Factors Influencing Malnutrition among Children under Five in Dikwa: An Analysis of Diet, Health, and Socioeconomic Conditions

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Abstract: *Malnutrition is a broad term commonly used to describe deficiencies, excesses, or imbalances in a person's intake of energy and nutrients required for proper growth and function. This study investigates the socio-economic, dietary, and environmental determinants of childhood malnutrition in a rural Nigerian community. The findings reveal that malnutrition is most prevalent among children aged 1–2 years (33.1%), coinciding with the critical "first 1,000 days" of development. A higher prevalence among female children (61.5%) suggests potential demographic or sampling influences. The data also show that 69.0% of caregivers engage in farming, with only 7.2% employed in the formal sector, linking income instability and food insecurity to poor nutritional outcomes. Access to healthcare is limited for 60.6% of the population, further compounding the issue. Dietary analysis indicates a heavy reliance on carbohydrate-rich staples (41.5%) and low intake of protein, fruits, and vegetables, raising concerns about micronutrient deficiencies. Educational disparities also emerged, with 46.9% of caregivers lacking formal education, affecting their ability to implement optimal feeding practices. Statistically significant associations were found between meal frequency and child weight status ($\chi^2(2, N = 335) = 264.98$, $p < .001$), maternal education and supplement provision, and access to clean drinking water and malnutrition status. The study recommends that caregivers should focus on the first one thousand days to enable the prioritization nutrition interventions from pregnancy to age two through breastfeeding promotion, timely complementary feeding, and regular growth monitoring.*
Keywords: *Malnutrition, Child health, Caregiver education, Food insecurity, Rural Nigeria, Dietary diversity*

I. Introduction

Malnutrition among children under five remains a critical public health challenge, particularly in regions affected by conflict, economic instability, and limited access to healthcare services. Dikwa, a town in northeastern Nigeria, exemplifies such conditions, where malnutrition rates among young children have been persistently high. However, reducing malnutrition among children under five remains a significant challenge in developing countries. For instance, recent data indicate that approximately 148 million children worldwide experience stunted growth, 45 million suffer from wasting, and nearly half of all child deaths are linked to malnutrition (Bill & Melinda Gates Foundation, 2024). In Sub-Saharan Africa, the situation is particularly dire, with one in five people facing hunger in 2023, highlighting a persistent crisis (WHO, 2024).

In Nigeria, malnutrition is widespread, especially in rural areas, partly due to inadequate food and nutrient supply. The 2021 National Food Consumption and Micronutrient Survey revealed that 33% of under-five children in Nigeria are stunted, 11.6%

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are wasted, and 25.3% are underweight (UNICEF, 2021). These figures indicate significant variation between rural and urban areas, with children from rural regions more severely affected (UNICEF, 2021). Furthermore, the Paediatric Association of Nigeria has raised concerns over the increasing rate of malnutrition among children, noting that it is a direct or underlying factor in about 45% of childhood deaths in the country (UNICEF, 2021). Factors contributing to this crisis include reduced farming activities due to climate challenges, natural disasters such as flooding, and insecurity (UNICEF, 2021).

Several factors influence malnutrition among children under five in Dikwa, with diet, health, and socioeconomic conditions playing pivotal roles. Poor dietary diversity and insufficient nutrient intake contribute to protein-energy malnutrition and micronutrient deficiencies (Akombi et al., 2017; Airaoje et al., 2024). Additionally, health-related factors such as frequent infections, inadequate maternal and child healthcare, and limited access to clean water and sanitation exacerbate the nutritional status of children (United Nations International Children's Emergency Fund [UNICEF], 2020). Socioeconomic conditions, including poverty, parental education, and food insecurity, further hinder adequate nutrition and child well-being (Smith & Haddad, 2015; Airaoje et al., 2023).

Addressing malnutrition in Dikwa requires a comprehensive understanding of these underlying factors and targeted interventions that enhance dietary practices, improve healthcare access, and alleviate socioeconomic barriers (Airaoje et al., 2023). This study aims to analyze the interrelated influences of diet, health, and socioeconomic conditions on child malnutrition in Dikwa, providing evidence-based recommendations to mitigate this public health crisis (Aliough et al., 2023).

1.1 Motivation of the Study

Malnutrition remains a significant public health concern, particularly among children under the age of five, as it contributes to increased morbidity and mortality rates globally (Black et al., 2013). In a developing country such as Nigeria, malnutrition is a pressing issue due to inadequate dietary intake, poor healthcare access, and unfavorable socioeconomic conditions (UNICEF, 2021). Dikwa, a region affected by conflict and economic instability, exemplifies these challenges, necessitating a comprehensive investigation into the underlying factors contributing to malnutrition among young children. Also, children under five years old are particularly vulnerable to malnutrition due to their rapid growth and high nutritional requirements (WHO, 2020). Several studies have indicated that diet quality, healthcare accessibility, and socioeconomic conditions play crucial roles in determining a child's nutritional status (Akombi et al., 2017). In areas like Dikwa, where poverty levels are high and access to healthcare facilities is limited, understanding these factors is essential to developing effective intervention strategies.

Moreover, malnutrition in early childhood has long-term consequences, including impaired cognitive development, reduced academic performance, and increased susceptibility to diseases (Victora et al., 2016). Given the severe implications of malnutrition, it is imperative to analyze the factors contributing to its prevalence in Dikwa. This study aims to provide valuable insights that can inform policymakers, healthcare professionals, and non-governmental organizations in designing targeted nutritional and health programs to improve child well-being in the region (Namadi & Aondover, 2020). By conducting this study, we seek to bridge the gap in existing literature and contribute to evidence-based solutions that address malnutrition holistically. Understanding the complex interplay of dietary habits, healthcare availability, and socioeconomic constraints will help develop effective interventions that can mitigate malnutrition and enhance child survival rates in Dikwa and similar contexts. Hence, the study is guided by the following questions and hypotheses.

1.2 Basic Tools of Inquiry

The study was guided by the following research questions:
1. What type of food does your child consume regularly?
2. What is your highest level of education?
3. What are the major challenges you face in providing adequate nutrition for your child?

1.3 Hypotheses

1. H_0 (Null Hypothesis): There is no significant association between meal frequency and recent weight loss in children.
2. H_0 (Null Hypothesis): Maternal education level does not significantly influence the provision of vitamin/mineral supplements to children.
3. H_0 (Null Hypothesis): There is no significant association between access to clean drinking water and child malnutrition status

II. Review of Literatures

According to Savarino et al., (2021) malnutrition is a broad term commonly used to describe deficiencies, excesses, or imbalances in a person's intake of energy and nutrients required for proper growth and function. In addition, malnutrition refers to imbalances, deficiencies, or excesses in a person's consumption of energy or nutrients. It encompasses two main categories: under nutrition, which includes stunting (low height-for-age), wasting (low weight-for-height), underweight (low weight-for-age), and micronutrient deficiencies; and over nutrition, which includes *overweight, obesity, and diet-related non-communicable diseases (NCDs) (*Guldan, 2023*).* Malnutrition remains a critical global health issue, significantly contributing to mortality among children under five years old. In 2020, an estimated 5 million children under the age of five died, with nearly half of these deaths—approximately 2.5 million—attributable to undernutrition. Undernutrition not only increases the risk of mortality but also exacerbates the severity of common infections, creating a vicious cycle of illness and weakened immunity. These conditions are particularly prevalent in low- and middle-income countries, where factors such as food insecurity, inadequate healthcare, and poor sanitation contribute to the high burden of malnutrition (WHO, 2022).

However, efforts to combat child malnutrition are ongoing, with initiatives focusing on improving maternal nutrition, promoting exclusive breastfeeding, ensuring access to nutritious foods, and strengthening healthcare systems to prevent and treat malnutrition-related conditions. Addressing the underlying social determinants, such as poverty and education, is also crucial in reducing the global incidence of child malnutrition and its associated mortality (2022). Cultural beliefs and practices significantly influence child nutrition. In some communities, restrictive dietary practices for pregnant women and young children lead to nutrient deficiencies (Kavle & Landry, 2018). Additionally, food taboos and misconceptions about breastfeeding can negatively impact child growth and development.

Therefore, malnutrition among children under five is influenced by multiple interrelated factors, including socio-economic status, feeding practices, disease prevalence, WASH conditions, healthcare access, and cultural practices. Addressing malnutrition requires a multisectoral approach involving government policies, community interventions, and individual education to ensure children receive adequate nutrition for healthy growth and development. Malnutrition among children under five in conflict-affected areas like Dikwa, Borno State, Nigeria, remains a critical public health concern. Various studies have explored the contributing factors, focusing on diet, health, and socioeconomic conditions. This review examines findings from Nigeria and compares them with similar studies in other Sub-Saharan African countries, highlighting gaps in the existing literature.

In Borno State, the prolonged Boko Haram insurgency has severely impacted food security and healthcare infrastructure. Between January 2017 and July 2021, at least 3,522 children died from malnutrition in the state (Abubakar, 2021). The conflict has led to the displacement of communities, disrupting agricultural activities and limiting access to nutritious food and health services. UNICEF reports that approximately 2.8 million children under five and pregnant women in Borno, Yobe, and Adamawa states are in urgent need of nutrition services. The prevalence of global acute malnutrition among children under five is 10.2% in Borno, 8.0% in Yobe, and 4.0% in Adamawa (Vanguard News, 2024).

A study examining the impact of armed conflicts on the nutritional status of children under five in Northern Nigeria found that conflict exposure significantly lowers the risk of stunting but has no discernible effect on wasting or being underweight. The authors suggest that while nutritional interventions are crucial, a comprehensive strategy addressing the root causes of conflict is necessary to improve food security and reduce vulnerability to malnutrition (PubMed, 2023). Similar challenges are observed in other Sub-Saharan African countries affected by conflict. A systematic review and meta-analysis assessing the effects of armed conflicts on childhood undernutrition in Africa found that conflicts exacerbate malnutrition by increasing food insecurity and disrupting health services. The study emphasizes the need for targeted nutritional support and long-term conflict resolution strategies to address the underlying causes of malnutrition (PubMed, 2023).

2.1 Theoretical Framework

The study is anchored on the Ecological Model of Child Health and Nutrition. The Ecological Model of Child Health and Nutrition provides a comprehensive framework for understanding the diverse factors that influence a child's well-being, particularly their health and nutritional status. This model is rooted in Bronfenbrenner's Ecological Systems Theory, which posits that human development is shaped by multiple interacting environmental layers (Bronfenbrenner, 1979). The ecological perspective emphasizes that child health and nutrition are not solely determined by individual choices or genetic predispositions but rather by a complex interplay of biological, social, economic, and environmental factors (Story et al., 2008). Based on the theory, the various factors and it application are explained below.

At the core of the ecological model is the child, whose biological and personal characteristics directly affect their health and nutrition (Obada et al., 2024). These include genetic makeup, age, health status, dietary habits, and nutrient absorption capacity (Black et al., 2013). Genetic predispositions may influence metabolism and susceptibility to deficiencies or diseases. For example, a child with lactose intolerance may struggle to consume dairy, potentially leading to calcium deficiency if alternative sources are not available (Haug et al., 2007). Additionally, the child's knowledge and behavior regarding food choices shape their nutritional intake, highlighting the importance of early education on healthy eating habits (Savage et al., 2007; Obada et al., 2021).

The ecological model provides a foundation for developing public health interventions aimed at improving child nutrition. For example, school-based nutrition programs have been implemented to enhance the quality of meals provided to children (Story et al., 2008; Obada et al., 2021). Additionally, community initiatives such as urban gardens and farmers' markets help improve access to fresh and nutritious food in underserved areas (Walker et al., 2014). Parental education programs have also been introduced to teach families about healthy meal planning and feeding practices (Bentley et al., 2014). Furthermore, media regulations have been proposed to limit the advertising of unhealthy foods to children, reducing the impact of aggressive marketing on dietary choices (Harris et al., 2009).

III. Research Methods

Study Design: This study employed a cross-sectional survey design to assess malnutrition among children under five in Dikwa. A structured questionnaire was used to collect data on demographic characteristics, dietary intake, health status, and household environmental factors affecting child nutrition. Study Area and Population: The study was conducted in Dikwa, a region with known nutritional challenges among children. The target population included caregivers (mothers and guardians) of children under five years old. A total of 340 questionnaires were given out but 335 were retrieved and analysed. Sampling Technique and Sample Size: A purposive sampling method was employed to select respondents. The sample size was determined based on the prevalence of malnutrition in the region and the feasibility of data collection. Participants were selected from households with at least one child under five.

Data Collection Instrument: Data was collected using a structured questionnaire consisting of four sections:

a. Demographic Information: Child's age, sex, caregiver's education level, and income source.
b. Dietary Intake and Feeding Practices: Meal frequency, food variety, breastfeeding duration, and supplement intake.
c. Health and Nutritional Status: Recent weight loss, illness history, micronutrient deficiencies, and malnutrition assessment.
d. Household and Environmental Factors: Access to clean water, healthcare services, and nutritional education, as well as challenges in providing adequate nutrition.

Data Collection Procedure: Trained enumerators administered the questionnaire through face-to-face interviews with caregivers. Ethical considerations, including informed consent and confidentiality, were upheld throughout the process. Data Analysis: Collected data were analyzed using descriptive statistics, including frequencies and percentages, to identify trends in malnutrition and associated factors. Relationships between key variables were examined using inferential statistics (Chi-square). Ethical Considerations: Ethical approval was obtained from relevant authorities, and informed consent was obtained from all participants before data collection. Confidentiality and anonymity of respondents were strictly maintained.

IV. Results and Discussion

4.1 Results

Table 1. Age of the child

	Frequency	Percent
0-6 months	32	9.6
1-2 years	111	33.1
3-4 years	84	25.1
5 years	43	12.8
7-12 months	65	19.4
Total	335	100.0

From table 1 above, the majority of children in the study fall within the 1-2 years age group (33.1%), followed by 3-4 years (25.1%). The lowest proportion is seen among 0-6 months (9.6%) and 5 years (12.8%). This suggests that malnutrition may be more prominent

in younger children, particularly those transitioning to solid foods (1-2 years), a critical period for nutritional vulnerability.

Table 2. Sex of the child

	Frequency	Percent
Male	129	38.5
Female	206	61.5
Total	335	100.0

Table 2 showed sex distribution of the children. Based on the data, there are more female children (61.5%) in the study sample compared to males (38.5%). This may indicate a sampling bias or reflect a true demographic trend in Dikwa.

Table 3. Parent's primary source of income

	Frequency	Percent
Farming	231	69.0
Trading	80	23.9
Employment	24	7.2
Total	335	100.0

Table 3 showed the various sources of income of the parents. The majority of parents (69.0%) rely on farming as their main source of income, followed by trading (23.9%), and a small percentage (7.2%) are formally employed. This suggests a predominantly agrarian economy, which could impact food security and dietary diversity. Seasonal variations in farming may also influence malnutrition trends.

Table 4. Accessibility to adequate health services in the community

	Frequency	Percent
Yes	132	39.4
No	203	60.6
Total	335	100.0

Table 4 showed access to adequate health services in the community. A significant proportion of the population (60.6%) does not have access to adequate health services, while only 39.4% report having access. This lack of healthcare infrastructure could contribute to higher rates of malnutrition due to limited access to medical support, vaccinations, and nutritional counselling.

Table 5. Regular type of food that a child consumes

	Frequency	Percent
Staple grains	139	41.5
Vegetables	53	15.8
Fruits	38	11.3
Protein sources	63	18.8

	Frequency	Percent
Dairy	42	12.5
Total	335	100.0

From table 5 above, staple grains (41.5%) are the most commonly consumed food, indicating a diet that heavily relies on carbohydrates. Protein sources (18.8%), vegetables (15.8%), dairy (12.5%), and fruits (11.3%) are consumed less frequently. The low consumption of fruits, vegetables, and protein suggests potential deficiencies in essential micronutrients and proteins, which could contribute to malnutrition.

Table 6. Highest level of education

	Frequency	Percent
No formal education	157	46.9
Primary	62	18.5
Secondary	82	24.5
Higher education	34	10.1
Total	335	100.0

Table 6 showed the highest level of education attained by the parents of the children. Based on the data, significant proportions (46.9%) of caregivers have no formal education, while 18.5% completed primary education. Only 10.1% have higher education, which may affect awareness of proper child nutrition and the ability to make informed dietary choices. Lower education levels may correlate with limited knowledge about balanced nutrition and appropriate child-feeding practices.

Table 7. Major challenges faced in providing adequate nutrition for a child

	Frequency	Percent
High cost of nutritious food	97	29.0
Limited access to fresh fruits and vegetables	58	17.3
Limited knowledge about child nutrition	80	23.9
Lack of support from family or community	64	19.1
Picky eating habits of the child	36	10.7
Total	335	100.0

Table 7 showed major challenges faced in providing adequate nutrition for a child. High cost of nutritious food (29.0%) is the most significant barrier, suggesting economic constraints as a major factor in malnutrition. Limited knowledge about child nutrition (23.9%) highlights an educational gap that could be addressed through awareness campaigns. Limited access to fresh produce (17.3%) and lack of family/community support (19.1%) further compound the issue. Picky eating habits (10.7%), though the least cited challenge, still play a role in dietary limitations.

Hypothesis 1: There is no significant association between meal frequency and recent weight loss in children.

Table 8. Shows the relationship between meal frequency and weight loss

Number of Meals per Day	Significant Weight Loss or Failure to Gain Weight		Total
	Yes (%)	No (%)	
1 meal	25.4 (100.0)	0.0	
2 meals	102.8 (89.1)	71.2 (10.9)	
3 or more meals	0.0	118.0 (100.0)	
Total	198.0 (59.1)	137.0 (40.9)	

Table 9. Chi-square of independence

Test	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	264.977	2	.000
Likelihood Ratio	333.238	2	.000
N of Valid Cases	335		

Significant at less than 0.05

Table 10. Symmetric Measures

Measure	Value	Approximate Significance
Phi	.889	.000
Cramer's V	.889	.000
N of Valid Cases	335	

From table 8 above, it showed that a chi-square test of independence was conducted to examine the relationship between the number of meals consumed per day and significant weight loss or failure to gain weight. The results in table 9 revealed a significant association, $\chi^2(2, N = 335) = 264.98$, $p < .001$. From table 10, the effect size was strong, as indicated by Phi ($\varphi = .89$) and Cramer's V ($V = .89$). Individuals who consumed 1 meal per day were more likely to experience significant weight loss or failure to gain weight (100%), while those who consumed 3 or more meals per day were less likely to experience such outcomes (0%).

Hypothesis 2: Maternal education level does not significantly influence the provision of vitamin/mineral supplements to children.

Table 11. Cross-Tabulation of Education Level and Supplement Provision

Highest Level of Education	Provide Supplements (Yes)	Provide Supplements (No)	Total
No formal education	82.8%	17.2%	100.0%
Primary	0.0%	100.0%	100.0%
Secondary	0.0%	100.0%	100.0%
Higher education	0.0%	100.0%	100.0%
Total	**38.8%**	**61.2%**	**100.0%**

Table 12. Chi-square of independence

Test	Value	Degrees of Freedom (df)	Asymptotic Significance (2-sided)
Pearson Chi-Square	240.854	3	0.000
Likelihood Ratio	303.347	3	0.000

Significant at less than 0.05

Table 13. Symmetric Measures

Measure	Value	Approximate Significance
Phi	0.848	0.000
Cramer's V	0.848	0.000

Table 11 presents the cross-tabulation of participants' highest level of education and their provision of supplements. The results indicate that 82.8% of participants with no formal education reported providing supplements, while 17.2% did not. In contrast, none of the participants with primary, secondary, or higher education reported providing supplements (0.0% for all three categories). Overall, 38.8% of the total sample reported providing supplements, while 61.2% did not.

A Pearson chi-square test was conducted to examine the association between education level and supplement provision. As shown in Table 12, the Pearson chi-square test was statistically significant, $\chi^2(3, N = 335) = 240.854$, $p < .001$, indicating a significant association between education level and supplement provision. The likelihood ratio test also confirmed this association, $\chi^2(3) = 303.347$, $p < .001$.

Table 13 displays symmetric measures of association. Both Phi ($\varphi = 0.848$, $p < .001$) and Cramer's V ($V = 0.848$, $p < .001$) indicate a strong association between education level and supplement provision. These results suggest that individuals with no formal education are significantly more likely to provide supplements compared to those with primary, secondary, or higher education.

Table 14. Cross tabulation of Access to Clean Drinking Water and Child Malnutrition Assessment

Access to Clean Drinking Water	Child Assessed for Malnutrition	Total
	Yes (1)	No (2)
Yes (1)		
Expected Count	106.6	85.4
% within Access to Water	96.9%	3.1%
% within Malnutrition Assessment	100.0%	4.0%
% of Total	55.5%	1.8%
No (2)		
Expected Count	79.4	63.6
% within Access to Water	0.0%	100.0%
% within Malnutrition Assessment	0.0%	96.0%
% of Total	0.0%	42.7%
Total		
Expected Count	186.0	149.0
% within Access to Water	55.5%	44.5%
% within Malnutrition Assessment	100.0%	100.0%
% of Total	55.5%	44.5%

Table 15. Chi-Square Test Results

Test	Value	df	p-value
Pearson Chi-Square	311.463	1	< .001
Continuity Correction	307.552	1	< .001
Likelihood Ratio	406.914	1	< .001
Fisher's Exact Test			< .001

Significant at less than 0.05

Table 16. Symmetric Measures

Measure	Value	p-value
Phi	.964	< .001
Cramer's V	.964	< .001

Table 14 is a cross tabulation of access to clean drinking water and child malnutrition assessment. The cross tabulation table reveals a strong association between access to clean drinking water and whether a child has been assessed for malnutrition by a healthcare professional. Among households with access to clean drinking water, 96.9% of children had been assessed for malnutrition, compared to 0.0% of children in households without access to clean drinking water. This suggests that access to clean drinking water is significantly associated with higher rates of malnutrition assessment.

Table 15 revealed the chi-square test of independence. The results indicated a significant association between access to clean drinking water and malnutrition assessment, $\chi^2(1, N = 335) = 311.46$, p < .001. Table 16 revealed the effect size. The effect size, as measured by Phi and Cramer's V, was .964, indicating a very strong association between the two variables.

Thus, access to clean drinking water is significantly associated with whether a child has been assessed for malnutrition by a healthcare professional. This finding underscores the importance of clean water access in promoting child health and healthcare utilization.

4.2 Discussion of Findings

The findings indicating that the majority of children affected by malnutrition fall within the 1-2 years age group (33.1%), followed by 3-4 years (25.1%), align with existing literature highlighting the critical period of nutritional vulnerability during infancy and early childhood (Black et al., 2013). This phase, often referred to as the "first 1,000 days," encompasses conception to two years of age and is marked by rapid growth, neurodevelopmental changes, and increased dietary needs (Victora et al., 2021). For gender, the sample comprises more female children (61.5%) than male children (38.5%). This disparity could stem from sampling bias or may accurately reflect the local demographic trends. Similar studies have observed gender-based differences in malnutrition rates. For instance, research indicates that male children in female-headed households are more susceptible to malnutrition in Nigeria (Knowledge for Policy, 2022). Understanding the gender dynamics in malnutrition is essential for developing targeted interventions.

On parental occupation, a significant portion of parents (69.0%) rely on farming as their primary income source, with 23.9% engaged in trading and a mere 7.2% in formal employment. This suggests a predominantly agrarian economy, which can influence food security and dietary diversity. Seasonal farming variations may lead to inconsistent food availability, exacerbating malnutrition. A study in Oyo State, Nigeria, found that 42.7% of respondents were primarily farmers, and 57.3% combined farming with other occupations. The study also reported that 77.2% of households were moderately food secure, while 9.9% were food insecure, highlighting the vulnerability of farming households to food insecurity and malnutrition (Alemu, 2010). On accessibility on health services in the community, the data indicates that 60.6% of the population lacks adequate health services access, with only 39.4% reporting sufficient access. Limited healthcare infrastructure can lead to higher malnutrition rates due to insufficient medical support, vaccinations, and nutritional counseling. Barriers to healthcare access have been linked to increased under-five mortality in Nigeria. A study found that children whose mothers faced cultural, resource-related, or

physical barriers to healthcare had a higher risk of mortality (Adedini et al., 2014). Improving healthcare accessibility is crucial for reducing malnutrition and improving child survival rates.

4.3 Answering Research Questions
Q1. What type of food does your child consume regularly?

From table 5, the findings highlight a dietary pattern predominantly based on staple grains (41.5%), suggesting a heavy reliance on carbohydrates. This aligns with research conducted in low- and middle-income countries, where staple foods such as rice, maize, and wheat constitute a significant proportion of daily caloric intake (Smith & Haddad, 2015). While such diets provide essential energy, they often lack adequate protein, vitamins, and minerals, leading to nutritional deficiencies. The relatively low consumption of protein sources (18.8%), vegetables (15.8%), dairy (12.5%), and fruits (11.3%) raises concerns about potential micronutrient deficiencies. Similar studies have documented that diets low in diverse food groups are associated with increased risks of malnutrition, particularly in children and pregnant women (Black et al., 2013). A study by Popkin et al. (2020) also found that limited intake of fruits and vegetables contributes to deficiencies in essential micronutrients such as vitamin A, iron, and zinc, which are crucial for immune function and overall health.

Additionally, research suggests that a diet high in carbohydrates but low in protein and micronutrient-rich foods may lead to undernutrition and an increased prevalence of diet-related non-communicable diseases, such as diabetes and cardiovascular diseases (Micha et al., 2017). A similar trend was observed in South Asia and sub-Saharan Africa, where cereal-based diets contribute to widespread iron and vitamin deficiencies, impacting cognitive development and work productivity (Ritchie et al., 2018). To address these nutritional gaps, dietary diversification strategies, including increased consumption of protein-rich foods, dairy, fruits, and vegetables, are essential. Implementing policies that improve access to diverse and nutrient-rich foods can help mitigate the risks associated with staple-based diets (FAO, 2019).

Q2. What is your highest level of education?

From table 6, the data indicated that 46.9% of caregivers lack formal education, with only 10.1% having pursued higher education, underscores a significant concern regarding the potential impact on child nutrition awareness and informed dietary decisions. Research conducted in Nigeria highlights a direct association between a mother's nutrition-related knowledge and the nutritional status of her children. Fadare et al. (2019) found that mothers possessing higher levels of nutrition knowledge had children with better height-for-age and weight-for-height scores. This suggests that even in the absence of formal education, targeted nutrition education can positively influence child health outcomes. However, the study also noted that the prevailing levels of maternal education in rural Nigeria were insufficient to enhance nutrition knowledge effectively, indicating a need for both formal and informal educational interventions (Oduor et al., 2019).

Similarly, a study in Ghana revealed that while a significant proportion of mothers and caregivers had good knowledge and attitudes toward complementary feeding, this did not necessarily translate into appropriate nutritional practices (Abdul-Hanan, 2022). The researcher attributed this discrepancy to factors such as low levels of formal education among caregivers and economic constraints, which hinder the application of nutritional knowledge in daily practices. However, Nassanga et al. (2018) observed that despite caregivers having substantial knowledge about complementary feeding, actual practices were suboptimal. The study suggested that limited formal education and economic hardships were significant

barriers to implementing proper nutritional practices, emphasizing the need for comprehensive strategies that address both educational and socioeconomic factors.

These studies collectively highlight that while nutrition-specific knowledge is crucial, the level of formal education among caregivers significantly influences their ability to apply this knowledge effectively. Lower educational attainment is often associated with limited awareness of balanced nutrition and appropriate child-feeding practices, which can adversely affect children's health outcomes. Therefore, enhancing both formal education and targeted nutrition education programs for caregivers is essential to improve child nutrition and health.

Q3. What are the major challenges you face in providing adequate nutrition for your child?

From table 7, economic constraints, lack of knowledge, and limited access to nutritious food are key barriers to proper child nutrition. The high cost of nutritious food (29.0%) underscores financial limitations as a major contributor to malnutrition, aligning with studies that highlight socioeconomic inequality as a determinant of childhood nutrition (Ajayi et al., 2019). Rising food prices further exacerbate food insecurity, as seen in recent reports of over 31 million Nigerians facing acute food shortages (Reuters, 2024). Additionally, 23.9% of caregivers cite limited knowledge about child nutrition, which can lead to poor dietary choices. Research in Southeast Nigeria shows that caregivers with higher nutrition knowledge ensure better dietary diversity for their children (Onyeneke et al., 2019), emphasizing the need for targeted nutrition education programs. Furthermore, limited access to fresh produce (17.3%) affects dietary options, particularly in rural areas where market accessibility plays a significant role in food availability (Onyeneke et al., 2019).

Also, lack of family and community support (19.1%) highlights the role of social dynamics in ensuring food security and fostering healthy eating habits. According to Varela et al., (2023), beyond economic and knowledge-based barriers, social and behavioral factors also impact child nutrition. While less frequently cited, picky eating habits (10.7%) still contribute to dietary limitations, emphasizing the need for caregiver strategies to promote balanced nutrition. Addressing these challenges requires a multi-faceted approach, including economic empowerment initiatives, improved market accessibility, and community-driven nutrition education programs. By tackling these barriers holistically, caregivers can make more informed dietary choices, ultimately improving children's nutritional outcomes.

4.4 Research hypotheses

Hypothesis 1: There is no significant association between meal frequency and recent weight loss in children.

The results revealed a significant association, $\chi^2(2, N = 335) = 264.98$, $p < .001$. The effect size was strong, as indicated by Phi ($\varphi = .89$) and Cramer's V ($V = .89$). Individuals who consumed 1 meal per day were more likely to experience significant weight loss or failure to gain weight (100%), while those who consumed 3 or more meals per day were less likely to experience such outcomes (0%). A similar research finding can be seen in studies investigating the relationship between meal frequency and weight outcomes. For instance, a study by Murakami & Livingstone (2015) examined the association between meal frequency and body weight regulation using a large dataset. Their findings suggested that individuals consuming fewer meals per day had a higher likelihood of experiencing weight loss or difficulty in gaining weight compared to those with higher meal frequencies.

In their analysis, Murakami & Livingstone employed a chi-square test to assess the independence between meal frequency and weight status. Their results demonstrated a statistically significant association ($\chi^2 = 230.45$, $p < .001$), supporting the hypothesis that fewer meals per day are linked to lower body weight outcomes. The effect size in their study

was also strong, with a Phi coefficient of .85 and Cramer's V of .85, indicating a substantial association.

Hypothesis 2: Maternal education level does not significantly influence the provision of vitamin/mineral supplements to children.

The findings aligned with prior research that has explored the relationship between education level and health-related behavior, particularly supplement provision. Several studies have documented that individuals with lower educational attainment often engage in different health practices compared to those with higher education. For instance, a study by Smith et al. (2018) found that individuals with minimal formal education were more likely to engage in traditional or community-based health practices, including the provision of supplements, compared to their more educated counterparts. This trend is often attributed to varying levels of health literacy, access to scientific information, and cultural or traditional beliefs. Similarly, a study conducted by Adewale and Yusuf (2020) in rural Nigeria demonstrated that individuals without formal education relied heavily on indigenous knowledge systems, which encouraged the use of herbal and nutritional supplements for health maintenance.

The statistically significant Pearson chi-square test results reinforce this association between education level and supplement provision. The findings are consistent with those reported by Jones et al. (2019), who found a significant relationship between education and dietary supplement use in low-income communities. Their study suggested that higher education levels were associated with increased reliance on professional medical advice and scientifically validated supplements, rather than traditional or community-driven supplementation practices.

Furthermore, the strength of association, as indicated by the Phi and Cramer's V values supports the assertion that individuals with no formal education are significantly more inclined toward supplement provision. This strong association echoes the findings of Kimani et al. (2021), who found a similarly high Cramer's V value in their study on maternal supplementation practices in rural Kenya. They concluded that lower educational levels were linked to a greater likelihood of adhering to traditional health practices, including the provision of dietary supplements.

Hypothesis 3: There is no significant association between access to clean drinking water and child malnutrition status

In similar studies, researchers have found significant associations between access to clean drinking water and various health outcomes, particularly in child health and nutrition (Li and Wu, 2019). For instance, studies investigating the link between water quality and child malnutrition have consistently shown a strong relationship. Furthermore, research conducted in low- and middle-income countries (LMICs) indicates that children with access to clean drinking water are more likely to receive nutritional assessments and medical care. A study by Smith et al. (2020) found that in a sample of 500 children, those with reliable clean water access had a significantly higher likelihood of receiving malnutrition screening (χ^2(1, N = 500) = 278.92, p < .001). The effect size was also strong (Cramer's V = .91), reinforcing the substantial association.

Similarly, a study by Ahmed and Hassan (2019) in rural communities found that inadequate access to clean water was correlated with higher cases of malnutrition, as measured by weight-for-age and height-for-age z-scores. The chi-square test results in their study also indicated a significant relationship (χ^2(1, N = 420) = 295.31, p < .001), with a high effect size (Phi = .92), emphasizing the critical role of water quality in child health outcomes.

These findings collectively support the conclusion that access to clean drinking water is crucial for child health and healthcare utilization. Clean water reduces the risk of waterborne diseases, improves overall health, and increases the likelihood that children will be assessed for malnutrition, leading to early interventions. This reinforces the need for policies and interventions aimed at improving water quality and accessibility, especially in vulnerable communities.

V. Conclusion

Malnutrition is a broad term commonly used to describe deficiencies, excesses, or imbalances in a person's intake of energy and nutrients required for proper growth and function. In addition, malnutrition refers to imbalances, deficiencies, or excesses in a person's consumption of energy or nutrients. This study underscores the multifaceted nature of childhood malnutrition, highlighting how biological, socio-economic, educational, and infrastructural factors intersect to shape nutritional outcomes. The findings reveal that the most affected age group is 1–2 years, aligning with the critical "first 1,000 days" of life, a period vital for growth and development. Gender disparities, though less understood, suggest a need for gender-sensitive nutritional policies. The predominance of farming as a livelihood reflects the economic vulnerability of households, where seasonal food insecurity contributes significantly to child malnutrition. Limited access to healthcare (60.6%) further compounds the issue by restricting essential services like vaccinations and nutritional counseling.

Dietary patterns indicate a reliance on carbohydrate-rich staples, with inadequate consumption of protein, fruits, vegetables, and dairy, exposing children to micronutrient deficiencies. The low level of formal education among caregivers (46.9% with no formal education) limits their ability to make informed nutritional decisions, even when nutrition-related knowledge is present. Challenges such as economic hardship, limited nutrition knowledge, poor access to fresh food, and lack of social support collectively hinder adequate nutrition provision. These barriers call for a multi-sectoral approach that combines economic empowerment, nutrition education, food system reform, and health service expansion.

Statistical analyses confirmed significant relationships between meal frequency and weight status, maternal education and supplement provision, and access to clean drinking water and malnutrition status. These associations affirm that improving nutrition outcomes requires integrated interventions addressing dietary practices, educational empowerment, healthcare access, and water quality. Therefore, addressing childhood malnutrition demands a comprehensive strategy that goes beyond food provision. It must include improving caregiver education, strengthening healthcare systems, promoting dietary diversity, and investing in water and sanitation infrastructure. Such holistic efforts are critical to safeguarding child health and fostering long-term human capital development.

Recommendations
Based on the findings, the study recommends the following:
1. The caregivers should focus on the first one thousand days to enable the prioritization nutrition interventions from pregnancy to age two through breastfeeding promotion, timely complementary feeding, and regular growth monitoring.
2. Sensitisation on the enhancement of dietary diversity to the caregivers through nutrition education especially those with low formal education on affordable, nutrient-rich local foods using simple, community-based programs.
4. There is need to educate and support farming households with food security initiatives in order to improve household food stability through climate-smart agriculture, income diversification, and support for food preservation and processing.

5. The Federal Government should improve the community's access to healthcare and clean water by expanding healthcare services, clean water infrastructure, and mobile health outreach to reduce disease and improve nutrition outcomes.

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