



Bio-ecological and cultural perspectives on sustainable healthy diets. A literature review

Perspektif bio-eco-culture pada sustainable healthy diets. Tinjauan literatur

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Abstract

Sustainable Healthy Diets (SHD) are understood to improve individual health while reducing environmental pressures; however, the integration of biological, ecological, and cultural dimensions remains insufficiently explored. This review aimed to describe SHD practices from these three perspectives to address gaps in knowledge regarding their bio-ecological and cultural interconnections. Methods: A literature review was conducted in March–April 2024 on English-language articles published between 2010 and 2024. Searches were performed in MDPI, PubMed, Science Direct, and *The Lancet Planetary Health* using the PECOS criteria. Of the 2,443 articles identified, 332 duplicates were removed, and 1,937 articles were excluded based on the inclusion criteria, leaving 174 articles for full-text assessment. The results showed that the SHD encompassed several dietary models, including local food-based diets, the Mediterranean diet, and the Planetary Health Diet, all of which emphasized plant-based choices. Biologically, SHD is associated with a reduced risk of non-communicable diseases, greater longevity, and adequate nutrient intake. Ecologically, SHD contributes to lower greenhouse gas emissions, reduced carbon and water footprints, and encourages food waste reduction. Culturally, SHD reflects moral values related to animal welfare, belief systems, veganism, and religious practices. In conclusion, this review highlights the importance of integrating biological, ecological, and cultural considerations to strengthen SHD implementation. This study supports evidence-based dietary recommendations and accelerates the transition toward healthier and more sustainable global food systems.

Keywords: Bio-eco-culture, dietary patterns, sustainable healthy diets

Abstrak

Pola makan sehat berkelanjutan (*Sustainable Healthy Diets*/SHD) dipahami mampu meningkatkan kesehatan individu sekaligus menurunkan tekanan terhadap lingkungan. Namun, keterkaitan aspek biologis, ekologis, dan budaya dalam penerapannya masih kurang dipahami. Tinjauan ini bertujuan menggambarkan praktik SHD dari tiga perspektif tersebut untuk mengisi kesenjangan pengetahuan mengenai integrasi bio-eko-budaya dalam pola konsumsi pangan. Metode, tinjauan literatur telah dilakukan pada Maret–April 2024 terhadap artikel-artikel berbahasa Inggris yang terbit pada 2010–2024. Pencarian dilakukan melalui database MDPI, PubMed, Science Direct, dan *The Lancet Planetary Health* menggunakan kriteria PECOS. Dari 2.443 artikel yang teridentifikasi, 332 duplikat telah dihapus dan 1.937 artikel dikeluarkan berdasarkan kriteria inklusi, sehingga tersisa 174 artikel untuk dianalisis secara penuh. Hasil, SHD mencakup berbagai model diet, termasuk diet berbasis pangan lokal, diet Mediterania, dan *Planetary Health Diet*, yang semuanya menekankan konsumsi pangan nabati. Secara biologis, SHD telah dikaitkan dengan pencegahan penyakit tidak menular, peningkatan

umur panjang, dan kecukupan gizi. Dari sisi ekologi, SHD terbukti menurunkan emisi gas rumah kaca, jejak karbon dan air, serta mendorong pengurangan limbah pangan. Dalam konteks budaya, SHD telah mencerminkan nilai moral terkait kesejahteraan hewan, keyakinan, veganisme, dan praktik keagamaan. Kesimpulan, tinjauan ini menegaskan bahwa integrasi dimensi biologis, ekologis, dan budaya penting untuk memperkuat penerapan SHD. Studi ini dapat mendukung perumusan rekomendasi pangan berbasis bukti dan mempercepat transisi menuju sistem pangan global yang lebih sehat dan berkelanjutan.

Kata Kunci: Bio-eco-culture, pangan sehat dan berkelanjutan, pola konsumsi pangan

Introduction

With the imminent challenge of a more than 50% increase in food production by 2050 from 2012, the need to meet the escalating food demand is not just pressing but urgent. As income surges in developing nations and living standards improve, the appetite for meat, dairy, and crops such as fruits, nuts, and vegetables also swells (Falcon et al., 2022). This surge in food demand has led to the depletion of natural resources, triggering soil erosion, biodiversity loss, and environmental pollution, thereby posing new hurdles to food security systems (Mehrabi et al., 2022).

Global food scarcity is a direct consequence of the residual nature of global food markets (Richards et al., 2023). The global food market serves as the ultimate reservoir for balancing food surpluses and shortages across countries, highlighting its interconnected nature, as surplus food enters the market while shortages drive imports, making it a crucial buffer for national supply-demand imbalances, with global food scarcity often arising from unequal food distribution in production and access (Ben Hassen & El Bilali, 2024).

The malnutrition crisis has become a complex global challenge, characterized by the 'triple burden' of undernutrition, micronutrient deficiencies, and rising obesity (Blankenship et al., 2020; Rah et al., 2021), driven by the global food system (Abbafati et al., 2020; Brauer et al., 2024), Food issues stemming not only from inadequate regional food production but also from factors such as high stunting rates in children under five years of age, limited access to clean water, and widespread poverty (Chaudhary et al., 2018; Friel et al., 2020; Nedzingahe et al., 2023). Therefore, measuring the food needs of a population is not limited to production aspects alone but must also consider

the characteristics of the food ecosystem in a region (Chaudhary et al., 2018).

The food ecosystem, which comprises elements such as water, land, biodiversity, producers, distribution, access, and utilization, forms a complex and interconnected system that shapes food production and consumption. The broader food system serves as a strategic framework for ensuring diverse, safe, and nutritious food for all (Béné et al., 2019; Willett et al., 2019) sustainable food systems designed to ensure long-term food security and nutrition without compromising economic, social, or environmental foundations and must be economically viable, socially equitable, and environmentally sustainable (HLPE, 2017) (FAO & WHO, 2019).

Although sustainable healthy diets (SHD) were first introduced by Gussow & Clancy in 1986 and later expanded by the FAO in 2010, they still lack a universally accepted definition, although they emphasize health benefits, environmental sustainability, affordability, and cultural acceptability of food. The EAT-Lancet Commission highlights the dual goals of sustainable food production and healthy consumption, whereas Indonesia's food system transformation integrates sustainability, inclusivity, and resilience by promoting local foods, diversifying sources, and supporting agroecological policies (Hendrie et al., 2022; Knuppel et al., 2019; Lin et al., 2023).

The bio-cultural perspective on food, introduced by Sanjur in 1981, highlights the interconnectedness of biological and cultural dimensions in nutrition, where the bio dimension pertains to nutrient processing for growth and health, whereas the cultural dimension encompasses societal influences on food choice, preparation, and consumption (Randall & Sanjur, 1981). The cultural dimension pertains to societal factors that

influence the types of food consumed, how it is prepared, and how it is consumed. The eco dimension further extends this perspective by emphasizing the role of natural resources and ecosystems in sustainable food systems, and ensuring responsible resource use, ecological balance, and long-term food security (Clark et al., 2020; Rockstrom et al., 2023; Society & 2013, 2002). As environmental challenges grow, the eco-dimension has expanded to address sustainability concerns, including reducing ecological footprints, mitigating climate change, and promoting sustainable food production, distribution, and consumption.

However, there is still a lack of comprehensive mapping of SHD from a bio-ecological-cultural perspective. Therefore, this review aims to provide an overview of sustainable healthy diets from a bio-eco-culture perspective, addressing this gap and exploring the interconnectedness of biological, ecological, and cultural factors in shaping sustainable healthy dietary practices.

Methods

To achieve the proposed objective, we performed a literature review. Literature reviews have historically been considered to hold less value as scientific evidence owing to the subjective nature of article selection and the potential for selection bias. Nonetheless, they are now regarded as essential contributions to the discourse on particular topics, posing critical questions and advancing the understanding of contemporary knowledge in the field. In addition, to enhance the rigor of the review, the Population, Exposure, Comparison, Outcome, and Study Design (PECOS) framework was applied to systematically define the inclusion and exclusion criteria, ensuring a structured and transparent selection of relevant studies. Table 1 describes the PICOS criteria for the inclusion and exclusion of studies.

Table 1. The PECOS criteria for inclusion and exclusion of studies

PECOS criteria	Inclusion	Exclusion
Population	All population group	Animal study
Exposure	Biological, ecological, and	None

	cultural indicator in sustainable healthy diets	
Comparator	No comparator	None
Outcome	Sustainable healthy diets practices	
Setting	All setting	None

This non-systematic review was conducted between March and April of 2024. A search for English-language articles published in peer-reviewed journals between 2010 and 2024 was conducted across four key databases: MDPI, PubMed, ScienceDirect, and The Lancet Planetary Health, which are highly relevant to food and nutrition research. The initial study period was determined based on the widely accepted definition of a sustainable healthy diet (SHD) from 2010, supplemented by a manual search of references from selected papers. The search utilized the following keywords: "sustainable healthy diet*," "sustainable healthy diet*," "planetary diet*," "planetary healthy diet*," "plant-based diet*," "Mediterranean diet*," "vegetarian," "flexitarian," and "pescatarian." The asterisk (*) indicates a wildcard symbol that can be used to broaden searches. All searches were conducted by one of the authors, with no restrictions on date, country, or field of knowledge. The study included original research, review articles, and gray literature in English.

Of the 2,443 articles screened across four online databases, 332 duplicates were removed and 1,937 articles were excluded based on the inclusion criteria. In total, 174 full-text articles were obtained and reviewed in full text. Any disagreements among independent reviewers regarding the eligibility of articles for inclusion were resolved through in-depth discussion among the reviewers until a consensus was reached. Based on themes relevant to the study question, the findings were categorized into four sections: (1) an overview of SHD and its related definitions; (2) biological perspective; (3) ecological perspective; and (4) cultural perspective.

Result and Discussion

Definitions and Concept of Sustainable Healthy Diets

SHD promotes individual health and well-being and is characterized by low environmental

impact, accessibility, affordability, safety, equity, and cultural acceptability of the built environment. These diets aim to support optimal growth, prevent all forms of malnutrition, reduce the risk of diet-related noncommunicable diseases, and preserve biodiversity and planetary health (FAO & WHO, 2019). According to the FAO, territorial diets are closely tied to specific geographic regions and shaped by local biophysical resources, ecologies, and cultural and historical contexts. These diets are unique to their region and are often based on locally available foods and traditional cooking methods (FAO & WHO, 2019). Examples include the Japanese, Mediterranean, traditional Nordic, and new Nordic diets. These diets, mainly the Mediterranean Diet, have gained recognition because of their health benefits. They continue to attract attention owing to the increasing global challenge of malnutrition in various forms, including micronutrient deficiencies and obesity.

The current WHO recommendations for a healthy diet emphasize several key guidelines for optimal health. These include exclusively breastfeeding infants for the first six months and continuing breastfeeding for up to two years or longer. Energy intake should balance energy expenditure, with total fat consumption limited to less than 30% of the total energy intake, a

shift from saturated to unsaturated fats, and the elimination of industrial trans fats. Free sugar intake should be limited to less than 10% of the total energy intake (ideally less than 5%), and salt consumption should be maintained below 5 g per day. Additionally, individuals should consume at least 400 g of fruit and vegetables daily to support their overall health (FAO & WHO, 2019).

Committee From a global perspective, the EAT-Lancet Committee has set a scientific goal to implement and measure a global framework for a safe operating space for food systems, aiming to improve human health and ensure the stability of planetary systems (Hirvonen et al., 2020). This framework considers several critical factors, including greenhouse gas (GHG) emissions, agricultural land use, nitrogen and phosphorus applications, water usage, biodiversity loss, and health risks. The universal health reference diet, also known as the "Planetary Health Diet," is a plant-based diet that emphasizes fruits, vegetables, whole grains, legumes, nuts, and unsaturated fatty acids while limiting the consumption of fish, white meats, added sugars, refined grains, and starchy vegetables. Table 2 describes the scientific targets for a planetary healthy diet with possible ranges for an intake of 2,500 kcal/day (EAT-Lancet Commission).

Table 2. Scientific targets for a planetary healthy diet with possible ranges, for an intake of 2,500 kcal/day (EAT-Lancet Commission)

Food category	Macronutrient intake (g/day)*	Calory intake (kcal/day)	Daily intake distribution (%)
Whole grains (rice, wheat, corn and other)	232	811	32.4
Tubers or starchy vegetables (potatoes and cassava)	50 (0 – 100)	39	1,6
Vegetables	300 (200 – 600)	78	3.1
Fruits	200 (100 – 600)	126	5.0
Dairy foods (whole milk or equivalent)	250 (0 – 500)	153	6.1
Protein sources			
beef, lamb, and pork	14 (0 – 28)	30	1.2
Chicken and other poultry	29 (0 – 58)	62	2.5
Eggs	13 (0 – 25)	19	0.8
Fish	28 (0 – 100)	40	1.6
Legumes	75 (0 – 100)	284	11.3
Nuts	50 (0 – 75)	291	11.6
Added fats			
Unsaturated	40 (20 – 80)	354	14.1
Saturated	11.8 (0 – 11.8)	96	3.8
Added sugar	31 (0 – 31)	120	0.8

*possible range

As shown in Table 2, the daily intake distribution aligns reasonably well with several WHO recommendations for a healthy diet. Cereals (32.4%) and plant-based proteins, such as legumes (11.3%) and nuts (11.6%), constitute a significant portion of the diet, reflecting a shift toward plant-based foods. The intake of unsaturated fats (14.1%) and saturated fats (3.8%) aligns with the recommendation to limit the total fat intake to less than 30% of the total energy while prioritizing unsaturated fat intake. Free sugar intake (0.8%) was well below the recommended limit of 10% of total energy intake. However, the combined intake of fruits (200 g) and vegetables (300 g) was 500 g. The relatively low consumption of animal-based protein also supports a more sustainable plant-based diet. Although the diet is mainly consistent with WHO guidelines, there is room to further increase fruit and vegetable consumption and ensure that total fat intake remains within healthy limits.

This distribution highlights the dominance of plant-based foods, with cereals accounting for a large part of the daily intake owing to their availability and affordability. The low contribution of animal protein suggests a shift towards more sustainable, plant-based diets in line with health and environmental recommendations. Moderate intake of plant-based proteins highlights the increasing importance of legumes and nuts as alternatives to animal proteins. This trend offers opportunities for further diversification, particularly in regions with limited animal protein consumption, while reducing environmental impacts by promoting plant-based options.

Indonesia has adopted the *Pola Pangan Harapan* (PPH) dietary diversity as a dietary pattern to promote healthy living through balanced nutrition from diverse food sources. Introduced by the FAO-RAPA in 1989, PPH emphasizes the ideal composition of food groups that meet energy and nutritional needs, while considering cultural, economic, and ecological factors (Badan Pangan Nasional, 2024). PPH scores are key indicators of food security and are used to assess the diversity of foods consumed. The PPH zonation approach aims to enhance food security based on local wisdom, optimize regional food resources, promote food diversification, and, importantly, reduce reliance on imports to ensure food security in Indonesia.

This method supports sustainable, inclusive, and resilient food systems, aligning with the government's goal of addressing the impacts of climate change. The zonation system, which includes regions such as Sumatra, Java, Bali, and Papua, connects local food consumption patterns to agroecological characteristics and cultural practices, thereby fostering a territorial dietary approach to regional food security (Badan Pangan Nasional, 2024).

Biological Perspectives on Sustainable Healthy Diets

The biological aspects are fundamentally linked to the health outcomes associated with dietary practices. Evidence indicates that dietary patterns, particularly those high in plant-based foods, are associated with reduced risks of chronic diseases, such as obesity, cardiovascular diseases, and diabetes (Long et al., 2023; Luo et al., 2022; Magkos et al., 2020). For instance, adopting a predominantly plant-based diet enhances individual health and may generate positive environmental effects by reducing the carbon footprint of livestock (Agyemang et al., 2022; Espinosa-Marrón et al., 2022). The association between diet and health outcomes has been substantiated across various populations, advocating for dietary practices that not only promote longevity, but also empower individuals to reduce disease burden (Knight et al., 2019; Magkos et al., 2020).

The biological dimension of SHD is pivotal for public health because it integrates nutritional adequacy with ecological considerations. SHD is characterized by its ability to meet nutritional requirements while minimizing environmental impact (Lin et al., 2023). To achieve this, diets should consist of diverse food groups that fulfil the recommended dietary allowances (RDAs) for essential nutrients. The inclusion of various food types ensures the intake of macro- and micronutrients and fosters dietary patterns that support health and well-being. For instance, the Mediterranean diet, which emphasizes fruits, vegetables, whole grains, legumes, fish, and healthy fats, is advocated for its beneficial profile in reducing the incidence rates of cardiovascular disease and associated morbidity (Knight et al., 2019; Martínez-González et al., n.d.; Primo et al., 2020).

Research has demonstrated that an SHD typically incorporates a significant proportion of plant-based foods, ideally consisting of 50-75%

of the total food intake, with a modest representation of animal-derived products (Agyemang et al., 2022). This combination facilitates an adequate supply of proteins, vitamins, and minerals essential for bodily functions and overall health maintenance. Specifically, well-planned plant-based diets can deliver ample protein, fiber, healthy fats, and a myriad of phytonutrients, thereby contributing to the prevention of chronic diseases such as obesity, diabetes, and various forms of cancer (Magkos et al., 2020). It is noteworthy that transitioning towards a predominantly plant-based diet has been shown to support individual health outcomes and yield sustainability benefits, including reduced greenhouse gas emissions and conservation of water and land resources (Hitaj et al., 2019; Semba et al., 2020).

When discussing portions, it is crucial to remember that specific dietary guidelines suggest that approximately half of one's plate should encompass fruits and vegetables, emphasizing whole grains as a primary source of carbohydrates, ideally comprising approximately 25% of dietary intake (FAO & WHO, 2019). In this context, lean protein sources, including legumes and fish, constituted 25%. This structured approach prioritizes nutrient density while adhering to sustainable practices. Addressing factors such as socioeconomic status and cultural influences can further enhance the acceptance and practicality of these recommendations across diverse populations (Agyemang et al., 2022). Thus, the biological factors surrounding SHD underscore the importance of nutritional diversity and proportion control in fostering public health, making individuals responsible for their own health.

Ecological Perspectives on Sustainable Healthy Diets

SHD plays a pivotal role in addressing global environmental challenges. A significant aspect of SHD, the ecological footprint, underscores the urgent need to transition towards plant-based food systems. This shift is crucial for decreasing the pressure on natural resources and reducing greenhouse gas emissions, a change to which we, as environmental scientists, policymakers, and individuals interested in sustainability and nutrition, can actively contribute (Clark et al., 2020; González-García et al., 2018; Lucas et al.,

2023; Ren et al., 2023; Rööös et al., 2013; Society & 2013, 2002).

The transition to SHD is crucial for addressing the significant environmental pressures of conventional food systems, particularly GHG emissions and water consumption. Research indicates that current dietary patterns account for over 30% of anthropogenic GHG emissions, with animal-based food production contributing to this (Ren et al., 2023; Rööös et al., 2013). One example of SHD practice is the 'flexitarian' diet, which involves reducing meat consumption and increasing the intake of plant-based foods (Derbyshire, 2017). Another example is the 'locavore' diet, which focuses on consuming locally sourced foods to reduce the carbon footprint of food transportation. Livestock farming, in particular, is responsible for high emission levels due to enteric fermentation, manure management, and land-use changes associated with grazing and feed production (Lynch et al., 2018). Transitioning to plant-based diets, which have been associated with lower carbon footprints, can reduce GHG emissions and contribute to climate change mitigation (Lynch et al., 2018).

In addition to GHG emissions, the water footprint associated with various food groups is a critical ecological factor in SHD. Agriculture is responsible for approximately 70% of global freshwater withdrawals, and different foods exhibit vastly different water usage intensities. For example, producing beef requires approximately 15,000 litres of water per kilogram, whereas a kilogram of vegetables may require only approximately 300-500 litres (Braun et al., 2021; Friel et al., 2020; Myers et al., 2017; Vermeulen et al., 2012). Given that unsustainable water usage can lead to the depletion of freshwater sources, particularly in arid regions, reducing reliance on water-intensive animal products and promoting plant-based alternatives offer significant benefits for freshwater conservation (Springmann et al., 2018). By emphasizing sustainable food sourcing that minimizes the water footprint, dietary patterns can be designed to preserve vital water resources while meeting nutritional needs.

Moreover, SHD are increasingly recognized for their potential to enhance ecological resilience. Implementing practices

that prioritize sustainable food sourcing, such as crop rotation, agroecological farming, and biodiversity preservation, not only lowers carbon and water footprints, but also strengthens the adaptability of food systems in the face of climate variability. This resilience potential offers a promising outlook for the future of food systems (Agyemang et al., 2022). Promoting locally sourced foods and seasonal production can further reduce transportation emissions and conserve resources, thereby fostering community-based mechanisms for resilience and sustainability in food production.

From an ecological perspective, reducing food waste is crucial because it directly correlates with the environmental impact of the food system. Research indicates that food waste is responsible for about 8-10% of global greenhouse gas emissions, emphasizing that, as a society, we must prioritize waste reduction as part of our sustainability goals to combat climate change (Agyemang et al., 2022). SHD choices characterized by minimal waste offer nutritional benefits and align with the larger goals of reducing ecological footprint and promoting biodiversity (Sun et al., 2018). For example, shifting from high-waste meat-heavy to vegetable-rich diets can significantly reduce the overall environmental burden because plant-based foods typically generate less waste and have a lower resource consumption footprint (Scarborough et al., 2023).

Food waste is a pervasive issue worldwide, contributing to approximately one-third of all the food produced for human consumption being wasted annually (Birney et al., 2017; Casonato et al., 2023; The World Bank, 2020). This waste not only represents a loss of valuable resources but also poses considerable environmental challenges, including increased greenhouse gas emissions, pollution, and depletion of natural resources. The ecological significance of tackling food waste lies in the fact that reducing waste can lead to reduced land and water use associated with food production and lower carbon footprints, owing to fewer resources needed for discarded food decomposition (Mondéjar-Jiménez et al., 2016; The World Bank, 2020).

Strategies to minimize food waste in SHD involve various approaches, ranging from consumer education to improvements in food distribution systems. For instance, consumers can be educated on proper food storage

techniques, portion size management, and meal planning, thereby reducing the risk of spoilage and waste (Monterrosa et al., 2020). Furthermore, implementing food redistribution programs, where surplus food from retailers, restaurants, and households is redirected to food banks or charitable organizations, can mitigate waste while addressing food insecurity (The World Bank, 2020). By encouraging such practices, SHD helps minimize food waste and promotes social equity by ensuring that surplus food reaches those in need of it.

From an ecological perspective, advocating for SHD and emphasizing local food sources are crucial for creating a more resilient and environmentally friendly food system. Local food systems minimize transportation emissions, reduce the carbon footprint associated with food distribution, and strengthen community connections with the food supply. Communities that rely on local agricultural production can significantly shorten the food supply chain, enhance access to fresh produce, and foster a sense of belonging (Montero-Vega et al., 2024; Pelletier et al., 2013). Research indicates that diets sourced from local systems are associated with lower environmental impacts, as they utilize fewer resources for transportation and preservation, thereby promoting healthier ecosystems (Pelletier et al., 2013).

Moreover, reducing food miles through local sourcing is vital for decreasing greenhouse-gas (GHG) emissions. A shift towards locally produced foods can reduce reliance on fossil fuels for transporting food over long distances, significantly contributing to carbon emissions (Montero-Vega et al., 2024). For instance, transportation within the food system has been reported to contribute approximately 11% of the total carbon footprint of food consumption (Agyemang et al., 2022). By encouraging dietary practices that promote local food production and consumption, a broader community can reduce its overall environmental impact, while supporting local farmers and producers, thereby enhancing local economic resilience (Willett et al., 2019).

Accessibility is a fundamental aspect of the local diet. The SHD must focus on environmental benefits and ensure that nutritious food is accessible and affordable to all socioeconomic groups in India. Integrating local food production systems in urban and rural settings

can help bridge the food accessibility gap often seen in food deserts where fresh and healthy food options are scarce (Hendriks et al., 2023). Employment opportunities in local agricultural practices can improve social equity and food security while increasing awareness of the importance of SHD choices (Çakmakçı et al., 2023).

The cultivation of local food systems has positive implications for biodiversity. Supporting a variety of local crops and livestock breeds contributes to preserving agricultural diversity, which is essential for enhancing ecosystem resilience to pests, diseases, and climate change (Valdes et al., 2021). A richer biodiversity within local food systems aligns with SHD guidelines and underscores the cultural heritage associated with food practices unique to specific regions (Knight et al., 2019).

Cultural Perspectives on Sustainable Healthy Diets

Cultural factors play a significant role in shaping dietary choices, particularly concerning moral considerations surrounding animal consumption and the increasing prevalence of vegetarianism in Japan. One of the primary cultural underpinnings for adopting vegetarian and plant-based diets is ethical treatment of animals. Sociocultural dialogue regarding animal rights has gained traction over the past few decades, prompting many individuals to reconsider their food choices based on moral principles. For example, a growing acknowledgement of sentient animals and the ethical implications of factory farming have catalyzed shifts toward vegetarian and vegan diets that seek to minimize harm to animals while promoting humane food production practices. The rise of animal rights movements has led to public awareness of the conditions under which livestock are raised, fostering a moral imperative among consumers to pursue alternative diets that align with their ethical values regarding nonhuman life (Hopwood et al., 2020).

Cultural narratives surrounding food often include beliefs about health and nutrition that are aligned with vegetarian dietary practices (Nemec, 2020). Research has shown that many individuals adopting plant-based diets cite health benefits as a motivation for their food choices, linking low meat consumption with reduced risks of chronic diseases, including

obesity, diabetes, and cardiovascular issues (WHO Regional Officer for Europe, 2021). Beyond health concerns, the Mediterranean diet, which emphasizes plant-based foods, has also been recognized for its cultural significance and has become associated with longevity and well-being (Di Daniele et al., 2017; Dominguez et al., 2021; Guasch-Ferré & Willett, 2021). The promotion of the Mediterranean diet by UNESCO as an Intangible Cultural Heritage of Humanity, highlights the cultural relevance of integrating traditional healthy and sustainable eating patterns (Saulle & La Torre, 2010). This indicates that cultural heritage is closely linked to food choices and can significantly influence attitudes toward consuming meat.

Moreover, the intersectionality of cultural identity and dietary practices illustrates how local contexts shape the acceptance of vegetarian diets. Factors such as ethnicity, religion, and community values can significantly influence individual dietary practices, highlighting the diversity of vegetarianism across cultural landscapes (Biesbroek et al., 2023; Valdes et al., 2021). For instance, individuals from cultures with longstanding traditions of plant-based eating often have more favorable views towards vegetarian diets and may view them as integral to their heritage. Such culturally rooted practices can enhance adherence to vegetarian diets, while promoting sustainable eating habits (Monterrosa et al., 2020).

Moreover, socialization processes related to food preparation and consumption tend to differ by sex. In many cultures, women are traditionally viewed as caretakers of family nutrition, which compels them to focus on sustainable food practices that promote their families' health and well-being. By contrast, men may be more influenced by marketing, societal norms, and peer behaviors, leading to higher dietary patterns in meat consumption (Wozniak et al., 2020). Another cultural consideration concerns the role of vegetarianism in the form of identity (Böhme et al., 2022; Fresán et al., 2020; Hendrie et al., 2022; Salonen et al., n.d.). Adopting a vegetarian diet can reflect a moral stance toward animal welfare, which studies have shown is more substantial among women, who may view dietary choices as expressing ethical values (Hopwood et al., 2020).

Traditional diets play an instrumental role in fostering SHD. Many traditional diets, such as

the Mediterranean and Okinawan diets, are characterized by high consumption of fruits, vegetables, and whole grains and moderate intake of fish and dairy products (Trichopoulou et al., 2014). These diets not only reflect local agricultural practices but also support biodiversity and ecological balance (Annunziata et al., 2019; Willcox et al., 2014). Traditional dietary patterns often align with cultural values and historical practices that emphasize the importance of locally sourced seasonal foods. Promoting these diets can enhance community cohesion and respect for cultural heritage, while encouraging healthier eating habits (Bach-Faig et al., 2011). Evidence suggests that adherence to such diets is associated with reduced risk of chronic disease, particularly when the Mediterranean diet is associated with a lower incidence of cardiovascular diseases (Knight et al., 2019).

Local food systems also significantly contribute to the acceptability of SHD (Enthoven & Van den Broeck, 2021). Local dietary practices can promote food sovereignty, allowing communities to maintain control over their food resources. Supporting local agriculture lowers transportation emissions, ensures fresh food, and aligns with local preferences. This connection enhances food security and encourages sustainable farming to preserve the environment (Fanzo et al., 2024; Garrity et al., 2024). Public policies that prioritize local food systems can incentivize sustainable agricultural practices and foster economic resilience within communities, making it easier for individuals to access sustainable food options (Fanzo et al., 2024).

Many traditional diets, such as the Mediterranean and Okinawan diets, are characterized by high consumption of fruits, vegetables, and whole grains and moderate intake of fish and dairy products (Baliwati & Rusyda, 2024). Economic barriers can significantly affect dietary choices as individuals with limited financial resources may resort to cheaper and potentially less healthy food options to meet their nutritional needs (Pechey & Monsivais, 2016). Studies have shown that price reductions on fruits and vegetables increase purchases among low socioeconomic groups, indicating that economic incentives can positively influence dietary quality (Dijkstra et al., 2015). At the social level, educational interventions can enhance knowledge of sustainable eating and help change perceptions

of plant-based diets. This is particularly vital across various demographic groups, as cultural preferences and beliefs play significant roles in food choices. Efforts must be made to respect and integrate these factors into dietary programs (Monterrosa et al. 2020).

Conclusion

SHD promotes individual well-being while minimizing environmental impact and ensuring accessibility, affordability, safety, equity, and cultural acceptability. These diets, such as the Mediterranean and Japanese diets, emphasize plant-based foods and align with WHO recommendations to prevent malnutrition and diet-related diseases. The EAT-Lancet Commission's Planetary Health Diet advocates a balance of whole grains, fruits, vegetables, and plant-based proteins, limiting animal-derived products and added sugars to promote health and sustainability.

From a biological perspective, SHD is linked to a reduced risk of obesity, cardiovascular diseases, and diabetes. Prioritizing nutritional diversity, portion control, and cultural considerations can optimize public health and sustainability. In an ecological context, SHD plays a crucial role in addressing global environmental challenges by reducing the ecological footprint, particularly GHG emissions and water consumption. Furthermore, cultural factors influence dietary choices through ethical concerns regarding animal consumption, traditional plant-based diets, and social norms that shape food preferences of individuals. Local food systems, economic accessibility, and educational initiatives play crucial roles in promoting SHD while respecting cultural identities and values.

To promote SHD, strengthening local food systems can enhance food security, reduce the carbon footprint, and support regional economies. Public health campaigns and educational programs should emphasize the benefits of sustainable diets while respecting cultural food traditions to encourage their widespread adoption. This review proposes that ecological considerations can serve as essential components of dietary recommendations, particularly within the SHD framework. However, as it was based on a non-systematic literature review, further observational and

experimental studies are required to strengthen the evidence base.

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