

# Healthy sustainable food patterns and systems: a planetary urgency

Mariane Lutz<sup>a,\*</sup> 

<sup>a</sup> Centro Interdisciplinario de Estudios en Salud (CIESAL), Departamento de Salud Pública, Escuela de Medicina, Universidad de Valparaíso, Viña del Mar, Chile

\*Corresponding author mariane.lutz@uv.cl

**Citation** Lutz M. Healthy sustainable food patterns and systems: a planetary urgency. *Medwave* 2021;21(7):e8436

**Doi** 10.5867/medwave.2021.07.8436

**Submission date** 18/1/2021

**Acceptance date** 1/7/2021

**Publication date** 6/8/2021

**Origin** Not commissioned

**Type of review** Externally peer-reviewed by three reviewers, double-blind

**Keywords** healthy diet, malnutrition, food security, food policy, global health

## Abstract

Food choice impacts human health and planetary sustainability. The feeding patterns that reduce risk factors for noncommunicable diseases and various mortality causes are recognized as healthy eating habits. The average world population is far from reaching these habits due to the lack of access to healthy foods and a high prevalence of malnutrition. Understanding the impact of healthy sustainable food systems is growing worldwide to reach food security for the global population and future generations. A systemic perspective of this concept includes the health and well-being of individuals and the environmental, economic, socio-cultural, public policies context, besides food, agriculture, and ecological sciences. We need to confront the menaces and challenges represented by the ongoing changes of our era, which strongly generate global food insecurity. This issue is relevant not only for human health but also for climate change and other threats, based on modifications in production, handling, and consumption of foods that consider health and welfare impact at individual and planetary levels. In this review, some key concepts related to healthy and sustainable food systems are presented.

## Main messages

- Population eating habits impact personal and planetary health, reducing disease, mortality, and environmental repercussion.
- By 2050, a population of 50 billion people is projected, whose food security depends on collaborative and inclusive actions.
- Healthy and sustainable food systems urgently require an inclusive approach, short-term actions and commitments to improve the people and planet's health for current and future generations.

## Introduction

People consume a wide variety of food that exerts synergic effects on the body, satisfying physiological needs. The dietary pattern is given by the foods consumed most frequently and is closely related to health<sup>1</sup> and environmental sustainability<sup>2</sup>. Current global food systems have led to malnutrition (nutritional deficiencies and obesity). With this awareness – based on scientific evidence of the imminent risks of this situation – one of the most significant challenges arises: to develop healthy and sustainable food systems that adequately

nourish the entire population, but without damaging the environment and the available resources<sup>3</sup>.

This review aims to introduce concepts and scopes related to healthy and sustainable food systems. To work under this scope is the only possible way to face the challenges posed by the growing global trend of malnutrition, food insecurity, and depletion of available food resources. The current COVID-19 pandemic is a complex scenario that threatens climate change and disrupts systems that are highly sensitive to emergencies. These factors have increased poverty and food insecurity, with rising prices and reduced incomes.

Healthy and sustainable food systems are resilient and point in the right direction. However, they require an integrated approach and urgent measures and commitments to improve in the short-term the people and planet's health for current and future generations.

## Food systems

Food's right is established in the Universal Declaration of Human Rights, recognizing all people's inherent dignity and equality as part of the right to an adequate standard of living. They were established to protect people's rights to feed themselves with dignity, to produce their food, or acquire it by other means<sup>4</sup>. Food plays an essential role in people's health, and how it is produced and handled affects the environment and planetary health. In this era, humanity has changed the global environment, and, in recent years, there is an urge to protect the threatened planetary sustainability<sup>5</sup>.

The Sustainable Development Goals of the United Nations (UN) include ending poverty and hunger, protecting planetary sustainability, and the need for the food chain (from production to consumption) to meet current and future demands<sup>6</sup>. The concept of sustainable food systems encompasses the environment, people, inputs, infrastructure and institutions, production activities, processing, packaging, distribution, marketing, buying and selling, preparation, consumption, and food waste. All of these steps impact the economic, social, and environmental spheres<sup>7</sup>. The fundamental aspects of food availability include the supply chain, food environments, and consumer behavior. These aspects affect consumption choices and are affected by them in return<sup>8</sup>.

Globalization, industrialization of agriculture, rural poverty, and urbanization have changed the way food is produced and consumed. They have led to the loss of food sovereignty and diversity, along with negative consequences for ecosystems and dietary quality. Today, agriculture is responsible for environmental damage. It has led to the loss of food identity and diversity of higher nutritional quality<sup>9</sup>, together with increasing access to calorie-dense foods high in digestible starches, sugars, sodium, saturated fats, and industrial processing. The latter generally come at a low price, therefore, affecting especially lower-income countries<sup>10</sup>.

## Food security and sustainable diet

Food security implies that "all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their nutritional needs and food preferences for an active and healthy life"<sup>11</sup>. It involves aspects of availability (quantity and quality), accessibility (meeting basic needs), and utilization (diverse, adequate diet, clean water, among others), as well as stable and resilient systems to cope with emergencies. The adoption of these food systems mitigates the effects of climate change and improves future food security<sup>12</sup>. Currently, global agricultural systems produce an excess of grains, fats and sugars, while the production of fruits, vegetables and proteins does not meet the nutritional needs of the world's population. Sustainable diets "are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources"<sup>13</sup>. Major transformations are required to achieve this goal and provide food for a constantly growing population<sup>14</sup>.

The UN recognizes human and planetary health challenges and proposes that in the Decade of Action on Nutrition (2016 to 2025), food security should be achieved for every inhabitant of the planet and their descendants<sup>15</sup>. This involves public policies such as price regulation (subsidies for nutritious foods, taxes on harmful foods), support for small farmers, improved working conditions, and marketing (redesign of value chains). In addition, the food system needs to increase non-agricultural rural employment, increase women's participation in the labor market, reduce production chains, increase local purchasing, reduce prices, and improve transportation, storage, infrastructure, and equity conditions. There is also a need for educational interventions to improve eating behavior in communities and especially in children. All these interventions could only be possible if access to products of better nutritional quality that reproduce healthy eating habits is present.

## Healthy eating habits

A healthy diet satisfies nutritional needs, is safe, promotes health and well-being, reduces risk factors for noncommunicable diseases, and increases life expectancy. In contrast, a suboptimal eating habit has the opposite effect<sup>16</sup>. The current high prevalence of malnutrition (undernutrition, micronutrient deficiencies, overweight, and obesity) converges in these diseases, while the coexistence of malnutrition and climate change constitutes a global syndemic<sup>17</sup>. Under this logic, poverty is an ally of food insecurity because it restricts access to proper food and is associated with rurality, which increases vulnerability, income volatility, and the risks of natural disasters that affect economic activities<sup>18</sup>.

The necessary changes must not jeopardize the environment and resources that are needed for future generations. To this end, food recommendations have been established that incorporate sustainability aspects<sup>19</sup>. Governments should consider consumption patterns and social and cultural aspects to design appropriate public policies that support consumer choices<sup>20</sup>. Increasing economic reforms, international treaties, and trade liberalization have harmed public health – particularly malnutrition, creating a global food market that has affected the availability, accessibility, and diversity of food. An example of this is the reduction in the relative prices of energy-dense foods<sup>21</sup>. Consequently, a multi-sectorial approach is needed to orient agriculture and trade to increase production and encourage the consumption of accessible healthy foods with sustainable production and management procedures<sup>22</sup>. The COVID-19 pandemic has highlighted the inequities in food and health systems, with a significant increase in poverty and the urgent need to make them equitable, resilient and sustainable, backed by social protection mechanisms.

## Healthy diets and prevention of noncommunicable diseases

Healthy diets reduce diseases associated with unhealthy foods, which affect the human capital of nations and their development with a high economic and public health cost<sup>2</sup>. The main risk factors for multiple diseases are linked to low consumption of fruits, vegetables, legumes, whole grains (cereals), nuts, dairy products, polyunsaturated fatty acids, calcium, and fiber, and high consumption of red meats, sugary beverages, trans-fatty acids, and sodium<sup>23</sup>. Healthy eating habits contain a wide variety of plant foods, which provide multiple phytochemicals that exert physiological synergic effects. Their presence affects the biomass and activity of the intestinal microbiota,

modulating the risk of noncommunicable diseases<sup>24</sup>. Interventions that promote healthier foods consumption (such as fruits and vegetables) are efficient and highly dependent on the food system, i.e., production, availability, access, consumer habits, and behaviors<sup>25</sup>. Intervention strategies should always consider food systems, which is an issue that has not been appropriately addressed.

Consumers have become aware of environmental aspects related to food production<sup>26</sup>. This is indicated by growing trends such as flexitarian, pescetarian, and vegetarian diets. These diets consider animal welfare and the environmental impact of their production, in addition to their nutritional benefits. Some diets, such as the Mediterranean diet, DASH (Dietary Approaches to Stop Hypertension) and MIND (Mediterranean-DASH Intervention for Neurodegenerative Delay), aimed at mental health maintenance, have been considered healthy for decades and are related to sustainability<sup>27</sup>. All of these diets are low in digestible carbohydrates and saturated fats, have a low glycemic load, and discourage highly processed foods high in sugar, sodium, or low in fiber. These dietary patterns are recommended among international guidelines that also add environmental impact into the global assessment, which leads to a healthy and sustainable production and consumption of foods<sup>28,29</sup>.

In turn, plant-based diets reduce risk factors for noncommunicable diseases through various mechanisms<sup>30</sup>. The inverse association of fruit and vegetable consumption with cardiovascular disease, cancer, and all-cause mortality is widely recognized. This is also true of nut intake with ischemic heart disease and type 2 diabetes. Legumes contribute to a low cardiovascular and diabetes risk due to their high fiber content and low glycemic index, helping to improve lipid profile, glycemic control, and blood pressure. On the contrary, unhealthy eating patterns contain excess energy, saturated fats, added sugars, and refined starches. While simple sugars and digestible starches are associated with increased triglycerides and lipogenesis, fermentable fiber generates short-chain fatty acids (through the action of gut microbiota) that reduce cholesterol levels and fatty acid synthesis. Other benefits of fiber include increased satiety, reduced dietary energy density, lower blood pressure, better insulin sensitivity, and a decreased gut microbiota-mediated inflammatory response. Fiber from fruits and vegetables also promotes eubiosis. They contain vitamins, minerals, various antioxidants, anti-inflammatory and antiplatelet phytochemicals, among other beneficial components. Fish provide EPA and DHA fatty acids that reduce triglycerides, blood pressure, arrhythmias, inflammation, platelet aggregation, and endothelial dysfunction by regulating gene expression. Some phytochemicals (such as certain polyphenols) reduce lipid and glucose absorption, inhibit cholesterol synthesis, reduce triglycerides, increase HDL cholesterol, are antioxidant and anti-inflammatory, and induce nitric oxide production that improves blood circulation<sup>31</sup>. In recent years, the role of anthocyanins, especially abundant in red fruits (e.g., maqui, calafate, and blueberries) and other phytochemicals, became important in the prevention of neurodegenerative and psychiatric pathologies such as depressive disorders and dementia<sup>32</sup>.

In all, the main health benefits of healthy diets include reduction of blood lipids (fiber, unsaturated fatty acids, phytosterols and phytosterols), protection from oxidative stress, inflammation and platelet aggregation (phytochemicals, EPA and DHA), modification of hormone and growth factor levels, and increased satiety by secretion of satiating proteins/peptides, which in turn contributes to regulate

body weight. In addition, these diets reduce the levels of insulin, estrogens, androgens, insulin-like growth factor (IGF-1) that stimulate tumor genesis and provide anti-cancer phytochemicals. A diet containing lots of vegetables contains less proteins, a lower animal/vegetable protein ratio and less methionine and branched amino acids, improves insulin sensitivity, glucose tolerance, and affects nutrient-sensing pathways<sup>33</sup>.

## Healthy dietary patterns: contributing to sustainability

The world's population is aging rapidly. The evidence suggests that a healthy dietary pattern increases longevity, improves the quality of life, is ecologically sustainable and environmentally friendly<sup>34</sup>. To achieve this, several changes are needed to address key issues such as accessibility because costs may be higher<sup>35</sup>. The transition to sustainability can involve different strategies, including resource management (soil, water, and other ecosystem components), biodiversity conservation, and human and planetary health improvement<sup>36</sup>. The UN Food and Agriculture Organization (FAO) has been working on this issue for years and has described several ways of approaching sustainability. These include shifting the focus of food systems from crop yields to nutritional quality, considering consumers as key actors in public decisions and policies, emphasizing access and utilization of better-quality food, giving space to emerging economies, and including gender aspects<sup>37</sup>. Likewise, food guidelines should consider not only the quality and nutrient density aspect but also the environmental impact that contributes to sustainability<sup>38</sup>.

## Final considerations

The latest Nobel Peace Prize (2021) was awarded to the United Nations World Food Program. To a large extent, this action reveals the need to improve current food systems, making them more resilient, inclusive, sustainable, and able to nourish every person and to reduce food insecurity. We urgently need to move from the current food pattern (based on a few staple foods, highly processed foods, with excess calories and low nutritional quality, low price, which compromises food security and promotes malnutrition), to a diversified diet with a high proportion and variety of plant-based foods in their natural or minimally processed state with sustainable and resilient food systems. This pattern is similar to the paradigm represented by the Mediterranean diet, with the corresponding adaptations according to local realities. However, this requires adapting food supply chains (short circuits, local purchasing, accessible prices, fair trade), food environments (nutritionally adequate food supply, nutritional information, seasonality of products), consumer behavior (advertising, marketing, education, food culture, appreciation of local products), among other key aspects. Food systems have an impact on equity, equality, dignity, prosperity, health, and ecosystems. In 2050, it is projected that we will have a population of 50 billion people whose food security depends on collaborative and inclusive actions taken right now.

## Conclusions

The available evidence demonstrates that needed healthy and sustainable food patterns are achievable. This depends on the commitment of many actors to cover all political, social, economic, ecological, and health aspects of this issue.

Transforming current food systems to more sustainable ones that reduce environmental impact could improve resilience to emergencies, food security, reduce the burden of noncommunicable diseases, and the possibility to access adequate nutrition in future generations. The active participation of crucial agents is required in a joint effort with a transdisciplinary approach, which considers a spectrum that includes the governmental political dimension, academia, industry, civil society, and consumers, to establish public policies to achieve the urgently stated objective.

## Notes

### Funding

The author declares that there were no external funding sources.

### Ethics

This study did not require evaluation by a scientific ethics committee because it worked on secondary sources.

### Competing interests

The author declares that she has no financial relationships with organizations that may have an interest in the published article in the last three years, and has no other relationships or activities that may influence the publication of this article.

### Language of submission

Spanish.

## References

- Hu FB. Dietary pattern analysis: a new direction in nutritional epidemiology. *Curr Opin Lipidol*. 2002 Feb;13(1):3-9. | [CrossRef](#) | [PubMed](#) |
- Rapallo R, Rivera R. Documento N°11, 2030 – Alimentación, agricultura y desarrollo rural en América Latina y el Caribe. Santiago de Chile: FAO; 2019. [On line]. | [Link](#) |
- Willett W, Rockström J, Loken B, Springmann M, Lang T, Vermeulen S, et al. Food in the Anthropocene: the EAT-Lancet Commission on healthy diets from sustainable food systems. *Lancet*. 2019 Feb 2;393(10170):447-492. | [CrossRef](#) | [PubMed](#) |
- Organización de las Naciones Unidas. Declaración Universal de los Derechos Humanos. ONU; 1948. [On line]. | [Link](#) |
- Steffen W, Crutzen J, McNeill JR. The Anthropocene: are humans now overwhelming the great forces of Nature? *Ambio*. 2007 Dec;36(8):614-21. | [CrossRef](#) | [PubMed](#) |
- United Nations. Transforming our world: The 2030 Agenda for Sustainable Development. Department of Economic and Social Affairs. UN; 2015. [On line]. | [Link](#) |
- High Level Panel of Experts on Food Security and Nutrition. Nutrition and food systems. Rome, Italy: HLPE; 2017. [On line]. | [Link](#) |
- United Nations, Food and Agriculture. Influencing Food Environments for Healthy Diets. Rome, Italy: FAO; 2016. [On line]. | [Link](#) |
- Clark MA, Springmann M, Hill J, Tilman D. Multiple health and environmental impacts of foods. *Proc Natl Acad Sci U S A*. 2019 Nov 12;116(46):23357-23362. | [CrossRef](#) | [PubMed](#) |
- Global Panel on Agriculture and Food Systems for Nutrition. Food systems and diets: facing the challenges of the 21st century. London, UK; 2016. [On line]. | [Link](#) |
- Food and Agriculture. Food Security. Policy Brief. Rome, Italy: FAO; 2006. [On line]. | [Link](#) |
- Raiten DJ, Allen LH, Slavin JL, Mitloehner FM, Thoma GJ, Haggerty PA, et al. Understanding the Intersection of Climate/Environmental Change, Health, Agriculture, and Improved Nutrition: A Case Study on Micronutrient Nutrition and Animal Source Foods. *Curr Dev Nutr*. 2020 May 27;4(7):nzaa087. | [CrossRef](#) | [PubMed](#) |
- Nutrition and Consumer Protection Division, FAO, Burlingame B, Dernini S. Sustainable diets and biodiversity: directions and solutions for policy, research and action. of the International Scientific Symposium on Biodiversity and Sustainable Diets: United Against Hunger. Rome, Italy: FAO; 2012. [On line]. | [Link](#) |
- Branca F, Lartey A, Oenema S, Aguayo V, Stordalen GA, Richardson R, et al. Transforming the food system to fight non-communicable diseases. *BMJ*. 2019 Jan 28;364:l296. | [CrossRef](#) | [PubMed](#) |
- High Level Panel of Experts on Food Security and Nutrition. Food Security and Nutrition: Building a Global Narrative towards 2030. Rome, Italy: HLPE; 2020. [On line]. | [Link](#) |
- GBD 2017 Diet Collaborators. Health effects of dietary risks in 195 countries, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet*. 2019 May 11;393(10184):1958-1972. | [CrossRef](#) | [PubMed](#) |
- Swinburn BA, Kraak VI, Allender S, Atkins VJ, Baker PI, Bogard JR, et al. The Global Syndemic of Obesity, Undernutrition, and Climate Change: The Lancet Commission report. *Lancet*. 2019 Feb 23;393(10173):791-846. | [CrossRef](#) | [PubMed](#) |
- FAO, IFAD, UNICEF, WFP, WHO. El estado de la seguridad alimentaria y la nutrición en el mundo. Transformación de los sistemas alimentarios para que promuevan dietas asequibles y saludables. Rome, Italy: FAO; 2020. | [CrossRef](#) |
- Kirkpatrick SI, Vanderlee L, Dias GM, Hanning RM. Can dietary guidelines support the transformation of food systems to foster human and planetary health? *UNSCN Nutrition*. 2019;44. [On line]. | [Link](#) |
- Culliford A, Bradbury J. A cross-sectional survey of the readiness of consumers to adopt an environmentally sustainable diet. *Nutr J*. 2020 Dec 9;19(1):138. | [CrossRef](#) | [PubMed](#) |
- Stuckler D, Nestle M. Big food, food systems, and global health. *PLoS Med*. 2012;9(6):e1001242. | [CrossRef](#) | [PubMed](#) |
- Cuevas García-Dorado S, Cornselsen L, Smith R, Walls H. Economic globalization, nutrition and health: a review of quantitative evidence. *Global Health*. 2019 Feb 20;15(1):15. | [CrossRef](#) | [PubMed](#) |
- World Health Organization. Increasing fruit and vegetable consumption to reduce the risk of noncommunicable diseases. Geneva: WHO; 2019. [On line]. | [Link](#) |
- Koudoufio M, Desjardins Y, Feldman F, Spahis S, Delvin E, Levy E. Insight into Polyphenol and Gut Microbiota Crosstalk: Are Their Metabolites the Key to Understand Protective Effects against Metabolic Disorders? *Antioxidants (Basel)*. 2020 Oct 13;9(10):982. | [CrossRef](#) | [PubMed](#) |
- Mason-D'Croz D, Bogard JR, Sulser TB, Cenacchi N, Dunston S, Herrero M, et al. Gaps between fruit and vegetable production, demand, and recommended consumption at global and national levels: an integrated modelling study. *Lancet Planet Health*. 2019 Jul;3(7):e318-e329. | [CrossRef](#) | [PubMed](#) |
- Hallström E, Carlsson-Kanyama A, Börjesson P. Environmental impact of dietary change: a systematic review. *J Clean Prod*. 2015;91:1-11. | [CrossRef](#) |
- Mozaffarian D. Dietary and Policy Priorities for Cardiovascular Disease, Diabetes, and Obesity: A Comprehensive Review. *Circulation*. 2016 Jan 12;133(2):187-225. | [CrossRef](#) | [PubMed](#) |
- Nelson ME, Hamm MW, Hu FB, Abrams SA, Griffin TS. Alignment of Healthy Dietary Patterns and Environmental Sustainability: A Systematic Review. *Adv Nutr*. 2016 Nov 15;7(6):1005-1025. | [CrossRef](#) | [PubMed](#) |
- Strid A, Hallström E, Sonesson U, Sjons J, Winkvist A, Bianchi M. Sustainability indicators for foods benefiting climate and health. *Sustainability*. 2021;13(7):3621. | [CrossRef](#) |
- Rose D, Heller MC, Roberto CA. Position of the Society for Nutrition Education and Behavior: The Importance of Including



- Environmental Sustainability in Dietary Guidance. *J Nutr Educ Behav.* 2019 Jan;51(1):3-15.e1. | [CrossRef](#) | [PubMed](#) |
31. Ringling KM, Marquart LF. Intersection of Diet, Health, and Environment: Land Grant Universities' Role in Creating Platforms for Sustainable Food Systems. *Front Sustain Food Syst.* 2020;4:70. | [CrossRef](#) |
  32. Lutz M, Vargas C, Stojanova J, Arancibia M. Diet and depressive disorders. *Arch Clin Psychiatry.* 2021;48:117–22. | [CrossRef](#) |
  33. Tosti V, Bertozzi B, Fontana L. Health Benefits of the Mediterranean Diet: Metabolic and Molecular Mechanisms. *J Gerontol A Biol Sci Med Sci.* 2018 Mar 2;73(3):318-326. | [CrossRef](#) | [PubMed](#) |
  34. Serra-Majem L, Tomaino L, Dernini S, Berry EM, Lairon D, Ngo de la Cruz J, et al. Updating the Mediterranean Diet Pyramid towards Sustainability: Focus on Environmental Concerns. *Int J Environ Res Public Health.* 2020 Nov 25;17(23):8758. | [CrossRef](#) | [PubMed](#) |
  35. Hirvonen K, Bai Y, Headey D, Masters WA. Affordability of the EAT-Lancet reference diet: a global analysis. *Lancet Glob Health.* 2020 Jan;8(1):e59-e66. | [CrossRef](#) | [PubMed](#) |
  36. International Food Policy Research Institute. *Global Food Policy Report.* Washington D.C.: IFPRI; 2016. | [CrossRef](#) |
  37. Frumkin H, Haines A. Global Environmental Change and Non-communicable Disease Risks. *Annu Rev Public Health.* 2019 Apr 1;40:261-282. | [CrossRef](#) | [PubMed](#) |
  38. Bälter K. The importance of considering both nutrient quality and climate impact to support sustainable development. *Am J Clin Nutr.* 2021 Jun 5:nqab167. | [CrossRef](#) | [PubMed](#) |

**Correspondence to**  
Angamos 655, Reñaca,  
Viña del Mar,  
Chile



Esta obra está bajo una licencia Creative Commons Reconocimiento-NoComercial-CompartirIgual 4.0 Internacional.