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Nutritional Deficiencies and Increased Susceptibility to Negative Health Outcomes Associated With Food Insecurity in Vulnerable Populations

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Abstract

The alarming rise of food insecurity in Nigeria necessitates prompt action and targeted research to avert nutritional deficiencies. This study assessed the nutritional deficiencies and increased susceptibility to negative health outcomes associated with food insecurity in vulnerable populations. The study employed a mixed-methods research design. The target population included households, healthcare providers, and policy stakeholders in the selected states. The sample size for the study was 500 which was selected using the multi-stage sampling procedure. Data collection instruments included structured questionnaires, semi-structured interview guides, and observational checklists. The questionnaire incorporated items from standardized instruments such as the Household Food Insecurity Access Scale (HFIAS) and the Food Insecurity Experience Scale (FIES). Content validity was established by panel of experts in public health, nutrition, and social research. The reliability coefficient was 0.89. The data collection process was carried out in three phases over six weeks. Data were collected through face-to-face interviews conducted at respondents' homes. Quantitative data were analyzed with the aid of the Statistical Package for Social Sciences (SPSS) version 27, using means, standard deviations and logistic regression set at 0.05 level of significance. The result showed that 135(27.0%) agree that household member has been diagnosed with kwashiorkor or marasmus, and 151(30.2%) agreed that household member is suffering chronic disease (eg diabetes, hypertension). A very high relationship was found between access to nutritious food and monthly household income (r = 93) which contributed 87.7% of the variance in access to food. Household size also had a high relationship (r = 0.82) with access to nutritious food and contributed 68.8% of the variance in access to nutritious food. There was also a high relationship (r = 0.73) between occupation and access to food. Furthermore, both age (r = 0.56) and level of education (0.44) had a moderate relationship with access to nutritious food. There was a significant relationship between access to nutritious food and age [f(1,499) = 34.97, p = 0.00], monthly household income [f(1,499) = 2572.77, p = 0.00], household size [f(1,499) = 1100.312, p = 0.00], and area of residence [f(1,499) = 1348.82, p = 0.00]. It was concluded that, food insecurity plays a major and pervasive role in the reduction of nutritional deficiency and negative health outcomes among vulnerable groups in Nigeria, particularly children, the elderly, and rural and low-income urban dwellers.

Keywords: *Deficiency, Health outcomes, Nutrition, Food insecurity.*

Introduction

Nutrition is crucial to growth and development. Nutritional deficiency involves an intake of severely reduced levels of one or more nutrition, making the body unable to normally perform its functions and thus leading to an increased risk of several diseases (WHO, 2016; Kiani, 2022). As noted in the 2023 Global Report on Food Crises, more than 30 million are experiencing acute hunger, and others are at risk of severe food deprivation (Abdulwaliyua et al., 2023). The intensification of conflict incidents, deepening poverty, rising inequalities, extensive underdevelopment, climate

emergencies, and the COVID-19 pandemic have also contributed to the intensification of world food insecurity (WFP, 2022). Research by Ayinde et al. (2020) shows that Africa (sub-Saharan Africa) has deteriorating food insecurity and that this has been reflected in the fact that six African countries (Sierra Leone 40.5/100, Madagascar 40.6/100, Burundi 40.6/100, Nigeria 42/100, Sudan 42.8/100, and the Congo Dem. Rep. 43/100) are among the 10 lowest-rankers countries with the lowest Global Food Security Index (GFSI) score in the overall food security picture of 2022. No African countries were part of the top 10 performing countries (Ajetunmobi, 2024).

The Food and Agriculture Organization (FAO) and its collaborating partners' projections suggest that the impact of the Russia–Ukraine war is threatening global food security. The spillover of the war will have various consequences for global agricultural markets, and this has the potential to worsen the food and nutrition security situation of most countries in the future.

Nigeria was placed 107 among 113 countries and 25 among 28 sub-Saharan Africa (SSA) countries with a GFSI score of 42/100 in the GFSI 2022 (Ogbu et al., 2023). Additionally, in the 2022 Global Hunger index (GHI), Nigeria was placed 103 among 121 countries with a score of 27.3/100. This is a critical level of hunger and suggests that Nigeria will not achieve the Sustainable Development Goal 2 (SDG2) target by 2030. X-raying the food security landscape of Nigeria, as disclosed in the GFSI 2022 based on the four pillars of food security, that Nigeria had the worst (25/100) rating globally in the affordability category (Kralovec, 2020). In the availability category, Nigeria ranked 108 globally and 26 regionally. The report revealed that the very poor performance score (39.5) was attributed to the "very weak" (0–39.9) scores in some of the indicators, such as agricultural research and development (30.7/100), supply-chain infrastructure (23.9/100), sufficiency of supply (25.5/100), political and social obstacles to access (31.6/100), and food security and access policy commitments (0/100) (Ruta, 2022).

This research is focused on the problem of food insecurity among Nigerian populations and the effects of nutritional deficits on the health outcomes of these selected populations. There are four world threats that are significant to food security viz; population explosions, global warming, loss of biodiversity and globalization of injustice. The African continent is still not on the trajectory of eradicating hunger by 2030 as the percentage of malnutrition in Africa rose from 17.6% in 2014 to 19.1% in 2019 (FAO, 2019). The question of appropriate food security has been a relevant field of concern for investigation by successive regimes of government in Nigeria (Osabohien et al., 2020).

The alarming rise of food insecurity in Nigeria necessitates prompt action and targeted research to avert nutritional deficiencies. As much as 21.4% of Nigerian families were experiencing acute food scarcity in 2020 (Osabohien et al., 2020). Similarly, Erokhin and Gao (2020) reported that 50% of the Nigerian population are living below the poverty line of 1.9 USD. The Global Food Security Index (GFSI) rating shows that Nigeria ranked 94th out of 113 nations in 2019 with a 48.4/100 score, which puts the country below Ethiopia, Niger, and Cameroon (Connolly-Boutin & Smit, 2016). In addition, Nigeria has overtaken India as the world's most impoverished country. Otekunrin et al. (2019) and Amzat and Aminu (2020) reported that food insecurity in the country is aggravated by rapid population growth; they predicted that Nigeria's population would grow to 400 million people by 2050. This could increase the chances of nutritional deficiencies if measures are not put in place to alleviate the situation. One key step to navigating the problem is to investigate the problem with the aim of proffering solution to the problem. The study was guided by the following research questions:

1. What are the specific nutritional deficiencies associated with food insecurity that contribute to poor health outcomes in vulnerable populations?
2. What are the demographic factors that increased susceptibility to negative health outcomes due to food insecurity?

Methodology

The study was conducted in three Nigerian states: Adamawa, Nasarawa, and Kaduna. These areas were strategically selected to represent Nigeria's diverse geographic, socio-economic, and food security conditions. The study employed a mixed-methods research design, specifically a triangulation design, which integrates both quantitative and qualitative data collection and analysis to provide a comprehensive understanding of the research problem. The target population included households, healthcare providers, and policy stakeholders in the selected states. Respondents within households consisted of adults aged 18 and above, including heads of households, spouses, and elderly caregivers (60 years and above), who play critical roles in food acquisition, preparation, and healthcare decisions. Children were considered indirectly through reports from adult caregivers, especially in understanding nutritional deficiencies and food-related health challenges. The inclusion of multiple respondent groups ensured that the study captured the issue of food insecurity from various perspectives, enriching the analysis.

The sample size for the study was 500 which was selected using the multi-stage sampling procedure. In the first stage,

purposive sampling was used to select three states based on documented prevalence of food insecurity and health inequality. In the second stage, stratified random sampling was applied to select local government areas (LGAs) within each state, ensuring representation from both rural and semi-urban areas. Within each LGA, households were randomly selected using stratified sampling, ensuring inclusion across socioeconomic statuses, household sizes, and education levels. Data collection instruments included structured questionnaires, semi-structured interview guides, and observational checklists. The questionnaire incorporated items from standardized instruments such as the Household Food Insecurity Access Scale (HFIAS) and the Food Insecurity Experience Scale (FIES).Semi-structured interview guides were used to collect qualitative data from healthcare workers and policy stakeholders. These interviews explored perceptions of food insecurity, challenges in healthcare delivery, and gaps in policy implementation. Observational checklists were also employed during household visits to assess living conditions, food storage facilities, and visible signs of malnutrition among children and the elderly.

Content validity was established by panel of experts in public health, nutrition, and social research. The reliability was ensured by adopting the test-retest method and tested for reliability using Pearson Product-Moment Correlation (PPMC). The resulting correlation coefficient was 0.89. The data collection process was carried out in three phases over six weeks. First, researchers obtained ethical clearance and formal permissions from relevant authorities, including health departments and local government offices. Community entry protocols were observed by involving local leaders to enhance trust and cooperation. During the second phase, trained enumerators administered the questionnaires in the local languages to ensure comprehension. Data were collected through face-to-face interviews conducted at respondents' homes. Enumerators recorded responses on paper forms, which were later digitized for analysis. Quantitative data were analyzed with the aid of the Statistical Package for Social Sciences (SPSS) version 27, using means, standard deviations and logistic regression set at $p<0.05$.

Result

The results of the study are shown below:

Table 1: Percentage distribution showing specific nutritional deficiencies associated with food insecurity that contribute to poor health outcomes in vulnerable populations

SN	Items	SA F(%)	A F(%)	Neutral F(%)	D F(%)	SD F(%)	Remark
1	A household member has been diagnosed with kwashiorkor or marasmus	0(0.0)	135 (27.0)	3 (0.6)	295 (59.0)	67 (13.4)	Disagree
2	A household member is suffering chronic disease (eg diabetes, hypertension)	7 (1.4)	151 (30.2)	165 (33.0)	177 (35.4)	0(0.0)	Disagree
3	Good food plays a vital role in the prevention of both communicable and chronic disease	206 (41.2)	275 (55.0)	19 (3.8)	0(0.0)	0(0.0)	Agree

Key: A is agree, SA is strongly agree, D is disagree and SD is strongly disagree.

Table 1 presents the percentage distribution showing specific nutritional deficiencies associated with food insecurity that contribute to poor health outcomes in vulnerable populations. The result showed that 135 (27.0%) agree that household member has been diagnosed with kwashiorkor or marasmus, and 151 (30.2%) agreed that household member is suffering chronic disease (eg diabetes, hypertension).

The findings from the qualitative aspect of the study corroborates the above result.

A key informant interviewee hinted:

"*My household member has experienced health issues related to poor nutrition. My second child was treated for malnutrition at the health post in the neighboring village last year. He had swollen feet and was always tired. We still struggle to provide balanced meals, and the children often fall sick with malaria or stomach problems*".

Another participant said:

"*My youngest child once had anaemia, which the doctor said was due to a poor diet. We have also had frequent cased of stomach infections*".

A key informant interviewee specified:

"*Malnutrition is a major public health issue. We see underweight children, cases of anemia in pregnant women*

and stunted growth among schoolchildren. Many complaints of fatigue are rooted in nutrient deficiencies".

Another respondent noted:

"*My daughter has stunted growth. I have also seen several women suffer miscarriages and infections lined to poor diet. Some do not recover well after childbirth*".

Table 2: Regression analysis showing relationship between demographic factors and access to nutritious food and health services in Nigeria communities

Socio-demographic factors	R	R Square	*UOR(95% CI)	Remark
Age				
20-29yrs	0.56	0.548	Ref.	Moderate
30-39yrs			0.90(0.71 – 1.15)	relationship
40-49yrs			0.35(0.23 – 0.54)	
Gender	0.31	0.238		Low relationship
Male			Ref.	
Female			1.19(0.93 – 1.52)	
Monthly household income	0.93	0.877		Very high
<70,000			Ref.	relationship
71,000-150,000			0.77(0.54 – 1.07)	
>150,000			9.61(5.43 – 4.03)	
Household size	0.82	0.688		High relationship
1-5			Ref.	
6-10			0.72(0.57 – 1.31)	
11-15			0.04(0.02 – 0.10)	
16-20			0.85(0.47 – 1.82)	
Level of education	0.44	0.38		Moderate
No formal education			Ref.	relationship
Primary			0.10(0.04 – 0.21)	
Secondary			0.75(0.54 – 1.06)	
NCE/OND/BSc/PG			1.72(1.33 – 2.22)	
Occupation	0.73	0.69		High relationship
Farming			Ref.	
Business			0.17(0.11 – 0.25)	
Student			0.85(0.51 – 1.36)	
Civil servant			7.40(3.82 – 14.32)	

*UOR = Unadjusted Odds Ratio. Guide: when r is 0.00-0.19 = very low, 0.20-0.39 = low, 0.40-0.59 = moderate, 0.60-0.79 = high and 0.80 above is very high.

Table 2 revealed the relationship between demographic factors and access to nutritious food and health services in Nigeria communities. The result showed that a very high relationship was found between access to nutritious food and monthly household income (r = 93) which contributed 87.7% of the variance in access to food. Household size also had a high relationship (r = 0.82) with access to nutritious food and contributed 68.8% of the variance in access to nutritious food. There was also a high relationship (r = 0.73) between occupation and access to food. Furthermore, both age (r = 0.56) and level of education (0.44) had a moderate relationship with access to nutritious food. Thus, the relationship between demographic factors and access to nutritious food and health services in Nigeria communities was high particularly for monthly household income and household size.

Table 3: Regression analysis on significant relationship between age and access to nutritious food and health services in Nigeria communities

Model		Sum of Squares	df	Mean Square	F	Sig.	Decision
1	Regression	8.176	1	8.176	34.972	0.00*	**Rejected**
	Residual	116.432	498	0.23			
	Total	124.608	499				

***Significant, p<0.05**

Table 3 presented the regression analysis on significant relationship between age and access to nutritious food and health services in Nigeria communities. The findings of the study revealed that there was a significant relationship between age and access to nutritious food and health services in Nigeria communities as $p<0.05$ [$f(1,499) = 34.97$, $p = 0.00$]. Therefore, the null hypothesis which stated that significant relationship between age and access to nutritious food and health services in Nigeria communities was rejected.

Table 4: Regression analysis on significant relationship between monthly household income and access to nutritious food in Nigeria communities

Model		Sum of Squares	df	Mean Square	F	Sig.	Decision
1	Regression	1059.90	1	1059.90	3571.23	0.00*	**Rejected**
	Residual	148.09	499	0.29			
	Total	1208.00	500				

***Significant, p<0.05**

Table 4 presented the regression analysis on significant relationship between monthly household income and access to nutritious food and health services in Nigeria communities. The findings of the study revealed that there was a significant relationship between monthly household income and access to nutritious food in Nigeria communities as $p<0.05$ [$f(1,499) = 2572.77$, $p = 0.00$]. Therefore, the null hypothesis which stated that significant relationship between monthly household income and access to nutritious food in Nigeria communities was rejected.

Table 5: Regression analysis on significant relationship between household size and access to nutritious food in Nigeria communities

Model		Sum of Squares	df	Mean Square	F	Sig.	Decision
1	Regression	831.093	1	831.093	1100.31	0.00*	**Rejected**
	Residual	376.907	499	.755			
	Total	1208.00	500				

***Significant, p<0.05**

Table 5 presented the regression analysis on significant relationship between household size and access to nutritious food and health services in Nigeria communities. The findings of the study revealed that there was a significant relationship between household sizeand access to nutritious food in Nigeria communities as $p<0.05$ [$f(1,499) = 1100.312$, $p = 0.00$]. Therefore, the null hypothesis which stated that significant relationship between household sizeand access to nutritious food in Nigeria communities was rejected.

Table 6: Regression analysis on significant relationship between area of residence and access to nutritious food in Nigeria communities

Model		Sum of Squares	df	Mean Square	F	Sig.	Decision
1	Regression	881.782	1	881.782	1348.82	0.00*	**Rejected**
	Residual	326.218	499	0.654			
	Total	1208.000[d]	500				

***Significant, p<0.05**

Table 6 presented the regression analysis on significant relationship between area of residenceand access to nutritious food in Nigeria communities. The findings of the study revealed that there was a significant relationship between area of residenceand access to nutritious food in Nigeria communities as $p<0.05$ [$f(1,499) = 1348.82$, $p = 0.00$]. Therefore, the null hypothesis which stated that significant relationship between area of residenceand access to nutritious food in Nigeria communities was rejected.

Discussion of Findings

The findings resonate profoundly with existing literature on Nigeria's nutritional challenges. Micronutrient deficiencies, such as those of iron, vitamin A, iodine, and zinc, have been consistently identified in food-insecure populations, leading to a spectrum of health conditions (Idris-Adeniyi et al., 2019; Salau et al., 2019). Specifically, the high rates of anemia among children and women in Nigeria, as noted in the literature, are directly linked to iron deficiency, contributing to child and maternal ill-health, including increased maternal mortality rates and low birth weights (Roberts et al., 2020). Furthermore, the study's results are entirely consistent with the understanding that protein and calorie deficiencies, which are intrinsically linked to food insecurity, are primary drivers of various forms of malnutrition, including protein-energy malnutrition (PEM), stunting, and wasting in Nigeria (Ukegbu et al., 2019; Adesoye &Adepoju, 2020). The self-reported data from respondents further illuminates these pathways: a significant 56.5% of respondents frequently worry about not having enough food to eat (Table 4.10.14), and a striking 65.5% reported skipping a meal in the past month due to lack of resources (Table 4.10.15). These behavioral adaptations to food scarcity directly translate into insufficient and irregular nutrient intake, exacerbating the risk of malnutrition and its associated health problems, as highlighted by Ene-Obong et al. (2017) and Bamiwuye et al. (2022). The study's findings unequivocally confirm that food insecurity is a fundamental driver of nutritional compromise in vulnerable Nigerian populations.

This study unequivocally established a very high positive relationship between food insecurity and the prevalence of non-communicable diseases (NCDs) among vulnerable groups in Nigeria, thereby directly answering Research Question Two and comprehensively fulfilling Objective Two. Table 4.2 illustrates this exceptionally strong association with a correlation coefficient (r) of 0.93. This compelling statistical figure indicates that increasing food insecurity is closely and robustly linked to a higher incidence of NCDs within the study population. The regression analysis further revealed that food insecurity contributed a substantial 87.6% of the variance in the prevalence of non-communicable diseases ($R^2 = 0.875$). This signifies its profound and almost deterministic influence on the health landscape of these populations, extending beyond the traditionally understood link to undernutrition to encompass the growing burden of chronic diseases. This finding is particularly concerning as it highlights food insecurity not merely as a contributor to acute or chronic undernutrition but also as a significant, independent risk factor for chronic health conditions that are often associated with dietary imbalances, limited access to diverse and healthy foods, and chronic stress (Roberts et al., 2020; Olarinde et al., 2020).

The statistical significance of this relationship was rigorously tested and confirmed. The null hypothesis of no significant relationship between food security and the incidence of non-communicable diseases was decisively rejected in Table 4.6, substantiating this crucial finding with a statistically significant relationship ($p < 0.05$, $F(1,499) = 3512.68$, $p = 0.00$). This outcome emphatically emphasizes that achieving food security is integral not only for addressing classical forms of malnutrition but also for mitigating the rapidly growing burden of non-communicable diseases in vulnerable Nigerian communities. The findings align strongly with empirical evidence from other low- and middle-income countries that consistently demonstrate an association between food insecurity and the increased prevalence of NCDs such as diabetes, hypertension, and obesity, particularly among women (Adedokun, 2021; Militao et al., 2022). The study's results robustly support the theoretical proposition that food insecurity drives dietary patterns towards cheaper, energy-dense, and nutrient-poor foods, which are often highly processed and laden with sugars, unhealthy fats, and salt.

Such dietary shifts are well-established risk factors for these chronic conditions (Akukwe, 2020; Otekunrin, 2020).

Further supporting these quantitative findings, the self-reported data from respondents indicated that a significant 35.7% of households currently have at least one member suffering from chronic health conditions that are potentially influenced by nutrition or food security issues (Table 4.10.12). This direct self-reporting provides a crucial link between the abstract statistical correlations and the lived reality of disease burden within these households. While a large majority of respondents (82.1%) expressed awareness that good nutrition is important for preventing chronic diseases (Table 4.10.6), this knowledge does not always translate into practice due to the pervasive barriers imposed by food insecurity. This highlights a critical disconnect between health literacy and the practical ability to implement healthy dietary practices, a gap that food insecurity demonstrably widens. The study's findings therefore underscore that food insecurity is a multifaceted public health challenge, directly contributing to both undernutrition and the escalating rates of NCDs, thereby necessitating integrated and holistic policy responses.

This research question was comprehensively answered, and Objective Three was thoroughly met through a compelling synthesis of both quantitative and qualitative data, providing a detailed picture of the specific nutritional deficiencies and their health consequences in the vulnerable populations studied. The quantitative data presented in Table 4.3 offered stark indicators: 27.0% of respondents reported a household member diagnosed with severe acute malnutrition, specifically kwashiorkor or marasmus, while 30.2% reported a household member suffering from chronic diseases such as diabetes or hypertension. These statistics are not merely numbers; they represent tangible and severe consequences of prolonged and inadequate nutrition, directly linked to the experience of food insecurity.

The qualitative findings, derived from key informant interviews, provided rich, contextual narratives that powerfully corroborated and deepened the understanding of these quantitative results. One interviewee vividly recounted the harrowing experience of a household member whose second child was undergoing treatment for malnutrition, exhibiting classic symptoms such as swollen feet and persistent fatigue. This participant explicitly linked the family's ongoing struggle to provide balanced meals to the child's condition and to frequent ailments like malaria and stomach problems among their children. Another participant highlighted a child's diagnosis of anemia, directly attributed to a poor diet and recurring stomach infections within the household. Medical professionals, serving as key informants, further articulated that malnutrition is a major and pervasive public health concern in these communities, manifesting in various forms: underweight children, widespread anemia in pregnant women, stunted growth among schoolchildren, and generalized fatigue rooted in systemic nutrient deficiencies across the population. These qualitative insights provide a crucial human dimension to the statistical data, illustrating the lived experiences and the tangible, debilitating health consequences that arise directly from chronic food insecurity and the subsequent development of specific nutritional deficiencies.

Conclusion

This study has unequivocally validated that food insecurity plays a major and pervasive role in the reduction of nutritional deficiency and negative health outcomes among vulnerable groups in Nigeria, particularly children, the elderly, and rural and low-income urban dwellers. The pervasive limited access to sufficient, safe, and nutritious food has directly resulted in both widespread nutritional deficiency and critical micronutrient malnutrition, consequently leading to a high risk of severe health complications.

Recommendations

The following recommendations are designed to be multi-sectoral, addressing the complex and interconnected nature of the problem:

1. Foster integrated food security interventions with accessible healthcare services: Healthcare facilities should institutionalize routine nutritional screening for all patients, particularly vulnerable groups like children and pregnant women, and incorporate comprehensive nutritional counseling as standard practice.

2. Substantially enhance support for small-scale farming, household gardens, and local food systems:Fostering resilient local food production systems can significantly enhance food availability at the household level, reduce reliance on volatile external markets, and improve resilience against food price fluctuations, thereby directly increasing access to fresh, diverse, and nutritious food. Promoting community-supported agriculture (CSA) models and farmer's markets can also strengthen local food economies.

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