Integrating One Health into Food Systems: A Literature Review on Health Risks and Sustainability

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ABSTRACT

Background: The food system is a complex network that shapes health outcomes across human, animal, and environmental domains. Increasing globalization, agricultural intensification, and environmental changes have amplified risks such as zoonotic diseases and antimicrobial resistance (AMR). The One Health approach provides an integrated framework to address these interconnected challenges. This study aimed to examine the role of One Health in food systems through a literature review of studies published between 2014 and 2025.

Methods: Articles were retrieved from PubMed, Scopus, and Google Scholar using relevant keywords. Selected studies were analyzed using a thematic approach focusing on human, animal, and environmental health perspectives.

Results: The findings indicate that food systems serve as important pathways for zoonotic disease transmission and the spread of AMR, particularly through intensive livestock production and inappropriate antibiotic use. In addition, food production contributes to environmental degradation, including pollution and greenhouse gas emissions, which further affect health outcomes.

Conclusion: Despite increasing recognition of the One Health approach, its implementation remains limited, especially in developing countries. Strengthening interdisciplinary collaboration and integrated policies is essential to improve food system safety, public health, and environmental sustainability.

Keyword : One health ; Food systems ; Zoonotic disease ; Antimicrobial resistance

Introduction

The Food System encompasses all processes involved in food production, processing, distribution, and consumption, forming a complex network that links agricultural practices, food industries, markets, and consumers. It plays a fundamental role in sustaining human life by ensuring food availability, accessibility, and nutritional adequacy. However, beyond its essential function, the food system also contributes to a range of complex and interconnected health challenges affecting humans, animals, and the environment.[1,2] Increasing global demand for food, driven by rapid population growth, urbanization, and changing dietary patterns, has led to the intensification of agricultural and livestock production systems. These changes, while improving productivity, have also increased the risk of disease transmission, environmental degradation, and unsustainable resource use.[3]

Global health concerns such as zoonotic diseases and Antimicrobial Resistance (AMR) have become increasingly significant within the context of modern food systems.[4] Zoonotic diseases, which are transmitted between animals and humans, account for a substantial proportion of emerging infectious diseases worldwide.[5] The emergence of infectious diseases, including COVID-19, underscores the close interdependence between human, animal, and environmental health systems.[6] Food production environments, particularly those involving intensive livestock farming and close contact between wildlife, domestic animals, and humans, create conditions that facilitate pathogen spillover events and the emergence of new infectious diseases.[7]

In addition, the widespread and often inappropriate use of antibiotics in livestock production has significantly accelerated the development of antimicrobial resistance.[8] Antibiotics are frequently used not only for treating infections but also for growth promotion and disease prevention in intensive farming systems. This practice contributes to the selection of resistant microorganisms, which can be transmitted to humans through multiple pathways, including food consumption, environmental contamination, and direct animal contact. As a result, AMR has emerged as a major global public health threat, compromising the effectiveness of essential medical treatments.

Environmental degradation further exacerbates these challenges. Agricultural expansion, deforestation, water pollution, and greenhouse gas emissions associated with food production can disrupt ecosystems and alter disease dynamics.[2] These environmental

changes may increase the risk of zoonotic disease transmission, reduce biodiversity, and threaten the long-term sustainability of food systems.

The One Health approach has been proposed as a comprehensive framework to address these interconnected challenges by integrating human, animal, and environmental health.[9] This approach emphasizes interdisciplinary collaboration, coordinated policy-making, and integrated surveillance systems. However, despite its recognized importance, the implementation of One Health remains limited and fragmented, particularly in developing countries, where institutional capacity, regulatory frameworks, and cross-sector coordination are often insufficient.[6]

Material and Methods

This study employed a literature review design to synthesize existing evidence on the relationship between the One Health approach and the Food System. The review was conducted between January and March 2026 using three major electronic databases, namely PubMed, Scopus, and Google Scholar. These databases were selected due to their comprehensive coverage of biomedical, environmental, and interdisciplinary research relevant to the study topic.

A structured search strategy was applied using combinations of keywords, including “One Health”, “food system”, “zoonotic diseases”, and “antimicrobial resistance”. Boolean operators such as AND and OR were used to refine the search results. The search was limited to articles published between 2014 and 2025 to ensure the inclusion of recent and relevant studies.

The inclusion criteria consisted of peer-reviewed journal articles published in English that addressed the interaction between human, animal, and environmental health within food systems. Articles were excluded if they were non-scientific publications, duplicates, or not directly related to the study topic. The selection process was conducted in two stages: initial screening based on titles and abstracts, followed by full-text review to determine eligibility.

Relevant data were extracted from the selected articles, including study focus, methodology, and key findings. The extracted data were then analyzed using a descriptive thematic approach. The findings were categorized into three main domains: human health, animal health, and environmental health, and interpreted within the One Health framework.

Descriptive statistics were used to summarize the number and characteristics of the included studies. Due to the qualitative nature of this review, no inferential statistical analysis was performed. This study utilized secondary data from previously published

literature and did not involve direct human or animal subjects; therefore, ethical approval from a local ethical committee was not required. However, the study adhered to ethical research standards, including proper citation and responsible reporting of findings.

Results

A total of relevant studies were included in this review that shown on table 1, demonstrating the complex and multidimensional relationship between food systems and health across human, animal, and environmental domains. The included studies consistently highlight that food systems act as a central pathway through which various health risks emerge and interact.

Table 1. Summary of studies addressing One Health issues related to food safety, antimicrobial resistance (AMR), zoonotic diseases, livestock systems, and integrated One Health approaches.

No	Author (Year)	Country/ Region	Study Design	Focus Area	One Health Domain	Key Findings
1	Grace (2015)	LMICs	Review	Food safety	Human	Food systems contribute significantly to foodborne disease burden
2	McEwen & Colligno n (2018)	Global	Review	AMR	Human–Animal	Antibiotic use in livestock is a major driver of AMR
3	Van Boeckel et al. (2019)	Global	Data analysis	AMR	Animal	Global antibiotic use in livestock is increasing rapidly
4	Havelaar et al. (2015)	Global	Burden study	Foodborne disease	Human	High global morbidity from unsafe food
5	Allen et al. (2017)	Global	Review	Zoonotic disease	Environment	Land-use change increases zoonotic risk
6	Robinson et al. (2016)	Global	Modeling	Livestock systems	Animal	Intensification increases disease transmission risk
7	Gebreyes et al. (2014)	Global	Review	One Health	All domains	Integrated approach improves health outcomes
8	Zinsstag et al. (2011)	Global	Conceptual	One Health	All domains	Interdisciplinary collaboration is essential
9	FAO (2021)	Global	Report	Food systems	Environment	Sustainability is critical for food systems
10	WHO (2020)	Global	Policy report	One Health	All domains	Implementation of One Health remains limited
11	Rwego et al. (2016)	Africa	Field study	Surveillance	Human–Animal	Weak integration of surveillance systems

12	O'Neill (2016)	Global	Report	AMR	Global	AMR poses major global economic and health risks
13	Thornton (2010)	Global	Review	Livestock systems	Animal	Livestock production impacts environment and health
14	FAO/WHO (2019)	Global	Joint report	Food safety	Human	Policy gaps in food safety regulation
15	UNEP (2020)	Global	Report	Environment	Environment	Environmental degradation affects disease dynamics
16	CDC (2022)	Global	Report	Zoonosis	Human–Animal	Majority of emerging diseases are zoonotic
17	World Bank (2021)	Global	Report	Food system sustainability	Environment	Food systems linked to economic and environmental risks
18	Lerner & Berg (2017)	Europe	Review	One Health ethics	All domains	Ethical framework needed in One Health
19	Wallace (2016)	Global	Review	Industrial farming	Animal–Environment	Intensive farming linked to disease emergence
20	Jones et al. (2013)	Global	Epidemiology	Zoonosis	Human–Animal	Livestock is a key source of emerging diseases

Human Health Impacts

The reviewed literature indicates that food systems significantly influence human health, particularly through food safety and nutritional pathways. Contaminated food products were consistently identified as major sources of foodborne diseases, including bacterial, viral, and parasitic infections. Poor hygiene practices during food handling, processing, and distribution further increase the risk of contamination.

In addition, several studies reported that exposure to antibiotic residues in food products, especially those derived from livestock, may contribute to the development of Antimicrobial Resistance. This exposure can occur through direct consumption of contaminated food or indirectly through environmental pathways. Furthermore, imbalances in food systems, such as unequal access to nutritious food, were also associated with malnutrition and diet-related diseases, highlighting the broader public health implications.

Animal Health Impacts

Livestock production was identified as a critical component of food systems with significant implications for animal health. The findings show that intensive farming practices, characterized by high animal density and limited biosecurity measures, increase the risk of infectious disease transmission among animals. These conditions also facilitate the emergence and spread of zoonotic pathogens that can be transmitted to humans.

The widespread and often inappropriate use of antibiotics in livestock production was

consistently reported as a major driver of antimicrobial resistance. Antibiotics are frequently used not only for treatment but also for disease prevention and growth promotion. This practice creates selective pressure that encourages the development of resistant microorganisms, which can then spread across animal populations and enter the human food chain.

Environmental Impacts

Food production activities were found to have substantial environmental impacts that indirectly influence health outcomes. Key issues identified include water contamination from agricultural runoff, soil degradation due to intensive farming practices, and deforestation associated with land conversion for agriculture.

Additionally, the studies highlight that food systems contribute significantly to greenhouse gas emissions, particularly from livestock production. These emissions play a role in climate change, which in turn affects agricultural productivity and alters the distribution of disease vectors. Environmental degradation also disrupts ecosystems, increasing the likelihood of human–animal interactions and the emergence of zoonotic diseases.

Integration under One Health

The findings demonstrate that food systems serve as a critical interface linking human, animal, and environmental health. The interconnected nature of these domains supports the application of the One Health approach as an effective framework for addressing complex health challenges.

Several studies emphasized the importance of integrated strategies, including cross-sector collaboration, coordinated surveillance systems, and sustainable agricultural practices. However, gaps remain in the implementation of such approaches, particularly in terms of data sharing, policy integration, and institutional coordination.

Overall, the results highlight that addressing health risks within food systems requires a holistic and interdisciplinary approach that considers the interdependence of human, animal, and environmental health.

Discussion

This study highlights the central role of food systems in shaping health outcomes across human, animal, and environmental domains. The findings confirm that food systems

are not only sources of nutrition but also critical pathways for the emergence and transmission of health risks, particularly zoonotic diseases and antimicrobial resistance (AMR). These results are consistent with previous global studies that emphasize the interconnected nature of health systems and the need for integrated approaches.[1,2]

From a human health perspective, the findings reinforce the well-established link between food systems and foodborne diseases. Previous research has estimated that unsafe food causes hundreds of millions of illnesses annually worldwide, indicating the substantial burden associated with food contamination.[3] In addition, the presence of antibiotic residues and resistant pathogens in food products raises serious concerns regarding long-term public health risks, particularly the spread of antimicrobial resistance through the food chain.[4,5]

In terms of animal health, this study confirms that intensive livestock production systems significantly increase the risk of disease transmission. High-density animal farming, combined with inadequate biosecurity measures, creates conditions that facilitate the spread of infectious diseases. These findings align with earlier studies showing that the expansion of industrial livestock production is a major driver of zoonotic disease emergence.[6,7] Furthermore, the widespread use of antibiotics in animal husbandry continues to be a key factor contributing to the global AMR crisis.[4,8]

Environmental factors also play a crucial role in shaping the relationship between food systems and health. The findings demonstrate that agricultural activities contribute to environmental degradation, including deforestation, water pollution, and greenhouse gas emissions. These environmental changes not only threaten ecosystem stability but also influence disease dynamics by increasing human–animal interactions and altering vector distribution.[9,10] Climate change, in particular, has been identified as a major factor affecting both food security and the emergence of infectious diseases.[11]

Despite the growing recognition of the One Health approach, its implementation remains limited and uneven across regions. The results of this study indicate that one of the main challenges is the lack of integration between sectors. Health, agriculture, and environmental policies are often developed independently, leading to fragmented responses to complex problems.[2,12] In addition, limited data sharing and weak surveillance systems hinder early detection and coordinated responses to emerging threats.[13,15]

In the context of Indonesia and other low- and middle-income countries, these challenges are further compounded by structural and resource limitations. Informal food markets limited regulatory enforcement, and gaps in infrastructure make it difficult to implement integrated One Health strategies effectively.[1,]14,15 This suggests that global

frameworks need to be adapted to local contexts to ensure successful implementation.

From a policy perspective, the findings underscore the importance of strengthening cross-sector collaboration and developing integrated surveillance systems. Coordinated efforts between public health authorities, veterinary services, and environmental agencies are essential for addressing health risks within food systems.[12,13] In addition, stricter regulation of antibiotic use in livestock and the promotion of sustainable agricultural practices are critical steps toward mitigating AMR and environmental impacts.4,9

This study also highlights several areas for future research. There is a need for more empirical studies that evaluate the effectiveness of One Health interventions in real-world settings. Quantitative research examining the relationship between food systems and health outcomes would also strengthen the evidence base. Furthermore, studies focusing on context-specific implementation strategies in developing countries are essential to bridge the gap between theory and practice.[1,2]

Overall, this study reinforces the importance of adopting a holistic and interdisciplinary approach to address the complex challenges associated with food systems. The integration of human, animal, and environmental health perspectives is essential for achieving sustainable and resilient food systems in the future.[1,2]

Conclusion

The integration of One Health principles into food systems is critical for addressing complex health challenges that span human, animal, and environmental sectors. While current evidence supports the benefits of interdisciplinary collaboration and integrated surveillance, significant gaps remain in policy implementation and evaluation, particularly in low- and middle-income countries. Future research should focus on developing context-specific One Health frameworks and assessing their effectiveness in improving food safety, reducing antimicrobial resistance, and enhancing sustainable food production.

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