Texila International Journal of Public Health
ISSN: 2520-3134
DOI: 10.21522/TIJPH.2013.11.02.Art012

Prevalence and Determining Factors of Undernutrition among Under-five Children in Three Local Government Areas of Niger State, Nigeria

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Abstract

The Nigerian economy depression, Covid 19 pandemic, nationwide insecurity, and global warming are quartile factors, that affected the already compromised nutritional status of under-five children in the country, with a resultant increase in morbidity and mortality. A community-based cross-sectional study was undertaken using two-stage cluster sampling method in Suleja, Tafa, and Gurara LGAs of Niger state. Data from 2350 under-fives were collected using questionnaires, and anthropometric measurements. WHO growth standard was used to determine the prevalence; multivariate logistic regression in IBM explored statistically significant independent variables associated with stunting, underweight and wasting using p-value of < 0.05. Prevalence of stunting was 47.4%, underweight 32.7%, and wasting 22.6% respectively. Severe stunting and underweight were higher in Suleja, severe wasting in Gurara, and male children were more affected by all indicators. Age of child, LGA, mother and father education, marital status, exclusive breastfeeding, and duration of breastfeeding; source and buying of drinking water, family type, maternal knowledge about malnutrition, and health seeking behavior of mothers were found as determinants. Under-five mortality is a good indicator of the health, and economic status of any community; thus, the health of under-fives needs the utmost attention. The high prevalence from the study is critical; a critical approach is urgently needed at the family, community, local government, state, and national levels with other stakeholders; to ensure under-fives receive adequate, quality, and affordable nutrients for health, and growth. Accessible, prompt, and sustainable interventions for identified cases are of utmost importance.

Keywords: *Determinants, Niger state, Prevalence, Undernutrition, Under-five.*

Introduction

According to the World Health Organization (WHO), malnutrition refers to deficiencies, excesses, or imbalance in a person's intake of energy and/or nutrient [1]. Malnutrition has been attributed to poor growth, high risk of infections, poor intellectual ability, repeated illness, and high hospital admission rate in children. It contributes to infant and under-five mortality, and sadly, almost half of the death in under-fives are being attributed to under-nutrition, mostly in low and middle-income countries. It is also a risk factor for increased frequencies, delayed recovery, and severity of infections in vulnerable, and high-risk children [2]. Two broad types of malnutrition exist, first is over-nutrition, a precursor of childhood obesity [3, 4], and the basal metabolic index (BMI) is used as an indicator [5]. The second is under-nutrition, which subtypes are wasting, stunting and under-weight, protein energy malnutrition, vitamins, and minerals deficiency. Stunting was said to have declined steadily since 2000 in some countries, while wasting and underweight persist at an alarming rate, and overweight is on the rise [2]. In 2020, at the global level, 149 million under-five children were estimated to be stunted

Received: 30.01.2023 ***Accepted: 08.03.2023*** ***Published on: 30.06.2023***
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(too-short-for-age), 45 million wasted (too-thin-for-height), 100 million underweight (low weight-for age), and 38.9 million were overweight [1, 6]. The Global 2020 estimated prevalence of stunting globally among under-fives was 33.1%, 29.1% in Africa, and 39% in Sub-Sahara Africa, (a sub-region always associated with high burden of infectious diseases, and poor health indices).

The under-five population in Nigeria has been estimated to be 32.9 million, however, the country has a downward trend in the prevalence of stunting from 42.3% in 2000 to 35.3% in 2020, which is still higher than the regional average [7]. The under-fives prevalence of wasting globally is 7%, Africa 6.4%, Sub-Sahara Africa 7.5%, and Nigeria 7% [7]. The prevalence of underweight is 12.6% globally, Africa 17.1%, Sub-Sahara Africa 16.9%, and 18% for Nigeria according to the World Bank [8, 9]. It is therefore not surprising, the infant and under-five mortality rates of Nigeria at 54.7 and 90.2 per 1000 live births respectively are critical, compared to many Africa countries, because undernutrition can result in morbidity and mortality [10].

The causes of undernutrition are multifactorial, many factors have been attributed, and studies conducted in different populations have been linked to environmental, behavioral, socioeconomical, and health service factors, all of which are health determinants. Poor environmental conditions of a child, which include lack of good hygiene, safe water, and sanitation among others, are precursors to infectious diseases like diarrhea, malaria, and respiratory infections, a triple childhood killer. Studies in Bougainville, in Papua New Guinea, and rural Ethiopia had found these tripods to be determinants of undernutrition in under-fives [11, 12]. Similarly, external environmental factors like global warming, insecurity, and internal displacement, which prevent farmers from farming, nor to harvest their already planted crops, lead to high cost of food and unavailability [13, 14]. Behaviorally, adverse cultural practices like forced feeding of infants, and large household size in polygamous settings can lead to food rationing [15, 16, 17, 18]. Socio-economically, poverty, and low maternal literacy rate, deprives mothers of proper knowledge about complimentary feeding preparation, timing, and the lack of economic power to institute balance diet with negative health consequences [19].

Intimate partner and gender violence can affect the physic of a woman resulting in lack of care, and attention to the feeding of the younger children [20, 21, 16]. Undernutrition can also result from early termination of breast feeding due to poor maternal health, and early return to work [22]. The lack of access to adequate maternal, and child health services, where proper nutritional education are taught, anthropometry indices measured; insufficient childhood nutritionists in communities [23], and lack of follow-up services, leave a nutritional gap, as discovered in an analysis of five provinces in Zambia at level-one hospitals [24]. In Nigeria, the recurrent unpleasant industrial actions by health workers, brain drain in health sectors, and health workers being target of kidnapping inside health facilities are big throwbacks [25]. The repercussions of undernutrition can be acute and chronic, as documented in studies [26, 27, 28].

Niger state is one of the hotspot states in the north central region of Nigeria, and badly affected by the on-going security challenges, with many internally displaced families [29, 30]. The current high inflation rate, compounded by the post Covid-19 job loss of young household's heads, lands encroachment by bandits, terrorism, and inadequate food supply are among reasons for the rising rate of malnutrition in the country as demonstrated in a recent study [31]. Also, of note is the contributory effects of political instability, and the high poverty index, which had hindered development [14, 32]. The above factors necessitated this cross-sectional survey, to find out how the nutrition status of under-five children who are more sensitive, and vulnerable has been affected [1]; moreover, to bridge the

gap in literature as no known study has been individually conducted in the selected three LGAs of Niger state, on the prevalence of undernutrition among under-five children, and the determining factors.

Methods

Study Design

The design was a community cross-sectional study, which is most suitable in obtaining the prevalence rate of the parameters under study [33]. Data for the survey were collected from eleven wards in three LGA of Niger state.

Study Setting

The three LGAs are Suleja, Tafa, and Gurara. Suleja is an urban town with an estimated population of 162.135 according to the Wordiometer 2021 estimate [10], the selected wards were Bagama 'A', Bagama 'B', Hashimi 'B' and Madalla.

Tafa is a semi-urban settlement, it has a current population estimate of 159,005 [34], the selected wards were Iku, Ijagbagi, Wuse East, and Zuma East.

Gurara is basically a rural community, though with a 2022 population estimate of 155,900 [35], Bonu, Lambatta, and Tufa wards were selected.

Sample Size

The sample size was calculated independently using the national prevalence for stunting, wasting and underweight of under-fives at 35%, 7% and 18% respectively, according to the global nutrition report of 2019 [7] for each of the LGA, using the Raosoft sample size calculator software with the formula stated below [36].

$$\frac{N = Z^2(P)(1-P)}{d^2}$$

Where Z is the statistic corresponding to the level of confidence (CI) of 95%, and 1.96 was used.

P is the expected prevalence or national prevalence/pilot study.

d is the precision corresponding to the effect size, and precision of 5% was used.

A sample size of 1029 was calculated for the study including 10% non-response rate, but 2350 under-fives were surveyed for a robust sample.

Sampling Technique

All the under-five children whose mother resided in the selected communities during the study period had equal opportunity, but two-stage cluster sampling methods was used. The LGA in the state were designated as clusters, from which three were selected. The selected LGAs were further divided into clusters at the ward level, and eleven wards were finally selected. A simple random sampling method was then used to select eligible samples. Special needs, chronically ill, and children on transit in the communities were excluded, and those whose mothers refused to participate.

Data Collection and Research Tools

The data were collected by community health workers in each ward. Structured questionnaires prepared in English language were used, but interpretation was done for mothers who did not understand English language. Questions captured were socio-demographic of the children and their mothers; maternal and child health; socio-economic and environmental factors; maternal knowledge on malnutrition, and health seeking behaviors of mothers. The tools used were as recommended by the WHO for anthropometric measurements. They included digital infant, and bathroom size measuring scales (SECA) to measured weight in kilograms, Tri-color tapes for MUAC; standard portable infantometers, and SECA wall growth charts for infants' length, and older children height to the nearest millimeter [37].

Definition and Variables

The dependable variables were stunting, underweight, and wasting. Stunting is the failure to achieve the expected height/length for age measurement in children and is an indicator of linear growth retardation [3]. It is measured using the height for age standardized Z-Score (HAZ) of at least -2SD below the median of the

WHO Growth Standard. Underweight is a composite of the measure of stunting and wasting. It is used to measure the magnitude of nutrition overtime, and can be used to measures the population's health, and mortality in children, which has been found to increases with the degree of underweight [3]. It is measured using weight for age standardized Z-score (WAZ) of at least -2SD below the median in the WHO Growth Standard. Wasting on the other hand, is the measure of the recent lack of nutrition, which may be due to recent acute illness, and not a constant state [3]. It is estimated using weight for height (WHZ) above 6 months, or weight for length (WLZ) in infants below 6 months of age with Z-score of at least -2SD below the median of WHO Growth Standard. There is also severe acute malnutrition (SAM), which is define as very low weight to height, and Z-score below -3SD of the median in the WHO Growth Standard; or a mid-upper arm circumference of < 115mm, and/or presence of nutritional edema [3]. Independent variables selected for the study were part of undernutrition determining factors which had been identified in literatures; they included age and gender of child; maternal age, education level, marital status, LGAs, religion and employment; child immunization status, birth order, breastfeeding type, and duration; diarrhea, type of toilet, housing, knowledge on malnutrition, and health seeking behavior of under-fives mothers.

Data Analysis

Analysis was performed using the IBM-SPSS statistic (IBM statistical product and service solutions) Version 23 software for descriptive and inferential statistics. while ENA for Smart 2020 (Emergency Nutrition Assessment for Standardized Monitoring and Assessment of Relief and Transition) was used to calculate the prevalence. Descriptive statistics were used to organize, describe, present and summarize the data. Bivariate and multivariate logistic regression were used to examine the relationship between the undernutrition indicators. Significance of the determinants were established using 95% (CI), at 5% significance, and a *p*-value of less than 0.05 ($p < 0.05$).

Results

Overall Descriptive Statistics

A total of 2350 under five were surveyed in the 3 LGAs, but only 2310 were analyzed. In the age distribution, majority (39.1%) were within 13-24 months, (24.8%) 0-12 months; female 53.7%, and male 46.3%. On the socio-demography data of parents, 34.1% and 31.4% of mothers were in the age group 26-30 years and 21-25 years, with 5.9% in 49–59-year group respectively. Secondary and post-secondary education attainment for mothers 33.4% and 23.4%, while 29.4% had no formal education. Father's education attainment followed the same pattern. 93.2% of mothers were married, 47.4% in monogamous relationship, 85.9% employed (formal & informal), and 74.9% identified as Muslims, 24.8% Christians. Geopolitically, majority (65%) were from the north-central zone, out of which 58.01% were from Niger state.

For maternal and child health data, 72.3% of under-five were fully immunized, 22.1% partially immunized, and 5.6% unimmunized; 32.9% were fourth born and above birth order, 23.9% third born, 25.2% second born, and only 18.1% were first born respectively. 55% were exclusively breastfed, complimentary feeding introduction >6 month of age was 61%, and 53.6% between 1 and 2 years. Only 20.8% reported diarrhea in the past 3 month before data collection.

Environmentally, 66.9% lived in households with water closet toilets (safely managed sanitation), 24% used pit latrines (unimproved sanitation), while 9.1% had no toilet facility. 43.4% of households buy their drinking water, 80% drink safely managed or improved water (44.3% borehole, 35.7% pipe borne supply), 16.8% use well water (unimproved water), and 3.2% stream water (surface water) respectively. House ownership was 63.0%, and 68.3% live in

compound. 51.4% of mothers demonstrated good knowledge on malnutrition. On mother health seeking behavior during child ill state, 75.4%, 73.1%, 47.7% and 99.3% patronized nurses, drugstore vendors (chemist shop), local herbal vendors, hospitals most of the times.

Descriptive statistics, and frequencies at the LGA level are detailed in Table 1.

Table 1. Descriptive Statistics of Independent Variables in Suleja, Tafa and Gurara LGA

Variables	**Suleja**	**Tafa**	**Gurara**
Total under five surveyed	945	764	601
Age of under-fives			
<12 months	26.5% (249)	31.5% (237)	13.7% (82)
13-24 months	31.2%(293)	53.6% (403)	33.2% (199)
25 – 36 months	19.5% (183)	9.0% (68)	24.5% (147)
37 – 48 months	15.4% (145)	4.4% (33)	19.5% (117)
49 – 59 months	7.4% (70)	1.5% (11)	9.0% (54)
Gender			
Male	45.4% (419)	44.8% (330)	49.6% (293)
Female	54.6% (503)	55.2% (406)	50.4% (298)
Mother age			
<20	5.2% (49)	5.3% (40)	15.2% (91)
21-25	19.7% (185)	32.1% (243)	48.8% (293)
26 – 30	36.8% (346)	41.5% (314)	20.3% (122)
31-35	19.1% (180)	14.0% (106)	5.7% (34)
36-40	10.9% (102)	5.4% (41)	7.8% (47)
41-45	7.0% (66)	1.2% (9)	1.5% (9)
46-50	1.3% (12)	0.4% (3)	0.7% (4)
Mother education level			
None	5.0% (47)	5.2% (39)	29.0% (174)
Islamiyah	10.3% (97)	15.9% (120)	33.0% (198)
Primary school	14.9% (140)	10.1% (76)	17.2% (103)
Junior secondary school	17.8% (168)	16.9% (128)	4.0% (24)
Senior secondary school	17.3% (163)	25.7% (194)	15.2% (91)
NCE	18.4% (173)	10.6% (80)	1.3% (8)
Polytechnique	8.0% (75)	9.0% (68)	0.3% (2)
University	8.4% (79)	6.7% (51)	0
Father education level			
None	2.2% (21)	0.7% (5)	15.0% (90)
Islamiyah	2.9% (27)	2.9% (22)	30.4% (182)
Primary school	4.9% (46)	4.8% (36)	12.4% (74)
Junior secondary school	10.2% (96)	12.7% (96)	3.8% (230)
Senior secondary school	22.7% (213)	28.8% (217)	29.2% (175)
NCE	16.2% (152)	11.3% (85)	6.7% (40)
Polytechnique	10.6% (100)	20.7% (156)	0.8% (5)
University	30.3% (285)	18.1% (136)	1.7% (10)
Family type			
Monogamous	53.8% (507)	37.2% (279)	50% (300)

Polygamous	36.4% (343)	48.5% (363)	49.5% (297)
Single mothers	9.8% (92)	14.3% (107)	0.5% (3)
Mother employment			
Employed	76.4% (714)	94.8% (750)	85% (510)
Unemployed	23.6% (221)	1.6% (12)	15.0% (70)
Mother religion			
Muslim	70.6% (657)	63.9% (473)	95.3% (569)
Christian	29.1% (271)	35.7% (264)	4.7% (28)
Others	0.3% (3)	0.4% (3)	0
Maternal marital status			
Married	89.7% (842)	94.8% (714)	96.7% (578)
Divorced	5.8% (54)	2.5% (19)	0.2% (1)
Single	1.6% (15)	1.3% (10)	3.2% (19)
Widow	2.3% (22)	0.4% (3)	0
Separated	0.6% (6)	0.9% (7)	0
Immunization history			
Fully	67.7% (630)	85.8% (647)	62.2% (368)
Partially	25.1% (233)	12.9% (97)	29.4% (174)
Unvaccinated	7.2% (67)	1.3% (10)	8.4% (50)
Birth order			
1 – 3	65.7% (619)	77.4% (590)	56.7% (3400
>3	34.4% (324)	22.5% (172)	43.3% (260)
Exclusive breastfeeding			
Yes	48.0% (449)	89.2% (666)	25.5% (151)
No	52.0% (447)	10.8% (81)	74.5% (442)
Age of complimentary feeding			
<6 months	31.2% (291)	20% (149)	75% (444)
>6 months	68.8% (641)	80.0% (595)	25.0% (148)
Duration of breastfeeding			
<6 months	5.7% (53)	8.6% (64)	17.6% (104)
1 – 2years	51.9% (485)	72.3% (539)	32.7% (193)
6 – 12months	42.4% (396)	19.1% (142)	49.7% (293)
Source of drinking water			
Well (unimproved)	5.1% (48)	16.8% (126)	35.3% (210)
Borehole (improved)	40.6% (380)	33.5% (251)	63.5% (378)
Pipe borne (improved)	51.0% (477)	44.0% (330)	1.0% (6)
Stream	3.2% (30)	5.7% (43)	0.2% (1)
Buying of drinking water			
Yes	60.3% (560)	30.3% (226)	33.5% (198)
No	39.7% (369)	69.7% (520)	66.5% (393)
House ownership			
Yes	45.9% (431)	67.6% (507)	84.0% (500)
No	54.1% (507)	32.4% (243)	16.0% (95)
Maternal knowledge			

Yes	54.1% (511)	58.6% (448)	37.9% (228)
No	45.9% (434)	41.4% (316)	62.1% (373)
Health seeking behavior			
Nurses			
Yes	75.2% (672)	47.9% (208)	96.0% (566)
Never	24.8% (222)	52.1% (226)	4.1% (24)
Drugstore (local drugs vendors)			
Yes	70.7% (25)	53.0% (243)	92.4% (543)
Never	29.2% (250)	47.1% (218)	7.5% (44)
Local herb vendors			
Yes	45.9% (396)	45.9%	81.8% (478)
Never	54.0% (465)	54.1%	18.3% (107)
Watery stooling (3 months)			
Yes	28.7% (265)	14.4% (107)	16.5% (96)
No	71.3% (659)	85.6% (634)	83.5% (497)
Type of toilet			
Pit latrine (unimproved)	24.0% (223)	9.8% (73)	41.9% (250)
Water closet (improved)	73.8% (687)	76.6% (572)	43.9% (262)
None	2.3% (21)	13.7% (102)	14.3% (85)
Type of housing			
Compound	63.8%	54.7%	92.1%
Flat	36.2	45.3%	7.9%

Prevalence of Undernutrition

Stunting: Overall prevalence of stunting was 47.4% for the 3 LGAs, boys (49.2%), girls (45.8%), severe stunting cut across all age groups, moderate stunting was more pronounced among 42 – 53 months (22.6%), 54 – 59 months (22.0%), and 30 – 41 months (19.2%) respectively. Stunting, and severe stunting were more prevalent in Suleja LGA at 49.4%, and 37.8% respectively.

Wasting or Global Acute Malnutrition (GAM): Total prevalence was 22.6%, boys 24.3%, girls (21.2%), severe acute malnutrition (SAM) 14.4%, moderate acute malnutrition (MAM) 8.2%, both higher in boys than in girls. SAM was higher in the 6 – 17 months age group (25.9%) and least in the group 42 – 53 months (8.6%), while MAM was higher in the 6 – 17 months (9.6%) and lowest in 54 – 59 months (2.3%). Based on weight for age (WHZ) and MUAC combined, the prevalence of wasting and severe wasting were 27.3% and 15.7% respectively. Wasting was more prevalent in Tafa LGA (22.9%), while severe wasting was highest in Gurara LGA (15.5%).

Underweight: Overall prevalence was 32.7%, boys 34.9%, and girls 30.8%. Moderate underweight was 15.1%, while severe underweight was 17.6%. Age wise, severe underweight was 26.4% in 30-41months, 25.0% in 6-17 months; moderate underweight highest in 42 – 53 months (19.9%), and 6 – 17 months (17.3%) respectively. Underweight and severe underweight prevalence were more pronounced in Suleja LGA (38.4%, 25.1%) and least in Gurara LGA (7.2%).

Table 2 details the prevalence of stunting, wasting and underweight at the LGAs level.

Table 2. Prevalence of Stunting, Wasting and Underweight in Under-five in Suleja, Tafa and Gurara LGA of Niger State

	Stunting (%)	**Severe stunting (%)**	**Moderate stunting (%)**	**Wasting GAM (%)**	**Severe Wasting (SAM) %**	**Moderate wasting %**	**Underweight (%)**	**Severe underweight (%)**	**Moderate underweight (%)**
Suleja LGA	49.4	37.8	11.6	20.7	11.3	9.4	38.4	25.1	13.3
Tafa LGA	43.2	31.4	11.7	22.9	14.0	8.9	30.0	15.8	14.1
Gurara LGA	49.0	33.3	15.7	18.5	15.5	3.0	10.1	7.2	3.0
Overall (3 LGAs)	47.4	34.6	12.7	22.6	14.4	8.2	32.7	17.6	15.1

Associated Factors in Multivariate Logistic Regression

In the bivariate and multivariate logistic regression analysis, statistically significant variables were age of child, mother and father educational level, marital status, family type; exclusive breastfeeding and duration of breast feeding, type of drinking water and buying of drinking water; maternal knowledge on malnutrition, health seeking behavior of mother, and local government area (table 3, 4, and 5). The gender of a child, maternal employment status, immunization, number of children in family, diarrhea disease, type of toilet, and house ownership were not statistically significant in this study.

Stunting: In the analysis for stunting, LGAs, age of under-fives, maternal education, family type, duration of breast feeding, health seeking behavior (mothers who never patronized local herbs vendors) were significant as determinants. The risk of stunting decreases at age level 49 – 59 months (AOR = 0.16, $p < 0.05$). Under-five in Suleja, and Gurara LGA have a reduced risk of stunting compared to under-five in Tafa LGA (AOR = 0.56, $p < 0.0001$; 0.387, $p < 0.05$) respectively. There is reduced risk of stunting among those whose mothers never patronized local herb vendors, similarly, maternal education up to the polytechnic level reduced the risk (AOR = 0.246, $p < 0.05$), and polygamous type of family (AOR = 0.273, $p < 0.05$). Children breastfed above 6 months, but less than 1 year of age showed two and a half higher risk of stunting (AOR = 2.725, $p < 0.05$).

Wasting: Determining factors found to be associated with wasting in the analysis were mother educational level, marital status, buying of drinking water, father education, duration of breast feeding and local herbs vendors' patronage. The odds of wasting increased by two and a half when mother attended junior Secondary School (AOR = 2.512, $p < 0.05$), similarly, being a widowed mother by fourfold (AOR = 4.631, $p < 0.05$); children breastfed for 6 months – 1 year (AOR = 1.411, $p < 0.05$), buying of drinking water (AOR = 1.470, $p < 0.05$) and those who never patronize local herbs vendors (AOR =1.443, $p < 0.036$), all increased the odd of wasting. Father education up to NCE, and Polytechnic level reduced the risk (AOR = 0.581, $p < 0.05$; AOR = 0.506, $p < 0.05$) respectively.

Underweight: Determinants associated with underweight in the study were LGA, age of under-fives, father education, exclusive breastfeeding, and duration of breastfeeding; source of drinking water, maternal knowledge of malnutrition, seeking treatment from nurses, drug vendors (chemist shops), and local herbal vendors. There is a reduced risk of underweight in age group 13-24 and 25-36 months (AOR = 0.097, $p < 0.001$; AOR = 0.151 $p < 0.001$) respectively, similar risk reduction in children from Suleja, and Gurara compared to Tafa LGA (AOR = 0.09 and 0.48). Family type (monogamous), and full immunization reduced the risk, as well as exclusive breastfeeding (AOR = 0.744, $p < 0.05$), while seeking treatment at chemist shops reduced the risk of wasting (A0R= 0.420, $p < 0.001$). Lack of father education and primary school attainment increased the risk three and two folds (AOR = 3.357, $p < 0.05$, AOR =2.391, $p < 0.05$) respectively. There was double increased risk in those breastfed between 6 month-1year, and 1-2 years (AOR = 2.230, $p < 0.05$; AOR = 2.119, $p < 0.000$). Drinking borehole water increased the risk three folds (AOR = 3.524, $p < 0.05$), while maternal knowledge on malnutrition reduces the risk. Increase risk is also seen among those who never patronizes nurses and local herbs vendors (AOR =1.817, $p < 0.05$; AOR = 1.806, $p < 0.001$) respectively.

Table 3. Statistically Significant Determinants of Wasting in Bivariate and Multivariate Logistic Regression

Variables	**AOR (95% CI)**	***P*–Valuable**
Mother education		
None*	-	-
JSS	2.512 (1.094 – 5.771)	0.03
Father education		
None*	-	-
NCE	0.581 (0.337 – 1.003)	0.05
Polytechnic	0.506 (0.290 – 0.885)	0.02
Marital status		
Married*	-	-
Widow	4.631 (2.337 – 9.178)	0.01
Duration of breastfeeding 1		
<6 months*	-	-
6 months – 1 year	1.411 (1.036 – 1.920)	0.03
Buying drinking water 1	1.470 (1.086 – 1.990)	0.01
Health seeking (herb vendors)		
Always*	-	-
Never	1.443 (1.024 – 2.035)	0.04

Table 4. Statistically Significant Determinants of Stunting in Bivariate and Multivariate Logistic Regression

Variables	**AOR (95%CI)**	***P*– Valuable**
Age of child		
Level 10 – 12*	-	-
Level 49 – 59	0.160 (0.103-0.312)	0.00
Maternal education		
Level 0 (None)*	-	-
Level 6 (Polytechnic)	0.246 (0.158-0.562)	0.02
Family type		
Level 0 (Monogamous)*	-	-
Level 1 (Polygamous)	0.027 (0.010-0.248)	0.05
Duration of breastfeeding		
Level 0 (<6 months)*	-	-
Level 1 (6 months - 1 year)	2.725 (1.520-4.923)	0.05
Local herb vendors		
Level 0 (Always)*	-	-
Level 3 (Never)	0.569 (0.344-1.026)	0.05
LGA		
Tafa*	-	-
Suleja	0.56 (0.250-0.858)	0.00
Gurara	0.387 (0.174-0.792)	0.03

Table 5. Statistically Significant Determinants of Underweight in Bivariate and Multivariate Logistic Regression

Variables	AOR (95%CL)	*P* – Valuable
Age		
0 – 12*	-	-
13 – 24	0.097 (0.50 – 0.189)	0.00
25 – 36	0.151 (0.80 – 0.284)	0.00
Father education		
None*	-	-
Islamiyah	3.357 (1.434 – 7.859)	0.01
Primary	2.391 (1.174 – 4.869)	0.02
Exclusive Breastfeeding 1	0.744 (0.551 – 1.003)	0.05
Duration of breastfeeding		
< 6 months*	-	-
6 months – 1 year	2.230 (1.262 – 3.940)	0.01
1 year – 2 years	2.119 (1.551 – 2.894)	0.00
Type of drinking water		
Well water*	-	-
Borehole	3.524 (1.389 – 8.941)	0.01
Knowledge 1	0.678 (0.506 – 0.909)	0.01
Health seeking		
Always*	-	-
Nurses (never)	1.817 (1.207 – 2.735)	0.00
Drugstore vendors (Sometimes)	0.420 (0.260 – 0.679)	0.00
Local herb vendors (never)	1.806 (1.281 -2.548)	0.00

Keys * Reference group; 1 is Adjusted Odd Ratio AOR; 2 is Confidence interval.

Discussion

The overall prevalence of undernutrition obtained among the under-five children, who resided in the three communities during the data collection period were, stunting 47.4% wasting 22.6%, and underweight 32.7%. These obtained undernutrition indicators are above the newly projected WHO prevalence thresholds for public health significance of < 5% and < 10% for wasting and stunting respectively, making the obtained prevalence in the study to be classified as "very high" [38]. It is also higher than the Nigeria, sub-Sahara, African, and global average of stunting (35.3%, 39%, 30.7%, 33.1%), wasting (6.5%, 7.5%, 6.0%, 7.0%), and underweight (18.0%, 16.9%, 17.1%, 12.6%) respectively [1, 7, 8, 9].

Some previous studies in the country had reported lower, and similar prevalence; in Borno and Yobe states in the northeast region, which were also worst hit by the insurgency, prevalence of wasting ranges from 8.9% to 14.3% [30]. A cross- sectional survey using data obtained by the Nigerian Demographic and Health Survey (NDHS) of 2018, reported 36.2%, 21.4%, and 6.7% for stunting, underweight and wasting, respectively [39]. Also in nearby Benue, another north-central state, stunting was 44%, wasting 7%, and underweight 6.5% [40]. Similarly, in two adjacent states, (rural Kaduna and IDP camp in FCT), 59.72%, 36.81%, and 13.54%; 42%, 29%, and 41% were obtained for stunting, underweight and wasting, respectively [41, 42]. The prevalence of undernutrition has always been found to be higher in IDPs camp,

because of the severe shortage of food, and high rate of infections [29]. However, the similarity in the present and the IDP camp studies can be attributed to the current food crisis in the nation [43]. Stunting prevalence has been documented to be the highest among the undernutrition indicators, outside Nigeria, studies in India reported 45% [44], like this study finding; however, lower values of 22% and 33.5% had been reported in Northeast Ethiopia and Uganda [45, 46]. Underweight is second in prevalence, and similar patterns have also been demonstrated elsewhere, [47, 42, 39]. It is believed to be worse in the northern part of the country, because of the prevailing level of poverty [16], and high rate of polygamy due to the predominant Islamic religion [15]; although, this study failed to see any significant relationship between polygamy and underweight.

Wasting is the least of the undernutrition in prevalence, and the reason cannot be dissociated from the fact that, it is an acute state which can be reversed when the condition normalized, and adequate nutrients are available [48, 42]. The high prevalence obtained in this study cannot be dissociated from the ongoing conflict in the region, which has resulted in reduced availability of food [17]. The high prevalence is similar to studies in Maharashtra, India 17.1%, Ethiopia 22.7%, and 41% in FCT IDP camp [44, 27, 42]. However, lower values of 2.5%, 5% and 6.7% had been obtained from South Sudan, Uganda, and NDHS 2018 review respectively [49, 46, 39]. It is believed that during the acute food shortage period, measures taken by some households are to borrow food from neighbors, friends, and families to alleviate hunger; buying less expensive food items, or food rationing within the household [23], however, the current high inflation rate affecting majority of households must have reduced these practices, resulting in undernutrition.

The age categories of undernutrition obtained differed from other studies. The severity of stunting among all age categories was in contrast to the NDHS 2018 review, in which severity was among 24-35 months only [39]. Also, severe wasting and underweight were found in only 12-23 months in a Uganda study [50], compared to the 6-17 and 30-41 age group obtained. The preponderant of male children having negative prevalence of undernutrition than female children has been found in similar studies [42, 46]. Reason for this may be that girls are always with their mothers in the kitchen, while the males are out playing. This however differs from findings in Ethiopia where male were 0.35 times more wasted than female, the reason being family preference for male children, which accorded them special privileges [27]. There was a significant association between maternal educational level and stunting, with reduced odd obtained with higher education, and increased with lower education attainment. Therefore, advanced education opportunity, when given to women is highly beneficial to children nutrition [51, 11, 52].

A low level of father education level was found to be associated with underweight, this is contrary to other studies in which low maternal education has been an associated determinant [53, 17, 51]. Exclusive breastfeeding of 55% obtained was higher than the national rate of 28.7% [7], but similar to 45.5% in nearby FCT [42]. This higher rate could have been responsible for the reduced odd of underweight in under-fives, who were exclusively breastfed. Children breastfed above 6 months were found to have an increased risk of stunting, underweight, and wasting, the reason is likely due to the prevailing economic situation, reduced maternal access to quality food, and reduced number of times breast milk is given in a day; equally, is the quest for mothers to resume work early in order to supplement the family income, and the nutritional care of the babies is thus, left to daycare services, baby sitters, older siblings, etc., who had little or no knowledge about nutritional requirements of children, which can result in frequent diarrhea disease [11, 22]. Unfortunately, no indicator was directly associated with diarrhea in the study. Although,

large family size has been associated with increased risk of undernutrition in some settings [15, 16, 17, 18], however in this study, a large polygamous household reduced the odd of under-fives stunting. The reason is likely because most mothers (93.2%) were still married, which can confer food protection to their children. The high risk of wasting in under-fives whose mothers were widows is not surprising, widows have low economic power, and may have to depend on family members for sustenance.

Unimproved source of water increased the odd of being underweight, while buying water also raised the odd of wasting like findings by [27]. According to the NDHS 2018, two third of the nation population have access to improved water source, this claimed was supported in this survey with a total of 80.0% household reporting getting water from improved water sources (pipe borne 35.7%, borehole 44.3%); while Spring survey reported 60% households in Niger sourcing water from boreholes [51, 23]. However, these sources cannot be accepted as safely managed water, because of the leaked pipes, and irregular supplies, thus, buying water for drinking is common. The process of transporting the water from point of sale to the households is highly predisposed to contamination.

Geographical differences between urban and rural areas were demonstrated, and more pronounced with underweight prevalence (38.4%) in Suleja, compared to 10.1% in Gurara, a rural settlement, and this pattern was like other studies [4, 52, 44]. Many reasons can be adduced to these phenomena which include access to processed food in the urban areas, and children taking snacks to school [40], compared to rural children, most of whom parents are farmers, and have more access to fresh food. Other rural-urban differences noticed in Gurara LGA were younger maternal age (15.2% of <20) [11], low maternal education (62% with no formal education, 0% university attendance), low practice of exclusive breastfeeding, introduction of complimentary food and duration of breastfeeding. Also demonstrated were reduced improved water source, type of housing and toilets, low maternal knowledge on malnutrition, and poor health seeking behavior of mothers during illness of under-fives illness. Some of the reasons for these differences could be poverty, inadequate health facilities with qualified personnel, local beliefs, and higher trust in nurses, drugstore, and herbal vendors. Studies in Ibadan, and Port Harcourt areas of the country supported these later claims and found a high rate of 81% and 80.9% usage of herbal/traditional medicine among the respondents [54, 55].

Preventive Measures

Primordially, nutritional education should be introduced into school curriculum [56]. Primarily, child nutrition tutorials should be taught to newly wedded couples, and pregnant mothers. [57]. Compulsory immunization growth charts should be a prerequisite for nursery and primary school enrollment [38]. Law should be enacted to enable women education to post-secondary school level, and male inclusiveness in under-fives nutrition is paramount [16, 58, 15, 59].

Proffering solutions to brain drains in the health sector, building more well-equipped health facilities in communities across the state, and increased budgetary allocation for health [24]. Halting the raging insecurity in the state, and integrated approach to policy on health, agriculture, water and sanitation, education, and road [30, 15]. Current federal government school feeding program should be extended to under-fives, mass deworming program [14], and state nutritional surveillance [49]. Secondarily, prompt diagnosis, and referral during well baby clinic, development, and promotion of locally available ingredients to produce high energy supplemental food suitable for the management of under nutrition. Tertiarily, establishment of well-equipped, and staffed nutritional rehabilitation centers across the nation, in view

of the endemic nature of undernutrition in the country as evident from this study, and other recent studies in the country.

Conclusion

The study has done a situational finding about the nutritional status among under-fives residing in three adjacent communities of Suleja, Tafa and Gurara in Niger state. The high prevalence of undernutrition indicators are in tandem with the poor nutritional state of the children, who are also victims of the prevailing economy depression, loss of jobs by parents, acts of terrorism, and ongoing banditry in the country, which has led to displacement of farmers with resultant expensive, and shortage of foodstuffs. The policy makers at all levels would do well to urgently address these maladies, in order not to jettison the future health of the under-fives and the unborn generations; and to make achievable the sustainable development goals (SDG) target 2:2 ‘‘to end all forms of malnutrition by 2030’’ [60].

Ethical Approval

Approvals and protocol for the survey were obtained from the ethical committees of the primary health management board of each LGA.

Limitation

Geographical zones were used as against the actual ethnicity of the mothers, because of multiple ethnic groups in the country. The inability to include household income as an independent variable because the majority of the families were self-employed, and a standardized method is needed to estimate the household wealth index. For further research, full comparison between the three LGAs determinants, households’ income, and the role of intimate partner violence in undernutrition should be explored.

Acknowledgements

Our sincere appreciation goes to the primary health board ethical committees for the approvals, all the health workers, and nutritional focal person in each LGAs who went into the field to collect the data, despite the insecurity in some areas. The deepest appreciation goes to the under five children and their mothers who participated in the survey.

Conflict of Interest

None declared. Both authors are staff of Citizen Hospital that financed the survey.

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