1.09, p < 0.001). Similarly, individuals residing in the Aegean region (M = 2.10, SD = 0.94, p < 0.001) have significantly higher sensitivity to food additives than those in Eastern Anatolia. People in Central Anatolia (M = 2.10, SD = 0.92, p < 0.001) also demonstrate significantly higher awareness of food additives compared to those in Eastern Anatolia (M = 1.90, SD = 1.09, p < 0.001). Likewise, individuals from the Black Sea region (M = 2.06, SD = 0.95, p < 0.001) exhibit significantly more concern about food additives than those in Eastern Anatolia. Participants from the Marmara region (M = 2.13, SD = 0.90, p < 0.001) also show significantly higher sensitivity to food additives compared to those living in Eastern Anatolia (M = 1.90, SD = 1.09, p < 0.001). These results indicate that individuals living in the Eastern Anatolia region consistently show lower attention to food additives compared to other regions. (f = 6.71, p < 0.001)

Graph 23 - Level of considering environment friendly packaging according to gender



According to the data in Graph 23, the level of attention individuals pay to environmentally friendly packaging is shown by gender. Based on the results of the independent samples t-test, women's level of attention to eco-friendly packaging (M = 2.01, SD = 0.817) was found to be significantly higher than that of men (M = 1.77, SD = 0.931), (t(9065.985) = -13.128, p < 0.001). These results indicate that women place more importance on environmentally friendly packaging compared to men.

Table 1 - Correlation between the frequency of reading food labels when purchasing food and the other food habits

Variables	1	2	3	4	5	6	7	8	9
1. Label Reading Frequency	—								
2. Storage Conditions	.45**	—							
3. Symbols on the Label	.40**	—							
4. Trans Fat	.39**	—	—						
5. Saturated Fat	.38**	—	—	—					
6. Total Fat	.37**	—	—	—	—				
7. Protein	.37**	—	—	—	—	—			
8. Easy to Prepare	.13*	—	—	—	—	—	—		
9. Food is Cheap	-0.03	—	—	—	—	—	—	—	

Not. p < .05 (*), p < .01 (**).

According to the data in Table 1, when the relationships between the frequency of reading labels while purchasing food and other food-related habits are examined in correlation with each other, the analysis shows that the highest correlation is between label reading frequency and "considering storage conditions," with a coefficient of 0.45. This is followed by the variable "symbols on the label" with a correlation of 0.40. The variables "trans fat" (0.39) and "saturated fat" (0.38) also show relatively high correlations. These are followed by "total fat" and "protein," both with a correlation of 0.37. On the other hand, there is a weak negative relationship of -0.03 between label reading frequency and "the food being inexpensive." Additionally, the variable "ease of preparation" shows the lowest positive correlation at 0.13.

2.4.3. Conclusion

According to the data obtained from the food literacy knowledge level survey conducted across Türkiye in 2024 with 9,283 participants, it is observed that the majority of respondents were from the Marmara and Black Sea regions, aged between 26–39, male, married, without children, employed as technical staff, university graduates, and from middle-income groups. Findings indicate that 46% of participants always read food labels, most commonly checking the expiration or recommended consumption dates. When purchasing food, participants consider taste, freshness, naturalness, and nutritional value as highly important factors.

Survey data also reveal that participants pay close attention to product quality and brand, while price and consumer reviews are considered secondary, and advertisements are deemed unimportant.

Gender-based analyses show that men demonstrate greater awareness in reading food labels compared to women; however, women pay more attention than men to information related to eco-friendly packaging, calorie/energy content, and food additives on labels.

In comparisons by marital status, married individuals were found to read food labels more frequently than singles.

Regional comparisons indicate higher label-reading rates in the Marmara and Black Sea regions, and lower rates in the Southeastern Anatolia region. The level of attention to food additives is highest in Southeastern Anatolia, followed by the Marmara and Mediterranean regions.

In comparisons based on education level, postgraduate participants reported the highest frequency of reading food labels. A positive correlation was found between educational attainment and food literacy.

2.5. PROFILE OF FOOD CONSUMERS IN TÜRKIYE BASED ON GENDER FACTOR: A CROSS-SECTIONAL STUDY[21]

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Declarations

Conflict of Interest: The authors declare that there are no financial or non-financial conflicts of interest to disclose.

Funding: The authors state that no funding, grants, or other support was received during the preparation of this article.

Data Availability: The data are available from the corresponding author upon request.

Ethical Approval: This study was conducted in accordance with the principles of the Declaration of Helsinki. Approval was granted by the Scientific Research and Publication Ethics Committee of Kırklareli University Rectorate (07/05/2025 - E-35523585-199-159771).

Informed Consent: Informed consent was obtained from all individuals who participated in the study.

21 This study is conducted in line with" Food Literacy" Project

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Abstract

In Türkiye, as in many other countries, adults are becoming increasingly attentive to reading food labels when making food purchasing decisions. This study aims to examine the food label reading behaviors of adults living in Türkiye, with a particular focus on the role of gender, food characteristics that influence purchasing decisions, and concerns related to food consumption. This study was conducted in 2024 among individuals aged 18 and older living in Türkiye. Participants were recruited through social media platforms and various communication tools. The collection. A total of 8,902 individuals participated in the study using a random sampling method. Of the participants, 56.6% were male, 45.8% were between the ages of 26 and 39, and 70.7% were married. The food label factor most frequently examined by participants was the "best before date" (BBD) and/or the "use-by date" (UBD). Among male participants, 68.7% reported always checking this factor, compared to 80.4% of female participants ($p < 0.001$). Statistically significant gender differences were observed in all other food label factors as well. Food quality was identified as the most influential product feature for both male (58.2% always) and female participants (65.8% always). The expiration date and/or the recommended consumption date emerged as the food characteristic of greatest concern for both male (86.6% always) and female (91.3% always) participants ($p < 0.001$). The findings suggest that in Turkish society, the expiration date is the most influential factor affecting food consumption, followed by attention to nutritional values and other label information. Food label literacy is a vital skill that individuals of all age groups should possess.

Keywords: Food literacy, food consumption behaviors, nutrition knowledge, food label usage

2.5.1. Introduction

In recent years, increasing awareness regarding health and nutrition has led to heightened consumer attention toward food labels (Duarte & Teixeira, 2021). In Türkiye, as in many other countries, adults tend to be more cautious about reading food labels when making purchasing decisions. This trend is partly driven by the rise in diet-related health problems and the growing demand for transparency in food products (Çalık et al., 2020; Vayısoğlu et al., 2022; Çolakoğlu et al., 2022). Understanding which aspects of food labels consumers focus on can provide valuable insights into their purchasing behavior and preferences. In this context, research has aimed to identify the factors that influence individuals' food choices to promote healthy eating behaviors.

Food labels can help consumers make healthier choices by providing information on the nutritional content of products at the point of purchase. A study conducted among university students found that food literacy, which is influenced by many factors, tends to be higher among women. However, there are also studies that report no significant effect of gender (Sarıyer et al., 2023).

Research shows that consumers often prioritize specific nutritional information such as energy content, sugar levels, and the presence of additives (Oostenbach et al., 2019; Kim et al., 2021). Additionally, factors such as organic certification, local sourcing, and ethical concerns significantly influence food choices (Varaldo et al., 2022; Danz et al., 2022; Rizzo et al., 2024). As adults attempt to navigate complex food labels and product features, concerns regarding food safety and quality play a critical role in shaping consumption habits (Liguori et al., 2022).

This study aims to examine the frequency of food label reading among adults living in Türkiye and focuses on the role of gender in prioritizing certain factors, the product characteristics that influence purchasing decisions, and food-related concerns. By investigating these factors, the study seeks to contribute to a better understanding of the evolving landscape of consumer behavior in Türkiye's food market and to raise societal interest and awareness on the topic.

2.5.2. Materials and Method

Participants

The target population of the study consisted of adults living in Türkiye. Individuals who were 18 years or older, residing in Türkiye, and who agreed to participate in the study were included.

A known-population sampling method was used to calculate the sample size. According to data from the Turkish Statistical Institute (TÜİK), the total population of Türkiye is 85,664,944, with 26% under the age of 18. Thus, the adult population (the target population) is 63,392,058. Based on the known-population sampling formula ($t = 0.1$, $p = 0.5$, $q = 0.5$, $d = 0.02$), the minimum required sample size was calculated as 6,723. To reduce the margin of error due to the online nature of data collection, the sample size was increased by 30%, resulting in a target of 8,740 participants.

A total of 9,322 individuals participated in the study. However, 284 participants were excluded for not residing in Türkiye, 134 were under 18 years of age, and 4 did not reside in Türkiye and were also underage. Consequently, the final sample consisted of 8,902 participants.

Data Collection

The sample was reached through face-to-face and digital communication tools. The sampling method used was simple random sampling.

All research questions were developed by the researchers based on food labels in Türkiye, the Turkish Food Codex Food Labeling and Consumer Information Regulation (2017), and literature review; no standardized scale was used. Data were collected online using these research questions. If individuals agreed to participate, they were administered a questionnaire consisting of five sections. The first section included questions about the individual's demographic characteristics (gender, age, average monthly salary range, occupation, etc.). The second section examined individuals' frequency of reading food labels when purchasing food, the third section focused on the elements that individuals pay attention to on food labels, the fourth section investigated the food characteristics that affect individuals' purchasing decisions, and the fifth section explored concerns individuals have

while consuming food.

Ethical Approval

Ethical approval for the study was obtained from the Scientific Research and Publication Ethics Committee of Kırklareli University Rectorate (07/05/2025 - E-35523585-199-159771). The study was conducted in accordance with the principles of the 2008 Helsinki Declaration.

Data Analysis

Descriptive statistics such as counts (n) and percentages (%) were used for analysis. The normality of distribution was assessed using the Kolmogorov-Smirnov test, and the data were found to be non-parametric. Differences in proportions between two independent groups were examined using the chi-square test. Data were analyzed using SPSS version 26.0, and the significance level was set at $p < 0.05$.

2.5.3. Results

The demographic characteristics of the participants are presented in Table 1. Among the participants, 56.6% were male, 45.8% were aged 26-39, 70.7% were married, 35.1% had no children, 47.3% were white-collar workers, 44.9% were university graduates, 42.4% had an income between 50,001 and 70,000 TL, and 19.8% lived in the Black Sea region.

The factors participants pay attention to on food labels are examined in Table 2. Regarding the elements considered on food labels, male and female consumers only showed similarity in the frequency of looking at the 'registration/approval number,' while all other factors showed differences ($p < 0.001$ for all other factors). 43.4% of male and 42.4% of female users stated that they never look at the registration/approval number ($p = 0.124$). The most frequently examined food label factor by participants was the expiration date (STT) and/or recommended consumption date (TETT). 68.7% of male and 80.4% of female participants reported always looking at this factor ($p < 0.001$).

Among male participants, 44.3% always looked at the food label, 39.1% sometimes at the ingredients list, 33.4% sometimes at food additives, 32.3% sometimes at storage conditions, 31.9% always at the country of origin, 30.0% sometimes at portion size, 32.3% never at nutrition claims, 29.8% never at calories/energy, 32.8% never at total fat, 30.1% never at trans fats, 31.3% never at saturated fat, 35.7% never at sodium, 33.6% never at carbohydrates, 28.9% never at protein, 34.3% never at fiber, 27.4% never at sugar, 28.2% sometimes at vitamins and minerals, and 29.8% never at symbols on the label. Female participants reported looking at these factors with the following frequencies: 50.4% always looked at the food label, 42.4% sometimes at the ingredients list, 38.8% sometimes at food additives, 41.0% always at storage conditions, 33.1% always at country of origin, 31.6% sometimes at portion size, 29.2% sometimes at nutrition claims, 32.3% sometimes at calories/energy, 29.9% sometimes at total fat, 29.7% sometimes at trans fats, 29.8% sometimes at saturated fat, 29.1% sometimes at sodium, 30.6% sometimes at carbohydrates, 29.1% sometimes at protein, 30.5% sometimes at fiber, 32.7% sometimes at sugar, 33.3% sometimes at vitamins and minerals, and 31.0% sometimes at label symbols.

Table 3 examines factors influencing food consumption. Female and male consumers showed statistically significant differences in all factors ($p < 0.001$ for all variables). Among male participants, 56.3% sometimes paid attention to ease of access, 51.6% sometimes to ease of preparation, 42.3% sometimes to low cost, 35.8% rarely to attractive packaging, 42.8% sometimes to eco-friendly packaging, 65.3% always to freshness, 60.0% always to good taste, 46.4% always to natural/organic status, 45.8% always to nutritive value, 37.1% always to allergen status, 34.6% sometimes to low calorie, 40.2% sometimes to high protein, 38.8% sometimes to low fat, 40.9% sometimes to vitamin/mineral richness, 36.7% always to no additives, 36.7% sometimes to no flavorings, 33.6% sometimes to weight control, and 44.2% always to halal certification. Among female participants, 58.3% sometimes paid attention to ease of access, 53.7% sometimes to ease of preparation, 45.4% sometimes to low cost, 38.3% rarely to attractive packaging, 49.4% sometimes to eco-friendly packaging, 75.4% always to freshness, 68.5% always to good taste, 56.1% always to natural/organic status, 58.5% always to nutritive value, 47.7% always to allergen status, 39.3% sometimes to low calorie, 44.3% sometimes to high protein, 45.4% sometimes to low fat, 45.8% sometimes to vitamin/mineral richness, 47.1% always to no additives, 40.0% always to no flavorings, 37.8% sometimes to weight control, and 49.1% always to halal certification.

Table 4 explores which product features influence purchase preferences. Female and male consumers showed statistically significant differences in all factors ($p < 0.001$ for all variables). Quality was the most influential product feature for both male (58.2% always) and female participants (65.8% always) ($p < 0.001$). Among

male participants, 47.4% reported that price sometimes influenced their purchasing preference, 53.2% said brand reliability always did, 41.5% reported advertising rarely influenced, 44.3% said expert recommendations sometimes influenced, and 47.5% said consumer reviews sometimes influenced their purchase decisions. Among female participants, 54.8% reported price sometimes influenced, 63.1% said brand reliability always did, 41.9% said advertising rarely influenced, 49.2% said expert recommendations sometimes influenced, and 50.5% said consumer reviews sometimes influenced their choices.

Table 5 analyzes concerns of food consumers about food consumption. Female and male consumers showed statistically significant differences in all factors ($p < 0.001$ for all variables). Both male (86.6% always) and female (91.3% always) participants were most concerned about the expiration date and/or recommended consumption date of food ($p < 0.001$). Among male participants, 82.5% were always concerned about purchase conditions, 63.8% about packaging type and material, 69.9% about the manufacturer, 72.8% about contaminants (heavy metals, etc.), 69.0% about pesticides, 68.0% about food additives, 64.5% about glucose/fructose syrup, and 62.9% about flavorings. Among female participants, 88.4% were always concerned about purchase conditions, 67.8% about packaging type and material, 74.6% about the manufacturer, 81.4% about contaminants, 76.8% about pesticides, 77.0% about food additives, 73.3% about glucose/fructose syrup, and 71.4% about flavorings.

2.5.4. Discussion

Nutrition depends on the socio-cultural and economic structures of societies.

There are many factors that influence societies' food consumption. This study examined several factors affecting participants' food choices. Looking at the demographic structure of our study in general, 56.6% of the participants were male, and 45.8% were between the ages of 26-39. In contrast, in the study by İncedal-Sonkaya et al., three-quarters of the group consisted of female students.

In our study, among the factors considered by male and female food consumers when reading food labels, only the frequency of checking the "registration/approval number" showed similarity, while all other factors differed significantly ($p<0.001$ for all other factors). Among male users, 43.4% stated they never checked the registration/approval number, and 42.4% of female users said the same. The most frequently checked food label factor among participants was the expiry date (STT) and/or recommended consumption date (TETT). 68.7% of male participants and 80.4% of female participants stated that they always checked this factor ($p<0.001$). Yurdagül also found in a study conducted with consumers that 66.3% of label information was not read (Yurdagül, 1991). Another study found that students paid the most attention to price and expiration date (İncedal-Sonkaya et al., 2018). Similarly, in the study by Gözener et al., 90.38% of participants checked expiration dates; this was 60.7% in the study by Alpuğuz et al., and 78.4% in the study by Yaman and Özgen (2007).

In the study by İncedal-Sonkaya et al., a relationship was found between gender and reading label information, with women reading labels more than men. In their study, the factors affecting food preferences were, in order: personal choice, family's financial situation, and advertisements. Additionally, price was found to be the primary factor considered when purchasing food (İncedal-Sonkaya et al., 2018).

It was determined that the most influential product feature regarding food quality was "quality" for both male participants (58.2% always) and female participants (65.8% always) ($p<0.001$). Regarding expiration or recommended consumption date, both male (86.6% always) and female (91.3% always) participants showed the most concern ($p<0.001$). Sağlık also reported that female students read label information more than male students when buying packaged food (Sağlık, 2003). Another study conducted with university students found that the calorie and fat content on the label influenced purchasing decisions (İncedal-Sonkaya et al., 2018; Kolodinsky et al., 2008). Alpuğuz et al. found that students paid attention to brand, production date, and calorie content. A small proportion of students (0.4%) also reported being influenced by advertisements.

In our study, it was found that although rarely, women were significantly more influenced by advertisements in their food preferences compared to men (44.9% and 41.5%, respectively).

In the study by İncedal-Sonkaya et al., the nutritional values that students paid the most attention to were energy, fat, salt, and carbohydrates, respectively. Our findings are consistent with their study in showing that consumers behave somewhat consciously when purchasing food. As Sarıyer et al. (2023) also noted, women's greater tendency towards healthy eating indicates they have higher levels of food

literacy compared to men. In our country, it has also been determined that women play a greater role than men in food selection, preparation, and consumption from the purchasing stage onward and possess higher levels of food and label literacy.

It has been found that women spend more time cooking than men. Additionally, compared to men, women are more involved in weight control and hold stronger beliefs regarding healthy food consumption. Therefore, women may be more involved in acquiring knowledge and skills related to healthy eating (Sponselee et al., 2021; Ertürk Yaşar, 2023).

Label literacy is a competency that individuals of all ages and genders should possess.

2.5.5. Conclusion, Limitations, and Recommendations

Nutrition labels aim to help consumers make healthier food choices by providing information about the nutritional content of food. It was found that the most attention is paid to the food's expiration date, followed by nutritional values and other factors.

There is a need to emphasize regulation in the processed food industry and to create environments that support healthy nutrition for children in their growth and development period. Studies with larger samples that include a variety of socio-economic levels, ages, and genders should also be conducted.

The limitation of this study is that it consisted of adults living in Türkiye. In addition, individuals under the age of 18 were not included in the sample. Another limitation is that the study data was collected based on participants' self-reports.

An important point to consider is that food choices can be classified as “positive” or “negative.” Since food choices considered negative may be less socially acceptable, some participants might have altered their responses toward more favorable ones. This issue should be addressed under the scope of social desirability bias and taken into account when interpreting the data. In future studies, it is important to consider these limitations, adopt data collection strategies that reduce social desirability bias, and employ qualitative research approaches to more comprehensively uncover the factors affecting negative food choices.

Conflict of Interest Statement: All authors declare that there is no conflict of interest regarding this article.

Table 1- Demographics of the Participants

Variables	n	%
Gender		
Male	5039	56,6
Female	3863	43,4
Age		
19-25	947	10,6
26-39	4071	45,8
40-59	3226	36,2
60 and above	658	7,4
Marital Status		
Single	2606	29,3
Married	6296	70,7
Child Status		
No children	3125	35,1
Has one child	1651	18,5
Has two children	2634	29,6
Has three or more children	1492	16,8
Occupation		
Unemployed	682	7,6
Housewife	186	2,1
Freelancer	1993	22,4
Healthcare worker	735	8,3
Educator	659	7,4
White-collar worker	4207	47,3
Blue-collar worker	417	4,6
Business owner, CFO, etc.	23	0,3
Educational Status		
Literate	152	1,7
Primary school	771	8,7

High school	1569	17,6
Vocational school	1241	13,9
Bachelor's degree	3993	44,9
Postgraduate Degree	1176	13,2
Income Status		
No income	735	8,3
0–26,005.50 TL	657	7,4
26.006-35000 TL	890	10,0
35001-50000 TL	1488	16,7
50001-70000 TL	3778	42,4
70001-90000 TL	1021	11,5
90000 TL üstü	333	3,7
Region of Residence		
Mediterranean	827	9,3
Eastern Anatolia	890	10,0
Aegean	1573	17,7
Southeastern Anatolia	706	7,9
Central Anatolia	1517	17,0
Black Sea	1756	19,8
Marmara	1633	18,3

Not. N: Number of samples, % Percent

Table 2 - Factors that Food Consumers Consider on Food Labels

Variables	Male		Female		P1
	n	%	n	%	
How often do you read food labels when purchasing food?					
Never	289	5,7	100	2,6	<0,001***
Rarely	831	16,5	468	12,1	
Sometimes	1686	33,5	1348	34,9	
Always	2233	44,3	1947	50,4	
Do you check the "Ingredients" list on food labels?					
Never	702	13,9	251	6,5	<0,001***
Rarely	1222	24,3	722	18,7	
Sometimes	1970	39,1	1639	42,4	
Always	1145	22,7	1251	32,4	
Do you check the food additives (colorants, preservatives, etc.) on food labels?					
Never	969	19,2	417	10,8	<0,001***
Rarely	1290	25,6	811	21,0	
Sometimes	1685	33,4	1500	38,8	
Always	1095	21,7	1135	29,4	
Do you check the Registration/Approval number on food labels?					
Never	2185	43,4	1636	42,4	0,124
Rarely	1189	23,6	870	22,5	
Sometimes	1005	19,9	791	20,5	
Always	660	13,1	566	14,7	
Do you check the storage conditions on food labels?					
Never	862	16,9	378	9,8	<0,001***
Rarely	1075	21,3	642	16,6	
Sometimes	1629	32,3	1260	32,6	
Always	1483	29,4	1583	41,0	
Do you check the country of origin on food labels?					
Never	854	16,9	516	13,4	<0,001***
Rarely	1045	20,7	794	20,6	
Sometimes	1535	30,5	1274	33,0	
Always	1605	31,9	1279	33,1	

I look at the portion size on the food label					
Never	1050	20,8	640	16,6	<0,001***
Rarely	1119	22,2	871	22,5	
Sometimes	1510	30,0	1220	31,6	
Always	1360	27,0	1132	29,3	
I check the nutrition statement on the food label					
Never	1629	32,3	1002	25,9	<0,001***
Rarely	1430	28,4	1008	26,1	
Sometimes	1252	24,8	1128	29,2	
Always	728	14,4	725	18,8	
I look at the calories/energy on the food label					
Never	1504	29,8	755	19,5	<0,001***
Rarely	1380	27,4	943	24,4	
Sometimes	1326	26,3	1247	32,3	
Always	829	16,5	918	23,8	
I check the total amount of fat on the food label					
Never	1652	32,8	863	22,3	<0,001***
Rarely	1396	27,7	1048	27,1	
Sometimes	1233	24,5	1156	29,9	
Always	758	15,0	796	20,6	

*Not. N: Sample size, %: Percentage, 1: Chi-square test (χ2), *: p<0.05, **: p<0.01, ***: p<0.001*

Table 2 - Factors that Food Consumers Consider on Food Labels (continued)

Variables	Male		Female		P1
	n	%	n	%	
I check for the amount of Trans fat on the food label.					
Never	1515	30,1	691	17,9	<0,001***
Rarely	1277	25,3	907	23,5	
Sometimes	1213	24,1	1146	29,7	
Always	1034	20,5	1119	29,0	
I look at the amount of saturated fat on food labels.					
Never	1575	31,3	777	20,1	<0,001***
Rarely	1318	26,2	931	24,1	
Sometimes	1205	23,9	1150	29,8	
Always	941	18,7	1005	26,0	
I look at the amount of Sodium (Salt) on the food label.					
Never	1798	35,7	989	25,6	<0,001***
Rarely	1366	27,1	1070	27,7	
Sometimes	1196	23,7	1124	29,1	
Always	679	13,5	680	17,6	
I look at the amount of carbohydrates on the food label.					
Never	1695	33,6	877	22,7	<0,001***
Rarely	1401	27,8	1014	26,2	
Sometimes	1202	23,9	1182	30,6	
Always	741	14,7	790	20,5	
I look at the amount of protein on the food label.					
Never	1457	28,9	788	25,2	<0,001***
Rarely	1279	25,4	961	25,2	
Sometimes	1358	26,9	1232	29,1	
Always	945	18,8	882	20,5	
I look for fiber content on food labels.					
Never	1728	34,3	896	23,2	<0,001***
Rarely	1337	26,5	965	25,0	
Sometimes	1210	24,0	1177	30,5	
Always	764	15,2	825	21,4	

I look at the amount of sugar on the food label.					
Never	1383	27,4	672	17,4	<0,001***
Rarely	1247	24,7	889	23,0	
Sometimes	1375	27,3	1265	32,7	
Always	1034	20,5	1037	26,8	
I look for Vitamins and minerals on food labels.					
Never	1395	27,7	722	18,7	<0,001***
Rarely	1304	25,9	899	23,3	
Sometimes	1423	28,2	1286	33,3	
Always	917	18,2	956	24,7	
I look at the symbols on the food label (radura, environment, good agricultural practices).					
Never	1503	29,8	825	21,4	<0,001***
Rarely	1360	27,0	946	24,5	
Sometimes	1335	26,5	1196	31,0	
Always	841	16,7	896	23,2	
I look at the Best Before (STT) and/or Best Before Date (TETT) on the food label.					
Never	259	5,1	98	2,5	<0,001***
Rarely	328	6,5	150	3,9	
Sometimes	988	19,6	508	13,2	
Always	3464	68,7	3107	80,4	

*Note. N: Sample size, %: Percentage 1: Chi-square test (χ2), *: p<0.05, **: p<0.01, ***: p<0.001*
*1: Chi-square test (χ2), *: p < 0.05, **: p < 0.01, ***: p < 0.001*

Table 3 - Factors Relevant to the Food Consumption of Consumers

Variables	Male		Female		P
	n	%	n	%	
I pay attention to easy access when purchasing the food I consume.					
Never	259	5,1	118	3,1	<0,001***
Rarely	556	11,0	310	8,0	
Sometimes	2838	56,3	2254	58,3	
Always	1386	27,5	1181	30,6	
I pay attention to the ease of preparation of the food I consume.					
Never	378	7,5	180	4,7	<0,001***
Rarely	1000	19,8	672	17,4	
Sometimes	2602	51,6	2076	53,7	
Always	1059	21,0	935	24,2	
I pay attention to the cheapness of the food I consume.					
Never	377	7,5	284	7,4	<0,001***
Rarely	1072	21,3	993	25,7	
Sometimes	2132	42,3	1755	45,4	
Always	1458	28,9	831	21,5	
I make sure that the food I consume has attractive packaging.					
Never	1068	21,2	857	22,2	<0,001***
Rarely	1805	35,8	1478	38,3	
Sometimes	1487	29,5	1133	29,3	
Always	679	13,5	395	10,2	
I make sure that the food I consume has environmentally friendly packaging.					
Never	567	11,3	199	5,2	<0,001***
Rarely	1146	22,7	655	17,0	
Sometimes	2159	42,8	1909	49,4	
Always	1167	23,2	1100	28,5	
I pay attention to the freshness of the food I consume.					
Never	88	1,7	25	0,6	<0,001***
Rarely	144	2,9	50	1,3	
Sometimes	1515	30,1	876	22,7	
Always	3292	65,3	2912	75,4	

I pay attention to the taste of the food I consume.					
Never	94	1,9	28	0,7	<0,001***
Rarely	185	3,7	72	1,9	
Sometimes	1737	34,5	1115	28,9	
Always	3023	60,0	2648	68,5	
I pay attention to whether the food I consume is natural/organic.					
Never	194	3,8	47	1,2	<0,001***
Rarely	476	9,4	210	5,4	
Sometimes	2029	40,3	1437	37,2	
Always	2340	46,4	2169	56,1	
I pay attention to whether the food I consume is nutritious.					
Never	203	4,0	56	1,4	<0,001***
Rarely	393	7,8	158	4,1	
Sometimes	2137	42,4	1390	36,0	
Always	2306	45,8	2259	58,5	
I pay attention to whether the food I consume is allergenic or not.					
Never	634	12,6%	222	5,7%	<0,001***
Rarely	882	17,5%	494	12,8%	
Sometimes	1654	32,8%	1303	33,7%	
Always	1869	37,1%	1844	47,7%	

*Note. N: Sample size, %: Percentage 1: Chi-square test (χ2), *: p<0.05, **: p<0.01, ***: p<0.001*
*1: Chi-square test (χ2), *: p < 0.05, **: p < 0.01, ***: p < 0.001*

Table 3 - Factors Relevant to the Food Consumption of Consumers (continued)

Variables	Male		Female		P
	n	%	n	%	
I pay attention to whether the food I consume is low in calories.					
Never	877	17,4	361	9,3	<0,001***
Rarely	1531	30,4	1004	26,0	
Sometimes	1745	34,6	1517	39,3	
Always	886	17,6	981	25,4	
I make sure that the food I consume has a high protein content.					
Never	725	14,4	299	7,7	<0,001***
Rarely	1100	21,8	712	18,4	
Sometimes	2026	40,2	1712	44,3	
Always	1188	23,6	1140	29,5	
I make sure that the food I consume is low in fat.					
Never	778	15,4	303	7,8	<0,001***
Rarely	1235	24,5	778	20,1	
Sometimes	1956	38,8	1752	45,4	
Always	1070	21,2	1030	26,7	
I pay attention to the vitamin/mineral richness of the food I consume.					
Never	706	14,0	284	7,4	<0,001***
Rarely	1038	20,6	591	15,3	
Sometimes	2061	40,9	1768	45,8	
Always	1234	24,5	1220	31,6	
I make sure that the food I consume does not contain additives.					
Never	564	11,2	214	5,5	<0,001***
Rarely	817	16,2	416	10,8	
Sometimes	1809	35,9	1412	36,6	
Always	1849	36,7	1821	47,1	
I make sure that the food I consume does not contain flavoring agents.					
Never	654	13,0	265	6,9	<0,001***
Rarely	1019	20,2	613	15,9	
Sometimes	1848	36,7	1440	37,3	
Always	1518	30,1	1545	40,0	

I pay attention to whether the food I consume helps with weight control.					
Never	896	17,8	381	9,9	<0,001***
Rarely	1363	27,0	931	24,1	
Sometimes	1694	33,6	1460	37,8	
Always	1086	21,6	1091	28,2	
I make sure that the food I consume is halal certified.					
Never	619	12,3	307	7,9	<0,001***
Rarely	702	13,9	467	12,1	
Sometimes	1492	29,6	1193	30,9	
Always	2226	44,2	1896	49,1	

*Note. N: Sample size, %: Percentage 1: Chi-square test (χ2), *: p<0.05, **: p<0.01, ***: p<0.001*
*1: Chi-square test (χ2), *: p < 0.05, **: p < 0.01, ***: p < 0.001*

Table 4 - Product Features That are Effective on The Purchase Decisions of the Consumers

Variables	Male		Female		P
	n	%	n	%	
PRICE of the product in my food purchasing choice					
Never	211	4,2	133	3,4	<0,001***
Rarely	472	9,4	392	10,1	
Sometimes	2389	47,4	2117	54,8	
Always	1967	39,0	1221	31,6	
The QUALITY of the product is my choice when purchasing food.					
Never	66	1,3	21	0,5	<0,001***
Rarely	101	2,0	23	0,6	
Sometimes	1937	38,4	1277	33,1	
Always	2935	58,2	2542	65,8	
BRAND RELIABILITY of the product in my food purchasing choice					
Never	112	2,2	28	0,7	<0,001***
Rarely	231	4,6	87	2,3	
Sometimes	2014	40,0	1312	34,0	
Always	2682	53,2	2436	63,1	
ADVERTISEMENTS of the product in my food purchasing choice					
Never	1269	25,2	645	16,7	<0,001***
Rarely	2091	41,5	1733	44,9	
Sometimes	1199	23,8	1149	29,7	
Always	480	9,5	336	8,7	
When I choose to buy food, the product is RECOMMENDED BY EXPERTS					
Never	642	12,7%	169	4,4%	<0,001***
Rarely	1091	21,7%	586	15,2%	
Sometimes	2233	44,3%	1899	49,2%	
Always	1073	21,3%	1209	31,3%	
CONSUMER REVIEWS of the product in my food purchasing choice					
Never	452	9,0	128	3,3	<0,001***
Rarely	721	14,3	367	9,5	
Sometimes	2394	47,5	1952	50,5	
Always	1472	29,2	1416	36,7	

*Note. N: Sample size, %: Percentage 1: Chi-square test (χ2), *: p<0.05, **: p<0.01, ***: p<0.001*
*1: Chi-square test (χ2), *: p < 0.05, **: p < 0.01, ***: p < 0.001*

Table 5 - Food Properties that Consumers are Anxious About

Variables	Male		Female		P
	n	%	n	%	
Sales conditions (Hygiene etc.)					
Never	120	2,4	80	2,1	<0,001***
Rarely	189	3,8	65	1,7	
Sometimes	575	11,4	302	7,8	
Always	4155	82,5	3416	88,4	
Packaging type and material					
Never	275	5,5	156	4,0	<0,001***
Rarely	443	8,8	268	6,9	
Sometimes	1108	22,0	821	21,3	
Always	3213	63,8	2618	67,8	
Manufacturer					
Never	237	4,7	112	2,9	<0,001***
Rarely	321	6,4	206	5,3	
Sometimes	961	19,1	662	17,1	
Always	3520	69,9	2883	74,6	
Best Before (STT) and/or Best Before Date (TEET)					
Never	130	2,6	69	1,8	<0,001***
Rarely	121	2,4	55	1,4	
Sometimes	423	8,4	212	5,5	
Always	4365	86,6	3527	91,3	
Contaminant (Heavy metal, mycotoxin, etc.)					
Never	335	6,6	142	3,7	<0,001***
Rarely	345	6,8	192	5,0	
Sometimes	690	13,7	385	10,0	
Always	3669	72,8	3144	81,4	
Pesticides					
Never	377	7,5	177	4,6	<0,001***
Rarely	414	8,2	227	5,9	
Sometimes	771	15,3	494	12,8	
Always	3477	69,0	2965	76,8	
Food additives (Preservatives / Colorants)					
Never	371	7,4	162	4,2	<0,001***
Rarely	405	8,0	197	5,1	
Sometimes	836	16,6	528	13,7	
Always	3427	68,0	2976	77,0	
Glucose/fructose syrup					
Never	418	8,3	188	4,9	<0,001***
Rarely	469	9,3	245	6,3	
Sometimes	901	17,9	599	15,5	
Always	3251	64,5	2831	73,3	
Flavorings					
Never	433	8,6	191	4,9	<0,001***
Rarely	498	9,9	282	7,3	
Sometimes	936	18,6	630	16,3	
Always	3172	62,9	2760	71,4	

*Note. N: Sample size, %: Percentage 1: Chi-square test (χ2), *: p<0.05, **: p<0.01, ***: p<0.001*
*1: Chi-square test (χ2), *: p < 0.05, **: p < 0.01, ***: p < 0.001*

2.6. ACADEMIC AND FIELD STUDIES CONDUCTED WITHIN THE SCOPE OF THE PROJECT

2.6.1. The Importance of the Concept of Food Literacy in Türkiye from the Perspective of Turkish Culture

Assoc. Prof. Osman Özkul[25]

Among the cultural codes of Turkish culture, food, hospitality, and sharing hold a significant place. The abundance of proverbs related to these values in cultural sources and the emphasis on one of the main duties of leaders being to "feed the hungry and shelter the needy" reflect their importance. In today's world, there is an indirect, if not direct, relationship between food literacy—discussed in the literature in connection with healthy nutrition and public health—and societies' eating and consumption cultures. The consumption patterns and culinary traditions of any society cannot be separated from their historical context of production and consumption culture. Indeed, research shows that factors such as susceptibility to chronic diseases, individual physiological reactions to certain foods, beliefs, cultural structures, and economic and geopolitical conditions are all influential in shaping dietary behavior. Therefore, it is understood that societies composed of individuals who can eat adequately and in a balanced way are more likely to achieve economic and social welfare. This highlights the critical role of a society's nutritional system (Bahar & Yılmaz, 2021, p. 498).

The methods to achieve the commonly cited goals of food literacy—such as making informed food choices, adapting to changes in the food system, and supporting a sustainable physical and social environment—inevitably vary from one society to another due to cultural differences. From a global perspective, adding goals such as improving global food accessibility and encouraging sharing with those in need could make food literacy a more inclusive and effective concept. In societies with high levels of welfare, identifying the material and moral factors that shape diet culture and practices can help promote a culture of sharing and improve public health (Ayşin & Kızıltan, 2020, p. 5). Therefore, the issue should not be viewed merely as a problem of relatively wealthy Western countries but rather approached from a more holistic and global perspective.

Despite the rising living standards and prosperity in some parts of the world with a global population reaching 8 billion, the number of people facing poverty and hunger has not been reduced as expected. According to 2023 data, although 25 countries have managed to halve multidimensional poverty over the past 15 years, there are still an estimated 1.1 billion people living in poverty (UN Report, 2023). These individuals are experiencing a decline in both their physical and social living standards. Additionally, the number of people forced to migrate due to wars and internal conflicts continues to rise. These individuals seek refuge in more prosperous countries and continents with the hope of accessing better food and achieving a better quality of life. Ironically, the very countries these people strive to reach also face different kinds of "food problems." In some cases, as societies become more economically prosperous, the expected improvements in physical and social health levels do not materialize. However, from a realistic standpoint, one indicator of what needs to be done for a healthy society is the level of food literacy and the culture of sharing among its members. The higher these are, the more harmonious and peaceful the society tends to be.

Thus, it is believed that strengthening the relationship between food literacy and the culturally significant concepts of sharing and dietary culture in Turkish society can contribute to the development of a healthier society both physically and socially. The relationship between humans and food is not merely physiological; it is a multidimensional, socio-cultural phenomenon influenced by factors such as identity, belonging, social status, habits, and accessibility (Adak, 2020, p. 201). Establishing a connection between the dietary culture—particularly influenced by fasting practices in Turkish society—and food literacy may significantly contribute to the development and sustainability of individual and public health. People who strengthen their willpower through fasting and learn patience gain resilience against hardships. Thus, they are better equipped to handle life's challenges. In turn, fostering food literacy and a healthy food consumption culture in a society of strong-willed individuals becomes more achievable.

According to a study conducted for the first time in the world at the University of Tokyo in Japan, it is understood that there is a direct relationship between the development of comprehensive food literacy for society and the diet culture/quality within the community. The goals of this research are focused on nutrition education and behavioral change to improve public diet quality. According to data obtained

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from surveys conducted by Kentaro Murakami with 5,998 individuals aged between 20 and 79, the higher a person's food literacy, the better the quality of their breakfast, lunch, and dinner throughout the day.According to Murakami, this study covers the relationship between food literacy and diet quality for the general public and is the first comprehensive study of its kind in the world. Taking the results of this study into account, an improvement in public health and food quality can be expected (Murakami, 2022, p.3). In addition to this research, other studies conducted in Western countries have also identified the development of the relationship between communities' dietary cultures, food literacy, and diet quality as one of the key priorities and scientific goals. Therefore, research is being carried out in various parts of the world, especially in Western countries, on the relationship between food literacy and food quality.As examples, one study examines the relationships between food and food values, dietary quality, knowledge, technology, and behavior (https://www.utokyo.ac.jp/content/400213992.pdf), and another study investigates the relationship between the consumption of ultra-processed foods and food knowledge, technology, values, and behavioral characteristics (https://www.m.u-tokyo.ac.jp/news/PR/2023/release_20231211.pdf).

Within the framework of the Türkiye Food Literacy Strategy and Action Plan published by the Food and Agriculture Organization of the United Nations and covering the years 2022–2028, the existing policies and actions related to food literacy in Türkiye, the goals of the Türkiye food literacy action plan, and the strategies and scope required to achieve these goals are included. As understood from the report, according to the "Türkiye Childhood Obesity Survey" (COSI-TUR 2013) conducted in 2013, the prevalence of obesity was 8.3%, and the prevalence of overweight was 14.2%. In the 2016 survey (COSI-TUR 2016), based on the BMI-Z (Body Mass Index) scores of 2nd-grade elementary students, 9.9% of children were found to be obese, 14.6% overweight, 74% normal, and 1.5% underweight. This shows that the prevalence of obesity among children has increased over the years (FAO, 2023, p.3). However, as previously noted, the content of these topics does not adequately address the aspects related to Turkish society's production and consumption culture. Nevertheless, important goals have been set, such as raising awareness about the impact of food literacy on individual health, broader social and economic welfare, and the environment; supporting the influence of sociocultural values, norms, and beliefs on food choices and eating practices; learning and sharing cooking skills; and promoting cultural and family dining practices (FAO, 2023, p.15).

According to research on the level of food literacy in educational institutions in Türkiye, the education system, curriculum, and teaching programs are found to be inadequate in terms of food literacy, failing to cover all dimensions and components and lacking the qualities necessary to raise food-literate individuals. It is understood that nutrition problems such as obesity due to inadequate and unbalanced diets are common among school-age children in our society (Bahar & Yılmaz, 2021, p.512).

From the perspective of all these facts and scientific data, it becomes clear that Türkiye has not sufficiently benefited from its cultural codes and historical heritage in developing food literacy. Accordingly, it is necessary to determine the required methods and practices with a holistic perspective and then develop short- and long-term programs. Addressing this issue in coordination with Türkiye's education, culture, and values system, which are fundamental components of individual and community health, means addressing it within the framework of a sustainable program.

2.6.2. The Relationship Between Eco-Anxiety and Psychological Well-Being in Young Adults: The Effect of Food Product Examination Behavior

Elvan, Kiremitçi-Canıöz[26] and Orhun Türker[27]

It is important to know how beneficial or harmful the foods purchased to meet nutritional needs are for the human body. While the substances contained in the product and its other characteristics may help meet nutritional needs, they may also have potentially harmful effects on the body. The habit of reading food labels refers to the individual examining the features of the product purchased for nourishment and deciding whether to buy it based on those features (Coşkun & Kayışoğlu, 2018; Dikmen & Gül, 2018; Kurt et al., 2022; Seçkin Sığırcı & Ziver Sarp, 2024). Understanding food label reading habits provides significant insight into consumer behavior (Aksu & Çalbayram, 2024; Arslan et al., 2022; Bulak & Özçelik Ersü, 2023; Coşkun & Kayışoğlu, 2016; Elibol, 2023).

Eco-anxiety, considered a response to global environmental issues, is defined as being aware of these problems and experiencing intense anxiety as a result. The habit of reading food labels is thought to be an emotional response to the anxiety

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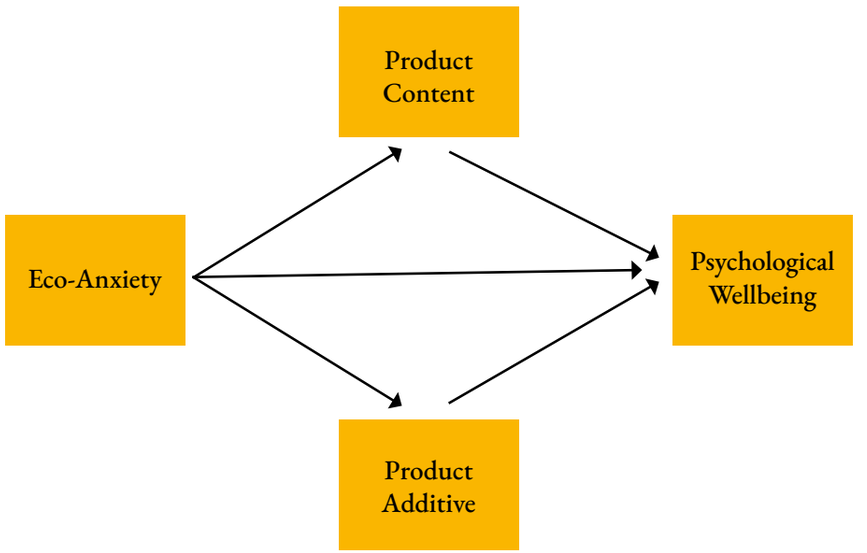
experienced about environmental issues. Individuals who experience this type of anxiety in daily life are expected to pay more attention to the content of the foods they consume (Aksu & Çalbayram, 2024; Bulak & Özçelik Ersü, 2023; Elibol, 2023; Karaca & Rakıcıoğlu, 2024; Meşe Yavuz & Başyiğit, 2022).Moreover, paying attention to the source of the food consumed, its ingredients, additives, and shelf life shows that the individual is focused on their nutritional needs (Demircan & Özdestan Ocak, 2019; Kıskaç et al., 2023; Sakar & Açkurt, 2019; Sönmez, 2024). Eco-anxiety also reflects how individuals interpret environmental problems (Kara, 2022; Pihkala, 2022; Öner, 2023; Uzun et al., 2022).Accordingly, for people who strive to lead a healthy life, it is expected that their nutritional concerns and anxiety about climate change are interconnected (Memiç İnan & Şarahman Kahraman, 2024). When reviewing the existing literature, it is found that there are very few studies examining the relationship between eco-anxiety and food label reading.

When discussing concerns about nutrition and climate change, it is also important to consider the impact on an individual's psychological health. Many studies on psychological well-being and eco-anxiety have shown a negative relationship between the two. Therefore, the aim of this study is to examine the relationship between eco-anxiety and psychological well-being, and the mediating role of attention to food content and additives in this relationship.

The hypotheses addressed in this study are as follows:

H1: There is a negative and significant relationship between psychological well-being and eco-anxiety.
H2: Attention to food content has a mediating role in the relationship between psychological well-being and eco-anxiety.
H3: Attention to food additives has a mediating role in the relationship between psychological well-being and eco-anxiety.

Figure 1 - Research Model



Method

Sample

Within the scope of this study, 260 university students were reached. The average age of the participants was found to be 21.99 (SD = 5.07). In terms of gender, the study included 210 female and 50 male university students. Regarding socio-economic status, 27 students identified as low, 224 as middle, and 9 as high.

Data Collection Tools

Eco-Anxiety Scale: The Eco-Anxiety Scale, developed by Hogg et al. (2021) and adapted into Turkish by Uzun et al. (2022), consists of 13 items. The items are prepared using a 4-point Likert scale. Higher scores on the scale indicate a higher level of eco-anxiety. In this study, the Cronbach's alpha reliability coefficient of the scale was found to be .88.

Psychological Well-Being Scale: The original scale was developed by Diener and Scollon (2009), and its Turkish adaptation was conducted by Telef (2013). This unidimensional scale consists of 8 items, prepared using a 7-point Likert scale. In the context of this study, the Cronbach's alpha reliability coefficient was also found to be .88.

Demographic Information Form: This form included questions about participants' gender, age, socio-economic status, and education.

To measure participants' food label reading behavior, questions were asked about their attention to the content and shelf life of the food products they purchase.

Procedure and Analysis

This study was prepared in accordance with the Declaration of Helsinki, published by the World Medical Association. Participants took part voluntarily after filling out an informed consent form. The scale forms prepared for the study were presented to participants online. It was stated that participants could withdraw at any point if they felt uncomfortable.

The data collected were analyzed using SPSS 23.0 and Hayes' PROCESS macro, specifically Model 4.

Findings

The aim of this study was to examine the relationship between eco-anxiety and psychological well-being, as well as the mediating effects of attention to food content and food additives in this relationship.

Findings Related to Scales and Variable Relationships

As a result of the analysis, the average score for eco-anxiety was found to be 15.90, the average score for psychological well-being was 38.55, the average score for attention to food content was 0.89, and the average score for attention to food additives was 0.63.

According to the correlation analysis, it was found that individuals with higher levels of eco-anxiety had lower levels of psychological well-being. Additionally, individuals with higher anxiety levels were found to pay more attention to the content and additives of the food products they consumed.

Table 1 - Findings Regarding Scales and Relationships Between Variables

	X	SS	1	2	3	4
Eco-anxiety	15,90	7,41	-			
Psychological wellbeing	38,55	8,44	-15*	-		
Product content	.89	.55	.16*	.06	-	
Additives	.63	.65	.16*	.15*	.49**	-

Note-1. *p < 0.05; **p < .01

Mediation Analysis

According to the findings of the mediation analysis, a negative and significant relationship was found between eco-anxiety and psychological well-being. As individuals' levels of ecological anxiety increase, their levels of psychological well-being decrease. Additionally, product content was found not to have a mediating role in this relationship, whereas attention to food additives did have a mediating role.

Table 2 - Findings of the Medation Analysis

	β	SH	t	p	95% GA	R	R^2
Model 1							
(DV=Product Content)							
Coefficient	.70	.08	8.85	0.00	[0.54–0.86]	.16	.03
Eco-anxiety	.01	.01	2.56	0.01	[0.01–0.02]		
Model 2							
(DV = Additives)							
Coefficient	.41	.09	4.30	0.00	[0.22–0.60]	.15	.02
Eco-anxiety	.01	.01	2.52	0.01	[0.01–0.02]		
Model 3							
(DV = Psychological wellbeing)							

Coefficient	40.31	1.38	29.21	0.00	[37.60-43.03]	.23	.05
Eco-Anxiety	-.20	.07	-2.84	0.00	[-.34 - -0.06]		
Product Content	-0.01	1.06	-0.01	0.99	[-2.10 – 2.07]		
Additives	2.28	0.91	2.52	0.01	[.50 -4.06]		

Note-1. *p < 0.05; **p < 0.01

Note-2: DV=Dependent Variable, β= Beta, SE= Standard Error

Discussion

The aim of this study was to examine the relationship between eco-anxiety and psychological well-being, and to investigate the mediating role of attention to food content and food additives in this relationship. As a result of the mediation analyses, a significant relationship was found between eco-anxiety and psychological well-being. Additionally, the mediating effects of attention to food content and food additives were examined.

Firstly, a negative and significant relationship was observed between psychological well-being and eco-anxiety. This finding is consistent with the existing literature: as individuals experience anxiety about climate change, it negatively impacts their psychological health. Consequently, their well-being is adversely affected. Individuals who worry about their environment tend to experience deteriorating mental health (Cankardaş & Sofuoğlu, 2021; Cianconi et al., 2020; Fritze et al., 2008; Gül, 2013; Stanley et al., 2021), and their level of psychological well-being decreases. Eco-anxiety can have a damaging effect on mental health (Adams, 2016; Bourque & Willox, 2014; Marazziti et al., 2021; Watts et al., 2015).

Secondly, the mediating role of attention to food content in the relationship between psychological well-being and eco-anxiety was examined but not found. However, a positive and significant relationship was found between eco-anxiety and attention to food content. As individuals' levels of ecological anxiety increase, they tend to pay more attention to the ingredients in the food they consume. Increased environmental awareness may lead individuals to be more attentive to the products they consume. More attention is given to what substances food products contain during purchase and consumption. Whether a product contains harmful chemicals may affect its desirability, and due to health consciousness, individuals may prefer to buy products with cleaner content. This behavior can lead individuals to purchase more ecologically packaged products (Riaz et al., 2023; Yemez & Delice-Akça, 2024). People experiencing eco-anxiety are expected to be more conscious consumers.

Lastly, a mediating role of attention to food additives was found in the relationship between eco-anxiety and psychological well-being. As individuals feel more concerned about climate change and its consequences, their need for healthier nutrition may increase. Therefore, they may be more inclined to examine the additives in food products (Delphla et al., 2009; Tirado et al., 2010).

Conclusion

The purpose of this study was to investigate the relationship between eco-anxiety and psychological well-being, and the mediating role of attention to food content and food additives in this relationship. According to the findings, a significant negative relationship was found between eco-anxiety and psychological well-being. Furthermore, the mediating effect of attention to food ingredients and additives was examined, and it was found that attention to food additives plays a mediating role in the relationship between eco-anxiety and psychological well-being.

In this study, data were collected only from university students. For future research, it is recommended to expand the sample group and include new variables in the model to enhance the ability to generalize and depth of analysis.

2.6.3. The Sociology of Consumption Habits: Understanding How and Why We Buy

Dr. Mevlüt UĞURLU[28]

Everyday life, in a sense, consists of choices related to consumption objects. The products we choose to consume for various reasons, ranging from the clothes we wear to the food we eat, the devices we carry, and the social media platforms we use daily, shape our identity, reflect our values, and communicate our social status to those we share the public space with. The sociology of consumption aims to uncover and analyze the various social, cultural, and economic factors that influence these everyday choices. Rather than viewing consumption as merely a result of personal

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preferences or economic necessities, this field considers it as a process intertwined with social structures, social groups, cultural norms, and collective identities.

In everyday life, how consumption habits are shaped by factors such as social class, cultural beliefs, and the rise of consumer capitalism has long been the subject of various studies. According to this research, consumption has become an important indicator of social status. Tastes and preferences can vary significantly among different social groups. Moreover, consumer behavior helps us understand societal changes, such as technological developments and globalization. As Veblen (2015) pointed out, consumption can be a symbol of prestige in many areas. Anthony Giddens (2012), in the introduction to his seminal book Sociology, connects the simple act of drinking a cup of coffee with many broader issues. For instance, while purchasing a cup of coffee may seem insignificant, it can reveal important patterns about one's socioeconomic status, cultural values, and even worldview. Whether one prefers a chain coffee shop, or an independent café can reflect lifestyle choices, status, and social group affiliation. As Erving Goffman (2009) explains in his work on impression management, this dynamic helps individuals control the impressions they give in everyday interactions.

Processes related to consumption habits also show how they guide the formation of individual identities. The rise of the internet and new media has made consumption a primary way for people to express themselves and align with particular groups. As a result, a 'consumer society' has emerged in which social identity is often expressed through purchasing habits and the types of goods one owns. Bauman (2023) similarly refers to this as a "society of consumers." The products that are bought, used, flaunted, and displayed through new media reflect the identities individuals wish to present. For instance, eco-friendly products may be chosen by those wanting to project a "green" identity, while luxury brands can symbolize wealth or privilege. Bourdieu's (2015) concept of "distinction" explains this well. Modes of consumption can reveal a person's class, status, and position within society.

Another issue to consider regarding consumption is inequality and access. Beyond individual preferences, consumption brings with it issues of inequality and accessibility. Globalization has made an unprecedented variety of products available, but this accessibility is not equally distributed across regions or income levels. Just as in the past, economic inequality continues to shape what people can and cannot purchase today. This creates various limitations and inequalities within consumer culture. As a result, necessary products may become inaccessible, and proper nutrition may not be achievable. Poor nutrition can lead to health problems, which in turn puts a significant burden on the healthcare system. As David Harvey (2019) describes in his theory of "Uneven Geographical Development," spatially unequal development—resulting from capitalist systems of production and consumption—can create serious disparities in access to consumption opportunities.

Various theories and concepts have been developed regarding consumption. Pierre Bourdieu's (1986) concept of "cultural capital," Thorstein Veblen's (2015) idea of "conspicuous consumption," Jean Baudrillard's (2021) notion of the "consumer society," and the rise of digital consumption via online platforms are all examples of influential concepts in this field. These concepts attempt to understand the social, economic, and political reasons behind consumption habits. Thus, the purchasing mechanism can be analyzed from many angles. These theories also shed light on how consumption shapes individuals' social environments and how they, in turn, are shaped by these environments. Through these concepts, it becomes evident that consumption reflects not only individual lifestyles but also collective social trends. As Herbert Marcuse (2016) emphasizes in his work One-Dimensional Man, modern consumer culture imposes artificial needs on individuals. These false needs replace real ones, leading to a lifestyle centered on consumption.

The Role of Consumption in Identity Formation

According to the sociology of consumption, consumer choices play a key role in the construction of personal identity. Bourdieu argues that consumption choices serve as a means of expressing cultural capital and maintaining social distinctions. For instance, an individual's preference for shopping at luxury stores or choosing high-end brands may indicate a desire to project a certain self-image and align with specific social groups. Giddens (2019) suggests that in modern societies, identity has become a project—and consumption is a key part of it. Individuals may purchase non-essential items in an effort to project or imitate a particular identity or to appear as though they belong to a certain group. This non-essential consumption can include clothing, food, various tools and gadgets, mobile phones, and cars. While such consumption often results in financial loss, non-essential food consumption may lead to health problems. Therefore, food choices should be made based solely on nutritional needs, independent of other concerns. While the primary goal of food selection should be healthy eating, this goal is

sometimes overshadowed by conspicuous consumption. Veblen's (2015) concept of "conspicuous consumption" explains how individuals use purchasing behavior to reflect their social status. Today, luxury brands, technology, and fashion are often used by consumers as a means to reflect success, taste, or environmental awareness.

Consumer Culture and the Influence of Media

In today's society, media and advertising play a significant role in shaping consumption habits. The widespread promotion of products on social media, television, and online platforms compels individuals to associate products with happiness, success, and identity. In doing so, media creates desires, sets trends, and establishes standards for an ideal lifestyle, shaping consumer culture. As Stuart Hall (1980) demonstrated in his "Encoding/Decoding" model, media texts encode specific ideologies and cultures, and audiences interpret these encoded messages in different ways depending on their social positioning. According to the ads constantly shown on social media, happiness is linked to the acquisition of various products, tools, and gadgets. Even minor differences between products can be exaggerated. People are directed toward dressing, housing, organizing their homes, and eating in ways that go beyond—or even contradict—their original lifestyles. As Guy Debord (2021) emphasized in The Society of the Spectacle, modern life has shifted from real experiences to the passive consumption of images and representations. For example, depictions of the "perfect" life on social media may lead consumers to try to replicate these standards through their purchases. The conditions, rules, and obligations imposed in the name of success and happiness may lead individuals to question their own lifestyles. This phenomenon is especially visible among younger generations. As they are the most active users of social media and the most susceptible to consumer culture, youth consumption habits are largely shaped and even reconstructed by social media advertisements and influencers.

The Social Psychology of Purchasing Behavior

The social psychology of consumption includes many components and factors, such as peer pressure, social norms, and collective identity. These social influences significantly affect consumer decisions. Purchasing behavior does not always arise out of necessity, a fact confirmed by numerous studies. Research shows that purchasing behavior often stems from emotional or social factors rather than need. As Leon Festinger's (1954) "Social Comparison Theory" states, people have an innate drive to compare themselves to others, which strongly influences consumption choices. For instance, individuals may buy certain products or adopt particular eating habits to fit into a social group, feel a sense of belonging, or avoid feelings of exclusion. In the effort to project a certain identity or to belong to a group, people may abandon traditional eating habits in favor of popular, but unhealthy ones. This highlights the importance of food literacy when it comes to dietary choices. Robert Cialdini's (2023) principle of "social proof" also shows that individuals can be influenced by the actions of those around them when making consumption decisions. Collective identities and social movements also play a substantial role in shaping consumption culture and habits. Some ideologies and movements promote consumption that supports environmental sustainability, while others prioritize human and animal rights. Therefore, religious beliefs and ideologies can also influence consumption habits and guide the process. For example, in some religions or ideologies, the purchase, use, or consumption of certain products is prohibited. In response, the capitalist system often tries to create markets for appropriate or substitute versions of these restricted goods.

Consumption and Class Distinctions

Consumption patterns vary among social classes. Economic factors such as income level, education, and access to resources significantly affect an individual's consumption habits. Bourdieu's (2015) concept of "taste" suggests that preferences for certain goods and habits are often class-based and reflect social hierarchies. Social classes have different tastes and expectations when it comes to goods and products. Low-income groups may prioritize functionality and necessity, while wealthier groups may focus on luxury goods or prioritize travel and leisure. As Veblen (2015) notes through his concept of "conspicuous consumption," luxury consumption often becomes a way to display social status and prestige. This distinction sometimes causes lower-income individuals to imitate the consumption habits of wealthier groups. For example, someone who owns an expensive item may not actually have a high income but may spend all their money on a phone to imitate upper-class individuals or to satisfy personal tastes—potentially neglecting essential needs. Another result of this distinction is that as lower-income groups imitate the consumption of higher-income groups, the latter change their tastes and habits in response. Consumption habits are closely tied to fashion. According to Simmel (1904), fashion exists because of social differentiation. As lower-income groups discover the tastes and habits of wealthier classes, the latter develop new consumption patterns to redraw and clarify distinctions—leading to marginal

lifestyles and dietary habits. In an effort to differentiate themselves from lower-income groups, some social groups may abandon traditional eating habits and adopt unhealthy diets.

Globalization and the Homogenization of Consumption

Globalization, as in many areas of life, has led to uniformity and sameness in the realm of consumption. People across different geographies often exhibit similar behaviors on many issues. This trend is also evident in consumption habits and consumer culture. Globalization has contributed to the spread of consumer culture, creating a state of homogeneity in consumption habits and patterns worldwide. George Ritzer's (1993) concept of "McDonaldization" reflects this phenomenon. As modern society becomes standardized based on principles of efficiency, calculability, predictability, and control, consumption habits also become increasingly homogeneous. This is observable on a global scale. Through global marketing, international brands have become symbols of modernity and prosperity, which has led to the convergence of tastes and preferences. Today, consumption is often associated with happiness and well-being, and marketing strategies drive consumers toward specific brands. This can clearly be seen in the popularity of global fast-food chains, luxury fashion brands, and digital platforms. Despite being unhealthy, global fast-food chains are preferred; people turn to certain fashion brands even when there is no real need; and all of these tendencies are shaped by worldwide digital platforms.

Environmental and Social Impacts of Consumption

While early studies on consumption mostly focused on the consumption process itself, the serious effects of consumption habits on both people and the environment have led to a shift in focus toward the environmental and social consequences of modern consumer behavior. Ulrich Beck's (2011) Risk Society can be used to explain this situation. Modern society is a risk society, where risks can arise from the relationship between production and consumption. For example, the rise of fast fashion has led to environmental degradation, waste, and unethical labor practices. Popular eating habits are causing health problems. Cheap consumer goods can pollute the environment, nature, and clean water sources. Similarly, uncontrolled consumption can negatively impact mental health. Excessive consumption driven by social pressure can result in financial stress, anxiety, and budget imbalances. Therefore, the psychological and sociological consequences of consumption are crucial to consider.

Conclusion: Rethinking Consumption in Society

The sociology of consumption reveals that our purchasing habits are deeply embedded in social structures, social media platforms, cultural norms, advertising and marketing strategies, and psychological motivations. Understanding these influences is essential for encouraging individuals to make more conscious choices and for raising awareness about the effects of uncontrolled and imbalanced consumer culture on society. Today, consumption habits are not separate from critical global issues such as climate change and economic inequality, they are interconnected processes. Conscious consumption habits must be promoted across society for individual well-being, happiness, and environmental sustainability.

Consumption is not merely the act of buying a product. The conditions under which that purchasing takes place and the consequences it entails must also be considered. Thus, every purchase and consumption process should occur within a framework of individual, social, and environmental responsibility. Our consumption preferences form part of a complex process that both shapes and is shaped by the social world around us. For this reason, it is vital to promote areas like information literacy, consumer literacy, digital literacy, and food literacy. Solving everyday problems and deficiencies depends heavily on the progress and efforts made in these fields.

2.6.4. A Content Analysis of Published Studies on the Relationship Between Food Literacy and Social Media

Assoc. Prof. Dr. Bahar URHAN[29]

Abstract

This study was designed to develop an understanding of the relationship between food literacy and social media. An unrestricted search was conducted in the Web of Science (WoS) database using the keywords "food literacy" and "social media." As a result, 22 studies were identified—1 book chapter and 21 articles. These studies were subjected to a descriptive content analysis based on their publication date, authors, source, country, research design, key findings, and conclusions. The analysis revealed that research focusing on the relationship between food

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literacy and social media began in 2019, indicating that it is a relatively new field. It was observed that the studies were mostly collaborative in nature, published predominantly in health-focused journals, and generally designed as qualitative research. The findings and results show that the use of social media in food literacy has the potential to yield positive outcomes. With the prominent findings from the descriptive analysis of the collected data, this study aims to contribute to the literature by offering a deeper understanding of the relationship between food literacy and social media.

Keywords: Food literacy, social media, digital health, nutrition literacy, descriptive content analysis

Introduction

Curiosity about the vital role of food in human life is an ongoing phenomenon as long as humans exist on Earth, making it a central focus of science. Humans, driven by the need to survive even under the harshest conditions, have always been producers, users, and consumers of food. Throughout history, and especially due to recurring food scarcity, humans have utilized modern technologies to avoid becoming slaves to hunger. Technological advancements have diversified materials—and therefore foods—increased food production and introduced a range of imbalances such as stockpiling food, storing it for hard times, overproducing, and eating more than the body can process. Thus, the historically problematic relationship between food and humans has become an uncontrollable issue in the wake of modern technologies. The fact that people are dying of hunger in one part of the world while others are dying from obesity in another is the most prominent evidence of this crisis. It is estimated that globally, 11 million deaths annually are linked to dietary risk factors (GBD, 2019).

The correct use of resources is essential for maintaining balance in nature. Proper use of food resources, their healthy production and consumption, raising awareness about these issues, and developing a strategic relationship with food for personal benefit are all heavily emphasized topics in modern times. In this context, steps toward awareness must evolve from ignorance to literacy—hence, food literacy has recently become a frequently encountered concept in the literature.

The various definitions of food literacy illustrate the degree of skill required to address the topic. Vidgen (2014) defines food literacy as "the ability to develop a positive relationship with food and apply individual food skills and behaviors within a complex food system." Rawl and colleagues (2008) define it as "the degree to which individuals have the capacity to obtain, interpret, and understand basic food and nutrition information necessary to make appropriate health decisions." Cullen et al. emphasize the ability to "build a positive relationship with food within a complex system and make sustainable and informed food choices."

These definitions, which show that establishing food literacy requires behavioral and attitudinal changes, underline the importance of developing an educational approach to food. Indeed, schools are considered the ideal setting for food education (FAO, 2019). The necessity of beginning food education in childhood highlights the central role of schools in this matter. Studies have shown that food education provided from primary school through adolescence contributes to the development of sustainable behaviors, cooking skills, and long-term health practices into adulthood (Laska et al., 2012; Lavelle et al., 2016). However, according to a 2018 report by Ofsted, there is currently no comprehensive global curriculum policy on food education. The recently emerging concept of food literacy is expected to meet this need and help address the lack of structured food education.

Research Method and Purpose

In an unrestricted general search conducted on the WoS (Web of Science) database using the keywords "food literacy" and "social media", a total of 22 publications published between 2019 and 2024 were found. These publications are analyzed using the descriptive content analysis method based on their content, type, field, author information, keywords, findings, and recommendations.

The reason for choosing the descriptive content analysis method in this study is the small number of articles and the desire to conduct a detailed examination. Descriptive content analysis allows for in-depth examination of previous studies and interpretation of findings, thereby helping to identify trends in a specific field (Çalık & Sözbilir, 2014). This method gives the researcher the advantage of deeply analyzing the selected data and observing prominent themes within the context of field knowledge. Another advantage of this method is that by thoroughly filtering the theoretical framework, research models, data, and findings of the studies, it provides the opportunity to offer recommendations regarding general trends for future research (Cohen, Manion, & Morrison, 2007).

Research

Research Questions

Within the scope of this study, the following research questions regarding the relationship between food literacy and social media will be addressed:

1. What is the number of studies published by year?
2. How many authors contributed to each study?
3. Where were the studies published?
4. What are the keywords used in the studies?
5. What research methods were selected in the studies?
6. What data collection and analysis methods were used in the studies?
7. What are the findings of the studies?

Findings

To reveal the relationship between food literacy and social media, the data obtained from the keyword search conducted in the WoS database without any restrictions were analyzed to identify the trends related to the topic.

Table 1 – Number of Studies Published by Year

Year	Number
2019	1
2020	1
2021	2
2022	5
2023	5
2024	7

When the distribution of the publications obtained from the search by year is examined, it is evident that the field is relatively new, as the first study was published in 2019. However, when looking at the number of publications per year, there is a noticeable increase starting from 2022, and by 2024, approximately one-third of the total publications were released within that year. This indicates a growing scientific interest in the relationship between food literacy and social media.

Table 2 – Distribution by Number of Authors

Author	Publication
Single Author	0
Multiple Authors	22

When examining the number of authors in the studies, it is seen that there are no single-author studies. This suggests that researching the topic through collaboration appears to be more productive.

Table 3 - Distribution of the Publications According to the Journals

Journal	Number
Advances in Food and Nutrition Research	1
Appetite	1
Applied Physiology Nutrition and Metabolism	1
BMC Nursing	1
Communıcations-European Journal of Communication Research	1
European Journal of Marketing	1
Food Policy	1
Frontiers in Sustainable Food Systems	1
Health & Social Care in the Community	2
Health Education	1
JMIR Pedıatrics and Parenting	2
JMIR Research Protocols	1
Journal of the American Nutrition Association	1
Nutrients	1
Nutrition Research and Practice	1
PLOS ONE	1
Public Health Nutrition	3
Revista Espanola de Nutricion Humana Y Dietetica	1

When the distribution of the journals in which the studies were published is examined, it is noteworthy that only one journal is in the field of communication.

This indicates that the relationship between food literacy and social media has not been sufficiently studied within the field of communication. The fact that the journals are generally related to health and nutrition suggests that the topic is considered more significant within the field of health sciences.

Table 4 – Frequency of Use of Repeated Keywords

Keyword	Frequency
Food literacy	7
Social media	6
Nutrition	6
Education	5
Diet	4
Health	4
Adolescents	4
Sustainable	3
Digital health	3
Intervention	3
Nutrition knowledge	3
Nutrition literacy	3
Mediterranean diet	3
eHealth	3
Food marketing	2
Food choice	2
Qualitative	2
Peer	2
School health promotion	2
Young adults	2
Lifestyle	2
Consumption	2
Meal kits	2
Cooking	2
Hypertension	2
Diasporas	2
Salt	2
Nutrition intervention	2
Digital interventions	2
Patient-centered	2
Resilience	2

When examining the distribution of keywords used in the publications, it is seen that the most frequently used keywords are food literacy, social media, nutrition, and education. Based on this data, it can be concluded that more studies focus on the use of social media for educational purposes in the context of food literacy.

Table 5- Distribution According to the Type of Research

Type	Number
Quantitative	5
Qualitative	17

When the types of studies conducted are analyzed, it is seen that only 5 studies were designed using quantitative research methods, 2 of which were experimental, while 17 studies were designed as qualitative research. Since the selection of research methods varies depending on the content of the subject, looking at the predominance of methods in the data set, it can be considered that the relatively more effective way to explore the relationship between food literacy and social media is through studies designed as qualitative research.

Table 6 – Data Collection and Analysis Methods of Qualitative Studies

Short name of the publication	Authors	Data Collection Method
Supporting consumers' informed food choices	Gert W. Meijera,b,*, Klaus G. Grunertc,d, and Liisa L€ahteenm€aki	Literature review
Meal kits in the family setting	Kylie Fraser, Penny Love, Karen J. Campbell, Kylie Ball, Rachelle S. Opie	Semi-structured, in-depth interview
Exploring contexts for using digital food retail services in Canada	Melissa A Fernandez, Jessica Dugan, Kim D Raine	Semi-structured, in-depth interview

"I use salt. However, I also use soy sauce, oyster sauce, sometimes chili sauce and..."	Alex Chan, Leigh Kinsman, Sally Wai-chi Chan	Semi-structured, in-depth interview
Emerging adults' food media experiences: Preferences, opportunities, and barriers for food literacy promotion (2023)	Lauranna Teunissen, Isabelle Cuykx, Paulien Decorte, Heidi Vandebosch, Christophe Matthys, Sara Pabian, Kathleen Van Royen, Charlotte De Backer	Focus group interview
Colorful candy, teen vibes and cool memes	Gaston Ares and Florencia Alcaire, Vanessa Gugliucci, Leandro Machín, Carolina de Leon, Virginia Natero, Tobias Otterbring	Cross-sectional content analysis
Social food	Nadia Steilsa, Zakia Obaidalaheb	Netnography
Costly, confusing, polarizing, and suspect	Katherine F. Eckert, Sabrina Douglas, Flora Zhang, Paula Brauer, Alison M. Duncan, Jess Haines	Thematic (template) analysis
Assessing the effectiveness of a 4-week online intervention on food literacy and fruit and vegetable consumption in Australian adults	Ashley H., Yasser ElGhattis, Jessica R. Biesiekierski, George Moschonis	Single group pretest-posttest experiment
What does healthy eating mean?	Gail Boddy, Alison Booth and Anthony Worsley	Semi-structured, in-depth interview
Social Media Interventions for Nutrition Education Among Adolescents	Yalinie Kulandaivelu, Jill Hamilton, Ananya Banerjee, Anatoliy Gruzd, Barkha Patel, Jennifer Stinson	Scoping review
Digital Interventions to Promote Healthy Eating in Children	Rachel Prowse, Sarah Carsley	Umbrella review of systematic reviews of studies
Effects of a Salutogenic Healthy Eating Program in Type 2 Diabetes (the SALUD Study)	Kristel C M M Polhuis; Lenneke Vaandrager, Maria A Koelen, Johanna M Geleijnse, Sabita S Soedamah-Muthu	Semi-blind randomized controlled trial
Nutrition-Related Information on Instagram	E. Denniss, R. Lindberg, S. McNaughton	Exploratory study
Exploring young Australians' understanding of sustainable and healthy diets	Rimante Ronto, Golsa Saberi, Julia Carins, Keren Papier and Elizabeth Fox	Semi-structured, in-depth interview
Determinants of dietary and physical activity behaviours among women of reproductive age in urban Uganda	Peter Yiga, Patrick Ogwok, Julian Achieng, Mary Devota Auma, Jan Seghers, Christophe Matthys	Focus group interview
The effect of eight-week nutrition education on nutrition knowledge, nutrition literacy, and Mediterranean diet in Turkish adolescents	Gökçe Ünal, Aslı Uçar	Single group pretest-posttest experiment

When the methods used in the qualitative studies are taken into account, it is observed that 5 studies were designed using semi-structured in-depth interviews, 2 studies used focus group interviews, and 2 studies followed a pretest-posttest experimental design. Other studies employed various methods such as literature review, cross-sectional content analysis, netnography, thematic analysis, scoping review, systematic umbrella analysis, single-blind randomized controlled trial, and exploratory study. Based on this, it can be concluded that the semi-structured in-depth interview method is predominantly preferred for investigating the topic.

Table 7 - Data Collection Methods of Quantitative Research, Sample numbers, Analysis Methods

Short name of the Publication	Authors	Data Collection Method	Sample Number
How gender, education and nutrition knowledge contribute to food insecurity among adults in Australia	Danielle Gallegos, Rebecca McKechnie, Ryan McAndrew Rebekah Russell-Bennett, Geoff Smith	Survey	1010
The Relationship of Food Literacy and Sustainable Consumption Behaviors with Anthropometric Measurements during the Covid-19 Pandemic Period	Cansu Çelik, Perim Fatma Türker, Hilal Çalışkan	Survey	200
Food-related media use and eating behavior in different food-related lifestyle groups of Korean adolescents in metropolitan areas	SooBin Lee, Seoyoung Choi, Se Eun Ahn, Yoon Jung Park, Ji-Yun Hwang, Gaeun Yeo, Jieun Oh	Survey	392
Nutrition knowledge and health vulnerability of mothers of pre-school children in north-central, Nigeria	Bosede Alice Omachi, Annette van Onselen, Unathi Kolanisi	Semi-structured in-depth interview	450
Food for teens: how social media is associated with adolescent eating outcomes	Yara Qutteina, Lotte Hallez, Maxime Raedschelders, Charlotte De Backer, Tim Smits	Survey	1002

When the methods used in the qualitative studies are examined, it is observed that 5 studies characterized their chosen method as quantitative. Four of these studies used the survey method, while one study, although conducted using semi-structured interviews with 450 participants, concluded the research with quantitative data and described it as a quantitative study.

Table 8 - Main Results of the Research

Short name of the Publication	Results
Supporting consumers' informed food choices: Sources, channels, and use of information (2023)	Health and sustainability information about food products comes from various sources with differing interests, making it difficult for consumers to know which sources to use and which ones to trust.
Meal kits in the family setting	Women reported that meal kits reduce their mental load by lessening the burden of food-related decision-making, increase family involvement in meal preparation, and provide opportunities for food literacy. Meal kits offer nutritionally dense meals and portion sizes aligned with national dietary guidelines by reducing the frequency of eating out.
Exploring contexts for using digital food retail services in Canada: A qualitative study (2024)	Regardless of age, gender, or lifestyle, the contexts in which digital food retail services are used are similar. These services facilitate food purchasing and preparation; however, this convenience may have a detrimental effect on food literacy.
"I use salt. However, I also use soy sauce, oyster sauce, sometimes chili sauce and....": interviews with Australians of Chinese ancestry regarding reducing salt consumption for hypertension prevention (2023)	Four facilitators for reducing salt consumption: 1)Individual perceptions of health benefits 2)Salt alternatives 3)Digital information 4)Awareness Barriers: 1)Subtle negative physical changes 2)Inadequate health education 3)Hidden salt 4)Low food literacy 5)Pricing 6)Busy lifestyle 7)Low sensitivity 8)Personal taste preferences and cooking habits
Emerging adults' food media experiences	Food media messages attract the attention of emerging adults by presenting content in an entertaining, engaging, and appealing way and by highlighting popular food personalities. Food media messages both enhance and undermine food literacy.
Colorful candy, teen vibes and cool memes	Graphic design and adolescent language are the most common indicators of marketing targeting teenagers. In posts aimed at teenagers, snacks and discretionary foods are mostly promoted. Differences have been observed in the content of posts identified as targeting or not targeting teenagers.
Social food	Food literacy can be constructed together in a social environment, either positively or negatively.
Costly, confusing, polarizing, and suspect: public perceptions of plant- based eating from a thematic analysis of social media comments (2024)	Themes: 1) Food ethics 2) Affordability and accessibility of food 3) Distrust towards food system stakeholders 4) Beliefs related to eating behavior, health, and the environment 5) Sensory aspects of plant-based proteins
Assessing the effectiveness of a 4-week online intervention on food literacy and fruit and vegetable consumption in Australian adults	Social media has the potential to increase fruits and vegetables consumption in adolescents through food literacy
How gender, education and nutrition knowledge contribute to food insecurity among adults in Australia	There are differences between men and women in terms of the determinants of household food insecurity. Education is significantly associated with household food insecurity among women.
What does healthy eating mean?	Teaching healthy eating helps improve the health and well-being of adolescents and their families. Teachers' knowledge and views about healthy eating are related to their interests, life experiences, education, and employment backgrounds.
Social Media Interventions for Nutrition Education Among Adolescents: Scoping Review (2023)	Adapting interventions, providing practical content, offering meaningful peer support, and involving families and communities have facilitated successful interventions.
Digital Interventions to Promote Healthy Eating in Children	There is a need for common definitions of types of digital interventions evaluated with validated measures to support policy and program decisions aimed at improving health in children.
Effects of a Salutogenic Healthy Eating Program in Type 2 Diabetes (the SALUD Study): Protocol for a Randomized Controlled Trial (2023)	The SALUD program can serve as a concrete, web-based tool. Combining quantitative and qualitative measures allows for a comprehensive evaluation of effects. This information can be used to further optimize T2DM interventions.
The Relationship of Food Literacy and Sustainable Consumption Behaviors with Anthropometric Measurements during the Covid-19 Pandemic Period: A Sample from Türkiye (2024)	87.2% of women and 40% of men have previously heard of the concept of sustainable nutrition. The total score average for Sustainable Consumption Behavior is statistically significantly higher in women compared to men. There is a statistically significant relationship between gender and the Self-Perceived Food Literacy score averages.
Nutrition-related information on Instagram: A content analysis of posts by popular Australian accounts (2023)	There are five comprehensive themes in Instagram content: 1) recipes and meal ideas; 2) food, nutrients, supplements, and related health outcomes; 3) the role of nutrition in achieving physical appearance and body weight goals; 4) food literacy; and 5) cooking at home and exercising.
Food-related media use and eating behavior in different food-related lifestyle groups of Korean adolescents in metropolitan areas (2024)	Implementing media-mediated nutrition education programs can promote healthy eating among adolescents with a high interest in nutrition habits. For adolescents with low interest in nutrition habits, implementing an education program focused on increasing food literacy may be beneficial in promoting healthy eating.
Nutrition knowledge and health vulnerability of mothers of pre-school children in north-central, Nigeria (2024)	Dietary diversity among mothers is associated with their socio-economic status and body mass index, which are strong determinants of meal quality and health outcomes in Nigeria and other food-insecure developing countries.
Food for teens: how social media is associated with adolescent eating outcomes	Food literacy mediates the positive relationship between basic food social media exposure and basic food intake. Health professionals can use social media to promote basic foods among adolescents.
Exploring young Australians' understanding of sustainable and healthy diets	Young adults are motivated to adopt more sustainable eating practices, but individual and environmental factors prevent them from doing so.

Determinants of dietary and physical activity behaviours among women of reproductive age in urban Uganda	Current cultural beliefs encourage dietary and physical activity behaviors different from healthy eating recommendations.
The effect of eight-week nutrition education on nutrition knowledge, nutrition literacy, and Mediterranean diet in Turkish adolescents (2023)	Having the necessary knowledge and experience helps adolescents develop healthy eating habits and prevent chronic diseases such as obesity. To improve adolescents' eating behaviors, internet and social media as well as school/home food environments should also be considered.

When looking at the main findings of the research, it is seen that information about food consumption can come from different sources through social media, which creates distrust and highlights the necessity of food literacy. Depending on the shared content, it is thought that social media users can be both positively and negatively influenced. It can be said that presenting practical information through colorful content on social media positively contributes to food literacy. Among the mentioned content, women—who have a higher role in providing food in families—and adolescents—who are more vulnerable to incorrect food consumption and related health problems—are relatively more affected. The findings emphasize the necessity for health professionals to utilize social media to promote food literacy and suggest that young adults may respond relatively positively to health messages based on food consumption delivered through social media. The positive aspects of promoting food literacy via social media in terms of public health is also highlighted as a notable finding.

Conclusion and Discussion

Studies aiming to reveal the relationship between food literacy and social media began to be conducted in 2019, and these studies have gained increasing momentum over the years. While the number of studies in 2019 was 1, this number rose to 7 in 2024, indicating growing interest in the subject. Regarding the number of authors, studies had between 2 and 8 authors, and no single-author publications were found. This suggests that research on the topic tends to require collaboration. Looking at the journals where these studies were published, only one journal was in the field of communication, and one publication appeared in a marketing-related journal. The other 20 publications were in journals related to food, nutrition, and health, which is a noteworthy finding. The fact that the largest number of publications appeared in a journal focusing on public health and nutrition gives the impression that the relationship between food literacy and social media is closely related to public health.

Examining the keywords of the studies, the word "education" stands out as the most frequently used keyword, which suggests an emphasis on the opportunity for food literacy education through social media. When looking at the research methods chosen in the studies, qualitative research designs were predominantly used. This implies that qualitative methods may be the most effective approach to investigate this topic. It is also a significant finding that the semi-structured in-depth interview method, a qualitative research technique, was used more frequently, which can guide future studies regarding method selection in related research.

When the main findings and results of the research are taken into consideration, it is possible to foresee that the relationship between food literacy and social media will become increasingly important. Indeed, there are frequent findings highlighting that women and young adults—who are relatively important to be aware of food literacy—can be educated through social media. Studies containing useful recommendations regarding the design of social media content and suggestions that could guide the practices of health professionals stand out. At the same time, studies also draw attention to the spread of misleading information and uninformed food consumption via social media, showing a consensus that social media has both positive and negative effects on food literacy.

The existing research aimed at revealing the relationship between food literacy and social media has tried to outline the dimensions and key points of this relationship through relevant studies. The results indicate that social media offers a useful platform for educating the public about food literacy. It is possible to benefit from social media content to ensure that food literacy is considered important, especially by young adults and women, who are mostly relied upon by families in food preparation. It is also worth emphasizing again that it is crucial for consumers to critically evaluate the content they encounter on social media and become conscious about food consumption for the sake of overall public health. Future studies are recommended to include not only women and adolescents but also different consumer groups.

3.1. LABELING IN FOOD

Tijen COŞKUN[30]

The Ministry of Agriculture and Forestry, through Law No. 5996 on Veterinary Services, Plant Health, Food, and Feed, aims to ensure and protect food and feed safety, public health, plant and animal health, as well as animal breeding and welfare, while also taking into account consumer interests and environmental protection. To this end, official controls are carried out in food businesses on food labeling to ensure compliance with the labeling sections of the Turkish Food Codex Regulation on Food Labeling and Consumer Information, which is part of the food legislation, and related product communiqués. These controls also cover advertising and promotional activities conducted through remote communication tools such as national and local television and radio broadcasts and social media, to ensure that consumers are accurately informed about food and are not misled.
Label: Any sign, mark, stamp, image, or other descriptive element written, printed, stenciled, marked, embossed, cold-pressed, affixed, or attached on the packaging or container of a food product.

Labeling: Any text, information, trademark, pictorial element, or sign related to food that appears on any packaging, document, notice, or label accompanying or referring to a food product. The aim is to ensure that the consumer knows what they are purchasing.

Food businesses are obligated to provide food-related information to the end consumer, including mandatory information about the food, through a label, accompanying materials, or other tools, including oral communication using modern technology.

While all mandatory labeling information must be present on prepackaged food products, some information is required on foods that are prepackaged for direct sale. Furthermore, except for foods prepackaged for direct sale, all mandatory information must accompany the food (including bulk products) during transportation to the sales location.

The **"Mandatory Information"** that must be present on the label is explained

30 Food Engineer, Head of Food Businesses and Codex Department

below:

a. **Name of the food:** This may come from product communiqués, such as "yogurt" or "sucuk," or it can be a commonly used or traditional name like "tarhana." If such names are unavailable, a descriptive name of the product must be used.
b. **Ingredients:** All ingredients must be listed in descending order by weight, starting with the ingredient present in the largest amount.
c. **Declaration of substances or products causing allergies or intolerances:** Ingredients such as gluten (which affects individuals with celiac disease), nuts, peanuts, shellfish, celery, etc., that may cause allergies or intolerances must be clearly indicated and emphasized.
d. **Indication of quantity of certain ingredients or categories of ingredients:** If an ingredient is highlighted in the product name or visually represented on the label (e.g., "Pistachio Chocolate"), its percentage must be stated.
e. **Net quantity of the food:** This must be indicated using volume or weight units. Volume units should be used for liquids, and weight units for solids.
f. **Best before or use-by date:**
    1. Use-By Date (UBD): Required for foods that are microbiologically perishable and may pose a risk to human health shortly after.
    2. Best Before Date (BBD): For foods that do not pose health risks after the indicated date but may lose quality.
    3. Date of Freezing: Must be stated for frozen products.
g. **Special storage and/or usage conditions:** Information on temperature and environment conditions that must be followed during storage must appear next to or near the date (UBD/BBD). For example, "Keep out of direct sunlight" for olive oil and honey, "Keep refrigerated" for cheese and yogurt, or "Store below +14°C" for margarine.
h. **Name or business name and address of the food business operator:** The label must include the name and address of the operator (brand owner, producer, importer, distributor, marketer, etc.).
i. **Registration number or identification mark of the establishment:** The Ministry assigns registration and approval numbers to food businesses according to their area of activity. In our province, registration numbers are given as "TR-34-K-number" and approval numbers in an oval shape as "TR-34-number."
j. **Country of origin:** The country of origin of the product must be indicated. If the main ingredient or the ingredient present in the highest amount has a different origin, this must also be specified. Imported products must include the country of manufacture.
k. **Instructions for use:** If the food cannot be properly consumed without them, preparation or usage instructions must be provided. For example, directions on how to prepare instant soup.
l. **Actual alcoholic strength by volume for beverages containing more than 1.2% alcohol by volume:** If the product (excluding alcohol-containing products) exceeds this alcohol content, the exact volume percentage must be indicated.
m. **Nutrition declaration:** For processed and packaged products composed of more than one ingredient, the nutritional values per 100g or 100ml must include "Energy," "Fat," "Carbohydrate," and may also include "Fiber," "Protein," "Salt," "Minerals," and "Vitamins."

Presentation of mandatory information:

- For prepackaged foods, the information must be either directly on the packaging or on a label affixed in a way that it cannot be separated from the packaging.
- The text on the label must be in font size no smaller than 1.2 mm.
- For unpackaged products sold in bulk or foods prepared for direct sale, it is sufficient for the following to be visible to the consumer: name of the food, allergen information, name and address of the food business operator, and country of origin.
- For products with a maximum surface area of less than 80 cm^2, the following must be included: product name, weight, use-by date, and alcohol content.

3.2. READING FOOD LABELS CORRECTLY

1 What to Look for on Food Labels?

Nutrition Facts Table
Check the calories, fat, carbohydrates, protein, sugar, fiber, and sodium amounts. Nutritional values on the label are usually for a single serving. Don't forget to multiply the values after you've consumed the entire package!

Table of Contents
Ingredients are listed in order of quantity. The ingredient listed first is the most abundant ingredient in the product. Pay particular attention to the first three ingredients.

E100-E199	Colorants
E200-E299	Preservatives
E300-E399	Antioxidants, acidity regulators
E400-E499	Stabilizer, emulsifier, thickener
E500-E599	Acidity regulator, anti-caking agent
E600-E699	Flavor enhancers
E900-E999	Sweeteners and brighteners
E1000-E1599	Other food additives

Additives and E-Codes
Identify unnatural additives and avoid them if possible. (Watch out for additives, preservatives, and artificial sweeteners.)

Expiration Date
Check the freshness and reliability of the product.

Portion Info
Check which serving size the nutritional values are for.

Energy and Nutrients	For 100 ml**	For 1 cup**	RI for 1 glass*
Protein (g)	3.7	3.7	3.7

* The Reference Intake (RI) value for an average adult is (8200 kJ / 2000 kcal)

** Values of the product prepared according to the recipe (14 g of drink powder + 180 ml of water)

2 Passwords on Labels: What Do They Mean?

Organic
Manufactured in accordance with specific standards.

Gluten Free
Does not contain gluten. Suitable for celiac patients.

Natural
100% NATURAL

It does not contain artificial additives. However, this does not always mean it is healthy.

Light, Reduced Fat
It means the fat or calories have been reduced by 25%.

3 Tips for Healthy Choices

Sugar
Keep your daily sugar intake below 25 grams.

Trans Fat
Choose products that do not contain trans fat.

Hidden Sugars
Sugar can be disguised as glucose syrup, corn syrup, or sucrose.

Salt
Choose products with low sodium content.
**Maximum 2,300 mg per day*

Fiber
Choose products with high fiber content.
**At least 25-30 grams per day.*

4 Common Mistakes

Thinking that "Light" or "Diet" products are healthy.

Not reading the ingredients list.

Ignoring portion size.

5 Conclusion: Be a Conscious Consumer

Reading food labels is the first step in making healthy choices. **Remember! It's your right to know what you're eating.**

3.3. FOOD FRAUD AND FOOD LABELING FRAUD

Tijen COŞKUN[31]

When it comes to healthy food, consumers should ask the following questions:

- Are the label details on the product I'm consuming accurate?
- Does the product match what's stated on the label?
- Is the food I bought as "organic" truly organic?
- Have any additives been used?
- Is the product of lower quality than claimed?
- Does it pose a health risk?

The most common type of fraud in food products is imitation (adulteration). In literature, adulteration refers to the deliberate or accidental alteration of a product's natural composition using another substance. In the food sector, there are two types of adulteration. Benign Adulteration: For producing foods that are safer, have a longer shelf life, or have functional benefits — and which do not pose a health risk. Deceptive Adulteration: Done to mix lower-quality ingredients into high-quality products to sell at the same price. This type undermines product quality, causes unfair competition, and may seriously threaten human health.

Notable Examples of Food Fraud

Use of Artificial Dyes in Chili Powder: In some Asian countries, chemical-based dyes (not related to food at all) have been used to make chili flakes appear more vibrant red. These dyes, known as Sudan I, II, III, IV, Para Red, and Sudan Red G, are soluble only in oil and organic solvents, not in water. These dyes are toxic and their detection in products like red pepper or curry powder must be certified using accredited national and international testing methods in Türkiye, the EU, and other developed nations.

Food Colorants: Most food colorants are legal and allowed in limited quantities. They are typically used in drinks and candies to give blue, green, yellow, or orange hues. However, using them excessively can pose health risks. Since most are synthetic (lab-produced), they are classified as food additives and carry potential health hazards.

Vegetable Oil Adulteration: High-quality oils like olive, hazelnut, or rapeseed oil are often diluted with cheaper oils like cottonseed or mineral oils and sold as pure, premium oils.

Other Examples of Imitation and Adulteration: Spoiled or expired eggs used in bakery products. Lead tetraoxide found in spices. Synthetic apple juice concentrate. Use of synthetic hormones in meat products. GMO rice mixed with regular rice. Artificial sweeteners used in honey. Use of other meats (e.g., pork, horse, donkey) in meat products. Adulteration in fruit juices and dairy products (Science and Technology – Erdal Ertaş, Bahar Topal, August 2009, pp. 38–41)

Common Food Frauds: Selling fruit syrup as grape molasses. Adding glucose syrup, inulin, extracts, corn syrup to grape molasses.Vegetable oils flavored and processed to resemble butter. Mixing sunflower, soybean, cottonseed, hazelnut oils into extra virgin olive oil. Adding poultry (chicken, turkey, duck, etc.) or offal (gizzard, heart) to meat products like kebab and meatballs. Mixing margarine or starch into cheeses. Adding food dyes to red pepper and tomato pastes. Mixing margarine blends and selling them as "natural butter." Using textile or synthetic dyes to darken black olives. Mixing iron powder into black pepper, sawdust into isot pepper, and starch into curry. Using carcinogenic dyes to enhance pepper color or adding salt to increase weight. All of the above are examples of consumer deception through label fraud.

Examples of Label Fraud:

1. Incomplete Declarations (e.g., missing allergen info)
2. Banana Milk: Contains as little as 0.1% banana puree or powder; often includes colorants, thickeners like carrageenan, and high amounts of sugar
3. Instant Chicken Soup: Contains only 1.8% chicken meat, but more flavor enhancers than actual chicken
4. Instant Salep: The amount of actual salep powder ranges between 0.01% and 2% depending on the brand
5. Smoked Turkey: Contains turkey breast, potato starch, spice blends, thickeners, preservatives, stabilizers, antioxidants, and unknown flavorings

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6. Fruit Juices: Include flavorings and acid regulators
7. Chocolate: May contain hazelnut powder instead of cocoa, lots of sugar, invert sugar syrup, and butter flavorings
8. Cake: Common ingredients include sugars, cocoa butter, palm/sunflower/canola oils, wheat flour, eggs, glucose-fructose syrup, chocolate, cocoa, humectants (glycerol), salt, emulsifiers, modified starch, raising agents, preservatives (sorbic acid), flavorings (vanillin), acidity regulators (citric acid), thickeners (xanthan gum, pectin), whey powder, milk powder, lactose monohydrate, emulsifiers (sunflower lecithin, polyglycerol polyricinoleate), chocolate cream fillings with more additives
9. Fruit Wafers: Contain only 0.5% to 2% of the named fruit powder, plus sugar, palm oil, flavorings, and colorants

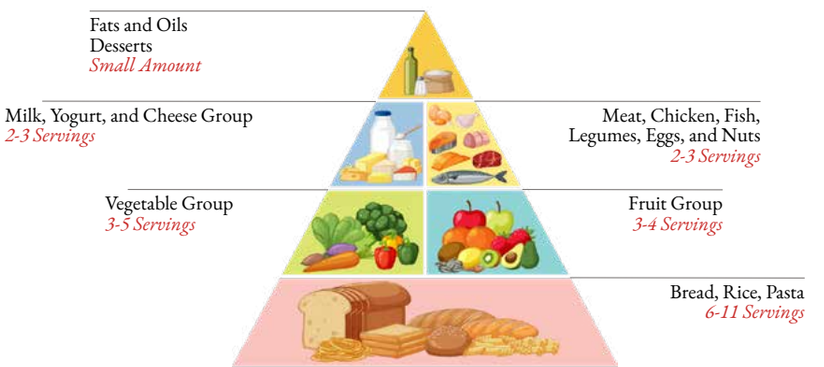
3.4. FOOD PYRAMIDS

Assoc. Prof. Dr. Arzu Altunkaya Dinçay[32]

The continuity of a healthy lifestyle is directly related to genetic factors, environmental conditions, and functional nutrition (Republic of Türkiye Ministry of Health, 2021). Nutrition is defined as the conscious and regular consumption of foods to support individuals' growth, development, protection, and improvement of health (FAO, 2019). Adequate and balanced nutrition is critically important for maintaining a healthy life, ensuring economic and social development, and achieving societal success (WHO, 2020).

In this context, food pyramids serve as practical guides to help individuals regulate their daily food intake. These pyramids present a structure that summarizes the daily recommended amounts from each food group and explains how to balance these amounts (Harvard T.H. Chan School of Public Health, 2022) (Figure 1).
A healthy diet is based on consuming sufficient quantities from various food groups and maintaining a balance in calorie intake. Since daily energy needs vary from person to person, this balance can be achieved by following the recommended servings from each food group in the pyramid (USDA, 2021).

Figure 1 - USDA food guide pyramid (Anonymous, 1996)



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Food pyramids aim to promote a healthy diet that helps prevent chronic diseases by presenting individuals with the nutrients and appropriate portion sizes they need to maintain a healthy life (WHO, 2020). The pyramid consists of five main food groups: grains and grain products; meat, eggs, and legumes; milk and dairy products; vegetables and fruits; and fats and sugars (FAO, 2019). This structure aims to ensure balanced nutrient intake through the categorization of foods.

The base of the pyramid is wide and includes foods that should be consumed in larger quantities, while the top of the pyramid represents foods that should be eaten sparingly (Ministry of Health, Türkiye, 2021). Food pyramids can be adapted to regional dietary habits and cultural differences. In general, foods are divided into three main categories: energy providers, body-building nutrients, and health-protecting elements (USDA, 2021). This organization allows the pyramid to be designed based on scientific data.

3.4.1. Grains and Grain Products

Grains form the bottom section of the food pyramid and are one of the most important components of carbohydrates, the body's primary energy source. Since the brain obtains energy solely from glucose, more than half of the daily energy intake in a healthy diet should come from carbohydrates (WHO, 2020).

The grain group not only provides energy but also helps regulate fluid and electrolyte balance in the body, reduces the need for protein by preventing its use for energy, and supports the intake of many essential vitamins and minerals (FAO, 2019). Grains are rich in nutrients such as vitamins B1, B2, B6, and E, as well as minerals like iron, zinc, and selenium. They are also significant sources of dietary fiber and protein. This group includes wheat, barley, rice, corn, and oats, along with products made from them such as bulgur, bread, noodles, semolina, couscous, and tarhana (USDA, 2021).

It is very important that carbohydrates come from healthy sources. Therefore, unprocessed whole grains and whole-grain products should be preferred. Whole grain foods contain much more dietary fiber than refined carbohydrates and help stabilize energy levels because they digest more slowly (Harvard T.H. Chan School of Public Health, 2022). These products also contain many nutritious components, especially B vitamins. Whole grain and bran products contain complex carbohydrates that help regulate blood sugar levels and contain neither fat nor cholesterol (Ministry of Health, Türkiye, 2021).

Dietary fiber contributes to the healthy functioning of the digestive system and creates a long-lasting feeling of fullness. It is recommended to consume at least 30 grams of dietary fiber per day, which can be easily obtained from foods such as whole grain bread, oats, bulgur, and brown rice (WHO, 2020).

However, processed foods like white bread and white rice are poor in fiber and are quickly converted into simple sugars, leading to rapid spikes and drops in blood sugar levels (USDA, 2021). These sudden fluctuations in blood sugar can cause hunger to return quickly and may lead to insulin resistance and metabolic disorders in the long term. Constantly elevated insulin levels can negatively affect cardiovascular health (Harvard T.H. Chan School of Public Health, 2022). For this reason, choosing whole grain and bran products as part of a healthy diet has a positive effect on digestive health and blood sugar control (Ministry of Health, Türkiye, 2021).

3.4.2. Fruits and Vegetables

Fruits and vegetables form the second level of the food pyramid and hold a very important place in a healthy lifestyle. Fruits are the mature seeds and parts close to the seeds of plants, while vegetables include the flowers, leaves, and stems (Micha et al., 2017).

Fruits and vegetables are rich in carbohydrates, proteins, fats, minerals, vitamins, and water. Vegetables generally contain 90–95% water, while the water content in fruits varies between 80–85%. Both groups are rich in carbohydrates and serve as essential sources of vitamins and minerals, playing a vital role in meeting the body's nutritional needs (FAO, 2020).

Regular consumption of fruits and vegetables strengthens the immune system and reduces the risk of various chronic diseases. The high dietary fiber and functional compounds found in these foods support digestive health, prevent digestive issues like constipation, and help regulate blood sugar and cholesterol levels (Slavin, 2013). Additionally, these foods help reduce oxidative stress, slow aging, and improve skin health (Boeing et al., 2012).

Fruits and vegetables generally provide limited energy and protein, but they are

crucial for supplying vitamin C and certain minerals. Orange and yellow fruits and vegetables are rich in carotene, a precursor of vitamin A, while citrus fruits and dark green leafy vegetables are excellent sources of vitamin C (Wang et al., 2015).

It is recommended to consume at least 3–5 servings of vegetables and 2–4 servings of fruit daily. To meet the body's needs for various nutrients, these servings should include a variety of colors and types. For example, throughout the day, vegetables like carrots, broccoli, potatoes, and tomatoes, along with fruits such as citrus fruits and strawberries, should be consumed (USDA, 2020).

Fruits and vegetables are more nutritious when consumed fresh and in season. Additionally, care should be taken during cooking to preserve their nutritional value; methods like steaming or light sautéing are recommended (Gibson et al., 2012).

3.4.3. Animal & Plant-Based Proteins

These foods are essential sources of protein and play a crucial role in strengthening muscle tissue. Muscle tissue is the part of the body that consumes the most energy (FAO, 2020). Proteins are broken down into amino acids in the stomach and intestines, then absorbed through the small intestine and transported to the cells. Inside the cells, these amino acids combine to form new proteins needed by the body. These newly formed proteins include enzymes and hormones that are important for regulating biochemical processes and also play a critical role in the production and repair of new tissues and organs (Micha et al., 2017). Therefore, it is necessary to consume all 20 amino acids, especially the essential ones, completely. Protein or amino acid deficiencies can negatively affect growth and development because one amino acid cannot be replaced by another, and each protein is distinguished by the specific sequence of amino acids (Boeing et al., 2012).

The quality of protein is an important evaluation criterion in terms of digestibility and bioavailability (Slavin, 2013). Protein quality varies among food sources. “Reference protein” refers to proteins that can be fully utilized by the body; “high-quality protein” refers to proteins that the body can mostly use; while “low-quality protein” sources have limited conversion (Gibson et al., 2012). In human nutrition, breast milk and eggs are considered reference protein sources, and animal proteins are evaluated as higher quality proteins compared to plant proteins (USDA, 2020).

a) Milk and Dairy Products

Milk is a unique source that provides almost all nutrients in a balanced way (FAO, 2020). Milk obtained from animals such as buffalo, sheep, cow, goat, and camel contains all kinds of nutrients, but its composition can vary depending on the animal species (Boeing et al., 2012). Especially cow’s milk, with 88% water content, offers more than 100 different components and is rich in proteins, fatty acids, minerals, vitamins, and biologically active compounds (Micha et al., 2017). Milk is a fundamental nutrient for a healthy life and is especially the best source of calcium (FAO, 2020). It is also rich in phosphorus, magnesium, certain B vitamins (especially riboflavin, B12), vitamin A, and protein. Milk proteins provide significant benefits in growth and development, calcium absorption, and strengthening the immune system (Slavin, 2013). Milk and dairy products can prevent tooth decay, help control body weight, and reduce the risk of heart diseases by lowering blood pressure (Boeing et al., 2012).

It is recommended to consume 2-3 servings of milk and dairy products daily. This amount is sufficient to meet the body's calcium and protein needs. Fermented dairy products, enriched with probiotics, support the healthy functioning of the digestive system (Micha et al., 2017).

b) Meat, Eggs, Nuts, and Legumes

Meat is a food containing proteins with high biological value and provides essential amino acids to the body (Gibson et al., 2012). It has been reported that the daily protein requirement of an adult is approximately 70 grams, with more than half of this needing to come from animal sources (Micha et al., 2017). However, the saturated fat content in meat can adversely affect heart health. Therefore, it is recommended to prefer lean meats and use healthy cooking methods (Boeing et al., 2012).

Poultry and fish meat contain less saturated fat compared to red meat and are rich in omega-3 fatty acids (USDA, 2020). Research shows that consuming chicken and fish instead of red meat reduces the risk of heart diseases and colon cancer (Slavin, 2013). For this reason, these alternatives can be preferred instead of red

meat, but the skin of poultry like chicken and turkey should not be consumed due to its high fat content.

The fat content of nuts largely consists of unsaturated fats (Gibson et al., 2012). Epidemiological studies reveal that nuts improve blood cholesterol levels and reduce the risk of heart diseases and diabetes (Boeing et al., 2012). Additionally, nuts may reduce obesity risk due to their satiating properties (FAO, 2020).

Legumes are an important food source worldwide. They play a significant role in a healthy diet with their high protein, dietary fiber, starch, vitamin, and mineral content (Micha et al., 2017). Like cereals, legumes contain no fat or cholesterol, so their regular consumption is necessary in a healthy diet.

In conclusion, meat, nuts, and legumes have an important role in a healthy diet. However, to limit saturated fat intake from meat, lean cuts should be chosen and cooking methods should be carefully considered. Nuts and legumes are important parts of the diet due to their rich nutrient content (Boeing et al., 2012).

3.4.4. Fats and Sugars

Sugars and high-energy foods, which are located at the top of the food pyramid, are quite poor in nutritional value. These types of foods serve only as sources of energy. Sweets such as cakes, sugar, jam, and marmalade are examples of this group and are not included among the necessary nutrients for healthy eating. Since these products have a very high calorie content, portion sizes should be controlled. Additionally, refined sugars used in beverages like fruit juices, carbonated drinks, tea, and coffee also belong to this group. Refined sugars can rapidly raise blood sugar levels and then cause a sharp decline, leading to insulin imbalances in the body. Excessive sugar consumption in the long term can cause health problems such as tooth decay, obesity, cardiovascular diseases, and diabetes (Lustig et al., 2012; DiNicolantonio et al., 2016).

Fats are nutrients that provide high energy to the body, and since they contain more calories per gram, the amount of energy they supply is higher than other nutrients. Among the primary functions of fats are the transport and effective use of fat-soluble vitamins (A, D, E, K) in the body. Fats also remain in the stomach for a long time, creating a feeling of fullness, and they play a role in the production of certain hormones essential for proper body function (Griel et al., 2004). Essential fatty acids, which cannot be produced by the body and must be obtained externally, need to be consumed through these nutrients.

Fats are classified into two main groups: plant-based and animal-based. Animal fats are generally solid at room temperature (e.g., butter, suet, tail fat), while plant oils are liquid (e.g., olive oil, sunflower oil, corn oil). It is recommended that daily fat intake does not exceed 30% of total calories (American Heart Association, 2020). Moreover, it is healthier to prefer plant oils containing unsaturated fats over animal fats that have high saturated fat content.

Plant oils are rich in monounsaturated and polyunsaturated fatty acids, and these fats should constitute at least two-thirds of the total daily fat intake (Bingham et al., 2003).

Fats can generally be divided into three main groups:

1. **Saturated Fats:** Found in meat and dairy products, as well as some vegetables (coconut, palm). Saturated fats can harm heart health and are associated with high cholesterol levels (Mensink et al., 2003).
2. **Monounsaturated Fats:** Found in oils such as olive oil, hazelnut oil, and canola oil. These fats have beneficial properties that protect heart health (Kris-Etherton et al., 2002).
3. **Polyunsaturated Fats:** Found in sunflower, soybean, corn oils, and some fish oils. These fats are especially rich in omega-3 fatty acids and can reduce the risk of heart diseases (Simopoulos, 2002).

Because fat contains more calories per gram than other nutrients, excessive consumption can accelerate weight gain. Additionally, fats taken directly into the body can be stored more efficiently than carbohydrates (Micha et al., 2017).

Fats and sweets should be consumed in limited amounts within a healthy diet. Since excessive sugar intake can lead to many health problems, caution is necessary. For fat consumption, preferring unsaturated fats is more beneficial for health. Maintaining balance in the consumption of these nutrients is important for keeping energy and nutritional values at an optimal level for a healthy life.

You should apply all these dietary recommendations and not forget your fluid

needs. At least 2 liters of non-alcoholic and calorie-free beverages (water, soda, fruit and herbal teas, diet drinks, etc.) should be consumed daily. Coffee, tea, and green tea do not provide fluids to the body; on the contrary, they may cause fluid loss. These drinks and milk should not be included in the amount that meets the body's fluid needs.

3.4.5. Updated Heathy Eating Pyramid

The food pyramid is a scientific guide designed to help individuals balance their daily nutrient intake for maintaining a healthy life. This model is prepared to ensure optimal nutrition and presents the basic principles of healthy eating. The food pyramid includes five main food groups: animal protein sources (meat, eggs, and legumes), milk and dairy products, grains, vegetables and fruits, fats and sugars (Sizer & Whitney, 2017).

Each country develops unique food pyramid models based on local eating habits, ecological conditions, and social structures. When examining the historical development of the food pyramid, it is seen that in 1943, during World War II, the US Department of Agriculture developed a guide based on seven basic food groups to maintain nutrition standards (USDA, 1943). In 1956, this guide was reduced to four main food groups, and later the food pyramid model became widespread. Many countries such as West Germany, Japan, and Scandinavian countries created their own food pyramids (Barrett et al., 2004).

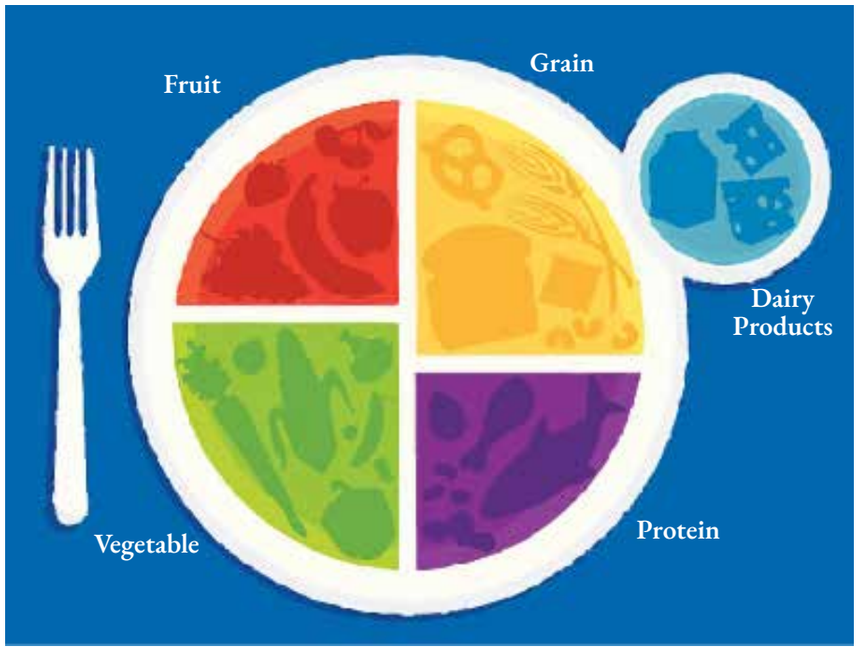
In 1992, the US Department of Agriculture introduced the "Food Guide Pyramid" model, where the bread, cereal, rice, and pasta group was placed at the widest base of the pyramid with 6-11 servings daily. This was followed by fruits (2-4 servings), milk and dairy products (2-3 servings), protein sources (meat, poultry, fish, legumes, eggs, and nuts; 2-3 servings), and at the top were fats and sweets recommended for limited consumption (USDA, 1992) (Figure 1).

However, with the increase in obesity rates in the US, the effectiveness of this model was questioned, and in 2005 it was revised under the name "MyPyramid." In the new model, exercise was emphasized and a climber figure was added to the pyramid. Also, the vegetable and dairy groups were shown equal in size to the grains, protein sources were represented in a narrow section, and fats were presented as a smaller band (USDA, 2005).

Figure 2 – MyPyramid model (https://en.wikipedia.org/wiki/MyPyramid)

In 2011, the "MyPlate" model was adopted. In this model, food groups are arranged so that half of the plate is filled with fruits and vegetables, and the other half with grains and protein sources, while milk and dairy products are shown in a separate section. This model recommends the amounts of food individuals should consume based on the proportion of food groups on the plate (USDA, 2011).

Figure 3 - Myplate Model (Tayyar et.al. 2017)



Nutrition pyramid models are shaped according to the needs of populations. These models have been developed to meet the nutritional requirements of communities and to promote a healthy lifestyle. The visual representations of the guidelines vary according to cultural elements (Özer et al., 2016). For example, Türkiye uses the four-leaf clover model, the UK uses the "healthy eating plate," Germany the three-dimensional food pyramid, Portugal the "food circle," China the "food guide pagoda," Canada the rainbow, Thailand the "food flag," Japan the "food guide spinning top," France the ladder, Hungary the house, and Denmark the compass as various visual representations (Micha et al., 2017). These representations reflect each country's nutrition strategies and cultural characteristics.

3.4.6. Four-Leaf Clover Model

The four-leaf clover model in Türkiye was developed considering the country's food production capacity, dietary habits, and health needs (Soyer & Doğan, 2017).

The model is based on four main food groups to meet individuals' daily nutritional requirements: milk and dairy products, meat and meat products, vegetables and fruits, grains and grain products. Fats and sugary foods should be consumed according to individual needs as determined by dietitians (Aydın & Şahin, 2018).

Figure 4 - Four-Leaf Clover Model (Tayar et al., 2017)

In the visual design of the model, the leaves are shaped like hearts to emphasize the importance of health and the theme of love. At the bottom, the phrase "Adequate and Balanced Nutrition" is written, and at the top, olive branches — part of traditional eating patterns — are depicted (Republic of Türkiye Ministry of Health, 2020). Inside the leaves are images representing their respective food groups: milk and dairy products in the top leaf, vegetables and fruits in the bottom leaf, meat and meat products in the right leaf, and grains and grain products in the left leaf (Tayar et al., 2017).

Although Turkey's traditional eating habits show regional differences, they generally reflect a balanced and healthy pattern. Habits such as giving great importance to animal protein sources, consuming dairy products (e.g., yogurt and ayran) with meals, and purchasing fruits and vegetables from markets contribute to public health (Güven & Hacıoğlu, 2020).

However, some traditional habits can have negative effects on health. Excessive

consumption of flour and flour-based products, in particular, makes it difficult to shift towards healthy carbohydrate sources and may lead to nutrition-related health problems (Karaca & Güneş, 2019). Therefore, awareness-raising efforts about healthy carbohydrates are important.

The "fast food" culture emerging with globalization has also affected eating habits in Türkiye, leading to the spread of unhealthy eating habits (Balcı & Yılmaz, 2021). This situation increases health problems such as obesity, diabetes, and cardiovascular diseases. To address these issues, healthy eating habits should be promoted, and fast food alternatives should be supported with healthy options (Çetin & Dönmez, 2020).

Conclusion

Nutrition guidelines of countries are important tools for maintaining a healthy life. Türkiye's four-leaf clover model serves as an example by combining traditional eating habits with modern needs. However, the effects of globalization and changing dynamics of traditional habits require new strategies for public health. At this point, awareness-raising efforts and healthy nutrition policies carry great importance for the future of society.

3.5. BALANCED NUTRITION

Assoc. Prof. Dr. Arzu Altunkaya Dinçay[33]

Nutrition is a fundamental requirement for the survival of every living being. Nutrition is not only a physiological need but also a psychological, sociological, and economic phenomenon, involving the use of nutrients for growth, sustaining life, and maintaining health. Adequate and balanced nutrition, which forms the basis of health, plays a critical role at every stage of life, from infancy to old age, for body growth and development, efficient functioning, and resistance against external factors and diseases (Whitney & Rolfes, 2005).

Nutrition is defined as "the intake of nutrients necessary for the body's functioning through food, digestion, absorption, and metabolism" (Günay, 1998). Nutrition never simply means filling the stomach or eating whatever we want. In this context, both the quantity consumed and the amount of energy obtained should be proportional to the individual's age, gender, work, and special conditions. In other words, nutrition must be both balanced and adequate. From the definitions given, nutrition can be expressed as the intake of necessary amounts of nutrients to meet the body's energy needs (National Research Council, 2005).

Vital processes such as cell renewal, energy production, and the immune system, which are the foundation of physical and mental health, are directly related to nutrition. Scientific studies reveal the critical role nutrients play in these processes (Gropper, Smith & Carr, 2009). Therefore, the goal of nutrition is for individuals to consume sufficient amounts of energy and nutrients according to their age, gender, physical activity level, and special conditions. This concept is defined as "adequate and balanced nutrition" (World Health Organization [WHO], 2003).

Extensive research to date has proven that humans need more than 50 different nutrients for growth, development, and staying healthy (Gropper, Smith & Carr, 2009). These include organic macronutrients (carbohydrates, lipids, and proteins) and inorganic micronutrients (water, minerals, and vitamins). Therefore, when one or more of these nutrients are insufficient, disruptions occur in body functions, leading to growth retardation, developmental delays, and health disorders.

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3.5.1. Carbohydrates

Carbohydrates are the most abundant nutrients in food and a primary source of energy for our bodies. They are an important food source not only for humans but also for animals. Carbohydrates support the healthy functioning of our digestive system, maintain water and mineral balance, and help eliminate harmful substances from the body (Sencer, 1991). Certain types of carbohydrates, in particular, help regulate the digestive system by increasing intestinal activity (Whitney & Rolfes, 2005). Additionally, they prevent a condition called "ketosis" that occurs when fats are burned instead of carbohydrates during starvation (Gropper, Smith & Carr, 2009).

Carbohydrates are organic compounds made up of carbon, hydrogen, and oxygen, and there are many types with different structures and properties. We can classify carbohydrates into three groups as shown in Table 1:

Table 1 - Classification of Basic Carbohydrates (Baysal, 2010)

Class / Degree of Polymerization	Subgroups	Compounds
Monosaccharides (Simple Sugars) (1-2)	Monosaccharides Disaccharides Polyols	Glucose, Galactose, Fructose, Mannose, Sucrose, Maltose, Lactose, Sorbitol, Mannitol, Lactitol
Oligosaccharides (3-9)	Malto-oligosaccharides Other oligosaccharides	Maltodextrin Raffinosis, Stachyosis, Fructo-oligosaccharides, Galacto-oligosaccharides
Polysaccharides (>9)	Starch Non-starch polysaccharides	Amylose, Amylopectin, Modified Starches Cellulose, Hemicellulose

3.5.1.1. Monosaccharides

Monosaccharides are the smallest units of carbohydrates and form the building blocks of other carbohydrates such as sucrose, starch, and cellulose by bonding to each other through glycosidic bonds. Also called simple sugars, monosaccharides are generally sweet. The most important monosaccharides from a nutritional perspective are glucose, fructose, and galactose (Whitney & Rolfes, 2005).

- Glucose (grape sugar): Free glucose found in the blood ranges from 80 to 120 mg per 100 ml of blood (recent research indicates this value can rise up to 135 mg). The brain and red blood cells can use only glucose as an energy source. Glucose is most commonly found in grapes and grape-based foods and drinks, as well as in honey. Pure glucose can be obtained from pharmacies. Although it is less sweet than table sugar, its absorption is quite rapid (Sencer, 1991).
- Fructose (fruit sugar): Found free in sweet fruits and honey.
- Galactose (milk sugar): Does not exist freely in nature; it is found in the structures of carbohydrates such as lactose and raffinose.

Among carbohydrates, only monosaccharides can be absorbed through the digestive system into the bloodstream. Of these monosaccharides, only glucose can be used by all cells. The others are converted into glucose in the liver before being used (Gropper, Smith & Carr, 2009).

3.5.1.2. Disaccharides

Disaccharides are formed when two monosaccharides are bonded together by a glycosidic bond. Compounds formed by the joining of two monosaccharide molecules with a glycosidic bond and without containing a water molecule are called disaccharides. Disaccharides are a subgroup of simple carbohydrates and are usually referred to as double sugars. Their general chemical formula is $C_{12}H_{22}O_{11}$ (Sencer, 1991).

The most important disaccharides nutritionally are sucrose, lactose, and maltose.

Sucrose: A disaccharide formed by a glycosidic bond between glucose and fructose. It is the most abundant disaccharide in nature, especially common in plants. It is obtained from sugar beet and sugar cane. It is the carbohydrate that we always use daily and commonly refer to simply as sugar.

Lactose is also known as milk sugar. It is synthesized only in the mammary glands of mammals. It is a disaccharide formed by a glycosidic bond between glucose and galactose. It helps with calcium absorption and supports the growth of beneficial

bacteria in the large intestine (Whitney & Rolfes, 2005).

Maltose is the simplest and most important of the disaccharides. It occurs during the acidic or enzymatic hydrolysis of starch. It consists of two glucose molecules bonded together by a glycosidic bond. It is usually found briefly in the seeds of plants. Additionally, it is an intermediate product formed during the digestion of complex carbohydrates such as starch. It is obtained by partial breakdown of starch in some foods such as beer and malt liquors.

3.5.1.3. Oligosaccharides

Oligosaccharides are formed by the polymerization of two or more monosaccharides bonded to each other by glycosidic bonds. Generally, short-chain carbohydrate polymers consisting of fewer than 10 sugar units are called oligosaccharides. This is what particularly distinguishes oligosaccharides from polysaccharides (Slavin, 2013).

Oligosaccharides are plant-based carbohydrates that cannot be absorbed by our digestive system but can be fermented by gut bacteria. This fermentation produces compounds such as short-chain fatty acids and lactic acid. These compounds support gut health, strengthen the immune system, and provide energy (Macfarlane & Macfarlane, 2012). Additionally, oligosaccharides may help lower cholesterol levels and regulate blood sugar (Roberfroid, 2005).

3.5.1.4. Polysaccharides

Polysaccharides are polymers consisting of hundreds to thousands of monosaccharides joined by glycosidic bonds. The most important polysaccharides nutritionally are starch, glycogen, and cellulose.

Starch is a polysaccharide made by the joining of many glucose molecules and serves as an energy reserve in plants. It is found in seeds, grains, and tubers of plants. Its digestion is slow, and it provides energy by converting into glucose in the body (Asp, 1996).

Glycogen is the stored form of carbohydrate in humans and animals. It functions as an energy reserve that can be rapidly mobilized when needed. It consists of many glucose molecules linked together and is soluble in hot water. It can be easily converted to glucose with the help of enzymes. It is mostly found in the liver, muscles, and other tissues. It is also known to be present in organisms such as dry yeast and fungi (Nelson & Cox, 2005).

Cellulose is found in plant structures and constitutes the indigestible fiber portion of food. About 10–15 grams of daily dietary intake comes from cellulose. Approximately 43% of ingested cellulose is excreted through feces. Cellulose increases bowel movements and supports regular bowel function. It helps prevent constipation and is recommended in weight-loss diets because it creates a feeling of fullness in the stomach and intestines. Raw fruits and vegetables eaten with their skins and whole grain products are rich sources of cellulose (Southgate, 1995).

The main function of carbohydrates is to provide energy to the body. One gram of carbohydrate provides approximately 4 calories of energy. About 40–50% of an adult's energy needs are met from carbohydrates. Around 300 grams of carbohydrates are consumed daily, with a large portion consisting of starch (~160 g) and sucrose (~120 g). Additionally, some lactose (~30 g) and glucose and fructose (~10 g) are consumed. Lactose from dairy products is also an important carbohydrate source.

Indigestible compounds such as cellulose, hemicellulose, and lignin found in plant foods make up dietary fiber. Fiber promotes bowel movements and easy elimination, preventing constipation and cancer, and lowers unwanted fat and sugar levels in the blood (National Research Council, 2005).

Since glucose is the only energy source used by the brain, it is essential for cognitive functions. Our body meets its glucose needs both by breaking down carbohydrates obtained from food and by converting non-carbohydrate substances. Enzymes in the digestive system break down complex carbohydrates like starch and sugar into simpler sugar units (glucose), thus digesting carbohydrates (Lehninger et al., 2000).

When carbohydrate intake is insufficient, the body attempts to meet its energy needs from the consumed proteins, preventing proteins from fulfilling their primary functions. Blood acid levels rise, and the resulting condition known as "ketosis" can pose a life-threatening risk. Deficiencies in B vitamins, some amino acids, and fiber may also occur. Additionally, fatigue, weakness, depression, forgetfulness, nervous system disorders, digestive problems, reduced protein synthesis and repair due to inability to use protein, and long-term cancer and heart disease risks due

to insufficient fiber intake may develop (Whitney & Rolfes, 2018). Moreover, if high-calorie carbohydrates are consumed less than protein, marasmus disease may occur.

Excess carbohydrate intake is converted into fat, leading to obesity, negatively affecting the cardiovascular system and causing arteriosclerosis. Carbohydrates are also linked to tooth decay. Especially frequent sugar consumption by children at short intervals is a significant factor in tooth decay. Sugars adhering to teeth promote bacterial growth, and the acids produced by these bacteria cause tooth decay (Touger-Decker & van Loveren, 2003).

3.5.2. Proteins

Proteins are the fundamental building blocks of the cells that make up our body. Proteins are formed by the joining of amino acids. Amino acids are organic molecules containing nitrogen. Like carbohydrates, they consist of carbon, hydrogen, and oxygen atoms; however, the distinguishing feature of proteins is that they contain nitrogen (Guyton and Hall, 2021).

Proteins are indispensable for the growth, development, and repair processes in our body. They are the structural components of tissues. They form the basic components of cells in our skin, muscles, bones, and organs. Therefore, growth or tissue repair without proteins is impossible (Nelson and Cox, 2017). After carbohydrates and fats, proteins are the third most important energy source for the body. When carbohydrate and fat intake is insufficient, the body uses proteins to meet its energy needs (Mahan et al., 2016).

One gram of protein provides about 4 calories of energy. Proteins are made up of smaller units called amino acids. The liver can use these amino acids to produce glucose. Glucose is the primary fuel that provides energy to the body's cells (Nelson and Cox, 2017). Proteins in blood plasma transport many important molecules in the body. Substances like drugs, hormones, and fats bind to blood proteins to be transported to tissues. The cytoplasm, the inner part of cells, is largely made up of proteins. These proteins are necessary for maintaining the cell's shape and carrying out many essential functions (Tortora and Derrickson, 2020).

Enzymes are indispensable for the vital activities of cells. Since enzymes are made of proteins, cells need protein for all their functions such as reproduction and digestion of nutrients. In our digestive system, proteins are broken down into smaller parts called amino acids. These amino acids are the building blocks of our body and are used in the formation of new proteins. Because the body cannot store excess amino acids, they must be continuously obtained from food. If sufficient amino acids are not consumed, the body starts to use its own proteins. This can lead to serious health problems in the long term, such as muscle loss and weakened immune system. Therefore, meeting the body's protein needs through a balanced diet is very important (Gropper et al., 2018).

Approximately 16% of an adult human body is composed of proteins. These proteins are the fundamental building blocks of all the cells in our body. Proteins are not only used as an energy source like carbohydrates and fats but also play a role in the formation of newly developed tissues, the normal functioning of mature tissues, and the repair of damage during these functions. They regulate the osmotic pressure of body fluids, maintain the acid-base balance of the body, and are involved in the production of enzymes, certain hormones, and antibodies. Thus, the body requires sufficient protein for the renewal process and the formation of new cells (Mahan et al., 2016).

Some amino acids in the body can be converted into others, so part of the amino acids can be formed from others. However, some amino acids cannot be made in this way or cannot be produced in sufficient amounts. Amino acids that cannot be synthesized by the body and must be obtained from dietary proteins are called essential amino acids (Nelson and Cox, 2017). It is necessary to regularly consume all essential amino acids in adequate amounts. If they are not obtained from outside sources when needed, the body cannot sufficiently synthesize proteins, protein balance cannot be maintained, and cell function and growth become inadequate. The essential amino acids are arginine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine. These amino acids are the basic building blocks needed for the body to form its own proteins.

Blood proteins are found in plasma, the liquid portion of blood. Plasma proteins include albumin (4-5.5 g%), globulin (1.5-3.5 g%), and fibrinogen (0.3 g%). The total average plasma protein value is 7 g (Guyton and Hall, 2021). These plasma proteins are important in many processes within the body. Albumin, in particular, provides information about nutritional status and liver health. Albumin levels can decrease in protein deficiency, liver diseases, or kidney problems. Also, fibrinogen, which plays a role in blood clotting, is one of the plasma proteins (Tortora and

Derrickson, 2020).

From a nutritional perspective, proteins are divided into two groups based on their source: plant proteins and animal proteins (Table 2). Animal proteins contain essential amino acids that humans cannot synthesize but are necessary for the body, in a balanced proportion. These amino acids are in a form that digestive enzymes can easily act upon within the protein molecule. Plant proteins, on the other hand, do not contain all essential amino acids, or if they do, they do not contain them in the necessary amounts or balanced proportions (Nelson & Cox, 2017). For example, many plant protein sources are poor in essential amino acids such as methionine, tryptophan, leucine, and isoleucine (Guyton & Hall, 2021).

Animal proteins (such as eggs, milk, and meat) are almost completely absorbed (%98) in our digestive system, whereas plant proteins (such as grains and legumes) experience greater loss during digestion (%78-85) (Mahan et al., 2016). Furthermore, the amino acid profiles of plant proteins may not fully match the amino acid requirements of the human body. Therefore, the body uses animal proteins more easily and efficiently than plant proteins (Nelson & Cox, 2017).

The utilization of proteins in the body varies depending on their source and type. The degree to which the body can use protein is expressed as “biological value.” Biological value depends on the variety and amount of amino acids in the protein composition, its digestion and absorption, and ultimately its conversion to body proteins. It indicates how well the body can use the protein or convert it to body protein (Mahan et al., 2016). When egg is consumed, about 94% is utilized by the body, which is why it is considered the reference protein (Guyton & Hall, 2021).

Table 2 - Protein rates and biological valence of foods rich in proteins (Guyton & Hall, 2021)

	Water (%)	**Protein (%)**	**Biological Valence**
Animal Source			
Egg	74,0	12,4	93,7
Milk	87,3	3,5	84,5
Beef	61,0	17,7	74,3
Offal (beef)	74,0	16,0	-
Chicken	66,0	20,0	74,3
Fish	74,0	18,8	76,0
Vegetable Origin			
Potato	78,0	2,0	66,7
Soy	8,0	38,0	72,8
Pea	11,0	22,5	63,7
Wheat	12,0	12,2	64,7
Lentil	11,4	24,2	44,6

Protein deficiency brings the body's protein balance into a negative state. In such a case, the body tries to maintain its functions by using its own tissues. As a result, especially in infants, children, and adolescents, growth may stop or be delayed, and body weight may begin to decrease. As the immune resistance weakens, the likelihood or frequency of infections increases; illnesses may last longer and be more severe (Guyton & Hall, 2021).

In individuals whose protein intake is limited but who consume a high-calorie diet rich in sugars and starches, a condition called Kwashiorkor may develop. In particular, insufficient protein intake in children aged 0–6, a critical period when brain development is not yet complete, can lead to mental retardation.
Excess protein that is not used by the body is converted into energy and stored as fat, which may result in unwanted weight gain. This conversion process can also lead to unnecessary energy expenditure.

Although there is limited direct and conclusive evidence regarding the potential harms of excessive protein intake, it is recommended to be cautious when following

a high-protein diet. For instance, high protein consumption can increase uric acid load, which may strain kidney function. Additionally, a high intake of protein may accelerate calcium loss from bones, increasing the risk of bone weakness and osteoporosis.

This is particularly important for women at high risk of osteoporosis. High-protein diets may also increase cholesterol levels and raise the risk of developing ketosis. Furthermore, they can increase the risk of colon cancer as well (Nelson & Cox, 2017). Protein intake should be adjusted in a balanced manner based on the individual's age, sex, physical activity level, and overall health condition.

3.5.3. Lipids (Fats)

In the human body, fats are compounds made up of carbon, hydrogen, and oxygen atoms. Approximately 18% of body weight consists of fat, although this proportion can vary by individual, age, gender, and level of physical activity (Jebb, 2008). Fats are the body's most important energy reserves. Unlike carbohydrates, fats contain more energy per gram. While 1 gram of fat provides about 9 calories, 1 gram of carbohydrate provides only 4 calories (Jenkins et al., 2009). Therefore, fats are a more suitable storage form to meet the body's long-term energy needs.

However, converting fats into energy requires more oxygen compared to carbohydrates. This limits the use of fats as an energy source during high-intensity physical activities. During such exercise, the body generally prefers carbohydrates (Coyle, 2004). For this reason, both macronutrients are essential for the body and fulfill different energy demands.

Beyond their caloric functions, fats play critical roles in nutrition. Various studies have shown that a fat-free diet is not sustainable. Among the important functions of fats in the diet are: providing essential components for cell structure and membranes, acting as carriers for fat-soluble vitamins (A, D, E, and K), and regulating blood lipid levels (Brennan, 2013). In addition, they protect internal organs by cushioning them against impact and external factors. They also help maintain body temperature and prevent heat loss. In the digestive system, fats slow gastric emptying, providing a sense of fullness and prolonging digestion (Akşit, 1991).

According to the World Health Organization, 25–30% of total daily energy intake should come from fats, with saturated fat intake not exceeding 10% (World Health Organization, 2018).

The most nutritionally significant lipids include fats, phospholipids, waxes, and cholesterol. Fats are esters formed by the combination of fatty acids and glycerol (glycerin). Fatty acids are primarily divided into two main categories: saturated and unsaturated.

- Saturated fatty acids: Most fats found in foods and stored in animals are in the form of triglycerides. Triglycerides made from saturated fatty acids are solid. Example: Margarine. Although calories from saturated fats are equal to those from other fats, they tend to promote fat accumulation and weight gain in the body (Gardner et al., 2005). To reduce cardiovascular diseases, it is recommended to lower saturated fat intake to less than 7% of total energy intake (Simopoulos, 2002).
- Unsaturated fatty acids: These are the best sources for essential fatty acids required by the body and are liquid at room temperature. They are further divided into two types. If the acid in the fat chain contains a single carbon bond, it is called a monounsaturated fatty acid; if it contains a double carbon bond, it is referred to as a polyunsaturated fatty acid. Main sources of monounsaturated fats include olives, hazelnuts, peanuts, walnuts, avocados, almonds, and sesame oil (Simopoulos, 2002). The polyunsaturated group can be further categorized into Omega-3 and Omega-6: Omega-3 is found primarily in animal-based foods like fish. In plant sources, it is found in flaxseeds, soybean oil, hemp seeds, pumpkin seeds, walnuts, purslane, and legumes. Omega-6 is found in sunflower oil, soybean oil, corn oil, and safflower oil (Brennan, 2013).

Phospholipids are the second most abundant lipids in the body after triglycerides and are found in many tissues and organs, including the brain, nerves, heart muscles, and liver. They contain higher amounts of unsaturated fatty acids and thus have physiological importance in nutrition. Phospholipids work together with proteins in transporting fats throughout the body. They help dissolve cholesterol and prevent its buildup in blood vessels, thereby reducing the risk of atherosclerosis. Additionally, they have a role in shortening blood clotting time. Lecithin is the most common phospholipid found in food and is abundant in egg yolk, brain, liver, lungs, kidneys, heart, and milk (Levy et al., 2009).

- Waxes are esters formed from fatty acids and higher molecular weight alcohols than glycerol. They are commonly found in nature, in secretions of some insects, on the skin, hair, and feathers of animals, and on the leaves, fruits, and peels of plants (Brennan, 2013).
- Cholesterol (Sterols): Cholesterol is a lipid from the sterol class and exists in the body both endogenously (produced internally) and exogenously (from food sources). It plays an important role in the structure of cell membranes and in lipid transport processes. Saturated fatty acids increase cholesterol synthesis and plasma cholesterol levels, whereas unsaturated fatty acids generally have hypolipidemic effects. Normally, cholesterol levels in plasma are expected to be between 180–220 mg/dl per 100 ml. High cholesterol is a major risk factor for atherosclerosis and related cardiovascular diseases. The richest dietary sources of cholesterol are egg yolk, meat, dairy products, and other animal-based foods, while plant oils contain no cholesterol (Levy et al., 2009).

In addition to forming a protective layer around internal organs, fats play key roles in the structure of brain tissue, hormone production, and various metabolic functions. However, both excessive and insufficient fat levels in the body pose health risks. Overconsumption of fat can lead to obesity and increase the risk of cancer, cardiovascular diseases, and other chronic illnesses. Therefore, fat intake should be balanced in accordance with the body's needs.

3.5.4. Minerals

Minerals are inorganic substances commonly found in nature that do not contain carbon, hydrogen, or oxygen. Although they make up only a small portion of the human body (about 4–6%), they play a crucial role in the formation of body structures. They are found in bones, teeth, muscles, blood, and other tissues.

Minerals required in amounts greater than 250 mg per day are classified as macro minerals, which include sodium, potassium, chloride (electrolytes), calcium, magnesium, and phosphorus. Minerals required in amounts less than 20 mg per day are called trace elements, which include chromium, copper, fluoride, iodine, iron, manganese, molybdenum, selenium, and zinc (Finkelstein, 2012; Gleason & Bishop, 2009).

Minerals play vital roles in the body's functioning. Sodium and potassium help maintain osmotic pressure in cells and regulate the balance between intracellular and extracellular fluids. They are also involved in enzyme function and activity. During excessive sweating, diarrhea, vomiting, or kidney disorders, when water is lost from the body, intracellular fluid moves outward to maintain equilibrium.

Calcium, phosphorus, and magnesium are key components of bones and teeth. They are also involved in muscle and nerve stimulation. Iron plays a role in blood formation and oxygen transport; iodine is necessary for thyroid hormone production; and sodium, potassium, and chloride are essential in circulatory system function (Baysal, 2010; Applegate, 2011).

Some Key Minerals;

- Calcium: A primary component of bones and teeth, calcium is one of the most abundant minerals in the body. Along with phosphorus, it strengthens the skeletal system and is essential for muscle movement and nerve transmission. It is found in milk, cheese, yogurt, eggs, nuts, legumes, and some fish species (Applegate, 2011; Baysal, 2010; Ünsün, 2003).
- Phosphorus: The second most abundant mineral in the body after calcium, phosphorus plays an active role in energy metabolism. It is found in bran, meat, fish, dairy products, and eggs (Finkelstein, 2012).
- Iron: Essential for the transportation of oxygen throughout the body and a key component of red blood cells. It is found in offal, eggs, legumes, almonds, raisins, meat, chicken, fish, potatoes, and cabbage. The iron in spinach is bound to other compounds and is not water-soluble, so it is not absorbed or digested (Applegate, 2011).
- Sodium: Found in salt, cow's milk, white cheese, yogurt, dark green leafy vegetables, carrots, meat, and eggs. It is necessary for many bodily functions (Applegate, 2011; Ünsün, 2003).
- Potassium: Present in leafy greens, tea, legumes, nuts, and potatoes. It performs similar functions to sodium and is essential for various bodily functions (Gleason & Bishop, 2009).
- Iodine: Found in the thyroid gland, skin, and skeletal system in amounts ranging from 20–50 mg in the human body. It aids in the production of thyroid hormones. Found in seafood, iodized salt, and dairy products (Finkelstein, 2012; Baysal, 2010).
- Zinc: Crucial for protein and genetic material metabolism. It supports growth, sexual development, and the immune system. Zinc deficiency can lead to dwarfism, delayed sexual development, weak immunity, and delayed wound

healing. Zinc is abundant in liver, meat, cheese, fish, milk, eggs, oily seeds, and legumes. Grains also contain zinc (Applegate, 2011; Baysal, 2010).

- Chromium: Found in very small amounts throughout almost all tissues in the body. It plays a role in carbohydrate metabolism. Major sources include brewer's yeast, beef liver, and honey (Finkelstein, 2012).
- Selenium: An important supportive mineral for cancer patients. Working with vitamin E, it protects cells from harmful effects of free radicals. It can reduce cancer risk and slow tumor growth. It also strengthens white blood cells (important for immunity), which destroy harmful substances and cancer cells (Applegate, 2011).

While all minerals are vital, both their excess and deficiency can lead to health problems. For instance calcium deficiency may cause rickets in children, osteomalacia in adult women, and osteoporosis in the elderly. Rickets and osteomalacia involve bone softening and deformation, while osteoporosis makes bones more prone to fractures. Iron deficiency causes anemia. School-aged children who consume insufficient iron often suffer from frequent illness, poor school attendance, reduced concentration and learning ability, and lower academic performance. Iodine deficiency can lead to goiter, which is the enlargement of the thyroid gland at the front of the neck. Zinc deficiency may result in growth retardation (dwarfism), delayed sexual development, weakened immunity, delayed wound healing, and taste/smell disorders. Chromium deficiency can impair glucose utilization and increase cholesterol levels (Finkelstein, 2012; Baysal, 2010).

3.5.5. Vitamins

Vitamins are essential organic compounds that the body requires in small amounts for metabolism, and they must be obtained from food. Because the body cannot synthesize them in sufficient quantities, they need to be supplied through diet. They are vital for sustaining life, growth, and play a regulatory role in the body (Smith and Jones, 2020).

Vitamins are classified into two groups:

1. **Fat-soluble vitamins:** Vitamins A, D, E, and K
2. **Water-soluble vitamins:** B-complex and Vitamin C

3.5.5.1. Vitamin A

Vitamin A is found in fish oil, butter, egg yolk, milk, cheese, and yellow-colored fruits and vegetables. Its most important function is its role in forming visual pigments in the liver, which enables vision in low-light conditions. It is also necessary for growth and the regeneration of body tissues, contributes to the healthy formation of bones and teeth, and strengthens resistance to diseases (Greenfield et al., 2019).

A deficiency in vitamin A can lead to night blindness as well as damage to epithelial tissues (such as dry and rough skin, degradation and dryness of the eye's epithelial layer, and loss of protective barriers), increased susceptibility to infections due to impaired immunity, and ulcers in the stomach. In children, vitamin A deficiency hinders normal growth and development. Excess intake of vitamin A is also harmful. It is absorbed in the small intestine with the help of bile; if bile or fat is absent, vitamin A cannot be absorbed properly (Greenfield et al., 2019).

3.5.5.2. Vitamin D

Vitamin D is found abundantly in fish liver oil. Other natural sources include fish, egg yolk, liver, milk, and butter. Another important source of vitamin D is sunlight exposure.

Vitamin D is essential for the effective utilization of calcium in the body. It enhances calcium absorption in the intestines and helps meet the body's calcium needs for bone development and repair (Thompson, 2021).

Vitamin D deficiency is commonly observed in individuals with limited sun exposure, rapidly growing children, and in countries with low sunlight. Deficiency in children leads to rickets, while in adults it causes osteomalacia, a bone disease characterized by soft bones with reduced calcium and phosphorus levels. Osteomalacia is often seen in women who have frequent pregnancies, poor and unbalanced diets, and little exposure to sunlight.

Since vitamin D is fat-soluble, it is not excreted in urine, making excess or random intake potentially harmful. Overconsumption can cause abnormal calcification in joints and soft tissues. In children, excessive and unregulated use may result in growth retardation, vomiting, and kidney stone formation (Thompson, 2021).

3.5.5.3. Vitamin E

Vitamin E is found in many foods that play an important role in our diet. Seeds (sunflower, pumpkin), vegetable oils (olive oil, sunflower oil), leafy green vegetables (spinach, broccoli), and nuts (almonds, walnuts) are among the best sources of vitamin E. Thanks to its antioxidant properties, vitamin E protects cells from harmful molecules and helps them stay healthy for longer. In this way, it contributes to overall health and strengthens the body's resistance to diseases. Studies have shown that vitamin E reduces the risk of developing cancer (Zhang and Lee, 2020).

Since it is found in sufficient amounts in everyday foods, deficiency symptoms are rarely observed in humans. In experimental animals, vitamin E deficiency has been shown to cause infertility, fatigue in the heart and other muscles, liver disease, and the easy breakdown of red blood cells. No harmful effects of excessive intake have been identified (Zhang and Lee, 2020).

3.5.5.4. Vitamin K

Vitamin K is mostly found in leafy green vegetables and tomatoes. It is also synthesized by microorganisms in the intestines. Therefore, vitamin K deficiency may occur after prolonged diarrhea. Vitamin K enables the liver to produce prothrombin, a protein involved in blood clotting (Patel and Hwang, 2022).

In cases of liver and digestive system disorders—especially when bile flow is obstructed—the absorption and use of vitamin K is impaired. Long-term antibiotic use can damage the intestines, reducing the effectiveness of vitamin K and leading to deficiency. In cases of overconsumption, the water-soluble derivatives of vitamin K may cause neonatal jaundice (hyperbilirubinemia) (Patel and Hwang, 2022).

3.5.5.5. B-Group Vitamins

The B group includes vitamins B1, B2, B3, B5, B6, B11, and B12. These vitamins play a vital role in the body's conversion of fat, carbohydrates, and proteins into energy. Since they are water-soluble, they cannot be stored in the body. Therefore, they must be consumed in sufficient amounts daily through food (Anderson and Clark, 2021).

Vitamin B1 (Thiamine)

It is found in brewer's yeast, legumes, organ meats, grains, and oily seeds such as hazelnuts and peanuts. It is essential for the regular functioning of the heart, the control of the nervous system, appetite, and digestive processes. It plays a regulatory role in carbohydrate and energy metabolism (Lee and Wang, 2022).

B1 deficiency leads to beriberi, a disease that causes joint swelling, pain, and balance disorders. Common symptoms of deficiency include appetite loss, vomiting, digestive disorders, heart failure, and restlessness. No known symptoms of excess intake have been reported (Lee and Wang, 2022).

Vitamin B2 (Riboflavin)

This nutrient is important for body growth and development. It plays a role especially in energy production and cell regeneration. The richest sources include eggs, milk, liver, meat, cheese, soybeans, peas, lentils, wheat, and green vegetables (Zhao et al., 2021).

It must be obtained through food. A deficiency may cause skin conditions (dermatitis), cracks on the lips (cheilosis), and lesions around the eyes. Neurological disorders and anemia may also occur. Eye burning, redness, and diarrhea are other symptoms (Zhao et al., 2021).

Vitamin B3 (Niacin)

The best sources of niacin are yeast, organ meats, and other types of meat. Legumes, oily seeds, and whole wheat flour are also considered good sources. Niacin plays a role in the metabolism of proteins, carbohydrates, and lipids. It supports blood circulation, skin health, and nervous system function (Clark and Lee, 2020).

Insufficient niacin in the diet can lead to pellagra, a disease characterized by symmetrical skin lesions in sun-exposed areas, and issues with the nervous and digestive systems. Pellagra is more common in populations that rely on a single food source, particularly corn-based diets. Common symptoms include loss of appetite, fatigue, and skin lesions on the sun-exposed parts of the arms and legs. Depression and other mental health issues are also common in affected individuals (Clark and Lee, 2020).

Vitamin B5 (Pantothenic Acid)

It was first discovered in rice bran. It is a B-group vitamin involved in carbohydrate, lipid, and protein metabolism. It is found in animal tissues such as liver, kidney, and egg, as well as in legumes and unprocessed grains. It is present in small amounts in milk, vegetables, and fruits (Tan and Goh, 2021).

Symptoms of pantothenic acid deficiency in humans include vomiting, abdominal pain, muscle cramps, and fatigue. Experimental studies on laboratory animals have shown signs such as growth retardation, infertility, nervous system disorders, changes in hair color, skin lesions, small intestine ulcers, and hair loss. No symptoms of excess intake are known (Tan and Goh, 2021).

Vitamin B6

It is produced by intestinal microflora or body tissues. It is most abundant in liver, grains, fish, vegetables, yeast, kidney, bulgur, rice, and peanuts. It is essential for the metabolism of carbohydrates, proteins, and fats, and for the synthesis of hemoglobin (Liu and Zhao, 2020).

B6 deficiency can cause dermatitis, digestive disorders, and convulsions. It may also lead to neuritis and seborrheic skin diseases (Liu and Zhao, 2020).

Vitamin B7 (Biotin / Vitamin H)

Biotin is a growth factor essential for all living beings. It is also synthesized by bacteria in the intestines. The best sources are egg yolk, liver, kidney, yeast, cauliflower, and tomatoes. It acts as a coenzyme in various metabolic reactions in the body (Xie and Sun, 2021).

Since biotin is present in sufficient amounts in daily foods, deficiency symptoms are rarely observed. No signs of toxicity or excess intake are known (Xie and Sun, 2021).

Vitamin B11 (Folic Acid)

Folic acid is a B-group vitamin involved in protein metabolism and helps protect against anemia. It plays a major role in the formation of red blood cells and is also known as “folate.” In the body, folic acid is used after being converted to its free form. It is found in high amounts in liver, yeast, green vegetables, kidney, grains, citrus fruits, walnuts, tomatoes, eggs, and fish (Liu and Zhao, 2020).

Folic acid deficiency leads to a decrease in blood production. It is especially common in pregnant women and children. Causes of deficiency include poor diet (particularly low fruit and vegetable intake), malabsorption, and excessive loss from the body. Deficiency is often seen in alcoholics and during pregnancy (Liu and Zhao, 2020).

Vitamin B12 (Cobalamin, Extrinsic Factor)

Vitamin B12 has a complex structure and performs many important functions in the body. It is particularly abundant in organ meats such as liver, kidney, and seafood. This vitamin is essential for cellular energy production, DNA synthesis, and the healthy functioning of the nervous system. Since it is not found in plant-based foods, vegetarians and vegans are at higher risk of B12 deficiency (Xie and Sun, 2021).

B12 deficiency can result in neurological disorders and pernicious anemia. Numbness in the arms and legs, decreased sensation, mental distress, and convulsions are the most prominent symptoms. Especially in those who consume only plant-based foods, or when food storage and cooking are inadequate, significant vitamin loss may occur. This vitamin is found only in animal-based foods (Xie and Sun, 2021).

3.5.5.6. Vitamin C (Ascorbic Acid)

Although it can be synthesized by plants and some animals, it cannot be synthesized by the human body and must be obtained through diet. It is the most unstable vitamin. The functions of vitamin C in the body include: (1) Participating in the synthesis of collagen, a component of connective tissue, (2) Enhancing the strength of bones and teeth, (3) Helping maintain the health and durability of blood vessel walls, (4) Reducing the severity of allergic reactions, (5) Promoting the healing of wounds and burns, (6) Protecting the body from infections and bacterial toxins, (7) Assisting in the absorption and utilization of certain vitamins, iron, and calcium, (8) Helping prevent cancer. It is most commonly found in citrus fruits, tomatoes, and potatoes. Recent studies have also found it in green peppers, kiwi, grape leaves, turnip greens, cauliflower, strawberries, peaches, spinach, liver, and green beans (Miller and Chan, 2019).

In cases of vitamin C deficiency, symptoms such as bleeding gums, abnormalities in teeth, fatigue, lack of motivation, and joint pain may occur. Severe deficiency can lead to scurvy. A weakened immune system, increased susceptibility to febrile illnesses, and frequent infections can also be associated with inadequate vitamin C intake. When consumed in excess, vitamin C is excreted through urine. However, excessive intake beyond the body's needs may lead to kidney stone formation, diarrhea, and allergic skin reactions (Miller and Chan, 2019).

3.5.6. Water

Water is one of the fundamental elements of life. In addition to being a nutrient, it plays a major role in enabling biochemical reactions in the body due to its content of minerals and compounds. Water helps maintain the body's acid-base balance, transports nutrients, and removes waste products. It is essential for the proper functioning of cells and the continuation of life. Therefore, water is not just a beverage—it is a vital fluid for life (Institute of Medicine, 2005).

The water content in our bodies varies depending on age. For example, while approximately 60% of an adult's body weight consists of water, this ratio can reach up to 75% in infants (Popkin et al., 2010). This age-related difference in body water content is important for understanding how metabolism works and how it affects health.

Water deficiency can cause health issues such as fatigue, dizziness, and difficulty concentrating (Armstrong et al., 2012). When the body is dehydrated, cells cannot function properly, which may lead to life-threatening conditions. Therefore, regular water consumption is critically important for maintaining health.

People meet their water needs not only from drinking water but also from foods and beverages. For example, fruits and vegetables, with their high water content, contribute significantly to hydration (World Health Organization, 2005).

Conclusion and Recommendations

In conclusion, adequate and balanced nutrition (healthy eating) can be defined as a conscious behavior aimed at maintaining, improving, and enhancing the quality of life at every stage, by consuming the essential nutrients the body needs in the right amounts and at the right times.

In this context, maintaining healthy eating habits and making correct food choices are essential for sustaining a healthy life. Individuals are encouraged to have sufficient nutritional knowledge and to apply this knowledge in their dietary practices.

3.6. FOOD LITERACY DURING PREGNANCY

Dr. Fatma Nazlı Demir[34]

Food and nutrition literacy encompasses individuals having accurate knowledge, attitudes, and skills regarding topics such as food, nutrition, food choice, food consumption, healthy eating, food security, and food safety. It also includes making informed decisions in these areas and developing behaviors aligned with them. The formation of a healthy individual begins in the womb. It is extremely important for an expectant mother to become aware of which foods she needs and which ones she should avoid during pregnancy, to develop the appropriate attitudes, and in essence, to develop pregnancy-specific food literacy. The following information has been written to contribute to pregnant women's nutrition literacy.

During pregnancy, the baby's growth and development, the mother's physiological adaptation, and changing nutritional needs require special attention. Adequate intake of macro and micronutrients by the mother promotes normal embryonic and fetal development. In contrast, malnutrition or overnutrition (e.g., obesity) can be associated with adverse pregnancy and pediatric outcomes. These may include miscarriage, certain congenital anomalies, pregnancy-related hypertension, gestational diabetes, preterm birth, fetal growth restriction, and small for gestational age infants.

Maternal nutritional status is a modifiable risk factor that can be assessed, monitored, and improved when necessary. It is important that these changes begin before pregnancy, because dietary adjustments made during pregnancy may not be early enough to prevent certain outcomes—such as folic acid supplementation

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to prevent neural tube defects or the onset of gestational diabetes associated with obesity. Ideally, individuals should have a healthy Body Mass Index (BMI) and be in an optimal nutritional state when they become pregnant; however, in reality, approximately 50% of women in high-income countries have a high BMI at the time of conception, and many women have insufficient micronutrient levels, especially in terms of iron and folate.

3.6.1. General Nutritional Guidelines for Optimal Pregnancy Outcomes

Following a healthy dietary pattern should include the consumption of:

- All types of vegetables: dark green, red and orange vegetables; legumes, peas, and lentils
- Fruits
- Grains
- Dairy products: fat-free or low-fat milk, yogurt, cheese, lactose-free versions, and fortified soy beverages and yogurt alternatives
- Protein-rich foods: lean meats, poultry, and eggs; seafood; legumes; nuts, seeds, and soy products
- Fats: oils from plants, seafood, and nuts (excluding tropical oils high in saturated fatty acids)

Consuming mostly unprocessed foods and beverages in appropriate amounts is important to ensure adequate but not excessive weight gain during pregnancy.

Limiting the intake of sugars, saturated fats, and sodium: Pregnant individuals often exceed the recommended limits for these components, which may lead to adverse health outcomes. The focus should be on increasing the intake of high-quality, nutrient-dense foods and limiting the consumption of processed foods and beverages that provide "empty calories." Avoiding or minimizing ultra-processed foods is a key way to reduce the intake of sugar, saturated fat, and sodium.

Appropriate Weight Gain During Pregnancy: Weight gain is monitored regularly throughout pregnancy. For healthy adult women, normal weight gain during pregnancy is 10–14 kg (approximately 1–1.5 kg per month). However, for those who begin pregnancy overweight, a total weight gain of 7–9 kg may be sufficient. The risk of pregnancy complications is higher at both the low and high ends of BMI and weight gain.

Avoiding Alcohol and Other Known or Potentially Harmful Substances

Limiting Caffeine Intake to 200–300 mg per day:

- 1 cup (200 ml) of filter coffee: 135–200 mg
- 1 cup (60 ml) of espresso: 100 mg
- 1 cup (200 ml) of cappuccino: 100 mg
- 1 cup of Turkish coffee: 57 mg

Caloric Intake: In the first trimester, the estimated daily energy requirement is similar to that of non-pregnant individuals. In the second and third trimesters, the daily energy requirement is calculated based on age, height, pre-pregnancy weight, gestational age, activity level, and additional caloric needs for energy storage: +300 kcal/day for underweight BMI, +200 kcal/day for normal BMI, +150 kcal/day for overweight BMI, −50 kcal/day for obese BMI. Applications to simplify this calculation are currently in development.

3.6.2. Macronutrients

Protein: In the second and third trimesters, the recommended dietary intake for protein is 71 g (1.1 g/kg/day), which is higher than the recommended amount for non-pregnant individuals (46 g/day or 0.8 g/kg/day). The increase in protein intake should be proportional to total calorie intake, as protein-derived calories account for 10% to 35% of total calorie intake in both pregnant and non-pregnant individuals. Healthy protein sources include lean meats, poultry, eggs, seafood, beans, peas, lentils, nuts, seeds, and soy products. Highly processed meats are not recommended. The use of special protein powders and high-protein supplements is not advised. For pregnant individuals, especially those with adequate protein intake, high-protein supplements have shown no identified benefit.

Carbohydrates and fiber-rich foods: During pregnancy, carbohydrate requirements increase from 130 g/day (for non-pregnant women) to 175 g/day. This increase is proportional to the rise in calorie requirements during pregnancy.

The recommended fiber intake during pregnancy is 28–36 g per day. Combined with sufficient fluid intake, this may help prevent or reduce constipation. High fiber intake may also have positive effects on blood glucose levels.

Fats: For pregnant individuals, it is recommended that 20% to 35% of total energy

intake comes from fats, with less than 10% from saturated fats. The daily target for essential fatty acids is 13 g linoleic acid (18:2) and 1.4 g linolenic acid (18:3). These targets are part of a healthy dietary pattern.

3.6.3. Micronutrients

During pregnancy, the requirements for most micronutrients increase. The needs for certain nutrients (such as calcium, magnesium, phosphorus, potassium, zinc, and vitamins A, C, and K) vary depending on the mother's age. Ideally, all or most nutrients should be obtained from nutrient-dense, fortified, and unprocessed foods and beverages. However, some nutrients (e.g., calcium, vitamin D, potassium, folate/folic acid, iron, iodine, and choline) are commonly underconsumed.

Multiple micronutrient supplements: Studies conducted in low- and middle-income countries, where micronutrient deficiencies are common, have shown that multiple micronutrient supplements during pregnancy slightly reduce the rate of low birth weight and may reduce the risk of preterm birth.

Well-nourished individuals may not need multiple micronutrient supplements to meet their daily needs. Supplements are recommended for groups at increased risk of micronutrient deficiencies (e.g., individuals with multiple pregnancies, heavy smokers, adolescents, vegans, substance users, and those who have undergone bariatric surgery or have gastrointestinal disorders due to malabsorption, such as Crohn's disease or intestinal resection). Daily supplements should generally include the key vitamins/minerals that are difficult to meet through diet alone, such as iron, folic acid, calcium, vitamin D, and iodine. In addition to these core nutrients, supplements should also provide adequate amounts of vitamins A, E, and C, B vitamins, and zinc.

3.6.4. Harmful Supplements and Food Consumption

The use of over-the-counter supplements is common, and many cases of vitamin or mineral toxicity due to overuse have been documented. Overconsumption of certain foods may also be potentially toxic for the fetus.

Preformed Vitamin A Supplements: High doses of preformed vitamin A (more than 10,000 IU per day) appear to be teratogenic. Unless there is a serious deficiency, pregnant individuals should avoid multivitamin or prenatal supplements that contain more than 5,000 IU (1,500 mcg retinol equivalent) of preformed vitamin A. Most supplements contain provitamin A carotenoids such as beta-carotene instead of preformed vitamin A (retinol, retinyl esters); high beta-carotene intake has not been associated with congenital abnormalities.

Liver: Liver is rich in preformed vitamin A. Therefore, it is recommended that liver consumption be avoided during pregnancy.

Iodine in Supplements and Seaweed: Excessive iodine intake may cause fetal goiter, but the safe upper limit of iodine intake during pregnancy is unclear. Cases of congenital hypothyroidism have been reported in pregnant individuals consuming between 2.3 and 12.5 mg of iodine per day. This amount exceeds the recommended dietary intake by more than tenfold.

Processed Trans Fatty Acids: Should be minimized as much as possible. These fatty acids can negatively affect fetal growth and development by interfering with essential fatty acid metabolism.

3.6.5. Supplements with No Proven or Uncertain Benefit During Pregnancy

Vitamin E, Vitamin C, Vitamin B6

Probiotics: The use of probiotic supplements is becoming increasingly popular; however, caution is advised during pregnancy due to the lack of conclusive evidence regarding their benefits and risks.

3.6.6. Fluid Requirements

Water and Other Fluids: During pregnancy, the estimated adequate intake of fluids (from water and other beverages) is approximately 2.3 L per day (about 10 cups). In addition, many factors such as ambient temperature, humidity, physical activity, exercise, and illness can affect total water needs.

Fluoride: Fluoride supplementation is not necessary during pregnancy. However, pregnant individuals who do not drink fluoridated water or who only consume non-fluoridated bottled water may not receive adequate fluoride.

3.7. NUTRITION IN SPECIAL CIRCUMSTANCES

Assoc. Prof. Dr. Arzu Altunkaya Dinçay[35]

3.7.1. Nutrition of Pregnant and Lactating Women

Nutrition is the intake of each of the energy and nutrients we need in appropriate amounts and at the right times to support growth and development, maintain health, and improve quality of life (World Health Organization [WHO], 2020).

Nutrition is not about suppressing hunger, satisfying one's appetite, or eating whatever one craves. The nutrients found in foods—proteins, fats, carbohydrates, minerals, and vitamins—are known as nutritional elements. These are divided into two groups: macronutrients and micronutrients. Macronutrients include proteins, fats, and carbohydrates; micronutrients consist of vitamins and minerals. Consuming these nutrients in specific amounts is of great importance for human health (Brown, 2011). This indicates that rather than simply eating, individuals must integrate all the necessary nutrients into their lives in sufficient quantities and in a balanced way.

Nutrition is an indispensable process of human life, but the required intake of nutrients can vary in certain circumstances. Studies have shown that factors such as gender, illness, age, physical activity, and pregnancy influence the type of nutrition and the amount of nutrients that should be consumed (Kaiser & Allen, 2008). During pregnancy, the amount of these nutrients needed changes compared to non-pregnant individuals. Considering the expected physiological changes during pregnancy, nutrition becomes even more critical. The needs of both the mother and the baby can only be met through adequate and balanced nutrition, which is key to a healthy pregnancy (Picciano, 2003). Nutrients that the mother does not consume adequately or at all may pose life-threatening risks to both her and the baby.

Nutrition during pregnancy is closely linked to the health of both mother and baby. The fetus grows and develops through the transfer of nutrients from the mother's daily diet via the placenta. In addition to the mother's own nutritional needs, the needs of the fetus must also be met. The energy and nutrients required for the milk produced to feed the newborn are derived from the mother's diet and her body's nutrient stores (Institute of Medicine, 2006). Therefore, during lactation, it is crucial for the mother to not only meet her own physiological needs but also to fully cover the energy and nutrients needed for milk production while maintaining her own nutrient reserves.

Pregnant women who are malnourished or consume an unbalanced diet face a higher risk of nutrition-related complications. Poor maternal nutrition during pregnancy can negatively impact the baby's length and weight (Kramer & Kakuma, 2003). It may also adversely affect mental development and lead to permanent developmental delays (Georgieff, 2007). Additionally, the baby meets its needs by drawing nutrients from the mother's tissues, depleting her stores and potentially causing conditions such as weight loss, anemia, tooth decay, and osteomalacia (Allen, 2005).

During lactation, the energy needed for breast milk production comes from two sources: energy stored as body fat during pregnancy, and energy derived from dietary intake. A breastfeeding mother must eat adequately and maintain a balanced diet to replenish her nutrient stores and to meet the energy, protein, vitamin, and mineral demands of milk production (Butte et al., 2004). To ensure sufficient milk production, it is necessary to consume at least 8–12 glasses of fluids per day (AAP, 2012). Nutrient-rich drinks such as milk and fruit juice are preferable alongside water.

Although calorie intake and weight gain are important indicators of nutrition during pregnancy, achieving adequate and balanced nutrition is more important than merely consuming calories (IOM, 2006). To protect both maternal and fetal health, it is essential to maximize nutritional quality and meet nutrient requirements. This is crucial for the fetus to begin and maintain a healthy life and to reduce the risk of chronic diseases in adulthood. Factors such as maternal age, pre-pregnancy body weight, nutrient stores, and physical activity influence the daily energy and nutrient requirements of women during pregnancy and lactation (King, 2003).

Pregnant women need an additional 200–300 kcal of energy daily, while vitamin and mineral needs can increase by 20–100%. Protein is essential for the developing fetal cells, maternal bodily changes, and especially the placenta. The need for vitamin B6, B12, and folic acid also increases to support protein synthesis and

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new cell production (Molloy et al., 2008). Additionally, women with limited sun exposure should receive vitamin D supplementation (Holick, 2007).

Based on these findings, it is believed that a baby's future health is determined from the moment of conception through the first 1000 days of life (Victora et al., 2010). Nutrition during pregnancy and lactation is not only linked to the mother's health but is also critical for the baby to have a healthy life. Nutrition encompasses not just adequacy but also balance. Dietary diversity is important not only for obtaining necessary macro- and micronutrients but also for consuming non-nutrient components such as phytochemicals and flavonoids (Boeing et al., 2012). Therefore, recommendations should not only focus on meeting mothers' energy and macronutrient needs, but also aim to enhance dietary quality through variety.

3.7.2. Child Nutrition

Nutrition, in its simplest definition, is the process of consuming and effectively utilizing the nutrients necessary for growth, sustaining life, and maintaining health (Whitney & Rolfes, 2016). This dynamic process especially requires the intake of sufficient and balanced energy and nutrients during childhood to ensure healthy development and for individuals to reach their full potential (Nelson Textbook of Pediatrics, 2020).

The critical role of raising healthy individuals in the socio-economic development of nations is increasingly recognized. As emphasized by Hasipek and Sürücüoğlu (1994), the need for mentally and physically strong, healthy, and capable generations is undeniable for societies to reach their desired level of civilization. In this context, adequate, balanced, and consistent nutrition from birth onward forms the essential foundation for a child to reach their optimal growth and development potential (Waterlow et al., 1988).

One of the most important factors that directly influences not only physical but also emotional and social development in children is adequate and balanced nutrition suited to the child's age, gender, and physical activity level (Krebs & Jacobson, 2003). While nutrition plays an important role in the etiology and treatment of adult health problems, it holds an even more central place in the lives of children. Among the pediatric age group, it is one of the primary factors shaping growth and development (Fomon, 1974).

3.7.2.1. Nutrition Between Ages 1–5

The period between ages one and five is a critical stage during which children's motor skills rapidly develop, their interactions with the environment increase, and they undergo significant learning processes (Piaget, 1952). During this phase, children may begin to show clear preferences or aversions to certain foods (Carruth et al., 2004). They may become less interested in food and more focused on their surroundings. Generally, they tend to prefer vegetables less and may dislike eating mixed foods. Although this process can be challenging for families, it is usually temporary and a sign that the child is beginning to explore food-related autonomy (Satter, 1983). Children may want to see foods in familiar forms, and during this time, families and caregivers should offer a variety of healthy foods, avoid creating routines around specific foods, and allow for some food refusal behaviors (Birch, 1998; Story et al., 2002).

The primary goal of nutrition in the preschool years is to support optimal growth and development by providing sufficient dietary variety (Williams Textbook of Endocrinology, 2016). While growth rate slows relatively during this period, motor skills progress rapidly. Therefore, establishing regular meal planning, fostering healthy eating behaviors, and laying the foundation for lifelong positive nutritional habits should be the focus (American Academy of Pediatrics, 2020).

One common behavior in children aged one to five is food refusal as a way to express discontent with family members or their environment (Forestell & Mennella, 2007). Family mealtimes may sometimes become conflict zones, and negative situations such as criticizing, punishing, or comparing the child to others during meals can contribute to food refusal (Hughes et al., 2005). Fluctuations in appetite may also reflect a child's overall behavior. Many eating problems in the preschool period are linked to psychological factors; some children may refuse to eat just to attract attention. Although this phase can be difficult for parents, it is generally temporary, and it's important for families to remain patient and understanding. Parents should observe their child's eating behaviors and note which foods are rejected.No snacks or drinks should be given about 1–1.5 hours before meals. Even a small snack can prevent the child from eating their main meal adequately. Excessive consumption of soft drinks instead of water or milk can lead to feelings of fullness and may cause chronic nonspecific diarrhea and carbohydrate malabsorption (Walker-Smith, 1975; Lifshitz & Aiges, 1985).

Excessive milk consumption can also interfere with the intake of other nutrients and create a sense of fullness. Therefore, daily milk consumption should be limited to 2–3 cups (500–750 ml) (Daniels et al., 2009). During this period, families should pay attention to the following points: preparing portions suitable for the child's needs, encouraging positive eating behaviors, making food easy for the child to eat, allocating sufficient time for meals, and offering a variety of foods.

3.7.2.2. Nutrition During School Age (6–12 Years): Integration into Society and Increasing Needs

With school age (6–12 years), children consciously step into a broader social life for the first time. The school period, which spans from ages 5 to 19, is critically important for building a healthy society (World Health Organization, 2003). The school years have their own dynamics in terms of growth, development, and nutrition. Growth continues at a steady but slower pace during primary school, while it accelerates significantly during adolescence (Tanner, 1962). For growth to proceed according to standards, children must adequately meet their energy and nutrient needs (Food and Nutrition Board, Institute of Medicine, National Academies, 2002).

Nutrition during the school years is crucial not only for growth and development but also for preventing chronic diseases later in life, such as obesity, type 2 diabetes, and cardiovascular disorders (Dietz, 1998; Willett, 2002). Various studies have shown that students who are undernourished or have unbalanced diets exhibit impaired growth and development, shortened attention spans, reduced cognitive ability, and difficulties in learning (Pollitt, 1995; Taras, 2005). During this phase, when lifelong attitudes and behaviors begin to form, the increased nutritional needs—such as protein, energy, vitamins, and minerals—must be met through a well-balanced and adequate diet.

For children's bone and dental development, consumption of calcium-rich foods such as milk, yogurt, and white cheese is important (Heaney, 2000). Daily intake of fresh fruits and vegetables is also recommended to enhance immunity and support healthy functioning of the eyes, skin, and digestive system (Block et al., 1992).

3.7.2.3. Nutrition During Adolescence (10–19 Years): Rapid Changes and Increased Demands

The post-primary school period, adolescence, is a transitional stage from childhood to adulthood characterized by rapid physical, emotional, and social growth and development. The World Health Organization (WHO) defines adolescents as individuals aged 10–19 years (World Health Organization, 2018).

During this period, increased basal metabolic rate leads to significantly higher energy requirements (Heaney, 2000). Due to increased muscle mass, blood volume, and hormonal changes, protein needs also rise (Forbes, 1985). In adolescents, 50–55% of daily energy intake should come from carbohydrates (Williams Textbook of Endocrinology, 2016). Dietary fats are critical for providing essential fatty acids and facilitating the absorption of fat-soluble vitamins (Whitney & Rolfes, 2016).

In parallel with increased energy demands during adolescence, the need for B vitamins such as thiamin, riboflavin, and niacin also rises to support carbohydrate metabolism (Institute of Medicine, 1998). During growth spurts, increased tissue synthesis and DNA/RNA metabolism require higher intake of folic acid and vitamin B12 (Allen, 2009). Accelerated skeletal growth increases the need for vitamin D (Holick, 2004). In order to maintain the structure and function of newly formed cells, the need for vitamins A, C, and E also rises (Bendich, 1993).

Among adolescent girls, the onset of menstruation increases iron requirements compared to boys (Bothwell, 1982). Zinc is also critically important during this period for growth, immune functions, and sexual maturation (Prasad, 1991).

Therefore, early interventions to reduce consumption of foods that exceed recommended limits in added sugars, saturated fats, and sodium support the development of healthy dietary habits in youth (World Health Organization, 2015). To increase food diversity in this age group, each meal should include foods from different food groups. A minimum of five servings of fruits and vegetables per day should be encouraged, and protein-rich foods should be regularly included in the diet. Dairy products should be emphasized to meet calcium and protein needs (National Osteoporosis Foundation, 2010).

3.7.3. Nutrition During Menopause

Menopause marks the end of a woman's reproductive life and typically occurs between the ages of 45 and 55. During this time, hormonal changes occur, especially a decline in estrogen and progesterone levels, leading to various physical and metabolic changes in the body. Menopause is not only the cessation of menstruation but also a period of significant transformation that can affect a woman's overall health.

During this stage, the body's nutritional needs also change, and maintaining a sufficient and balanced diet is critically important to support health post-menopause.

3.7.3.1. The Biological Process of Menopause and Nutritional Needs

Menopause begins with changes in the body's hormone production. This process typically follows the perimenopausal period, which lasts around 1–2 years, and is marked by the complete cessation of menstruation. In the postmenopausal phase, the drop in estrogen levels leads to many physiological changes, such as decreased bone density, increased risk of cardiovascular disease, metabolic alterations, weight gain, hot flashes, sweating, and emotional fluctuations (Sturdee & Panay, 2010).

Nutrition and Adequate Energy Intake: The menopausal period is generally associated with a decrease in energy requirements. Nevertheless, it is still crucial for women to consume a balanced intake of nutrients and meet their energy needs. Changes in physical activity levels, body composition, and metabolic rate can influence caloric needs during this time. Thus, maintaining body weight depends on appropriate energy intake (Bergmann et al., 2015).

3.7.3.2. Menopause and Nutrients

During menopause, the requirements for some nutrients increase, while others may decrease. For example, due to estrogen's effect on bone health, calcium and vitamin D intake should be increased to protect bone health after menopause (Christie et al., 2014). Additionally, the decline in estrogen production raises the risk of cardiovascular issues such as heart disease and hypertension, requiring a reduction in saturated fats and cholesterol in the diet.

Calcium and Vitamin D

Calcium is a critical mineral for maintaining bone health and reducing the risk of osteoporosis. Postmenopausal women face a higher risk of bone loss, making increased calcium intake important. Vitamin D is also essential for the effective absorption and utilization of calcium. In regions with limited sun exposure, vitamin D supplementation may be necessary (Bolland et al., 2011).

Iron

As menstrual bleeding stops with menopause, women’s iron requirements decrease. However, a reduction in iron intake can lead to health issues such as anemia. Therefore, it is important for postmenopausal women to monitor their iron intake, but avoid excessive or unnecessary iron supplementation (Sokol et al., 2011).

Fatty Acids

The type of fat consumed becomes especially important during menopause. Saturated and trans fats can increase the risk of heart disease and should be limited in the diet. Instead, the intake of monounsaturated fats and omega-3 fatty acids should be increased. Omega-3s help support cardiovascular health and reduce inflammation (O’Connor et al., 2017).

3.7.3.3. Cardiovascular Health and Hypertension

The decline in estrogen levels during menopause increases the risk of heart disease and hypertension. Therefore, it is important for menopausal women to consume foods rich in potassium, magnesium, and dietary fiber. Potassium helps regulate blood pressure, while magnesium supports heart health. Excessive sodium intake should be avoided (Barton et al., 2012).

3.7.3.3. The Role of Physical Activity During Menopause

Women in the menopausal period can maintain a healthy body weight, preserve bone density, and improve cardiovascular health through regular physical activity. Aerobic exercises, strength training, and stretching provide significant health benefits after menopause (Kokkinos et al., 2012). Moreover, physical activity may help alleviate menopausal symptoms such as hot flashes and night sweats.

Conclusion and Recommendations

The menopausal period is a significant transitional phase that can affect women's health. Nutrition and physical activity habits play a critical role in alleviating the negative effects of this phase. Adequate intake of calcium and vitamin D, avoiding saturated fats, consuming sufficient protein, and engaging in regular

physical activity are essential for ensuring a good quality of life for women during menopause. Nutrition not only aids in weight control but also helps reduce the risk of heart disease, hypertension, bone loss, and other health issues.

3.7.4. Nutrition in the Elderly

According to the World Health Organization, old age is defined as the period covering individuals aged 65 and over. As the global elderly population grows rapidly, age-related health problems are gaining increasing importance, and nutrition lies at the center of these concerns. In elderly individuals, nutrition aims not only to provide sufficient energy and nutrients but also to improve quality of life and prevent diseases. As people age, inevitable physiological changes occur in the body. These changes significantly impact nutritional needs and the ability to process nutrients. A decrease in metabolic rate, reduction in muscle mass (sarcopenia), and decrease in bone density (osteoporosis) require special attention to the dietary patterns of elderly individuals (Morley, 2001). Inadequate and unbalanced nutrition can negatively influence these physiological changes, exacerbate chronic conditions, and lower quality of life.

3.7.4.1. The Critical Importance of Nutrition in Old Age

Old age is a stage with high risk for nutritional deficiencies. Factors such as decreased appetite, changes in taste and smell perception (Schiffman, 1997), chewing and swallowing difficulties (dysphagia), reduced functional capacity of the gastrointestinal system, and the effects of certain medications on nutrient absorption can all contribute to undernutrition. Additionally, social isolation and economic difficulties can adversely impact eating habits. Undernutrition can weaken the immune system, increase the risk of infections, reduce muscle strength and functionality, raise the risk of bone fractures, and ultimately shorten life expectancy (Guigoz, 2006). Therefore, the nutritional status of elderly individuals should be regularly assessed, and nutrition strategies tailored to individual needs must be developed.

3.7.4.2. Key Principles of Nutrition in Old Age

To support healthy aging, the following fundamental principles and current scientific approaches should be considered:

1. Energy Balance and Nutrient Density: While energy requirements generally decrease with age, the need for vitamins, minerals, and other essential nutrients may remain the same or even increase (Russell, 2001). Therefore, consumed foods should be low in energy but high in nutritional value. Processed, high-calorie, low-nutrient foods should be avoided, and instead, nutrient-dense foods like vegetables, fruits, whole grains, and lean protein sources should be preferred.
2. Importance of Protein Intake and Management of Sarcopenia: Sarcopenia, the age-related loss of muscle mass, is a major issue in older adults, leading to functional impairment, increased risk of falls, and reduced quality of life (Cruz-Jentoft et al., 2019). Adequate protein intake stimulates muscle protein synthesis, helping maintain muscle mass. The recommended daily protein intake for older adults is 1.0–1.2 grams per kilogram of body weight, and this may increase in cases of illness or stress (Bauer et al., 2013). Distributing protein intake evenly throughout the day and consuming protein-rich in leucine (dairy, eggs, meat) are beneficial for muscle health.
3. Role of Fiber and Gut Health: Fiber-rich foods help prevent constipation, regulate blood sugar, and control cholesterol levels, all of which are common concerns in older adults (Anderson et al., 2009). Additionally, dietary fiber supports gut microbiota health, which strengthens the immune system. A daily intake of 25–30 grams of fiber is recommended, which can be achieved through whole grains, vegetables, fruits, and legumes.
4. Fat Quality and Cardiovascular Health: The risk of cardiovascular diseases increases with age. Therefore, intake of saturated and trans fats should be limited, while monounsaturated and polyunsaturated fats (olive oil, avocado, nuts, seeds) and especially omega-3 fatty acids (fish, flaxseeds, walnuts) should be prioritized (Willett, 2000). Omega-3s may help protect heart health and support cognitive functions due to their anti-inflammatory effects.
5. Vitamin and Mineral Requirements and Supplements: Deficiencies in certain vitamins and minerals are common in older adults. Key micronutrients to monitor include vitamin D, calcium, vitamin B12, and folic acid (Allen, 2008).
    a. Vitamin D and Calcium: These are vital for bone health. Due to reduced sun exposure and inadequate dietary intake, supplementation may be necessary. Adequate vitamin D levels are crucial for calcium absorption.
    b. Vitamin B12: Necessary for nerve function and red blood cell production. Absorption can be impaired due to reduced stomach acid, making supplementation important.

c. Folic Acid: Essential for DNA synthesis and cell division. Adequate intake may help preserve cognitive functions.

Vitamin and mineral levels should be checked regularly, and appropriate supplements should be used under medical or dietitian supervision.

6. Importance of Fluid Intake and Prevention of Dehydration: The sense of thirst may diminish with age, and kidneys' ability to retain water can decline, increasing the risk of dehydration (Rolls & Engell, 1991). Adequate fluid intake is essential for kidney function, electrolyte balance, and prevention of constipation. At least 1.5–2 liters of fluids daily (water, herbal teas, diluted juices, soups) is recommended.
7. Meal Frequency and Portion Control: Eating smaller, more frequent meals instead of large and infrequent ones aids digestion, stabilizes blood sugar, and maintains energy levels. Portion control also helps manage weight by preventing excess calorie intake.
8. Conscious Management of Salt and Sugar Consumption: High salt intake increases the risk of hypertension (He & MacGregor, 2009). Hidden salt in processed foods should be noted, and table salt use should be limited. Excess sugar consumption raises the risk of obesity, type 2 diabetes, and cardiovascular diseases. Sugary drinks and processed sweets should be avoided.

3.7.4.3. Strategies for Addressing Nutritional Issues in Old Age

Here are some effective strategies for addressing potential nutritional issues that may arise in old age:

- Coping with Loss of Appetite: Offering small portions of nutrient-dense foods, preparing favorite meals, making meals more visually appealing (colorful vegetables, creative presentations), engaging in light physical activity before meals, and eating in a social environment can help stimulate appetite.
- Managing Chewing and Swallowing Difficulties: Modifying the texture of foods (pureed, mashed, or liquid forms), eating in small bites, chewing thoroughly, and eating slowly are important. Support from a speech and language therapist can be sought for swallowing rehabilitation.
- Dealing with Loss of Taste and Smell: Enhancing meals with various spices, herbs, and aromas; offering foods with different tastes and textures; and preparing visually appealing plates can stimulate the sense of taste. However, excessive use of salt or sugar should be avoided.
- Reducing the Effects of Social Isolation: Participating in social meal activities through family members, friends, or community centers supports regular eating habits and helps reduce feelings of loneliness.
- Coping with Economic Constraints: Choosing seasonal and affordable foods, using batch cooking methods, and making use of leftovers can be economically helpful. Getting information about local food banks and support programs can also be beneficial.

Conclusion

Old age is a critical phase that requires careful assessment of individual nutritional needs and support through appropriate strategies. Healthy and balanced nutrition allows elderly individuals to maintain physical and mental well-being, reduce the effects of chronic diseases, and lead a more active and independent life. Therefore, cooperation between older adults, their families, caregivers, and healthcare professionals is vital to ensure optimal nutritional status during this important life stage. It should not be forgotten that each individual has different nutritional requirements, and personalized nutrition plans form one of the cornerstones of healthy aging. Seeking professional support from a geriatric specialist or a registered dietitian will help meet the nutritional needs of older adults correctly.

3.7.5. Nutrition of Workers

Working life is a period in which individuals exert significant physical and mental effort. During this time, adequately and appropriately meeting the body's energy and nutrient needs is of vital importance for protecting workers' health, increasing productivity, and supporting overall well-being (Pelletier, 2011). Inadequate or unbalanced nutrition can lead to workforce loss, fatigue, lack of concentration, increased risk of work-related accidents, and various long-term health problems (Burton et al., 2005). This section will focus on workers' nutritional needs and present essential principles and practical suggestions for a healthy working life.

3.7.5.1. Importance of Workers' Nutrition

Proper nutrition is a basic necessity for workers to be healthy and productive, just like suitable working conditions and safety measures. The physical and mental demands of the work environment increase the body's need for energy and nutrients (Åstrand & Rodahl, 1986). In cases of inadequate nutrition, the following issues may arise in workers:

- Low Energy and Fatigue: Insufficient intake of carbohydrates (Finkelstein et al., 2000) and other energy sources can lead to chronic fatigue, which negatively affects work performance.
- Attention and Concentration Problems: Insufficient intake of glucose, vitamins, and minerals necessary for brain function can lead to difficulty focusing and increase the risk of errors (Bryan, 2004).
- Weakened Immune System: Inadequate intake of protein (Grimble, 2001), vitamins, and minerals can weaken the immune system, making workers more vulnerable to illnesses. This situation can increase workforce losses.
- Decreased Muscle Strength and Endurance: For those in physically demanding jobs, adequate protein intake is essential for maintaining muscle mass and strength (Phillips et al., 2012). Insufficient protein can reduce work productivity.
- Increased Risk of Chronic Diseases: Unhealthy eating habits in the long term can increase the risk of chronic diseases such as obesity (Malik et al., 2006), diabetes (Brand-Miller et al., 2003), heart disease (Keys et al., 1986), and certain cancers. These issues can result in workforce loss and increased healthcare costs.

3.7.5.2. Basic Nutritional Needs of Workers

Workers' nutritional needs vary depending on the type, intensity, and hours of their work, as well as their individual characteristics (age, gender, health status) and environmental factors (climate, work environment). However, some basic nutritional principles should be followed:

- Adequate Energy Intake: Sufficient calories should be consumed to replace energy expended during work (FAO/WHO/UNU, 2004). Energy needs should be adjusted according to the physical or mental intensity of the job. Main sources of energy are carbohydrates (whole grains, vegetables, fruits) and fats (healthy fats).
- Sufficient and High-Quality Protein Intake: Adequate protein intake is essential for muscle repair and development, immune function, and enzyme production (Wolfe, 2017). Good protein sources include meat, poultry, fish, eggs, dairy products, legumes, and tofu. Those in labor-intensive jobs may require more protein (Lemon, 1998).
- Consumption of Fiber-Rich Foods: Fiber-rich foods such as vegetables, fruits, whole grains, and legumes help regulate the digestive system, balance blood sugar levels, promote satiety, and support heart health (Anderson et al., 2009).

- Importance of Healthy Fats: Monounsaturated and polyunsaturated fats like olive oil (Trichopoulou et al., 2003), avocado, nuts, and seeds, along with omega-3 fatty acids (Simopoulos, 2002) found in fish, flaxseed, and walnuts, are important for brain function, cell health, and reducing inflammation. Saturated and trans fats should be avoided.
- Vitamin and Mineral Intake: Adequate intake of essential vitamins and minerals is crucial for various bodily functions (Institute of Medicine, 2006). Specifically, iron (Bothwell, 1982) (for energy production and oxygen transport), iodine (Zimmermann, 2009) (for thyroid function), calcium and vitamin D (Holick, 2004) (for bone health), B vitamins (Kennedy, 2016) (for nervous system and energy metabolism), vitamin C (Padayatty et al., 2003) (for immune system), and antioxidant vitamins (Diplock, 1997) (E and A vitamins) are especially important for workers.
- Adequate Fluid Intake: Dehydration (Sawka et al., 2005) can cause fatigue, headaches, and reduced performance. Workers should regularly consume enough water or other healthy fluids (herbal teas, diluted fruit juices), especially in hot environments or during intense physical activity.
- Regular Meals: Skipping meals or prolonged fasting can cause blood sugar drops and fluctuations in energy levels. Eating regularly (breakfast, lunch, dinner, and snacks) helps maintain stable energy levels (Jenkins et al., 1981).

3.7.5.3. Nutrition Practices and Recommendations in the Workplace

Employers and workers can collaborate to promote and implement healthy eating habits in the workplace:

Recommendations for Employers

- Provide Healthy Meal Options: Employers should encourage the offering of healthy and balanced menu options in workplace cafeterias or nearby food venues. Meals should emphasize vegetables, fruits, whole grains, and lean protein sources.
- Nutrition Education and Awareness Campaigns: Regular nutrition education programs and awareness initiatives should be organized for workers to emphasize the importance of healthy eating and offer practical guidance.
- Provide Healthy Snacks: Supplying healthy snacks at the workplace, such as fruit, yogurt, and nuts, can help prevent workers from turning to unhealthy options.

- Promote Water Consumption: Easy access to drinking water in the workplace and encouraging regular hydration is essential.
- Schedule Appropriate Meal and Snack Times: Even in busy work environments, efforts should be made to allow time for regular meals and snacks.
- Offer Nutrition Counseling Services: Large-scale workplaces may consider providing nutrition counseling services tailored to their employees.

Recommendations for Workers

- Don't Skip Breakfast: Starting the day with a balanced breakfast helps boost energy levels and improves focus throughout the day (Rampersaud et al., 2005).
- Choose a Healthy Lunch: Whether eating at the workplace cafeteria or elsewhere, selecting a healthy and balanced lunch is important.
- Don't Forget Snacks: Healthy snacks like fruit, yogurt, or nuts between meals help regulate blood sugar and manage hunger.
- Drink Plenty of Water: Aim to drink water regularly throughout the day. A drop in performance often indicates that dehydration has already begun.
- Avoid Processed Foods: Choose fresh, natural foods over processed items high in sugar, salt, and saturated fats.
- Eat Slowly and Chew Well: Eating slowly and chewing thoroughly improves digestion and promotes a feeling of fullness.
- Special Nutrition Strategies for Shift Workers: Those who work shifts should pay extra attention to their nutrition due to changes in sleep patterns. It can be helpful to establish regular mealtimes and choose light, easily digestible foods during night shifts (Smith et al., 1998).

Conclusion

The health, productivity, and well-being of workers are directly linked to proper and adequate nutrition. In addition to creating healthy working conditions, it is crucial for employers to support employees in developing healthy eating habits. Workers themselves must also take an active role by making informed nutrition choices to protect their health and enhance performance. A well-nourished workforce means fewer workplace accidents, reduced illness rates, increased productivity, and an overall happier and more motivated work environment. It should be remembered that investing in workers' nutrition leads to significant long-term benefits for both individuals and organizations.

3.7.6. Nutrition for Athletes

Sport is an activity that requires a high level of physical and mental performance. Therefore, nutrition for athletes plays a critical role, not only in meeting basic health needs but also in optimizing training adaptations, enhancing performance, reducing injury risk, and speeding up recovery processes. A sufficient and balanced nutrition plan enables athletes to reach their genetic potential and achieve sustainable success.

This section focuses on the unique nutritional needs of athletes and outlines key principles and practical recommendations, taking into account different sports and training intensities.

3.7.6.1. The Importance of Nutrition for Athletes

Athletes' nutritional requirements differ from the general population, primarily due to increased energy and nutrient demands. Proper nutrition offers the following benefits to athletes:

- Optimal Energy Supply: Meeting energy needs during training and competitions and maintaining energy stores (e.g., glycogen).
- Increased Muscle Mass and Strength: Supporting protein synthesis to promote muscle hypertrophy and enhance strength.
- Faster Recovery: Facilitating muscle repair and replenishing energy stores post-exercise.
- Immune System Support: Strengthening the immune system during intense training periods and enhancing resistance to illness.
- Improved Body Composition: Increasing lean mass and optimizing fat mass.
- Maintaining Hydration: Ensuring adequate fluid intake to sustain performance and prevent health issues.
- Reducing Chronic Disease Risk: Contributing to the maintenance of a healthy lifestyle in the long term.

3.7.6.2. Essential Nutrient Needs of Athletes

An athlete's nutrition plan should include all essential nutrients, both macronutrients (carbohydrates, proteins, fats) and micronutrients (vitamins, minerals), in sufficient amounts. These needs vary depending on the sport, training

intensity, and individual characteristics.

Carbohydrates

Carbohydrates are the primary source of energy during prolonged and high-intensity exercise. They are stored in muscles as glycogen and rapidly converted to energy during physical activity (Ivy, 1991). Athletes' carbohydrate needs range from 6–10 grams per kilogram of body weight per day, depending on the duration and intensity of training (Burke et al., 2017).

Endurance athletes (e.g., marathon runners, cyclists) require higher amounts. Good carbohydrate sources include whole grains (oats, brown rice, whole wheat bread), fruits, vegetables, and legumes. Easily digestible carbs (like bananas, energy gels, and sports drinks) are beneficial pre- and during workouts, while complex carbs should be consumed post-exercise to replenish glycogen stores.

Proteins

Proteins are essential for muscle repair, growth, and enzyme production. Athletes have higher protein requirements than sedentary individuals—typically 1.2–2.0 grams per kilogram of body weight per day (Phillips et al., 2012). Strength athletes (e.g., weightlifters, bodybuilders) and those performing high-intensity interval training may need more.

High-quality protein sources include meat, poultry, fish, eggs, dairy products, soy products, and legumes. Spreading protein intake throughout the day and consuming it post-workout helps optimize muscle protein synthesis.

Fats

Fats provide energy and are necessary for hormone production, vitamin absorption, and cell functions. Athletes' fat intake should comprise 20–35% of total energy intake. Saturated and trans fats should be limited in favor of healthy fats, such as monounsaturated and polyunsaturated fats (Willett, 2000).

Good fat sources include olive oil, avocado, nuts, seeds, and fatty fish (rich in omega-3s). Omega-3 fatty acids help reduce inflammation and support recovery.

Vitamins and Minerals

Vitamins and minerals play vital roles in energy production, bone health, immune function, and antioxidant defense. Due to increased energy expenditure and sweat loss, athletes may need higher levels of certain micronutrients.

Key nutrients include: (1) Vitamin D – bone health, (2) Iron – oxygen transport, (3) Calcium – bone and muscle function, (4) Zinc – immunity and tissue repair, (5) Magnesium – muscle function and energy production, (6) B vitamins – energy metabolism (Lukaski, 2004).

Most athletes can meet these needs with a balanced diet, though supplements may be necessary for those restricting calories or certain food groups. Any supplementation should be under expert supervision.

Fluids and Electrolytes

Hydration is crucial for performance and health. Athletes lose significant amounts of fluids and electrolytes (sodium, potassium, chloride, magnesium) through sweat during exercise (Sawka et al., 2005). Dehydration can lead to fatigue, cramps, decreased performance, and impaired heat regulation.

Athletes should drink fluids before, during, and after exercise. While water is usually sufficient, sports drinks with electrolytes are beneficial during prolonged, intense workouts. Hydration needs vary based on sweat rate, environmental conditions, and duration of activity. Monitoring urine color and body weight can help assess hydration status.

3.7.6.3. Nutrition Strategies Based on Training and Competition

Athletes should adjust their nutrition plans according to the timing of training and competitions:

Pre-Workout Nutrition

A pre-training meal should provide energy, prevent hunger, and stabilize blood sugar. It's best consumed 2–4 hours before exercise, featuring easily digestible carbohydrates (e.g., oats, bananas, rice) and a small amount of protein. High-

fat and high-fiber foods should be avoided as they slow digestion and may cause gastrointestinal discomfort.

During Exercise Nutrition

During prolonged (over 1 hour) and intense training, carbohydrate supplementation can boost performance (Jeukendrup, 2017). Sports drinks, energy gels, or easy-to-digest fruits (like bananas) are useful. Continue hydrating throughout the session.

Post-Workout Nutrition

The first 1–2 hours after exercise are crucial for glycogen replenishment and muscle repair (Ivy & Portman, 2004). Meals during this window should contain both carbohydrates (preferably high glycemic index) and protein. Good examples include: Milk or yogurt, Protein shakes, Fruit and nuts

Pre-Competition Nutrition

In the days and hours leading up to a competition, the focus is on maximizing energy stores and avoiding stomach issues. Carbohydrate loading can improve endurance performance (Sherman et al., 1993). About 3–4 hours before the event, a high-carb, easily digestible meal (e.g., pasta, rice, bread) is recommended.

During Competition Nutrition

In long events (e.g., marathon, triathlon), carbohydrate and fluid intake is critical to sustain performance. In shorter events, fluid intake alone is often sufficient.

Post-Competition Nutrition

Similar to post-training nutrition, a combination of carbohydrates and protein should be consumed to restore glycogen and support muscle recovery.

3.7.6.3. Special Considerations

- Weight Management: In sports where weight is crucial (e.g., wrestling, boxing, gymnastics), energy intake must be managed carefully. Avoid unhealthy weight loss methods and seek professional guidance for performance-safe plans.
- Supplements: Many athletes use supplements to boost performance. However, their effectiveness and safety must be evaluated, and any supplementation should be done under expert supervision (Maughan et al., 2018). Some may carry doping risks.
- Vegetarian and Vegan Athletes: Special attention is needed to meet needs for protein, iron, vitamin B12, calcium, and omega-3s from plant sources. Working with a dietitian is highly beneficial.
- Female Athletes: Women may have different needs for iron and calcium. Menstrual cycles and bone health must be considered in their nutrition plans.
- Young Athletes: Due to ongoing growth and development, young athletes have increased energy and nutrient demands. Adequate intake of calories, protein, calcium, and iron is especially important.

Conclusion

Athlete nutrition is a complex and dynamic process that directly impacts performance. A successful sports nutrition plan must consider individual needs, the type of sport, training intensity, and timing. Ensuring a balanced intake of essential nutrients, maintaining adequate hydration, and applying nutrition strategies aligned with training and competition schedules enable athletes to reach their full potential and train healthily.

Therefore, it is highly important that athletes and coaches are knowledgeable about nutrition and seek support from a sports dietitian when necessary.

3.7.7. Obesity and Nutrition

Changing lifestyles around the world—including rapid urbanization, increased screen time, easy access to high-energy foods, and reduced physical activity—have led to an obesity epidemic. The World Health Organization (WHO, 2021) emphasizes that obesity is not only an individual issue but a systemic threat that causes global economic losses.

By 2030, it is estimated that nearly 50% of the world population will be overweight or obese (World Obesity Atlas, 2022). Health expenditures related to obesity constitute a significant portion of countries' healthcare budgets.

3.7.7.1. Definition and Epidemiology of Obesity

Obesity is defined as an excessive increase in body fat that poses a risk to health. The most commonly used indicator for diagnosis is Body Mass Index (BMI), which classifies individuals with a BMI of 30 kg/m² or more as obese, and those with a BMI between 25–29.9 as overweight.

However, it is known that BMI can be misleading in individuals with high muscle mass and should be supported by more accurate metrics such as body fat percentage and waist circumerence (WHO, 2021).

Table 1 – Weight Evaluation Based on Body Mass Index in Adults

BMI(Body Mass Index)(kg/m2)	Condition of the Body Weight
Less than 18,5	Thin
18.5 - 19.9	Considered normal (slim)
20 - 24.9	Normal
25 - 29.9 30 - 34.9 35 - 39.9 40 and above	Slightly fat I. level fat I I. level fat I I I. level fat

(Türkiye nutrition and health research (TBSA, 2017))

According to the results of the Turkish Nutrition and Health Survey (TBSA, 2017), the obesity rate in Türkiye is 25% among men and 39% among women. These rates indicate that obesity is more common in women. Approximately 4 out of every 10 women in Türkiye are obese.

3.7.7.2. Causes Leading to Obesity

Many factors play a role in the development of obesity. These can be summarized as follows:

- Energy Imbalance: Consuming more calories than are expended leads to increased fat accumulation in the body. This situation is generally associated with increased consumption of processed foods, larger portion sizes, and lack of physical activity (Swinburn et al., 2011).
- Genetic Predisposition: The risk of developing obesity in children of obese individuals ranges between 40-80%. Genetic polymorphisms can affect hormones that regulate appetite, such as leptin and ghrelin.
- Microbiota: The composition of gut microbiota can affect energy absorption, increasing the risk of obesity. Particularly, a high Firmicutes/Bacteroidetes ratio is associated with energy imbalance (Turnbaugh et al., 2006).
- Hormones and Medications: Hormonal imbalances such as polycystic ovary syndrome and hypothyroidism, as well as the use of antipsychotics, steroids, and antidepressants, can cause weight gain.
- Psychosocial Factors: Depression, anxiety, loneliness, and stress have a bidirectional relationship with obesity and can influence eating behaviors.
- Environmental Factors: Urban living, eating late at night, insufficient sleep, and environmental toxins (endocrine disruptors) are factors that trigger obesity.

3.7.7.3. Diagnosis and Evaluation Methods

Body Mass Index (BMI) alone may not be sufficient for diagnosis. The following measurements should also be used:

- Waist circumference: >102 cm in men and >88 cm in women indicate abdominal obesity.
- Waist-to-hip ratio: >0.9 in men, >0.85 in women.
- Body fat percentage measurement by bioelectrical impedance analysis.
- Laboratory tests: fasting glucose, insulin resistance (HOMA-IR), lipid profile, liver enzymes.

3.7.7.4. Consequences of Obesity

Obesity is a risk factor not only for metabolic diseases but also for many systemic and psychosocial disorders:

- Metabolic Diseases: Type 2 diabetes, hypertension, dyslipidemia, atherosclerosis.
- Oncological Risks: Associated with breast, colon, endometrium, pancreas, and liver cancers.
- Psychological Effects: Depression, anxiety, low self-esteem, social isolation.
- Childhood Obesity: Obese children have a high risk of remaining obese in

adulthood (Serdula et al., 1993).

3.7.7.5. Prevention and Treatment Methods

Fighting obesity requires multidimensional and individualized strategies.

Preventive Approaches:

Nutrition education: Healthy eating habits should be taught to children starting from school age.
Community interventions: Making healthy foods more affordable, improving food labeling systems.
Promotion of physical activity: Building bike paths, walking areas, promoting gyms.

Treatment Methods:

- Medical nutrition therapy: Energy-restricted diets (e.g., Mediterranean diet, low glycemic index diets).
- Physical activity: At least 150 minutes of moderate exercise per week is recommended.
- Psychological counseling: Behavioral therapy for eating disorders and motivation issues.
- Pharmacotherapy: FDA-approved drugs (e.g., orlistat, liraglutide) can be considered in appropriate cases.
- Bariatric surgery: Surgical options may be considered for individuals with BMI ≥40 or BMI ≥35 with comorbid conditions.

Conclusion and Recommendations

Obesity is not merely an individual lifestyle problem but a complex public health issue. Its prevention and treatment require interdisciplinary approaches, government policies, community education, and individual responsibility. To leave healthier societies for future generations, spreading a culture of healthy living is essential.

3.7.8. Thinness and Nutrition

Thinness is characterized by low body weight relative to height, with Body Mass Index (BMI) or percentile values falling below normal ranges (WHO, 2021). This condition is generally associated with prolonged energy imbalance and insufficient fat tissue (Gibney et al., 2013). Groups at risk include children in their growth period, elderly individuals, those with chronic illnesses, and breastfeeding women (Black et al., 2008).

3.7.8.1. Factors Causing Thinness

The primary cause of thinness is when energy intake from diet is lower than energy expenditure (Müller & Bosy-Westphal, 2013). Additionally, hormonal disorders (e.g., hyperthyroidism), gastrointestinal diseases, infections, inadequate socioeconomic conditions, and psychosocial factors also play a role (Pelletier et al., 1995; Bhutta et al., 2013).

Consumption of low-nutrient foods, insufficient nutritional knowledge among families, gender-based discrimination, and incorrect diet practices are also significant factors (Victora et al., 2008). Moreover, smoking can contribute to thinness by suppressing appetite (Potter et al., 2004). Eating disorders that begin during adolescence can persist into older age, leading to chronic thinness (Smink et al., 2012).

3.7.8.2. Health Problems Caused by Thinness

Thinness can lead to growth retardation, especially during the growth period (Martorell et al., 1992). It can also cause many health issues such as weakened immune system, increased susceptibility to infections, and decline in physical and mental performance (Scrimshaw & SanGiovanni, 1997).

In women, consequences may include fertility problems, low birth weight, reduced milk production during breastfeeding, and increased risk of osteoporosis after menopause (Krebs et al., 2017). Due to insufficient subcutaneous fat tissue, maintaining body temperature becomes difficult, and fatigue and anemia are common (Manary & Sandige, 2008).

3.7.8.3. Medical Nutrition Therapy

The primary step in treating thinness is identifying and eliminating the underlying cause. Then, an individualized nutrition plan should be created (Elia & Stratton, 2009). The diet should be high in energy and quality protein, easily digestible, and meet vitamin and mineral requirements (Norman et al., 2008).

Foods should be prepared to increase appetite; fried foods should be avoided, and cooking methods such as boiling and baking should be preferred. Fluid intake should be limited during meals, and food presentation should be hygienic and appealing. In thin individuals, excessive fatty foods that remain in the stomach for a long time should be used cautiously as they may suppress appetite (Silk et al., 2015).

3.7.8.4. Public Health Approach

To prevent thinness: Policies aimed at raising public awareness should be developed (UNICEF, 2013), Warnings should be issued about uninformed diet programs and harmful products, Socioeconomic inequalities should be addressed, Gender-based nutritional discrimination should be prevented (UNICEF, 2019). It should be remembered that every individual, especially children, has an equal right to nutrition regardless of gender.

Conclusion

Contrary to common belief, thinness can lead to serious health problems. Achieving ideal body weight and composition is important not only for individual health but also for public health. Therefore, multidisciplinary and sustainable solutions should be developed to address the causes of thinness.

3.8. FOODBORNE ILLNESSES AND FOOD POISONINGS

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Foods carry great importance for food safety and public health starting from the raw material production stage before being offered for consumption. If appropriate conditions are not maintained during the stages of producing, transporting, storing, and presenting foods from healthy raw materials in modern and hygienic environments, they may be exposed to a wide variety of factors that can threaten human health.

Despite advancing technology and hygiene measures, infections and food poisonings caused by pathogens continue to increase. Furthermore, some microorganisms can develop resistance to substances and methods used for hygiene.

Factors causing foodborne illnesses and poisonings include zoonotic diseases, natural food toxins, chemicals, metals, pesticides, detergents, plastics, parasites, viruses, bacteria, molds, and yeasts. Some chemical substances that contaminate foods from various sources or are added externally in certain amounts can also lead to food poisoning if they exceed specific levels.

Among microorganisms, bacteria are especially responsible for many foodborne diseases. Foodborne illnesses may occur when contaminated food is consumed, allowing pathogenic microorganisms to develop in the intestines and/or when toxins produced by pathogenic microorganisms in the food enter the body. Symptoms in humans can include diarrhea, nausea, vomiting, abdominal pain, cramps, dizziness, blurred vision, or nervous system effects such as paralysis, redness, and itching. Symptoms usually appear within 30 minutes to 72 hours after consuming contaminated food. The symptoms vary depending on the type of microorganism/toxin ingested, the level of contamination, the amount of food consumed, and the individual's sensitivity.

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3.8.1. Zoonotic Diseases (Diseases Transmitted from Animals to Humans)

Animals can sometimes carry harmful microorganisms that can be transmitted to humans and cause disease; these are called zoonotic diseases. More than 200 diseases are common between animals and humans, some transmitted through direct contact and some through animal products. It is estimated that three-quarters of newly emerging diseases worldwide are zoonotic.

Zoonotic diseases can be transmitted to humans via foodborne and waterborne routes, direct contact (contact with saliva, blood, urine, mucus, feces, or other body fluids of an infected animal), indirect contact (contact with contaminated environments or objects), or vector-borne routes (bites or stings by insects such as mosquitoes, ticks, lice, fleas carrying pathogens from infected animals).

Examples of zoonotic diseases include rabies, brucellosis, bovine spongiform encephalopathy (mad cow disease), anthrax, salmonella infection, avian influenza (bird flu), leptospirosis, and ringworm. Millions of people and animals worldwide are affected by zoonotic diseases every year.

Brucellosis: A significant zoonotic disease affecting cattle, sheep, goats, and pigs, especially targeting genital organs like testes, udder, and uterus, causing abortions and infertility. The causative agent spreads to the environment through feces, milk, and discarded fetal membranes of infected animals, causing disease in humans. Infection can occur through consumption of meat, milk, and dairy products of infected animals or via environmental contamination.

Rabies: Seen in all wild mammals such as wolves, foxes, jackals, skunks, hyenas, bears, bats, and domestic mammals like dogs, cats, cows, sheep, goats, and donkeys. Transmission occurs through bites or scratches from rabid animals (especially dogs), contact of rabid animal saliva with broken skin or mucous membranes (eyes, mouth, nose), consumption of raw meat or milk from rabid animals, or close contact with a rabid person.

Anthrax: One of the oldest known zoonotic diseases, most common in sheep. Transmission occurs through ingestion, inhalation, or skin contact. Humans become infected by slaughtering and skinning infected animals, eating their meat, or handling their hides and wool.

Avian Influenza (Bird Flu): A disease causing respiratory and digestive symptoms in domestic and wild birds and many mammals, often with high mortality, and resembling flu in humans. Transmission occurs through direct contact with secretions (especially feces) of infected animals, contaminated feed, water, equipment, clothing, or contact with clinically healthy water and seabirds.

Bovine Spongiform Encephalopathy (BSE or Mad Cow Disease): Characterized by behavioral and motor disorders in cattle. The main cause is transmission of scrapie disease agent from sheep to cattle via consumption of meat-and-bone meal made from infected sheep. It is not transmitted directly from animal to animal. Humans contract the disease by consuming infected meat, especially brain and spinal tissues, which are particularly dangerous.

Leptospirosis: A zoonotic disease seen in cattle, sheep, goats, pigs, horses, dogs, and humans. Transmission occurs via mating, inhalation, direct contact with infected materials, or ingestion of contaminated water, feed, or milk. Transmission can also occur through blood-sucking parasites and reservoir animals.

Salmonellosis: Diseases caused by Salmonella bacteria, presenting with septicemia symptoms or subacute and chronic gastrointestinal inflammation. Salmonella bacteria are pathogenic for humans and animals and are widespread in nature.

3.8.2. Food Poisoning

Food poisoning occurs as a result of consuming food contaminated by bacteria, viruses, parasites, or toxins. It manifests with symptoms such as nausea, vomiting, diarrhea, and abdominal pain. The main causes are insufficient cooking, lack of hygiene, and improper storage conditions.

Food poisoning is a general term for infections or intoxications that occur after consuming any food or beverage. Food poisonings can occur in two ways:

Foodborne infection: Develops when a pathogenic bacterium grows in the intestines after consuming contaminated food. Examples include Salmonella, Campylobacter, E. coli O157, etc.

Foodborne intoxication: Occurs when toxins produced by a pathogenic microorganism in the food are ingested. Examples include Bacillus cereus, Staphylococcus aureus, Clostridium botulinum, etc.

3.8.3. Food Poisoning Caused by Natural Toxins

Some foods naturally contain toxic compounds known as toxins. Certain types of mushrooms, mad honey, and greened or sprouted potatoes can cause food poisoning due to the natural toxic substances they contain.

Mushroom poisoning can vary depending on the type of mushroom consumed and the toxins it contains. Symptoms may include dizziness, drowsiness, blurred vision, redness of the face and neck, metallic taste, nausea, vomiting, and excessive sweating. Depending on the species, symptoms may appear within 2 to 6 hours after consumption—or even later. Foraging for wild mushrooms requires knowledge and caution, as confusing edible species with poisonous ones can lead to serious health issues.

Mad honey poisoning is caused by a toxic type of honey found particularly in Türkiye's Black Sea region, especially around Samsun, Çarşamba, and Kastamonu. Bees produce this honey from the nectar of Rhododendron flavum and R. ponticum. Consuming as little as 50–100 grams can lead to poisoning.

Shellfish poisoning (from mussels, oysters, etc.) is caused by toxins produced by dinoflagellates. Shellfish consume algae containing these toxins and store them in their bodies. When humans consume these shellfish, the toxins are released and can cause muscle paralysis.

Pufferfish and porcupinefish contain a potent toxin called tetrodotoxin, which is produced and stored by symbiotic bacteria. This toxin poses serious risks to human health and can cause a variety of health problems. It is crucial to be absolutely sure that a fish is not poisonous before consuming it. Fish poisoning is a form of food poisoning and can have severe consequences.

Food can also be contaminated by metals due to toxic substances leaching from the containers used for storage. For example, storing acidic foods in copper or lead-containing vessels or keeping food in uncoated copper containers can lead to heavy metal poisoning. For this reason, foods should not be stored in uncoated copper, painted plastic, or aluminum containers.

Poisonings caused by agricultural chemicals (pesticides) are generally accidental. These occur mainly due to failure to take protective measures during pesticide

application or leaving pesticides in easily accessible places, resulting in accidental exposure—especially by children. Poisoning can also occur when pesticides mix with food and water during or after pesticide use.

3.8.4. Bacteria That Cause Food Poisoning

Salmonella species: Found in the intestines of many farm and poultry animals, including birds. Therefore, raw or undercooked chicken, meat, eggs, fish, and unpasteurized milk are common sources for the growth of Salmonella.

Escherichia coli (E. coli): A bacterium commonly found in the intestines of humans and animals. It can be transmitted to humans through animal-based foods. Rapidly growing sources include raw or undercooked ground meat, unpasteurized milk, spring water contaminated with feces, and poorly washed fruits and vegetables irrigated with contaminated water.

Listeria monocytogenes: A highly resilient bacterium commonly found in the environment. It can grow even at near-freezing temperatures. Most Listeria-related food poisonings are linked to raw meat, poultry, frozen foods, cheese, and cream.

Staphylococcus aureus: Naturally present in the human nose, throat, and skin. It can also be found in skin boils, acne, infected wounds, and cuts. The main source of contamination is individuals handling the food. It easily multiplies in dairy products, salads, cream-filled pastries, other desserts, raw meat, and poultry.

Shigella species: Found in human and animal feces. Main sources include contaminated drinking water and all foods that have come into contact with contaminated water, especially chicken, fish, and raw fruits and vegetables. Shigella species are infectious and can cause serious illnesses including dysentery.

Clostridium perfringens: Found in soil, in the digestive tracts of humans and animals, and in water contaminated with feces. It proliferates rapidly in raw meat and meat products, especially when cooked meat is left to cool slowly.

Clostridium botulinum: Found in soil, spring water, and seawater. Since this bacterium can grow in oxygen-free environments, canned foods are its most significant source of poisoning.

Bacillus cereus: Commonly found in soil and many plants. It grows rapidly especially in rice, pasta, creams, and milk puddings. The main cause of poisoning by Bacillus cereus is usually improperly cooled and reheated foods containing cooked rice.

3.8.5. Aflatoxins

Aflatoxin contamination remains a major food safety concern. Aflatoxins are highly toxic and carcinogenic substances. Long-term consumption of foods containing high levels of aflatoxins poses a public health risk. Aflatoxins can cause acute or chronic toxicity in humans through contaminated food or products derived from animals fed with contaminated feed.

Increased moisture and temperature in human food, grains, animal feed, and all kinds of dried foods promote the growth of fungi, which produce harmful toxins known as mycotoxins (mold toxins). The most important among these are aflatoxins, produced by the fungi Aspergillus flavus and Aspergillus parasiticus.

Aflatoxins are especially found in hard-shell nuts like pistachios, peanuts, almonds, and hazelnuts; in dried fruits like dried figs; in grains such as wheat, barley, and rice; in corn; and in spices like red pepper. They can also be found in the milk and milk products of animals that consume aflatoxin-contaminated feed. Aflatoxins cannot be removed from food through any processing method.

3.8.6. Sources of Microorganism Contamination in Food

Before reaching our kitchens and during production, food can become contaminated by harmful substances from various sources. The main contamination sources are dust, soil, insects, rodents, other animals, humans, water, potentially risky foods, and waste.

To prevent food from causing harm, hygiene must be maintained during production, sale, storage, preservation, service, and consumption. Attention must be paid to food hygiene, personal hygiene, and the cleanliness of surfaces and utensils that come into contact with food. Additionally, practices that may promote microorganism growth during stages like freezing, thawing, cooking, and serving must be avoided.

Applying adequate heat treatment and preventing cross-contamination are also key measures to control the spread of microorganisms.

3.8.7. Protection from Foodborne Illnesses and Poisonings

In Türkiye, the Ministry of Agriculture and Forestry is the main institution responsible for food safety and hygiene inspections. Its authorized units regularly inspect food businesses to protect public health. These inspections help establish trust and ensure consumers can safely consume food products. Regular monitoring of food businesses ensures continued compliance with hygiene standards and encourages hygienic production environments.

The Ministry of Health monitors foodborne diseases and takes necessary precautions when public health is at risk. It conducts investigations during poisoning cases and informs the public.

Municipalities, as local administrative units, supervise marketplaces, street vendors, and designated food sales areas. Through municipal police units, they enforce general hygiene rules in licensed workplaces and report violations to relevant ministries.

To prevent zoonotic diseases and protect the public, the Ministry of Agriculture and Forestry and the Ministry of Health collaborate under a "One Health" approach. The General Directorate of Food and Control handles animal-related disease control, while the General Directorate of Public Health manages public health.

In Türkiye, zoonotic disease prevention and public health measures are outlined in detail under Law No. 5996 on Veterinary Services, Plant Health, Food and Feed. The Ministry of Health also published and implemented the Türkiye Zoonotic Diseases Action Plan (2019–2023).

Besides institutional efforts, every individual has responsibilities. Microbes can survive in many environments and reach your kitchen. By following four simple steps at home, you can help protect yourself and your family from foodborne illnesses: (1) Refrigerate food quickly after purchase, (2) Place it in the fridge immediately, (3) Never leave perishable food out for more than 2 hours, (4) When consuming frozen food, thaw it safely in the refrigerator, microwave, or cold water.

Choose safer food options. Learn which foods are more likely to cause food poisoning and which are safer alternatives. Use the following table as a guide to make better food choices.

Red Meat - Poultry Meat	
Riskier Choice	**Safer Choice**
Raw or undercooked poultry, red meat. • Poultry meats such as chicken and turkey. • Beef, pork, lamb, and veal.	When cooking red meat and poultry such as chicken and turkey, the internal temperature should reach the cooking temperature and should be measured with a food thermometer if necessary. • Poultry meats such as chicken and turkey, as well as ground meat, should be cooked to 73°C. • Red meat (beef, lamb, lamb, etc.) cooked to 62°C should be allowed to rest for about 3 minutes before consumption. • Ground meat made from red meat should be cooked to 71°C.
Fruits and Vegetables	
Riskier Choice	**Safer Choice**
Raw or undercooked sprouts, such as alfalfa sprouts, soybean sprouts, and bean sprouts. • Unwashed fruits and vegetables; raw fruits and vegetables, especially spinach, lettuce, and other leafy greens. • Cut melons left out for more than 2 hours (1 hour if exposed to temperatures higher than 32°C); in situations such as picnics or being left in the car.	Vegetable sprouts cooked in boiling water or steamed. • Washed vegetables and fruits (Washed and then cooked are the safest ones). • Melons consumed immediately after cutting or melons that have been refrigerated for up to 7 days.
Fruit juices - musts	
Riskier Choice	**Safer Choice**
• Unpasteurized fruit juices, ciders, musts.	• Pasteurized fruit juices, cider, musts. • Unpasteurized fruit juices and cider should be stirred and steamed or boiled for at least 1 minute before drinking.
Milk and dairy products	
Riskier Choice	**Safer Choice**
• Unpasteurized (raw) milk and dairy products made from raw milk	• Pasteurized milk and dairy products made from pasteurized milk

Cheese	
Riskier Choice	**Safer Choice**
• Soft cheeses made from unpasteurized (raw) milk and some moldy cheeses (such as Camembert, queso fresco, brie, blue-veined cheese)	• Hard cheeses such as cheddar, Swiss, and cottage cheese. • Cottage cheese, feta cheese, string cheese, cream cheese, and string cheese. • Processed cheeses such as American cheese. • Soft cheeses clearly labeled "made with pasteurized milk."
Egg	
Riskier Choice	**Safer Choice**
Raw or undercooked (runny) eggs and foods containing raw or undercooked eggs, such as: • Caesar salad dressing • Raw cookies, cakes, pastry dough • Homemade eggnog	• Eggs cooked until the yolk and white are firm. • Egg dishes (frittatas, quiches, casseroles) cooked to an internal temperature of 73°C if they contain red meat or poultry. • Egg dishes cooked to an internal temperature of 71°C if they do not contain red meat or poultry. • Pasteurized eggs in foods that will not be cooked to a safe temperature, such as mousses and salad dressings.
Seafood	
Riskier Choice	**Safer Choice**
• Raw or undercooked fish or shellfish, including sashimi, sushi, and ceviche.	• Fish is cooked to a safe internal temperature of 140°F (62.78°C), or until the flesh is opaque and easily separated with a fork. • Shellfish are cooked until the shells open during cooking or until the flesh is pearly, white, and opaque. • Live oysters should be boiled for an additional 3-5 minutes after opening.
Flour	
Riskier Choice	**Safer Choice**
Dough or raw dough made from flour that has not been heat-treated.	Foods made with flour cooked according to package directions or a recipe. • Mixes and doughs made with heat-treated flour and pasteurized eggs. • Baking mixes and doughs labeled "edible" or "safe to eat raw."

For safe food, pay attention to cleanliness, keep separate, cook, cool

be clean | separate | cook | cool

Pay Attention to Cleanliness: Wash your hands and surfaces frequently.

Wash your hands with soap and warm or cold water for at least 20 seconds before preparing food, while preparing it, after preparation, and before eating. Clean kitchen tools, cutting boards, and countertops that have come into contact with raw meat, poultry, other fowl, seafood, flour, or eggs with hot, soapy water.

Separate: Avoid cross-contamination.

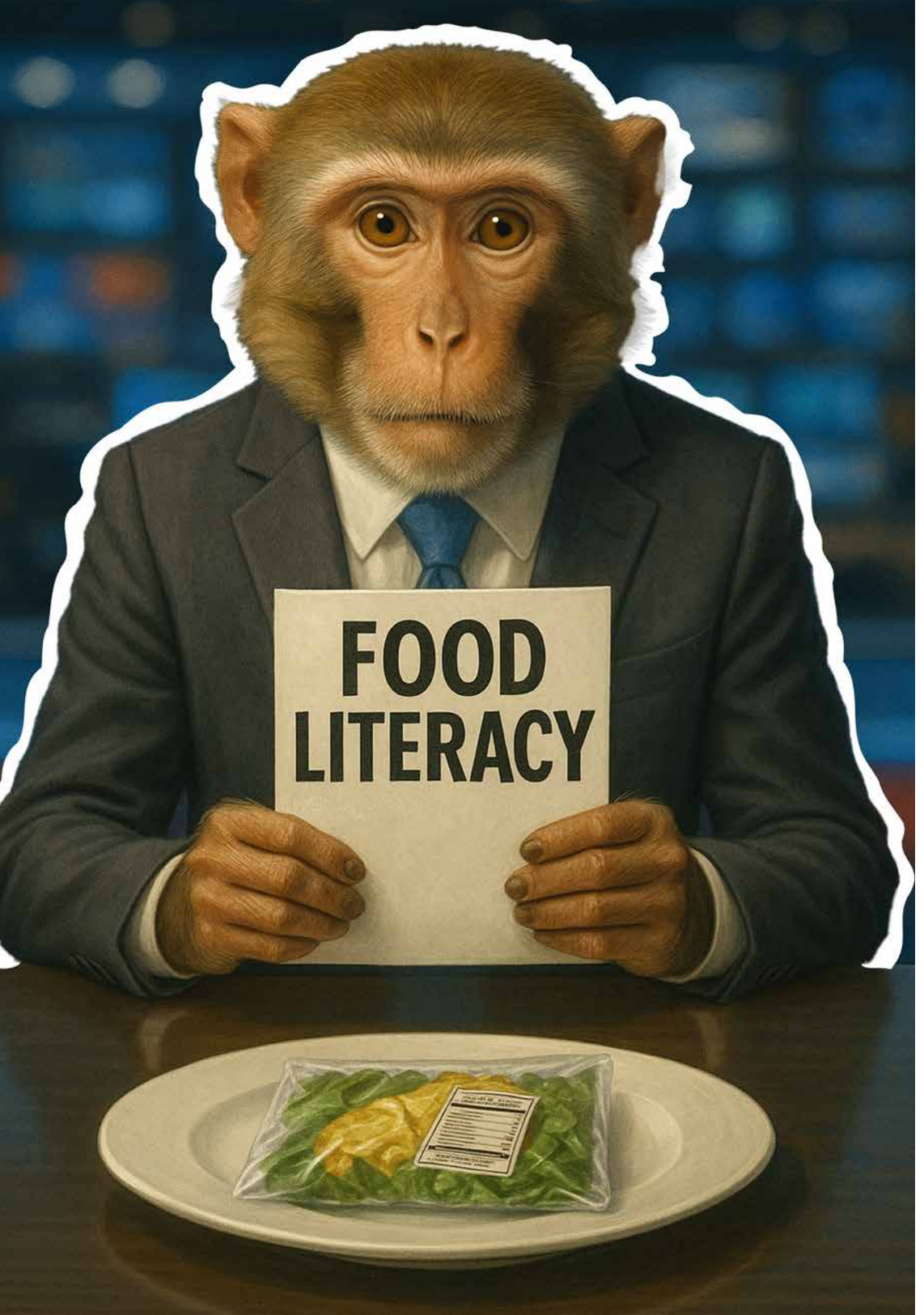
- Raw meat, poultry, seafood, and eggs can contaminate ready-to-eat foods if not kept separate.
- When grocery shopping, keep raw meat, poultry, seafood, and their juices away from other foods. Store them in separate compartments in the refrigerator. Store in sealed containers or wrap tightly to prevent leakage.
- Do not use the same cutting board or plate used for raw meat, poultry, or seafood for fruits, vegetables, bread, or other foods that will not be cooked.

Cook your food at the correct temperature.

Food is considered safely cooked when its internal temperature is high enough to kill the germs that can make you sick. Use a food thermometer if necessary to ensure the food has reached a safe internal temperature. Follow recommended cooking and resting times.

3.9. MAJOR FOOD SUBSTANCES THAT CAUSE ALLERGIES OR INTOLERANCES

1. Cereals containing gluten: wheat (e.g., spelt and khorasan wheat), rye, barley, oats, or their hybridized strains and products made from them
2. Crustaceans and products made from them
3. Eggs and egg products
4. Fish and fish products
5. Peanuts and peanut products
6. Soybeans and soybean products
7. Milk and milk products (including lactose)
8. Tree nuts: Almonds (Amygdalus communis L.), hazelnuts (Corylus avellana), walnuts (Juglans regia), cashews (Anacardium occidentale), pecans (Carya illinoiesis (Wangenh.) K.Koch), Brazil nuts (Bertholletia excelsa), pistachios (Pistacia vera), macadamia nuts and Queensland nuts (Macadamia ternifolia) and products made from them
9. Celery and celery products
10. Mustard and mustard products
11. Sesame seeds and sesame seed products
12. Sulphur dioxide and sulphites (in ready-to-eat or prepared products, where the total concentration, calculated as SO_2, exceeds 10 mg/kg or 10 mg/L)
13. Lupin and lupin products
14. Molluscs and products made from them



4.1. FREQUENTLY ASKED QUESTIONS

Tijen COŞKUN[37]

Question 1: Is information about active (Approved/Registered) food businesses published?

All food businesses are registered at the following link:
https://ggbs.tarim.gov.tr/cis/servlet/StartCISPage?PAGEURL=/FSIS/ggbs.onayliIsletmeSorgu.html&POPUPTITLE=AnaMenu

Question 2: Where can I find information about the details of raw milk sales?

The relevant communiqué titled "Communiqué on the Supply of Raw Milk" can be accessed by searching under the Communiqués section at the following link:
https://kms.kaysis.gov.tr/Home/Kurum/24308110

Question 3: Who is authorized for procedures related to dietary supplements?

Dietary supplements are foods produced in forms such as lozenges, capsules, tablets, or sachets to support normal nutrition. The Ministry of Agriculture and Forestry is authorized for the approval, import, export, and inspection of dietary supplements. Dietary supplements not approved by our Ministry cannot be placed on the market.

Question 4: How can we find out if a product is approved?

The list of dietary supplements approved by the Ministry of Agriculture and Forestry is published under the section "List of Approved Dietary Supplements" on the following website:https://ggbs.tarim.gov.tr/

Question 5: I want to place a dietary supplement on the market. What should I do?

Dietary supplements must obtain approval before they are produced or imported.

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37 Food Engineer, Head of Food Businesses and Codex Department

Approval applications for dietary supplements are submitted to provincial directorates. If the product is to be imported, only the Istanbul and Ankara Provincial Directorates are authorized for the approval process. If it is to be produced domestically, all 81 provincial directorates are authorized. The application file must include the documents specified in Annex-1 of the "Implementation Guidelines for the Approval Procedures of Dietary Supplements"

Question 6: Are dietary supplements considered medicine? Are products aimed at weight loss or enhancing sexual performance approved by the Ministry of Agriculture and Forestry?

Dietary supplements are not medicine and cannot be marketed or advertised with claims suggesting they treat or cure diseases or other medical indications. Our Ministry does not approve any product under the name of dietary supplement that claims to cause weight loss, weight gain, height increase, enhanced sexual performance, smoking cessation, disease treatment, cell regeneration, intelligence enhancement, brain development, or immunity boosting.

Question 7: Are herbal teas, weight-loss teas, coffee, or paste-like products considered dietary supplements?

Foods in the form of tea, coffee, or paste are not considered dietary supplements and are therefore not subject to approval. Foods outside the scope of approval must be produced in food establishments that have obtained a Registration and/or Approval Certificate from our Ministry and must comply with the Turkish Food Codex before being marketed.

Question 8: Can health claims be made on the labels of dietary supplements?

According to Law No. 7151, as of 05.12.2018, the authority for the use of brands, statements, and visuals on food products that include or imply health claims lies with the Turkish Medicines and Medical Devices Agency.

Question 9: Why are there weight limitations in bread production? What is the minimum weight for standard bread?

During the preparation of the Turkish Food Codex Communiqué on Bread and Bread Varieties, factors such as bread production technology, preventing consumer deception, achieving standardization in bread production across the country, and reducing bread waste were considered. Opinions from various institutions and organizations were gathered and individually evaluated.

Bread weight was last revised with the Communiqué published in the Official Gazette dated 01.12.2017. Standard bread, whole wheat bread, whole meal bread, and sourdough breads can be marketed starting from a minimum weight of 200 grams, increasing in increments of 10 grams.

Question 10: Is halal certification mandatory for the production of foodstuffs?

Our Ministry carries out its activities under the framework of Law No. 5996 on Veterinary Services, Plant Health, Food and Feed, with the aim of ensuring food and feed safety, public health, plant and animal health and welfare, consumer protection, and environmental preservation.

Ensuring food safety and protecting consumers from food-related risks is one of the Ministry's main objectives. Under the current regulations issued by the Ministry, there is no requirement or application related to halal food and certification for products offered in the domestic market. However, consumer demands and sensitivities are taken into account when preparing food regulations. In this context, some regulations and implementations by our Ministry include:

1. According to the Turkish Food Codex legislation, the use of pork-derived food additives and enzymes in any food product is not permitted.
2. The use of pork-derived products in materials and substances that come into contact with food, such as food brushes, is also prohibited.
3. According to our Food Labeling and Consumer Information Regulation, if any ingredient derived from pork or alcohol is present in a food product, it must be clearly indicated on the label.
4. During market inspections, particular attention is paid to detecting pork or horse meat in products such as sausages and salamis, as well as in meat dishes served at restaurants, cafeterias, and especially in products like meatballs, pitas, and lahmacun fillings.

Question 11: Are bread prices regulated by the Ministry of Agriculture and Forestry?

Our Ministry takes indirect measures to keep bread prices at reasonable levels for both consumers and producers. However, bread prices are not directly regulated by our Ministry.

The determination of bread price tariffs is managed by relevant institutions and organizations under the "Regulation on Price Tariffs for Goods and Services Produced by Tradesmen and Craftsmen" and the "Regulation on the Regulation of Maximum Price Tariffs for Goods and Services Produced by Traders and Industrialists."

Question 12: What is being done to promote the production and consumption of whole wheat bread?

Our Ministry recommends products made from whole wheat flour and flours with relatively higher dietary fiber content instead of products made from low-bran flours, and campaigns are organized accordingly.

The Turkish Food Codex Communiqué on Wheat Flour was published on 02.04.2013. With this communiqué, bread wheat flour was defined in a single category. The ash content of bread wheat flour must be more than 0.7% on dry matter basis, significantly increasing the bran content of the wheat flour used in regular bread production.

Additionally, awareness campaigns are conducted by our Ministry to encourage the consumption of whole wheat bread.

Furthermore, according to the Turkish Food Codex Communiqué on Bread and Bread Varieties, published on January 4, 2012, it has become mandatory to offer whole wheat bread and/or whole wheat flour bread and/or bran bread at places selling regular bread.

Question 13: What additives are added to bread? Is it true that the additive called L-cysteine is made from human hair and added to bread?

The additives permitted in bread are regulated under the Turkish Food Codex Regulation on Food Additives, published in the Official Gazette dated 30/6/2013, No. 28693, and the Communiqué on Bread and Bread Varieties (Communiqué No: 2012/2), which came into effect on 04/01/2012.

According to this communiqué, for unpackaged bread, whole wheat flour bread, whole wheat bread, bran bread, and sourdough bread, no additives, including E 920 (L-Cysteine), are allowed.

Only E 300 (Ascorbic acid) is permitted in the wheat flour used to make these breads at food businesses producing flour.

The Turkish Food Codex Regulation on Food Additives includes the clause: "Food additives derived from pork cannot be used in food, food additives, food enzymes, and food flavorings." Therefore, pork-derived food additives are not allowed in any food product.

Additionally, the Turkish Food Codex Regulation on Specifications of Food Additives includes the provision that "Human hair cannot be used as a source of L-cysteine."

Thus, the production, import, and use of L-cysteine derived from human hair as a food additive is not permitted.

Question 14: What measures were taken regarding bread sales during the coronavirus pandemic?

To ensure that bread and bread varieties are produced, stored, transported, and marketed hygienically and in accordance with technical standards, their specifications are determined by the Turkish Food Codex Communiqué on Bread and Bread Varieties.

Due to the continuation of the Coronavirus (Covid-19) pandemic, and in consideration that some consumers may not follow established hygiene rules, creating risks to public health, our Ministry deemed it necessary to take certain precautions under Article 26(5) of Law No. 5996.

Within this scope, bread and other bread varieties can be sold in the following three ways:

1. Pre-packaged and labeled.
2. In packaging material: Bread and bread varieties can be placed in paper-based or plastic-based packaging materials suitable for food contact. It is acceptable to leave the opening of the packaging unsealed to allow moisture to escape.
3. Unpackaged products: These may only be displayed in cabinets or counters where hygiene measures prevent contamination and consumer contact. Upon consumer request, the product must be placed in suitable packaging by the staff before being handed to the consumer.

Non-compliance with hygiene rules is followed up with necessary inspections if reported to the Alo Gıda 174 hotline or to the WhatsApp Food Tip Line at 0501 174 0 174.

Question 15: Is the expression "100%" allowed on the labels of fruit juice and similar products?

Fruit juice, fruit juice from concentrate, fruit juice concentrate, fruit juice extracted with water, fruit juice powder, fruit nectar, fruit puree, and fruit puree concentrate products are regulated under the Turkish Food Codex Communiqué on Fruit Juice and Similar Products (Communiqué No: 2014/34), published in the Official Gazette dated 6/8/2014 and numbered 29080.

According to this Communiqué, fruit juice is defined as: "The unfermented but fermentable product obtained from the edible parts of sound, ripe, fresh or chilled or frozen fruit, or a blend of such fruits, possessing the characteristic color, aroma, and taste of the fruit(s) from which it is derived."

Fruit juice produced from concentrate is defined as: "The product obtained by restoring the water removed during concentration, and, if necessary, the aroma, pulp, and cells separated during processing, back into the fruit juice concentrate." According to Article 13 paragraph (1) titled "Labeling" of the same Communiqué: "The phrase '100% fruit juice' may be used on the labels of fruit juice and fruit juice from concentrate products." Therefore, the "100%" statement can only be used for fruit juice and fruit juice made from concentrate.

Question 16: Is jam made from dried fruits allowed?

In Türkiye, jam regulations are governed by the Turkish Food Codex Communiqué on Jam, Jelly, Marmalade, and Sweetened Chestnut Puree, which came into effect after being published in the Official Gazette dated 30/12/2006 and numbered 26392. Products must comply with the provisions of this Communiqué.

According to Annex-2 titled "Processing Principles of Raw Materials," it is permitted to subject the fruits used in jam production to heating, cooling, freezing, freeze-drying, or concentrating as technically possible. Additionally, apricots and plums used in jam making may also be dried using methods other than freeze-drying.

Question 17: What is a processing aid? Is it allowed in Türkiye?

Processing aids are defined in the Turkish Food Codex Regulation on Food Additives as:

"Substances not consumed as food by themselves, used during the processing of raw materials, food, or food components for a specific technological purpose, which may be present in the final product unintentionally and in unavoidable quantities, provided that such residues do not pose health risks and have no technological effect on the final product."

There is no specific regulation solely for processing aids within the Turkish Food Codex Regulation. However, it refers to national standards where available, or international standards when national ones are lacking.

International references include the Food Chemicals Codex (FCC) and national legislation from other countries (e.g., France's list of processing aids).

Question 18: Are the terms "additive-free" and "natural" allowed on tomato paste labels?

Food additive regulations in Türkiye are governed by the "Turkish Food Codex Regulation on Food Additives," which came into effect after being published in the Official Gazette dated 30.6.2013 and numbered 28693.
Tin-packaged tomato paste falls under food category "04.2.3. Fruits and vegetables in tin or glass containers" in Annex-II Section E of this Regulation.
Use of food additives allowed under this category is permitted in tomato paste production.

Rules for the use of the terms “additive-free” and “natural” are illustrated in the “Guide on the Turkish Food Codex Regulation on Food Labeling and Consumer Information.”

According to this guide: If a food product is allowed to contain additives but contains none (excluding those that occur naturally or are carried over from ingredients), it may be labeled as “additive-free” or with similar expressions such as “does not contain additives,” “no additives present,” “no additives added,” etc.

The term “natural” may be used for products that:

- Consist of a single ingredient
- Contain no additives, flavors, or other added components
- Are not subjected to any process other than physical, enzymatic, or microbiological treatment
- Originate from plants, algae, fungi, animals, microorganisms, or minerals
- Have not undergone any processing that significantly alters their natural structure.

If tomato paste is produced without using additives (although permitted), then using the term “additive-free” on the label is allowed. Since it is made durable through only physical processing, the use of the term “natural” is also permitted on its label.

Question 19: What does an E number mean? Do E-numbered substances contain pork-derived ingredients?

An E number is the code number assigned to each food additive approved by the European Union. As in EU countries, in Türkiye it is mandatory to indicate either the name or the E number of a food additive on the label along with its function. The E code represents an additive that has undergone necessary safety tests and for which specifications are fully defined—it indicates safety.

Additives allowed in food are determined by the Codex Alimentarius Commission established by the UN’s Food and Agriculture Organization (FAO) and World Health Organization (WHO), of which Türkiye is a member.

The Joint FAO/WHO Expert Committee on Food Additives (JECFA) studies the effects of additives through long-term toxicological, carcinogenic, teratogenic, and mutagenic studies on lab animals. It determines ADI (acceptable daily intake) values for those deemed safe.

The European Food Safety Authority (EFSA) also evaluates toxicological data and provides scientific reports that are implemented as European Community Directives.

In line with EU harmonization, Türkiye updates its legislation accordingly and considers EFSA’s safety assessments in case of risks. Türkiye’s national regulation is the “Turkish Food Codex Regulation on Food Additives,” effective from 30/6/2013, published in Official Gazette No. 28693.

Information on the sources of food additives is available in the “Turkish Food Codex Regulation on Specifications for Food Additives,” published in the Official Gazette dated 3/4/2017 and numbered 30027. Moreover, Article 6, paragraph 2 of the Turkish Food Codex Regulation on Food Additives states: “A food additive derived from pork cannot be used in foods, food additives, food enzymes, or food flavorings.” Thus, food additives used in Türkiye cannot be pork-derived.

Question 20: Are E-numbered substances halal?

Regarding halal food, the Law No. 7060 on the Establishment and Duties of the Halal Accreditation Agency, prepared by the Ministry of Economy, was published in the Official Gazette dated 18/11/2017 and numbered 30244. However, the Ministry of Agriculture and Forestry’s Law No. 5996 on Veterinary Services, Plant Health, Food, and Feed only contains regulations to ensure food safety. It does not include any regulations on halal food, and halal food practices do not fall within the authority, responsibility, or duties of the Ministry.

Question 21: Do colorants have harmful effects on children?

The purpose of the “Veterinary Services, Plant Health, Food and Feed Law” No. 5996, dated 13/6/2010, is to protect and ensure food and feed safety, public health, plant and animal health, as well as animal breeding and welfare, taking into account consumer interests and environmental protection.

Food additives permitted for use in food products are determined by the Codex Alimentarius Commission, established jointly by the Food and Agriculture

Organization (FAO) and the World Health Organization (WHO) of the United Nations, of which our country is also a member. The Food Additives Expert Committee (JECFA) established by this commission examines all food additives for all effects through long-term studies on laboratory animals, including toxic, carcinogenic, teratogenic, and mutagenic effects, and determines the ADI (acceptable daily intake) values for any additive it deems not harmful to health. Based on these results, the committee determines which additives can be used in foods and their usage limits.

The EFSA (European Food Safety Authority) forms panels on food additives, evaluates scientific studies and toxicology data, and prepares reports. These reports are then implemented as "European Community Directives." Within the scope of EU harmonization, these additives are regulated in accordance with the European Parliament and Council Directives, with necessary updates made. If there is any potential health risk from an additive, EFSA's risk and safety assessments are taken into account both in the EU and in our country.

In this regard, the legal regulation in our country is the "Turkish Food Codex – Regulation on Food Additives," published in the Official Gazette No. 28693 dated 30.6.2013, which clearly states in which foods and which additives can be used. E 129 Allura Red AC, E 110 Sunset Yellow FCF / Orange Yellow S, and E 102 Tartrazine are colorants that are permitted within specified limits in certain foods under this Regulation. Furthermore, as per Article 24 of the Regulation, the labels of foods containing these colorants must include the statement found in Annex V of the Regulation:

"Name or E-code of the colorant(s): may have an adverse effect on activity and attention in children." Therefore, consumers are advised to carefully read the ingredients list and any additional information provided on the product label.

Question 22: Is the additive called Carmine obtained from insects?

The food additive with the code E 120, known as Cochineal, Carminic Acid, and Carmines, listed in the Turkish Food Codex – Regulation on Food Additives, is a type of coloring pigment obtained from the Dactylopius coccus insect. It functions as a colorant and is permitted for use in certain foods.

Although some additives are obtained from natural sources, their structure may change during processing, turning them into chemical substances.

Nevertheless, the risk and safety assessments of international organizations are taken into account regarding the use of additives in foods, and necessary measures will be taken if there is any situation that threatens human health.

Question 23: Is L-cysteine obtained from human hair?

In the "Turkish Food Codex – Regulation on Specifications for Food Additives," published in the Official Gazette No. 30027 dated 3/4/2017, it is stated in the definition of the additive L-cysteine (E 920) that "Human hair cannot be used as a source for this substance." Based on this provision, the use of L-cysteine derived from human hair is not permitted in our country.

L-cysteine (E 920) is an amino acid widely found naturally in the structure of proteins and can be obtained from animal and plant sources, as well as synthetically. The legal regulation on food additives in our country is the "Turkish Food Codex, Regulation on Food Additives," published in the Official Gazette No. 28693 dated 30.6.2013, which clearly states in which foods and which additives can be used. L-cysteine (E 920) is permitted within specified limits in certain foods under this Regulation.

Question 25: Why was honey-flavored syrup banned?

With the "Turkish Food Codex Regulation," published in the Official Gazette No. 31044 on 19.02.2020 and put into effect on the same date, the production of products that give the impression of honey—such as honey-flavored syrup, pine-flavored syrup, honey syrup, and similar names—by adding flavorings or honey, was prohibited as of 19.02.2020 to prevent consumer deception.

Only products that do not create the impression of honey (e.g., packaging with images of honey, bees, or hives) and that have the product name "honey-flavored syrup" written on the package in the same color, font size, and font style in accordance with labeling legislation, were allowed to remain on the market until the end of 2020. Other honey-flavored syrups that create a perception of honey and mislead consumers were prohibited from being produced or marketed.

Question 26: In some products (for example, where plastic cups are sold wholesale), cups are delivered in boxes, and you said labeling only on the box may be sufficient. However, 100-piece packages inside the box can be sent to the point of sale. In this case, label tracking becomes impossible. Wouldn't it be better to have labeling for each product? Should traceability marks be on the product itself in non-retail stages?

In the "Turkish Food Codex, Regulation on Materials and Articles in Contact with Food," it is stated that different labeling practices can be applied for retail and non-retail stages. In this case, if the final point of use of the plastic cups arriving in boxes is, for example, a mass consumption location (hotel, restaurant, café, etc.), it is sufficient for the required information to be present only on the box. However, the operator must ensure traceability of these cups when necessary. On the other hand, if the cups in boxes, packaged in quantities such as 100 or 10, are sent to retail businesses and offered for sale to consumers, then all mandatory information must also be present on these packages. The key point here is ensuring that the end consumer is informed.

Question 27: Is the use of aluminum pots in mass consumption locations appropriate?

Regarding aluminum in contact with food, the rules in the "Turkish Food Codex, Regulation on Materials and Articles in Contact with Food" apply. A limit of 5 mg/kg has been set for aluminum that may migrate from food contact materials into food, and it is mandatory to include a warning on the label stating that uncoated aluminum is not suitable for contact with acidic, basic, and salty foods. It has been scientifically proven that aluminum migration increases in acidic, basic, and salty environments. Therefore, the use of aluminum in mass consumption locations should also be evaluated in this context. For example, cooking in aluminum pots would not be suitable if the environment is acidic, basic, or salty. In any case, the 5 mg/kg limit must not be exceeded. Although the transition period for the regulation is still ongoing, businesses should be informed about this issue during official inspections.

Question 28: If it is specified that a material in contact with food is intended for a specific product group, should we take into account the analysis results done with other food simulants?

If the label information of a food contact material or article states which foods it should not be used with (such as "not for use with fatty foods"), there is no need to perform analysis using the food simulant for that food group.

Question 29: The numbers inside the triangle do not appear in our legislation, but do they exist in international regulations? What is their validity?

The various numbers inside the triangular recycling symbol on plastic materials and articles are regulations included in the "Regulation on the Control of Packaging Waste" and indicate the type of raw material the plastic is made from. This numbering process falls under the responsibility of the Ministry of Environment and Urbanization.

Question 30: How should oxygen absorber packets be evaluated? How should the outer packaging and the contents be assessed?

Such materials are considered active materials and articles in contact with food. Their definitions and rules of use are provided in the "Turkish Food Codex, Regulation on Materials and Articles in Contact with Food" and the "Turkish Food Codex, Communiqué on Active and Intelligent Materials and Articles in Contact with Food."

The most important point to note here is that any changes caused by the active ingredient in the structure of the food contact material must not alter the characteristics of the food. Additionally, for these small packets such as those containing iron powder placed inside food packaging, necessary measures must be taken to ensure that the printed surface of the packet does not come into contact with food (e.g., having a coated printed surface). When it comes to active materials and articles, each case should be evaluated on a product-by-product basis. Therefore, it is advisable to contact our Directorate General regarding new products encountered.

Question 31: Will the Food Hygiene Regulation be required for businesses producing materials and articles in contact with food?

It is important to ensure good manufacturing practice (GMP) conditions. Operators are also required to fulfill their obligations under the "Regulation on the Registration Procedures of Businesses Producing Materials and Articles in

Contact with Food and on Good Manufacturing Practices" (Official Gazette: 03.08.2012–28373).

Question 32: Will a registration certificate be issued to a water company that produces carboys from preforms and fills them with water?

The business that produces the preform must be registered. However, a business that purchases this preform and uses it solely for filling its own products does not need to obtain an additional registration certificate as a business producing materials and articles in contact with food. What is important here is that the suitability of the physical processes applied to the preform in the food business is also guaranteed by the business that produced the preform.

Question 33: Is palm oil harmful to health?

The Ministry evaluates palm oil within the scope of the "Communiqué on Oils Named After Plants" (Official Gazette: 12.04.2012–28262). The communiqué provides seven definitions for palm oil and its fractions (palm kernel, palm kernel olein, palm kernel stearin, palm olein, palm stearin, palm super olein, palm oil). The physical and chemical properties that palm oil must meet are specified in this communiqué. Palm oil offered to the final consumer or used in the food industry must comply with the criteria in the communiqué, which have been prepared based on national and international studies and data.

In addition, all plant-named oils, including palm oils, must comply with the provisions of the general food codex (contaminants, labeling, etc.). If products are found to be produced in violation of the legislation during official inspections conducted by the Ministry, sanctions are applied.

Question 34: Is high-fructose corn syrup (NŞB) harmful?

The purpose of the "Veterinary Services, Plant Health, Food and Feed Law" No. 5996, dated 13/6/2010, is to protect and ensure food and feed safety, public health, plant and animal health, as well as animal breeding and welfare, taking into account consumer interests and environmental protection. Article 23 of the law authorizes the Ministry to prepare and publish the food codex, which sets minimum technical and hygiene criteria, residues of plant protection products and veterinary medicines, additives, contaminants, sampling, packaging, labeling, transportation, storage requirements, and analysis methods for food and materials in contact with food.

When preparing food-related legislation, food safety and public health are given priority. Food business operators must produce their products in accordance with the Turkish Food Codex Regulation and relevant communiqués. The Ministry regularly carries out official inspections through provincial directorates in all 81 provinces to determine whether products comply with the Turkish Food Codex.

The Turkish Food Codex Sugar Communiqué was prepared in line with the EU Directive 2001/111/EEC on sugars intended for human consumption. Glucose syrup, glucose-fructose syrup, or fructose-glucose syrup are evaluated under this communiqué and are defined as purified and concentrated aqueous solutions of nutritive saccharides obtained from starch, inulin, or their mixtures. The types of sugars and quantities that may be used in foods are determined based on technological requirements of the production process and consumer preferences. For example, according to the "Turkish Food Codex Communiqué on Fruit Juice and Similar Products" (Official Gazette: 06.08.2014–29080), the addition of sugar to fruit juice is prohibited, while in fruit nectars, the rule is: "Sugars and/or honey and/or sweeteners may be added to fruit nectar. However, the added sugar and/or honey may not exceed 20% of the total weight of the final product."

The Ministry carries out the necessary inspections to ensure food safety, and the variety of products on the market reflects consumer demand and preferences. Consumers are advised to carefully read the ingredients section and additional information on product labels.

On the other hand, there is no scientific data or consensus in international scientific sources that high-fructose corn syrup causes cancer or metabolic diseases. Authorities such as WHO (World Health Organization), EFSA (European Food Safety Authority), and JECFA (Joint FAO/WHO Expert Committee on Food Additives), which bring together experts worldwide to conduct risk assessments on food, have not issued any publications or declarations stating that HFCS can be directly linked to cancer or metabolic diseases. The Ministry closely monitors research regarding possible adverse health effects of HFCS and will conduct risk and safety assessments if any national or international health risk arises.

Question 35: What should we pay attention to when preparing food?

Hygiene rules must be followed during food preparation:

- The safety seal/safety band on product packaging must be intact.
- When preparing animal products (especially when thawing frozen ones), the leaked liquid must be removed and cooking should begin immediately.
- When handling ready-to-eat and raw products, separate equipment (such as chopping boards, knives, etc.) should be used to prevent cross-contamination, or if the same equipment is used, it must be cleaned and disinfected between each process.
- Raw animal foods must be thoroughly cooked.
- Vegetables and fruits should be washed thoroughly with plenty of water before consumption.

Before preparing and consuming raw fruits, vegetables, and other unheated products, general hygiene rules such as hand washing should be observed, and cooking processes should be carried out adequately.

Question 36: Is the sale of unpackaged bread hygienic?

To ensure that bread, bread varieties, other bread types, and sourdough bread offered for consumption are produced, stored, transported, and marketed in a technically appropriate and hygienic manner, their specifications are determined in the "Turkish Food Codex Communiqué on Bread and Bread Varieties."

Products covered by the communiqué that are sold unpackaged must comply with the hygiene criteria specified in Annex-2 of the communiqué, in addition to the provisions of the Food Hygiene Regulation and the Turkish Food Codex Regulation on Microbiological Criteria.

According to the communiqué, unpackaged bread offered for sale must be stored and sold in bread cabinets or on counters in a way that prevents customers from touching them, under the control of the food business operator, or the operator must ensure that consumers use gloves when picking up bread. It is considered important that consumers use single-use gloves provided by the business to avoid direct hand contact when selecting bread.

Food safety inspections are carried out by control officers in the 81 Provincial Directorates of Agriculture and Forestry in accordance with Law No. 5996. In cases where non-compliance is detected during official inspections, the necessary legal actions are taken under the Law.

Question 37: Do flatbread (yufka) and bazlama count as bread varieties?

Flatbread (yufka) and bazlama are not included in the bread and bread varieties category.

Question 38: Is it mandatory to use gloves and hairnets in businesses?

Under Law No. 5996 and related regulations, there is no specific obligation regarding glove use. If the use of hairnets and/or gloves is stated as a preventive measure in the business's HACCP plan (depending on the nature of the business), then it must be implemented. However, if glove use is not specified in the HACCP or prerequisite program, it is not required, provided that an effective method for hand hygiene is in place (e.g., sinks with taps that do not require hand/arm contact, liquid soap, single-use towels, paper towels, etc.).

Considering the current sensitivities, raising hygiene standards to the highest possible level is considered a national and human responsibility, even if it does not carry a legal penalty.

Question 39: How should bread be sold?

To ensure that bread and bread varieties are produced, stored, transported, and marketed in a technically appropriate and hygienic manner, their specifications are determined in the "Turkish Food Codex Communiqué on Bread and Bread Varieties."

In order to protect public health and reduce the spread of epidemics, the Ministry has deemed it appropriate to take certain measures under Article 26(5) of the "Veterinary Services, Plant Health, Food and Feed Law" No. 5996.

Accordingly, bread and bread varieties may be sold in the following three ways:

1. Prepackaged and labeled

2. In packaging material: Bread and bread varieties may be placed in food-contact-safe paper- or plastic-based packaging. The opening of the packaging may be left unsealed to allow moisture to escape.
3. Unpackaged: These products may only be kept in cabinets or on counters where hygiene measures have been taken to prevent contamination and consumer contact, and must be placed in suitable packaging by business staff upon customer request before being handed to the consumer.

In addition, during periods when epidemic risk continues, bread and bread varieties, whether packaged or unpackaged, may not be sold in markets, greengrocers, on streets, or from mobile vehicles.

In line with all these points, if you believe that a business is operating in violation of the legislation, you may report its name and address to the Ministry's "Alo 174 Food Hotline," and an official inspection will be carried out.

Question 40: We have been informed that bread sales outside of bakeries and markets are prohibited. How should we respond?

In the sale of bread and bread varieties placed on the market, direct access by consumers to the products will be prevented. Bread, bread varieties, and other bread types may be offered for sale in the following three ways:

1. Pre-packaged
2. Inside packaging material: Bread and bread varieties may be placed in food-contact-safe paper-based or plastic-based packaging material for sale. It is acceptable for the mouth of the packaging material to be left open to allow moisture from the product to escape.
3. Products not placed in packaging material: These products may only be stored in cabinets and counters where hygiene measures have been taken to prevent contamination and consumer contact, and may be offered to consumers in suitable packaging material by business staff upon request.

In addition, during the period when the epidemic risk continues, the sale of bread and bread varieties, whether packaged or unpackaged, will not be allowed in places such as markets, greengrocers, on the streets, or in mobile vehicles.

Question 41: How will the weekend closure process for agricultural pesticide dealers work?

Procedures for the wholesale, retail sale, and storage of plant protection products are carried out according to the provisions of the Regulation on the Wholesale and Retail Sale and Storage of Plant Protection Products dated 13.02.2019 and numbered 30685. This regulation requires plant protection product dealers and wholesalers to keep their sales locations open at least five days a week. There is no requirement regarding being open or closed on Saturdays and Sundays.

Question 42: Will raw milk sales be allowed?

As is known, the manner in which raw milk is to be offered to the final consumer is determined by the Communiqué on the Offering of Raw Milk published in the Official Gazette dated April 27, 2017, and numbered 30050. The communiqué permits the sale of raw milk by livestock enterprises with a disease-free certificate, either through vending machines or packaged, via retailers.

Consumers who will use raw milk should choose products registered with the Ministry and must boil the raw milk before consumption. There is no objection to boiling such milk for yogurt production and consumption within the scope of the communiqué.

Question 43: Isn't pest control required for businesses to continue production?

Food businesses are obliged to maintain hygiene in their facilities not only due to coronavirus but at all times, according to the Food Hygiene Regulation. During official inspections, businesses that fail to meet hygiene requirements are subject to legal action under Law No. 5996.

Question 44: What are the main food items that cause allergies or intolerances?

- Cereals containing gluten: wheat (e.g., spelt and khorasan wheat), rye, barley, oats, or their hybridized strains, and products thereof
- Crustaceans and products thereof
- Eggs and egg products
- Fish and fish products
- Peanuts and peanut products

- Soybeans and soybean products
- Milk and milk products (including lactose)
- Tree nuts: almonds (Amygdalus communis L.), hazelnuts (Corylus avellana), walnuts (Juglans regia), cashew nuts (Anacardium occidentale), pecan nuts (Carya illinoiesis), Brazil nuts (Bertholletia excelsa), pistachios (Pistacia vera), macadamia nuts and Queensland nuts (Macadamia ternifolia), and products thereof
- Celery and celery products
- Mustard and mustard products
- Sesame seeds and sesame seed products
- Sulphur dioxide and sulphites (at concentrations of more than 10 mg/kg or 10 mg/L in terms of total SO_2, for products ready for consumption or prepared according to manufacturers' instructions)
- Lupin and lupin products
- Molluscs and products thereof[38]

Question 45: How are allergens indicated on food labels?

In the list of ingredients, allergens are indicated in a way that clearly distinguishes them from the rest of the list; for example, by using bold, italics, or a different color. This ensures that they can be easily noticed by the consumer.[39]

Question 46: Things to pay attention to when buying food: Put packaged raw red meat, poultry, and seafood in an extra bag!

Place packaged raw red meat, poultry, and seafood in a separate bag before putting them in your shopping cart. This prevents any liquid that may leak from the packaging from coming into contact with other foods, thereby avoiding cross-contamination. When bagging at the checkout, also keep these products separate from other foods. This reduces the risk of contamination to fruits, vegetables, or other ready-to-eat foods.[40]

38 Source: https://guvenilirgida.tarimorman.gov.tr/Haber/Detay/15071
39 Source: https://guvenilirgida.tarimorman.gov.tr/Haber/Detay/15086
40 Source: https://guvenilirgida.tarimorman.gov.tr/Haber/Detay/15040

Question 47: Does bread contain additives?

According to regulations, no additives — including the additive E 920 (L-Cysteine) — are allowed in bread, whole wheat bread, whole meal bread, bran bread, or sourdough bread. The only exception is that in flour production facilities producing the wheat flour used for making these breads, E 300 (Ascorbic acid) may be added.[41]

Question 48: What information is found on the eggshell?

Farming Method Code: Indicates the conditions in which the egg was produced. "0" for organic farming, "1" for free-range farming (access to open areas), "2" for cage-free indoor farming, and "3" for caged farming. This code is assigned automatically by the system.

Country Code: In eggs produced in Türkiye, this is shown as "TR".

Province Traffic Code: Indicates in which province the egg was produced.

Farm Number: A number assigned to poultry farms by the Provincial/District Directorates of the Ministry, indicating at which farm the egg was produced.

Henhouse Number: Each flock in poultry farms is assigned a number such as 1, 2, 3, etc., by the Provincial/District Directorates of the Ministry.

Laying Date: The laying date can be stamped on Class A eggs.

Example Code and Explanation:

Code: 0TR060000060000-01

Breaking down the code:
Farming Method Code = 0 → Indicates it is an organic chicken egg
Country Code = TR → Produced in Türkiye
Province Traffic Code = 06 → Produced in Ankara
Business Number = 0000060000 → Code specific to the business

41 Source: https://guvenilirgida.tarimorman.gov.tr/Haber/Detay/15032

Question 49: What does the E Code mean? Do E-coded substances contain pork products?

The E code refers to the code number that uses the first letter of the word Europe, determined and approved by the European Union for each food additive. The E-code indicates additives that have passed necessary safety tests and have all specifications defined; it represents a safety assurance. Just like in European Union countries, in our country it is mandatory to indicate either the name or the E code of each additive used on the label along with its function. The use of food additives derived from pork in foods is prohibited.

Question 50: Are food additives with E-codes harmful to health?

To ensure a standard for food additives used in foods, food additives have been numbered through an international system. The letter E at the beginning of the numbers stands for Europe. The presence of an E code on an additive shows that risk assessment studies have been completed, and it has been approved by the Scientific Committee on Food of the European Union.

Question 51: What do the numbers inside the triangle on food packaging mean?

The various numbers found inside the recycling symbol shaped as a triangle on plastic materials and substances used in food packaging indicate the raw material from which the plastic is made. This numbering system is a voluntary practice and falls under the responsibilities of the Ministry of Environment and Urbanization.

Question 52: What mandatory information must be included on food labels?

Rules regarding the labeling of foods are regulated by the Turkish Food Codex Food Labeling and Consumer Information Regulation. It is mandatory for all prepackaged foods to include the following information on their labels:

- Name of the food,
- List of ingredients,
- Specific substances or products causing allergies or intolerances,
- Quantity of certain ingredients or ingredient groups,
- Net quantity of the food,
- Recommended consumption date or expiration date,
- Special storage and/or usage conditions,
- Name or trade name and address of the food business operator,
- Business registration number or identification mark,
- Country of origin,
- Instructions for use if the food cannot be properly consumed without them,
- Actual alcohol content by volume for beverages containing more than 1.2% alcohol by volume,
- Batch number,
- Nutrition declaration (amounts of energy and nutrients such as fat, saturated fat, carbohydrates, sugars, salt, protein per 100 grams or 100 ml of the food).

Question 53: Are there additional mandatory details on food labels?

In addition to the mandatory information, depending on the production technique and food ingredients used, the following must also be included on the label:

- Foods packaged with certain gases,
- Foods containing sweeteners,
- Foods containing glycyrrhizic acid or ammonium salt of glycyrrhizic acid,
- Foods containing high amounts of caffeine,
- Foods with added plant sterols, plant sterol esters, plant stanols, or plant stanol esters,
- Foods containing ethyl alcohol and/or alcoholic beverages,
- Foods containing substances derived from pork.

Question 54: What is the amount of trans fats in foods marketed in our country?

In Türkiye, except for naturally occurring trans fats in animal fats, the trans fat content in foods offered to the end consumer cannot exceed 2%.

Question 55: Why are the amounts of some ingredients written on the label while others are not?

The quantity of ingredients must be provided in the following cases:

- If the relevant ingredient or ingredient group is included in the name of the

food,

- If the relevant ingredient or ingredient group is generally associated with the food's name by the consumer (e.g., the amount of minced meat in lahmacun),
- If the relevant ingredient or ingredient group is emphasized on the label with words, pictures, or graphics,
- If the quantity of the relevant ingredient or ingredient group is essential for identifying the food and distinguishing it from similar products due to its name or appearance.

Question 56: How are allergens indicated on the label?

- Names of substances or products causing allergies in the ingredients list are highlighted clearly and distinctly from the rest of the list by using a specific text format (e.g., font, style, or background color).
- Example: Ingredients: Wheat Flour, Sugar, Fructose Syrup, Glucose Syrup, Hazelnut, Cocoa Powder, Milk Powder, Egg, Salt, ...

Question 57: Where can we find out if a dietary supplement is approved?

The list of dietary supplements approved by the Ministry of Agriculture and Forestry is published on the website https://ggbs.tarim.gov.tr/ under the section "Approved Dietary Supplements List."

Question 58: What does RA (Reference Intake) on the label mean?

It shows, as a percentage, how much of the recommended daily intake of energy or nutrients is provided by 100 g or 100 ml of the ready-to-eat food. RA is the average daily nutrient intake that meets the nutritional needs of almost all healthy people of a certain age and gender. This value may also be given per portion or consumption unit on the label.

Question 59: What is a nutrition claim?

A nutrition claim is defined as any message that states, suggests, or implies that a food has beneficial nutritional properties due to its energy, nutrient content, or other components. Nutrition claims such as high fiber, low fat, reduced energy are voluntarily applied in food labeling to inform consumers.

Question 60: What should be considered when buying food?

- Always read the label information on foods.
- Check whether there is an expiration date or recommended consumption date. Do not buy foods past their expiration date.
- Do not buy packaged foods with damaged, swollen, bulging, punctured, or leaking packaging.
- Pay attention to warnings on the label and check whether each product is offered under its specific storage conditions (temperature, humidity, light, etc.).
- Pay attention to maintaining the cold chain for frozen foods.

Question 61: What should be considered when storing food at home?

- Store purchased foods at appropriate temperatures.
- Store meat and meat products, milk, and dairy products in refrigerator conditions at 0-4°C.
- Consume cooked foods immediately or cool them quickly if they will be consumed later, store them in the refrigerator, and heat only the amount to be consumed.
- Avoid reheating cooked food repeatedly.
- Store dry foods in a dark, cool, and dry place.
- Store frozen products at -18°C, thaw them in the refrigerator when needed, and do not refreeze after thawing.

Question 62: Where can consumers submit their complaints and requests about food?

Consumers can report all kinds of complaints and requests regarding "food" to the Alo174 Food Hotline Call Center from anywhere in Türkiye. Reports and complaints received by this call center are forwarded to relevant units of the Ministry according to their content via web-based software. Information about the procedures taken following evaluation and inspection is recorded in the same software, and an application tracking number is given to the person who applied in return for their Turkish ID number.

The applicant can check the status of their complaint or request only by using their Turkish ID number and the application number either by calling Alo174 again

or through the website www.alo174.gov.tr. The personal identity information of applicants is not visible to the Alo Food contact points. This precaution is taken to prevent the sharing of personal information with other individuals or institutions during the application process.

Applications are responded to as soon as possible.

Access channels to the Alo174 Food Hotline Call Center are being developed according to current conditions and needs (Phone, e-mail, social media, mobile app, web chat, video call, e-Government, Alo Food WhatsApp 05011740174, Bip).

Question 63: What is GMO?

A genetically modified organism obtained by transferring genes using modern biotechnological methods. In other words, these are organisms created by transferring genes between species where gene exchange is not possible through classical hybridization methods, using biotechnological techniques.

Question 64: Are there GMO foods in our country?

The Biosafety Board currently has approved 15 soybean genes and 21 corn genes for use only as animal feed; no genes have been approved for food purposes. Importing GMO products for food purposes is not permitted.

Question 65: How many types of sugar production are there in our country?

In Türkiye, two main types of sugar production are carried out: beet sugar and starch-based sugar. Both types of starch-based sugar, glucose syrup and isoglucose (HFCS), are produced domestically.

Question 66: Are all food additives harmful to human health?

Food additives are components added to food for technological purposes (such as preservatives, colorants, thickeners, emulsifiers, anti-caking agents, sweeteners, etc.).

The Joint Expert Committee on Food Additives (JECFA), formed by experts from the United Nations Food and Agriculture Organization and the World Health Organization, evaluates additives and determines which additives and usage amounts do not pose risks to human health.

The use of food additives in foods is permitted only if they are deemed appropriate following risk assessment and usage limits are set.

Food additives can be used according to the Turkish Food Codex Food Additives Regulation, which is prepared in consideration of international standards.

Question 67: Are all food additives artificial?

Food additives can be artificial, natural, or nature-identical substances. For example:

- Betanin (E 162), a red coloring obtained from beet juice, is natural.
- Citric Acid (E 330), identical to the natural one, is nature-identical.
- Some additives such as Acesulfame K (E 950) and Aspartame (E 951) are chemically produced by humans and are artificial.

Question 68: Would our foods be healthier if we did not use additives?

Food additives are added to foods due to technological necessities required by production processes. The use of food additives is inevitable for processed food products to be stored without spoiling for a long time and to maintain their quality.

For example, processed meat products (salami, sausage, sucuk, etc.) without added nitrites or nitrates can spoil microbiologically very quickly. This can cause food poisoning like botulism, which can be fatal. Another example: without antioxidants in food, fats can oxidize and become harmful to health.

Question 69: Are there additives in fruit juices?

It is prohibited to add additives such as sweeteners, flavorings, colorants, preservatives, and added sugar to fruit juices. In other words, they are very similar to the juice you squeeze at home. The biggest difference is that in food processing facilities, fruit juices undergo heat treatment to preserve nutritional value without spoiling during shelf life.

However, it should be remembered that fruit juice and fruit-flavored beverages are not the same products.

Question 70: Does the nutritional value of canned products decrease?

Canning is a method that uses heat treatment to preserve a food as close to fresh as possible for a long time. The raw materials chosen for canning should be fresh and in season. It is known that high heat treatment of vegetables causes losses in some vitamins (especially B vitamins and vitamin C). However, the amounts of other essential nutrients such as protein and calcium remain the same or the loss is negligible.

Research shows that canned products have nutritional qualities as good as fresh or frozen preparations. Canned products do not lose their nutritional value as long as they are produced according to the appropriate techniques.

Question 71: Can the moldy parts of foods like cheese, yogurt, or tomato paste be cut off and the rest consumed?

If there is mold on high-water content products such as yogurt, cream, jam, tomato paste, bread, fruit juices; meat products like red meat, white meat, sausages, salami; soft vegetables and fruits (cucumber, tomato, peach, etc.), and cooked meals, it is recommended not to consume them even if the moldy part is cut off. This is because mold mycelia can penetrate deeply into the food, even if not visible to the eye, and some mold types produce toxic compounds harmful to humans.[42]

Question 72: What is the Turkish Food Codex (TGK)?

The Turkish Food Codex is the entire legislation that determines the minimum technical and hygiene criteria related to food and materials in contact with food, pesticide and veterinary drug residues, additives, contaminants, sampling, packaging, labeling, transportation, storage, and analysis methods in accordance with our country's standards.

Food legislation is prepared based on the needs of our country and consumer demands, aligned with the European Union acquis, standards from the United Nations Food and Agriculture Organization (FAO), World Health Organization (WHO), and globally accepted scientific approaches.

42 Source: https://guvenilirgida.tarimorman.gov.tr/Sayfa/Detay/1864

The legislation and criteria under it are updated based on scientific evaluations considering potential physical, chemical, and microbiological risks.

Our Ministry also gives great importance to protecting traditional and regional products in regulatory arrangements.[43]

Question 73: What is a Dietary Supplement?

According to Law No. 5996, dietary supplements are products prepared in solid or liquid forms such as capsules, tablets, lozenges, single-dose powder packets, liquid ampoules, dropper bottles, etc., containing concentrated or extracted vitamins, minerals, proteins, carbohydrates, fibers, fatty acids, amino acids, or other plant, plant-based, and animal-derived substances with nutritional or physiological effects, either alone or in mixtures, with a defined daily intake dose, intended to supplement normal nutrition.

Brief definition: Dietary supplements are foods that support normal nutrition, prepared in solid or liquid forms with defined daily consumption units, containing vitamins, minerals, plants, or other substances with nutritional and physiological effects used alone or together.

Usage: Dietary supplements are sold in pharmacies, markets, online, and other sales channels worldwide, especially in the European Union. Their contents and amounts are regulated by legislation. Our Ministry requires pre-market approval for all produced or imported dietary supplements.

- No dietary supplement approval is granted for children aged 0-2 years.
- Products claiming to reduce weight, increase weight, promote height, enhance performance, regulate development, etc., are not approved as dietary supplements.
- The list of approved dietary supplements is available at https://ggbs.tarim.gov.tr/, and consumers should check this list before purchasing products.
- No approval is granted for licensed pharmaceutical brands.
- Food additives are not allowed in products specifically for 2-3 year-olds.

Mandatory statements on dietary supplement labels:

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- The name characterizing the product.
- Recommended daily portion amount.
- “Do not exceed the recommended daily portion.”
- “Dietary supplements cannot replace a balanced diet.”
- “Keep out of reach of children.”
- “Not a medicine. Not to be used for preventing or treating diseases.”
- “Consult your doctor during pregnancy, breastfeeding, illness, or medication use.”

There is no harmonized list in EU legislation for substances other than vitamins and minerals that show nutritional or physiological effects and their limits. The “Restricted Substances List for Dietary Supplements” is published at https://ggbs.tarim.gov.tr/.[44]

Question 74: What are the symbols on food labels and their meanings?

Organic Product Logo

This logo symbolizes a certified product produced in accordance with organic farming practices. In our country, it is mandatory to use the organic product logo on the packaging of products produced as part of food safety and reliability and marketed as organic. Products without the organic product logo on their labels cannot be presented or advertised as organic in our country. For products offered in the domestic market, the logo language must be in Turkish.

The diameter of logos varies between 6 mm and 40 mm depending on the packaging size. The logos use green, blue, black, and white colors. Use of colors and shades other than those specified is prohibited. Sample logos can be found in the annex of the relevant regulation and can be used in black and white or color, with or without background.

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Iodized Salt Logo

The label of finely ground iodized salts presented directly to the end consumer must have the iodized salt logo. Although the minimum amount an adult needs daily is quite low, iodine has been added to salt due to observed iodine deficiencies, and this symbol indicates that.

The reason for iodized salt use is to increase iodized salt consumption and reduce iodine deficiency-related diseases in our country upon the Ministry of Health's request. Iodine deficiency is the most common and significant preventable cause of intellectual disability worldwide and represents a major public health issue.

Food Contact Compliance Logo

This logo, consisting of a glass and fork, indicates that the product is suitable for contact with food. According to the Turkish Food Codex Regulation on Materials and Articles in Contact with Food, materials and articles that come into direct or indirect contact with food or are expected to come into contact are regulated in all stages of production, processing, and distribution to ensure high-level protection of human health and consumer interests.

Currently, materials and articles not yet in contact with food when marketed bear the phrase “Suitable for food contact” or symbols or phrases specific to their use such as “for soup spoons,” “for wine bottles,” or “for coffee machines.”

However, for materials and articles clearly intended for food contact, specifying this information is not mandatory.

At the retail stage, this information appears on the material or article, its packaging, a label attached to them, or if labeling or printing is not possible due to technical reasons, a note must be placed where the item is sold, visible to the buyer.

The presence of the above symbols and statements on materials and articles indicates they are produced for food contact and that, under normal and foreseeable use conditions, no components from these materials will migrate into the food.

Good Agricultural Practices (GAP) Logo

İYİ TARIM
UYGULAMALARI

This logo indicates that agricultural production is carried out without harming the environment, human, and animal health; natural resources are protected; traceability and sustainability in agriculture are ensured; and reliable product supply is provided. In our country, as part of food safety and reliability, products certified under Good Agricultural Practices must have label information in accordance with the provisions of the Turkish Food Codex Food Labeling and Consumer Information Regulation. Additionally, the following information must be included:

- The owner of the product,
- Information that the product is produced in accordance with the Good Agricultural Practices Regulation,
- The name, code number of the authorized control and certification body, and the product certificate number,
- The logo related to good agricultural practices.

The code numbers of the authorized institutions start with TR.İTU, and the certificate number is created linked to this code number.

The phrase and logo for Good Agricultural Practices are registered as a trademark by the Turkish Patent and Trademark Office on behalf of the Ministry of Agriculture and Forestry. No product without a Good Agricultural Practices certificate can be sold under the name of Good Agricultural Practices, nor can the logo be used.

The procedures and principles regarding the use of the Good Agricultural Practices logo are determined by the Circular on the Use of Good Agricultural Practices Logo (2014/002).

Food Irradiation Symbol (Radura)

Irradiation can be applied to foods to extend shelf life, prevent insect infestation, and reduce microorganisms. This symbol indicates that the food has been exposed to an adequate dose of ionizing radiation in accordance with the proper procedure. Irradiation is performed at a specified dose under appropriate technological and hygienic conditions for one or more purposes such as preventing foodborne diseases, destroying spoilage-causing microorganisms, preventing or delaying spoilage to extend shelf life, reducing food losses caused by sprouting, germination, and ripening, and neutralizing organisms harmful to plants or plant products.

For prepackaged irradiated foods, the phrases “Irradiated” or “Irradiation treatment applied” and the green international food irradiation symbol “Radura” must be clearly visible on the label in a prominent area.

Symbols on Alcoholic Beverage Labels

These are health warnings intended to raise consumer awareness and inform about the harms of alcoholic beverages.

Geographical Indication Logos

These are quality marks that show and guarantee the connection between the product's characteristics and the region where it is produced. Geographical indication registration protects products whose quality, traditional nature, and local raw materials have earned them a certain reputation based on their regional characteristics.

Designation of Origin

These are names that define products originating from a specific region or exceptional cases a country, whose geographical boundaries are defined, and whose entire or essential characteristics are due to natural and human factors unique to that geographic area. The production, processing, and all other operations must take place within the boundaries of this geographical area.

For example: Finike Orange and Malatya Apricot.

Geographical Indication

These are names that define products originating from a specified region or country, identified by a distinct quality, reputation, or other characteristics attributable to that geographic area, where at least one of the production, processing, or other operations is carried out within the defined geographic area.

For example: Antep Baklavası (Traditional Product Name).

Traditional Product Name

Names that do not fall under designation of origin or geographical indication but have been proven to be used in the market for at least 30 years. For a product to be considered traditional, it must have a traditional production or processing method, a traditional composition, or be made from traditional raw materials or ingredients.

In our country, applications for both Geographical Indication and Trademark registration are made to the TURKISH PATENT AND TRADEMARK OFFICE.

4.2. COMMON MISCONCEPTIONS ABOUT FOODS / TRUTH BEHIND MISCONCEPTIONS

Tijen COŞKUN[45]

Claim 1 – Village eggs are organic.

The promotion of village eggs and free-range chicken eggs as healthier and organic shows that the differences between terms like natural, organic, and free-range eggs are not clearly understood. Village eggs sold by unregistered or unauthorized producers without traceability can pose health risks. Not every village egg is organic, and not every organic egg is a village egg.

Claim 2 – Milk sold in bulk (openly) is healthier than milk sold in packages.

Milk sold in bulk always carries the risk of containing microorganisms causing brucellosis and antibiotic residues. Raw milk used for processing is accepted only after various tests (e.g., antibiotic testing) and those that do not meet criteria are rejected. Disease-causing microorganisms are eliminated by processes like pasteurization and sterilization.

Claim 3 – The reason yogurts do not spoil for a long time is because they contain additives.

The long shelf life of yogurts is due to advances in dairy production technology. Heat treatment reduces the water content and kills all microorganisms that can cause foodborne illnesses. Controlled fermentation in yogurt production prevents the formation of substances causing souring and spoilage. Homemade yogurts spoil faster because the microorganisms (starter cultures) come from the previous batch, and fermentation temperature and duration are not controlled.

Claim 4 – All food additives are harmful to human health.

Food additives can be used according to the Turkish Food Codex Regulation prepared with international standards in mind. The Joint FAO/WHO Expert Committee on Food Additives (JECFA) evaluates additives and permits their use in amounts that do not pose health risks.

Claim 5 – E-coded food additives are harmful to health.

Food additives are numbered internationally to maintain standards. The letter "E" stands for Europe. An additive with an E code means that all safety studies have been completed and it is approved by the European Union's Scientific Committee on Food.

Claim 6 – All food additives are artificial.

Food additives can be artificial, natural, or nature-identical. For example, red coloring E162 from beet juice is natural; citric acid is nature-identical; dodecyl gallate, octyl gallate, and butylated hydroxyanisole are artificial additives produced synthetically.

Claim 7 – If we don't use additives, our foods will be healthier.

On the contrary, the use of additives is essential for preserving food safely and maintaining flavor. For example, processed meat products (salami, sausage, etc.) without nitrite or nitrate can suffer microbiological spoilage, leading to botulism poisoning, which can be fatal. Also, without antioxidants, fats oxidize and become harmful to health.

Claim 8 – Dark yellow eggs are fresher.

The color of the egg yolk depends on the breed and diet of the hen. Yolk color should not be used as a quality standard.

Claim 9 – Village chickens are natural because they take longer to cook.

Cooking time relates to breed and age. Industrially bred broilers grow quickly and cook faster, while village chickens take longer because they are not bred for fast growth. Villagers usually keep hens longer to benefit from eggs and do not sell them for slaughter until they get tougher, which makes their meat cook more slowly and differ from broilers.

45 Food Engineer, Head of Food Businesses and Codex Department

Claim 10 – The color of butter, yellow or white, affects its quality.

Butter color depends on the animal's diet and varies by season. Color is not a quality indicator. If cows, sheep, or goats mostly eat green plants, the pigments in the plants make the butter more yellowish.

Claim 11 – 100% fruit juices contain additives.

Adding sugar, sweeteners, flavorings, colorants, preservatives, or other additives to 100% fruit juices is prohibited. They are very similar to freshly squeezed juice at home, with the main difference being that they undergo heat treatment to preserve nutritional value and shelf life.

Claim 12 – Rock salt is healthier than refined iodized salt.

Rock salt has no advantage over other salts. It is basically table salt with small amounts of other elements mixed in. Scientific studies have shown excessive salt intake is linked to heart and vascular diseases, especially hypertension. The main culprit is excess sodium intake. Since rock salt is about 97% sodium, excessive consumption is also harmful.

The World Health Organization recommends a daily salt intake below 5 grams per person, roughly a teaspoon or heaping teaspoon. This recommended amount includes all salt consumed throughout the day from all foods, not just salt added at the table.

Claim 13 – Gluten consumption is harmful to everyone.

Less than 1% of the population has celiac disease and must exclude gluten from their diet. People with gluten intolerance or allergy should avoid gluten as much as possible based on their sensitivity. However, gluten only causes problems because of the reaction in people who have the disease or allergy, not because gluten itself is harmful to everyone.

Claim 14 – Frozen foods cannot preserve their nutritional value.

One of the most common misconceptions about frozen foods is that they lose nutritional value compared to fresh foods. However, thanks to Quick Freezing technology, foods are frozen at -40 degrees Celsius within minutes. This high-tech freezing prevents cell membrane rupture, so nutritional values remain preserved as on the first day for a long time.

Claim 15 – Frozen fruits and vegetables contain added preservatives.

Freezing is one of the oldest and most practical methods humans use to preserve food. When applied correctly, freezing food quickly does not require the addition of preservatives. Fruits and vegetables are transported to factories as soon as possible after harvesting, washed, sorted, then frozen and packaged with the latest technology, so no additional preservatives are needed.

Claim 16 – Hormones are used in chickens.

Research worldwide shows that the expected results from hormone use in chickens are not achievable and using hormones is neither economical nor practical. Hormones are not administered to promote rapid growth in chickens. No hormone used for this purpose exists either in Türkiye or globally.

There have been no cases reported or detected of hormone use in poultry raised in Türkiye by authorized institutions. Hormone use in poultry farming in Türkiye is illegal, uneconomical, and not feasible.

Claim 17 – Antibiotics are used in chicken production.

Regulations on antibiotic use in Türkiye comply with EU legislation. Except for treatment and disease cases aimed at protecting healthy animals, antibiotics are prohibited as feed additives. No drug banned in the EU is licensed or used in Türkiye. Antibiotics can only be used under a veterinarian's prescription. It is legally mandatory to observe withdrawal periods before slaughter to eliminate any risks.

Claim 18 – Dietary supplements should be used for non-nutritional purposes (e.g., height increase, quitting smoking).

Products permitted for production and import by the Ministry are not allowed to be marketed as weight loss, weight gain, height increase, smoking cessation, disease prevention, treatment, or healing products. It is against regulations to promote

supplements with such claims. These products should not be consumed for these expectations. Dietary supplements support meeting daily nutritional needs.

Claim 19 – Chicken and meat should be washed before cooking.

Chicken is often rinsed before cooking, but thoroughly cooking it is sufficient as bacteria die during cooking. Washing risks spreading bacteria around the kitchen. Similar rules apply to beef and lamb. Washing meat exposed to dirty environments spreads bacteria and promotes their growth. Dirty parts should be cut off instead of washing.

Claim 20 – Dirty eggshells should be washed.

We think washing off dirt, feathers, or manure on eggshells cleans them, but this is a big mistake. Washing draws microorganisms through microscopic pores in the shell, increasing infection risk. Pre-packaged eggs should be kept without washing in covered containers suitable for food contact.

Claim 21 – Spinach is an iron storehouse.

Spinach contains more iron than many other vegetables—about 2.6 mg per 100 grams, which is even higher than some meats. For example, beef tenderloin has about 2.5 mg per 100 grams. However, this doesn't make spinach a super source of iron because the iron in spinach is not absorbed as well as the iron in meat. About 1.7 % of spinach iron is absorbed by the body, while iron absorption from meat is around 20%. So, eating 100 grams of spinach provides about 0.044 mg of absorbable iron, while 100 grams of meat provides about 0.5 mg.

Claim 22 – Cooking wild mushrooms removes their toxicity.

Most toxic compounds in mushrooms are heat-resistant, and cooking, boiling, or drying does not eliminate their toxicity.

Claim 23 – Canned products lose their nutritional value.

The raw materials chosen for canning must be fresh and in season. Due to high heat processing, some vitamins (especially B vitamins and vitamin C) are known to be lost. However, the amounts of other nutrients like protein and calcium remain the same or the loss is negligible. Research shows that with optimized heat processing, canned products can be as nutritious as fresh or frozen foods. Proper heat treatment can even increase the bioavailability of certain antioxidants in fruits and vegetables. When produced according to the Turkish Food Codex, canned products do not lose their nutritional value.

Claim 24 – Long-lasting milk contains additives.

Milk's shelf life is extended through technological processes and aseptic packaging. Raw milk is accepted at factories based on quality criteria and then subjected to heat treatment at 135–150°C, which kills all bacteria. Although this temperature seems high, the exposure lasts only 2-4 seconds, so nutrient loss is minimal. There is no loss of milk sugar, fat, or protein; calcium and vitamin C decrease by 10-20%. The milk is then packaged aseptically (in packaging that prevents bacteria and moisture entry). No additives are added.

Claim 25 – Fresh cheeses sold in markets are healthy.

Some consumers buy fresh cheeses from market stalls believing they are healthy. These cheeses are made from raw milk and are not pasteurized, posing health risks. If the milk comes from animals carrying diseases like brucellosis or tuberculosis, the bacteria can transfer to the cheese and infect consumers. Therefore, it is important to avoid fresh cheeses of unknown origin sold in markets.

Claim 26 – Foods sold openly are natural, nutritious, even organic.

To prevent bacterial spoilage, preserve nutritional value, and maintain sensory qualities like taste and flavor, food must be well protected from air, light, and inappropriate temperatures. Packaging eliminates these risks, ensuring food reaches consumers without deterioration.

Consumers should avoid unlabeled products and not buy food from unlicensed sources. Unlabeled food is not safe. Products made by unlicensed "backstreet" producers are often sold without labels under names like homemade, village-style, organic, or natural to deceive consumers. Such unlabeled foods are dangerous. Reliable food producers confidently label their products with brand, address, and registration number, and submit their products to all required inspections. Those who cheat often avoid labeling to hide themselves.

Claim 27 – Frozen foods should be defrosted at room temperature.

Defrosting occurs from the outside inward. Microorganisms can begin to grow on the outer parts before the inside is defrosted. Therefore, frozen foods should not be defrosted at room temperature, in water, on or near heaters, over low heat, or in direct sunlight. The best method is slow thawing in the refrigerator's interior or lower shelves where the temperature is controlled.

Defrosted foods should not be stored but cooked immediately and never refrozen.

Claim 28 – Moldy parts of foods like cheese, yogurt, and tomato paste can be cut off and the rest consumed.

If there is mold on moist, high-water content foods like yogurt, cream, jam, tomato paste, bread, fruit juices; on meat products such as red and white meat, sausages, salami; on soft vegetables and fruits (especially those forgotten at the back of the fridge like cucumbers, tomatoes, peaches, etc.); or on cooked meals, the food should not be consumed even if the moldy parts are cut away. This is because mold mycelia, even if not visible, grow deep into the food, meaning the moldy food has effectively been consumed.

Claim 29 – Yogurt should not be eaten with fish.

Fish from clean waters, properly cooked and eaten with yogurt, will not cause poisoning. The protein called histamine in fish increases in spoiled fish. Fish that is not quickly chilled after being caught develops higher histamine levels, and eating such fish can cause allergic reactions and poisoning. Yogurt also contains histamine. Eating yogurt with spoiled fish can increase histamine and is not recommended. However, the important factor is the freshness of the fish. If the fish is fresh, there is no problem eating it with yogurt.

Claim 30 – Pasteurization, UHT, and homogenization processes make milk harmful.

Although some consumers mistakenly believe raw milk is a healthier alternative to packaged pasteurized milk, foodborne diseases remain a health risk. The presence of pathogens in raw/unpackaged street milk makes pasteurization mandatory. Examples include Salmonella, E. coli O157:H7, Listeria, Campylobacter, Brucella...

Pregnant women, elderly, children, and immunocompromised individuals are especially at risk. Therefore, pasteurized or UHT milk is safer for human health and nutrition.

Claim 31 – Brown sugar is healthier than white sugar.

The main difference between white table sugar and brown sugar is that brown sugar contains molasses, which gives it its color, aroma, and moisture. Brown sugar contains small amounts of fiber and other micronutrients from molasses, but it is not healthier than white sugar. To gain significant fiber or nutrients from brown sugar, excessive amounts must be consumed, which is unhealthy. The World Health Organization recommends free sugar intake be reduced to less than 10% of total energy intake. Therefore, the presence of fiber and micronutrients does not make brown sugar healthier, and it should not be considered a fiber source.

Claim 32 – Milk powder is harmful.

Milk powder is produced by evaporating about 90% of the water content in milk under low pressure. All other components of milk remain the same. This process prevents spoilage and makes milk durable for long periods. Milk powder can be reconstituted into milk by adding about 10 times clean drinking water and mixing.

Claim 33 – Butter causes heart and vascular blockages.

Milk fat (butter) is completely melted at normal body temperature (37°C) and exists in a melted, clear form in the human body, so it does not cause heart or vascular blockages. Conversely, vegetable oils and margarine products sold as butter do not fully melt at body temperature and may contribute to heart and vascular blockages.

Claim 34 – Milk's effect on bone development only works during growing age.

Due to its high calcium content, milk supports bone development in early ages and also protects the body against diseases such as osteoporosis in older age. Milk, as a source of excellent nutrients, minerals, and vitamins, is beneficial for people of all ages who do not have specific allergies to milk components like lactose or casein.

Claim 35 – Dairy products cause indigestion and bloating, so their consumption is harmful.

Due to a genetic deficiency of the enzyme lactase, which helps digest the carbohydrate lactose found in milk (lactose intolerance), milk can cause bloating in some people. However, when milk is consumed fermented, such as yogurt, ayran, kefir, or cheese, the lactose is naturally broken down, so it does not cause bloating or digestive problems.

Claim 36 – They use dye to make olives black.

There is no need to add dye to olives. The phenolic compounds naturally present in black olives (which are beneficial to health) darken the olive. The darkening increases especially when exposed to air. These are all natural processes.

Claim 37 – If the pit is black, the olive is dyed.

The black color of the pit is related to ripeness. As olives ripen on the tree, black/purple phenolic compounds move from the skin toward the pit. In fully ripe olives, these phenolics reach the pit and darken it.

Claim 38 – Rusty metal is thrown into olive pools to blacken the olives.

Iron is not needed to darken olives. No olive producer uses metal/iron to blacken olives. According to the Olive Communiqué, ferrogluconate and/or ferrolactate may be used in amounts permitted by the Turkish Food Codex to stabilize the color of black olives darkened by oxidation.

Claim 39 – Olives processed with caustic soda are harmful.

If done correctly, caustic soda is not harmful. Most olives worldwide are produced using caustic soda, especially whole green olives. In Türkiye, black olives produced this way are less favored in taste. Use of caustic soda in black olive production is rare. The production method must be indicated on the olive label. If caustic residue remains, a soapy taste may be detected.

Claim 40 – Bitter olives are not tasty; olives with no bitterness should be preferred.

The bitterness of olives comes from phenolic compounds. Bitter olives are healthier. There are more than 20 phenolic compounds in olives, primarily oleuropein, which gives the olive its bitter taste. The bitterness is reduced somewhat during processing. Consuming slightly bitter olives is recommended as it increases intake of phenolic compounds. Acclimating the palate to bitter olives is expected to increase future consumption of bitter olives.

Claim 41 – Olives cannot be produced without using salt.

Türkiye is a leader in R&D for producing olives without salt and water. From a health perspective, olives with low salt content should be preferred. Salt masks the natural aroma of olives. Low-salt olives have a better flavor. Technologies such as drying, ethylene, carbon dioxide, and ultrasound are being developed to produce olives in shorter times without salt and/or water in environmentally friendly ways.

Claim 42 – Unlabeled olive oil is farmer's oil and more natural.

Selling unlabeled food is against regulations. Do not buy unlabeled food. Buying unlabeled food means trusting a person who does not take responsibility for what they produce.

Claim 43 – Olive oil labels are unimportant; the taste is what matters.

What is written on the label is very important. The olive oil category on the label gives information about its composition, quality, health benefits, price, and how it should be consumed.

Claim 44 – The important factor in olive oil is the region where it is produced.

The production region means nothing. What matters is the classification on the label (Extra virgin olive oil, virgin olive oil, refined olive oil, pomace oil, refined pomace oil, refined oil).

Claim 45 – All oils are extra virgin.

Only oils labeled as "extra virgin" can be called extra virgin. They are naturally obtained without heat or chemicals and contain antioxidants. Around 30 characteristics are checked to detect fraud.

Claim 46 – You can understand the quality of olive oil from its price.

Olive oils are grouped not by price but according to national and international regulations. Olive oils are classified by quality ranking as: extra virgin olive oil, virgin olive oil, refined olive oil, pomace oil, refined pomace oil, and refined olive oil.

Claim 47 – The quality of olive oil can be understood from its color, appearance, or fluidity.

The external appearance and fluidity of olive oil do not provide reliable information about its quality. Olive oils with high phenol content have rich sensory characteristics. Their polyunsaturated fatty acids are sensitive to oxidation and must be protected from heat, light, and air. When selecting olive oil, attention should be paid to dark-colored bottles, olive oil class, producer's name and address, and other mandatory label information.

Claim 48 – Olive oil does not cause weight gain and has fewer calories.

Olive oil has the same calorie content as other oils. All animal and vegetable fats have the same calorie value—about 9 calories per gram of fat. However, olive oil has a unique taste and composition.

Claim 49 – There is a product called "olive milk" which is very beneficial.

There is no such product as olive milk. It is no different than olive oil and is a marketing trick. Analysis results have shown that some oils sold under the label "olive milk" do not meet the quality standards of extra virgin olive oil.

Claim 50 – Every cold-pressed olive oil is the highest quality oil.

Cold pressing/extraction alone does not guarantee quality. The term cold pressed is allowed only for oils produced at temperatures not exceeding 27°C. Cold pressing is one factor that helps produce olive oil with higher phenol content. About 1-2% of olive oil consists of non-fat components, the most important of which are phenols.

Claim 51 – Stone-pressed olive oil is the highest quality.

The term "stone pressed" is not mentioned in the Turkish Food Codex Olive Oil and Pomace Oil Communiqué. Instead, the term "first cold pressing" is defined and permitted for extra virgin and virgin olive oils obtained by mechanically pressing olive paste with a hydraulic press below 27°C. The phrase "stone pressed" is often seen on labels but is not an indicator of quality or naturalness.

Claim 52 – If olive oil freezes, it means there is no fraud.

The freezing of olive oil in a cool place has no meaning regarding quality. Naturally occurring waxy esters in olive oil cause it to solidify at low temperatures. Each olive oil has a unique amount and type of these esters. Freezing is commonly observed in olive oil stored outside in winter or in cool places. To return olive oil to liquid clarity, simply leave it at room temperature. Oleic acid, which forms the majority of olive oil, freezes at about 4-5 °C. The freezing point depends on the olive variety, growing conditions, ripeness, and production process. Freezing or not freezing does not indicate quality, fraud, or naturalness.

Claim 53 – If honey crystallizes or freezes, sugar has been added.

Floral honeys naturally crystallize over time. The rate of crystallization depends on the levels of glucose, fructose, and water content. If glucose is closer in proportion to fructose, honey crystallizes quickly; if the difference is large, it crystallizes more slowly. Because the ratios of glucose, fructose, and water vary according to the source of honey, crystallization times differ.

Claim 54 – Honey should be taken with a wooden spoon.

This misconception dates back to when stainless steel spoons were not available and spoons were made from aluminum. Considering the acidity of honey (pH 3.5 to 5.5), organic acids can dissolve some of the metal from aluminum spoons and containers. For this reason, using a wooden spoon was recommended to avoid changing the metal composition. Nowadays, high-quality stainless steel

spoons pose little risk. Honey is stored in stainless steel containers, which is the recommended metal in beekeeping, and honey can be safely consumed with standard metal spoons.

Claim 55 – Honey should be sweet.

Some honeys are not sweet; for example, chestnut honey is bitter. Additionally, this honey is more valuable and expensive than others. The more variety in this honey, i.e., the higher the percentage of chestnut pollen grains, the stronger or more bitter its taste. Also, mint honey has a sourer taste compared to other honeys. Good air conditions, good plant environments, and strong bee colonies should coincide for quality honey.

Claim 56 – If you put a spoonful of honey into water, real honey sinks to the bottom while fake honey dissolves.

Determining the quality and authenticity of honey requires detailed laboratory analysis. It cannot be reliably tested at home. Depending on moisture content, some of the honey dissolves and some does not. The dissolution rate depends on honey's moisture content and the water temperature. Honey with 19-20% water dissolves faster than honey with 15% water. The warmer the water, the faster the honey dissolves.

5.1. FOOD SAFETY

Food safety broadly refers to the approaches applied during food production, harvesting, transport, processing and storage to ensure that food does not harm health and to prevent the occurrence of foodborne diseases due to the consumption of unsafe food. It is estimated that 600 million people (that's almost one in ten people in the world) fall ill after eating contaminated food every year, with 420,000 of them dying as a result. Food that is not safe can contain harmful biological, physical and chemical hazards that can cause more than 200 diseases, ranging from diarrhea to cancers. It also causes a cycle of disease and malnutrition, especially for babies, young children, the elderly and the sick. Food safety is a complicated issue that affects everyone, from ordinary people to the government, industry, and academic institutions. Therefore, food safety is one of the most important health issues today. Food safety is an important issue for the following reasons:

- Food safety, nutrition, and food security are closely interconnected.
- Around 600 million people fall ill and 420,000 die each year from contaminated food.
- In low- and middle-income countries, unsafe food leads to an annual loss of US$110 billion in productivity and healthcare costs.
- Children under five account for 40% of foodborne disease cases, with 125,000 deaths each year.
- Foodborne illnesses strain healthcare systems, harm economies, and negatively impact tourism and trade.

Ensuring food safety is a shared responsibility requiring a multisectoral, One Health approach. Many cases of food-borne illness are the result of simple mistakes in the preparation or handling of food, either in food service establishments or at home. Thus, ensuring the safety of food should be out top priority. This means making sure that it is not contaminated with any harmful substances such as bacteria, parasites, viruses, toxins, chemicals and or radionuclides. It is very important to have enough good food that is also healthy if you want to live a long, healthy life. It is important to note that a number of foodborne diseases have the potential to result in long-term disability and even fatality.

On the other hand, it's great to know that we're all working together to make sure that food is safe. Every single one of us has a part to play, whether we're the

ones preparing the food or just eating it. That's why we all need to do our bit for sustainable safe food and to stop food-related diseases. You play a role in food safety. Since different pathogens pose different risks, the best approach is to follow a few simple steps that lower the risk from most of them).

- Wash your hands before and after handling food, and between handling different items. Do the same for utensils, equipment, and surfaces.
- Rinse raw fruits and vegetables under running water. Even if they seem safe, washing helps reduce the risk of contamination.
- Cook food to the right temperatures to kill harmful bacteria like Salmonella, Listeria, E. coli, and parasites.
- Separate raw and cooked foods to avoid cross-contamination. Use different containers and tools, or wash them thoroughly between uses.
- Refrigerate cooked food quickly at 4.4 °C or below. Proper chilling slows bacterial growth and lowers the risk of foodborne illness.

The world health organization (WHO) started a health campaign with five simple rules to help people understand their responsibilities for making sure that food is safe. These are "Five keys to safer food", which were created to teach consumers and food handlers how to handle food safely. These five keys to safe food are:

1. Keep clean
2. Separate raw and cooked
3. Cook thoroughly
4. Keep food at safe temperatures
5. Use safe water and raw materials.

Five keys to safer food

Keep clean

- Wash your hands before handling food and often during food preparation
- Wash your hands after going to the toilet
- Wash and sanitize all surfaces and equipment used for food preparation
- Protect kitchen areas and food from insects, pests and other animals

Why?

While most microorganisms do not cause disease, dangerous microorganisms are widely found in soil, water, animals and people. These microorganisms are carried on hands, wiping cloths and utensils, especially cutting boards and the slightest contact can transfer them to food and cause foodborne diseases.

Separate raw and cooked

- Separate raw meat, poultry and seafood from other foods
- Use separate equipment and utensils such as knives and cutting boards for handling raw foods
- Store food in containers to avoid contact between raw and prepared foods

Why?

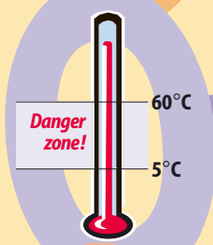
Raw food, especially meat, poultry and seafood, and their juices, can contain dangerous microorganisms which may be transferred onto other foods during food preparation and storage.

Cook thoroughly

- Cook food thoroughly, especially meat, poultry, eggs and seafood
- Bring foods like soups and stews to boiling to make sure that they have reached 70°C. For meat and poultry, make sure that juices are clear, not pink. Ideally, use a thermometer
- Reheat cooked food thoroughly

Why?

Proper cooking kills almost all dangerous microorganisms. Studies have shown that cooking food to a temperature of 70°C can help ensure it is safe for consumption. Foods that require special attention include minced meats, rolled roasts, large joints of meat and whole poultry.



Keep food at safe temperatures

- Do not leave cooked food at room temperature for more than 2 hours
- Refrigerate promptly all cooked and perishable food (preferably below 5°C)
- Keep cooked food piping hot (more than 60°C) prior to serving
- Do not store food too long even in the refrigerator
- Do not thaw frozen food at room temperature

Why?

Microorganisms can multiply very quickly if food is stored at room temperature. By holding at temperatures below 5°C or above 60°C, the growth of microorganisms is slowed down or stopped. Some dangerous microorganisms still grow below 5°C.

Use safe water and raw materials

- Use safe water or treat it to make it safe
- Select fresh and wholesome foods
- Choose foods processed for safety, such as pasteurized milk
- Wash fruits and vegetables, especially if eaten raw
- Do not use food beyond its expiry date

Why?

Raw materials, including water and ice, may be contaminated with dangerous microorganisms and chemicals. Toxic chemicals may be formed in damaged and mouldy foods. Care in selection of raw materials and simple measures such as washing and peeling may reduce the risk.

Design: Marilyn Langfeld. Illustration: Janet Pellegrene

Food Safety
World Health Organization

Knowledge = Prevention

WHO/SDE/PHE/FOS/01.1
Distribution: General
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5.1.1. Foodborn Hazards

Physical Hazards	Chemical Hazards	Biological Hazards
Glass, splinters, stones, wood, plastic, hair, nails, etc.	Drug residues, machine residues, detergent residues, etc.	Mikroorganisms, bacteria, microbes, toxins, etc.

5.1.1.1. Physical Hazards

Physical hazards are hard and sharp parts that are not expected to be present in the food product. They can cause serious harm or injury, such as choking, cuts to the mouth or throat, or broken teeth. Foreign substances such as glass, metal, paper, rubbish, hair, feathers, feathers, bones, insect parts that are inside the food or contaminated from outside are considered as physical risks. Physical hazards in food can be categorized with 6ps:

6 Ps of Physical Hazards	Example
People	Hair, fingernails, plasters and bandages, jewellery, disposable gloves and hairnets
Packaging	Shards of glass, wood splinters, plastic bags, ceramic fragments or bits of textiles
Product	Soil and mud on vegetables, stones from harvesting, fishbones, chicken bones, fruit pips, eggshells and nut shell
Pests	Insects, rodents, droppings, feathers, claws and fur
Premises	Item used on the food production premises, such as cooking utensils, food thermometers, staples, noticeboard pins and pens.
Plant	Anything part of the machinery used for food manufacture, such as nuts and bolts, light bulbs, batteries, wire and flakes of paint.

Sometimes, these foreign substances can be a health risk because they can have microbes or chemicals on them. They also show that the product was not made in a clean environment. It's easy to get rid of physical risks at home by sorting and washing things properly. In the food industry, there are technical facilities that can do this.

5.1.1.2. Chemical Hazards

There is a risk that chemicals could enter food at any stage of production or at any point in its supply chain. For example, food can be contaminated with chemical hazard from environment such as pollution, incinerators, contaminated soil and water, plant diseases, or animal feed.

Also, chemicals that are dangerous to humans can be enter food during processing and production: For example, when food is cooked, a chemical called acrylamide can contaminate food. Other chemicals that can make people sick, called mycotoxins, can be added to food while it is being stored or when cleaning materials are used incorrectly . Below are some examples of chemicals hazards in food.

Category	Description
Mycotoxins 	These chemicals are naturally-occurring and produced by certain types of mould. They can cause serious harm to consumers if consumed in large amounts. Aflatoxins are the most harmful type, with the potential to cause cancer and/or problems with digestion, reproduction or the immune system.
Organic Environmental Pollutants 	Organic pollutants, also known as persistent organic pollutants (POPs), are chemicals that enter food from the environment in which it is cultivated or reared. It should be noted that these chemicals can be detrimental to animals and fish at high concentrations, with potential implications for human health as well. Examples are pesticides, herbicides, fungicides and fertilisers used in farming, heavy metals such as lead, mercury and cyanide found in earth and dioxins, often originating from animal feed.
Acrylamide 	Acrylamide is a naturally-occurring by-product that is produced when starchy, carbohydrate-rich foods are exposed to temperatures of 120 °C and above during the frying, roasting, baking, grilling or toasting process. It is not possible to eliminate acrylamide entirely from the production process, however scientific research has demonstrated that exposure to high levels of this chemical compound is carcinogenic. Potato chips and crisps, bread, breakfast cereals, biscuits and crackers are the foods most likely to cause high levels of acrylamide when they are cooked.

Cleaning Chemicals 	It's easy to see how cleaning chemicals, if not stored correctly and if they aren't washed off properly after use, can end up in food products. Sanitizers, disinfectants and bleaches are all very harmful to health if they get into food and drink that is meant to be eaten.
Bisfenol A (BPA) 	BPA is a chemical used mainly in the production of plastics and resins. For example, BFA is used in polycarbonate to produce a transparent and hard plastic. Polycarbonates are also used in many food contact materials such as plates, cups, glasses and recyclable beverage bottles
Polycyclic Aromatic Hydrocarbons (PAHs) 	PAHs are contaminants that can form in the environment as a result of the incomplete combustion of organic matter. Human activities contribute to the formation of polycyclic aromatic hydrocarbons (PAHs) through industrial processes, motor vehicle emissions, and tobacco smoke. Major industrial sources include waste incineration, cement production, oil refining, coke and asphalt manufacturing, as well as aluminum and iron-steel industries.
Pestisits 	Pesticides are chemical substances used to prevent, eliminate, or control harmful organisms or diseases. They are primarily applied to protect plants and plant-based products during agricultural production, storage, and transportation. The most common types of pesticides include insecticides (used against insects), fungicides (used against fungi), and herbicides (used against weeds

5.1.1.3. Biological hazards

Foods contain many tiny organisms from their raw materials or from outside. Some of these microorganisms can cause diseases in humans. Microbiological hazards happen when food is contaminated by microorganisms, which can be found in the air, food, water, rubbish, soil, animals and the human body. Lots of microorganisms are actually really important for life, but if the conditions are right, some of them can cause food poisoning. Microbiological hazards are basically tiny organisms like bacteria, parasites, fungi and viruses. They can develop if food is not handled properly or if there's contamination from outside.

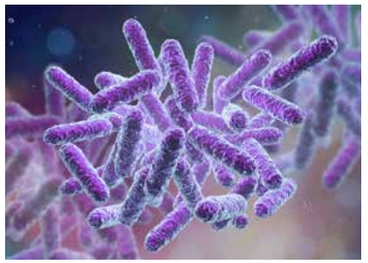
Microorganisms need something to carry them. When germs move from one surface to another, it's called contamination. Our hands are one of the main ways this happens. Microorganisms can spread quickly through food and water. Pets can also be a source of contamination. There are microorganisms everywhere around us in nature and is impossible to imagine a world without them but the most common places are listed below.

- **In faeces:** Human and animal faeces carry disease-causing microorganisms.
- **In soil and water:** One teaspoon of soil contains more than one billion microorganisms.
- **Mice, rats, insects:** There are microorganisms on all living things.
- **Pets, sea creatures and farm animals (e.g. dogs, fish, cows, chickens and pigs):** Animals carry microorganisms in their mouths, on their feet, on their skin.
- **Humans (mouth, nose, intestines, hands, nails and skin):** On average, 100,000 bacteria can be found on every square cm of human skin.

Microbiological food poisoning is caused mainly by bacteria and viruses and less commonly by parasites. In addition, ‘prions’, which are normal proteins of the body but can cause diseases in the brain, and ‘antimicrobial resistance’ developed by bacteria against antibiotics in recent years are among the microbiological risks in foods.

Bacteria

Bacteria are single-celled organisms. Most bacteria are harmless and beneficial for humans or nature. However, some bacteria can enter the body and cause diseases. These usually enter the body through contaminated food or water. Some bacteria produce poisons that cause disease. These poisons can cause symptoms of disease in the body. Other bacteria do not produce poisons, but can cause some unpleasant symptoms when the body's defense system (immune system) fights against the bacteria.



The most important agents of foodborne diseases worldwide are microorganisms. Examples of diseases caused by microorganisms are diseases caused by bacteria such as Salmonella, Listeria, Enterohemorrhagic Escherichia coli, Campylobacter and diseases caused by toxins.

Some of the most common foodborne diseases are caused by Salmonella, Campylobacter, and enterohaemorrhagic Eschericia coli. These can sometimes seriously and even fatally infect millions of people every year. The following symptoms may be indicative of the condition: fever, headache, nausea, vomiting, abdominal pain and diarrhea.

Bacteria that cause food poisoning usually do not change the smell, taste or appearance of food. Some bacteria cause disease when they reach high population densities, while others can cause disease even in very small numbers. For this reason, various methods such as cooling, freezing, cooking, drying are used in the fight against bacteria. Below table is information on some bacteria and viruses that cause foodborne diseases. Bacteria reproduce by binary fission approximately every 20 minutes. Since bacterial growth occurs rapidly between 5°C and 60°C, this temperature range is referred to as the "danger zone" or "dangerous temperature range." Even after food is cooked, bacterial spores and toxins may still pose a health risk. Under unfavorable environmental conditions, some bacteria can form resistant spores.

Bacterias need 6 things to live and multiply:

1. Food
2. Humidity
3. Appropriate temperature
4. Appropriate acidity
5. Oxygen
6. Time

Viruses

Viruses, which are even smaller than bacteria, have the potential to make us sick even in very small amounts when they are contaminated with food. The presence of viruses has been identified in the faeces of infected individuals, with a particular prevalence observed in cases of neuroviruses. They can therefore be transmitted to food through sick people working in production or cooking in the food business. It is spread through sewage infiltration into the water we use in food.

ORGANISM	COMMON NAME OF ILLNESS	ONSET TIME AFTER INGESTING	SIGNS & SYMPTOMS	DURATION	FOOD SOURCES
Bacillus cereus	B. cereus food poisoning	10-16 hrs	Abdominal cramps, watery diarrhea, nausea	24-48 hours	Meats, stews, gravies, vanilla sauce
Campylobacter jejuni	Campylobacteriosis	2-5 days	Diarrhea, cramps, fever, and vomiting; diarrhea may be bloody	2-10 days	Raw and undercooked poultry, unpasteurized milk, contaminated water
Clostridium botulinum	Botulism	12-72 hours	Vomiting, diarrhea, blurred vision, double vision, difficulty in swallowing, muscle weakness. Can result in respiratory failure and death	Variable	Improperly canned foods, especially home-canned vegetables, fermented fish, baked potatoes in aluminum foil
Clostridium perfringens	Perfringens food poisoning	8–16 hours	Intense abdominal cramps, watery diarrhea	Usually 24 hours	Meats, poultry, gravy, dried or precooked foods, time and/or temperature-abused foods
Cryptosporidium	Intestinal cryptosporidiosis	2-10 days	Diarrhea (usually watery), stomach cramps, upset stomach, slight fever	May be remitting and relapsing over weeks to months	Uncooked food or food contaminated by an ill food handler after cooking, contaminated drinking water
Cyclospora cayetanensis	Cyclosporiasis	1-14 days, usually at least 1 week	Diarrhea (usually watery), loss of appetite, substantial loss of weight, stomach cramps, nausea, vomiting, fatigue	May be remitting and relapsing over weeks to months	Various types of fresh produce (imported berries, lettuce, basil)
E. coli (Escherichia coli) producing toxin	E. coli infection (common cause of “travelers’ diarrhea”)	1-3 days	Watery diarrhea, abdominal cramps, some vomiting	3-7 or more days	Water or food contaminated with human feces

E. coli O157:H7	Hemorrhagic colitis or E. coli O157:H7 infection	1-8 days	Severe (often bloody) diarrhea, abdominal pain and vomiting. Usually, little or no fever is present. More common in children 4 years or younger. Can lead to kidney failure	5-10 days	Undercooked beef (especially hamburger), unpasteurized milk and juice, raw fruits and vegetables (e.g. sprouts), and contaminated water
Hepatitis A	Hepatitis	28 days average (15-50 days)	Diarrhea, dark urine, jaundice, and flu-like symptoms, i.e., fever, headache, nausea, and abdominal pain	Variable, 2 weeks-3 months	Raw produce, contaminated drinking water, uncooked foods and cooked foods that are not reheated after contact with an infected food handler; shellfish from contaminated waters
Listeria monocytogenes	Listeriosis	9-48 hrs for gastrointestinal symptoms, 2-6 weeks for invasive disease	Fever, muscle aches, and nausea or diarrhea. Pregnant women may have mild flu-like illness, and infection can lead to premature delivery or stillbirth. The elderly or immunocompromised patients may develop bacteremia or meningitis	Variable	Unpasteurized milk, soft cheeses made with unpasteurized milk, ready-to-eat deli meats
Noroviruses	Variously called viral gastroenteritis, winter diarrhea, acute non- bacterial gastroenteritis, food poisoning, and food infection	12-48 hrs	Nausea, vomiting, abdominal cramping, diarrhea, fever, headache. Diarrhea is more prevalent in adults, vomiting more common in children	12-60 hrs	Raw produce, contaminated drinking water, uncooked foods and cooked foods that are not reheated after contact with an infected food handler; shellfish from contaminated waters
Salmonella	Salmonellosis	6-48 hours	Diarrhea, fever, abdominal cramps, vomiting	4-7 days	Eggs, poultry, meat, unpasteurized milk or juice, cheese, contaminated raw fruits and vegetables
Shigella	Shigellosis or Bacillary dysentery	24-48 hrs	Abdominal cramps, fever, and diarrhea. Stools may contain blood and mucus	4-7 days	Raw produce, contaminated drinking water, uncooked foods and cooked foods that are not reheated after contact with an infected food handler
Staphylococcus aureus	Staphylococcal food poisoning	1-6 hours	Sudden onset of severe nausea and vomiting. Abdominal cramps. Diarrhea and fever may be present	24-48 hours	Unrefrigerated or improperly refrigerated meats, potato and egg salads, cream pastries
Vibrio parahaemolyticus	V. parahaemolyticus infection	4-96 hours	Watery (occasionally bloody) diarrhea, abdominal cramps, nausea, vomiting, fever	2-5 days	Undercooked or raw seafood, such as shellfish
Vibrio vulnificus	V. vulnificus infection	1-7 days	Vomiting, diarrhea, abdominal pain, bloodborne infection. Fever, bleeding within the skin, ulcers requiring surgical removal. Can be fatal to persons with liver disease or weakened immune systems	2-8 days	Undercooked or raw seafood, such as shellfish (especially oysters)

5.2. FOOD HYGIENE

Food safety covers the prevention of hazards that may arise from food at all stages of the food chain, from primary production to consumption, that is, from the field or farm to the table. In general, hygiene is the practices carried out for the protection of health. World Health Organization defines food hygiene as "the conditions and measures necessary to ensure the safety of food from production to consumption."

The concepts of danger and risk, which we often use in daily life, are used for situations where possible negative consequences are expected. In terms of food safety, A hazard is a biological, chemical or physical agent present in food that has the potential to cause adverse health effects; For example, there are many harmful microorganisms that may be present in raw eggs. These can cause food poisoning in humans. For example, Salmonella is considered a biological hazard and a potential risk in raw eggs. Giving up eating eggs because of this risk would be the wrong choice as it would mean giving up a basic food stuff.

Everyone involved in producing, processing, distributing and selling food has a responsibility to ensure that it is safe and free from contamination. This applies to food producers, processors, distributors, retailers, caterers and consumers alike. Those who work in the food industry, such as chefs, cooks and food handlers, must pay particular attention to food hygiene. They must be aware of the risks of food contamination and take steps to prevent it, both for humans and for animals.

The aim of food hygiene is to:

- provide education and training on the proper and safe handling of food for

those involved in its processing, preparation and manufacturing;
- maintain and extend food shelf life through clean processing;
- prevent food spoilage due to contamination caused by unhygienic working practices and conditions; and
- It also aims to avoid producing and selling food that may be unsafe and threaten public health.

5.2.1. Hazard Analysis Critical Control Points (HACCP)

HACCP is a management system that addresses food safety issues by analyzing and controlling biological, chemical and physical hazards. It covers all stages of the production and distribution of food items., from raw material procurement and handling through to manufacturing, distribution and consumption of the finished product. HACCP is designed for use in all parts of the food industry. This includes growing, harvesting, processing, manufacturing, distributing, selling and preparing food for eating.
The development of a HACCP plan follows a clear process:

HACCP is a method for controlling risks to food safety. It is vital that HACCP principles should underpin food safety.

- Identifying potential risks to food safety
- Identifying critical control points to ensure those risks are removed or reduced to safe levels.
- Determining what to do if something goes wrong
- Verifying that processes are being followed and functioning properly.
- Keeping records to proof procedures are working.

5.2.1.1. Prerequisite Programs

Enterprise Hygiene

Business hygiene is all the things you do to make sure food is good quality and safe for people to eat. This includes how food is made, processed, stored, delivered and sold. To keep their products fresh and stop them getting contaminated, businesses need to make sure they must fulfil hygiene requirements. If a business doesn't have good hygiene, it can cause damage to the business. No factory wants the raw material it receives and processes to be packaged and presented to the consumer as a product with a reduced shelf life due to hygienic design deficiencies in the enterprise. Likewise, no restaurant would risk losing customers due to contamination caused by staff neglecting to use protective equipment.

Hygienic design is a process that involves the decision-making and implementation of the environment, equipment design, infrastructure needs of the food business by experts in the field in order to protect the food against contamination, to preserve the organoleptic properties of the food and to provide occupational safety to the employees. Hygienic design provides the following benefits to enterprises:

- Protection from external hazards (airborne contamination, pests).
- Protection from internal hazards.
- Elimination of possible hazards
- Ensuring cleaning and maintenance
- Prevention of cross contamination.
- Creating an environment to protect and improve food safety and quality.
- Providing economic profit in long run
- Ensuring aasy compliance with laws and various standards.

Water Hygiene

Water hygiene is concerned with the determination of the qualities of water used in production and domestic work and drinking water, prevention of water pollution and disinfection of water. Epidemics spread by water are called water epidemics. Salmonella, Vibrios, Shigella, Anthrax, Burcellose, Ruam and many other pathogenic bacteria and viruses that can cause dangerous water epidemics can be mixed into the water with the faeces of porters. Therefore, epidemics of cholera, typhoid, dysentery and infectious hepatitis occur.

Water must be completely clean in terms of its chemical, physical and microbiological properties, i.e. it must be clear, odourless, colourless, must not contain any substances harmful to health and must not contain any pathogenic substances. For this purpose waters are cleaned in three methods:

- Physical methods: Heat and ultraviolet radiation are used to remove odour and turbidity.
- Mycobiological methods: Disinfection of water with ozone, iodine, potassium permanganate and chlorinated lime.
- Chemical methods: It is the process of cleaning the toxic substances transmitted to the water from the soil, installation, industrial wastes and residues from the containers they are in by using various chemicals.

Staff Hygiene

In food business the most important factor in ensuring sanitation is personnel hygiene, since one of the most important sources of contamination in food enterprises is personnel. Staff may carry microorganisms that they can transmit to food in every stage of food production. Personnel working in food businesses should also pay attention to body hygiene, food care, oral and dental care, hair and beard care, eye, ear and nose hygiene, as well as toilet hygiene.

Body hygiene: Employees working in food establishments are recommended to bathe regularly every day. Over time, sweat, dirt, dust, oil secretions and dead skin cells accumulate on the skin's surface. This can lead to the growth of microorganisms. Regular bathing prevents these accumulations.

Hand hygiene: Hand hygiene is vital in the food industry as bacterial, viral and parasitic pathogens on the hands can be transmitted to food. The risk of disease is reduced by hand hygiene at every stage of food production. Therefore, hands should be washed frequently. Hands should be washed after:

- Using the bathroom
- Entering the kitchen
- Touching raw meat, seafood, poultry, or eggs
- Touching hair or face
- Coughing or sneezing
- Handling garbage, dirty dishes, money, or chemicals
- Eating, drinking, or smoking
- Taking a break or using his/her phone

Foot Care: For both personal hygiene and environmental reasons, a person should regularly clean their feet every day. They should be washed before going to school or work, before going to bed, and before leaving the house.

Oral and dental care: This flora can be transmitted through coughing, sneezing or food, and can make other people sick. People with infectious diseases, particularly bacterial or viral ones, have high levels of pathogens in their oral secretions.

Waste Disposal

Controlled removal of waste is very important to ensure hygiene. To ensure this:

- Waste bins should have a system such as a pedal or photocell that allows the lids to be opened and closed untouched and should be used with a sealed nylon bag. Lids should be kept closed at all times. Waste should be removed from the environment in a closed manner without waiting for excessive accumulation.
- Waste bins and by-product containers must be identified and separate.
- No waste other than by-products (bones, trimmings, etc.) should be kept in refrigerated cabinets or storage areas.
- Wastes such as dirty meat, sinew, etc. resulting from the processes carried out during the day must be kept in a separate refrigerated cabinet until they are removed from the workplace. However, in small workplaces where it is not possible to place a separate refrigerated cabinet, the wastes generated during the day may be allowed to be stored in a separate section of the existing refrigerated cabinet and provided that they do not come into contact with other products if the following conditions are met.

For this purpose:

- The waste shall be stored in a clean, leak-proof and sealed bag that will not cause contamination.
- Necessary information, including the date, will be placed on the bag.
- The bags will be removed from the workplace at the end of the same day.

Pest Control

Pests are all kinds of flying, walking or gnawing creatures that transmit disease in various ways. Examples of these pests include insects, rodents, birds and domestic animals. Various physical, chemical, sensory and microbiological spoilage can be caused by the presence of animals, such as insects and rodents, in food production areas. Pests like flies, cockroaches and mice spread germs, which can cause a range of health problems. For more effective pest control, it is easier to prevent pests from entering in the first place than it is to get rid of them once they are inside. Pest control consists of the following steps:

- Keeping pests out: keep doors and windows shut or screened. Cover holes where pests can enter .
- Use garbage cans with tight fitting lids
- Clean requlary and keep food covered
- Look out for signs of pests, such as droppings or chewed packaging.

Common Pests	Signs
Rodents	Small footprints in dust, droppings, holes in walls and doors, nests, gnawed goods or packaging, grease or smear marks, urine stains on food packaging.
Flies and fying insects	Bodies of insects, live insects, webbing, nests, droning or buzzing, maggots.
Cockroaches	Eggs and egg cases, moulted 'skins', the insects themselves, droppings.
Ants	Small piles of sand or soil, the insects themselves, flying ants on hot days.
Beetles and weevils	Moving insects, particularly in dry food, small maggots

Cleaning and Disinfeciton

Cleaning and sanitizing differs from each other as cleaning uses soap and water to get rid of food, dirt, and grease while sanitizing uses chemicals or heat to kill germs. Approved sanitizers are chlorine bleach, quaternary ammonium, lodine.

The following sequence should be followed when cleaning and disinfecting.:

- Removal of coarse dirt
- Cleaning (using water and detergent)
- Rinse after cleaning
- Disinfection
- Rinse after disinfection

Allergen Management

According to the law, allergen information for foods offered by food service establishments must be provided to consumers in writing and in a clear manner. Similarly, allergenic substances in the list of ingredients in prepacked foods should be clearly indicated. Prepacked products are foods that are packaged before being put on sale. An ingredients list must be present on the packaging of prepacked food. Any allergens present in the product must be emphasized each time they appear in the list of ingredients. Food is prepacked when:

- it is fully or partly enclosed by the packaging;
- it cannot be altered without opening or changing the packaging
- It is ready for sale.

Due to the food information for consumers regulation, allergenic foods listed below as well as any products derived from them should always be labeled.

Specific substances or products that cause allergy or intolerance:

1. cereals containing gluten, (i.e. Wheat, rye, barley, oats, or their hybridized strains)
2. Crustaceans
3. Eggs
4. Fish
5. Peanuts
6. Soybeans
7. Milk (including lactose)
8. Nuts (including almonds, hazelnuts, walnuts, cashews, pecan nuts, brazil nuts, pistachio nuts and macadamia nuts)
9. Celery
10. Mustard
11. Sesame seeds
12. Sulphur dioxide and sulphites at concentrations of more than 10mg/kg or 10mg/litre expressed as so2
13. Lupin
14. Molluscs

5.2.1.2. Preliminary Stages

The HACCP plan development process has 3 components: the development of prerequisite programs, the completion of the five preliminary stages and the development of the 7 principles of the HACCP plan.

1. Assemble The HACCP team

The primary step in the development of the HACCP system is the establishment of a dedicated team. In the process of forming a team, it is imperative to ensure that individuals from each department are included. The composition of the team is to be such that its members possess the relevant expertise. It is essential to ensure that representatives with expertise in production, quality assurance, food safety, and food microbiology are present to avert any potential loss of control in the process. It's really important that the team includes someone with HACCP training. If there is no such person, an external advisor or consultant will need to be hired .

2. Describe the Food and its distribution

After assembling a team, the all the food used in premise should be comprehensively described. Each product made must have a list of the raw materials or ingredients used. All food composition or raw materials needed, the finished product groups, the storage conditions and distribution conditions must be listed.

3. Describe the intended use and consumer of the product

To help identify all potential hazards associated with the product, it must accurately describe the product and its intended use. The HACCP team should also define how the product is normally or typically used by customers and consumer target groups. Fallowing questions should be answered in description:

1. What are the products' common and usual names?
2. What is the product's composition, including water activity (aw), pH, etc., if those apply? Is it ready-to-eat or not-ready-to-eat?
3. Where will the product be sold? Who is the intended consumer (especially important if at-risk populations are involved, such as school children, nursing home residents, hospital patients, etc.)?
4. What is the finished product's intended use, for example: for further processing at USDA establishments, for institutional use only, for retail sale to end-use consumer, etc.?
5. What is the packaging's durability? What are the storage conditions, for example, temperature control?
6. What is the product's expected shelf life? At what temperature?
7. What special labeling statements are needed, e.g., allergen warning, animal production claims, or gluten free.
8. What special distribution controls are needed during distribution, for example, temperature control?

4. Develop a flow diagram

A flow diagram or production scheme must be created by HAACP team. A flow chart is a simple schematic, graphical, or textual representation of the production process used in your establishment. It should provide an accurate, detailed, and clear depiction of all steps and activities essential for the proper production of the final product. This diagram doesn't need to look as professional as an engineering

drawing; what is important is that all the methods and conditions are specified in a logical sequence for each process step and that the linear flow of the product is graphically represented.

5. Verify flow diagram

Once the flow chart has been prepared, the HACCP team should verify it on site during operating hours. The HAACP team must walk through the establishment to make sure the flow chart includes all the steps in the process and In the correct order. Any deviations observed must lead to revisions of the original flow chart to ensure its accuracy. The final preliminary task is to verify, through on-site plant observation, that all areas have been properly covered.

5.2.1.3. Seven Principles Of Haccp

The HACCP system involves a systematic process for identifying, evaluating, and controlling food safety hazards. HACCP is one of the most well-known food safety management systems in the world. The food industry and states have adopted seven principles of HACCP:

Principle 1: Hazard analysis

This principle aims to compile a comprehensive inventory of hazards that are of such significance that they are reasonably likely to result in injury or illness if not effectively mitigated. Conducting a hazard analysis typically involves two steps. First, you identify potential hazards to human health that may arise before, during, or after production. While many establishments tend to focus mainly on hazards during production, a thorough hazard analysis must also consider hazards that could occur before and after production to ensure the product's safety.

Principle 2: Determine the critical control points (CCPs)

Determining points in the process where the identified hazards can be controlled or eliminated. For every food safety hazard that is reasonably likely to occur, you must identify a Critical Control Point (CCP) to manage that hazard — either at the point where it is identified or at a subsequent step in the process. For each decision regarding the identification of a CCP, you must include credible, documented scientific or technical justification to support that decision within your HACCP plan.

Principle 3: Establish critical limits

A critical limit is the maximum or minimum value, or range, to which a physical, biological, or chemical hazard must be controlled at a Critical Control Point (CCP) in order to prevent, eliminate, or reduce the identified food safety hazard to an acceptable level. Critical limit is utilized to differentiate between safe and unsafe operating conditions at a critical control poits. Critical limits define the safety boundaries for preventive measures applied at Critical Control Points (CCPs). They are typically expressed as measurable readings or observations—such as temperature, time, product characteristics (e.g., water activity), or chemical properties (e.g., available chlorine, salt concentration, or pH). This principle ensures that maximum or minimum limits are identified at each critical control point to control the hazard.

Principle 4: Establish monitoring procedures

Implementation of procedures to monitor the critical control points. Monitoring procedures are routine activities—performed either by personnel or automated

systems—to measure processes at each Critical Control Point (CCP) and to generate records for future reference. Continuous monitoring is always the preferred approach. However, when it is not feasible, the HACCP team must establish non-continuous monitoring procedures, define the frequency of these checks, and specify the calibrated equipment that will be used.

Principle 5: Establish corrective actions

When critical limits are exceeded or an unexpected hazard occurs, corrective actions to be taken to eliminate the problem are determined. One of the critical issues in this stage is ensuring no unsafe product reaches consumers. In case of a deviation from critical limit make sur:

- The cause of the deviation is identified and eliminated;
- The CCP will be under control after the corrective action is taken;
- Measures to prevent recurrence are established; and
- No product that is injurious to health or otherwise adulterated due to the

Principle 6: Establish verification procedures

It is the process of verifying that the prepared HACCP plan works smoothly from a scientific and technical point of view. Thus, it is ensured all the hazards are identified and controlled. The validation of HACCP plan's adequacy in controlling the food safety hazards identified during the hazard analysis. Each establishment must validate that the HACCP plan is adequate for controlling the food safety hazards identified during the hazard analysis, and must verify that the plan is being implemented effectively. The verification principle also makes sure that everyone on the team is following the current HACCP system. This principle includes three initial validation, ongoing activity of verification, and reassessment.

Principle 7: Establish record-keeping and documentation procedures

One of the seven HACCP principles is keeping records of all important activities, such as the HACCP plan, hazard analysis summary, monitoring, deviations, corrective actions, verifications, and standard procedures. The purpose of this principles is to ensure an effective recordkeeping system procedures that document HACCP system. Recordkeeping system should include Summary of hazard analysis, HACCP plan, supporting documentation and daily operational records.

HACCP records are the best evidence that an establishment is producing a safe product. The document where your personnel record monitoring results during official observation serves as the primary record.

Annex 1: Basic Concepts of Food Safety and Food Hygiene

Food that poses no risk to human health and is suitable for consumption is defined as safe food. Food safety involves handling, preparing, and storing food in a manner that minimizes the risk of foodborne illnesses and ensures the health of consumers. Food safety encompasses not only scientific and technical issues such as food hygiene, foodborne illnesses, food additives, contaminants, and residues of veterinary drugs and pesticides, but also system-related aspects including food legislation, inspection systems, certification schemes, and international trade. To avoid conceptual confusion on this topic, some key definitions are provided below.

A genetically modified organism: is an organism which contains genetic material that has been deliberately altered and which does not occur naturally through breeding or selection.
Adverse effect: A change in the health, growth, behavior or development of an organism that impairs its ability to develop or survive.
Allergen: A normally harmless substance, such as an ingredient in a foodstuff, that causes an (immediate) allergic reaction in a susceptible person.
Chemical hazard: Health hazard resulting from exposure to a chemical; for example, irritation, burns, carcinogenicity.
Codex Maximum Limit for Pesticide Residues: The maximum concentration of a pesticide residue (expressed as mg/kg), recommended by the Codex Alimentarius Commission to be legally permitted in or on food commodities and animal feeds.
Contaminant: Any substance occurring in foodstuffs that was not added intentionally. Contaminants can arise from packaging, food processing and transportation, farming practices or the use of animal medicines. The term does not include contamination from insects or rodents.
Cross contamination: The process by which microbes are unintentionally transferred from one substance or object to another, with harmful effect.
Degradation product: Chemical that is formed when a substance breaks down or decomposes
E number: A number used in the European Union to identify permitted food additives. An E number means that an additive has passed safety tests and has been approved for use

Food additive: A substance deliberately added to foods or beverages for beneficial technological reasons (e.g. to preserve, flavour, colour or ensure a particular texture). Food additives are not normally consumed by themselves nor used as typical ingredients in food

Food Additive Any substance not normally consumed as a food by itself and not normally used as a typical ingredient of the food, whether or not it has nutritive value, the intentional addition of which to food for a technological (including organoleptic) purpose in the manufacture, processing, preparation, treatment, packing, packaging, transport or holding of such food results, or may be reasonably expected to result, (directly or indirectly) in it or its by-products becoming a component of or otherwise affecting the characteristics of such foods. The term does not include "contaminants" or substances added to food for maintaining or improving nutritional qualities.

Food contact material: Any material, typically packaging or kitchen equipment, designed to come into contact with foodstuffs

Food Hygiene: "Food hygiene comprises conditions and measures necessary for the production, processing, storage and distribution of food designed to ensure a safe, sound, wholesome product fit for human consumption."

Food: "Food means any substance, whether processed, semi-processed or raw, which is intended for human consumption, and includes drink, chewing gum and any substance which has been used in the manufacture, preparation or treatment of "food" but does not include cosmetics or tobacco or substances used only as drugs."

Foodborne disease: An illness caused by foods or drinks which have been contaminated by toxins or harmful microbes (e.g. bacteria, viruses)

Foodborne outbreak: Two or more people developing the same foodborne illness after eating or drinking the same food

Genetically modified organism: An organism which contains genetic material that has been deliberately altered and which does not occur naturally through breeding or selection

HACCP: A hazard analysis and critical control point (HACCP) is a system that identifies, evaluates and controls hazards to food safety. It is implemented by food businesses to ensure safe production, storage and transport of food

Hazard: A substance or activity which has the potential to cause adverse effects to living organisms or environments

Pathogen: Organism (e.g. bacterium, virus and parasite) that can cause disease

Pest: A living organism (e.g. an insect, rodent, weed, fungus or virus) that is harmful to plants and/or their products (e.g. seeds, fruits)

Pesticide: Pesticide means any substance intended for preventing, destroying, attracting, repelling, or controlling any pest including unwanted species of plants or animals during the production, storage, transport, distribution and processing of food, agricultural commodities, or animal feeds or which may be administered to animals for the control of ectoparasites. The term includes substances intended for use as a plant growth regulator, defoliant, desiccant, fruit thinning agent, or sprouting inhibitor and substances applied to crops either before or after harvest to protect the commodity from deterioration during storage and transport. The term normally excludes fertilizers, plant and animal nutrients, food additives, and animal drugs.

Ready-to-eat food: Food intended by the producer for direct consumption without the need for cooking or other processing

Risk assessment: A specialised field of applied science that involves reviewing scientific data and studies in order to evaluate risks associated with certain hazards. It involves four steps: hazard identification, hazard characterisation, exposure assessment and risk characterization

Risk communication: The interactive exchange of information and opinions throughout the risk analysis process, including the explanation of risk assessment findings and the basis of risk management decisions. The levels of interactive exchange include: the dissemination of public information about risks to consumers or other affected groups; the dialogue within and between risk assessment and risk management; engagement with interested parties affected by risk analysis outcomes.

Risk: Characterisation The final stage of risk assessment, in which the likelihood that a particular substance will cause harm is calculated in the light of the nature of the hazard and the extent to which people, animals, plants and/or the environment are exposed to it

Toxicity : The potential of a substance to cause harm to a living organism

5.3. HOME FOOD PRODUCTION

The term “home food production” refers to the practice of individuals growing, harvesting and preparing food for personal or family consumption in their private residences, often using small-scale equipment. This practice has gained importance not only for economic reasons, but also as a result of the quest for healthy, safe and sustainable diets. In recent years, growing environmental concerns, the repercussions of climate change, disruptions in food supply chains and global crises such as epidemics have served to increase public interest in food security and self-sufficiency.

Producing food at home also encourages reconnection with the natural world. As individuals become more involved in the production process, they become more familiar with concepts such as seasonality, soil health, waste management and develop environmentally conscious habits. While it is an educational process for children, it can also be used as a stress-reducing and productivity-enhancing hobby for adults.

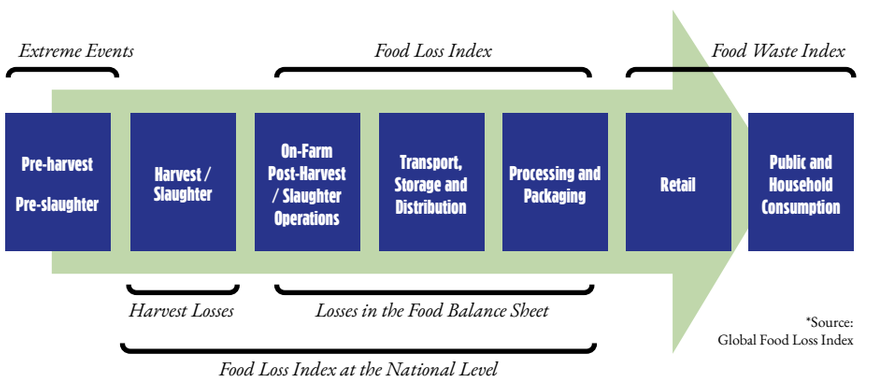
Today, it is possible to grow a wide range of produce, from growing vegetables on balconies to fermenting yogurt in home kitchens, from sun-drying tomatoes to making homemade jams. Moreover, advances in technology and increased access to information have made these production methods more accessible and science based.

Home food production is not merely an individual undertaking; it also harbours considerable potential for fostering social solidarity, environmental sustainability and contributing to the local economy. In many countries, it is encouraged for its positive impacts on food safety, sustainability and personal health. The objective of this book chapter is to facilitate the reader's transformation into a well-informed and competent producer by addressing the fundamental principles, applicable techniques, legal framework and challenges associated with home food production.

5.4. FOOD WASTE PREVENTION

According to the Veterinary Services, Plant Health, Food and Feed Law No. 5996, food is defined as; “All processed, partially processed or unprocessed substances or products, drinks, gums and water or any other substance used during the production, preparation or treatment of food, except for live animals not offered for direct human consumption, feed, unharvested plants, medical products used for therapeutic purposes, cosmetics, tobacco and tobacco products, narcotic or psychotropic substances and residues and contaminants, which are eaten, drunk or expected to be eaten or drunk by humans.”

Waste refers to the unnecessary use or waste of a resource or material. There are many types of waste. Food waste is one of the most important of these. There are different definitions of food waste. Although these definitions are related to food loss, the two concepts actually have different meanings. While food loss occurs in the production and processing stages, food waste occurs in the consumption stage due to the behaviors of both retailers and consumers. In short, food waste is mostly a type of waste originating from consumers. Food loss occurs in the food supply chain. Therefore, these two concepts cover different processes. The areas where global food losses and waste occur are indicated in Figure 1.



Food waste is a problem that causes great costs both economically and environmentally, and it is becoming an increasingly serious problem worldwide.

When the data of the Food and Agriculture Organization of the United Nations (FAO) is examined, it is seen that approximately one-third of the food produced worldwide is wasted. The countries where food waste is most common are developed countries. The reason for this can be stated as the high income of these countries, the variety and consumption of food, the widespread habit of eating out and the increase in the number of shopping malls. There are approximately two billion people who have great difficulty in accessing food. Despite this, the fact that a large proportion of the food produced is wasted has drawn the attention of people around the world to food waste and has led to the prioritization of efforts to prevent waste. Because food waste or loss actually means wasting not only food but also water, energy, time and resources. Therefore, food waste is both an economic and environmental problem.

5.4.1. Causes of Food Loss and Waste

It is stated that approximately 56% of the world's food loss and waste occurs in developed countries, while 44% occurs in developing countries. While food waste in developed countries mostly occurs in the retail and consumption stages, food losses in developing countries occur more frequently due to inadequate infrastructure in the production, storage, processing, transportation and marketing processes. In the 2021 Food Waste Index Report published by the United Nations Environment Program; it is reported that 61% of food waste occurs as household waste, 26% as service sector and 13% as retail sector.

Causes of food loss and waste at all stages of the food chain:

- Pre-harvest factors and unharvested part
- Harvest and initial treatment
- Storage
- Processing and packaging
- Transportation and Logistics
- Retail
- Consumption

5.4.1.1. Pre-Harvest Factors and Unharvested Portion

Although climatic and biological damage experienced in the field before harvest are not directly included in the scope of food loss and waste, they can affect factors such as product quality, shelf life and suitability for transportation and cause food loss in the later stages. In addition, due to economic reasons such as products not being suitable for the market, low market price and high labor costs, some crops are left in the field without being harvested, which leads to significant losses. Inadequate consideration of meteorological forecasts and agricultural practices also increases these losses.

5.4.1.2. Harvest and Initial Treatment

Wrong harvest time, improper processing and packaging practices cause food loss and waste; especially in sensitive products, multiple processes increase the risk of damage. Failure to manage temperature and humidity correctly reduces product quality and leads to spoilage in later stages.

5.4.1.3. Storage

Post-harvest products can be stored for short or long periods of time, depending on the conditions. While proper storage provides advantages in terms of time management and marketing, it can cause serious losses in poor conditions. The

shelf life of the products depends not only on storage but also on the processes before and during harvest (whether they are collected properly, the duration of waiting under the sun, etc.).

5.4.1.4. Transportation and Logistics

In fresh products, physical, chemical and biological risks that occur between production and consumption are the main causes of food loss and waste. Losses caused by transportation are caused by inadequate packaging, inappropriate transportation methods, long and difficult road conditions, lack of cooling and humidity control and improper transportation of products together.

5.4.1.5. Processing and Packaging

Processing food can reduce food loss and waste by extending the shelf life, especially in perishable products. However, technical errors and lack of standards during processing can result in sub-quality products (wrong size, shape, appearance, damaged packaging, etc.) and lead to waste. Packaging is critical in both extending shelf life and preventing waste. Therefore, packaging should be carefully planned and optimized at every stage of the food chain.

5.4.1.6. Retail

According to Law No. 5996, retail is defined as "the processing or treatment or storage of food at the point of sale or distribution to the end consumer, including main distribution centers, ready-to-eat food services, workplace and institutional cafeterias, restaurants and other similar food service locations, shops, wholesale outlets, supermarket distribution centers." Retailers, as the last link in the chain, have a major impact on product quality, shelf life and consumer preferences. While rejecting products that do not meet aesthetic standards leads to waste, other examples of food waste at the retail stage include:

- Lack of production planning in mass consumption places such as catering, cafeterias and restaurants
- Inadequate stock management, poor hygiene conditions, untrained personnel, lack of alternative portions and open buffet practices
- Treats offered to consumers without asking
- Consumers damaging fresh fruits and vegetables by touching them while choosing
- Failure to sell products whose Best Before Date (BEST) is approaching.

5.4.1.7. Consumption

Increasing income and demographic changes in the last 20 years have led to an increase in the consumption of processed foods and the use of animal products. This has also led to the spread of health problems such as obesity. As the level of welfare increases, food waste also increases.

Causes of food waste at the consumer level:

- Unplanned shopping that leads to excess purchases
- Throwing away products due to not knowing the difference between the Best Before and the Expiry Dates
- Inappropriate storage conditions and poor stock management at home
- Not eating over-prepared meals
- Losses in the quality and quantity of food due to incorrect preparation techniques
- Failure to utilize surplus food
- Consumers not making the right food consumption plan and not procuring enough food to consume.

According to the Türkiye Waste Report (2018), 5.4% of consumers throw away leftover food, and 23% of purchased food is wasted without ever being consumed. Only 31% of people go shopping with a list. Unplanned shopping causes food to spoil. According to Nielsen's 2019 data, the most thrown away foods at home are fruits and vegetables (42%) and dairy products (41%).

Tablo 1. Gıda kaybı ve israfının sebepleri

Pre-harvest factors and un-harvested part	Harvest and initial treatment	Storage	Processing and packaging	Transpor-tation and Logistics	Retail	Consumption
Biological and biotic factors (out of scope)	Inadequate harvest timing and planning	Inappropri-ate storage conditions	Inappropriate vehicle loading and unloading methods, uncontrolled movement of products within the vehicle	Errors during processing causing defects in the final product	Lack of protective packaging	Inadequate purchasing planning
Different suita-bility in terms of transportation and shipping	Careless collection of the product		Transport vehicles do not have ventilation, hu-midity and temperature conditions suitable for the product	Inadequate process and standard management	Lack of tempera-ture and humidity control	Ignorance of date labels
Different storage durability	Temperature management errors		No cooling before loading into the transport vehicle		Lack of proper display conditions	Inappropriate storage conditions
Different shelf life after harvest	Inappropriate harvesting techniques		Mixed transportation of inappropriate products (some fruits and vege-tables produce ethylene gas during ripening, which shortens the shelf life of other fruits and vegetables you store together)		Tending to provide uniform and perfect products	Excessively prepared and inedible foods
Failure to meet certain quality standards			Losses caused by the driver		Inadequate stock management	Wrong preparation techniques
Low market, high labor price						
Unplanned production						

5.4.2. Food Waste and Food Loss Management and Prevention Activities

Food loss and waste constitute a serious burden on a global scale and negatively affect the economic, social and environmental aspects of sustainable development. The loss and waste of consumable food undermines both food security and nutritional conditions, and also prevents access to sufficient food, which is a basic human right. The United Nations Sustainable Development Agenda for 2030 includes a specific target for reducing food loss and waste. In this context, Sustainable Development Goal 12 is included under the title of "Ensuring sustainable consumption and production habits" and in line with target 12.3, it is aimed to halve food waste per capita at the retail and consumer level by 2030 and to reduce food losses (including post-harvest losses) in production and supply chains. Preventing food waste and waste can make significant contributions not only in terms of food security and nutrition, but also to achieving other development goals that support environmental sustainability. There are a number of regulatory mechanisms that the Food and Agriculture Organization of the United Nations (FAO) has deemed useful in combating food loss and waste. These are:

- Establishing an adequate institutional framework
- Establishing a food hierarchy
- Establishing legally binding targets to reduce food loss and waste
- Establishing a food donation system
- Ensuring food safety and quality
- Determining clear date label requirements
- Taking appropriate financial measures

5.4.2.1. Establishing an Adequate Institutional Framework

In this mechanism, which emphasizes the need to determine the responsible institutions and organizations and to distribute tasks in order to implement the legal framework for reducing food loss and waste, it is important to cooperate among public institutions due to the multi-area nature of the issue, as well as to include civil society and the private sector in the process. In this context, this can be achieved by countries authorizing a single institution, sharing tasks among existing authorities, or establishing a special structure that will provide coordination between institutions.

5.4.2.2. Establishing a Food Hierarchy

In 2018, the Food and Agriculture Organization of the United Nations (FAO) requested the development of codes of conduct for reducing food loss and waste. FAO has developed a Voluntary Code of Conduct to Reduce Food Loss and Waste (CoC FLW) using an inclusive approach involving various stakeholders. The Code of Conduct is not legally binding and was adopted by the FAO Conference in June 2021. The food hierarchy was also proposed by the CoC FLW and provides guidance on which steps should be taken first in combating food loss and waste. Hierarchies are often schematically represented as an inverted pyramid and are useful guidance for national and regional governments, food producers, retailers, farmers

and consumers on how to prevent and manage food waste.

The food use and waste hierarchy aim to prioritize the most environmentally appropriate options for combating food waste. Therefore, the most effective solution, "prevention," is at the top of the inverted pyramid, while the least preferred method, "disposal," is at the bottom. In practice, the action at the top of the pyramid is started; if this is not possible, the process continues by moving on to the option at the next lower level.

The options that can be applied in the food hierarchy are in order of priority:

1. Preventing food loss and waste in food supply chains as a priority.
2. Recovering and redistributing surplus food or unsold/unmarketable food, if it meets all food safety and nutritional requirements.
3. Diverting excess food or unsold/unmarketable food into animal feed or converting it into non-food products, if it meets all safety and quality requirements
4. Recycling excess food, the material that leaves the food supply chain as food loss and waste, inedible parts and by-products, through anaerobic digestion to produce energy and composting for use as fertilizer.
5. Burning the material to produce energy, taking measures to limit any toxic release into the atmosphere (energy recovery process)
6. Disposal by burning or in landfills.

How Can We Apply the Nutrient Use Hierarchy to Our Daily Lives?

The first priority is to **prevent waste**. Food suitable for human consumption should be shared with people to make the best use of all resources invested in that food.

- Prepare a shopping list and buy only the food you need.
- Store the food you buy under appropriate storage conditions.
- Consume the food in your home by following its expiration dates.
- If you cook too much food, share it with your neighbors or family.

The next priority is **recycling:**

- Some local authorities recommend collecting household food waste for recycling. For example, in Türkiye, some municipalities collect household waste cooking oil.
- Compost food at home if your home is suitable, or check your local area for community groups running composting projects.

Minimise the food you throw away. When waste cannot be prevented, recycled or recovered, it ends up in landfill. This has high costs and contributes to greenhouse gas emissions, soil depletion and pollution.

5.4.2.3. Legally Binding Targets to Reduce Food Loss & Waste

CoC FLW calls on states to establish a solid starting point to be used as a reference point for monitoring the reduction of food loss and waste (FLW) and to set time-bound, achievable targets accordingly. For this purpose, legally binding targets can be set, taking the approach of climate change framework laws as an example. Although the preparation of such laws requires lengthy negotiations, the effectiveness of legal binding has been emphasized by FAO (2020). FLW measurement tools, data collection systems and reliable statistics are necessary to set accurate starting point values. In this context,

food supply chain actors can be required to regularly report the amount of FLW they generate. For example, in Poland, Law No. 1680 on Combating Food Waste, adopted in 2019, imposed an annual reporting obligation on suppliers above a certain capacity. Similarly, in Uzbekistan, the Council of Ministers Decree No. 574 of 2021 includes additional measures to reduce agricultural product and food losses.

5.4.2.4. Establish Food Donation System

When developing strategies to combat FLW, preventing the formation of FLW is a top priority. However, since some food surplus is inevitable, legislation should still mandate the establishment of an effective food donation system for edible and nutritious foods. Food donation is an important starting point for countries in the fight against FLW from a legal perspective. The relevant legislation should ensure that donated food is safe and nutritious, clarify the principles governing food donation, and clearly define the duties, roles, and responsibilities of donors and beneficiaries. An example of food donation laws is the Food Donation Special Regime Law No. 25,989 (DONAL), adopted in Argentina in 2005. This law introduced a special regulation for food donations. Similarly, the Food Waste Combat Law No. 138, enacted in France in 2016, provided new momentum in this area by making food donation mandatory for certain retailers.

5.4.2.5. Ensure Food Safety and Quality

National legal systems should have food safety and quality legislation designed specifically for the purpose of ensuring the supply of safe food for human consumption without increasing food loss and waste, and effective procedures for its implementation. This legislation should be compatible with internationally accepted standards, in particular the Food Standards (Codex Alimentarius), adopt a risk-based approach and ensure that it is compatible with efforts to reduce GQI without compromising food safety. For example, businesses that donate food should be subject to the same requirements as other food businesses and should be guaranteed to be safe for consumption. Food safety authorities should ensure that donated food is subject to the same risk-based controls that apply to other foods on the market. In addition, food businesses may be able to revise their food safety and quality obligations to encourage donations without endangering consumer health.

5.4.2.6. Determine Clear Date Label Requirements

Governments should establish clear and harmonized regulations for food date labeling, taking into account the Codex labeling standards. While the "best before" date indicates quality, the "Expiration Date" date indicates the safety of the food. Lack of understanding between consumers and retailers about the difference between these two dates is a major factor contributing to food waste. Clear distinctions in date labeling are also critical for food donation systems, allowing donations of food that is approaching its best before date but can still be safely consumed. For example, Croatia's 2019 Food and Animal Feed Donation Regulation allows such donations.

The Codex Alimentarius General Labeling Standards for Prepackaged Foods distinguish between the two concepts as follows:

- "Best Before" or "Best if Used By/Before": The date on which the product is unopened and fully marketable under specified storage conditions, maintaining certain quality characteristics. However, the food can still be consumed after this date.
- "Expiration Date" or "Use-By": The date after which the product should no longer be sold or consumed due to its reliability and quality under specified storage conditions.

5.4.2.7. Take Appropriate Financial Measures

CoC FLW recommends making tax legislation sensitive to VAT, which means encouraging practices that reduce VAT by making behaviors that lead to VAT unattractive. Measures can be taken to discourage VAT, such as restricting the ability to deduct lost or wasted food from tax or implementing garbage taxes on food that ends up in the trash. CoC FLW

calls this system “pay for what you throw away” and aims to make food that ends up in landfills the most cost-effective option. For example, in Chile, Law No. 21.210 on the Reform of Tax Legislation, 2020, states that voluntary disposal of food that is fit for human consumption but cannot be commercialized is not considered an expense. Thus, the taxpayer cannot deduct the disposal of food from income tax, but can deduct donations from tax. Confusion between the “best before” and “recommended consumption date” among consumers and retailers is a major factor in food waste. Tax incentives, especially the tax deduction of food donations, can be effective in combating FDI. Colombia’s Law No. 1,990, 2019, “Establishing a Food Loss and Waste Prevention Policy and Other Provisions” provides an example of this strategy by offering the opportunity to benefit from the advantages provided in donation legislation. In China, Law No. 78, 2021, Combating Food Waste introduced some tax policies aimed at reducing food waste.

5.5. SUSTAINABLE FOOD SYSTEM

A food system broadly refers to all activities and infrastructures involved in feeding a population, including those related to production, distribution, consumption, and waste management. All stages such as cultivation, harvesting, processing, packaging, transportation, marketing, consumption and waste management constitute the components of this system. Food systems are generally classified into conventional (traditional) and alternative systems. Increasing population, resource depletion, climate change and economic problems have increased the need for alternative and more sustainable food systems on a global scale. In this direction, approaches to the creation of sustainable food systems are gaining more and more importance today.

5.5.1. Functioning and Problems of Traditional Food Systems

The traditional (conventional) food system primarily aims to produce a high supply and to meet the market demand as a result of this supply. While this approach brings with it the need for continuous storage and stocking, it causes both waste in the processes of food from production to the table and problems in food access due to supply-demand imbalances. In addition, many consumers do not know exactly how the products they consume are produced, what chemicals they are exposed to during the production phase, and what stages they go through to reach their homes.

Traditional agricultural practices often involve the use of various synthetic inputs such as chemical fertilizers, pesticides, and genetically modified organisms. Today, there are many inputs that adversely affect human health, such as genetically modified seeds, chemical pesticides, chemical fertilizers, synthetic food additives, industrial solvents, and gamma and UV rays in foods produced by traditional methods.

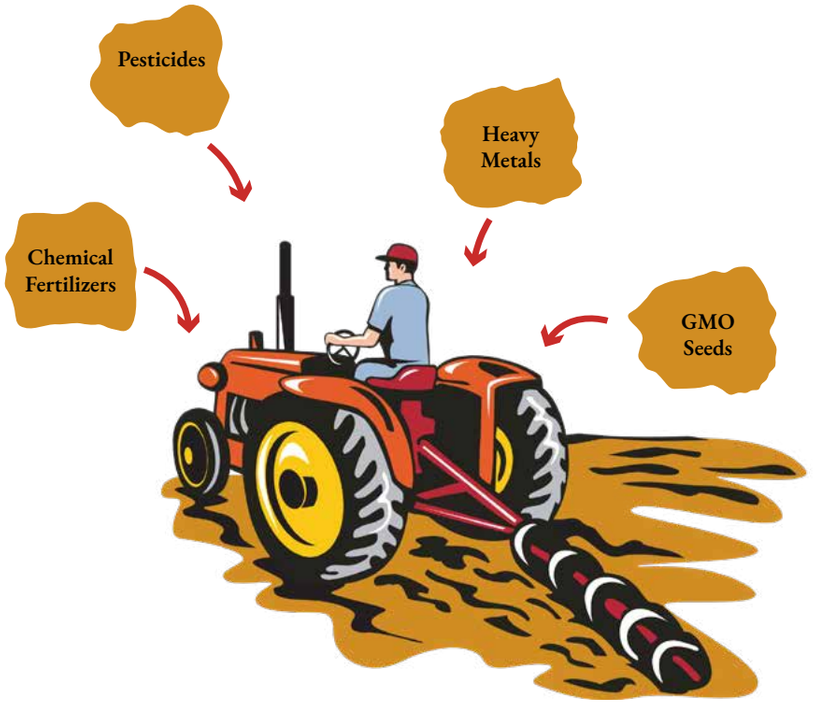
Many scientific studies reveal that nutrients obtained from plants grown with chemical fertilizers and pesticides cause various problems in human and animal health. Risks in traditional foods include the amount of nitrite and nitrate in the structure of foods, pesticide contamination and heavy metal residues. In particular, excessive use of fertilizers and growing plants in environments with excess nitrogen cause nitrate accumulation. Nitrate ingested through contaminated food is

converted into harmful nitrite ions in the human body. These ions react with hemoglobin, forming methemoglobin, which impairs the blood's ability to carry oxygen. This condition, known as methemoglobinemia, poses a serious health risk, particularly for infants, young children, and the elderly, and may be fatal if left untreated. Methemoglobinemia is a serious disease that occurs as a result of an increase in methemoglobin, the abnormal form of hemoglobin protein responsible for transporting oxygen in blood cells, and can result in death if left untreated. In addition, carcinogenic and mutagenic substances formed as a result of the reaction of amines with nitrites can cause diseases such as leukemia and cancers of the digestive system; This poses a risk for all age groups.

Although pesticides are substances used to control harmful organisms, it is known that certain amounts of pesticide residues in foods cause cancer and various diseases. Pesticides also cause soil, air and water pollution and cause the extinction of non-target species.

Reducing the uptake of heavy metals by plants is one of the important problems to be solved in agriculture. Heavy metals such as cadmium, lead, arsenic, mercury and zinc enter the food chain from various sources such as industry, transportation, waste and agriculture. For example, phosphorus fertilizers used in conventional agriculture can cause cadmium in the soil to pass to plants. In addition, the metal industry and transportation activities lead to cadmium contamination in soil and plants.

Today, rapidly changing global conditions, crises and challenges such as pandemics reveal the necessity of transforming traditional food systems more than ever. It is necessary to take measures now to create sustainable food systems that eliminate health and environmental problems for the future of societies all over the world and aim to create healthy individuals and a livable world.



Traditional Food Production in Agriculture

5.5.2. What is a Sustainable Food System?

Since the concept of sustainability can have different meanings depending on the situation in which it is handled, it is difficult to make a precise and universal definition. In the report of the World Environment Conference held in Stockholm in 1972, the concept of "sustainability" was officially discussed for the first time. **Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs.**

Sustainability is conceptualized as a mindset rooted in global solidarity, aiming to secure access to essential resources for future generations without compromising current quality of life. It operates within the framework of social responsibility and economic viability.Although this concept is applied in different disciplines, the food industry, which is one of the most important areas in our vital processes,

stands out as one of the critical goals of sustainability.

After the Industrial Revolution, the need for energy for agricultural production processes has increased around the world, and accordingly, there have been significant changes in the consumption amounts of individuals. These developments have led to the rapid depletion of natural resources on earth; Since the 1950s, this situation has become more evident and the search for urgent solutions has been brought to the agenda.

Like all living species, humanity turns to nature for food, water and resources for survival; It is dependent on security against environmental threats such as epidemics and natural disasters. However, the physical basis that enables the survival of living things, which depends on the benefits provided by nature or what science calls "environmental services", is not sufficiently protected.

Assessments for a successful food future need to focus on the system as a whole on a global scale rather than at local levels. The existence of individuals in the world who prefer reliable food consumption, take care to cause the least damage to the environment, natural life and ecosystem, and also want to support local production and farmers, has led to the development and implementation of sustainable food systems as an alternative to existing systems.

Sustainable food systems, in line with the principles of sustainability, provide access to sufficient and safe food; It refers to a long-term structure that allows the conservation of resources that can meet the needs of future generations.

Sustainability in the field of food; It is defined as a system that is culturally acceptable, accessible, economically fair and feasible, while at the same time providing nutritionally sufficient, reliable, healthy and affordable food to the consumer.

5.5.3. Global Impact of Food Production Processes

Transition to sustainable food systems against environmental, economic and social problems that increase with climate change; It is considered as a multidimensional solution that enables not only the reduction of environmental impacts, but also the efficient use of resources and long-term food security.

Globally, food production accounts for approximately 30% of greenhouse gas emissions, with nearly half attributed to the livestock sector. Almost half (14.5%) of these emissions are reported to originate from the livestock sector alone. In addition, it has been determined that food production occupies about 40% of the land worldwide and consumes 70% of freshwater resources. This situation is considered as one of the main threats in terms of loss of biodiversity; It leads to eutrophication (nutrient surplus) and the formation of dead zones in lake and coastal ecosystems.

Approximately 60% of fish stocks are reported to be fully fished and 33% are overfished, while only 7% are underfished or not caught at all. In line with these data, it is concluded that the current structure of food systems contributes significantly to global environmental change and these changes; It is seen that it brings many problems such as human health, frequency of disease, social conflicts and food insecurity.

It is accepted that the current agricultural production structure is both the main trigger of global environmental change and one of the sectors most affected by this change. In this process, which continues without taking any precautions, the risk of not achieving the goals set in the United Nations Sustainable Development Goals and the Paris Agreement is seriously on the agenda.

Therefore, it is made clear that the current global food systems are not sustainable; In this context, the necessity of reviewing both food production methods and eating habits comes to the fore.

A sustainable food system economically promotes local production and distribution infrastructures; It makes nutritious food accessible and affordable for everyone. It also protects and supports farmers, farm workers, consumers, and communities with a humane and equitable approach.

5.5.4. Structural Dynamics of the Sustainable Food System

Sustainable nutrition and sustainable food systems are increasingly being studied from an interdisciplinary perspective. Internationally recognized, it guides the shaping of policies aimed at eliminating hunger and malnutrition and achieving sustainable development goals. Today, there is a widespread consensus that the global food system is not sustainable.

Food production and consumption are among the main architects of not only the food that reaches our plates, but also the environmental destruction. The fact that one-third of the food produced every year is lost or wasted reveals the unsustainability of the current system. According to FAO's data, a 60% increase in global food demand is predicted by 2050 in line with changing consumption habits and increasing population. This table is not only about production; It is also directly related to soil, water, climate and biodiversity.

Food systems today transcend the mere production and distribution of food; they are intricately linked to global health, ecological balance, and socio-economic structures. Many factors such as health, environmental sustainability, cultural values and social justice have become the main elements that shape these systems. For this reason, every step towards sustainability is not only based on habits; It also requires a transformation of values and priorities. This transformation can only be possible with effective policies, supportive structures and social awareness. Because it's no longer just about what we eat, it's about how we want to live.

In this context, we can list the structural dynamics of food systems as follows:

- Sustainable Agricultural Practices and Ecological Food Systems
- Sustainable Food Logistics
- Sustainable Consumption Habits
- Waste Reduction

5.5.5. Sustainable Agricultural Practices and Ecological Food Systems

Agricultural production is the basic building block of the food chain and plays a critical role in ensuring a sustainable food system. Agriculture; It is an important sector that covers a wide range of stakeholders from producers to farmers, from workers to suppliers. Today, agricultural production on a global scale faces many environmental, economic and social challenges. Long-term production and consumption models that are compatible with nature are urgently needed.

In this context, sustainable agriculture refers to production systems that aim to both meet the nutritional needs of the current society and protect the resources of future generations. Sustainable agricultural practices prioritize the protection and development of farmland, natural resources, farmers, and ecosystems. At the same time, it aims to increase agricultural productivity, support economic development and increase social welfare.

The agroecology approach offers a holistic system that promotes nutritious, reliable and nature-friendly food production with ecological farming methods, is economically viable and observes social justice. These systems aim to create durable and sustainable production models while scientifically addressing the interactions between agricultural ecosystem components.

Today, there are more than 200 sustainability-based certification systems. These include 4C Association, Better Cotton Initiative, Bonsucro, Cotton made in Africa, Fairtrade International, Forest Stewardship Council, GLOBALG. There are international programs such as A.P., IFOAM-Organics International, ProTerra Foundation, Rainforest Alliance, Roundtable on Sustainable Palm Oil, Round Table on Responsible Soy and UTZ. Worldwide, agricultural areas with sustainability certificates account for approximately 1.96% of the total agricultural areas. The largest part of these areas belongs to organic farming certification with 1.4%.

With the increasing spread of the concept of sustainability, various agricultural and food production systems based on this philosophy have been developed and started to be implemented. Organic agriculture has been instrumental in shaping sustainability-driven food production models and remains a cornerstone of ecological farming practices.

Public institutions, private sector, cooperatives and non-governmental organizations actively continue their policy development processes in order to increase sustainability and productivity in agriculture. For example, within the scope of the European Green Deal (EGD), member countries are required to allocate at least 40% of their Common Agricultural Policy (CAP) budgets to combat climate change. In addition, many policies and documents supporting sustainable agriculture have been developed within the scope of the EGD, such as zero waste management, circular economy action plan and "Farm to Fork" strategy. In line with the decision taken by the European Commission in 2020, it is aimed to carry out organic farming activities in at least 25% of agricultural areas and to significantly reduce the use of water, energy and plastics.

In addition, beyond certificate programs that support the diversification of

sustainable agriculture and food systems; Different systems and social movements such as permaculture, the local food movement, the slow food movement, fair trade, and community-supported agriculture are also becoming increasingly important.

5.5.6. Sustainable Food Logistics

In food systems, the supply chain starts from production and ends with consumption; However, this process encompasses many intermediate stages. The sustainability of all stages, from planting to harvesting, from processing to packaging and finally to the distribution of agricultural products to the consumer's table, forms the basis of an effective and resilient food distribution system.

Sustainability is made possible by the adoption of shared responsibility by every stakeholder in the supply chain. Careful planning of all stages of the chain ensures that healthy, safe and sufficient food can be left for future generations.

In this context, the understanding of sustainability should be maintained from production to the end consumer. The strong transportation infrastructure ensures the fast and healthy transportation of products; Otherwise, long storage and transportation processes due to inadequate infrastructure reduce product quality, making it difficult for the manufacturer to obtain a fair price. A decline in market demand under challenging conditions exacerbates food losses and adversely affects pricing mechanisms.

In many developing countries, farmers earn only half of global market prices. When efficiency in the supply chain is achieved, the prices to be paid by consumers living in the city can be kept at more reasonable levels. In addition, the flow of accurate and timely information about the market will increase with the improvement of infrastructure, thus reducing the dependence of farmers on the market.

5.5.7. Sustainable Consumption Habits

Nutrition – or diet, in other words – is not only a factor that directly affects the health of individuals; It also plays a critical role in the functioning of food systems and ensuring food safety. As is known, a balanced and adequate diet is indispensable for maintaining health and preventing diseases. However, this action is not only an individual choice, but also a conscious process that includes social and environmental responsibility.

Sustainable healthy nutrition ensures that the necessary nutrients are taken in sufficient amounts and at the right time to increase the quality of life of individuals; It aims to support the healthy development of not only current generations but also future generations. This approach, in addition to ensuring growth and development; It contributes to the prevention of all types of malnutrition such as malnutrition, micronutrient deficiencies, overweight and obesity. It also aims to strengthen public health by reducing the risk of nutrition-related non-communicable diseases (e.g. diabetes, cardiovascular diseases, hypertension).

The health effects of the foods we consume, as well as the environmental impact of their production, vary greatly. Although increased food production in recent decades has led to positive results such as longer life expectancy and stronger fight against hunger, these gains have been threatened by the spread of processed and energy-dense foods. With the increase in income level and urbanization, traditional plant-based diets have been moved away and a Western-type, high-calorie and refined food diet has become widespread.

In particular, the production of foods of animal origin such as red meat and dairy products; It triggers environmental crises such as greenhouse gas emissions, deforestation, overexploitation of water resources and loss of biodiversity. Therefore, sustainable nutrition carries a responsibility to protect the health of not only individuals, but also the planet.

FAO (Food and Agriculture Organization) and WHO (World Health

Organization) define sustainable healthy diets as "with low environmental impact; diets that guarantee the nutritional needs of present and future generations and the right to a healthy life". In this context, the main characteristics of sustainable diets are:

- It should be adequate and balanced in terms of health; it should support the physiological, mental and social development of individuals.
- It should have a low environmental impact; it should protect biodiversity and ecosystems.
- It should be accessible and economically affordable; it should aim for sustainability at a level that is within the reach of every individual.
- Must be culturally acceptable and respectful of local eating habits.
- It should reduce the consumption of processed foods, contain less animal-derived and more plant-based nutrients.
- It should prevent food waste and be based on efficiency in the use of resources.

This multidimensional approach represents a holistic structure that brings together both individual-level health outcomes and ecological, economic and social sustainability. In particular, models such as the planetary health diet make these principles concrete, establishing a strong link between nutrition and the environment.

The following basic principles can be adopted for the integration of a sustainable diet into daily life:

- High energy and nutritional value; However, a structure that does not exceed the recommended daily energy requirement should be targeted.
- Meals with a predominance of plant-based foods should be encouraged: vegetables, fruits, whole grains, legumes and nuts.
- Consumption of processed and packaged foods should be reduced as much as possible.
- Animal products should be consumed in a controlled and limited amount (for example, no more than 100 grams of red meat per week).
- It should contribute to food safety and food security.

- Production processes with a low carbon footprint should be preferred.

Nutrition is no longer just a matter of individual preferences; It has become a collective responsibility that spans a wide range of areas, from health policies to agricultural practices, from cultural norms to the fight against climate change. Sustainable healthy eating is a powerful strategy that protects both individuals and our planet, is based on scientific foundations, and has feasible and long-term effects.

With this holistic approach, it is possible for us to build healthy individuals and a livable world not only today but also tomorrow.

5.5.8. Waste Reduction

Alongside the transition towards a planetary health diet, building a more sustainable food system necessitates not only individual dietary choices, but also sweeping transformations in production, consumption, and waste management processes. In this direction, it is of great importance to increase efficiency in food production practices, to reduce losses in the supply chain and to prevent food waste, especially at the consumer level.

Food waste is a multidimensional problem that can occur at every stage of the production chain. In the process from the field to the table; A significant amount of food is wasted due to microbiological and physical losses, climatic effects, errors in processing and cooking processes or consumer behavior. Food waste generally falls into two main categories:

- **Food loss** is the disposal of food before it reaches the consumer due to technical or structural problems in production, harvesting, processing, storage and distribution processes.
- **Food waste**, on the other hand, refers to the deliberate waste of consumable food at retail or consumption stages.

Around one-third of the food produced globally is wasted, posing serious threats not only in terms of food security and economic losses, but also in

terms of environmental sustainability. Methane gas, which is produced as a result of the decomposition of food wastes in landfills, is one of the main greenhouse gases that accelerate global warming. For example, it is estimated that reducing food waste by just 15% could feed more than 25 million individuals per year.

In order to build a sustainable food future, various strategies need to be implemented at the individual and institutional level. These include;

- Increasing consumer awareness,
- Encouraging conscious behaviors about shopping, storage and portion control,
- Improving food processing and cooking techniques,
- Strengthening food donation systems,
- Dissemination of recycling practices such as animal feed, compost, biogas and natural fertilizer production plays an important role.

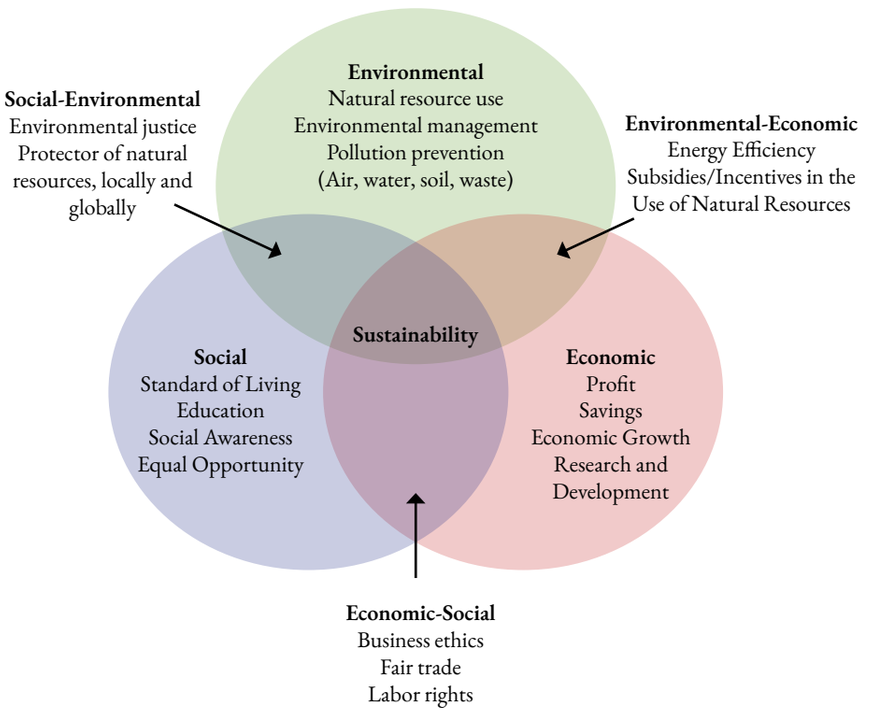
The fight against food waste is also a priority target within the scope of the United Nations Sustainable Development Goals (SDGs) and under the heading of SDG 12, concrete indicators are determined for the measurement and reduction of food loss and waste. In this context, initiatives such as the "Food Waste Challenge" launched in the USA in 2013; It offers a multi-actor solution model with the cooperation of farmers, producers, retailers, educational institutions and local governments. Among the goals of such initiatives are;

1. Improving product development, storage, labeling and cooking processes,
2. Bringing food donors together with anti-hunger organizations,
3. There is a circular economy through reuse of waste.

As a result, the sustainability of a habitable planet can be achieved not only by increasing production, but also by using existing resources effectively and responsibly. Preventing food waste directly contributes not only to reducing environmental impacts, but also to maintaining social justice, economic efficiency and public health. For this reason, it is essential for individuals, societies and states to assume common responsibilities in this regard.

5.5.9. Advantages of a Sustainable Food System

Sustainable food systems offer a versatile structure that not only ensures adequate and balanced nutrition of individuals, but also encourages the efficient use of natural resources with production and consumption models that take into account ecological balance. These systems make positive contributions in many areas such as reducing environmental impacts in agricultural production, preventing food waste, reducing social inequalities and supporting economic development, both increasing the welfare of existing communities and ensuring the food security of future generations. Therefore, sustainable food systems play a strategic role in combating climate change and supporting healthy living on a global scale.



5.5.9.1. Financial Advantages

Agricultural practices play a central role in the process from production to consumption by forming the basic building blocks of food systems and food supply chains. In this context, sustainable agriculture makes it possible not only to protect environmental resources, but also to guarantee food security, to increase the welfare level of farmers and to support economic development in the long term. Agricultural activities carried out with sustainable methods; While preserving natural resources such as soil, water and biodiversity, it also provides efficient and quality products.

Ensuring food security, maintaining economic stability and supporting social development are among the main reasons for the orientation towards urban agriculture practices today. In addition to supporting the healthy and balanced eating habits of individuals, urban agriculture also contributes to the strengthening of social ties between communities. It also has significant potential to increase household income, balance spending on food, and create employment opportunities at the local level.

The amount and nutritional value of food in a household are among the factors that directly affect food security. Unfortunately, lack of access to adequate and healthy food is a widespread problem even in developed countries and can have serious health and developmental impacts, especially on children and adolescents. In this context, urban agriculture practices can contribute to both reducing food insecurity and eliminating food access inequalities in rural and urban areas.

Urban agriculture increases food production in low-income urban households, improves the quality of products and contributes positively to the nutritional quality of households by increasing food diversity. Depending on production preferences and volume, these activities can support the household budget in a variety of ways. Basic foods, such as rice, provide economic security through direct consumption; Vegetables, on the other hand, are sold at higher market values, allowing additional income to be obtained. Small-scale livestock farming yields economic benefits via the production of dairy products and organic fertilizers, contributing to diversified income streams and local food security.

In some households, additional income is provided only by the sale of surplus products, while in other cases, urban agriculture plays an important role in reducing poverty by turning into the main source of livelihood of households. While the income from the sale of products can generate capital to meet other basic needs of households; Especially in communities where income management is concentrated in men, it can contribute to women's financial independence by increasing their participation in economic decision-making processes.

5.5.9.2. Achievements at the Social Level

Sustainable food systems are based on a holistic approach that draws attention not only for its environmental and economic impacts, but also for its principles of social welfare and equality. These systems are; In addition to ensuring the continuity of ecosystem services, it is structured in line with policies that support social equality, increase social welfare and make access to food fair. In essence, sustainable food systems; It aims to provide access to affordable, culturally acceptable, nutritious and safe food.

Social sustainability; It includes practices that protect the fundamental rights of individuals, support communities and ensure access to food, especially for vulnerable groups. In this context, the integration of social sustainability into food systems does not only affect individual well-being; It also supports the general health level of societies, cultural continuity and social integration.

The main indicators that determine social sustainability can be listed as follows:

- Respect for human rights and observing the principle of equality,
- Conducting human resources management in a fair and inclusive manner,

- Ensuring a high level of occupational health and safety standards,
- Adherence to the principles of consumer health and food safety,
- Adopting responsible marketing and communication strategies,
- Encouraging social responsibility projects that directly contribute to societies.

These elements make the effects of sustainable food systems on social structure visible and strengthen social resilience in the long run.

5.5.9.3. Investigation of Food Quality and Nutritional Value in the Context of Sustainability

Nutrition is of vital importance for all humanity and is an indispensable component of daily life. The main purpose of nutrition; It is to ensure that individuals can get the energy and basic nutrients they need in a balanced and adequate way in line with their age, gender, physiological status and physical activities. In this direction, the maintenance of a healthy life is directly related to the existence of a qualified and balanced diet.

The United Nations often emphasizes the importance of sustainable food systems due to its orientation towards healthy diets. These systems are; It aims at food safety and the provision of accessible, reliable and nutritious diets for everyone, and covers the entire process from production to consumption. These systems, which include stages such as production, processing, packaging, distribution, retail sales and consumption of food, also play a critical role in terms of sustainable development. In this context, sustainable food systems are not only in terms of individual health; At the same time, it makes multidimensional contributions in terms of environmental protection, economic development and social welfare.

One of the main components of human nutrition is foods of animal origin. These foods play an important role in addressing common micronutrient deficiencies globally by providing not only high-quality protein but also rich micronutrients. While iron deficiency is common in Western societies; In low-income countries, carbohydrate-heavy, low-quality diets are observed to cause zinc, iron, vitamin A and B12 deficiencies. In this context, foods of animal origin do not only meet the nutritional needs; It also supports the sustainability of agriculture and livestock-based industry.

Sustainable food value chains aim to increase food access, especially for low-income households. However, the increase in income level generally brings with it the preference of products with high nutritional value and more beneficial in terms of health, not the amount of food consumed. This change in consumer behavior plays a triggering role in terms of innovation and value creation at every stage of the food system. Thus, a continuous improvement in food supply is ensured and consumer welfare is increased.

5.5.9.4. Challenges in the Transition to Sustainable Food Systems

The sustainability of food systems is one of the key priorities that needs to be addressed on a global scale. However, different approaches are emerging on the way to achieving sustainability; These approaches vary as efficiency-oriented strategies, limitation of consumption demand and paradigms based on the radical transformation of the system. Each approach has its own strengths, weaknesses or inherent inconsistencies, complicating solutions for food sustainability. Therefore, addressing sustainability issues effectively necessitates the development of a holistic framework that is inclusive of all approaches.

In order to build such a framework, it is of great importance to leave personal interests and subjectivities in the background and to understand in depth the value differences that make it difficult to reach a consensus among stakeholders. Although each stakeholder ultimately aims to achieve similar outcomes, there are differences in the vision and ethical perspectives on how to achieve this outcome. This situation leads to the diversification of evidence-based suggestions and solution models; Most of the time, it results in conflict and inaction in decision-making processes.

More conceptual and empirical studies are needed to understand the value sets and perspectives that lie at the root of the challenges in sustainable food

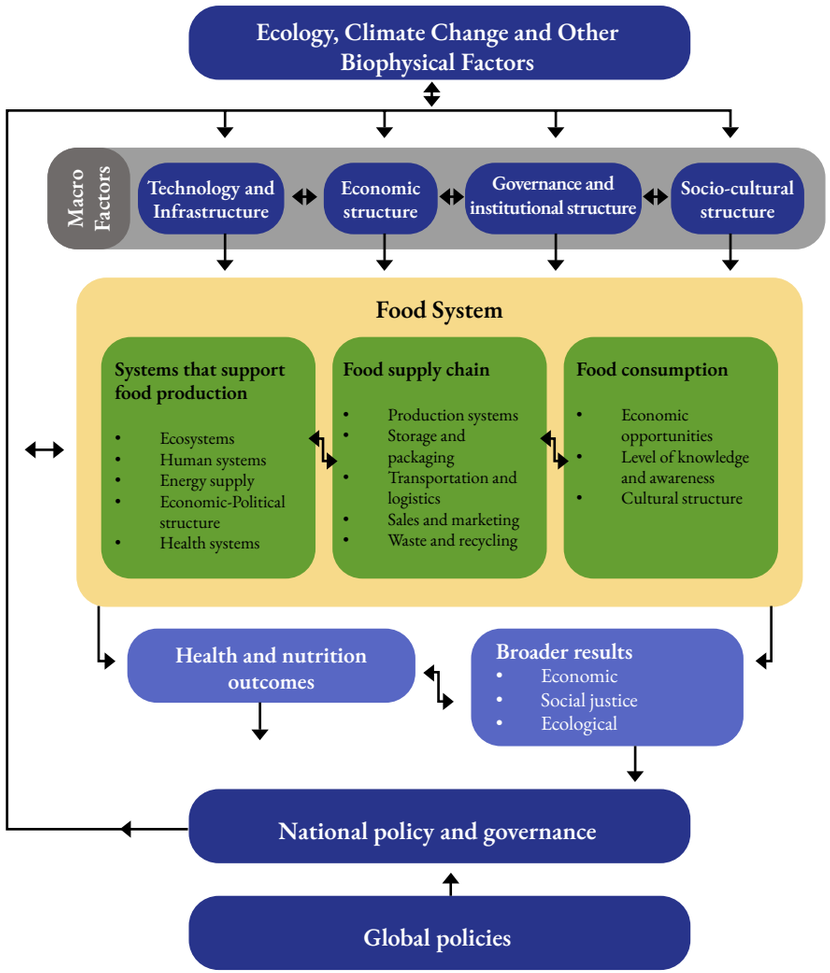
systems. Such analyses will be functional in revealing how stakeholders form their different positions, on what ethical and societal foundations these positions are based, and how a common ground of consensus can be built.

There are many variables that determine the sustainability and effectiveness of food systems. These variables are; biological, economic, social and governance fields and establish strong interactions with each other. This multi-layered structure can be both the cause and the result of advances in sustainability.

The European Commission's 2011 report titled "Sustainable Food Production and Consumption in a Resource-Limited World" also drew attention to this complex network of relationships. The key findings highlighted in the report are as follows:

- Volume, method and variety of products of food production; It reduces biodiversity through overuse of natural resources and environmental pollution and can trigger climate change.
- Most of the time, water and energy crises are not caused by physical insufficiency, but by unplanned and low-efficiency use.
- Biodiversity loss and climate change interact with each other, weakening the resilience capacity of food systems and increasing their vulnerability to shocks.
- While economic growth brings with it an increase in food demand; This increase can lead to resource scarcity. However, these negativities can be minimized with strategies such as recycling, use of technology and increasing productivity in resource management.
- Public authorities are the main actors that both cause the problems to deepen and can direct the solution. Because governance mechanisms; It acts as an intermediary between market structures, consumer behavior and policy decisions.

In this context, it is clear that developments in sustainable food systems are multidimensional and each parameter should be evaluated in mutual relationship with the others. This complex structure necessitates strategic integrity and interdisciplinary cooperation in achieving sustainability goals.



The rapid increase in urbanization around the world has increased the demand for agricultural products with the change in the economic structure, which has created new challenges in production and supply chains. While

urbanization has increased the intensive use of natural resources (water, energy, land), the decrease in rural population has reduced the agricultural workforce and started to threaten food security. The productivity of agricultural land decreases due to erosion, misuse and inheritance; This necessitates sustainable agricultural practices.

Climate change, on the other hand, directly affects agricultural production, reducing the amount and diversity of products, reducing water resources and increasing the frequency of natural disasters. While these effects are felt more acutely, especially in low-latitude regions, global warming leads to fluctuations in food prices and disruptions in supply chains. Problems such as drought, crop loss, livestock mortality and soil erosion severely limit food production.

Conservation of biodiversity is critical to maintaining ecosystem balance. The loss of genetic resources threatens the sustainability of food systems. In addition, the use of agricultural land for biofuel production is increasing, which negatively affects access to food and price stability.

Finally, the volatility and increase of food prices make it difficult to access adequate and healthy nutrition, especially in low-income communities. In order to prevent this situation, coordinated policies at the global and local level, information flow and risk management to ensure price stability become critical.

5.5.10. Sustainable Food Approaches on a Universal Scale

With the rapidly increasing world population and industrialization, the use of natural resources is increasing and the risk of depletion of these resources is growing. In parallel with this, while the demand for food is constantly increasing, the wastes originating from production and consumption seriously trigger the problem of environmental pollution. In particular, excessive consumption and destruction of natural resources such as oceans and forests are tried to be prevented.

Today, with urbanization, the development of global food supply chains and advances in food processing technologies, many food products are offered to consumers in packaged form. However, increasing packaging waste poses a significant threat to environmental pollution. For example, paper-cardboard packaging used in milk, yogurt, egg boxes and fast food products, and plastic bags commonly used in shopping are among the types of waste frequently encountered in daily life.

With the "Regulation on the Control of Packaging Wastes", which entered into force in 2004, environmental criteria were determined in the European Union harmonization process and the importance of recycling packaging wastes was increased. Sustainable packaging designs have become increasingly important in reducing environmental pollution. The use of biodegradable and environmentally friendly materials instead of non-biodegradable packaging is encouraged.

The main principles to be considered in sustainable packaging materials are as follows:

- Removal of unnecessary packaging, extra boxes or layers,
- Reducing the amount of packaging by using optimally sized packages,
- Dissemination of reusable packaging,
- Preferring biodegradable or compostable materials produced from renewable resources,
- Use of recyclable packaging,
- Packaging design at optimum cost in line with these principles,
- Increasing awareness and training on sustainability.

The paper industry is one of the industries that cause the most damage to nature. Compared to plastic, air pollution increases by 70% and water pollution by 50% during paper production. In addition, 50 times more water is consumed and 40% more energy is consumed to produce a paper bag than a plastic bag. The cutting of trees used in paper production causes great damage to forests; For example, only 1 ton of pulp is obtained from 3 tons of wood.

Only 5.2% of plastic bags are recycled worldwide, and their biodegradable time ranges from 100 to 10,000 years. Up to 10-15% of paper waste can be recycled, but the recycling process requires more energy than plastic.

5.5.11. Examples of Sustainable Food Systems Around the World

- **Brussels – Good Food Strategic Action Plan:** This plan aims to create a new food culture, increase the demand for local products, raise awareness of good food products among the public, and promote innovation to improve food systems.
- **Netherlands – Plus Supermarket Project:** In this project, local and sustainable foods were prioritized in the product range, and at the same time, positive arrangements were made in the supply and distribution processes.
- **Netherlands – Food Education in Primary Schools Project:** In the event called "Pancake Safari", students prepared their own pancakes; They visited the local farmer and mill to obtain ingredients and learn about the nutritional composition of the dishes and the sustainability of the food. Thus, sustainable food awareness in children was developed at an early age.

Sustainable food systems have a multi-layered structure that needs to be addressed not only in terms of environmental but also economic and social dimensions. Dynamics such as increasing population, climate change, depletion of natural resources and changing global consumption habits reveal the necessity of a systemic transformation in food production and consumption. Sustainability of food systems; Effective management of resources is directly related to harmonizing the production-consumption cycle with nature, minimizing waste and transitioning to a circular economy. In addition, food safety and accessibility issues are not only related to production techniques; It is also closely linked to raising the level of awareness, education and consciousness in all segments of society. In order to achieve sustainability goals, systematic, multi-stakeholder and long-term approaches need to be adopted. In this context, the development of policies supported by scientific research, the dissemination of nature-friendly technologies, the transformation of producer and consumer behavior, and the implementation of sustainable development principles in sectoral integrity are among the basic strategies that will shape the future of food systems.

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Food literacy is not just about knowing what we eat, but also the ability to make conscious choices that affect our health, the environment, and society. This book is prepared with the aim of helping young individuals become conscious consumers who question the food system and can make ethical and sustainable decisions.

The “Food Literacy Handbook” offers its readers a wide range of information from food safety to label reading skills, from reducing food waste to the relationship between nutrition and the environment. Accompanied by engaging visuals, creative content, and thought-provoking questions, it encourages both increasing individual awareness and being part of a societal transformation.

This book serves as a guiding resource for anyone who wants to rethink their relationship with food.