Rwanda Medical Journal RMJ

ORIGINAL ARTICLE Open Access

Socio-demographic correlates of childhood malnutrition in a rural community in Southwest Nigeria - A call for targeted interventions for vulnerable children

Authors: O. A. T. Fatunla[1,*]; O. S. Olatunya[2]; E. O. Ogundare[2]; T. O. Fatunla[3]; T. A. Agbesanwa[3]; A. B. Taiwo[4]; O. A. Oyelami[2]

Affiliations: *[1]Department of Paediatrics, Afe Babalola University, Ado-Ekiti, Nigeria; [2]Department of Paediatrics, Ekiti State University, Ado-Ekiti, Nigeria; [3]Department of Family Medicine, Ekiti State University Teaching Hospital, Ado-Ekiti, Nigeria; [4]Department of Paediatrics, Zankli Medical Centre, Abuja, Nigeria*

ABSTRACT

BACKGROUND: Nigeria has the second-highest burden of stunted children globally. Yet, only two out of ten malnourished Nigerian children benefit from intervention programs to address malnutrition. This study describes some socio-demographic factors associated with malnutrition among children living in a rural community in Southwest Nigeria.

METHODS: This study was a community-based cross-sectional study involving 364 children randomly selected from their homes aged 1–15 years. Factors such as socioeconomic status, birth order, and whether the mother was alive were obtained. Weights, heights, and body mass index (BMI) were measured and interpreted using the WHO z-scores. Chi-squared test of associations was used for categorical variables and an independent t-test was used to compare the mean BMI between both genders. The level of significance was set at a p-value <0.050.

RESULTS: There were 185 (51%) females: 173(48%) belonged to the age group 1–5 years and 168 (46%) belonged to the lower socio-economic class. Over 80% of the participants had normal nutritional status: 19 (6%) were underweight, 36 (10%) were stunted, and 29 (8%) were thin (low BMI, <-2SD). Maternal demise was associated with thinness. Males from lower socio-economic classes and first-born males had a higher mean BMI than the females (p<0.050).

CONCLUSION: Although malnutrition prevalence was low, there is a need to use targeted interventions to further reduce malnutrition among vulnerable children. There is also a necessity for more studies to identify and address the risk factors for stunting in the study area.

Keywords: Children, Malnutrition, Orphan, Socio-economic, Nigeria

INTRODUCTION

Childhood malnutrition (under- and over-nutrition), is a global health concern. Malnutrition is associated with 45% of childhood mortality, especially in developing countries [1]. Different forms of malnutrition exist; these include stunting (low height for age), underweight (low weight for

***Corresponding author:** Odunayo A T Fatunla, Department of Paediatrics, Afe Babalola University, Ado-Ekiti, Nigeria, Email: odunayofatunla@yahoo.ca; Tel: +234 803 439 7539; **Potential Conflicts of Interest (CoI):** All authors: no potential conflicts of interest disclosed; **Funding:** All authors: no funding has been sought or gained for this project; **Academic Integrity.** All authors confirm that they have made substantial academic contributions to this manuscript as defined by the ICMJE; **Ethics of human subject participation:** The study was approved by the local Institutional Review Board. Informed consent was sought and gained where applicable; **Originality:** All authors: this manuscript is original has not been published elsewhere; **Review:** This manuscript was peer-reviewed by three reviewers in a double-blind review process; **Type-editor:** Kishan (USA).

Received: 11th February 2022; **Initial decision given:** 15th March 2022; **Revised manuscript received:** 28th April 2022; **Accepted:** 30th July 2022.
 Publisher: Rwanda Biomedical Centre (RBC)/Rwanda Health Communication Center, P. O. Box 4586, Kigali. ISSN: 2079-097X (print); 2410-8626 (online)

Citation for this article: O. A. T. Fatunla; O. S. Olatunya; E. O. Ogundare et al. Socio-demographic correlates of childhood malnutrition in a rural community in Southwest Nigeria: A call for targeted interventions for vulnerable children. Rwanda Medical Journal, Vol. 79, no. 3, p. 60-69, 2022. https://dx.doi.org/10.4314/rmj.v79i3.7

age), wasting (low weight for height), overweight and obesity (high body mass index for age) and micronutrient deficiencies, among others [2,3]. Stunting indicates chronic malnutrition and it has the highest prevalence in Nigeria, compared to the other forms of malnutrition that are based on anthropometry [2-4]. According to the United Nations Children's Fund (UNICEF) about 32% of under-five children are stunted and about two-million Nigerian children have severe malnutrition [3,4]. Nigeria has the second-highest burden of stunted children globally [4]. Stunting is associated with poor cognition, and poor productivity in adulthood and also increases the risks of death [4].

Only two out of every ten malnourished children receive treatment in Nigeria, despite community-based programs to address malnutrition [4]. Some of these programs, such as feeding interventions, food supplementation, and health education, are integrated into Nigeria's primary health care (PHC) system. The PHC system in Nigeria was introduced over two decades ago. In recent times, however, the PHC system has had challenges including poor staffing and inadequate infrastructure, thereby hampering effective service delivery [5]. In addition, due to the changes in the population dynamics over the past decade, the importance of regular surveillance to assess the nutritional status of Nigerian children is heightened. Surveillance is pertinent for accurate tracking of progress and for policy review. This study aimed to assess the nutritional status of children living in a rural community in Southwest Nigeria and to describe some socio-demographic factors associated with childhood malnutrition in the community.

METHODS

Study design: This is a sub-component analysis of a larger community-based prospective cross-sectional study conducted between April and June 2019. The larger study described the relationship between splenomegaly and malaria parasitemia among children living in Ire-Ekiti, a rural community in Southwest Nigeria [6]. The community is primarily agrarian and known for subsistent and commercial rice farming. The annex of the government-owned Ekiti State University Teaching Hospital (EKSUTH) is located within this community in partnership with a private-owned Joan Taiwo Daramola Memorial Hospital.

Children aged 1 – 15 years living in Ire-Ekiti, Nigeria, were recruited into the study. The sample size required for the study was 334 children, calculated using the formula $N = [Z^2 \times p\ (1-p)]/d^2$ [7]. Where: 'N' is the number of participants, 'Z' is 1.96 at a 95% confidence level, 'p' is 32%, the prevalence of stunting among Nigerian children, and 'd' is 5%, the acceptable margin of error [4].

A house-to-house survey, of 182 houses, was conducted and a list of children within the age group of interest was drawn. Participants were then selected from the list by simple random sampling [8] using computer-generated numbers. There were 767 eligible children and 364 (47.5%) were recruited. A maximum of three attempts were made to contact the caregivers of selected children who were unavailable at the point of recruitment before they were eventually replaced if no response was obtained. Children who had recently relocated into the community within three months before the study were excluded from the study. The three month period was chosen to ensure that the findings truly reflected those of the community and not elsewhere.

Interviewer-administered questionnaires were used to obtain information about participants' socio-demographics, including age, sex, socioeconomic status, position among maternal siblings, and whether the mother was still alive.

Measurements: The participants were weighed in kilograms (kg) on a digital weighing scale by Tian shan® - 2003[A] and recorded to the nearest 0.01 kilogram (kg). Their heights were measured with a stadiometer by Leaidal Medical® NB – 160 in centimeters (cm) using a stadiometer while barefoot, standing with their occiputs, buttocks, and heels touching the stadiometer, and the eyes looking straight horizontally. The participants' body mass index (BMI) (kg/m^2) was calculated by dividing their respective weights (in kg) by the square of their heights (in meters (m)) [9].

Using an inelastic tape, the occipitofrontal circumference (OFC) and the mid-arm circumference (MAC) of children aged 1 – 5 years were measured. For the OFC (measured to the nearest 0.5 cm), the tape was placed around the uncovered head, using the forehead (above the eyebrows) and the occiput as landmarks. The MAC was measured to the nearest 1 millimeter (mm), mid-point between the acromion process of the left shoulder and the olecranon process of the left

elbow. The measurements were taken three times, and each participant's average was recorded.

Data management and analysis: Data was analyzed using International Business Machines, Statistical Package for the Social Sciences version 25 by SPSS Inc., Chicago, United States of America. Participants were grouped by their ages into three groups and further grouped into preadolescents (< 10 years) and adolescents (>10 years) according to the definition of the United Nations Children's Fund (UNICEF) [10]. Using the further grouping based on adolescence, the relationship between adolescence and BMI, as well as the differences in BMI based on gender, were further assessed. They were also grouped by their socio-economic strata into the upper, middle, and lower classes using the criteria by Oseni and Odewale [11].

Nutritional status was classified using the z-score charts developed by the World Health Organization (WHO) [12,13]. Values of participants' weights, heights, OFC, and MAC were considered normal if the z-scores for their age and sex were within -2 standard deviations (SD) and +2SD. Z scores below -2SD were taken as low, while scores above +2SD were taken as high. Underweight, stunting, microcephaly and undernourished were z-scores <-2SD for participants' weight, height, OFC and MAC, respectively. Overweight, tall stature, macrocephaly and over-nourished were z-scores >+2SD for participants' weight, height, OFC and MAC, respectively.

There were no WHO z-scores for weight-for-age of children older than 10 years, neither were there WHO z-scores for OFC and MAC of children older than 5 years [8,9], hence these parameters were not analyzed for the respective age groups.

BMI was classified as thin (<-2SD), normal (between -2SD and +1SD), overweight (between +1SD and +2SD) and obese (>+2SD) [9,14]. To further test the association between participants' socio-demographic characteristics and BMI, BMI was further classified as low (thin), normal, and high (overweight and obese). The BMI and weight-for-height both combine weight and height. The WHO has z-score interpretations for all the ages, whereas that of weight-for-height is restricted to children aged 5 years and younger [12,13]. However, for uniformity and ease of interpretation, BMI was preferred over weight-for-height in this study.

The participants' ages were not normally distributed; hence, the median and interquartile range (IQR) were reported. The chi-squared test was used to test associations between categorical variables. An independent t-test was used to compare the mean BMI between both genders across the different socio-demographic groups. The level of significance was set at a p-value <0.05.

This study was conducted in accordance with the World Medical Association Declaration of Helsinki. The larger study was approved by the Ethics and Research Committee of the Ekiti State University Teaching Hospital (EKSUTH), Nigeria, with approval number EKSUTH/A67/2018/06/005. Informed consent was obtained from the caregivers of the participants and assent from children aged seven years and older. Participants with malnutrition were referred to EKSUTH for further evaluation and management.

RESULTS

There were 364 children recruited into the study. There were 185 (50.8%) females, 173 (47.5%) belonged to the age group 1 – 5 years and 168 (46.2%) belonged to the lower socio-economic class. The median (IQR) age was 6 (3 – 9) years. The participants' socio-demographic characteristics are displayed in Table 1.

The birth orders of the participants, among their maternal siblings, ranged from first to ninth child. About one-third of the participants were first-born children (112; 30.8%). Four children belonged to the group of 'seventh–ninth' positions; one of these four belonged to the middle class while the other three belonged to the lower class. Only five (13.2%) of participants in the upper class were fourth – sixth positions, whereas 31 (19.6%) participants in the middle class and 42 (25.0%) participants in the lower class were fourth – sixth positions (p=0.305).

More than 80% of the participants had a normal nutritional status for their respective age and sex (Table 2). There were 19 (6.4%) who were underweight for age, 36 (9.9%) were stunted, 29 (8.0%) were thin, 4 (2.3%) had microcephaly and 11 (6.4%) were undernourished by MAC. There were 25 (6.9%) participants with tall stature and 4 (1.1%) obese participants.

Among the 36 stunted participants, 13 belonged to the age group 11 – 15 years; while 19 of the

Table 1: Characteristics of Participants

CHARACTERISTICS	FREQUENCY N=364	PERCENTAGES (%)
Age Groups:		
1 – 5 years	173	47.5
6 – 10 years	123	33.8
11 – 15 years	68	18.7
Sex		
Male	179	49.2
Female	185	50.8
Socioeconomic strata		
Upper class	38	10.4
Middle class	158	43.4
Lower class	168	46.2
Position among maternal siblings		
First	112	30.8
Second	97	26.6
Third	73	20.1
Fourth	44	12.1
Fifth	23	6.3
Sixth	11	3.0
Seventh – Ninth	4	1.1
Is mother alive?		
Yes	361	99.2
No	3	0.8

N: Number of participants

25 participants with tall stature belonged to the age group 1 – 5 years (p=0.001) (Table 3). The participants' sex, socio-economic class, position among siblings, or if the mother was alive did not have any significant relationship with their heights.

Children belonging to the age group 1 – 5 years accounted for a significant majority of those with high BMI (12 out of 14) and with low BMI (17 out of 29) (p=0.021). Only three (0.8%) participants were maternal orphans; two belonged to the upper class and one to the lower class. The two in the upper class were thin but not stunted, while the one in the lower class was stunted but had a normal BMI. The participants' ages and whether their mother was alive were significantly associated with their BMIs (Table 3).

Generally, there was no significant difference between the mean BMI of both sexes. However, there were significant differences within age subgroups, lower socio-economic class, and birth order group first – third positions (Table 4). There were 279 (76.6%) preadolescents and 85 (23.4%) adolescents; the preadolescent males had significantly higher mean BMI than their female

Table 2: Nutritional Status of Participants

CHARACTERISTICS		FREQUENCY	PERCENTAGES (%)
Nutritional status for age and sex			
Weight*:	Underweight†	19	6.4
	Normal‡	276	93.2
	Overweight§	1	0.3
	Total	296	100.0
Height:	Stunted†	36	9.9
	Normal‡	303	83.2
	Tall stature§	25	6.9
	Total	364	100.0
BMI:	Thin†	29	8.0
	Normal¶	321	88.2
	Overweight**	10	2.7
	Obese§	4	1.1
	Total	364	100.0
OFC††:	Microcephaly†	4	2.3
	Normal‡	165	95.4
	Macrocephaly§	4	2.3
	Total	173	100.0
MAC††:	Undernourished†	11	6.4
	Normal‡	161	93.1
	Overnourished§	1	0.6
	Total	173	100.0

*BMI: Body Mass Index; OFC: Occipitofrontal circumference; MAC: Mid-arm circumference; *: WHO reference values available for ages 1 – 10 years; ††: WHO reference values available for ages 1 – 5 years; †: <-2 Standard deviations of z-scores for age and sex; ‡: Between -2 Standard deviations and +2 standard deviations of z-scores for age and sex; §: >+2 Standard deviations of z-scores for age and sex; ¶: Between -2 Standard deviations and +1 standard deviations of z-scores for age and sex; **: Between >+1 Standard deviation and +2 standard deviations of z-scores for age and sex*

counterparts (mean difference (SD) 0.8 (0.1) kg/m^2; p <0.0001) while the adolescent females had higher mean BMI than the male adolescents (mean difference (SD) 1.3 (0.5) kg/m^2; p=0.008).

Among the participants belonging to the lower class, the males had significantly higher mean BMI (SD) (15.8 (1.4) kg/m^2) than the females (15.2 (2.2) kg/m^2) (mean difference (SD) 0.6 (0.3) kg/m^2; p=0.026). Similarly, among children in the birth order group of first – third, the males had a higher mean BMI (SD) (15.6 (1.6) kg/m^2) than the females (15.0 (2.1) kg/m^2), with a mean difference (SD) of 0.6 (0.2) kg/m^2; p =0.013.

DISCUSSION

The prevalence of malnutrition (under-nutrition or over-nutrition) among the participants in this study was generally less than 10% across all the parameters. Our study findings are much lower than the prevalence rates of under-nutrition of more than 25% (underweight 26.2%, stunting 28.6% and thinness 26.4%), reported by Olatunya et al. [15] in 2015 among children aged 2 – 15 years in a rural community in Ekiti State. The low prevalence of malnutrition observed in this study may have been influenced by an annex of a tertiary hospital with staff proficient with child nutrition,

Table 3: Relationships between socio-demographic characteristics, heights and BMI of participants

CHARACTERISTICS	TOTAL	NUTRITIONAL STATUS (HEIGHT) (%)*				NUTRITIONAL STATUS (BMI) (%)*			
	N=364	STUNTED§	NORMAL¶	TALL**	P-value‡	LOW§	NORMAL†	HIGH††	P-value‡
		N=36 (9.9)	N=303 (83.2)	N=25 (6.9)		N=29 (8.0)	N=321 (88.2)	N=14 (3.8)	
Age Groups (%)*									
1 – 5 years	173	16 (9.2)	138 (79.8)	19 (11.0)	0.001	17 (9.8)	144 (83.2)	12 (6.9)	0.021
6 – 10 years	123	7 (5.7)	110 (89.4)	6 (4.9)		6 (4.9)	116 (94.3)	1 (0.8)	
11 – 15 years	68	13 (19.1)	55 (80.9)	0 (0.0)		6 (8.8)	61 (89.7)	1 (1.5)	
Sex (%)*									
Male	179	19 (10.6)	152 (84.9)	8 (4.5)	0.196	11 (6.1)	158 (88.3)	10 (5.6)	0.120
Female	185	17 (9.2)	151 (81.6)	17 (9.2)		18 (9.7)	163 (88.1)	4 (2.2)	
Socioeconomic strata (%)*									
Upper class	38	2 (5.3)	32 (84.2)	4 (10.5)	0.692	6 (15.8)	31 (81.6)	1 (2.6)	0.160
Middle class	158	18 (11.4)	129 (81.6)	11 (7.0)		14 (8.9)	140 (88.6)	4 (2.5)	
Lower class	168	16 (9.5)	142 (84.5)	10 (6.0)		9 (5.4)	150 (89.3)	9 (5.4)	
Position among maternal siblings (%)*									
First – Third	282	29 (10.3)	233 (82.6)	20 (7.1)	0.776	25 (8.9)	246 (87.2)	11 (3.9)	0.788
Fourth – Sixth	78	6 (7.7)	67 (85.9)	5 (6.4)		4 (5.1)	71 (91.0)	3 (3.8)	
Seventh – Ninth	4	1 (25.0)	3 (75.0)	0 (0.0)		0 (0.0)	4 (100.0)	0 (0.0)	
Is mother alive? (%)*									
Yes	361	35 (9.7)	301 (83.4)	25 (6.9)	0.370	27 (7.5)	320 (88.6)	14 (3.8)	0.001
No	3	1 (33.3)	2 (66.7)	0 (0.0)		2 (66.7)	1 (33.3)	0 (0.0)	

*BMI: Body Mass Index; *: Percentage of row total; ‡:Chi-squared test; df: Degree of freedom; Significant P-values in bold; §: <-2 Standard deviations of z-scores for age and sex; ¶: Between -2 Standard deviations and +2 standard deviations of z-scores for age and sex; **: >+2 Standard deviations of z-scores for age and sex; †: Between -2 Standard deviations and +1 standard deviation of z-scores for age and sex; ††: >+1 Standard deviation of z-scores for age and sex*

Table 4: Mean differences between BMI of male and female participants

CHARACTERISTICS	TOTAL N=364		BMI (Kg/m²)			P-VALUE‡
			MEAN [SD]	DIFF BTW M AND F		
	M	F	M	F	MEAN [SD] (95% CI)	
Overall (N=364)	N=179	N=185	15.6 [1.6]	15.2 [2.2]	0.4 [0.2] (-0.0 – +0.7)	0.069
Age Groups (%)*:						
1 – 5 years (N=173)	89 (51.4)	84 (48.6)	15.3 [1.7]	14.7 [1.6]	0.7 [0.2] (0.2 – 1.2)	0.007
6 – 10 years (N=123)	56 (45.5)	67 (54.5)	15.5 [1.1]	14.6 [1.7]	0.8 [0.3] (0.3 – 1.3)	0.002
11 – 15 years (N=68)	34 (50.0)	34 (50.0)	16.5 [1.6]	17.8 [2.4]	-1.3 [0.5] (-2.3 – -0.4)	0.008
Age Groups (%)*:						
Preadolescents (<10yrs) (N=279)	136 (48.7)	143 (51.3)	15.4 [1.5]	14.6 [1.6]	0.8 [0.2] (0.4 – 1.2)	<0.0005
Adolescents (≥10yrs) (N=85)	43 (50.6)	42 (49.4)	16.3 [1.6]	17.4 [2.4]	-1.1 [0.4] (-2.0 – -0.3)	0.012
Socio-economic strata (%)*:						
Upper class (N=38)	19 (50.0)	19 (50.0)	15.2 [1.6]	15.2 [2.2]	-0.0 [0.6] (-1.3 – +1.3)	0.987
Middle class (N=158)	74 (46.8)	84 (53.2)	15.4 [1.6]	15.3 [2.1]	0.1 [0.3] (-0.5 – +0.7)	0.654
Lower class (N=168)	86 (51.2)	82 (48.8)	15.8 [1.4]	15.2 [2.2]	0.6 [0.3] (0.1 – 1.2)	0.026
Birth Order (%)*:						
First – Third (N=282)	134 (47.5)	148 (52.5)	15.6 [1.6]	15.0 [2.1]	0.6 [0.2] (0.1 – 1.0)	0.013
Fourth – Sixth (N=78)	43 (55.1)	35 (44.9)	15.7 [1.5]	16.0 [2.2]	-0.3 [0.4] (-1.1 – +0.5)	0.451
Seventh – Ninth (N=4)	2 (50.0)	2 (50.0)	16.0 [1.3]	18.6 [4.9]	-2.6 [3.6] (-18.1 – +12.9)	0.550

*BMI: Body Mass Index; SD: Standard Deviation; Diff Btw: Difference Between; CI: Confidence Interval; N: Number of participants; M: Male; F: Female; *: Percentage of row total; ‡: Independent t-test; Significant P-values in bold*

growth monitoring, and health education who are available to provide these services to the members of the community. In addition, the children in this farming community may have had reasonable access to nutritious farm produce. It may also give credence to collective efforts toward addressing malnutrition in Ekiti State. Nevertheless, this study did not assess nutritional status based on macro/micronutrients.

Most of the participants with stunting and low body mass index in this study belonged to the age group 1 – 5 years; this buttresses the vulnerability of children within this age group that are primarily dependent on their caregivers and justifies the need to continue to focus on this age group for intervention programs. This study also observed that about one out of every five adolescents was stunted. Since stunting is a consequence of chronic or recurrent under-nutrition, it can be inferred that these adolescents had been undernourished from early childhood, as implied by Bosch et al. [16]. However, contrary to the observation of Senbanjo et al. [17], who observed that stunting was significantly associated with low socio-economic class among adolescents in Southwest Nigeria, there was no significant relationship between the stunted adolescents' heights and their socio-economic classes in this study. Nevertheless, there is a need to further explore the dietary, socio-economic, and other environmental factors that increase the risk of stunting among the adolescents in the study area, so that they can be addressed.

This study also observed an association between being a maternal orphan and thinness (having a low BMI); this finding was significant despite the small sample size of the maternal orphans in this study. Ardington and Little reported a similar observation among South African children in 2016; the authors observed that maternal orphans had significantly lower BMI for age and attributed their findings to poor socioeconomic conditions [18]. However, in this study, the maternal orphans with low BMI belonged to the high socio-economic class; this observation supports the inference that maternal demise can disrupt a child's social activities and adversely affect a child's nutritional status. Plausible explanations for this include child neglect or the presence of the risk factors such as human immunodeficiency virus infection in the mother and child pair, causing maternal death and thinness in the orphans [19]. However, this study did not obtain information on the cause of death of the orphans' mothers. There is a need to reinforce the social, nutritional, educational and vocational support rendered to orphans [20] to forestall dire consequences on their growth.

Generally, the pre-adolescent males in this study had a higher body mass index than the females, while the adolescent female participants had a higher body mass index than their male counterparts. These observations were similar to those reported by Maruf et al. in 2013 among Nigerian children aged 2 – 18 years [21]. A higher body mass index has been associated with early puberty, which is commonly observed among female adolescents [22,23].

The statistically significantly higher mean BMI observed among the male participants in the lower socio-economic class and the first – third born males is an interesting finding. It can be speculated that caregivers in these groups have the tendency to pay more attention to the males than the females. Previous studies have suggested that Nigeria is a patriarchal society where sons are reportedly preferred over daughters. This preference may have influenced the negligent attitudes of the caregivers towards the nutritional status of first – third-born females and the female participants from the lower socio-economic class in this study [24,25]. More studies are required to explore this observation in the study area and address it as necessary. Nonetheless, there is a need to orientate the community on gender equality so that female children in the lower socio-economic class and first-born females can equally enjoy optimal growth and development.

The limitations of this study include the fact that there were very few maternal orphans in this study; although the findings were significant, they may not be generalizable. There is a need for longitudinal studies on the nutritional status of orphans to review the factors associated with malnutrition among this vulnerable group of children and to design intervention programs to mitigate them. Furthermore, this study's observations regarding birth order and gender may not be sufficient to draw conclusions. Therefore, a case-control study matching genders and birth orders may be required for studies on malnutrition in this regard.

CONCLUSION

The prevalence of malnutrition in this study was relatively lower than in earlier reports. Nevertheless, concerted efforts are required to reduce further malnutrition among vulnerable groups such as age group 1 – 5 years, maternal orphans, and female children from the lower socio-economic class. There is also a need for more studies to identify and address the risk factors for stunting among the adolescents in the study area.

REFERENCES

[1] World Health Organization, 'Malnutrition', World Health Organization, 2022. https://www.who.int/westernpacific/health-topics/malnutrition (accessed Feb. 04, 2022).
[2] United Nations Children's Fund, 'Nutrition; Malnutrition rates in children under 5 years', UNICEF Nigeria 2016. p8. https://www.unicef.org/nigeria/media/1646/file/Nigeria-equity-profile-nutrition.pdf
[3] The Global Nutrition Report, 'Country nutrition profiles: Nigeria', 2022. https://globalnutritionreport.org/resources/nutrition-profiles/africa/western-africa/nigeria/ (accessed Mar 14, 2022)
[4] United Nations Children's Fund, 'Nutrition | UNICEF Nigeria', UNICEF, 2022. https://www.unicef.org/nigeria/nutrition (accessed Feb. 05, 2022).
[5] B. S. Aregbeshola and S. M. Khan, 'Primary Health Care in Nigeria: 24 Years after Olikoye Ransome-Kuti's Leadership', Front Public Health, vol. 5, p. 48, Mar. 2017, doi: 10.3389/fpubh.2017.00048.
[6] O.A.T. Fatunla, O.S. Olatunya, E.O. Ogundare, T.O. Fatunla, I.O. Oluwayemi, K.S. Oluwadiya and O.A. Oyelami, 'Towards malaria control in Nigeria: implications of the malaria parasite rate and spleen rate among children living in a rural community in southwest Nigeria', Trans R Soc Trop Med Hyg, vol. 115, no. 11, pp. 1330–1338, Nov. 2021. doi: 10.1093/trstmh/trab131.
[7] J. Charan and T. Biswas, 'How to calculate sample size for different study designs in medical research', Indian Journal of Psychological Medicine, vol. 35, no. 2. p. 121, 2013. doi: 10.4103/0253-7176.116232.
[8] Lund Research Limited, 'Simple random sampling', 2012. https://dissertation.laerd.com/simple-random-sampling.php (accessed Apr. 28, 2022).
[9] World Health Organization, 'Body mass index - BMI', Apr. 30, 2020. http://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi (accessed Apr. 30, 2020).
[10] World Health Organization, Adolescent Health- The Missing Population in Universal Health Coverage. 2019. [Online]. Available: https://pmnch.who.int/resources/publications/m/item/adolescent-health---the-missing-population-in-universal-health-coverage (accessed: Apr. 28, 2022).
[11] T. A. Oseni and M. Odewale, 'Socioeconomic status of parents and the occurrence of pelvic inflammatory disease among undergraduates attending Irrua Specialist Teaching Hospital, Irrua, Edo State, Nigeria', Niger Postgrad Med J, vol. 24, no. 2, p. 114, 2017, doi: 10.4103/npmj.npmj_28_17.
[12] World Health Organization, 'The WHO Child Growth Standards', 2019. https://www.who.int/childgrowth/standards/en/ (accessed May 15, 2019).
[13] World Health Organization, 'Growth reference 5-19 years', 2019. https://www.who.int/growthref/en/ (accessed May 15, 2019).
[14] 'Body mass index - BMI'. https://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi (accessed Nov. 04, 2020).
[15] O. Olatunya, A. Isinkaye, and M. Olatunya, 'School meal practices and nutritional status of school children in two different Nigerian settings: Two sides of the same coin', African journal of health sciences, vol. 28, no. 1, pp. 113–126, Mar. 2015.
[16] A. M. Bosch, A. H. Baqui, and J. K. van Ginneken, 'Early-life Determinants of Stunted Adolescent Girls and Boys in Matlab, Bangladesh', J Health Popul Nutr, vol. 26, no. 2, pp. 189–199, Jun. 2008.
[17] I. O. Senbanjo, K. A. Oshikoya, O. O. Odusanya, and O. F. Njokanma, 'Prevalence of and Risk factors for Stunting among School Children and Adolescents in Abeokuta, Southwest Nigeria', Journal of Health, Population, and Nutrition, vol. 29, no. 4, p. 364, Aug. 2011, doi: 10.3329/jhpn.v29i4.8452.
[18] C. Ardington and M. Little, 'The Impact of Maternal Death on Children's Health and Education Outcomes', Cape Town: SALDRU,

University of Cape Town, 2016. Accessed: Sep. 28, 2021. [Online]. Available: http://www.opensaldru.uct.ac.za/handle/11090/842

[19] G. Morantz, D. Cole, R. Vreeman, S. Ayaya, D. Ayuku and P. Braitstein, 'Child abuse and neglect among orphaned children and youth living in extended families in sub-Saharan Africa: What have we learned from qualitative inquiry?', Vulnerable Child Youth Stud, vol. 8, no. 4, pp. 338–352, Jan. 2013, doi: 10.1080/17450128.2013.764476.

[20] Institute of Human Virology, Nigeria, 'Orphans and Vulnerable Children' 2022. http://ihvnigeria.org/prevention-care-and-treatment-pct-department/orphans-and-vulnerable-children/ (accessed 14 Mar 2022)

[21] F. A. Maruf, U. Aronu, K. Chukwuegbu, and A. E. Aronu, 'Influence of gender on prevalence of overweight and obesity in Nigerian school children and adolescents', Tanzan J Health Res, vol. 15, no. 4, pp. 247–251, Oct. 2013, doi: 10.4314/thrb.v15i4.6.

[22] S. S. Abou El Ella, N. F. Barseem, M. A. Tawfik, and A. F. Ahmed, 'BMI relationship to the onset of puberty: assessment of growth parameters and sexual maturity changes in Egyptian children and adolescents of both sexes', Journal of pediatric endocrinology & metabolism : JPEM, vol. 33, no. 1, pp. 121–128, Jan. 2020, doi: 10.1515/jpem-2019-0119.

[23] J. B. Tryggestad and S. D. Chernausek, 'BMI changes through childhood: the impact on puberty, linear growth and hormonal regulation', Pediatr Res, vol. 88, no. 1, pp. 11–13, Jul. 2020, doi: 10.1038/s41390-020-0903-9.

[24] E. C. Inyang-Etoh and A. M. Ekanem, 'Child-Sex Preference and Factors That Influenced Such Choices among Women in an Obstetric Population in Nigeria', Open Access Library Journal, vol. 3, no. 10, Art. no. 10, Oct. 2016, doi: 10.4236/oalib.1103005.

[25] A. Milazzo, Son Preference, Fertility and Family Structure: Evidence from Reproductive Behavior among Nigerian Women. The World Bank, 2014. doi: 10.1596/1813-9450-6869.