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Factors associated with food security in rural communities across the globe

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Abstract

Food security is a global issue that affects millions of people worldwide. Several studies have been carried out to understand the dynamics of food security resulting from emerging issues across the globe such as climate change, conflict, etc. The authors have reviewed in this article the factors associated with food security in rural communities considering the socio-economic characteristics of individuals, livelihood concerns, inflation in the economy and purchasing power of households, the use of technology, governmental or non-governmental support and the effect of food insecurity on individuals and households. The studies have shown that lack of employment opportunities, low income of households, climate change, inflation and instability of food prices, poor rural infrastructure, inefficient government policies, and lack of technology at household level are major contributing factors to rural food insecurity. Moreover, one of the key conclusions of the published studies is that food insecurity negatively impacts health in both adults and children.

Keywords: Food security; Food insecurity; Rural communities; Socio-economic; Climate change

1. Introduction to Sociodemographic Characteristics in Relation to Food Security

Food security has been at the center of discussions in many world conferences including Paris Climate Agreement adopted in 2015 and is one of the 17 sustainable development goals established by United Nations in 2015: "End hunger, achieve food security and improved nutrition and promote sustainable agriculture" (SDG-2) [1]. Food security is defined as a situation that "exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (Food and Agriculture Organization) [2].

Several studies have examined the socio-economic profile of rural communities and found that the potential for household income diversification and livelihood is a major factor in poverty and food security. Ganiyu and Omotayo reported that it is worth mentioning that addressing the problem of food security in isolation, without taking into account the corresponding security of the individual's or household's means of subsistence, may not yield sufficient policy recommendations [3].

Furthermore, Masuku, Selepe and Ngcobo, who conducted a quantitative research study in rural South Africa [4], stated that food insecurity is a significant public health issue in rural communities across the globe. The unemployment rate exceeded 50% and a certain percentage (25%) of the respondents was diverting to self-employment as a means of generating income. The results obtained indicated that 42% of the study population was earning the low income of 700 South African Rand per month, and majority of the respondents were not actively involved in entrepreneurship activities. The majority of the respondents had poor socio-economic profiles and this makes them vulnerable to food insecurity.

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Tasmania, an island state off the coast of south-east Australia, has compared to other Australian states significantly higher rates of socio-economic disadvantage, a more widely distributed population in rural areas, and an older population (for example, 23.2% of Tasmania's population is 65 years or older compared with the national average of 14%) [5].

In general, the head of the household's educational level and the size of the family are significant predictors of food security for smallholder farmers in addition to income. A study conducted in Northern Nigeria by Sennuga, Baines, Conway and Naylor [6] reported that responders had no reliable options for employment outside farming. It is also noted in Nigeria by Ogunniyi et al. [7] that different families have different socio-economic status and different levels of resource endowment for their livelihoods, which has an impact on their resilience to risk and their capacity to avoid, reduce or manage hazards for favorable livelihood outcomes, such as increased food security.

On the other hand, the most distinguished socio-economic element reported in Pakistan by Esturk and Oren [8] was income, and the other factors influencing food security were the size of households, employment position, educational level and gender of the head of the household.

Similarly, in a study in Ivory Coast, the poor income of household heads, which drives households to primitive eating patterns, particularly during the lean season, exacerbates the food security predicament [9].

A study carried out by Awoyemi, Issahaku and Awuni [10] reported that food consumption in Ghanaian homes may be low for a variety of reasons, including low educational attainment, unemployment and living in a rural area. Hernández and Camardiel [11] in Venezuela state that food is a necessity during food crisis, but it competes with other needs like housing, transportation and medical care. For this reason, having decent meals is also influenced by one's social status. Affluent households possess the means to buy a greater variety and quantity of food compared to impoverished households.

Another study on diet quality and meeting dietary guidelines in South-East USA [12], took into account the food security of privileged and underprivileged communities, in comparison to those who live in neighborhoods with relatively greater advantages. Residents of neighborhoods characterized by social, economic and environmental disadvantages typically have less access to supermarkets and healthy food options, greater access to fast food restaurants and less healthy food options, higher levels of food insecurity, and poorer quality diets. Moreover, Lee, Shin and Kim [13], in their cross-sectional design through socio-economically disadvantaged groups, showed that the frequency of felt depression in adults was significantly influenced by females and the status of being divorced, widowed, or separated from the spouse on an individual basis. Perceived depression was far more likely when one or more of these characteristics were associated with food insecurity.

Several studies have highlighted the socio-demographic characteristics with respect to rural food security. Despite the different approaches adopted in the studies, income level of households and lack of employment opportunities are the key socio-economic factors undermining food security in rural areas.

2. Food Insecurity Concerns in Rural Areas

So many studies have delved into food insecurity using different schemes but the majority of the study findings were done in rural settings so as to get an insight into some of the concerns; a research conducted in agricultural based households in Mozambique [14] explained that households experienced hunger during the pre-harvest season as a result of natural disaster, climate change, and pests destroying crops. Moreover, the undernourishment rate in Sub-Saharan Africa (SSA) is approximately 19%, and children under the age of 5 are stunted. As a result of the decreased agricultural yields and impact on the majority of people who work in the field, they may be in danger of food insecurity. The identification of food insecure people or households and the classification of the nature of their food insecurity through measurements are two strategies to achieve food security. According to Matavel, these two strategies form the basis of tracking the development and results of programs to combat food insecurity.

Pitoro and Chagomoka [15] added that food security indicators can be categorized into two groups: one group uses indirect approaches to measure adequacy of food consumption (e.g. dietary diversity and food consumption scores) whilst the other directly measures behavior and life experiences of household food security (such as food insecurity experience scale). Hence, a holistic analysis is required to fully understand the application and comparison of different food security indicators including mixed methods in order to analyze and describe food security.

According to Mutisya et al. [16], resource-constrained households also have weaker immune systems due to their poor nutritional status which can take two different forms: chronic or temporary in nature. The 1990s marked the end of the prolonged food price decrease. Real food prices have been rising since the middle of that decade, peaking at an average level that is almost 60% more than it was in the early years of this century in early 2008. They have stabilized at a somewhat higher level than in the early 1990s, having lost at least two thirds of the price rise by July 2009. According to the majority of models and experts, food costs will likely continue to grow over the next several decades and will actually be greater than they were a decade ago.

As a result of continuing rapid population growth and rising incomes in Asia and Africa, there is a growing demand for food, which is predicted to gradually drive up real agricultural prices globally [17]. According to Fedderke, Perkins and Luiz [18], the infrastructure in South Africa serves to increase capital's marginal productivity and promote private investment. Poor rural roads that are difficult to access have a negative impact on food security. The bad roads and poor transportation infrastructure and network made it difficult for homes, local businesses, and farmers to get their commodities to markets. Additionally, poorly maintained roads are dangerous for vehicles. Residents in the northern, western, and eastern regions of Obuka, Obika, and Obizo in South Africa are forced to walk more than five kilometers to access a local road due to a lack of roads [19].

A number of factors, including high population growth rate and other new concerns like climate change and the growing need for biofuels are predicted to make the issue of food insecurity worse. International organizations have provided research priorities to address these issues. Ahmadi et al. [20] in Iran justified why food security assessment in rural areas is one of the most important research priorities. According to the researchers, it can play a significant role in determining high-risk areas for food security, measuring the level of food security, and taking the necessary action to address food insecurity.

Sasidharan, in a study at the University of Birmingham [21], elaborated on the significance of road infrastructure and that the ensuing delivery of secure, dependable, and reasonably priced transportation services in rural regions have the ability to spur social and economic growth, thereby reducing poverty, boosting food security and productivity, and reducing the incidence of hunger. About a billion rural inhabitants still lack year-round access to road networks.

A study carried out in the Middle East [22] has reported that food insecurity can emerge from a lack of food production as a result of catastrophic weather events such as droughts or floods, and from increases in population that outpace the production of food, and from rising food costs as a result of weak economic growth and unstable markets. The 2011 drought in the region caused a food crisis for 13 million people in East Africa, resulting in the deaths from starvation of 250,000 people in Somalia. For countries that heavily depend on rain (example, Sierra Leone) for major food production to take place due to improper water management and deficiency in irrigation, Nephawe et al. [23], emphasized that the cost of maintaining water supply and conservation measures means that the majority of water infrastructure is neglected for extended periods of time, which can negatively affect cropland and pasture productivity as water availability declines or becomes more scarce. As a result, the yields of staple crops like maize decline when agricultural needs for water are not met.

Among the numerous food security concerns mentioned by many scholars, inadequate rural infrastructure is a key factor stressed upon that negatively influenced food security. Furthermore, among food security concerns raised by many studies, population growth and climate change in Sub-Saharan Africa were predicted to make the worst impact. Even though both urban and rural areas are investigated for food security vulnerability, but more focus has been centered on rural areas despite the fact that the majority of its population are engaged in growing food for consumption.

3. Inflation and Purchasing Power in Relation to Food Security

Harrigan [24], in his analysis of Arab food sovereignty reported that some of the factors that influence food and nutrition security, such as dietary changes and a fall in productivity, have long-term effects. Other factors, such as changes in currency and crude oil prices, have medium-term effects. Still other factors, such as drought and export limits, have short-term effects. Due to the significant proportion of household expenditure on food in developing countries, there is a great deal of concern about how rising food prices would affect food and nutrition security.

The evidence from Ethiopia reported by Matz, Kalkuhl and Abegaz [25] showed that households spent over 53% of their income on food in 2010–11, with the majority of that amount going toward staple cereals. More specifically, it was calculated that grain made up 64.3 and 67.7%, respectively, of the average daily gross calorie intakes per adult equivalent in urban and rural areas. According to these authors, the Federal Democratic Republic of Ethiopia Central Statistical Agency, in 2012 investigated the distributional effects of rising food prices on the wellbeing of rural

households in Ethiopia in a related study. Based on data from the Ethiopian rural household survey panel, this was done using a quadratic, nearly ideal demand system. It was discovered that price increases benefit cereal sellers while harming cereal customers. Other empirical studies concentrate on the effects of the 2007–2008 price spikes on global poverty rates, Overall, the available evidence links higher grain prices to fewer meals consumed and a greater chance of consuming items not preferred by the household. However, there is no correlation between higher grain prices and calorie consumption or dietary diversity.

According to The World Bank Food Security Update published in 2023 [26], the Dashboard for Food Price Inflation, the rise in Consumer Price Index from year to year, serves as a measure of the domestic food price inflation rate, which is still relatively high. Almost all low- and middle-income countries experience significant inflation. Inflation rates have exceeded 5% in 92.9% of lower-middle-income countries and 89% of upper-middle-income countries, with several experiencing double-digit inflation. While much remains to be discovered on the nutritional effects of the recent price spikes, a great deal of knowledge about past shocks of all kinds and their effects exists. Families utilize a range of strategies to deal with shocks that restrict their access to food, such as droughts, economic crises, high costs, and other events. A portion of these coping mechanisms are centered on eating, while others are not. Food-based techniques involve modifications to the quantity, quality, and diversity of meals consumed. They often begin with consuming fewer foods from various food groups and switching from higher-cost to lower-cost calories.

Moreover, Gustafson [27] reported in the case of India that there are frequently very few other less expensive options when the price of other meals increases and basic grain costs rise sharply. Another strategy is to eat fewer meals in a day and reorganize meal allocation within the family. Alternative non-food coping mechanisms include selling assets, looking for alternative sources of income, and cutting back on health and educational expenses. The World Bank has made a forecast that the global economy would grow by 1.7% in 2023 and 2.7% in 2024. High interest rates, rising inflation, poor investment, and disruptions caused by Russia's invasion of Ukraine have been the main causes slowing down global economic growth.

Obiora et al. [28], in their review of the effects of high prices on food security in Nigeria also revealed increases in domestic food price over the years due to its detrimental consequences on Nigerians who spend a significant portion of their income on food. Inflation in the cost of food commodities has attracted attention in recent years. This fluctuation in food prices has affected trade balances negatively, reduced investment, increased rates of malnutrition and food insecurity among the poor, and perhaps even sparked social upheaval in the majority of developing countries worldwide. According to the authors, the National Bureau of Statistics reports that the annual rate of inflation increased, rising from 15.60% in January 2022 to 21.82% in January 2023, On a class basis, however, the headline index's percentage price index of food commodities climbed for bread and cereal (21.67%), potato, yam and tuber (6.06%), vegetables (5.44%), and meat (4.78%). The percentage change over the previous twelve-month period, as determined by the average consumer price index for the twelve months ending in January 2023, was 19.36%. This represents an increase of 2.49% over January 2022, when the measure climbed by 16.87%.

In Malaysia, Amra and Bakar [29], found an association between income of households and food prices and reported that whenever there is inflation in food prices, it will certainly affect many people. Because of high prices, the purchasing power will decrease. It is possible that income may not affect consumption because with income people are able to buy other goods and services. However, there will be a problem when income is low but food prices are high; this will affect consumption.

According to another study conducted in Zimbabwe [30], there is evidence that the real purchasing power of households was severely undermined by increases in food prices in various food groups between 2009 and 2016, particularly foods that were imported. Non-food products were primarily affected by the actual impact of independent factors on inflation. Given Zimbabwe's high unemployment rate and predominately rural population, it may be assumed that these disadvantaged groups bore the brunt of the distributional burden of the consequences of rising non-food costs between 2009 and 2016, as they had the least amount of disposable income.

4. Technology and Government Support to Achieve Food Security

Shukla, Singh and Shankar [31] in India explained how climate smart agriculture can be done using technology. The inequalities brought about by climate change pose the greatest threat to food security today. Crop productivity is thought to drop by 5% for every 1ºC increase in temperature. The use of technology, such as computers, sophisticated radars, and weather satellites, is essential for gathering the data required for weather forecasting and decision-making. Farmers may plant seeds and harvest plants at the appropriate times and locations with the aid of accurate weather forecasting.

According to Weisenfeld and Wetterberg [32], the widespread adoption of local and cutting-edge techniques and technologies is essential for raising agricultural output and productivity. Kassie et al. [33] reported that using the right technology can raise productivity and high volume manufacturing for both home consumption and higher household income.

Herens, Pittore and Oosterveer [34] also documented how collaboration among stakeholders can transform food systems. In order to better engage the various actors in the food system and collaborate across sectors, administrative jurisdictions, public and private domains, temporal and spatial scales, and diverse normative frameworks, new approaches to governance arrangements appear necessary. One such governance setup to support food system governance could be multi-stakeholder platforms.

A study conducted in rural Ethiopia [35], however, mentioned that the opportunity to improve food security through the use of agricultural technologies is diminished by the limited success in introducing and disseminating the technologies at the household level even though the adoption of agricultural technologies was positively and significantly associated with households' food security situation. Improved access to agricultural technology packages is necessary, as evidenced by the clear insignificance and occasionally irrelevant effects of government extension services and marketing infrastructure. A concerted effort is needed to develop, introduce, integrate and disseminate suitable agricultural technology packages in order to increase agricultural productivity and production. This will enhance food security.

Tripathi et al. [36], shed light on how government effort in India has impacted food security. Government-run agriculture programs have been instrumental in revolutionizing the industry, empowering farmers and guaranteeing the country's food security. These programs are intended to help farmers overcome a range of obstacles, including limited access to capital, technology, irrigation systems and market connections. These efforts have expanded over time to include a variety of projects.

Rahmanto, Purnomo and Kasiwi [37] reported that in Indonesia, disparities in the accessibility of high-quality food for the greatest number of people impede the promotion of the value of sociocultural equality. Nutrition and the culture of consumption, the agricultural land area, incentive structures, human resource capacities, land tenure and injustice, and higher education concerns remain the primary challenges facing the industry. In addition to these primary issues, there is the impact of the fourth industrial revolution, which required all groups including farmers to adapt to the most recent developments in technology.

It is clear from the various studies that technology is needed in all aspects to achieve food sufficiency and one way is to have the necessary equipment to gather information to counteract the effect of climate change. It is also reported that the adoption and embracing of technology by farmers can raise agricultural output. Moreover, studies have also reported that government efforts through multilateral approaches and transformation of industries have a positive effect on food security. However, the use of technology is reduced by inadequate technology in households. Ineffective government services and poor marketing infrastructure were found to influence food security.

5. Effects of Food Insecurity on a Population

Results from both clinical and cross-sectional studies on both children and adults have demonstrated that food insecurity has a negative impact on health. Gregory and Coleman-Jensen [38] examined food insecurity among the working-age adults and found that all of the chronic diseases that have been studied—hypertension, chronic obstructive pulmonary disease, hepatitis, stroke, cancer, asthma, diabetes, and renal disease—have higher odds when there is less food security. The likelihood of chronic disease in general, the quantity of chronic conditions reported, and self-assessed health are all substantially correlated with one another and with one's food security status. Children have been the focus of most studies looking at food insecurity in general and how it affects health outcomes. According to this research, there is a link between food insecurity and higher risks of certain birth abnormalities, anemia, reduced nutrient intakes, cognitive issues, anger, and anxiety.

Gundersen and Ziliak [39] added that food insecurity is linked to worse general health, higher chance of hospitalization, asthma, behavioral issues, melancholy, suicidal thoughts, and worse oral health, among other things. Food security is essential to people's health and well-being, Further, the World Health Organization (WHO) argues that health is wealth and poor health is an integral part of poverty. Governments should actively seek to preserve their people's lives and reduce the incidence of unnecessary mortality and avoidable illnesses; lack of food is one of the factors which affect health outcomes. Every year, millions of people worldwide—especially in Sub-Saharan African countries—die from hunger and diseases associated to famine.

In a recent study, Beyene [40] stated that the connection between food insecurity and health status is the current focus of policy makers and scholars. Additionally, the association between food insecurity and children's behavior may reflect several mechanisms. First, food insecure families are disproportionately exposed to multiple risks which can impair children's development and mental health, including poverty, marital discord, single parenthood, violence, parental substance abuse and psychopathology.

According to Melchior et al. [41], our analyses are controlled for income, family structure and functioning, as well as parental psychopathology and attitude towards children, but we cannot entirely rule out the possibility of residual confounding, whereby the association between food insecurity and children's behavior is not causal but rather reflects the co-occurrence of other risk factors. Secondly, early food insecurity may psychologically contribute to a child's weak relationship to their parents, which may later have detrimental effects on the child's mental health. Thirdly, there may be a connection between food insecurity and mother's depression, which affects the mental health of children. Fourthly, due to poor nutrition, food insecurity may be a direct predictor of the emergence of behavioral issues.

There could be a number of reasons for the correlation between children's behavior and food insecurity. Children's development and mental health can be negatively impacted by a number of dangers that food insecure families are disproportionately exposed to. These risks include poverty, marital discord, single motherhood, violence, parental substance misuse, and psychopathology.

Sun et al. [42], reported the effect of food insecurity on health among US adults. Food insecurity is linked to an increased risk of mortality from all causes and cardiovascular disease (CVD), even when controlling for other well-established risk factors like socio-economic status.

Hazzard, Loth, Hooper and Becker [43] did a cross-sectional study and found that relationships between food insecurity and eating disorder (ED) pathology are consistently supported by current findings, especially when it comes to adult bulimic-spectrum ED pathology.

Seivwright, Callis and Flatau [44] in Australia added that physical health as well as social and economic engagement are significantly impacted, both short- and long-term, by food insecurity. Stress, cycles of fasting and bingeing, and the substitution of relatively expensive, higher-nutrition foods with less expensive, higher-energy foods are all frequently brought on by food hardship, foods which can lead to malnutrition, altered metabolism, weight reduction, or, ironically, paradoxically, obesity and overweight.

Another study [45] that investigated the longitudinal consequences of lack of food among tertiary students that were self-reliant in terms of support also found that those who are subject to food insecurity have worse health and poor interaction and achieve less in academia as compared to their peers who have access to food security. Those who experienced food insecurity had worse health and psychosocial outcomes as well as lower academic accomplishment. The relationship between food insecurity and academic performance was mediated by poorer psychosocial health.

Crews et al. [46], in their American study discovered that almost 25% of lower-income Americans living in large cities and in the overall population experienced food insecurity, which was linked to chronic kidney disease (CKD). The relationship was complex; only people with diabetes or hypertension in the general population had an independent relationship between food insecurity and higher frequency of CKD, but there was no statistically significant independent relationship between food insecurity and CKD in an urban population.

In their Canadian study, Jessiman-Perreault and McIntyre [47] pointed out that certain features in their disaggregation of difficulty of food at household level into a four-level variable were supported by the statistically significant relationship between marginal household food insecurity and the chance of reporting all six unfavorable mental health outcomes such as depressive thoughts in the past month, major depressive episodes in the past year, anxiety disorder, mood disorder and fair/poor mental health status, suicidal thoughts in the past year using odds ratios. A complex interaction of genetic, biochemical, individual and societal factors leads to mental disease. Regardless of the angle being considered, biological or sociocultural, the role of stress in the process leading to mental disease has been underscored by current psychosocial research on the development of mental illness. Household food insecurity (HFI) is a modifiable component that should not be disregarded in this intricate interplay, as it is a well-documented source of anxiety and stress among affected households. The estimates of the significant declines in mental health outcomes that could be anticipated with the elimination of HFI are provided by the marginal effect reduction analysis. We should anticipate a percent point reduction for anxiety disorders and depressed thoughts in the last month of 8.01 and 25.2, respectively, if individuals experiencing severe HFI were to achieve food security. In general, this research study came to the conclusion that HFI causes or is linked to negative outcomes in terms of mental health. The study investigated how the

HFI gradient increases the probability of six outcomes at each increased level of severity, extending the result that HFI is an independent risk factor for negative mental health outcomes. Based on the outcome of this research, severe HFI may be considered a long-term stressor that has a major impact on mental health at the community level within the intricate interactions between biological, social, and genetic elements that are thought to have a role in the development of mental health disorders that are detrimental.

6. Conclusion

Studies have demonstrated that food insecurity in rural areas is often linked to socio-economic factors such as illiteracy, population growth, low household income, and limited job opportunities. Additionally, global food price inflation, climate change, and inadequate rural infrastructure can further contribute to food security concerns. When food prices rise and household incomes remain low, people may adopt coping strategies that lead to a reduction in meal consumption and the quality of food they consume. Fortunately, technology and effective government policies can help to enhance food security, even for those with low incomes. However, a lack of access to technology at the household level can undermine these efforts. It is important to recognize that food insecurity can lead to reduced immunity and increased vulnerability to disease, particularly among children and adults. By addressing the socio-economic factors and investing in rural infrastructure and technology, we can work towards a more food-secure future for all.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that there are no competing or potential conflicts of interest.

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