7. SUSTAINABLE HEALTHY DIETS

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Abstract

The main challenge of our time is, on the one hand, malnutrition or the increasing number of overweight and obese people, and on the other hand, degradation of the environment and natural resources as a result of production. There is an urgent need to promote well-balanced and safe diets that have a low negative impact on the environment, while being culturally acceptable and economically accessible to all. This chapter discusses the concept of a "sustainable healthy diet" in the context of international and national dietary guidelines as well as the environmental impact of production and consumption of selected food groups and types of dietary patterns.

Keywords: sustainable nutrition, dietary guideline, diet quality, environmental impact.

JEL codes: Q01, I12, I14.

Introduction

Over the last 200 years, there has been rapid growth in the world's population. It is estimated that the total population will reach eight billion in 2023, compared to one billion people in the early 19th century. Furthermore, the population is expected to grow steadily until 2060, when the number of people will reach over 10 billion (Statista, 2023). Still the same amount of natural resources must feed an ever-growing population, and it should be remembered that there are huge differences between countries and regions. The main challenge of the present times is, on the one hand, malnutrition or the increasing number of overweight and obese people, and on the other hand, degradation of the environment and natural resources caused by urbanisation and production, including food production. At present, food production and agriculture are the main causes of the global environmental

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change (Willett et al., 2019). It is reported that agriculture occupies approximately 40% of global land (Foley et al., 2005; Kirova et al., 2019). Food production is responsible for about 70% of freshwater use (Brauman et al., 2016; Mbow et al., 2019), and between 19% and 37% of global greenhouse gas emissions (GHGE) (Clark et al., 2020; Crippa et al., 2021; Mbow et al., 2019; Poore & Nemecek, 2018; Vermeulen et al., 2012).

The growth of the world's population and the extension of life is a huge challenge in the context of sustainable development aiming to secure the needs of future generations. To meet this challenge, countries around the world adopted the 2030 Agenda for Sustainable Development (United Nations 2030 Agenda) and its 17 Sustainable Development Goals (SDGs). SDGs are directly or indirectly related to nutrition, which should be not only healthy but also sustainable. The definition of sustainable diet was proposed by the experts during the International Scientific Symposium on "Biodiversity and Sustainable Diets—United Against Hunger" held on 3–5 November 2010 in Rome. This definition states that: "Sustainable diets are those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimising natural and human resources" (FAO, 2010). This definition indicates that the SHDs or sustainable nutrition patterns need to be nutrient-rich and safe, culturally acceptable, as well as low cost (affordable) and with low environmental impact. It affects various dimensions of sustainability (agricultural, nutritional, environmental, social, cultural and economic) and highlights the role of food consumption in contributing to the achievement of the SDGs, especially Goals 1 (No poverty), 2 (Zero hunger), 3 (Good health and well-being), 4 (Quality education), 8 (Decent work and economic growth), 12 (Responsible consumption and production) and 13 (Climate action) (FAO & WHO, 2019; Grosso, Mateo et al., 2020) (Table 7.1).

The definition of sustainable diet has provided a framework for discussion and actions on food system changes to implement the SHDs. Public health policy both at national and global levels requires a new vision of food systems and dietary guidelines considering the consequences of food production and under-, mal- and over-consumption for future generations and the planet. These actions include the following (FAO & WHO, 2019):

- providing affordable and desirable food for SHDs for the most vulnerable, considering the perspective of those who experience poverty and deprivation,
- promoting strategies for dietary behaviour change, including effective food and nutrition education,

Table 7.1. Link between main SHD indicators and SDGs

SHDs indicators	Explanation	Link to SDGs
Health aspects	1. Adequate nutrient intake ensures proper development and maintenance of health 2. Healthy nutrition reduces the risk of diet-related diseases such as obesity, cardiovascular diseases, cancer and other diseases 3. Malnutrition affects learning abilities 4. Awareness of SHDs affects better choice of food	(3) Good health and well-being (4) Quality education (6) Clean water and sanitation (12) Responsible consumption and production
Environmental aspects	1. Limitation of meat production and industrial agriculture (based on chemical use) protects environment and biodiversity 2. SHDs reduce GHGE, soil and water contamination related to food production 3. Sustainable solutions in food production and consumption ensure that the nutritional needs of a growing population are met	(6) Clean water and sanitation (12) Responsible consumption and production (13) Climate action
Affordability, acceptability, economic and sociocultural aspects	1. Poverty limits access to adequate food intake and fulfilling nutritional recommendations; therefore, affordable healthy diets may reduce malnutrition 2. Access to industrial innovation and infrastructure to change food production to greener and safer for human health and the environment affects human and animal welfare 3. Consumption of local food may contribute to territorial development 4. Short supply chains can benefit either consumers (lower product cost) or producers (increased income)	(1) No poverty (2) Zero hunger (8) Decent work and economic growth (9) Industry, innovation and infrastructure

Source: own elaboration.

- identifying potential trade-offs to make SHDs accessible, affordable, safe and attractive to all,
- development of national dietary guidelines defining SHDs, taking into account social, cultural, economic, ecological and environmental considerations.

7.1. Nutritional versus environmental recommendations

Developing dietary guidelines is not an easy process, as it requires demonstrating the relationship between health and a specific nutrient included in a food or diet. Dietary recommendations have changed over the years, and the most current ones for adults according to the World Health Organization (WHO) include the following (FAO & WHO, 2019):

- Energy intake should balance energy expenditure.
- Total fat intake should be less than 30% of total energy requirements, with a shift from saturated fat consumption to unsaturated fats, and the elimination of industrial *trans* fats.

- Free sugars intake should be less than 10% (or even less than 5%) of total energy intake.
- Salt intake should be less than 5 g/day (iodized salt is recommended).
- Eating at least 400 g of fruits and vegetables a day.

These recommendations are especially important due to the fact that unhealthy diets, along with tobacco use, physical inactivity and harmful use of alcohol, are key factors of noncommunicable diseases (NCDs), including heart disease, stroke, cancer, diabetes and chronic lung disease. They are responsible for 74% of all deaths worldwide. Most deaths from NCDs occur in low- and middle-income countries. The epidemic of NCDs has enormous health and socio-economic impacts on individuals, families and communities, and its health care-related costs represent a huge burden for the healthcare system (WHO, 2023).

Various national food-based dietary guidelines (FBDG), including the Polish ones, have adopted the WHO recommendations, but these guidelines vary around the world. In 2019, the EAT-Lancet Commission published the Report on Healthy Diets from Sustainable Food Systems, which focuses on the concept of planetary health and how it relates to our food choices. The report highlights that the current global food system is unsustainable and poses a serious threat to both human health and the planet. It identifies the need for transformational changes in food production and consumption. This report primarily promotes a plant-based diet, with a significant emphasis on fruit, vegetables, whole grains, legumes and nuts. It recommends limiting consumption of animal-based foods, especially red meat, limiting sugar, and encourages a shift to more sustainable sources of protein.

Nutrition recommendations are usually presented in the form of the Healthy Food Pyramid or the so-called Double Pyramid (Figure 7.1). The Double Pyramid (DP) is a graphic illustration of the concept of a balanced diet, which combines two pyramids: the Healthy Food Pyramid and the Environmental Pyramid. The Healthy Pyramid represents the nutritional quality of food. It sorts food products into 18 groups on 7 levels according to the recommended frequency of consumption. The foods that should be consumed most often are located at the bottom (fruit, vegetables and whole grains), while products that should be eaten rarely (beef meat and sweets) are at the top. The Environmental Pyramid represents the environmental impact of food production and consumption. The DP is based on the Mediterranean Diet (MD), which has been indicated by the FAO as an exemplary sustainable diet (FAO, 2010). The concept of DP was developed by the Barilla Center for Food and Nutrition (BCFN) and it provides a useful framework for guiding food choices that promote both health and sustainability. This can involve choosing foods that have a low environmental impact and are high in nutritional value, such as plant-based foods and sustainably sourced animal products.

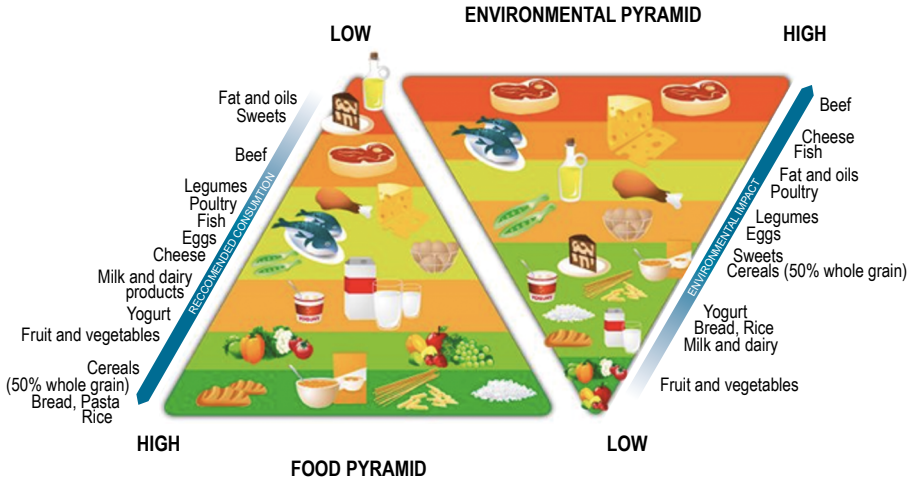

Figure 7.1. Double pyramid for adults
Source: (BCFN, 2014; Ruini, Ciati, Marchelli et al., 2016).

In some countries, governments, health councils and nutritional institutes have started to add sustainability concerns to the traditional FBDG. It should be noted that specific recommendations in individual countries may vary depending on cultural, regional and individual contexts. Sweden, for example, promotes plant-based alternatives, reduces food waste and encourages sustainable agricultural practices. German dietary guidelines suggest limiting meat consumption, choosing plant--based protein sources and considering the ecological footprint of food choices. Finnish Nutrition Recommendations emphasise a plant-based diet and focus on local and seasonal food choices. They promote sustainable fish. The Dutch and Danish governments have implemented programs to reduce food waste, promote organic farming and encourage the consumption of locally produced foods. In Greece, Italy and Spain, the MD has been adopted as a sustainable and healthy dietary pattern (FAO, 2016; Harrison et al., 2022; Szenderák et al., 2022). Polish nutritional guidelines do not explicitly include sustainable development criteria. However, consumers are becoming more and more conscious of the environmental impact of their food choices and are increasingly seeking locally sourced, organic and seasonal food products. There is also a rising demand for plant-based alternatives and a reduction in meat consumption (Raport Roślinniejemy, 2019). Table 7.2 presents recommended daily quantities for six major food groups (protein food, dairy, grains, fruit, vegetables and oils/fats) and total GHGE for exemplary FBDG. A recommended daily intake of protein food ranges from 75 g in India to 167 g as proposed by the EAT-Lancet Commission. The recommended amounts of dairy foods range from 194–300 mL in the EAT-Lancet, Thai and Indian diets

to 524–710 mL in Germany and the US. This reflects the importance of dairy products, mainly as contributors to the calcium intake, in Western diets. There is also a big difference between the recommended amounts of grains (184–600 g), fruit (100–784 g) and vegetables (200–512 g). The EAT-Lancet diet recommends the highest oil/fat intake, while the Indian diet recommends the lowest. The total GHGE related to a country's recommended diet may range from 0.86 kg CO_2-eq in India to 3.83 kg CO_2-eq in the United States. It means that the footprint of Indian diet is about 5.2 lower than that of the US diet (Kovacs et al., 2021). The discrepancies in the FBDG are mainly due to cultural and regional differences, as mentioned above.

Table 7.2. Daily recommended amounts of food groups[1] and total GHGE of a diet pattern by country (Seconda et al., 2018)

	Protein foods[a] (g)	Dairy[b] (mL)	Grains (g)	Fruit (g)	Vegetables (g)	Oils/fats (g)	GHGE (total) kg CO_2-eq
US[c]	156	710	170	392	350	27	3.83
US vegetarian[c]	97	710	184	392	350	27	1.80
Germany[d]	99	524	362	250	512	35	2.25
India[d]	75	300	330	100	500	25	0.86
Thailand	135	237	600[e]	784	200	N/A	1.83
EAT-Lancet[f]	167	194	186	160	280	42	1.36

1 – daily recommendations for a 2000-kcal diet, a – including legumes and pulses, b – converted to mL when the FBDG specified dairy products in grams, c – includes recommended amounts of discretionary calories (270 kcal in US, 290 kcal in US vegetarian), d – includes recommended amounts of sugar/sweeteners (32 g in Germany, 30 g in India), e – include roots and tubers, f – the planetary health diet proposed by the EAT-Lancet Commission.
Source: own elaboration.

7.2. Contribution of foods and dietary patterns to SHDs

A sustainable diet typically includes a variety of foods from different food groups, each providing specific nutrients necessary for optimal nutrition. It balances the nutritional needs of individuals with the need to minimise the negative environmental impact of food production and consumption. The environmental and economic costs of food production and consumption can be measured in terms of the resources used, such as land, water and energy, as well as emissions and waste generated during production and disposal. Different food groups have different environmental and economic costs, so the sustainability of a diet may vary depending on the type and amount of food consumed as well as culinary preferences (Aldaya et al., 2021). Eliminating animal products from the current diet has potential to reduce land use (an average reduction of 76%), GHGE (an average reduction of 49%), acidification by 45%–54%, eutrophication by 37%–56%, and freshwater use by 19% for food

production. Moreover, reducing consumption of more discretionary products (oils, sugar, alcohol and stimulants) by 20% through avoiding production with the highest land use can reduce both land use (by 39% on average), emissions (by 31%–46%) and freshwater use (by 87% on average) (Poore & Nemecek, 2018).

Table 7.3 shows how different food groups contribute to the concept of a sustainable diet considering various environmental aspects. In Table 7.4, the characteristics and the environmental impact of four dietary patterns (omnivorous, flexitarian, vegetarian and vegan) are compared. As mentioned above, the MD has been indicated by the FAO as an exemplary sustainable diet. It can be considered as a flexitarian diet and is therefore not included in Table 7.4. The MD is based on the traditional dietary patterns of the so-called Mediterranean countries, reflecting their cultural and culinary practices. Its main goal is to improve overall health by preventing disease and reducing the risk of cardiovascular disease, type 2 diabetes, high blood pressure and various types of cancer. It focuses on wholesome foods, plant-based ingredients and healthy fats (particularly polyunsaturated fats from olive oil, nuts and seeds). It allows moderate consumption of fish and poultry, with a limited intake of red meat. The MD, being mainly plant-based, generally has a lower negative impact on the environment compared to diets based largely on animal products. It is indicated that a shift from dietary patterns in Europe and the USA (Western diet) towards the MD can reduce land use by 41% and 55%, water use by 18% and 2%,

Table 7.3. Environmental impact of food groups

Environmental aspects	Explanation	References
Meat and poultry		
Land use	• Livestock production, including poultry, requires large amounts of land for grazing and to grow feed crops; however, production of beef meat requires about 27 times more land than production of poultry meat • Beef production is particularly land-intensive meat production; it requires 10–17 times more land per unit of protein compared to plant-based protein sources like legumes and grains	Belgacem et al., 2021 Cleveland & Gee, 2017 Poore & Nemecek, 2018
Water use	• Animal agriculture is generally more water-intensive than plant production (significant amounts of water for drinking, sanitation and crop irrigation for feed production) • It takes approximately 15 times more water to produce one kilogram of beef compared to one kilogram of wheat • Water use is about 2.5 higher for beef or pork meat production than for poultry meat	Cleveland & Gee, 2017 Belgacem et al., 2021 Mekonnen & Hoekstra, 2010 Poore & Nemecek, 2018
GHGE	• GHGE are much greater for ruminant animals such as cattle, sheep and dairy than for pigs or poultry. For example, GHGE from beef production (per kilogram) are 7.2–10 times greater than those of poultry • Animal farming accounts for 70% of GHGE in EU agriculture	Belgacem et al., 2021 Chai et al., 2019 EC, 2020 Hannah & Roser, 2020 Heller et al., 2020

Table 7.3 – cont.

Environmental aspects	Explanation	References
Other	• Animal agriculture generates vast amounts of waste, including manure, which can pose challenges for proper management • Poorly managed manure can contribute to GHGE and pollutants entering the environment • Animal welfare has not yet been incorporated into the EU sustainability policy	Cleveland & Gee, 2017 EC, 2020
Cereals and legumes		
Land use	• Cultivation requires significant land use • Clearing land for agricultural purposes can lead to deforestation, habitat loss and biodiversity decline • Compared to animal agriculture, the land footprint of plant-based crops is generally lower. For example, producing a gram of protein from legumes may require about 10–17 times less land compared to producing the same amount of protein from beef • Sustainable land management practices, such as agroforestry and organic farming, can minimise the negative environmental impact	Aldaya et al., 2021 Grosso, Fresán et al., 2020 Poore & Nemecek, 2018
Water use	• Production sometimes requires substantial water usage for irrigation (e.g. rice). The global average water footprint for rice is about 2,500 litres per kilogram • Efficient irrigation methods and water conservation strategies can help to reduce the environmental impact	Mekonnen & Hoekstra, 2010
GHGE	• Production and transportation involve energy-intensive processes, including machinery operation and processing • Compared to animal agriculture, plant-based crops generally have a lower carbon footprint • Implementing energy-efficient technologies and optimising supply chain logistics can reduce negative environmental impacts	Aldaya et al., 2021 Chai et al., 2019
Pesticide and fertiliser use	• Excessive use of pesticides and nitrogen/phosphorus-containing fertilisers can contribute to water and soil pollution, soil acidification, water eutrophication, and it can have a negative impact on biodiversity and human health • Sustainable agricultural management practices, such as organic farming, can reduce pesticide use and minimise the negative environmental impact	Awuchi et al., 2020
Dairy and dairy alternatives		
Land use	• Production requires significant land for grazing cows and growing animal feed crops. This can lead to deforestation • Plant-based dairy alternatives have the potential to reduce land use requirements if they are based on crops with lower land requirements. For example, land requirements for lupine-based cheese production are 0.02 ha per 100 kg/year, while 0.1 ha is needed to produce the same amount of cow milk-based cheese	Kanyama et al., 2021 Reijnders & Soret, 2003

Table 7.3 – cont.

Environmental aspects	Explanation	References
Water use	• Production requires large amounts of water for animal drinking and crop irrigation for feed production • Compared to plant-based milk, cow's milk production uses 2–20 times more freshwater • The water footprint of plant-based dairy alternatives can vary depending on the specific crop and farming practices used	Kanyama et al., 2021 Poore & Nemecek, 2018
GHGE	• Production, particularly from cows, is associated with significant GHGE, primarily in the form of methane • Plant-based alternatives generally have lower GHGE compared to dairy milk. For example, 9–12 times lower emission was noted for the production of lupine-based cheese than for cheese production based on cow's milk	Cleveland & Gee, 2017 Peterson & Mitloehner, 2021 Reijnders & Soret, 2003
Waste	• Dairy farms generate significant amounts of manure, which can contribute to water and soil pollution • Sustainable waste management practices are crucial for minimising environmental impacts	Peterson & Mitloehner, 2021 Poore & Nemecek, 2018
Fruit and vegetables		
Land use	• Cultivation requires relatively less land compared to animal agriculture	Poore & Nemecek 2018 Reijnders & Soret, 2003
Water use	• Production can have varying water requirements depending on the specific crop • Sustainable water management techniques, such as drip irrigation and precision farming, can help reduce water usage	Mekonnen & Hoekstra, 2010 Poore & Nemecek, 2018
GHGE	• Crop production is responsible for about 20% of the whole food emissions and generally has a lower carbon footprint compared to animal-based foods • Promoting local and seasonal products as well as optimising supply chains can reduce negative environmental impacts	Hannah & Roser, 2020 Poore & Nemecek, 2018
Pesticide and fertiliser use	• Excessive use of pesticides and nitrogen/phosphorus-containing fertilisers can contribute to water and soil pollution, soil acidification, water eutrophication, and it can have a negative impact on biodiversity and human health • Organic farming methods or integrated pest management practices can reduce pesticide use and the negative environmental impact	Özkara et al., 2016
Waste	• Fruit and vegetable waste (e.g., peel fractions, pulps, pomace and seeds) account to about 16% of total food waste and contribute to about 6% to global GHGE • Minimising food waste through improved harvesting, storage, distribution and consumer practices is crucial for reducing the environmental impact	Cassani & Gomez-Zavaglia, 2022 Cleveland & Gee, 2017
Fats and oils		
Land use	• Production can involve significant land use, especially for crops like oil palm trees. The expansion of oil palm plantations has been linked to deforestation in tropical regions, causing habitat loss, declining biodiversity and contributing to climate change	Awuchi et al., 2020 Poore & Nemecek, 2018

Table 7.3 – cont.

Environmental aspects	Explanation	References
Water use	• Production can require substantial water resources, both for irrigation and processing	Poore & Nemecek, 2018
GHGE	• Deforestation associated with palm oil production releases significant amounts of carbon dioxide, increasing GHGE. • Burning of land for oil palm plantations contributes to air pollution	Poore & Nemecek, 2018

Source: own elaboration.

Table 7.4. Characteristics and environmental impact of selected dietary patterns

Diet	Characteristics	Advantages	Disadvantages	Environmental impact*	References
Omnivorous	An omnivorous diet does not exclude any foods or food groups. It is a typical Western diet including meat and other animal-based foods. In Europe, omnivores make up about 70% of the population	The omnivorous diet, which includes a variety of plant and animal foods, provides all the necessary nutrients. If well balanced, there is no need to use fortified foods or supplements	Animal agriculture can have negative environmental impacts (see Table 7.3)	7 omnivore portions per day: • carbon footprint—6,556 • water footprint—4,639 • ecological footprint—38.1 A 2140-kcal menu: • carbon footprint—7,058 • water footprint—5,031 • ecological footprint—42.0	Ruini, Ciati, Pratesi et al., 2015 Kovacs et al., 2021 Ruini, Ciati Marchelli et al., 2016
Flexitarian	A flexitarian diet can be broadly defined as a semi-vegetarian, plant-based diet that includes dairy, eggs and fish, and allows occasional meat consumption. It offers flexibility and personalisation in food choice and is not tied to any specific cultural or geographical region. It is estimated that between 10% and 30% of Europeans are now flexitarians	It promotes a variety of plant-based foods, including fruit, vegetables, whole grains, legumes, nuts and seeds. It contributes to the preservation of agricultural biodiversity. This diversity supports sustainable agricultural practices, helps maintain resilient ecosystems and protects endangered plant species	The flexitarian diet, although occasionally, still allows the consumption of animal products (animal farming inherently has a negative impact on the environment)	5 vegetarian and 2 omnivore portions per day: • carbon footprint—3,613 • water footprint—2,421 • ecological footprint—21.5	Ruini, Ciati, Pratesi et al., 2015

Table 7.4 – cont.

Diet	Characteristics	Advantages	Disadvantages	Environmental impact*	References
Vegetarian	It excludes meat, including seafood and poultry. However, it typically allows for the consumption of other animal-derived products such as eggs, dairy and honey, depending on the specific type of the vegetarian diet (e.g. lacto-vegetarian, ovo-vegetarian, lacto-ovo-vegetarian)	A well-balanced vegetarian diet tends to be reach in fibre, vitamins, minerals and antioxidants, while being lower in saturated fat and cholesterol. It can support a correct body weight, reduce the risk of chronic diseases and promote overall well-being. For many people, the vegetarian diet is consistent with their beliefs and ethical values. Giving up the consumption of animal products reduces animal suffering and promotes animal welfare. This ethical dimension of vegetarianism contributes to more sustainable food	Although the vegetarian diet may be nutritionally adequate, it requires careful attention to ensure sufficient intake of certain nutrients, particularly vitamin B12, calcium, iron and zinc. Adopting the vegetarian diet can be socially and culturally challenging, especially in communities where meat consumption is deeply rooted in traditions	7 vegetarian portions per day: • carbon footprint—2,436 • water footprint—1,533 • ecological footprint—14.8 A 2393-kcal menu: • carbon footprint—2,598 • water footprint—2,305 • ecological footprint—16.1	Ruini Ciati, Pratesi et al., 2015 Kovacs et al., 2021 Ruini, Ciati, Marchelli et al., 2016 Rosi et al., 2018
Vegan	It excludes all animal products and any other ingredients or products derived from animals, such as gelatine, honey, eggs, dairy products, animal-based additives (colourings: cochineal or carmine, some food flavourings, as well as emulsifiers or stabilisers)	The vegan diet, like the vegetarian diet, generally has a lower environmental impact compared to diets containing significant amounts of animal products	Vegans, excluding all animal-based foods, should take care of wholesome proteins. They should also rely on fortified foods (e.g. plant-based milk, breakfast cereals) or take supplements to meet their vitamin B12 and calcium needs	7 vegan portions per day: • carbon footprint—1,683 • water footprint—1,389 • ecological footprint—13.8 A 2326-kcal menu: • carbon footprint—2,336 • water footprint—2,455 • ecological footprint—14.5	Ruini, Ciati, Pratesi et al., 2015 Kovacs et al., 2021 Rosi et al., 2018

* Carbon footprint in g CO_2eq; water footprint in litres/capita/day, ecological footprint in global m^2.

Source: own elaboration.

GHGE by 36% and 44%, eutrophication potential by 36% and 31% in Europe and the USA, respectively. In term of land use and GHGE, the Western diet is more impactful because it is characterised by high consumption of beef (Belgacem et al., 2021). Moreover, the MD promotes the use of locally sourced and seasonal foods. This helps to reduce GHGE associated with food transport and supports local agriculture systems and producers. This corresponds well to the economic and socio-cultural aspects of HSD (Table 7.1). However, some components of the MD, such as certain fruit, vegetables and olive oil, may be less available or more expensive in some countries. This can be a problem for people with limited financial resources to follow the diet. Strict adherence to the traditional MD, which is deeply rooted in the cultural traditions of the Mediterranean countries, may not be compatible with the cultural or dietary preferences of people with different backgrounds.

The data published show that plant-based diets, although plant crops require significant use of land and water, have a lower negative environmental impact compared to animal agriculture and diets including meat (Table 7.3 and 7.4). The results of the NutriNet-Santé cohort study (Seconda et al., 2018) conducted in France showed that diets with high GHGE (ranging from 2318 to 4099 kg CO_2-eq/year) contained more animal-based food and provided more calories, and diets with low GHGE had a high nutritional quality. Moreover, primary energy consumption (ranging from 3978 to 8980 MJ/year), land occupation (ranging from 1693 to 7188 m^2/year), and monetary diet cost (from 6.89€ to 7.68€/year) increased with GHGE. The authors of the study also observed that participants with lower GHGE diets were the highest organic food consumers.

Conclusions

Many countries include sustainability in their dietary guidelines, but only a few have already incorporated the quantitative recommendations based on nutrition and sustainability considerations. To strike a balance between nutrition and sustainability, it is recommended to reduce the consumption of meat and meat products in favour of fruit and vegetables, encourage the consumption of plant-based protein substitutes and avoid food waste. Dietary patterns which include a variety of plant products with occasional consumption of meat provide all the necessary nutrients and have a lower negative impact on the environment. Promoting local and seasonal products and optimising supply chains can also reduce negative environmental impacts of such diets and contribute to territorial economic growth. Respecting cultural habits and food preferences is essential for food acceptance. When they are culturally acceptable and affordable, they can be regarded as SHDs. Every consumer, through conscious food choices, can follow a healthy sustainable diet, regardless of whether the national FBDG incorporate the sustainability aspects.

Abbreviations

FBDG – food-based dietary guidelines
GHGE – greenhouse gas emissions
MD – Mediterranean diet
SHDs – sustainable healthy diets

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