

Prevalence and Determinants of Undernutrition among Under-Five Children in Nigeria: A Systematic Review

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Abstract

Background: Child undernutrition is a key public health issue that both causes and contributes to disease and death. Undernutrition accounts for 45% of under-five deaths globally most of which occur in Low- and Middle-income countries (LMIC). Malnutrition has a substantial and long-lasting effect on individuals, families, communities and the entire nation. This study aimed to assess the prevalence and determinants of undernutrition in under-five children in Nigeria.

Methodology: This systematic review was done following the Cochrane library guidelines. A search of literature written in English language and published between 2000 and 2022 was done using PubMed, CINAHL, MEDLINE and ProQuest databases. The initial search resulted in 760 studies. These were exported to End note version 9 to remove duplicates. Titles and abstracts were screened for studies that met the inclusion criteria. Finally, 11 studies that met the inclusion criteria were thoroughly assessed and data that were relevant to this systematic review were captured. The study findings were analyzed using descriptive statistics.

Results: The prevalence of undernutrition was between 1.0% and 43.3%. The highest prevalence of underweight, wasting and stunting were 43.3%, 29.3% and 41%, respectively. Factors associated with undernutrition were age, sex, birth order, recent acute diarrhoea and acute respiratory infection, maternal literacy level, maternal income <\$20 and socio-economic class among others.

Conclusion: Under-five undernutrition is a huge public health issue in Nigeria. Prevalence of undernutrition varies widely across geo-political zone with a myriad of associated risk factors. Multi-level and multidisciplinary interventions are required to sustainably address the determinants of under-five undernutrition.

Keywords: Prevalence, undernutrition, determinants, under-fives, Nigeria

1. Introduction

Undernutrition in children is one of the world's leading causes of morbidity and mortality (Hall et al., 2020). It is defined as "the lack of proper nutrition caused by not having enough food or not eating enough food containing substances necessary for growth and health" (Brits et al., 2022). Undernutrition is a major public health issue in Low- and Middle-Income Countries (LMICS) (Hall et al., 2020). In addition to it being a public health issue, it also hinders economic growth, productivity and the eradication of global poverty (Dukhi, 2020). Undernutrition is an important indicator for tracking nutritional status and survival (Agho, 2019). Adequate nutrition is a child's right and it is critical for a child's healthy growth and development (Gebre et al., 2019; Ghodsi et al., 2021; World Health Organization, 2022a). The first one thousand days of life are the most crucial in terms of child development (Brits et al., 2022). Poor nutrition is associated with delayed brain development during this period and it has a negative effect on adult cognitive development, educational achievement and economic productivity. The consequences of undernutrition during this critical period can be irreversible (Njigang et al., 2021). When children are well nourished, they are more able to develop, learn and engage in their communities and they are also

irrepressible in the face of disease or any other challenge (United Nations Children's Fund, 2022). Risk factors of undernutrition are found at the level of the child, mother, household and the community (Wete, Zerfu, & Ambese, 2019; Ndimu et al., 2020). Research has shown that investing in childhood undernutrition can have a significant effect in later life. If 10 dollars is spent on nutrition per child yearly, for instance, it can prevent stunting in 65 million children and the death of 3.7 million children (Fufa & Laloto, 2021).

The Sustainable Development Goals (SDG) 2030 agenda represents a shared framework for promoting sustainable development through international collaboration. SDG 2 aims to "End hunger, achieve food security and improved nutrition and promote sustainable agriculture" (Grosso et al., 2020).

In 2020, an estimated 149 million under-five children were stunted and 45 million wasted, globally. Undernutrition is responsible for about 45% of under-five deaths. Between 2000 and 2018 the global rate of stunting fell from 32.5% to 21.9%. This drop, however, is not uniform across countries and regions (Akombi-Inyang, 2021). According to the World Health Organization, LMICs are the most affected (World Health Organization, 2022b). Sub-Saharan Africa is home to a third of the world's undernourished children (Akombi-Inyang, 2021). Undernutrition accounts for about 35% of under-five deaths in Africa (Agho, 2019). Nigeria ranks 160 out of 165 countries in terms of its progress towards achieving the SDGs. With regards to achieving SDG 2, the country has progressed only minimally in lowering the prevalence of wasting and stunting among children under the age of five years (Hackman, Bainamndi, & Trigui, 2021).

Nigeria has one of Africa's highest rates of undernutrition (Akombi-Inyang, 2021). The Nigerian Demographic and Health Survey (NDHS) of 2018 reported that 37% of children aged 6-59 months were stunted, 7% were wasted and 22% were underweight (NPC & ICF International, 2019). The prevalence of stunting remained the same from 2013 to 2018 (Akombi-Inyang, 2021). About two-thirds (66%) of under-fives in Nigeria suffered from undernutrition in 2018. This is alarming and therefore, identifying the determinants of undernutrition is crucial to reverse this trend. Considering this background this study aims to assess the prevalence and determinants of undernutrition among under-fives in Nigeria.

2. Methodology

2.1 Search Strategy and Criteria for Selection

The systematic review was done following the Cochrane library guidelines and the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) checklist. Articles published between 2000 and 2022 were searched for. Four databases were used to search for articles including PubMed, CINAHL, MEDLINE and ProQuest. The search was conducted in June 2022. The keywords used were malnutrition, children, under-fives, prevalence, undernutrition, undernourishment, protein-energy malnutrition, wasting, stunting, determinants, associated factors, causes, and Nigeria. These terms were combined using the Boolean operators 'AND' and 'OR' (Grewal, Kataria, & Dhawan, 2019).

2.2 Selection Criteria

Articles included in this systematic review were peer-reviewed studies on the prevalence of undernutrition, studies on associated factors of undernutrition, studies in English, studies covering the three main dimensions of undernutrition (underweight, stunting and wasting), studies carried out in Nigeria and studies in under-fives.

Studies that were excluded were abstract-only papers, case reports, case series, systematic reviews, narrative reviews, meta-analyses, conference proceedings and editorials. Studies with participants with co-existing morbidities especially chronic conditions like sickle cell anaemia, Human Immunodeficiency Virus infection (HIV), congenital heart disease and 'grey literature' were also excluded.

2.3 Selection Process and Data Extraction

The initial search resulted in 760 studies. The search results from each database were exported to End note version 9 to remove duplicates. Following this, titles and abstracts were screened for studies that met the inclusion criteria. Of the 715 studies screened, 688 did not meet the inclusion criteria. Finally, 11 studies were included out of the 27 identified for full version screening. The selection process is shown in the PRISMA diagram (Figure 1). The full-text studies that met the inclusion criteria were thoroughly assessed and data that were relevant to this systematic review were captured. The relevant characteristics of the studies (author/s, date, study location, aim, study design, methods and the main findings) were captured in a data extraction sheet (Table 1). The study findings were analyzed using descriptive statistics and the variables were tabulated using frequencies and percentages. The risk factors were grouped into the following sub-themes: child, maternal, household, socio-economic and cultural factors.

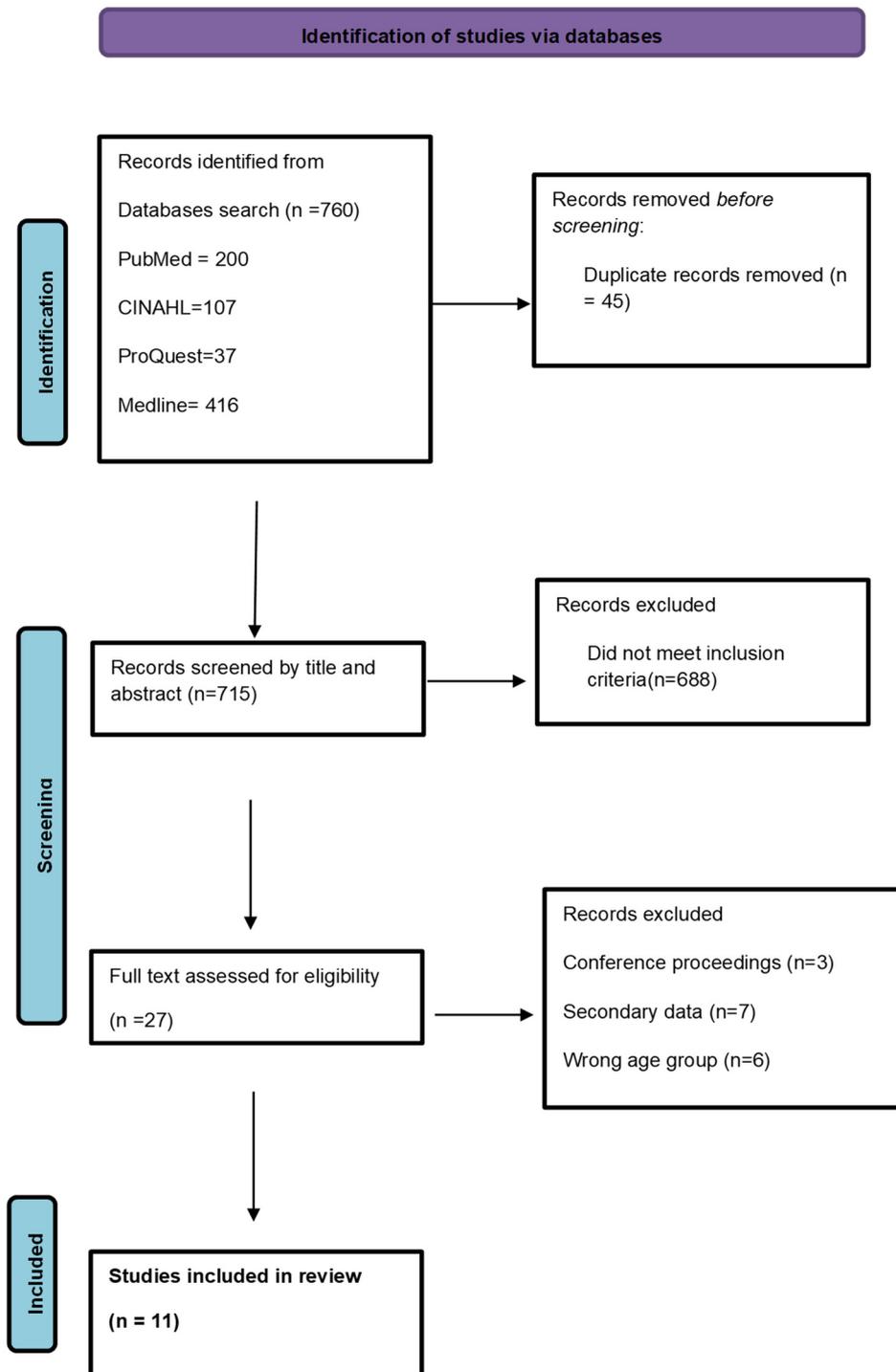


Figure 1. PRISMA flow diagram adapted from Page *et al.*, 2021; University Libraries Health Sciences Library, UNC, 2022

Table 1. Data Extraction Sheet

Study characteristics	Study objective	Methods	Main findings
Odunayo and Oyewole (2006) Osun state, south-western Nigeria	Determine the nutritional status and the influence of feeding practices and family characteristics on the nutritional status of under-fives in rural Nigeria	Descriptive cross-sectional /Multistage /n=420	Prevalence PEM=20.5% (Underweight:19.5%, Marasmus: 1.0%) Determinants; Highest in the second year of life; Overcrowding; Low maternal income; Use of infant formula in children aged \geq 6 months
Olusanya and Renna (2012) Lagos state south-west Nigeria	Determine the pattern of severe malnutrition in the first three months of life and its relationship with the place of delivery to facilitate early case finding in urban settings in low-income countries	Matched case control/mother-infant pair drawn from a previous study population / 918 cases to 1836 controls	Determinants; Infants born in residential homes had 2-3 folds odds of being severely underweight ($p=0.002$), severely stunted ($p<0.001$) and severely wasted ($p=0.008$) compared to those born in public hospitals. -Infants born in private hospitals were also significantly associated with severe stunting ($p=0.032$)
Senbanjo <i>et al.</i> 2013 Lagos State, south-west Nigeria	Determine the relationship between the nutritional status of mothers and their children and the risk factors for undernutrition among mothers and children in rural and urban communities in Lagos State, Nigeria	Descriptive cross-sectional study/Multistage sampling technique/n=300 mother-child pair (150 rural and 150 urban)	Prevalence Rural Underweight: 19.4%; Stunting:9.3%; Urban Underweight: 43.3%; Stunting:12.6% Determinants; The risk of stunted mothers having stunted children was seven times higher than those who were not, in rural communities; Undernourished in urban communities were 11 times and 12 times higher risk of having underweight and wasted children, respectively.
Manyike <i>et al.</i> , 2014 Abakiliki, Ebonyi state, south-east Nigeria	Assess the prevalence of malnutrition among pre-school children in Abakiliki, Ebonyi state	Descriptive cross-sectional/ Systematic sampling/n=616	Prevalence Acute malnutrition:9.7%; Moderate Acute Malnutrition (MAM):5.4% Severe Acute Malnutrition (SAM):4.4%; Stunting: 9.9% Determinants; Sex: stunting was slightly higher in males than in females; Age: a higher prevalence is 2- and 3-year-olds compared to 1-, 4- and 5-year-olds.
Owoaje, Onifade and Desmennu (2014) Memorial children's hospital Ibadan (south-west Nigeria)	To determine the socio-economic and family-related risk factors for undernutrition among children in Ibadan, Nigeria	Case-control/Cases were from the new cases of underweight children who presented at the nutrition clinic of the Oni Memorial children's hospital while controls were children in the target group who weren't underweight /n=100 cases and 200 controls	Determinants Maternal level of education lower than secondary; Monthly income below \$20; Polygamous marriage; Residence in high-density area; Living in a single room; Family weekly food expenditure of $<$ \$55; Incomplete immunization status; Recent acute diarrhoea and acute respiratory infection.

Hamel <i>et al.</i> (2015) Cross River State (south-south Nigeria) and Bauchi State (north-eastern Nigeria)	To assess the association, if any between the care of women during pregnancy and childbirth and the nutritional status of their young children	Cross-sectional study/ Stratified sampling technique/3643 in Cross River and 2706 in Bauchi	Prevalence: Undernourished; Cross River: 4.4%; Bauchi: 14.7% Determinants: Poor care of women in pregnancy and childbirth
Ocheke and Thandi (2015) Jos University Teaching Hospital (JUTH)/Plateau state, north-central Nigeria	To describe the prevalence and pattern of malnutrition presenting with acute illnesses at JUTH	Cross-sectional study/ Not stated/n=379	Prevalence Wasting: 26.9%; Severe wasting: 5.9%; Stunting: 18%; Severe stunting: 4.6%
Senbanjo, Olayiwola and Afolabi (2016) Lagos State, south-west Nigeria	To compare dietary practices and nutritional status in children in rural and urban communities in Lagos State, Nigeria	Comparative Cross-sectional study / Multistage sampling technique/n=300 (150 for rural and 150 for urban)	Prevalence Underweight (Rural: 19.4%; Urban: 9.3%); Stunting (Rural: 43.3%; Urban: 12.6%) Determinants; The urban and rural communities showed similar diversity in food choices and frequency of consumption
Jude, Chukwunedum and Egbuna (2019) South-eastern Nigeria	To identify the prevalence of malnutrition in Enugu metropolis	Descriptive cross-sectional study /Stratified sampling technique/ n=782	Prevalence Undernutrition: 5.9% (Wasting: 2.4%; Stunting: 3.5%) Determinants; Wasting was found in 2.1% and 2.7% of children whose mothers had primary and post-primary education, respectively; Stunting was found in 5.4% and 2.1% of children whose mothers had primary and post-primary education, respectively; Stunting was four times more common in children in the lower socioeconomic class compared to those the in upper.
Idowu et al (2020) Abuja, north-central Nigeria	To identify the determinants on anthropometric indices among under-five children in internally displaced persons camps in Abuja, Nigeria	Descriptive cross-sectional study / Simple random sampling/n=317	Prevalence: Underweight: 42.0%; Wasting: 29.3%; Stunting: 41.0% Determinants; Underweight and stunting were higher in males; Good anthropometric index was 2.5 times higher in children below 12 months than ≥ 37 -month-olds, 2.4 times in first birth order than in fifth
Alamu <i>et al.</i> (2020) Akwa Ibom, south-south Nigeria	Assess the anthropometric indices among women of childbearing age and children 6-59 months in Akwa Ibom state	Descriptive cross-sectional study / Multistage sampling technique/n=547	Prevalence: Underweight: 18.2%; Wasting: 13.1%; Stunting: 37.4% Determinants; There was no statistical difference between boys and girls in wasting and stunting and also no statistically significant association between children's anthropometric indices and the BMI of their mother

3. Results

3.1 General Characteristics and Nature of Reviewed Studies

There were 11 studies (n=11,028) in this review. Nine studies were on the prevalence of undernutrition and its determinants while three studies were on determinants of undernutrition only (Table 1). There was one study before 2010, six studies between 2010 and 2015 and four studies after 2015 (Table 2).

Table 2. Distribution of studies according to year (n=11)

Year of study	Frequency	Percentage
<2010	1	9.1
2010- 2015	6	54.5
>2015	4	36.4

As Table 3 shows, all 11 studies were quantitative studies. Majority of the studies were cross-sectional studies (81.8%). The sampling technique used the most was multistage sampling techniques (36.4%). Questionnaires were used as the data collection tool in all the studies.

Table 3. Distribution of studies based on study design, sampling technique and method of data collection (n=11)

Variable	Frequency	Percentage
Study design		
Cross-sectional studies	9	81.8
Case-control studies	2	18.2
Sampling technique		
Multistage	4	36.4
Systematic	1	9.1
Stratified	2	18.2
Simple random	1	9.1
Not stated	1	9.1
Not applicable	2	18.2
Data collection tool		
Questionnaires	11	100.0

3.2 Prevalence of Under-Five Nutrition

Prevalence of undernutrition varied across geo-political zones. The highest prevalence for underweight, wasting and stunting were 43.3% (south-west), 29.3% (north-central) and 41% (north-central) respectively. Prevalence was higher in rural areas than the urban.

3.3 Determinants of Under-Five Nutrition

There were 18 associated risk factors of undernutrition pooled from the 11 studies. The age of children was a risk factor in three studies (Odunayo & Oyewole, 2006; Manyike et al., 2014; Idowu et al., 2020).

Two studies for the following: Sex (Manyike et al., 2014; Idowu et al., 2020): Rural areas (Senbanjo et al., 2013; Senbanjo, Olayiwola & Afolabi, 2016): Maternal education (Owoaje, Onifade, & Desmennu, 2014; Jude, Chukwunedum, & Egbuna, 2019): Maternal income (Odunayo & Oyewole, 2006; Owoaje, Onifade, & Desmennu, 2014)

One study for the following: Birth order, place of delivery (Olusanya & Renna, 2012), overcrowding, use of infant formula, (Odunayo & Oyewole, 2006), polygamous marriage, residence in a high-density area, living in a single room, family weekly food expenditure, incomplete immunization status, recent acute diarrhoea and acute

respiratory infection (Owoaje, Onifade, & Desmennu, 2014), poor care of women in pregnancy and childbirth (Hamel et al., 2015), socio-economic class (Jude, Chukwunedum, & Egbuna, 2019).

4. Discussion

This systematic review synthesized the evidence on the determinants of childhood undernutrition in Nigeria based on available data. Factors associated with undernutrition were child factors (Age, sex, birth order, incomplete immunization status, use of infant formula, recent acute diarrhoea and acute respiratory infection), maternal factors (Literacy level, maternal income, poor care of women in pregnancy and childbirth) socio-economic, cultural and household factors (place of delivery, overcrowding, polygamous marriage, residence in high density area, living in rural areas, living in a single room, family weekly food expenditure and socio-economic class).

This review showed that prevalence of undernutrition varied across the geopolitical zones in Nigeria but stunting and wasting were highest in Northern Nigeria. Similarly, the NDHS 2018 reported that the highest prevalence of malnutrition is in Northern Nigeria but in contrast to the finding in this review, the north central zone had the highest prevalence of stunting as opposed to the north west zone in the NDHS (NPC & ICF International, 2019). This may not actually be the case as there were no study done in the northwest zone in this review. The high burden of undernutrition in northern Nigeria could be due to a number of factors. Monetary and multidimensional poverty is largely concentrated in this region (Lain & Vishwanath, 2021). Northern Nigeria accounted for 87% of Nigeria's poverty rate in 2016 (Punch, 2020). Poverty rate is 77.7%, 76.3% and 67.5% in North east, North west and north central, respectively (Jaiyeola & Choga 2020). There is poor utilization of public health and medical services in the region and male staff domination creates a cultural barrier to women using them (Benson et al., 2017). Malnutrition in whatever form has enormous direct and indirect costs on a country. Stretching an already frail economy leading to significant economic aftermath at all levels. It leads to impaired physical and cognitive development and also affects educational achievements and economic productivity at the level of the individual. It weakens the immune system leading to increased susceptibility to infectious diseases also at this level. There are both healthcare and opportunity costs due to ill health at the household level. A nation's economic viability is mainly determined by its human capital and good child nutrition is critical to achieving this (Akombi-Inyang, 2021).

Child factors that were found to be determinants of undernutrition in this review are age, sex, birth order, incomplete immunization status, use of infant formula, recent acute diarrhoea and acute respiratory infection. Undernutrition was generally more in children between 2 and 3 years of age. This is similar to the findings in studies done in Ghana and Ethiopia (Boah et al., 2019; Amare, Ahmed, & Mehari, 2019). Malnutrition during this period has been linked to inappropriate complementary feeding (Esan et al., 2022). Also, at this age children start to feed themselves more and this may contribute to insufficient intake of protein and energy (Rahman, 2016). Stunting was found to be higher in males in two studies in this review and this is similar to the findings by Thurstans et al., (2022) and also by Amare, Ahmed and Mehari (2019). Genetic, social and environmental factors are said to be responsible for this (Thurstans et al., 2022). One of the most important predictors of stunting is birth order (Rahman, 2016). Undernutrition was found to decrease with birth order in this review which is in contrast with the findings in other studies where there was an increase in undernutrition with birth order (Aturupane, Deolalikar, & Gunewardena, 2008; Boar et al, 2019). Children that are fully vaccinated have been shown to have a better nutritional status than those that are partially vaccinated which is in agreement with the finding in this review (Abedi and Srivastava, 2012). Use of infant formula, respiratory tract infections and diarrheal disease were also determinants of undernutrition. Breastmilk is high in anti-infective factors that protect against diarrheal disease and respiratory tract infections. So exclusive breastfeeding in the first six months enhances the child's immunity against these infections. Respiratory tract infections and diarrheal diseases are common causes of undernutrition in developing countries (Murarkar et al., 2020). Infection worsens undernutrition and undernutrition reduces immunity, leading to increased susceptibility to infections. It is a vicious cycle (Farhadi & Ovchinnikov, 2018).

Maternal education below the secondary school level is associated with undernutrition in this review. This is in agreement with other studies which show a strong association between maternal education and the nutritional outcome of children (Abuya, Ciera, & Kimani-Murage, 2012; Johri et al., 2016; Khattack, Iqbal, & Ghazanfar, 2017). There is an inverse relationship. Stunting decreases as maternal education increases. Educated women have better child nutrition practices and health-seeking behaviour (Amaha & Woldeamanuel, 2021). Low maternal income was also a determinant of undernutrition. A global review showed that every 6% increase in maternal income translates to a 1cm increase in the height of a stunted child (Murarkar et al., 2020). Poor maternal care during pregnancy and childbirth as a factor associated with undernutrition was in concordance with other studies (Svefors et al., 2020; Muze et al., 2020). Good nutrition during pregnancy and even pre-pregnancy is very

important because research has shown that growth faltering starts during foetal life (Svefors et al., 2020).

The study by Jude, Chukwunedum and Egbuna, 2019 in this review identified low socioeconomic class as a determinant of undernutrition. So, did studies in Ethiopia and Bangladesh (Amare, Ahmed, & Mehari, 2019; Khanam, Shimul, & Sarka, 2019). Place of delivery is a predictor of undernutrition in this review as in other studies (Amaha & Woldeamanuel, 2021). There is better obstetric and medical care when delivery is in a health facility and the women will also receive information on childcare (Kang & Kim, 2018). Poor living conditions (living in a single room, living in a high-density area) were also recognized as predictors of malnutrition. Galgalmuwa et al., (2017) also found that living in one or two rooms is a determinant of undernutrition. Children in crowded living spaces are more prone to undernutrition (Kavosi et al., 2014). Those living in rural areas were more at risk of undernutrition than those in urban areas. The same was found in other studies (Kandala et al., 2011; Ahmad, Afzal, & Imtiaz, 2020). But it was the other way round in some studies (Kavosi et al., 2014; Murarkar et al., 2020). A low level of education, low socioeconomic class, inadequate water supply and infectious diseases could be responsible for the higher prevalence in rural areas (Kavosi et al., 2014). The studies where the prevalence of undernutrition was more in the urban areas thought it to be due to urbanization and poverty, especially in the urban slums. Also, those in the rural areas can live on seasonal crops including fruits and vegetables which are more affordable (Kavosi et al., 2014; Murarkar et al., 2020).

5. Strengths and Limitations

The review had wide coverage of the country. Covering both northern and southern Nigeria. This will enable the planning of interventions based on the peculiar determinants of the various regions. It also opens areas for further research. Research can be done to find effective interventions to tackle the determinants of malnutrition found in this review leading to evidence-based policies to prevent undernutrition. Highlights the need for more research on risk factors of undernutrition, seeing that most of the risk factors were mentioned in only one study

The overall prevalence could not be calculated because the studies used different measurements to assess undernutrition and also not the same classification was used.

The link between women's autonomy, i.e., her freedom to take decisions independently and also having a say when key decisions are being made in the household and under-five undernutrition was not captured. This can be a determinant with regards to taking decisions on both her nutrition and that of the children. Father's educational levels and employment status were also not considered. Even though mothers are more often than not the primary givers, these two variables are important because a low level of education and not being gainfully employed will result in a poor household wealth index leading to food insecurity and poor living conditions.

6. Conclusion

We are still a long way from a world free of undernutrition. It remains a major global health challenge especially, in LMICs like Nigeria. SDG 2 aims to achieve zero hunger, which means eliminating undernutrition. There has been a steady global decline in stunting since the year 2000 but the rate of progress needs to increase if the SDG 2030 target is to be met. The rate of wasting on the other hand is on the increase so there has to be a reversal of this trajectory to achieve the target. The situation is dire in Nigeria. The prevalence of undernutrition was generally high with regional variations with higher prevalence in Northern Nigeria. A myriad of determinants of undernutrition was found in this review. If Nigeria is to achieve SDG 2 and other SDGs a concerted effort by the government, NGOs, communities and individuals is needed.

7. Recommendations

Solving this global challenge of achieving 'Zero hunger' requires collaboration among key players. A crucial shift in policy is required to prevent undernutrition. It is also critical to develop and scale-up solutions that address the determinants of undernutrition in Nigeria.

What is needed is an improvement in the nutrition of under-fives to meet SDG 2. To achieve this, a multisectoral, multidimensional and multilevel approach is required. The three levels of government in Nigeria (National, State and Local Government Area) should be committed to tackling the problem of undernutrition with more effective evidence-based policies and programmes for alleviating poverty, girl child education, sanitation, etc.

Regional policies to prevent and control undernutrition according to the determinants peculiar to that region are needed. At the individual and household levels, there should be increased awareness by continuously educating mothers and fathers on the determinants of undernutrition. At the community level, there can be the provision of fortified cereals at subsidized prices. Educating the community on the importance of the girl child education, safe water, personal hygiene, environmental sanitation.

Competing Interests Statement

The authors declare that they have no competing interests.

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