Volume 3, Issue 4, 2025

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

FOOD WASTE AND NUTRITION SECURITY: A HIDDEN CRISIS IN PAKISTAN

Maria Haris[*1], Amna Nawaz[2], Muhammad Mudassir Rasheed[3], Saira Saeed[4], Waqas Khalid[5], Arfa Ali Hassan[6], Fatima Afzal Khan[7], Zainab Ahmad[8]

[*1]*Associate Lecturer, Department of Food Science and Technology, University of Central Punjab, Lahore*
[2]*Student, University of Central Punjab, Lahore*
[3]*Lecturer*
The University of Chenab Gujrat
[4,5,6]*Student, Department of Food Science and Nutritional sciences*
[7,8]*Student, Department of Food Science and Technology, University of Central Punjab, Lahore*

[*1]mariaharis@ucp.edu.pk, [2]amnajutt1188@gmail.com, [3]mudassir@ahs.uchenab.edu.pk, [4]sairasaeed424@gmail.com, [5]waqas456ky@gmail.com, [6]arfausman682@gmail.com, [7]fatimaafzalkhan123@gmail.com, [8]zainabahmad143gb@gmail.com

DOI: https://doi.org/10.5281/zenodo.15645948

Keywords

Article History
Received on 28 April 2025
Accepted on 28 May 2025
Published on 06 June 2025

Corresponding Author: *
Maria Haris

Abstract

Food waste and nutrition insecurity are interrelated issues that endanger the well-being of millions of Pakistanis. Despite being an agricultural country, Pakistan experiences high rates of food loss and waste across the supply chain, from production to consumption, while a significant proportion of the people continues to suffer from malnutrition and suppressed hunger. This review investigates the scope, causes, and implications of food waste in Pakistan, with an emphasis on the hospitality industry and family practices. It also explores the current situation of nutrition insecurity, emphasizing widespread micronutrient deficits, geographical differences, and the vulnerability of children and women. The essay goes on to explore how food waste worsens nutritional insecurity and hinders food system sustainability. The effectiveness and implementation gaps of current policy measures, including provincial agriculture programs and the National Food Security Policy, are thoroughly examined. The review ends by offering evidence-based, integrated strategies that link better nutrition outcomes with less food waste. In order to attain long-term food and nutrition security in Pakistan, it emphasizes a food systems approach and urges improved institutional coordination, the adoption of sustainable practices, and enhanced policy coherence.

INTRODUCTION

A reduction in the amount of food meant for human consumption along the food chain (from production to consumption) is referred to as food waste also known as food losses and waste [FLW]). Since more than one-third of the world's food output is lost or wasted, FLW is accepted as a global problem that affects the sustainability of food systems as well as food and nutrition security (1). Pakistan's pervasive health deprivation is worsened by food and nutrition insecurity, which is a growing problem in the nation. A third of people are food insecure, according to the World Food Program, and this number is projected to rise as a result of population growth, climate change, and unstable economies.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

More than half of the population suffers from deficiencies in vital vitamins and minerals, giving poor nutrition another significant issue in the nation (WFP, 2018) (2). Defects in food and nutrition impair health, lower productivity, and raise medical expenses (3). Pakistan is a low-income developing nation, and as its main goal is to feed its rapidly expanding people with nutritious meals, agriculture is its most vital industry. Over the previous 60 years, the total cultivated area has grown by just 40%, despite the population having increased more than four times and the urban area expanding seven times, creating mega towns and intensifying the strain on cultivated land (4).

Food security and nutrition quality can be successfully tackled by measures aimed at reducing food waste, which is linked to nutrient waste (5). Food sustainability and nutrition quality can be effectively addressed by measures aimed at reducing food waste, which is linked to nutrient waste. Currently, food redistribution schemes do not address lower-income communities' access to nutrient-dense, sustainably sourced foods. Future research and practice opportunities involve addressing nutrition priorities, plastic waste, and food waste, as well as creating more effective food redistribution the processes to reduce the waste of high-quality meals (6).

Pakistan has to cope with a serious and frequently disregarded nutrition crisis. Millions of Pakistanis health and well-being are seriously endangered by hidden hunger, a type of malnutrition brought on by insufficient consumption of important minerals and vitamins (7). The prevalence and effects of hidden hunger in Pakistan are discussed in this editorial, along with its underlying causes and the pressing need for comprehensive remedies to solve this silent disaster (8).

THE STATE OF FOOD WASTE IN PAKISTAN:

Between the farm and the plate, one-third of the food produced for human consumption is wasted yearly. Water, agricultural acreage, and soil fertility are among the resources wasted in the production of food. Given their limited availability, these resources ought to be utilized effectively and sustainably (9). Due to the pressing need to feed nine billion people by 2050, there has been an increase in attention recently on measuring the problem of food waste and examining its causes. We emphasize on Pakistan among developing nations since it has the sixth-largest population in the world and has severe problems with starvation and food insecurity (10).

Food waste can be generated at various stages of the food supply chain, such as retail, household level and hospitality level. In this study, we focus on collecting much-needed empirical evidence on food waste from the hospitality sector (restaurants, hotels, and catering) of Pakistan (11).

Pakistan has a population of 207.77 million in 2017 according to the latest Pakistan Economic Survey, of which 36% suffer from food insecurity (12). It is important to quantify food waste in Lahore, Pakistan's hotel industry for a number of reasons. Without knowing how much trash we generate we are unable to evaluate our food waste reduction strategies (13). There is a lot of room to reduce food waste in the hotel industry. Food waste has been hinted to in Pakistani media stories and in the results of a few research. Using authentic measurements of everyday waste and classifying restaurants into high-, medium-, and low-end niche sectors, we discover that overproduction and liability worries are the main causes of excessive food preparation and inappropriate disposal (14).

According to surveys and live-tracking, the average percentage of food wasted in the dining establishments was 15% and 17%, respectively (15). Similarly, restaurants had the least amount of trash per customer (79.9 g based on surveys and 73.4 g based on live tracking), followed by hotels (138.4 g) and caterers (140 g). The main cause of food waste has been found to be plate leftovers, which were followed by excess output and food spoiling (16).

NUTRITION INSECURITY IN PAKISTAN

Malnutrition among mothers and children in Pakistan is caused by a lack of availability to an adequate amount of nutrient-dense food (17). Early childhood nutritional deficiencies have long- term effects (18). A child's nutritional status is linked to dietary diversification (19). The poorest households in Pakistan consume 23% fewer calories on average than what is advised (20).

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Wheat and rice are the main sources of calories consumed; the average diet in the nation is not entirely varied, and the cost of consumption is lower in poor and rural homes than in non-poor and urban households (21). According to the provincial research, 53.3% of households in the province of Baluchistan are food insecure, with KP (49.5%), Sindh (43.9%), and Punjab (35.5%) following directly behind. 44.6% of the population as a whole had a protein shortfall, which was prevalent across all provinces. Over 55.9% of households do not eat a diet that is balanced in terms of fats, proteins, and carbohydrates (22).

Sindh province continues to have some of the worst rates of undernutrition in South Asia, according to Pakistan's 2011 National Nutrition Survey (NNS). Action Against Hunger (ACF) conducted a Nutrition Causal Analysis (NCA) in two districts of Sindh province in order to get a better understanding of the factors that contribute to acute and chronic malnutrition. According to ACF studies, during the crucial 1,000-day window, infant and young child feeding (IYCF) practices do not receive the attention they need to prevent the irreparable harm caused by undernutrition (23).

Malnutrition is predicted to become more common as a direct result of climate change's effects on agricultural output and the food system overall. Therefore, depending on the kind of livelihood system individuals are reliant on, climate change has a more direct effect on food availability and access and an indirect effect on nutrition insecurity (24).

THE LINK BETWEEN FOOD WASTE AND NUTRITIONAL INSECURITY:

New research shows unexpected relationships between environmental sustainability, nutrition, and food waste that should be taken into account when creating waste reduction plans (25). For the millions of undernourished people worldwide, food waste is viewed as a barrier to attaining food and nutrition security (Bagherzadeh et al., 2014). In 2010–2012, the vast majority of people (852 million, or 14.9% of the total population) lived in developing nations, and nearly 870 million people, or one in eight people worldwide, were undernourished (FAO, 2013). Along the food supply chain, over one-third of the world's food output is lost or misused (26). Society suffers when resources are used inefficiently and unsustainable ways across supply chains (27). Food security has been compromised by FLW, which helps to decrease food supply and access (28). Through the use of direct measures, this study seeks to determine the prevalence of both household food waste and household food insecurity as well as the relationship between the two (29). Food waste (FW) is a serious problem that has spread around the world. The average FW per person worldwide in 2019 was 121 kg annually, with families supplying 61% of it (30). At the micro, meso, and macro levels, high levels of FW significantly affect food security

and nutrition as well as the sustainability of the food system in the economic, environmental, and social domains (31). There has been much discussion of the macro-level relationship between food waste and food security (32). In the meanwhile, reducing food waste can greatly increase food security at the home level, particularly in households where food supply is a major problem

(33). There aren't many studies on the direct measurement (34). And a comparison of the amount of FW at the home level between households that are food secure and those that are not (35).

With a 1.92% growth rate, Pakistan is the sixth most populated nation. Despite reports from the Government of Pakistan (GOP, 2020) that the country's per capita income increased from $1531 to $1629, food insecurity is still a major problem in Pakistan (36). The Pakistan National Nutrition and Demographic Health Survey found that 37.8% of children under five were stunted, with 38.2% of males and 37.1% of females, while 36.9% of households experienced food insecurity (37,38,39).

Deficits in food and nutrition impair health, lower productivity, and raise costs associated with medicine (40). Particularly in rural areas, the agricultural sector is essential to the nation's economic development, food security, employment creation, and reducing poverty (41).

The average calorie intake per adult equivalent at the national, provincial, and regional scales seems sufficient, with the exception of Baluchistan. Punjab consumed the most calories per adult equivalent, followed by Sindh, Baluchistan, and Khyber Pakhtunkhwa (KP). Because of this, 40.2% of

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Pakistani households consumed less calories per day than what was advised. According to headcount measurements, 95.1 million people in Pakistan are food insecure, and 13.4 million households consume fewer calories per day than is advised. The situation in the provinces is far worse: 44.4 million people (39.6%) in Punjab, 23.9 million people (50%) in Sindh, 19.8 million people (55%) in KP, and 7.0 million people (56.6%) in Baluchistan consume less calories than recommended (42).

NATIONAL NUTRITION SURVEY 2018

Policy Landscape and Institutional Response

Policy Environment and Institutional Reaction to the 2018 National Nutrition Survey Nations and governments at the national and international levels have acknowledged the importance of nutrition for development. Governments have repositioned food and nutrition security as a crucial pillar of development as a result of the asymmetric economic growth in various contexts and the widespread inequalities that arose during the 1960s, primarily due to unbalanced economic growth and the resulting lacking access to sufficient and nutritious food

(43). Sindh province continues to have some of the worst rates of undernutrition in South Asia, according to Pakistan's 2011 National Nutrition Survey (NNS) (44).

2018 National Food Security Policy Pakistan's legal system, which includes numerous federal and provincial laws, rules, and policies, is complex and guarantees food security. In order to provide food security for every group of people, the National Food Security Policy of 2018 is a comprehensive plan. These policies, like Punjab's Agriculture Policy 2018 and KP's Agriculture Policy (2015–25), set forth plans and initiatives to develop the agricultural industry. Crop production, land use, water management, and technology adoption are just a few of the concerns they cover (45).

Integration in food and nutrition policymaking is still pending, and the nation's transition from the "nutrition sciences" to "food and nutrition policy" is still ongoing (46). Several groups in developed nations have started working to alleviate the social, environmental, and economic effects of "food waste" in recent years (47). By using inputs just where and when they are required, precision agriculture optimizes resource usage efficiency. This lessens the environmental impact of agriculture, conserves resources, and decreases waste (48).

Food waste and loss could be greatly decreased by emerging technologies. These include sensor technology to track food freshness, cold chain logistics to preserve food quality throughout transit, and advanced packaging materials to increase the shelf life of perishable goods (49). Some potentially interesting new directions to accelerate progress towards SDG2 are provided by a major overhaul of agriculture and food systems (50). The nation diagnostic reports indicate a revived interest in using a food systems approach to meet SDG 2's zero hunger targets. The obesity pandemic is largely responsible for the rising curiosity in food systems (51).

RECOMMENDATIONS:

The intricacies and difficulties of food security and climate change can be tackled through a number of policy suggestions. Governments should pass coordinated policies that tackle climate change and food security at the same time. This strategy can guarantee that food systems are fair and nutrition-sensitive, support sustainable agriculture, and increase resilience to hazards associated with climate change (52).

Understanding how food systems have a significant influence on nutrition highlights how urgent it is to implement sustainable practices in order to assure a healthier and more resilient future for both people and the environment (53). Countries are guided and assisted in tackling these issues by international organizations like the Food and Agriculture Organization (54).

We can turn our food systems into robust, just, and sustainable sources of nutrition by adopting sustainable agricultural practices, cutting down on food loss and waste, strengthening global supply chains, using digital technologies, passing progressive regulations, and encouraging association on a global basis (55).

CONCLUSION

Pakistan's long battle with food waste and nutrition insecurity reveals a major contradiction: despite

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

being an agriculture-based economy, the country continues to suffer from widespread hunger, malnutrition, and inefficient food management. Despite adequate food production, significant amounts are lost or squandered across the supply chain from fields to consumers while a large section of the population continues to lack key nutrients. This double burden is exacerbated by socioeconomic disparities, poor food diversity, insufficient infrastructure, and the rising effects of climate change.

Food waste has far-reaching repercussions, including lost nutrients, missed opportunity to address hunger, and increased demand on natural resources. Malnutrition not only harms public health, but it also has long-term economic consequences by reducing productivity and raising healthcare costs. Although Pakistan has developed important policy frameworks such as the National Food Security Policy (2018) and provincial agriculture programs, implementation gaps remain a significant impediment. The implementation of sustainable agriculture, food redistribution schemes, and novel technologies shows promise but these solutions demand greater coordination among government institutions, business actors, and civil society.

Addressing food waste must be an essential strategy in the larger endeavor to improve nutrition security. Pakistan may make tangible progress toward attaining the Sustainable Development Goals by adopting a holistic and inclusive approach, particularly SDG 2 (Zero Hunger) and SDG 12 (Responsible Consumption and Production). Transforming this hidden crisis into an opportunity will necessitate political will, cross-sector collaboration, and a dedication to creating a more egalitarian and resilient food system for all.

REFERENCES:

Palmisano GO, Bottalico F, El Bilali H, Cardone G, Capone R. Food losses and waste in the context of sustainable food and nutrition security. InFood security and nutrition 2021 Jan 1 (pp. 235-255). Academic Press. https://www.sciencedirect.com/science/article/abs/pii/B9780128205211000101#preview-section-cited-by

WFP. Pakistan food security bulletin. Fighting hunger worldwide. https://scholar.google.com/scholar_lookup?title=Pakistan+food+security+bulletin.+Fighting+hunger+worldwide&publication_year=2018

Berry EM, Dernini S, Burlingame B, Meybeck A, Conforti P. Food security and sustainability: can one exist without the other?. Public health nutrition. 2015 Sep;18(13):2293-302.

Ahmad M, Farooq U. The state of food security in Pakistan: Future challenges and coping strategies. The Pakistan Development Review. 2010 Dec 1:903-23. https://www.jstor.org/stable/41428696

Ahmad M, Farooq U. The state of food security in Pakistan: Future challenges and coping strategies. The Pakistan Development Review. 2010 Dec 1:903-23. http://jstor.org/stable/41428696

Brennan A, Browne S. Food waste and nutrition quality in the context of public health: A scoping review. International journal of environmental research and public health. 2021 May 18;18(10):5379. https://www.mdpi.com/1660-4601/18/10/5379

Amjad M, Akbar M. Role of socioeconomic factors to overcome micronutrient malnutrition in Pakistan: Application of partial proportional odds model. Progr Nutr 2020; 22(3): e2020021. DOI: https://doi.org/10.23751/pn.v22i3.8404

Ahmed F. Understanding food insecurity experiences, dietary perceptions, and practices in the households facing hunger and malnutrition in Rajanpur District, Punjab Pakistan. Pak Perspect 2019; 24(2): 115-33.

Khalid S, Naseer A, Shahid M, Shah GM, Ullah MI, Waqar A, Abbas T, Imran M, Rehman F. Assessment of nutritional loss with food waste and factors governing this waste at household level in Pakistan. Journal of cleaner production. 2019 Jan 1;206:1015- 24. https://www.sciencedirect.com/science/article/abs/pii/S0959652618328610

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Aamir M, Ahmad H, Javaid Q, Hasan SM. Waste not, want not: a case study on food waste in restaurants of Lahore, Pakistan. Journal of Food Products Marketing. 2018 Jul 4;24(5):591-610. https://www.tandfonline.com/doi/abs/10.1080/10454446.2018.1472695

Forbes H. Food waste index report 2021. https://www.sidalc.net/search/Record/oai:wedocs.unep.org:20.500.11822-35280/Description

Pakistan UN. National Nutrition Survey 2018—Key Findings Report. Islamabad: UNICEF Pakistan. 2018. UNICEF Pakistan. National Nutrition Survey 2018—Key Findings Report; UNICEF: Lahore, Pakistan, 2018. [Google Scholar]

Imteaz A. Follow up on food waste quantification in Swedish public catering.

Imteaz, A. Follow up on food waste quantification in Swedish public catering. Master's Thesis, Swedish University of Agricultural Sciences, Uppsala, Sweden, 2022. [Google Scholar]

Aamir M, Ahmad H, Javaid Q, Hasan SM. Waste not, want not: a case study on food waste in restaurants of Lahore, Pakistan. Journal of Food Products Marketing. 2018 Jul 4;24(5):591-610. https://www.tandfonline.com/doi/abs/10.1080/10454446.2018.1472695

Aamir M, Ahmad H, Javaid Q, Hasan SM. Waste not, want not: a case study on food waste in restaurants of Lahore, Pakistan. Journal of Food Products Marketing. 2018 Jul 4;24(5):591-610. https://www.tandfonline.com/doi/abs/10.1080/10454446.2018.1472695

Afzal N, Basit A, Daniel A, Ilyas N, Imran A, Awan ZA, Papargyropoulou E, Stringer LC, Hashem M, Alamri S, Bashir MA. Quantifying food waste in the hospitality sector and exploring Its underlying reasons—a case study of Lahore, Pakistan. Sustainability. 2022 Jun 6;14(11):6914. https://www.mdpi.com/2071-1050/14/11/6914

Mauricio Reis, 'Food Insecurity and the Relationship between Household Income and Children's Health and Nutrition in Brazil', Health Economics, 21:4 (2012), 405-427.

Cesar G Victora, Adair Linda, Fall Caroline, C Hallal Pedro, Martorell Reynaldo, Richter Linda, and Harshpal Singh Sachdev, 'Maternal and Child Undernutrition: Consequences for Adult Health and Human Capital,' The Lancet, 371:9609 (2008): 340-57. Also see, Grantham-McGregor S. Yin Bun Cheung, Santiago Cueto, Paul Glewwe, Linda Richter, Barbara Strupp and the International Child Development Steering Group, 'Developmental Potential in the First 5 Years for Children in Developing Countries,' Lancet (London, England) 369:9555 (2007), 60-70. https://doi.org/10.1016/S0140-6736(07)60032-4, accessed 16 May 2019.

Evita Hanie Pangaribowo, Nicolas Gerber and Maximo A. Torero, 'Food and Nutrition Security Indicators: A Review,' SSRN Electronic Journal, 2013

World Bank, Revisiting the Poverty Debate in Pakistan: Forensics and the Way Forward, Washington, DC: World Bank, 2016.

Malik Sohail Jehangir, Hina Nazli, and Edward Whitney, 'Food Consumption Patterns and Implications for Poverty Reduction in Pakistan', The Pakistan Development Review, 54:4 (2015), 651-69.

Jed Friedman, Seo Yeon Hong and Xiaohui Hou, Impact of the Food Price Crisis on Consumption and Caloric Availability in Pakistan: Evidence from Repeated Cross-Sectional and Panel Data (Washington: World Bank, 2011).

Hameed A, Padda IU, Karim S. Spatial analysis of food and nutrition security in Pakistan: a holistic pathway towards zero hunger policies. GeoJournal. 2023 Jun;88(3):2563-85. https://link.springer.com/article/10.1007/s10708-022-10762-w

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Fazal S, Valdettaro PM, Friedman J, Basquin C, Pietzsch S. Towards improved food and nutrition security in Sindh Province, Pakistan. IDS Bulletin. 2013 May;44(3):21-30. https://onlinelibrary.wiley.com/doi/abs/10.1111/1759-5436.12027

Crahay P. (2010). The Threats of Climate Change on Under-nutrition. A neglected issue that requires further analysis and urgent actions. In: United Nations Standing Committee on Nutrition (SCN), SCN News 38 2010: Climate change – food and nutrition security implications. SCN, Geneva.

Conrad Z, Blackstone NT. Identifying the links between consumer food waste, nutrition, and environmental sustainability: a narrative review. Nutrition Reviews. 2021 Mar 1;79(3):301-14. https://academic.oup.com/nutritionreviews/article-abstract/79/3/301/5862610?redirectedFrom=PDF

Khalid S, Naseer A, Shahid M, Shah GM, Ullah MI, Waqar A, Abbas T, Imran M, Rehman F. Assessment of nutritional loss with food waste and factors governing this waste at household level in Pakistan. Journal of cleaner production. 2019 Jan 1;206:1015- 24. https://www.sciencedirect.com/science/article/abs/pii/S0959652618328610.

do Canto, N.R.; Grunert, K.G.; De Barcellos, M.D. Circular Food Behaviors: A Literature Review. Sustainability 2021, 13, 1872. [Google Scholar] [CrossRef]

Corrado, S.; Caldeira, C.; Eriksson, M.; Hanssen, O.J.; Hauser, H.E.; van Holsteijn, F.; Liu, G.; Östergren, K.; Parry, A.; Secondi, L.; et al. Food waste accounting methodologies: Challenges, opportunities, and further advancements. Glob. Food Secur. 2019, 20, 93–100. [Google Scholar] [CrossRef] https://link.springer.com/article/10.1186/s42506-024-00168-6

United Nations Environment Programme. Food Waste Index Report 2021. Nairobi: United Nations Environment Programme; 2021. Available from: https://www.unep.org/resources/report/unep-food-waste-index-report-2021. Accessed 15 Mar 2021.

High-Level Panel of Experts (HLPE). Food losses and waste in the context of sustainable food systems: a report by the high level panel of experts on food security and nutrition of the committee on World Food Security. Rome; 2014. Available from: http://www.fao.org/3/a-i3901e.pdf. Accessed 4 Jan 2021

FAO. The state of food and agriculture 2013: food system for better nutrition. Rome: FAO; 2013. Available from: https://www.fao.org/4/i3300e/i3300e00.htm. Accessed 17 Aug 2020.

FAO. The state of food and agriculture: moving forward on food loss and waste reduction. Rome: FAO; 2019. Available from: https://www.fao.org/3/CA6030EN/CA6030EN.pdf. Accessed 16 Oct 2020.

Diana R, Martianto D, Baliwati YF, Sukandar D, Hendriadi A. Determinants of household food waste in Southeast Asia: a systematic review. J Hunger Environ Nutr. 2023. https://doi.org/10.1080/19320248.2023.2174060.

Yu Y, Jaenicke EC. Estimating food waste as household production inefficiency. Am J Agric Econ. 2020;102(2):525–47. https://doi.org/10.1002/ajae.12036.

GOP. (2020). Economic survey of Pakistan 2018–19. The Ministry of Finance.

Mahmood, A., & Sultan, M. (2006). National Institute of Population Studies (NIPS)(Pakistan), and Macro International Inc. Pakistan Demographic and Health Survey, 7, 123–145.

GOP, & UNICEF. (2019). National nutrition survey 2018: Key findings report. UNICEF Pakistan.

WFP. (2018). Pakistan food security bulletin. Fighting HUNGER WORLDWide. World Food Programme.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Berry EM, Dernini S, Burlingame B, Meybeck A, Conforti P. Food security and sustainability: can one exist without the other?. Public health nutrition. 2015 Sep;18(13):2293-302.

GOP. (2021). Economic survey of Pakistan 2020–21. The Ministry of Finance.

Hameed A, Padda IU, Karim S. Spatial analysis of food and nutrition security in Pakistan: a holistic pathway towards zero hunger policies. GeoJournal. 2023 Jun;88(3):2563-85. https://link.springer.com/article/10.1007/s10708-022-10762-w

Shekar, M., Heaver, R., & Lee, Y. K. (2006). Repositioning nutrition as central to development: A strategy for large scale action. World Bank Publications

Fazal S, Valdettaro PM, Friedman J, Basquin C, Pietzsch S. Towards improved food and nutrition security in Sindh Province, Pakistan. IDS Bulletin. 2013 May;44(3):21-30. http://onlinelibrary.wiley.com/doi/abs/10.1111/1759-5436.12027 https://www.nipapeshawar.gov.pk/KJPPM/PDF/CIP/P30.pdf

Milani-Bonab A, Kalantari N, Takian A, Haghighian-Roudsari A. Food and agriculture, nutrition and health related policy integration in Iran's national development agenda and their alignment with the sustainable development goals. Environment, Development and Sustainability. 2023 Apr;25(4):3353-78. https://link.springer.com/article/10.1007/s10668- 022-02171-3

Mourad M. Recycling, recovering and preventing "food waste": Competing solutions for food systems sustainability in the United States and France. Journal of Cleaner Production. 2016 Jul 10;126:461-77. https://www.sciencedirect.com/science/article/abs/pii/S0959652616301536

Abbass K, Qasim MZ, Song H, Murshed M, Mahmood H, Younis I. A review of the global climate change impacts, adaptation, and sustainable mitigation measures. Environmental Science and Pollution Research. 29: 42539-42559 (2022)

Cane M, Parra C. Digital platforms: mapping the territory of new technologies to fight food waste. British Food Journal, 122(5): 1647-1669 (2020)

Food Systems and Diets: Facing the Challenges of the 21st Century

Global Panel on Agriculture and Food Systems for Nutrition, London, UK (2016) Available from: http://glopan.org/sites/default/files/ForesightReport.pdf https://www.sciencedirect.com/science/article/pii/S2211912420300766

Islam MS, Kieu E. Tackling regional climate change impacts and food security issues: A critical analysis across ASEAN, PIF, and SAARC. Sustainability. 2020 Jan 24;12(3):883.

1 Roberts DP, Mattoo AK. Sustainable agriculture-enhancing environmental benefits, food nutritional quality and building crop resilience to abiotic and biotic stresses. Agriculture. 8(1): 8 (2018)

2 Din MSU, Mubeen M, Hussain S, Ahmad A, Hussain N, Ali MA, Sabagh AEl, Elsabagh M, Shah GM, Qaisrani SA. World nations priorities on climate change and food security. In Building climate resilience in agriculture (pp. 365-384). Springer (2022).

Iqbal B, Alabbosh KF, Jalal A, Suboktagin S, Elboughdiri N. Sustainable food systems transformation in the face of climate change: strategies, challenges, and policy implications. Food Science and Biotechnology. 2024 Sep 18:1-3. https://link.springer.com/article/10.1007/s10068-024-01712-y.