

Transforming Food Systems for a Sustainable Future: A Health Perspective

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ABSTRACT

The growing demand for food presents a significant global problem that requires the establishment of sustainable food systems. To address this issue, it is essential to combine sustainability with food security, considering the environment, society, and economy. Efforts to ensure sustainable diets, alternative protein sources, technological innovations, agricultural intensification and food waste reduction are vital for food security and environmental sustainability. In this context, interdisciplinary collaboration among nations, policymakers, and organizations such as the Food and Agriculture Organization is essential to devise effective strategies for tackling the food crisis. This in turn enables the establishment of sustainable food systems to facilitate the optimization of health outcomes for both humans and the environment.

Keywords: Sustainable Food Systems, Environmental Sustainability, Food Security, Sustainable Diets, Sustainable Agriculture

Introduction

Our world is undergoing rapid transformations, and one of the greatest challenges we face is the increasing demand for food. How can we meet the increasing food demand and ensure access to nutritious diets for future generations without depleting Earth's resources and compromising its sustainability? This crucial question prompts us to explore effective strategies that balance food production with environmental conservation and long-term viability [1]. Poverty, hunger and malnutrition, inadequate diets, land degradation, water scarcity, social inequalities, biodiversity loss, and climate change are inherently rooted in the way we produce, distribute, and consume food. By considering sustainability alongside food security, we can address the environmental, social, and economic aspects of our food systems. A sustainable food system (SFS) is the one which guarantees the nutrition and food security for everyone while maintaining the social, economic, and environmental foundations intimate for future generations [2]. By adopting this approach, we can enable viable transitions to reduce waste, lower ecological footprints, and minimize carbon. This, in turn, enables the establishment of sustainable food systems that align with urbanization needs and contribute to a more resilient and equitable future.

Sustainable Diets

Diets are considered sustainable when they align with the definition given by the Food and Agriculture Organization (FAO). Sustainable diets are characterized by their minimal impact on the environment and their contribution to nutrition, food security, and the overall well-being of present and future generations. These diets focus primarily on the protection and preservation of ecological integrity, while also being accessible, culturally acceptable, and inexpensive. Furthermore, sustainable diets aim to provide optimal nutrition, ensuring safety and health, while efficiently utilizing natural and human resources [3].

One critical aspect of sustainability is the impact of meat consumption, which affects both human health and anthropogenic climate change. However, it is important to note that diets consist of various foods that form dietary patterns. Merely reducing meat intake doesn't guarantee emission reductions; alternative food choices can even increase greenhouse gas emissions (GHGE).

Moreover, avoiding entire food categories may affect micronutrient provision, highlighting the issue's complexity. Instead, effective mitigation strategies are crucial to address the livestock industry's environmental impact and climate change. These include taxation, carbon labeling, nutritional guidelines, waste reduction, and sustainable intensification. Coordinated implementation ensures a comprehensive approach to reduce GHGE linked to meat consumption [4].

Exploring Sustainable Food Sources and Technological Innovations

Addressing the challenges posed by climate change on traditional plant protein sources like cereals and legumes has led to the investigation of alternative protein options. One such source is the cactus pear, which requires fewer resources, offers the potential for utilizing biomass waste (cladodes), and can be cultivated in arid and semiarid areas. Aquatic photosynthetic organisms like microalgae, cyanobacteria, and duckweed are also promising as they can be harvested year-round, have high biomass yields, and can be grown using non-irrigation water on non-arable land. These organisms provide higher protein yields and exhibit resistance to pests and diseases [5].

Furthermore, environment-friendly food items are being processed using emerging innovations and technologies. Mycoproteins, derived from fungal biomass, serve as protein substitutes. Cellular agriculture is a promising industry aiming to produce food items like milk, meat, eggs, and gelatin from animal and plant cells and microorganisms through in vitro methods. Cultured meat production offers advantages such as lower greenhouse gas emissions and reduced land requirements compared to conventional red meat production. This can potentially free up land for other purposes like industrial crop production [1]. However, more research is necessary to fully comprehend the benefits, drawbacks, and overall impact of these novel food sources on sustainable and healthy food systems.

Sustainable Cropland Management

The United Nations' Sustainable Development Goals (SDGs) strive to promote global well-being and ensure environmental sustainability. Among these goals is the objective to end global starvation and achieve zero hunger by 2030. However, meeting this goal faces significant challenges due to population growth, dietary changes, and biofuel consumption, leading to an increased demand for food production [6]. To address this challenge, effective strategies are needed to raise future food production without further cropland expansion.

Agricultural intensification, achieved through increasing crop yield per unit area or increasing cropping intensity, offers a viable solution. While improving crop yields has been proposed, there are doubts about its ability to meet future food demand. Additionally, closing the yield gap requires addressing technical and market constraints and considering the potential environmental impacts. Increasing cropping intensity by intercropping or growing multiple crops per cycle presents an alternative approach to boost global food production without expanding cropland [7]. By adopting sustainable cropland management practices, we can enhance food production while preserving biodiversity, mitigating greenhouse gas emissions, and managing climate changes.

Minimizing Food Loss and Waste for Sustainable Future

Minimizing food loss and waste is of paramount importance for sustainable food systems and requires collaboration among various stakeholders. Approximately 1/3rd of the food produced globally for human consumption is lost or wasted yearly, leading to adverse economic, social, and environmental consequences.

Food Loss

Food loss occurs in the early stages of the supply chain due to inefficient harvesting, storage facilities, infrastructure, and limited market access. To address food losses, improvements in farming methods, infrastructure, and market access are crucial, especially in middle- and low-income economies. These measures can help reduce food loss and enhance food security.

Food Waste

Food waste, on the other hand, refers to edible food discarded by consumers and retailers. In high-income countries, wasteful practices in the food industry and consumer behaviors contribute significantly to food waste. Strategies to prevent food waste involve behavior changes in the food industry and individuals, such as optimizing portion sizes and raising awareness about the importance of reducing food waste. Additionally, recovery and recycling initiatives, including food donations, redistribution, and alternative uses like animal feed and composting, can help minimize food waste [8]. By taking action to minimize food loss and waste, we can mitigate economic losses, address social and environmental challenges, improve food security, and conserve valuable resources for a growing population.

Addressing Challenges for Sustainable Food Systems and Food Security

- Climate change presents a significant impact on the agricultural production and nutritional quality of crops globally
- Water scarcity, heat stress, and increased CO₂ and ozone levels can reduce crop yields and nutritional value
- Staple crops, fruits, and vegetables are highly susceptible to adverse effects from temperature fluctuations and ozone exposure
- Efforts to promote sustainable plant-based protein sources may be complicated by reduced fruit and vegetable availability
- Production of industrial crops, such as oil palm and sugarcane, can compete with food systems for land
- Balancing the sustainable production of healthy industrial crops and reducing consumption of unhealthy ones is challenging
- Reducing markets for industrial crop commodities may have economic effects on emerging and developing economies
- Unsustainable practices in industrial crop production can strain the environment and impact biodiversity, GHG emissions, and pollution

Challenges like climate change, water scarcity, and competing land use must be overcome for successful implementation of sustainable food systems [1].

Promoting Sustainable Food Systems: A Path to Global Food Security

In conclusion, food security is an alarming issue that poses a significant risk to the future of our planet. By implementing improved practices, harnessing technology for efficient resource utilization, and promoting biodiversity and ecosystem preservation, we can boost food production and enhance global food security. It is crucial for nations, policymakers, and organizations like the Food and Agriculture Organization to join forces in redeveloping strategies to address the food crisis. Through concerted efforts, we can overcome the challenges of food insecurity and pave the way for a world where everyone has access to an abundance of nourishment.

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