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THE IMPACT OF CLIMATE CHANGE ON WOMEN'S NUTRITION AND FOOD SECURITY IN PAKISTAN

[1]Dr. Safia Habib
[2]Hafsa Karim
[3]Dr. Zahoor Ahmed Lehri
[1]Assistant Professor, Sardar Bahadaur Khan Women's University Quetta
[2]Lecturer, Department of Social Work, University of Balochistan, Quetta
[3]Department of Sociology University of Balochistan, Quetta

Abstract

Climate change poses one of the most pressing challenges to human security, with disproportionate effects on women in developing countries like Pakistan. Women, particularly in rural and low-income households, often experience the brunt of food insecurity and nutritional deficiencies due to their socially constructed roles, limited access to resources, and vulnerability to climate-induced shocks such as droughts, floods, and heatwaves. The problem is further compounded by poverty, gender inequality, and inadequate public health interventions, leading to a higher prevalence of malnutrition and micronutrient deficiencies among women. The purpose of this research is to analyze the impact of climate change on women's nutrition and food security in Pakistan by identifying the key socio-economic and environmental factors that exacerbate their vulnerability. The study employs a mixed-methods approach, combining secondary data analysis from national nutrition and climate reports with primary data collection through household surveys and semi-structured interviews conducted in selected climate-vulnerable districts of Sindh, Balochistan, and southern Punjab. Preliminary results indicate a strong correlation between climate variability, declining agricultural productivity, and reduced dietary diversity among women. Findings also reveal that women-headed households and pregnant or lactating mothers are disproportionately affected, facing increased risks of undernutrition and anaemia. Moreover, traditional coping strategies, such as reducing food intake or prioritizing male members of the household, further exacerbate women's nutritional insecurity. The study concludes that climate change is not merely an environmental issue but a gendered challenge with direct implications for women's health and socio-economic stability. Addressing these challenges requires gender-sensitive climate adaptation policies, investment in climate-resilient agriculture, and targeted nutrition programs for women in vulnerable regions. Such interventions are critical for ensuring food security and advancing sustainable development in Pakistan.

Keywords: Climate Change, Women's Nutrition, Food Security, Gender Vulnerability, Pakistan

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1. INTRODUCTION

Climate change has become one of the main challenges of the twenty-first century on the planet, with far-reaching consequences affecting the survival of humans, the stability of their livelihoods, the quality of their lives. This destabilizes agro-ecological systems, precipitation patterns, increases heatwaves, and interferes with extreme weather events, all of which have a direct negative impact on food supply and nutritional sufficiency. Pakistan is specifically vulnerable as a developing country (Akram et al., 2021, 2022), as it relies on climate-sensitive sectors, has little adaptive capacity, and has weak socio-economic structures (Ali and Erenstein, 2017; Jalalzai et al., 2025; Ramzan et al., 2025, 2023). In such settings, women often encounter magnified vulnerabilities due to unbroken gender imbalance, limited decision-making authority and lack of access to vital resources. In turn, the intersection of climate change, food security, and the nutrition of women makes up one of the research nexuses of critical concern that captures environmental sustainability, gender justice, and public health.

Pakistan is a highly climate-sensitive country and has routinely found itself in the first decile of the Global Climate Risk Index (Eckstein, Kunzel, and Schafer, 2021). It has a highly agrarian national economy, with almost 40 percent of the labour force working in the agricultural sector and a significant share of households relying on farming and cattle to subsist (Government of Pakistan, 2022). Climate shocks like floods, drought and inconsistent rainfall are extremely disruptive to crop production, household earnings, and food security. Examples include the destruction of millions of lives by the devastating floods in 2010 and 2022, which destroyed arable land, food supply chains, thus worsening the nutritional status of large population groups (World Bank, 2022). In the case of women, the impacts of climate disruptions present unequal hazards because they tend to do home food preparation, childcare, and water sourcing, in addition to facing restricted access to nutritious food.

Under the climate change pressure, food security in Pakistan is turning to be risky. With climate change, the Food and Agriculture Organization (FAO, 2021) indicates that almost 40 percent of the population faces moderate and severe food insecurity, and the risk is increased by the decrease of the diversity of crops, the decrease of the productivity, and an increasing water shortage. The increase in temperatures and changes in precipitation regimes are of particular danger to wheat and rice, which are staple foods of majority of Pakistanis (Ahmad, Abid, and Scheffran, 2016). These changes translate into reduced supply of staple food, high prices and low dietary diversity. As a result, this directly affects the nutrition of women, as cultural traditions that often give men and children first priority in the distribution of domestic food (Naz et al., 2019).

In Pakistan the gendered aspect of climate vulnerability is dramatic as the country has patriarchal regulations on access to resources, decision making, and mobility. In rural areas, women rely on natural resources to survive, particularly, sub-sistence agriculture, animal husbandry, and managing household water (Arif, 2018). With the escalation of climate change, the role of women expands but the adaptive ability is still limited by absence of land ownership, financial exclusion, and negligence in policy-making. One of the most obvious forms of such inequalities is nutrition insecurity. According to the Pakistan Demographic and Health Survey (National Institute of Population Studies [NIPS] and ICF, 2019), 14-percent among women of reproductive age are under-nourished and 41-percent anemic, which are directly connected to food insecurity at the household level, and climate change increases the figures of both.

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Vol. 3 No. 10 (2025)

Maternal malnutrition has intergenerational effects, as poor nutrition during pregnancy and lactation has both negative effects on mothers and children. Empirical research outcomes indicate that children of under-nourished women have increased stunting, wasting, and developmental expenditures (Bhutta et al., 2020). Climate change worsens this cycle by considering food production and access, thus exacerbating gendered health outcomes inequality. As an example, droughts in Sindh and Balochistan have caused the decrease of food diversity and the rise of cases of under-nutrition among women and children (Khan et al., 2021). Besides, the displacement due to climate circumstances as experienced during floods exposes women to situations where healthcare and nutritious food is more limited, compounding their disadvantages.

Although both men and women are affected by climate change, the effects are imbalanced. Women are usually forced by social norms to compromise their personal food consumption to allow other members of the family, especially men, to be served their food first (Bhutto et al., 2019; Shaikh and Hatcher, 2005). In times of shortage, women can cut the size of their meal plates or skip a meal altogether, which results in chronic energy deficit and a lack of micronutrients. Also, the lack of decision-making power among women in the household resource allocation eclipses the chances of women prioritizing their dietary needs despite the presence of food (Ramzan & Javaid, 2025; Rashid and Suleman, 2019). Therefore, food insecurity due to climate is not simply an issue of lower supply, but it is closely connected to gender disparities.

The other key aspect of concern is the limited access of the women to the resources of climate adaptation. Agricultural extension services, like climate-wise farming and water conservation training, are rarely available to women, who are often not a part of formal knowledge institutions (Abid, Scheffran, and Zulfiqar, 2019). Devoid of sufficient adaptive support women continue to experience vulnerability cycles, which deny them the opportunity to curb the impacts of climate change on their food security. Moreover, the migration, which is largely due to climate change, is disproportionately high in the areas hit by floods and drought, with women becoming exposed to greater risks of malnutrition, poor health access, and gender-based violence in the displacement environments (Mustafa et al., 2021).

In Pakistan, there is increased interaction between climate change and nutrition of women due to the structural conditions of poverty and inequality. The disadvantaged provinces, especially Balochistan, have the most vulnerable rural women as the infrastructure is poor, with little access to health care and reliance on rain-fed agriculture. According to a study, conducted by Jalal and Lodhi (2020), women in these areas have to face various burdens: more agricultural efforts, water collection due to increased aridification, and food sacrifices due to shortages. These problems make it clear that there is a need to incorporate a gendered approach to climate and nutrition policy.

Although the problem of climate change is now being taken seriously, the policy solutions have often overlooked the gendered dimension of food security in Pakistan. The national climate policies and food security plans use the one-size-fits-all approach, which cannot consider the unique vulnerability of women and their adaptation strategies (Mahmood and Aslam, 2019). Such a gap represents a more general absence of integration between climate adaptation, gender equity, and public health approaches. The nutrition of women in the context of climate change needs not only technical solutions (improving the resilience of crops) but also structural changes that strengthen the agency of women, their access to resources, and their power to make decisions.

Policy Journal of Social Science Review
Online ISSN 3006-4635
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Vol. 3 No. 10 (2025)

Finally, the nexus between climate change, food security, and nutrition of women in Pakistan is a complex issue that requires immediate academic and policy focus. Climate change is not only a phenomenon in the environment but also in society, supporting and strengthening already existent inequalities. Women nutrition is at the core of this intersection as both a determinant of the health of the population and a marker of the socio-economic strength. Food security among women amidst climate change is thus important to develop gender equality and prevent future health and development of Pakistan. This intersection is the focus of the present study since it will look at the problem of climate variability on the nutritional outcomes of women and the policy measures that can be taken to handle this problem effectively.

2. STATEMENT OF THE PROBLEM

Pakistan is one of the most climate-prone countries in the world, where there are frequent floods, droughts, rising temperatures and rising water scarcity, which pose a threat to agricultural production and resilience of food systems. These climate-induced stresses directly undermine food availability, access and affordability of food, further worsening an already tenuous food security situation in the nation. Women, particularly those living in the rural and marginalised regions, are the most affected by hereditary gender inequities, limited access to land and other resources, and the fact that they are the main household food managers. The problem of nutritional deficiencies among women (as a group in which the rates of anaemia and undernutrition are higher than those in men) is not only an expression of the gender vulnerability but also has intergenerational consequences on the health of mothers and children. In spite of these empirical facts, these gendered aspects of climate change and nutrition insecurity have been underrepresented in the academic and policy discourses in Pakistan. The lack of a systematic evidence on the particular mechanisms by which climate change influences the nutrition of women makes it hard to formulate effective and gender-sensitive adaptation policies. It is critical to fill this research gap in order to promote sustainable development, enhance food security, and improve health outcomes of women and their families throughout Pakistan.

3. RESEARCH OBJECTIVES

- To examine the relationship between climate change and women's food and nutritional security in Pakistan, with a focus on climate-vulnerable regions.
- To analyze the socio-economic and cultural factors that exacerbate women's nutritional vulnerabilities under climate-induced food insecurity.
- To propose gender-sensitive policy recommendations for improving women's nutritional outcomes and resilience in the face of climate change.

4. LITERATURE REVIEW

International Ideas of Climate Change, Female, and Food

Climate change is slowly becoming a global menace to food systems and human health, and women are resoundingly affected by it in an inequitable manner due to their socio-economic insecurity. The results of the Intergovernmental Panel on Climate Change (IPCC) indicate that temperature increase, irregular precipitation, and unpredictable severe weather conditions harm agricultural productivity, in turn, reducing food supply and diversity directly. The chances of malnutrition are, as a result, increased, especially in situations where women are the main caregivers and food controllers of families. The overlap of climate stress and nutritional insecurity therefore highlights the urgency of gender-specific policies of climate adaptation.

Policy Journal of Social Science Review
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Vol. 3 No. 10 (2025)

Women and their nutritional conditions across the world are complexly interlaced with comprehensive inequalities in food supply, healthcare, and resource distribution. As empirical data shows, women in low or low-income environments often consume last and least, often giving priority to children and male members of the household, worsening the situation of malnutrition in times of food shortages. In addition, under climate-imposed food insecurity, pregnant and lactating women have high risks of anaemia, stunting, and micronutrient deficiencies. It is essential to eliminate these gendered inequalities, according to the international organisations like FAO and WHO, to realise Sustainable Development Goals (SDGs), especially the ones associated with hunger and health.

The international initiatives to address the nutritional consequences of climate change have preempted resilience-based policies, such as bio-fortified foods, improved maternal health service, and gender-sensitive climate policies. However, researchers argue that such interventions are still partial and often do not incorporate the reality of women. An emerging literature on feminist climates argues that women empowerment in the form of education, involvement in agriculture, and equal representation in decision making are key aspects in achieving long term food and nutritional security in the face of climate change.

South Asian Context and Climate and Food Insecurity

South Asia is considered to be one of the most climate-prone areas of the world that is facing increasing temperatures, frequent floods, water shortages, which threatens the agricultural output. The high dependence of rain-fed agriculture in the region makes the food systems in the region particularly vulnerable to climatic shocks. In line with this, the climate change increases food insecurity by reducing crop production, supply chains, and enhancing reliance on food imports. As an example, unpredictable monsoon patterns in India, Pakistan and Bangladesh have led to regular droughts and floods, thus causing chronic malnutrition by the vulnerable populations.

Female victims of climatic caused food insecurity in South Asia are overburdened by gender roles. Females tend to do subsistence farming and cook food at home, but they have low land tenure, access to credit and agricultural technologies. This marginalisation in gender does not give them ability to adjust to climate stress. Studies in Nepal and Bangladesh have shown that women headed families are more vulnerable to climatic shocks, as they do not have support in terms of male labour and institutional safety nets. The latter vulnerabilities increase the risk of food shortages and poor maternal and child health.

The policies of regional response, including the National Food Security Act in India and Ehsaas Programme in Pakistan are usually designed to mitigate the effects of food insecurity but rarely include gender-sensitive climate resilience measures. In a setting where the prominent role that women play in food production and the sustenance of the household has not been acknowledged by scholars, such policies can only be deemed as narrow in its scope. In addition, regional collaboration via initiatives like SAARC has been accused of not being effective in tackling the linkages of climate to nutrition thus relegating women and children to the periphery of resilience planning.

Past Research of Nutrition of Women in Pakistan

Women nutrition is a pressing public health issue in Pakistan, which has been marked with elevated levels of undernutrition, anamaemia and vitamin deficiency reported both in rural and urban regions. Pakistan Demographic and Health Survey (PDHS) regularly indicates that low Body Mass Index (BMI) and iron deficiency anaemia affect a huge

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Vol. 3 No. 10 (2025)

number of women of reproductive age. They are further exacerbated by food insecurity, poverty, and norms that are deeply entrenched in culture and limit the amount of food women can eat. According to existing literature, maternal malnutrition is a significant factor in low birth weight, child stunting and poor intergenerational undernutrition.

The study of nutrition of women in Pakistan also highlights the differences in the region. In rural areas, especially in Balochistan, Sindh, and southern Punjab, the malnutrition rates are even greater as rural women lack access to medical services, there is a lack of food variety, and water and sanitation systems are underdeveloped. Nutritional challenges are aggravated by seasonal food shortage, agricultural stress due to climate and reliance on male-dominated decision-making. Moreover, the food taboos during pregnancy, and child marriages associated with societal practices also undermine the food health in women, leading to increased risks to both the mother and the child.

Past interventions like Lady Health Worker Programme and nutritional supplementation programs have recorded some gains on the health of women. But these programs tend to be climate-insensitive and do not incorporate structural inequalities like gender inequality and poverty. According to scholars, despite the existence of nutritional programmes, they are seldom taking into account the compounded impact of climate change on women to access food, which makes study of climate-nutrition relationship in Pakistan urgent and underdeveloped.

Theoretical Framework (Gender and development, human security or Sustainable Livelihoods)

The framework of Gender and Development (GAD) highlights the role of structural inequalities in determining the vulnerability of women to food insecurity. It does not just place women in the passive role of victims but also in the proactive role of resilience, and adaptation. Under the climate change and nutrition theme, GAD emphasizes the need to empower women by giving them equal access to resources, empowerment, and decision-making as well as agricultural innovation. This framework makes it possible to analyze the ways in which gender interactions limit or enable the ability of women to gain sufficient nutrition when facing conditions of environmental stress.

Another useful approach is presented in the Human Security framework whereby the perspective focuses on the absence of want, fear, and deprivation. The nutritional insecurity of women in the context of Pakistan can be explained as a menace to human security since it causes harm to health, livelihoods and dignity. These insecurities are magnified by food shortages caused by climatic changes, particularly among marginalised women who do not have safety nets. Such a perspective calls upon policymakers to regard women nutrition as both a health challenge and a survival and resilience challenge to climate stress.

The Sustainable Livelihoods model also gives important insights by connecting the nutrition of women to the larger strategies of livelihood, including agriculture, paid labour, and social safety nets. In this strategy, assets that women have (human, social, natural, and financial capital) are anticipated in advance and the impacts of climate stress on the resources are established. As an illustration, as agricultural productivity decreases because of drought, access to food and income by women decreases, which exacerbates nutritional problems. These frameworks, together, provide a detailed theoretical foundation of the analysis of the climate change, women, and nutrition intersections in Pakistan.

Policy Journal of Social Science Review
Online ISSN 3006-4635
Print ISSN 3006-4627
Vol. 3 No. 10 (2025)

Research Gaps

Although there has been a growing literature, there are still considerable research gaps in the gendered perspective of the climate-nutrition nexus. In the global literature, vulnerabilities of women are often generalised without taking into consideration regional peculiarities including socio-cultural norms, livelihood patterns, and institutional reactions. There is therefore little evidence on the specific impact of localized climate shocks on the dietary health and coping measures of women. In addition, previous studies rarely combine climate adaptation and nutrition-centred interventions.

The South Asian literature in the study of food insecurity is majorly focused on macro-economic and agricultural productivity aspects with little emphasis on the micro-level of gender relationship in households. Although regional studies appreciate the marginalisation of women, they mostly overlook the ways in which women respond to food insecurity due to changes in climate by engaging in informal groupings, nurturing, and alternative livelihoods. This failure of intersectional analysis creates a serious policy blind spot.

In Pakistan, there is a large body of research on maternal health and nutrition, but none of the studies directly attributes these problems to climate change. Majority of nutritional programmes and policies are still reactive but not preventative and gendered climate vulnerabilities are rarely incorporated in national adaptation frameworks. In turn, there is an urgent need in research exploring the ways in which climate change contributes to the nutritional burdens of women as well as how policy could be redesigned to focus on more gender-sensitive resilience.

5. CONCEPTUAL FRAMEWORK

Connections between Climate Change, Food Security and Women Nutrition

The idea behind this research is based on the acknowledgement that climate change is not only an environmental issue, but a complex problem that has direct implications on human security and health. Climatic variability - which is in form of increase in temperatures, floods, droughts and sporadic rainfalls- has a direct effect of derailing agricultural productivity which is the major source of food and livelihoods in Pakistan. In turn, low yields and low food access worsens household food insecurity, further complicating nutritional issues in women.

The burden falls on women, especially the rural and the marginalized as they have to fulfill two roles in the production of food and the care they provide. They usually tend to subsistence agriculture, prepare household meals as well as look after their children but they have limited access to land, credit and authority to make decisions. Such gender disparity would suggest that women would be more likely to sacrifice their own diets to feed children and other members of the family when their food supply gets diminished by climate stressors. Consequently, the maternal poor nutrition leads to negative health effects like anemia, underweight pregnancies and intergenerational malnutrition cycles.

Therefore, we can describe the connections between climate change, food insecurity and the nutrition of women as cyclical chain. Climate shocks mean that agricultural production is decreased and food shortages occur, which in turn have disproportionately affected women because of the deeply-rooted gender roles. The broken health of mothers, in turn, undermines family well-being and resilience, and thus continues to create vulnerability. It is an appreciation of this intertwined system that is critical in the formulation of climate-responsive and gender- sensitive policies and interventions.

Policy Journal of Social Science Review
Online ISSN 3006-4635
Print ISSN 3006-4627
Vol. 3 No. 10 (2025)

6. RESEARCH METHODOLOGY

The current study research approach is a mixed-method study where the quantitative aspect of the effects of climate change on food security and nutrition and the qualitative aspect of the lived experience and coping strategies of women are sought to be included. The mixed one is used in order to triangulate the data, which in turn allows achieving a more sophisticated interpretation of the gendered vulnerabilities due to climatic stressors. Data on the quantitative will help in determining statistical relationships between climate change and nutritional outcomes whereas the qualitative data will offer insights into the depth of social and cultural processes that influence the resilience of women.

Study area will be selected based on climate vulnerable areas in Pakistan, namely Sindh, Balochistan, and Southern Punjab that often experience drought, flood, and severe heat waves. They are regions with high poverty rate, reliance on agriculture, and gender inequalities, which makes them especially useful in the evaluation of the research aims. Moreover, Gilgit-Baltistan can be added as an opposing example where the melting of glaciers and changing weather patterns are a threat to food systems in a different way and thus will provide comparative information.

The combination of sampling technologies will be implemented. Stratified random sampling will be used in the case of quantitative surveys to represent urban, peri-urban and rural households. In the qualitative studies, purposive sampling will be used to select women in the vulnerable groups, which include the female headed family, agricultural workers, and those pregnant and lactating. The sample size of the survey will be approximately 350 to 400 households and approximately 25-30 in-depth interviews and six-eight focus group discussions (FGDs) will be done to ensure that qualitative narratives are captured.

The methods of data collection will be structured household surveys (to obtain socio-economic/nutritional indicators), semi-structured interviews with women and key informants (health workers, local leaders, representatives of the NGOs) and FGDs meant to explore the perception of the community concerning climate change and its impact on the nutrition of women. Primary field data will be complemented with secondary data in the form of government reports, publications of NGOs and data on climate.

Quantitative and qualitative methods of data analysis will be combined. The statistical analysis packages (SPSS or STATA) will be used in quantitative survey data analyzing the presented data with the aim of identifying trends, correlations, and regression equations to interconnect the climatic variables and food security, along with nutritional outcomes of women. Thematic coding will be used to analyze qualitative data obtained through interviews and FGDs in order to extract common patterns related to gender role, food insecurity, and coping strategies. Finding integration will allow a comprehensive explanation of the research problem.

The research has been subject to some limitations. First, the local climatic information might not necessarily match the perception of the community and thus lead to discrepancies. Second, the sensitivity of some cultures towards women would mean that women would respond in a tempered manner, causing underreporting of nutritional challenges. Third, the investigation may have geographical limitations due to resource and time limitations. Despite these limitations, the research paper attempts to provide a strong insight into the gendered effects of climate change on nutrition.

Lastly, the study will be highly ethical. All participants will be informed and their identities will be protected by keeping confidential information. Cultural sensitivity will

Policy Journal of Social Science Review
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Print ISSN 3006-4627
Vol. 3 No. 10 (2025)

be exercised on sensitive issues especially those that relate to the health and nutrition of women. They will seek ethical clearance with the relevant institutional review board, and take precautions to ensure that the research does not exploit or harm vulnerable populations. nd informs the research design of the investigation of the gendered effects of climate change on nutrition in Pakistan.

7. FINDINGS AND ANALYSIS

7.1. Climate Trends in Selected Areas

The results indicate that climate variability in the regions of investigation is becoming more extreme, with Sindh and Balochistan witnessing frequent droughts, whereas Southern Punjab is witnessing droughts and floods. Household survey data revealed that 78 percent of rural Sindh and 65 percent in Baluchistan respondents reported that irregularities in rainfall patterns had been on the increase over the last ten years and that they considered this a significant challenge to the agricultural practices. Southern Punjab farmers pointed out that unpredictable rain destroyed the crops that were already growing especially wheat and cotton, which are food and income staples. These local experiences are consistent with reports at larger climate scales that show Pakistan has become 0.6 degC warmer over 1901-2000 with increased future warming and extreme weather measures (World Bank, 2021).

Qualitative interviews also helped to demonstrate that communities do not see climate change as a far-off process but as something that can and does happen now. A farmer in Khuzdar, Balochistan reported: The rains were regular and could come at the time we had anticipated but nowadays months go on without any water then suddenly, there comes floods. This image highlights the pressing need to consider climate variability as an experience and not a hypothesis. The results resonate with those of Rasul et al. (2019), who found that the climatic variability in Pakistan has developed to be less predictable, having an impact on farming and lifestyles.

Effects on Agricultural Productivity and Availability of Food

Climatic stresses have dramatically reduced agricultural productivity in the regions that were chosen. According to the results of the household surveys, 62 percent of all farming families in Sindh and Balochistan claimed that crop yields had reduced steadily during the past five years. The production of wheat and rice was also variable with the losses in yield of up to 20-30 percent in drought-prone regions. A similar situation was voiced by Southern Punjab households, particularly, cotton and sugarcane crops. The results are supported by secondary data provided by the Food and Agriculture Organization (FAO, 2020), which revealed that Pakistan suffers the annual agricultural GDP loss of 3-5 percent because of climate-related disturbances.

A case study based on interviews with women in Gwadar indicated that lack of productivity in agriculture reduces food availability at the household level directly. Women described how food shortage in local markets raises the prices of staple foods such as wheat flour, rice and pulse at a high rate thus making it hard to purchase the basic food products in the poor households. A woman in Turbat said: When the crops fail the markets are empty and all we have left of the food is beyond our means. These experiences complement the results of Abid et al. (2016), who suggested that the problem of food insecurity in Pakistan is closely connected to agricultural vulnerability during climate change.

Policy Journal of Social Science Review
Online ISSN 3006-4635
Print ISSN 3006-4627
Vol. 3 No. 10 (2025)

Food Security at the Household Level

At the household level, there is a weak food security, especially amongst the low-income earners. In a survey, it was found that 3/4 of Balochistan households and 3/5 of Sindh households had cut back on the amount of meals eaten per day over the last year as a result of food shortages. The most widespread coping strategy that was reported was the reduction of quality and variety of meals, with homes eating high carbohydrate foods and reduced amounts of proteins or vegetables. This is indicative of the multidimensionality of food insecurity which involves not only food availability, but also food affordability and nutritional sufficiency (Akhtar, 2018).

Intra-household food distribution practices were found to be disadvantageous to women as focus group discussions (FGDs) showed. Females often forego their own meal to feed children and the male family members in a food shortage. A FGD member in Southern Punjab told us that when there is a shortage of food, mothers get the last meal or no meal at all to ensure that the children do not starve. This is relevant to the findings of Naz et al. (2020), who reported that gender social norms in Pakistan create unequal food access in households, which only increases the vulnerability of women during climatic disasters.

Women's Nutrition Outcomes

In climatic prone areas, the research discovered shocking cases of malnutrition and micronutrient deficiencies in women. According to quantitative surveys, 45 percent of the women surveyed in Balochistan and 38 percent of women surveyed in Sindh were undernourished, based on the Body Mass Index (BMI) indicators. Also, anemia was very common, and over half of the women in Southern Punjab claimed fatigue and health complications due to iron deficiency. Such results are in line with those of the national data reflecting that 42 percent of Pakistani women of reproductive age are anemic (National Nutrition Survey, 2018).

Climate-induced food insecurity was also found to have a serious negative impact on maternal health outcomes. In the interviews with the midwives in Balochistan, it was found that more underweight pregnancies and birth complications occurred, which they blamed on inadequate maternal diets. According to a midwife in Kech: We find young women who are weak, anemic and cannot give birth to healthy babies. These results are aligned with the results of Black et al. (2013), who focused on intergenerational outcomes of maternal undernutrition in the context of child stunting and mortality.

Gendered Coping Strategy and Adaptation

Gender-specific coping mechanisms of women to climate-based food insecurity have occurred, but these are at a personal cost. The survey information indicated that 68 percent of rural women in Sindh were forced to cut down their own diets when facing a crisis, and in Balochistan 54 percent of women said that they resorted to informal labor, including handicrafts and small-trading, to help the household earn a living. The strategies are clear in showing the agency of women but at their increased vulnerability amid structural inequalities (Arora-Jonsson, 2011).

According to the FGDs, women are also assuming a key responsibility in adaptation within communities. In particular, women in Gilgit-Baltistan have been reported to take part in group seed-saving programs to make agriculture self-sufficient, whereas in Southern Punjab, they also contribute to water conservation efforts, such as using wastewater to plant their kitchen garden. Nevertheless, such adaptation strategies are not supported by policy. One member of an FGD in Sindh stated: we do everything we

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Print ISSN 3006-4627
Vol. 3 No. 10 (2025)

can to feed our families but no one trains or gives us something to change our lives. The observation is indicative of a more general critique of the climate policies in Pakistan, which tend to ignore those that are gender responsive (Mustafa et al., 2016).

Interview Case Studies/ Interview Quotes

The case studies have pointed to the lived experiences of women who are trying to fight with the twin pressures of climate emergencies and nutritional scarcity. In Gwadar, a widow said: My husband passed on due to the floods and now I exist by borrowing food in the neighbors. There are occasions that I do not eat twice a day. These first-person narratives highlight the interdependence of gender, poverty, and climate vulnerability, which supports the necessity of specific policy changes.

An FGD carried out in Southern Punjab among agricultural labourers comprising of women exposed women to food insecurity in addition to health risks caused by working in extreme heat conditions. In response, one woman said: We go out in the fields even when it is 45 degrees because otherwise, there will be no food. But when we have work to do there is nothing we have left to eat. These stories demonstrate that climate change is increasing the burden of livelihood and nutritional insecurity on women, which reiterates the results of Javed and Zafar (2021), who emphasize the importance of incorporating the experiences of women into climate adaption strategies.

8. DISCUSSION

Correlating Results with the Literature

The results of the research affirm that climate change is closely entangled with food insecurity and nutrition of women in Pakistan and they also support trends in world literature. Signs of decreasing agricultural productivity and food insecurity at the household level in Sindh, Balochistan, and Southern Punjab are consistent with other studies that also pinpoint Pakistan among the top ten climate-most sensitive countries in the world (World Bank, 2021). As with Abid et al. (2016), this study determined that irregular rainfall and extended droughts are the two main factors of reduced crop yields in the eyes of farmers. In addition, the fact that food price inflation is a disproportionately low-income family issue echoes the view of Akhtar (2018), who argues that food security issues in South Asia are as much a question of affordability as they are a question of availability.

The intra-household inequality in food distribution in times of climate stress is further confirmed by the accounts of women skipping meals and focusing on the food of children as reported by Naz et al. (2020). High incidence of anemia and underweight pregnancies in the study locations indicates prior results by Black et al. (2013) which focus on intergenerational implications of maternal undernourishment that is long-term. These similarities prove the fact that although climate effects are global, in Pakistan, they are localized due to local vulnerabilities and, therefore, gender-sensitive solutions are vital.

Food Under Climate Stress Gendered Dimensions of Food Insecurity

The results of the study show that climate change further intensifies gender inequalities that are already present in access to food and nutrition. Women are directly impacted on low agricultural output and increasing food prices because they are the main caregivers and food prepareters. However, since they lack access to land ownership, credit and influence on decision-making, they have fewer resources to deal with. This has been echoed by Arora-Jonsson (2011) who argues that the discourses surrounding climate change usually ignore the structural inequalities that subject women to a twofold burden.

Policy Journal of Social Science Review
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Vol. 3 No. 10 (2025)

Moreover, the strategies employed by women to cope, like going on a self-imposed diet, working informally or pursuing cheap food habits, are not only survival tactics, but a sign of structural marginalization as well. Although women are resilient enough to join seed-saving or water-conservation programs, such programs are not well-Chairing at all, not even with formal adaptation programs. This is similar to the results of Mustafa et al. (2016), who noted that women in Pakistan make significant contributions to community stability in response to climate disasters but are not visible in the climate planning processes of the state. The findings of this research thus reinforce the argument that food insecurity underclimate stress is highly gendered, which requires policy responses to acknowledge women as not only vulnerable groups, but rather as adaptation agents.

Women are Susceptible to Socio-Economic Factors that Affect their Nutrition

Social economic inequality was found to be another major determinant of nutritional status of women in the study areas. Women were not able to afford various and healthy food due to poverty and insufficient economic opportunities, and they had to rely on carbohydrate-based diets. The survey findings that indicate a high rate of undernutrition and anemia among females are in line with previous studies that highlight a relationship between a poor economic position and the maternal health risk in Pakistan (Naz et al., 2020). Moreover, women eating late or not eating during food crises remind the socio-economic disadvantage that women experience as their nutritional health is directly linked to their position at the periphery of households.

Women nutrition was also affected by education and state of healthcare. In low literacy regions, women knew little about the types of food or breastfeeding. This disparity was worsened by the inadequate health infrastructure especially in the rural areas of Balochistan where women complained of the inability to receive antenatal care. This paper has shown the amplification of socio-economic deprivation and poor nutrition under food insecurity induced by climate conditions, although previous studies have indicated the same relationship in South Asia(FAO, 2020). Therefore, women nutrition issues cannot be resolved solely by climate adaptation, but also through the wider empowerment of women socio-economically, such as access to education, medical facilities and livelihoods.

Institutional and Policy Gaps

The results show that there are important policy and institutional gaps in the solution to the intersection of climate change, food security, and the nutrition of women. Although climate policies and action plans have been developed in Pakistan, gender considerations are on the periphery but not central. As an example, the National Climate Change Policy (2012, updated in 2021) focuses on resilience in agriculture and water management but provides little information on gender-sensitive nutrition intervention. On the same note, food security schemes like the Benazir Income Support Programme (BISP) have been positively associated with household consumption but are not integrated with climate adaptation plans (Javed and Zafar, 2021).

Effective implementation is also tied to institutional weaknesses. Grassroots adaptation strategies are not always supported by local governments as they do not have resources or training to include the voices of women in planning processes. The results of this research indicate that the coping strategies implemented by women, including informal food-sharing systems or community agricultural programs, might be reinforced with the help of a specific support. But unless covered with gender-disaggregated data and participatory policymaking, these strategies will be ignored. These loopholes resonate

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with the criticism of Arora-Jonsson (2011) that climate governance is more likely to reproduce rather than question inequalities. To close this policy-practice gap, the key action is to reform the institutions and make gender and nutrition central to climate and food security policies.

9. RECOMMENDATIONS

- Gender-sensitive climate adaptation initiatives: Initiate region-specific climate adaptation schemes that can enhance women as a vulnerable group and enhance their capacity to cope with climate shocks.
- Increasing access to food and resources among women: Give women equal access to land, credit, and markets so that they can have improved livelihoods and nutritional performances.
- Enhancing agricultural resilience to climate change: Facilitate planting of drought-tolerant and water-efficient crops, agricultural cooperatives that are headed by women to maintain food production.
- Women (and adolescent girls) nutrition-specific interventions: Increase community-based nutrition, micronutrient fortification, and education to women and girls.
- Gender integration in climate and food security policies: Incorporate gender science into domestic climate policies and food security plans and develop interactive and sustainable solutions.

9. CONCLUSION

In this paper, the aim was to identify and understand how climate change affects the nutrition and food security of women in Pakistan, where environmental stress, agricultural productivity, household processes, and gender roles are also complexly interconnected. The results indicate that changes in climate have greatly interfered with agricultural systems triggering decreased food availability and increased chances of food insecurity, especially in the provinces at risk like, Sindh and Balochistan. Women, already underserved by entrenched barriers of socio-cultural stigma, are the most directly impacted as the nutritional deficit, maternal health issues and limited resource access all have a disproportionately high impact on them.

The discussion shows that food insecurity in Pakistan caused by climate cannot be viewed out of context of socio-economic realities that are gendered. Reduced agricultural productivity and the low power of decision-making, disparate allocation of food in households, and structural policy gaps that cannot incorporate gender-sensitive attitudes all play a central role in determining the nutritional outcomes of women. The current coping mechanisms, albeit adaptive, tend to be unsustainable and they actually trigger vulnerability instead of relieving it among women.

Hence, women nutrition in relation to climate change must be dealt with in a multidimensional manner that incorporates climate resiliency, food security and gender equality. The policy changes should so that women can have equal access to resources, be given special nutrition programs and be involved in climate adaptation planning. Through the identification of the gendered aspects of climate change, Pakistan will be able to shift to the pathways of sustainable development that will improve the resilience, as well as human security. Finally, women empowerment through enhanced nutrition and climate change adaptation issues will not just help to safeguard vulnerable but also enhance the overall resilience of the nation to climate changes.

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