ISSN: 2347-467X, Vol. 09, No. (2) 2021, Pg. 409-422

Current Research in Nutrition and Food Science

www.foodandnutritionjournal.org

Prevalence and Determining Factors of Stunting Among School-Aged Children In A Rural Nigerian Community: A Cross-Sectional Study

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Abstract

Stunting, an indicator of chronic childhood under-nutrition, is a challenging community health issue among rural Nigerian school children. This study assessed the prevalence and determining factors of stunting among school-aged children (SAC) in a rural Nigerian community. Three hundred and eighty SAC from government primary schools in Achi, Oji-River Local Government Area, Enugu state were selected for the study using multistage sampling technique. Structured and validated questionnaire, anthropometric measurements and biochemical assessments of serum zinc, presence of malaria and intestinal parasites were used for data collection.Stunting, underweight, thinness and overweight prevalence were 21.1%, 17.0%, 16.6% and 10.0%, respectively. Zinc deficiency, malaria and intestinal parasitemia existed in 12.5%, 27.5% and 35.0%, respectively. SAC who were males, 6-8 years, of the third birth order, underweight, overweight, zinc deficient and had intestinal parasitemia had higher odds of being stunted. Having secondary education, farming as an occupation and low monthly income among the mothers; nuclear family system and household size of ≥ 9 were other determinants of stunting observed in the study. These findings suggest the need for targeted intervention against the major determinants of stunting in the area.

Article History
Received: 30 August 2020
Accepted: 30 March 2021

Keywords
Intestinal Parasite;
Malaria Parasite;
Overweight;
Thinness;
Underweight;
Zinc Deficiency.

Introduction

School age is an important period of physical and mental growth characterized by increased physiological needs for essential nutrients which if not met leads to malnutrition. Malnutrition is a multi-factorial problem caused by the combined effects

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Doi: http://dx.doi.org/10.12944/CRNFSJ.9.2.05

of poverty, food insecurity, lack of dietary diversity, infectious diseases, low access to clean water and sanitation, and poor understanding of nutrition and hygiene.[1,2] Malnutrition among children has lifetime consequences; its effects not only cover the entire life but are also transmitted from one generation to another.[3] Stunting is a form of malnutrition which continues to be a major problem among this group. Stunting has been implicated in reduced physical, neuro-developmental and economic capacity and an elevated risk of metabolic disease in adulthood.[4] It is a well-established child-health indicator of chronic malnutrition which reliably gives a picture of the past nutritional history and the prevailing environmental and socioeconomic circumstances.[5]

Stunting in children is defined as having a height-for-age more than two standard deviations below the World Health Organization (WHO) Child Growth Standards median.[6] Stunting is one of the challenging and most serious public health problems in the world.[7] According to the 2015 Millennium development goals report, about 24.5% of children are stunted globally.[8] Stunting affects more than 161 million children and one third of these live in Africa.[9] Prevalence of stunting, associated with multiple determinant factors combined with prolonged lack of proper nutrition, is a noteworthy problem among people living in resource-poor countries.[7] Inadequate attention has been given to stunting despite having severe implications on morbidity and mortality of children,[10] and guarded interest on the indicator of stunting is a vital component of policy dialogue on community nutrition programs.[11]

Likelihood of exposition to nutritional deprivation for children stunted at school-age exists given that early childhood and level of stunting usually increases all through the school-age years.[7] In Nigeria, stunting is one of the chronic nutritional problems experienced by SAC, however, most studies on stunting focus on under-fives creating a gap in the literature on the incidence of stunting among SAC. There is a need to provide information for a better understanding of the occurrence and determinants of stunting among Nigerian SAC for successful intervention in order to decrease stunting prevalence among this group. Therefore, the main aim of this study was to evaluate the prevalence and determining factors of stunting among school-age children in a rural Nigerian community.

Materials and Methods

Study Design, Area and Population

A school-based, cross-sectional study was conducted in Achi, a rural town located in Enugu State, south-eastern Nigeria. It is the largest town in Oji- river Local Government Area of Enugu state and consists of 12 villages divided into two sectional communities with each sectional community comprising of six villages. Achi is located on latitude 6°8'36'' N and longitude 7°21'50'' E. The inhabitants are Ibos who are predominantly farmers and traders. The main staple foods are cassava, yam, cocoyam, rice and maize. All school children (1,417) aged 6-12 years in Achi constituted the study population.

Participants

The sample size was determined using the sample size formula as described in Ayogu, Okafor and Ene-Obong (2015)[12] with 5% margin of error, 31.5% prevalence of stunting among SAC and 10% non-response rate. This gave a total of 380 participants with 10% of the selected participants used as sub-sample for biochemical determinations.

Multi-stage sampling technique was used to select study participants. The selection was done in four stages. In the first stage, eight government primary schools were selected from twenty-six primary schools in Achi using random sampling by balloting without replacement. In the second stage, the school registers were used to obtain the number of students in each class who were within the ages of 6-12 years. Proportional sampling was used to determine the number of students in each class to be sampled in the third stage. In the fourth stage, random sampling by balloting without replacement was used to select the participants that were used for the study.

Ethical Clearance and Consent for Participation

Health Research Ethics Committee of the University of Nigeria Teaching Hospital Ituku-Ozalla, Enugu state, Nigeria issued the ethical clearance certificate (NHREEC/.05/01/2008B-FWA00002458-1RB00002323) for the research.Prior to signing the informed consent form, the parents/guardians of the participants were informed about the need for this study and the freedom to withdraw the minors at any time during the study.

Assessment of Phenotypical characteristics

To overcome the language barrier, facilitate community mobilization and data collection, two indigenous people from the study area were trained in anthropometric measurements and how to obtain information through a questionnaire. In preliminary visits to the Local Government Area (LGA) and the selected schools, information was provided about the study, the selection of the participants, the procedure with the school and the caregivers of the selected participants, and finally, the corresponding permission to carry out the study was requested. Data was obtained using a structured and validated questionnaire which was self-administered to literate caregivers but was interviewed-administered to illiterate caregivers.

Anthropometric Measurements

Anthropometric measurements of weight and height were obtained from the participants using standard procedures. The body mass index (BMI, kg/m^2) of the respondents was determined [Weight (kg) / Height^2 (m^2)]. The WHO Child Growth Standards was used to classify respondents as underweight (< -2SD weight-for-age), stunted (< -2SD height-for-age), thin (<-2SD BMI-for-age) and overweight (> +1SD BMI-for-age).

Biochemical Determinations

Five milliliters of venous blood was obtained from the sub-sample with disposable needles that were attached to plastic tubes. Two milliliters of blood sample was put into well-labelled sample bottle containing anticoagulant K_2EDTA tube for malaria parasite detection using microscopy of thin blood films stained with Giemsa stain. Three milliliters of blood was put into a well-labelled trace element free sample bottle and was allowed to stand for 30 minutes at room temperature for complete clotting and clot retraction. The clotted blood was centrifuged at 3000 rpm for 10 minutes and clear serum sample obtained was used for zinc determination using spectrophotometer as described by Shar and Bhanger.[14]

Determination of Intestinal Parasites

A 20-mlwide-mouthed, screw-capped, well-labelled container each with an accompanying spatula was given to the participants for the collection of freshly voided stool samples. Participant's caregivers were instructed to collect the faecal sample of respondents without contamination by urine, water or sand. Direct saline wet mount microscopy was used for microscopic faecal examination and the intestinal parasites detected were reported by their scientific names.

Statistical Analysis

The ageof participants was categorized as 6 - 8 years, 9 - 10 years and 11 – 12 years. Eating less than three meals a day was classified as skipping meals. Zinc deficiency was defined as serum zinc concentration of < 80 µg/dl. Malaria parasite was present when different *Plasmodium* species were identified and quantified in the erythrocyte. Intestinal parasite infestation was categorized as present when intestinal parasite was detected and the type determined microscopically. Educational background of participant's parents was categorized as primary education, secondary education, tertiary education and no formal education. Monthly income was categorized as < ₦20, 000, ₦20,000 - ₦49,000 and ≥ ₦50,000. Occupation of participant's parents was classified as unemployed;civil servants; and traders, farmers and drivers for those who were self-employed. Family type was defined as nuclear or extended. Household size and number of children in a household were categorized as 1 – 4, 5 – 8 and ≥ 9.

Descriptive statistics were performed using frequencies and percentages for categorical variables. Chi-square test was used to detect significant differences among these variables. Multivariate logistic linear regression analysis which calculated the odds' ratio (OR) and its 95% confidence interval (95% CI) was carried out to find the association between each independent variable and low height-for-age (stunting). Crude odds' ratio (COR) was defined as follows: COR <1 indicates that the independent variable was associated with lower odds of stunting; COR > 1 indicates that the independent variable was associated with higher odds of stunting; and COR = 1 indicates that the independent variable did not affect the odds of stunting.Logistic regression categorized participants into the two following groups: (i) stunted (low height-for-age) and (ii) not stunted. This group was called the reference group. The accepted level of significance was p <0.05. The collected data was analyzed using IBM Statistical Product for Service Solution (SPSS) Statisticsfor windows version 25.0 (Armonk, New York).

Results

A total of 380 SACs were enrolled in the study. The socio-demographic, anthropometric and biochemical indices of the children by gender are presented in Table 1. A good number of the male (40.1%) and female (42.4%) respondents were aged 11-12 years. Among the male and female respondents, 34.1% and 29.8% were of the first and third birth orders, respectively. There was a significant ($p < 0.05$) difference in the meal skipping habit of the respondents with more males (68.1%) than females (48.0%) skipping meals. Height-for-age of the respondents differed significantly ($p < 0.05$) with more females (25.3%) than males (16.5%) being stunted. More females than males were underweight (19.3% vs 14.7%) whereas more males than females were thin (18.1% vs 15.2%) and overweight (10.4% vs 9.6%). More males than females were zinc deficient (15.0% vs 10.0%) and had malaria parasitaemia (35.0% vs 20.0%). Intestinal parasite infestation (35.0%) was present among the respondents with *Ascaris lumbricoides* (27.5%) being the most prevalent intestinalparasite infestation among the respondents.

Table 1: Socio-demographic, anthropometric and biochemical indices of the children by gender (N = 380)

Variables	Male N (%)	Female N (%)	Total N (%)	χ^2 value; p-value
Age (years)				1.414; 0.493
6 – 8	60 (33.0)	71 (35.9)	131 (34.5)	
9 -10	49 (26.9)	43 (21.7)	92 (24.2)	
11-12	73 (40.1)	84 (42.4)	157 (41.3)	
Total	182 (100.0)	198 (100.0)	380 (100.0)	
Birth order of child				43.852; 0.000
First	62 (34.1)	30 (15.2)	92 (24.2)	
Second	21 (11.5)	45 (22.7)	66 (17.4)	
Third	20 (11.0)	59 (29.8)	79 (20.8)	
Fourth	40 (22.0)	22 (11.1)	62 (16.3)	
Fifth	39(21.4)	42 (21.2)	81 (21.3)	
Total	182 (100.0)	198 (100.0)	380 (100.0)	
Skip meals				15.772; 0.000
No	58 (31.9)	103 (52.0)	161 (42.4)	
Yes	124 (68.1)	95 (48.0)	219 (57.6)	
Total	182 (100.0)	198 (100.0)	380 (100.0)	
Height-for-age				4.387; 0.036*
Stunted	30 (16.5)	50 (25.3)	80 (21.1)	
Normal	152 (83.5)	148 (74.7)	300 (78.9)	
Total	182 (100.0)	198 (100.0)	380 (100.0)	
Weight-for-age, n = 223 (6-10 years only)				0.841; 0.230
Underweight	16 (14.7)	22 (19.3)	38 (17.0)	
Normal	93 (85.3)	92 (80.7)	185 (83.0)	
Total	109 (100.0)	114 (100.0)	223 (100.0)	
Body mass index-for-age				0.764; 0.682
Thin	33 (18.1)	30 (15.2)	63 (16.6)	
Overweight	19 (10.4)	19 (9.6)	38 (10.0)	
Normal	130 (71.4)	149 (75.2)	279 (73.4)	
Tot/al	182 (100.0)	198 (100.0)	380 (100.0)	
Serum zinc status				0.229; 0.500
Deficient	3 (15.0)	2 (10.0)	5 (12.5)	
Normal	17 (85.0)	18 (90.0)	35 (87.5)	

Total	20 (100.0)	20 (100.0)	40 (100.0)	
Malaria parasite				1.129; 0.240
Present	7 (35.0)	4 (20.0)	11 (27.5)	
Absent	13 (65.0)	16 80.0)	29 (72.5)	
Total	20 (100.0)	20 (100.0)	40 (100.0)	
Intestinal parasite infestation				0.000; 0.629
Present	7 (35.0)	7 (35.0)	14 (35.0)	
Absent	13 (65.0)	13 (65.0)	26 (65.0)	
Total	20 (100.0)	20 (100.0)	40 (100.0)	
Type of intestinal parasite infestation present				3.091; 0.378
Entamoeba histolytica	2 (10.0)	0 (0.0)	2 (5.0)	
Ascaris lumbricoides	5 (25.0)	6 (30.0)	11 (27.5)	
Hookworm	0 (0.0)	1 (5.0)	1 (2.5)	
Absent	13 (65.0)	13 (65.0)	26 (65.0)	
Total	20 (100.0)	20 (100.0)	40 (100.0)	

Legend:*= p< 0.05

Table 2 shows the socio-demographic, anthropometric and biochemical indices of the children by age group. Most of the respondents aged 6-8 years, 9-10 years and 11-12 years were of the third (22.9%), fifth (22.8%) and first (25.5%) birth orders. Meal skipping (61.1%) existed more among the 11-12 year olds. The anthropometric indices which differed significantly ($p < 0.05$) with age revealed that stunting (31.2%) existed more among the 11-12 year olds, underweight (23.9%) among the 9-10 year olds, thinness (19.1%) and overweight (15.3%) among the 6-8 year olds. The 6-8 year olds were more zinc deficient (27.3%) while malaria parasitemia (41.7%) was more prevalent among the 9-10 years. Intestinal parasite infestation (45.5%) was mostly prevalent among the 6-8 year old with *Ascaris lumbricoides* being the parasite present.

Table 2: Socio-demographic, anthropometric and biochemical indices of the children by age group (N = 380)

Variables	6 – 8 years N (%)	9 - 10 years N (%)	11 – 12 years N (%)	Total N (%)	χ^2 value; p value
Gender					1.414; 0.493
Male	60 (45.8)	49 (53.3)	73 (46.5)	182 (47.9)	
Female	71 (54.2)	43 (46.7)	84 (53.5)	198 (52.1)	
Total	131 (100.0)	92 (100.0)	157 (100.0)	380 (100.0)	
Birth order of child				2.908; 0.940	
First	32 (24.4)	20 (21.7)	40(25.5)	92 (24.2)	
Second	19 (14.5)	19 (20.7)	28 (17.8)	66 (17.4)	
Third	30 (22.9)	17 (18.5)	32 (20.4)	79 (20.8)	
Fourth	24 (18.3)	15 (16.3)	23 (14.6)	62 (16.3)	
Fifth	26 (19.8)	21 (22.8)	34 (21.7)	81 (21.3)	
Total	131 (100.0)	92 (100.0)	157 (100.0)	380 (100.0)	
Skip meals					2.416; 0.299
No	55 (42.0)	45 (48.9)	61 (38.9)	161 (42.4)	
Yes	76 (58.0)	47 (51.1)	96 (61.1)	219 (57.6)	
Total	131 (100.0)	92 (100.0)	157 (100.0)	380 (100.0)	

Height-for-age					28.215; 0.000*
Stunted	8 (6.1)	23 (25.0)	49 (31.2)	80 (21.1)	
Normal	123 (93.9)	69 (75.0)	108 (68.8)	300 (78.9)	
Total	131 (100.0)	92 (100.0)	157 (100.0)	380 (100.0)	
Weight-for-age, n = 223 (6-10 years only)					5.233; 0.029*
Underweight	16 (12.2)	22 (23.9)	- (-)	38 (17.0)	
Normal	115 (8	70 (76.1)	- (-)	185 (83.0)	
Total	131 (100.0)	92 (100.0)	- (-)	223 (100.0)	
Body mass index-for-age					10.943; 0.027*
Thin	25 (19.1)	16 (17.4)	22 (14.0)	63 (16.6)	
Overweight	20 (15.3)	10 (10.9)	8 (5.1)	38 (10.0)	
Normal	86 (65.6)	66 (71.7)	127 (80.9)	279 (73.4)	
Total	131 (100.0)	92 (100.0)	157 (100.0)	380 (100.0)	
Serum zinc status					3.066; 0.216
Deficient	3 (27.3)	1 (8.3)	1 (5.9)	5 (12.5)	
Normal	8 (72.7)	11 (91.7)	16 (94.1)	35 (87.5)	
Total	11 (100.0)	12 (100.0)	17 (100.0)	40 (100.0)	
Malaria parasite					2.036; 0.361
Present	3 (27.3)	5 (41.7)	3 (17.6)	11 (27.5)	
Absent	8 (72.7)	7 (58.3)	14 (82.4)	29 (72.5)	
Total	11 (100.0)	12 (100.0)	17 (100.0)	40 (100.0)	
Intestinal parasite infestation					0.746; 0.418
Present	5 (45.5)	5 (41.7)	4 (23.5)	14 (35.0)	
Absent	6 (54.5)	7 (58.3)	13(76.5)	26 (65.0)	
Total	11 (100.0)	12 (100.0)	17 (100.0)	40 (100.0)	
Type of intestinal parasite infestation present					8.619; 0.196
Entamoeba histolytica	0 (0.0)	0 (0.0)	2 (11.8)	2 (5.0)	
Ascaris lumbricoides	5 (45.5)	4 (33.3)	2 (11.8)	11 (27.5)	
Hookworm	0 (0.0)	1 (8.3)	0 (0.0)	1 (2.5)	
Absent	6 (54.5)	7 (58.3)	13 (76.5)	26 (65.0)	
Total	11 (100.0)	12 (100.0)	17 (100.0)	40 (100.0)	

Legend: *=p < 0.05

The socio-economic information of the school children's parents is shown in Table 3. Respondents' fathers and mothers had no formal education (11.1% vs 13.9%), secondary education (40.8% vs 42.4%) and tertiary education (17.4% vs 10.3%). Trading was the occupation of 41.6% and 47.9% of the fathers and mothers, respectively. More fathers (19.2%) than mothers (11.8%) were civil servants whereas more mothers (29.2%) than fathers (2.4%) were unemployed. Most (55.5%) of the fathers earned ₦20,000 – ₦ 49, 000 while the mothers mostly earned <₦20,000 (54.5%).

Household characteristics of the respondents are shown in Table 4. Most of the children (86.6%) were from nuclear family while few (13.4%) were from extended family. The household size of majority of the children was 5-8 (59.2%) whereas 22.6% had a household size of ≥9. The number of children in the households ranged from 1-4 (32.1%) to ≥9 (12.9%).

Characteristic determinants of the stunted child are presented in Table 5. SAC who were males (COR =1.712; 95% CI =1.032 – 2.839), 6-8 years (COR = 6.976; 95% CI = 3.163 – 15.383), of the third birth order (COR =1.061; 95% CI=0.464 - 2.428), underweight (COR = 9.888; 95% CI =4.268 – 22.906), overweight (COR = 4.520; 95% CI = 1.056 – 19.342), zinc deficient (COR 1.833; 95% CI =0.183 – 18.370), h ad malaria (COR = 1.200; 95% CI =0.257 – 5.612) and intestinal (COR = 3.750; 95% CI = 0.690 – 20.377) parasitaemia, had higher odds of being stunted. Being a male, 6-8 years, underweight, thin and overweight were significant ($p < 0.05$) determinants of stunting in the area.

Table 3: Socio-economic information of the school children's parents (N = 380)

Variables	Father N (%)	Mother N (%)
Educational background		
Primary education	117 (30.8)	127 (33.4)
Secondary education	155 (40.8)	161 (42.4)
Tertiary education	66 (17.4)	39 (10.3)
No formal education	42 (11.1)	53 (13.9)
Total	380 (100.0)	380 (100.0)
Occupation		
Civil servant	73 (19.2)	45 (11.8)
Trader	158 (41.6)	182 (47.9)
Farmer	60 (15.8)	42 (11.1)
Driver	80 (21.1)	0 (0.0)
Unemployed	9 (2.4)	111 (29.2)
Total	380 (100.0)	380 (100.0)
Monthly income		
< ₦20, 000	84 (22.1)	207 (54.5)
₦20,000 – ₦ 49, 000	211 (55.5)	134 (35.3)
≥ ₦50,000	85 (22.4)	39 (10.3)
Total	380 (100.0)	380 (100.0)

Table 4: Household characteristics of the respondents(N =380)

Household characteristics	N (%)
Family type	
Nuclear family	329 (86.6)
Extended family	51 (13.4)
Total	380 (100.0)
Household size	
1 – 4	69 (18.2)
5 -8	225 (59.2)
≥9	86 (22.6)
Total	380 (100.0)
Number of children in the household	
1-4	122 (32.1)
5-8	209 (55.0)
≥9	49 (12.9)
Total	380 (100.0)

Table 5: Characteristic determinants of the stunted child(N = 380)

Variables	Height-for-age				
	Not stunted N (%)	Stunted N (%)	Total	COR	95% CI
Sex of child					
Male	152 (50.7)	30 (37.5)	182 (47.9)	1.712*	1.032 – 2.839
Female	148 (49.3)	50 (62.5)	198 (52.1)	1.00	
Total	300 (100.0)	80 (100.0)	380 (100.0)		
Child's age (years)					
6 – 8	123 (41.0)	8 (10.0)	131 (34.5)	6.976*	3.163 – 15.383
9 -10	69 (23.0)	23 (28.8)	92 (24.2)	1.361	0.762 – 2.432
11-12	108 (36.0)	49 (61.2)	157 (41.3)	1.00	
Total	300 (100.0)	80 (100.0)	380 (100.0)		
Birth order of child					
First	70 (23.3)	22 (27.5)	92 (24.2)	0.665	0.314 – 1.406
Second	47 (15.7)	19 (23.8)	66 (17.4)	0.517	0.236 – 1.133
Third	66 (22.0)	13 (16.2)	79 (20.8)	1.061	0.464 – 2.428
Fourth	50 (16.7)	12 (15.0)	62 (16.3)	0.871	0.371 – 2.044
Fifth	67 (22.3)	14 (17.5)	81 (21.3)	1.00	
Total	300 (100.0)	80 (100.0)	380 (100.0)		
Skip meals					
No	124 (41.3)	37 (46.2)	161 (42.4)	0.819	0.499 – 1.345
Yes	176 (58.7)	43 (53.8)	219 (57.6)	1.00	
Total	300 (100.0)	80 (100.0)	380 (100.0)		
Weight-for-age of child					
Underweight	21 (10.9)	17 (54.8)	38 (17.0)	9.888*	4.268 – 22.906
Normal	171 (89.1)	14 (45.2)	185 (83.0)	1.00	
Total	192 (100.0)	31 (100.0)	223 (100.0)		
Body Mass Index-for-age of child					
Thin	41 (13.7)	22 (27.5)	63 (16.6)	0.468*	0.258 – 0.849
Overweight	36 (12.0)	2 (2.5)	38 (10.0)	4.520*	1.056 – 19.342
Normal	223 (74.3)	56 (70.0)	279 (73.4)	1.00	
Total	300 (100.0)	80 (100.0)	380 (100.0)		
Serum zinc status					
Deficient	4 (14.3)	1 (8.3)	5 (12.5)	1.833	0.183 – 18.370
Normal	24 (85.7)	11 (91.7)	35 (87.5)	1.00	
Total	28 (100.0)	12 (100.0)	40 (100.0)		
Malaria parasite					
Present	8 (28.6)	3 (25.0)	11 (27.5)	1.200	0.257 – 5.612
Absent	20 (71.4)	9 (75.0)	29 (72.5)	1.00	
Total	28 (100.0)	12 (100.0)	40 (100.0)		
Intestinal parasite infestation					
Present	12 (42.9)	2 (16.7)	14 (35.0)	3.750	0.690 – 20.377
Absent	16 (57.1)	10 (83.3)	26 (65.0)	1.00	
Total	28 (100.0)	12 (100.0)	40 (100.0)		

Legend: *= $p < 0.05$;COR = Crude Odds Ratio; 95% CI = Confidence Interval

Table 6: Family socioeconomic determinants of stunting (N = 380)

Variables	Height-for-age		Total	COR	95% CI
	Not stunted	Stunted			
Educational background of father					
Primary education	92 (30.7)	25 (31.2)	117 (30.8)	0.736	0.292 – 1.854
Secondary education	121 (40.3)	34 (42.5)	155 (40.8)	0.712	0.290 – 1.744
Tertiary education	52 (17.3)	14 (17.5)	66 (17.4)	0.743	0.272 – 2.026
No formal education	35 (11.7)	7 (8.8)	42 (11.1)	1.00	
Total 300 (100.0)	80 (100.0)	380 (100.0)			
Educational background of mother					
Primary education	98 (32.7)	29 (36.2)	127 (33.4)	1.098	0.519 – 2.326
Secondary education	131 (43.7)	30 (37.5)	161 (42.4)	1.419	0.677 – 2.977
Tertiary education	31 (10.3)	8 (10.0)	39 (10.3)	1.259	0.464 – 3.416
No formal education	40 (13.3)	13 (16.2)	53 (13.9)	1.00	
Total 300 (100.0)	80 (100.0)		380 (100.0)		
Occupation of father					
Civil servant	58 (19.3)	15 (18.8)	73 (19.2)	0.483	0.056 – 4.170
Trader	123 (41.0)	35 (43.8)	158 (41.6)	0.439	0.053 – 3.632
Farmer	52 (17.3)	8 (10.0)	60 (15.8)	0.812	0.089 – 7.392
Driver 59 (19.7)	21 (26.2)	80 (21.1)	0.351	0.041 – 2.978	
Unemployed	8 (2.7)	1 (1.2)	9 (2.4)	1.00	
Total 300 (100.0)	80 (100.0)	380 (100.0)			
Occupation of mother					
Civil servant	36 (12.0)	9 (11.2)	45 (11.8)	0.989	0.416 – 2.353
Trader	141 (47.0)	41 (51.2)	182 (47.9)	0.850	0.475 – 1.521
Farmer	34 (11.3)	8 (10.0)	42 (11.1)	1.051	0.427 – 2.585
Unemployed	89 (29.7)	22 (27.5)	111 (29.2)	1.00	
Total 300 (100.0)	80 (100.0)	380 (100.0)			
Fathers' monthly income (₦)					
< 20, 000	67 (22.3)	17 (21.1)	84 (22.1)	0.845	0.391 – 1.826
20,000 – 49, 000	163 (54.3)	48 (60.0)	211 (55.5)	0.728	0.382 – 1.385
≥ 50,000	70 (23.3)	15 (18.8)	85 (22.4)	1.00	
Total 300 (100.0)	80 (100.0)	380 (100.0)			
Mothers' monthly income (₦)					
< 20, 000	165 (55.0)	42 (52.5)	207 (54.5)	1.179	0.520 – 2.671
20,000 – 49, 000	105 (35.0)	29 (36.2)	134 (35.3)	1.086	0.464 – 2.543
≥ 50,000	30 (10.0)	9 (11.2)	39 (10.3)	1.00	
Total 300 (100.0)	80 (100.0)	380 (100.0)			
Family type					
Nuclear family	261 (87.0)	68 (85.0)	329 (86.6)	1.181	0.587 – 2.378
Extended family	39 (13.0)	12 (15.0)	51 (13.4)	1.00	
Total 300 (100.0)	80 (100.0)	380 (100.0)			
Household size					
1 – 4 57 (19.0)	12 (15.0)	69 (18.2)	0.846	0.359 – 1.994	
5 -8 170 (56.7)	55 (68.8)	225 (59.2)	0.550	0.283 – 1.069	
≥9 73 (24.3)	13 (16.2)	86 (22.6)	1.00		
Total 300 (100.0)	80 (100.0)	380 (100.0)			

Number of children in the household					
1-4	94 (31.3)	28 (35.0)	122 (32.1)	0.468	0.181 – 1.215
5-8	163 (54.3)	46 (57.5)	209 (55.0)	0.494	0.198 – 1.234
≥9	43 (14.3)	6 (7.5)	49 (12.9)	1.00	
Total	300 (100.0)	80 (100.0)	380 (100.0)		

Legend: *= $p < 0.05$;COR = Crude Odds Ratio;

Table 6 shows family socioeconomic determinants of stunting. Having secondary education (COR = 1.419; 95% CI = 0.677 – 2.977), farming as an occupation (COR = 1.051; 95% CI = 0.427 – 2.585) and low monthly income (COR = 1.179; 95% CI =0.520 – 2.671) among the mothers and nuclear family system (COR = 1.181;95%CI =0.587 – 2.378) were family socio economic determinants of stunting observed in the study.

Discussion

This study assessed the prevalence and determining factors of stunting among SAC in a rural Nigerian community. Stunting, which signifies long-lasting effect of nutritional issues in the community and is insensitive to recent, short-term deviations of dietary intake, 15 had medium prevalence (21%) among SAC in the study area. Rurality of the area, socio economic factors, feeding habits, educational and cultural differences, parasitic infections and micronutrient deficiencies might have contributed to the presence of stunting among this group. Prevalence of stunting increased with increasing age, however, the odds of being stunted was almost 7 times higher among younger SAC (6-8 years) compared to 9–10-year-olds indicating that these children may have been exposed to under-nutrition in utero or in their early childhood years. Rural nature of the study area could have contributed to this as there may have been inter-generational cycle of stunting where a stunted mother gives birth to a stunted child as a result of inadequate intake of essential nutrients during pregnancy due to poverty. This, in addition to sub-optimal infant feeding practices, recurrent infections and micronutrient deficiencies, predisposes the child to chronic malnutrition which reflects stunting early in life. Astatkie[16] reported that rural habitation significantly increases the menace of stunting in younger cohorts than in the older cohorts. Secondly, young children depend only on their caregivers for food and nutrition unlike the older ones who obtain theirs from their immediate and extended families, friends and also have the potential for catch-up growth. The child who is stunted in early childhood may experience growth recovery associated with late childhood if nutrient intake improves.

Increased nutrient requirement, basal metabolic rate and physical activity level associated with males and inadequate nutrient intake might be the reason for the higher odds (COR =1.7; 95% CI =I.032 – 2.839) of stunting seen among male than female SAC who are usually less active and have more access to food since they are usually at home and are involved in food preparation translating to better nutritional status. Kububo-Mariara *et al*.[17] observed that boys are more prone to chronic under-nutrition. Not skipping meals was associated with lower odds (COR = 0.819) of stunting probably because frequent meal consumption might contribute to intake of essential nutrients needed for growth and development.

Inadequate dietary intake associated with meal skipping and increased nutritional need associated with this group might be the reason for the higher odds in this group.

Competition for food within the household and childcare being left in the hands of older children by their parents in order to provide for the economic and social needs of the family could be the reason for children of higher birth order being more at risk of stunting. Though their study was among Bangladesh preschool children, Akram *et al*.[18] observed that children of higher birth order had significantly elevated risk of stunting congruent with the findings of this studywhere the risk of stunting was more on children of the third birth order. Children of high birth order indicate increasing household size seen in this study, demonstrating the need for extra care and food supply in the increasing household.

Underweight, a significant indicator of malnutrition in children which leads to long term effects such as abnormalities in physical and mental health, behavioural problems, and low educational attainment,[8, 19] had medium prevalence (17%) and was a determinant of stunting in the study as underweight SAC were 9.8 times more likely to be stunted. Underweight is a measure of previous and recent weight loss or failure to gain weight[20] which is largely due to shortage in food supply, availability or intake.[21] According to Caballero[22] childhood underweight escalates overweight and obesity risks later in life. This implies overweight/obesity presence in adulthood of the underweight children with its negative health consequences. Double burden of malnutrition though uncommon in this study could be seen in this group where under-nutrition and over-nutrition existed in the same child. Stunting and overweight coexisted in children (< 5 years) but was rare in older children (5 to 9 years) and adolescents (10 to 20 years)[30] congruent with the findings of this study. Overweight was a determinant of stunting as they were 4.5 times more likely to be stunted than their counter parts with normal BMI-for-age. Among young Mexican children, mild stunting was implicated in the accumulation of excess body fat.[31]

Though zinc deficiency prevalence reported in this study was high (12.5%) it was not yet a public health problem. Zinc deficiency prevalence reported was lower than the 43.3% reported among SAC in a rural South-eastern Nigerian community.[15] The odds of being stunted were 1.8 times more among zinc deficient SAC compared to those with normal zinc status. Zinc plays a vital role in protein synthesis and IGF-1 synthesis can be impaired by zinc deficiency.[23] Zinc deficiency impairs growth in children since a vital role is played by zinc in biological processes such as cell growth, differentiation and metabolism.[24,25] Inadequate consumption of animal source foods rich in zinc and increased intake of phytate-rich traditional foods that interfere with zinc absorption may have contributed to this.

Teh *et al*.[26] reported 41.7% malaria parasitemia prevalence in children (< 15 years) residing in different altitude along the slope of Mount Cameroon lower than what was observed in this study(27.5%) probably because this study was carried out in the dry season when exposition to mosquito bite is less. Poor environmental and housing conditions with bushes around the house, poverty, food insecurity, limited access to health care and attention and unavailability of insecticide-treated nets which are common in the rural area is an indication of a higher prevalence in the rainy season and could be the reason for the higher odds (COR = 1.2; 95% CI = 0.257 – 5.612) of stunting seen among SAC with malaria parasitemia.

Prevalence of intestinal parasite infection (IPI) reported was 35.0% with the soil-transmitted helminth (STH), *Ascaris lumbricoides*, being the most common (27.5%). Hotez and Kamat[27] noted disproportionate presence of soil-transmitted helminth infections in sub-Saharan African children, especially school-aged children. IPI was a determinant of stunting in the area as SAC with IPI had higher odds (3.7) of being stunted than their uninfected counterparts probably because of mal-absorption and diarrhoea associated with IPIs. IPIs cause decrease in nutrient absorption by their interface with absorptive surfaces, physical blockage of intestinal lumen, production of proteolytic substances and ingestion of nutrients meant for the body.[28,29] In non-developed countries, serious damage to children's development which are linked to failure to thrive, reduced physical activity and learning power are caused by IPIs.[30] The highest rate of morbidity from intestinal parasites is seen majorly among children of school age.[31] Limited access to clean water, toileting system which is mostly pit latrine and improper waste disposal may have contributed to this.

Socio-economic characteristics of the respondents' parents, such as monthly income, occupation and educational background, were determinants of stunting observed among the SAC. Being uneducated (11.1% fathers; 13.9% mothers) makes one less employable and engage in irregular menial jobs such as working in people's farm for daily income (15.8% fathers; 11.1% mothers) in order to provide for ones' family. This might be the reason for the odds of stuntingseen among SAC whose mothers (COR = 1.051) and fathers (COR = 0.812) were farmers. This result to irregular and low family income for food and other family needs leading to chronic malnutrition as the children eats only what is available and what the family can afford and not what they need for growth. Low income earning of the mothers (54.5%) negatively affected the growth of these children, however, high income earning of the fathers (≥ ₦50, 000) did not affect the odds of stunting.

Rural nature of the area and practice of extended family system could be the reason for the high prevalence of stunting seen in households with 5–8 children and household size. Large household size lowers food availability for children and other family members qualitatively and quantitatively and increases the risk of overcrowding, infection and diseases which leads to malnutrition. Having many children (N = ≥5) to feed cause less attention to be paid on childcare, child feeding and child nutritional needs. Besides, group eating is practiced in the area where children eat from the same plate placing the slow eaters at risk of chronic malnutrition. Families who have more children are more economically stretched, cannot provide enough nourishment for them and face difficulty in providing the daily nutritional needs for appropriate child growth.[32]

The prevalence of stunting among school-aged children can be reduced through combined efforts of the family (parents) and the government. Parents or caregivers especially those living in rural communities should be properly enlightened on the determinants of stunting among rural SAC and the government should make policies that will assuage existing environmental and socio-economic conditions.

The strengths of this study are that it is among the first studies to be conducted among SAC in Achi and it is conducted among SAC who are capable of catch-up growth or growth recovery from early stunting if targeted interventions are offered. The limitations of this study are: the study was a school-based study and may not have been a true representation of all SAC in the community as a result the burden of stunting may have been under-estimated. Furthermore, it is a cross-sectional study in which previous information on nutritional status has not been taken into account. Nevertheless, the study was carried out in a rural area and in the dry season whose findings could not be compared with findings in the urban area and rainy season.

Conclusion

In this study, SAC who were between 6 and 8 year olds, males, skip meals,of higher birth order, underweight or overweight, zinc deficient, had malaria and intestinal parasite infestations especially Ascaris lumbricoides, were more likely to have stunted growth. Being uneducated by respondents' parents/caregivers, low income earning of the mothers, rurality of the area, practice of extended family system and families with many children were socio-economic factors which negatively had effect on the growth of these children.

Acknowledgements

The authors are thankful to the students and their parents for their consent and willingness to participate in the study. The help of their research assistants who made movement in the community and data collection easy is highly acknowledged. The authors wish to thank the Local Government Chairman, headmasters/mistresses and the teachers of the various schools used and the laboratory scientist for their approval and cooperation throughout the study.

Funding

The authors received no funding for the study, authorship, and/or publication of this article.

Conflict of Interest

The authors declare that there are no conflicts of interest.

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