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Interconnection of Sustainable Food Systems and Determinants of Health: A Multidimensional Approach to Achieving Zero Hunger and Well-being

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ABSTRACT
The global food system faces complex challenges with 821 million people still experiencing hunger despite theoretically sufficient food production. This study analyzes the relationship between food systems and people's well-being using a systematic literature review with the PRISMA approach. The results identify five main dimensions that influence well-being: food availability, economic access, food quality and safety, environmental sustainability, and socio-cultural aspects. The analysis shows the need for a multidimensional approach that integrates agroecological production system transformation, strengthening local food systems, coherent food policies, consumer empowerment, and principles of food equity and sovereignty. Implementation of this approach requires multi-stakeholder collaboration to overcome the challenges of conflicting interests, policy fragmentation, and capacity gaps in achieving Zero Hunger and optimal well-being.

Keywords: Food availability, Zero Hunger, Wellbeing

1 Introduction

Modern global food distribution systems struggle with sophisticated problems in providing adequate nutrition for the world's continuously growing population. Although global food production is theoretically sufficient to feed the entire world's population, unequal distribution and inadequate infrastructure mean that 821 million people still suffer from hunger.[1].In Indonesia, infrastructure disparities between urban and rural areas contribute to significant regional differences in food security.[2]. This problem is worsened by unstable global food prices that impact the buying capacity of at-risk populations, particularly those allocating over half their earnings to food purchases and experiencing greater vulnerability to nutritional insecurity.[3].

Food system challenges are not only related to availability and economic access, but also to aspects of food quality and safety. Consumption of unsafe and low-quality food is associated with an increased risk of non-communicable diseases and infections (WHO, 2020). Research in Indonesia found that 32% of food samples in traditional markets contained pesticide residues above the permitted threshold, indicating potential health risks for consumers.[4]. Additionally, the transformation of diets to favor highly processed foods loaded with sugar, salt, and trans fats is contributing to the growing prevalence of obesity and diabetes.[5]. This aspect makes the relationship between food systems and social welfare increasingly complex and requires a multidimensional approach.

Environmental sustainability in food production practices is also a major concern in the global food system. The present-day food supply chain contributes 30% of total greenhouse gas emissions while using 70% of global freshwater reserves.[6]. In Indonesia, forest conversion for monoculture plantations has had serious environmental impacts, including loss of biodiversity and increased risk of natural disasters, which in turn affect food security and the well-being of local communities.[7]. Meanwhile, the erosion of traditional food knowledge and local food diversity is correlated with declining nutritional status in many indigenous communities.[8]. Research using ethnographic methods in Central Sulawesi

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indicates that safeguarding traditional dietary systems benefits food availability while simultaneously reinforcing cultural identity and emotional well-being within communities.[9].

Health determinants at multiple levels also significantly influence and are influenced by food systems. At the individual level, socio-economic factors including income, education, and food literacy are strong predictors of nutritional status and well-being.[10]. At the community level, traditional systems of mutual cooperation in agricultural land management and food sharing play an important role in reducing vulnerability to seasonal food insecurity.[11]. Meanwhile, at the structural level, agricultural policies that prioritize commercial export crops often sacrifice the production of diverse and nutritious local foods, which has a negative impact on the nutritional status of communities.[12]. An evaluation of the Non-Cash Food Assistance (BPNT) program in Indonesia found that despite increasing access to staple foods, the program has not been optimal in supporting the diversity and nutritional quality of beneficiary food consumption. This complexity indicates the need for a transformation of the food system that integrates health, environmental, economic, and socio-cultural aspects to achieve sustainable food security and optimal well-being for all.

2 Literature Review

Food Availability

Food availability is a fundamental dimension in the food system which refers to the quantity and type of food available for consumption at a certain geographical level, including aspects of production, distribution and food infrastructure.[13] [14]defines food availability as the number of calories per capita available for human consumption derived from domestic production, imports, and food reserves, while[15]broaden the definition by including aspects of food availability stability across time and space. According to[16] Food accessibility encompasses the system's capacity to generate, deliver, and ensure physical reach to adequate food volumes that satisfy the population's fundamental nutritional requirements. Meanwhile,[17] points out that food adequacy relates not only to absolute food volumes but also to the spectrum of food choices available to communities, which impacts nutritional outcomes and the adaptability of food systems overall.

The function of food supply in sustainable food frameworks is extremely tactical and varied. Primarily, food availability acts as an essential foundation for other food security aspects such as distribution, consumption, and reliability.[18]. Second, adequate food availability allows for the creation of well-functioning food markets and supports local economic development, especially in rural areas that depend on the agricultural sector.[19]. Third, stable and evenly distributed food availability can be a buffer against various external shocks such as natural disasters, conflicts, and economic crises.[20]. Fourth, the availability of diverse food contributes to the resilience and sustainability of the food system through diversification of production sources and distribution channels.[21]. Fifth, infrastructure that supports food availability, such as storage, processing, and transportation facilities, plays an important role in reducing food loss and waste, while ensuring that food quality and safety are maintained from producers to consumers. Overall, the food availability dimension is an integral component in a multidimensional approach to achieving food security, improved nutrition, and community well-being.

Zero Hunger

The concept of "Zero Hunger" is the second Sustainable Development Goal (SDGs) set by the UN, with the main target of ending hunger, achieving food security, improving nutrition, and promoting sustainable agriculture by 2030.[22]. According to[13], zero hunger does not only mean eliminating physical hunger but also includes aspects of access to safe, nutritious, and sufficient food throughout the year. This concept involves the dimensions of food availability, food access, food utilization, and food stability.[19]emphasizes that sustainable food security must also consider aspects of economic affordability and ecological sustainability in food production.

As a foundation for human well-being, Zero Hunger has direct links to several other SDG targets, including poverty eradication (SDG 1), health and well-being (SDG 3), quality education (SDG 4), gender equality (SDG 5), and climate action (SDG 13), creating a multiplier effect in socio-economic development.[23]. The Zero Hunger approach focuses on sustainable food systems promoting environmentally friendly agricultural practices, biodiversity conservation, and climate change mitigation.[6]. Socially, Zero Hunger plays a vital role in reducing inequality, preventing conflicts

triggered by food insecurity, and building community resilience to external shocks such as natural disasters, pandemics, and economic crises.[24].

The Concept of Zero Hunger and Well-being

Well-being is a multidimensional concept that encompasses the physical, mental, social, and economic aspects of human life.[25] The definition presents well-being as a condition enabling each individual to actualize their abilities, navigate typical life pressures, maintain productive employment, and participate constructively in community life.[26]conceptualizes well-being as a balance between the psychological, social, and physical resources possessed by individuals and the challenges faced. In the context of food security, well-being is not only measured by the fulfillment of nutritional needs but also includes satisfaction with food choices, food safety, and the socio-cultural context of food consumption practices.

The relationship between zero hunger and well-being is bidirectional. Hunger and malnutrition directly affect an individual's physical and mental health, productivity, and learning capacity, thus negatively impacting well-being (Development Initiatives, 2020). Conversely, low levels of well-being, especially in the economic and social dimensions, can limit access to nutritious food and lead to food insecurity.[27]shows that an approach that integrates food security with well-being must consider aspects of equity and sustainability in the food system as a whole.

Recent studies by[28]reveals that zero hunger and well-being are influenced by interrelated determinants at multiple levels, from the individual to global policies. At the individual level, socio-economic factors such as income, education, and employment influence purchasing power and food choices. At the community level, local food infrastructure, social norms, and social capital play a role in shaping food accessibility and consumption practices. At the macro level, agricultural policies, international trade, and global food governance mechanisms influence food availability and distribution.[29]. These aspects interact with each other in a complex socio-ecological system, affecting both food security and population well-being.

3 Research Methods

This study used the systematic literature review (SLR) method with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) approach to systematically identify, evaluate, and integrate findings from previous studies. The process was carried out in four main stages: (1) identification, including searching for articles in scientific databases such as Scopus, ScienceDirect, and Google Scholar using relevant keywords; (2) screening, by applying inclusion and exclusion criteria to select appropriate articles based on title, abstract, and relevance; (3) eligibility, namely reviewing the full text of selected articles by evaluating methodological quality, significance of findings, and suitability to the research theme; and (4) final analysis, in the form of systematic data extraction, synthesis of key findings, and mapping of knowledge gaps to answer the research questions. This approach ensures a comprehensive, transparent, and reproducible review of the existing literature, resulting in a strong theoretical foundation for the study.

4 Results and Discussion

Analysis of the collected literature reveals five main dimensions of the food system that significantly affect people's well-being. The food availability dimension includes aspects of food production, distribution, and infrastructure. The findings reveal that while worldwide food production could theoretically nourish the global population, disparate distribution patterns and insufficient infrastructure result in 821 million individuals continuing to face food insecurity.[13]. In Indonesia, a study by[30]shows that infrastructure disparities between urban and rural areas contribute to significant regional differences in food security. The dimension of economic access to food is also closely related to poverty and income inequality. According to 2022 World Bank findings, households dedicating more than 50% of their budget to food face elevated risks of hunger and diminished welfare. Unstable global food pricing compounds this problem by undermining the economic ability of disadvantaged communities to access adequate nutrition.[19].

Studies of health determinants illustrate that factors operating across different dimensions substantially shape and are shaped by food distribution systems. On the individual dimension, socio-economic elements such as wealth, academic background, and food knowledge continually appear as robust predictors of dietary status and well-being. Studies by[31]of 1,200 households in five provinces in Indonesia found that maternal education and family food literacy were positively correlated with children's dietary diversity and better nutritional status. The study also revealed that interventions that improve nutritional knowledge and food processing skills can improve food utilization even in conditions of economic constraints. Social networks and cultural norms at the interpersonal and community levels also influence food production and consumption practices. Research by[11]in rural communities in Yogyakarta showed that traditional mutual cooperation systems in agricultural land management and food sharing play an important role in reducing vulnerability to seasonal food insecurity. Similarly, a comparative study by[32]between villages with high and low levels of social capital in East Java found significant differences in household food security during drought periods, with communities with high social capital showing better resilience.

Based on the synthesis of these findings, a multidimensional approach to integrating sustainable food systems with health determinants is essential. Transforming food production systems towards more sustainable agroecological practices is a key component of this approach. Case study by[33]shows that agroecological approaches can increase crop yields by up to 80% in some regions while increasing biodiversity and resilience to climate change. In Indonesia, research conducted by[34]in Bali revealed that the traditional Subak system integrated with modern sustainable agricultural practices resulted in better food security and increased farmer welfare. Strengthening local food systems and inclusive value chains is also important. Meta-analysis by[35]of 42 studies show that territorial food systems that link local production with local consumption reduce vulnerability to external shocks and increase access to fresh and nutritious food. The "Farmer's Market" program in several cities in Indonesia that connects farmers directly with consumers has shown positive results in increasing farmers' incomes and consumers' access to quality food at affordable prices.[7].

5 Conclusion

The global food system currently faces complex challenges in meeting the nutritional needs of the world's population, with issues including inequitable distribution, inadequate infrastructure, insecure food quality, unsustainable production practices, and erosion of traditional food knowledge. Literature analysis reveals five key dimensions of food systems that influence well-being: food availability, economic access, food quality and safety, environmental sustainability, and socio-cultural aspects, all of which are influenced by health determinants at the individual, community, and structural levels. Achieving Zero Hunger and optimal well-being requires a multidimensional approach that integrates the transformation of production systems towards agroecological practices, strengthening local food systems, coherent food policies across sectors, empowering consumers through nutrition education, and incorporating principles of equity and food sovereignty into governance, all of which require cross-sectoral and multi-stakeholder collaboration to address the challenges of conflicting interests, policy fragmentation, and capacity gaps.

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