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Research Article

Malnutrition and Its Associated Factors among Primary School Children In Nsukka, Nigeria

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ABSTRACT

The fortune of any community is measured by the nutritional status of its children. The study ascertained prevalence of anthropometric indices of malnutrition, malaria and intestinal parasites; and associated factors of malnutrition among primary school children (6-12 years) in Nsukka, Nigeria. Multi-stage random sampling technique what to select 396 participants from five public primary schools in Nsukka. Age, height and weight measurements were used to determine their anthropometric indices. Structured questionnaire was used to obtain information on factors associated with malnutrition. Malaria and intestinal parasite determinations were carried out using thin blood film and wet mount direct methods, respectively. Data were analysed using chi-square and logistic regression. Thinness (13.0%), stunting (5.6%), underweight (1.3%), overweight (6.1%), obesity (2.1%), malaria (56.1%) and typhoid (36.6%) were prevalent. Toilet facilities used by 22.0%, 2.8% and 1.5% were pit latrine, bush system and bucket latrine, respectively. Intestinal parasites seen among respondents were *Entamoeba histolytica* (7.3%) and *Ascaris lumbricoides* (34.1%). Polyparasitism existed in 2.4% of respondents. Risk of being stunted for pupils whose mothers earned ≤ N30,500 were about six folds higher (RR=5.534; CI = 0.733 - 41.780) compared to those whose mothers earned >N30,500. Risk of being underweight for pupils whose mothers and fathers were unemployed were about four folds higher (RR=4.222, CI = 0.427 - 41.784; RR=3.78, CI = 0.385 - 37.012, respectively) compared to respondents whose mothers and fathers were employed. Socio-economic factors were seen to increase their risk to malnutrition.

Keywords: Stunting, School age children, Parasitic infections, Birth order, Thinness, Malaria

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INTRODUCTION

Primary school life is a dynamic period of physical growth as well as mental development of children and therefore represents an active growing phase of childhood (Srivastava *et al*, 2012). Concern has been raised regarding the health and nutritional status of school age children which stated that not much emphasis has been put on this group, instead the focus of most countries has been on child survival and welfare programmes which target pre-school children only (Chesire et al, 2011).The school-age period is, however, a nutritionally significant period because this is the prime time to build up body stores of nutrients in preparation for rapid growth of adolescence (Sunil, 2014).

Malnutrition occurs in school-age children majorly due to inadequacies in one or more of the three main preconditions for good nutrition: food, care and health (Mwaniki & Makokha, 2013). In reality, in a country like Nigeria with inequitable distribution of wealth among households, milestone of child development cannot be achieved either in part or in whole for some children due to many factors such as low family income, illiteracy amongst parents, poor environmental conditions, inadequate nutrient intake and poor health conditions. These factors thereby predispose children to poor nutrition and poor growth which in turn affects their social, mental and physical development.

Stunting and underweight are among the main nutritional problems facing the school age child (United Nations Standing Committee on Nutrition [UNSCN], 2000). Overweight and obesity are also increasing problems in the school-age child for some countries like Nigeria experiencing nutrition transition and can also co-exist with under-nutrition (UNSCN, 2000). Young children who are undernourished are more susceptible to diseases and even feeding them later in

life is too little, too expensive and too late to improve nutrition or future productivity (Burgess & Danga, 2008). According to WHO (2016), about 60% of children who died from common diseases like malaria and diarrhoea would not have died if they were not undernourished in the first place.

Several studies have investigated anthropometric indices of preschool children in Nigeria, but there is a paucity of data on associated risk factors of malnutrition in school age children. It is of paramount importance to identify those factors that expose school children to malnutrition and undermine their growth. This study was therefore aimed at assessing anthropometric indices and associated risk factors of malnutrition among children (6-12 years) attending public primary schools in Nsukka Urban.

MATERIALS AND METHODS

Preliminary visits: Nsukka Local Government Education Board was visited with an identification letter obtained from the Head, Department of Nutrition and Dietetics to obtain the total number of public primary schools in Nsukka urban. A visit was also made to obtain permission to carry out the study from headmistresses/masters of selected schools.

Study design, sample size and sampling technique: This cross-sectional survey was carried out in urban part of Nsukka, a town with 20 registered public primary schools. Sample size was obtained using the formula:

$$N = 4P(1-P) / W^2$$

Where N = sample size,

P = proportion of respondents assumed to have malnutrition (39.4% = prevalence of malnutrition in semi-urban school children in Nigeria by Fetuga *et al*, (2011).

W = probability level (0.05 or 5%)

$$N = \frac{4 \times 0.394\,(1-0.394)}{0.05^2} = 382 \text{ students}$$

Sample size was increased by 5% to account for contingencies such as non-response or recording error (382 + 19 = 401 respondents). Ten per cent of sample size was used as sub-sample for biochemical determinations. Correctly filled questionnaires (396) were used for data analysis.

Multi-stage sampling technique was used to select respondents for the study. At the first stage, five out of the twenty public primary schools in Nsukka were selected by random sampling by balloting without replacement. Balloting without replacement enables selection from the population only once and entirely by chance. At the second stage, the number of students aged 6 – 12 years was obtained from the five selected public primary schools using the school registers. Proportionate sampling was used to determine the number of students in each school. At the third stage, the students used for the study were selected from the five schools using random sampling by balloting without replacement.

Data collection methods:

Questionnaire: Structured and validated questionnaire was used to obtain information on personal data, food habits of respondents and socio-economic status of respondents' caregivers. Questionnaires were given to each respondent to be filled at home by parents/guardians and they were collected the following day.

Table 1:
General characteristics of the subjects

Variables	Frequency	Percentage
Type of house		
Flat	176	44.4
One room apartment	82	20.7
Duplex	10	2.5
Bungalow	64	16.2
Self-contained rooms	64	16.2
Total	**396**	**100.0**
Type of toilet facilities used		
Pit latrine	87	22
Bush system	11	2.8
Bucket latrine	6	1.5
Water cistern	292	73.7
Total	**396**	**100.0**
Source of drinking water supply		
Rain water collected in a tank/container	105	26.5
Well water	26	6.6
Stream	7	1.8
Borehole	248	62.6
Sachet water	10	2.5
Total	**396**	**100.0**
Sleeping under insecticide-treated net		
Yes	144	36.4
No	252	63.6
Total	**396**	**100.0**
Number of children in family		
1-4	151	38.1
5-8	222	56.1
9 and above	23	5.8
Total	**396**	**100.0**
Birth order		
Ist	67	16.9
2nd	80	20.2
3rd	87	22.0
4th	87	22.0
Above 4th	75	18.9
Total	**396**	**100.0**
Household size		
1-4	78	19.7
5-8	249	62.9
9 and above	69	17.4
Total	**396**	**100.0**
Skipping of meals		
Breakfast	32	8.1
Lunch	24	6.1
Supper	21	5.3

Anthropometric measurements: Anthropometric measurements of height and weight were obtained from respondents using standard procedures. Height of respondents was measured with a height metre and measurements were taken to nearest 0.1m. Weight was measured using Hana bathroom weighing scale of 120kg capacity. It was read and recorded to the nearest 0.1kg.

BMI of respondents was calculated using height and weight measurements of each child as shown below:

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height } (m^2)} = \text{kg}/m^2$$

BMI-for-age, weight-for-age (W/A) and height-for-age (H/A) of each respondent was compared with WHO (2007) reference standard.

Biochemical tests: Two millilitres of blood were collected from each respondent by a medical laboratory scientist for malaria and typhoid parasite tell the blood film stained with Giemsa's stain was used to detect presence of malaria parasites. Malaria parasites were differentiated and a positive result was recorded when different stages of growth of plasmodium were seen inside the erythrocytes. Tube agglutination test method (Ochei & Kolhatkar, 2008) was used to detect presence of typhoid parasites in the blood. Positive was recorded at observable agglutination and negative for no agglutination. Stool samples were collected into well-labelled clean wide mouth screw-cap sample bottles for macroscopic and microscopic detection of intestinal parasites using wet mount method (Watson *et al*, 1988; Parija *et al*, 2003).

Ethical consideration and informed consent: Ethical approval(NHREC/05/01/2008B-FWA00002458-1RB00002323) for the study was obtained from Health Research Ethics Committee, University of Nigeria Teaching Hospital, Ituku-Ozalla, Enugu state.

Consent of respondents to be part of the study was obtained through the respondents and their care-givers (parents and guardians) after holding a meeting/discussion with them. Those whose caregivers consented signed the consent forms and were recruited.

Data analysis: Data collected was coded and analyzed using IBM Statistical Package for the Social Sciences, SPSS (version 21). Frequencies and percentages were used for data presentation. Chi-square and multinomial logistic regression were used to establish relationship between variables at $p < 0.05$.

RESULTS

General characteristics of respondents are shown in Table 1. Water cistern was the type of toilet facility used by majority (73.7%). A good number of the respondents (63.6%) do not sleep under insecticide-treated net. Majority of the families (56.1%) had 5 – 8 children and 22.0% were of third birth order. Household size of 62.9% of respondents was 5 – 8. Breakfast and lunch were skipped by 8.1% and 6.1% respondents, respectively

Cross-tabulation of anthropometric indices by age and sex is shown in Table 2. Underweight, stunting, thinness, overweight and obesity were seen in 1.3%, 5.6%, 13.0%, 6.1% and 2.1% of the respondents, respectively. Weight-for-age, height-for-age and BMI-for-age were significantly ($p < 0.05$) associated with age.

Table 2:
Cross-tabulation of anthropometric indices by age and sex

	Age groups						Total
	6 – 9 years		10 -12 years		Total		
	Male	Female	Male	Female	Male	Female	
Variables	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**N (%)**
Weight-for-age							
Underweight	2 (0.5)	3 (0.8)	0 (0.0)	0 (0.0)	**2 (0.5)**	**3 (0.8)**	**5 (1.3)**
Normal	58 (14.7)	99 (25.0)	2 (0.5)	2 (0.5)	**60 (15.2)**	**101 (25.5)**	**161 (40.7)**
*NA	0 (0.0)	0 (0.0)	106 (26.7)	124 (31.3)	**106 (26.7)**	**124 (31.3)**	**230 (58.0)**
Total	**60 (15.2)**	**102 (25.8)**	**108 (27.2)**	**126 (31.8)**	**168 (42.4)**	**228 (57.6)**	**396 (100.0)**
Height-for-age							
Stunted	1(0.3)	1 (0.3)	8 (2.0)	12 (3.0)	**9 (2.3)**	**13 (3.3)**	**22 (5.6)**
Normal	59 (14.9)	101 (25.5)	100 (25.2)	114 (28.8)	**159 (40.1)**	**215 (54.3)**	**374 (94.4)**
Total	**60 (15.2)**	**102 (25.8)**	**108 (27.2)**	**126 (31.8)**	**168 (42.4)**	**228 (57.6)**	**396 (100.0)**
BMI-for-age							
Thin	12 (3.0)	14 (3.5)	17 (4.2)	9(2.3)	**29 (7.2)**	**23 (5.8)**	**52 (13.0)**
Normal	40 (10.1)	77 (19.5)	83 (21.0)	112 (28.2)	**123 (31.1)**	**189 (47.7)**	**312 (78.8)**
Overweight	5 (1.3)	6 (1.5)	8 (2.0)	5 (1.3)	**13 (3.3)**	**11 (2.8)**	**24 (6.1)**
Obese	3(0.8)	5 (1.3)	0 (0.0)	0 (0.0)	**3 (0.8)**	**5 (1.3)**	**8 (2.1)**
Total	**60 (15.2)**	**102 (25.8)**	**108 (27.2)**	**126 (31.8)**	**168 (42.4)**	**228 (57.6)**	**396 (100.0)**

*NA: Not applicable i.e.≥10years+1month which was not captured in the WHO child growth chart
Weight-for-age: by age χ_2 =379.867, P = 0.000*; by sex χ_2 =3.600, P = 0.308
Height-for-age: by age χ_2 = 9.756, P = 0.002*; by sex χ_2 =0.022, P = 0.882 ; BMI-for-age: by age χ_2 = 15.685, P = 0.003*; by sex χ_2 =10.041, P = 0.040*

Table 3:
Biochemical indices of respondents

Variables	Frequency	Percentage
Presence of intestinal parasite		
Yes	18	56.1
No	23	43.9
Total	**41**	**100.0**
Type of intestinal parasite seen		
Negative	23	56.1
Ascaris lumbricoides	14	34.1
Entamoeba histoytica	3	7.3
Ascaris lumbricoides + *Strongyloides stercoralis*	1	2.4
Total	**41**	**100.0**
Recently dewormed		
Yes	270	68.2
No	126	31.8
Total	**396**	**100.0**
Last time of deworming		
Less than a month ago	70	25.9
1-3 months ago	76	28.1
More than 3 months ago	124	45.9
Total	**270**	**100.0**
Presence of malaria parasite		
Yes	23	56.1
Not seen	18	43.9
Total	**41**	**100.0**
Presence of typhoid parasite		
Yes	15	36.6
No	26	63.4
Total	**41**	**100.0**

Biochemical indices of respondents are shown in Table 3. Prevalence of intestinal, malaria and typhoid parasites were 56.1%, 56.1% and 36.6%, respectively. *Ascaris lumbricoides* was seen in 34.1% of respondents.

Table 4 shows factors associated with stunting and underweight. Children of low birth order were more at risk of stunting (OR =1.054, CI = 0.346 – 3.212) than those of high birth order. Children of unemployed mothers (OR = 1.338, CI = 0.297 – 6.042) and unemployed fathers (OR = 2.526, CI =0.694 – 9.192) were more at risk of stunting. Children of unemployed mothers were 4 times more at risk of underweight whereas those of unemployed fathers were 3 times more at risk of underweight

Factors associated with thinness and overweight/obesity is shown in Table 5. Thinness, overweight/obesity existed more among the 6 – 9-year old, males, children whose parents (fathers and mothers) had formal education and children of unemployed fathers.

DISCUSSION

Thinness had a prevalence that was lower than 27.8% and 19.4% reported in rural Philippines (Ross et al, 2017) and Ghana (Appiah & Amos, 2014), respectively. Males had significantly ($p < 0.05$) above normal BMI- for-age than females probably because they are preferentially desired in traditional Igbo setting as heirs to their father's inheritance and are usually given more food and care than their female counterparts. Prevalence of stunting and underweight reported in this study was lower than 27.9% and 30.3% reported among school children in Mandya district, Karnataka, respectively (Shivaprakash & Joseph, 2014). Obiakor-Okeke (2014) reported higher prevalence of stunting (40.1%) and underweight (25.2%) in Owerri, Nigeria than findings of this study. Stunting was significantly ($p < 0.05$) associated with age as 10 – 12-year old were more at risk of stunting than 6 -9 years. This is not surprising as stunting reflects long-term chronic malnutrition. The children may have been exposed to poor nutrition or infection since early childhood. According to Adekanmbi *et. al.* (2013) stunting reflects poor linear growth accumulated during pre- and/or postnatal periods because of poor nutrition and/or health. Finding of this study was similar to reports of Paraga (2006) and Mwaniki and Makokha (2013) who noted that stunting increases with age. Underweight, which is used as a composite indicator to reflect both acute and chronic under-nutrition (Bose et al, 2008) was of low prevalence possibly due to the non-inclusion of subjects who were ≥10 years which the WHO child growth standard did not capture. Bello *et al.* (2016) reported 15% prevalence in Lagos state, Nigeria whereas 24.8% was reported in Ethiopia (Feleke, 2016).

Most of these children lived in medium-sized households. This is expected as the study was done in an urban area, however, some still lived in large households and this usually has implication on child's nutritional status. Lack of food (household food insecurity) or meal not ready before leaving for school may have contributed to skipping of breakfast by some respondents. This is worrisome because it will most likely affect the growth and school performance of these children gravely since breakfast is the most important meal of the day.

Children of low birth order were more at risk of stunting (COR = 1.054; 95% CI =0.346 – 3.212) and underweight (COR = 0.964; 95% CI = 0.933 – 0.995) probably because parents may have paid less attention to their nutritional needs. The risk of overweight/ obesity (COR = 1.011; 95% CI =0.398 – 2.566) seen among children of low birth order who were more at risk of stunting is not surprising as overweight/obesity is a risk factor for stunting which may have a negative and irreversible effect on older children's nutritional status. Findings of this study is in agreement with report of Girma and Genebo (2002) who emphasized that children of lower birth order are at a higher risk of stunting because of mothers' lack of experience in terms of place and method of delivery, lack of awareness about the importance of breastfeeding, all of which are important contributors to child nutrition. However, Collins (2013) and Jayachandran and Pande (2013) noted that lower birth order children are naturally favoured than higher birth order children as a result of resource dilution due to an additional child. Children of higher birth order were probably left under the care of their older siblings. This may explain high risk (COR = 0.979; 95% CI = 0.465 – 2.064) of thinness that existed among them. This finding is, however, contrary to earlier report that children born later in the birth order have an added advantage as parents are more experienced and aware with each additional pregnancy making the environment more favourable for higher birth order children.

Table 4:
Factors associated with stunting and underweight

Exploratory variables	Stunted				Underweight			
	%	OR	95% CI	P-value	%	OR	95% CI	P-value
Age (years)								
6 -9	1.2				3.1	0.969	0.943 – 0.996	0.721
10 -12	8.5	0.134	0.031 – 0.580	0.002*	0.0			
Sex								
Male	5.4				3.2	1.122	0.182 – 6.909	0.901
Female	5.7	0.936	0.391 – 2.244	0.882	2.9			
Birth order								
1 – 4	5.6	1.054	0.346 – 3.212	0.926	3.6	0.964	0.933 – 0.995	0.296
> 4	5.3				0.0			
Mother's education								
No formal education	3.4				0.0			
Formal education	5.7	0.058	0.760 – 4.538	0.607	3.2	1.033	1.004 – 1.063	0.545
Father's education								
No formal education	0.0				0.0			
Formal education	6.0	1.064	1.037 – 1.091	0.183	3.2	1.033	1.004 – 1.063	0.545
Mother's employment status								
Unemployed	7.1	1.338	0.297 – 6.042	0.704	10.0	4.222	0.427 – 41.784	0.182
Employed	5.4				2.6			
Father's employment status								
Unemployed	12.0	2.526	0.694 – 9.192	0.146	9.1	3.775	0.385 – 37.012	0.222
Employed	5.1				2.6			
Mother's income (₦)								
<30, 500	6.6	5.534	0.733 - 41.780	0.063	3.6	0.964	0.933 – 0.995	0.296
>30, 500	1.3				0.0			
Father's income (₦)								
<30, 500	7.0	3.066	0.890 –10.560	0.063	3.4	1.600	0.174 – 14.700	0.675
>30, 500	2.4				2.1			
Typhoid								
Yes	0.0							
No	23.8	-	1.301 – 2.259	0.070				
Malaria parasite								
Yes	21.1	3.579	0.364 –35.233	0.250				
No	5.9							
Intestinal parasite								
Yes	9.5							
No	20.0	0.476	0.071 – 3.209	0.439				

It is surprising that children of parents who received formal education were more at risk of all forms of malnutrition (stunting, underweight, thinness and overweight/obesity). Formal education is expected to make one more informed on what constitutes an adequate diet and earn more so as to provide nutrient-dense meals and a favourable environment for child growth and health. It was either the parents did not practice what they were taught or they were too busy pursuing their career to look into child's nutrient intake. Our findings were at variance with earlier report in Sri Lanka (Galgamuwa *et al*, 2017).

Unemployed parents had children who were more at risk of stunting (COR = 1.338 and 2.526), underweight (COR = 4.222 and 3.775) and thinness (COR = 1.474 and 2.583). This is expected as unemployment is a factor that contributes to food insecurity at household level predisposing these children to malnutrition and its severe consequences. Unemployment may have made these families to adopt coping strategies such as modification in the quality and quantity of foods eaten which negatively have affected anthropometric indices of these children. Reason for high risk of overweight/obesity (COR = 2.829; 95% CI = 0.879 – 9.105) seen more among children of unemployed fathers, was unclear, however some of them have mothers who were employed. Employed mothers earn salaries, tend to spend more on food and can afford energy-dense snacks and foods, thus the high prevalence overweight/obesity among their children.

Parents who earned less than ₦30, 500 monthly were at an increased risk of having stunted (COR = 5.534 and 3.066), underweight (COR = 0.964 and 1.600) and overweight/obese (COR = 1.032 and 1.415) children. This is expected because it is from this income that expenses on food and other basic necessities of life are made. Our findings are similar to conclusion of Fernald and Neufeld (2007) that children of lower socio-economic status were more exposed to occurrence of concurrent overweight and stunting; and to the findings of Atsu et al. (2017). Bello *et al.* (2016) reported that children living under conditions of poverty and deprivation are always at risk of becoming undernourished. Less income groups have the tendency to consume less adequate diets (De Irala-Esterez et al, 2000).

Table 5:
Factors associated with thinness and overweight/obesity

Exploratory variables	Thinness				Overweight/Obesity			
	%	OR	95% CI	p-value	%	OR	95% CI	p-value
Age (years)								
6 -9	16.0	1.529	0.852 – 2.745	0.153	14.0	2.436	1.160 – 5.114	0.016*
10 -12	11.1				6.3			
Sex								
Male	19.1				11.5	1.537	0.741 – 3.186	0.246
Female	10.8	1.937	1.071 – 3.504	0.027*	7.8			
Birth order								
1 – 4	14.2				9.3	1.011	0.398 – 2.566	0.982
>4	14.5	0.979	0.465 – 2.064	0.956	9.2			
Mother's education								
No formal education	11.1				7.7			
Formal education	14.5	0.735	0.213 – 2.533	0.624	9.4	0.800	0.180 – 3.552	0.769
Father's education								
No formal education	3.7				3.7			
Formal education	15.1	0.216	0.029 – 1.625	0.102	9.8	0.355	0.047 – 2.706	0.297
Mother's employment status								
Unemployed	19.2	1.474	0.530 – 4.100	0.455	8.7	0.924	0.206 – 4.133	0.917
Employed	13.9				9.3			
Father's employment status								
Unemployed	28.6	2.583	0.954 – 6.995	0.054	21.1	2.829	0.879 – 9.105	0.070
Employed	13.4				8.6			
Mother's income (₦)								
<30, 500	13.4				9.4	1.032	0.407 – 2.618	0.948
>30, 500	17.8	0.714	0.359 – 1.421	0.336	9.1			
Father's income (₦)								
<30, 500	14.2				10.2	1.415	0.614 – 3.261	0.413
>30, 500	14.5	0.971	0.519 – 1.817	0.927	7.4			
Typhoid								
Yes	7.7				14.3	0.261	0.021 – 3.178	0.264
No	8.0	1.043	0.086 – 12.710	0.973	4.2			
Malaria parasite								
Yes	8.7	1.333	0.110 – 16.144	0.821	0.0			
No	6.7				17.6	1.214	0.974 – 1.513	0.045*
Intestinal parasite								
Yes	0.0				4.3			
No	18.8	1.231	0.973 – 1.557	0.034*	13.3	0.295	0.024 – 3.587	0.315

Not sleeping under insecticide-treated nets (ITNs) by majority of respondents and timing of the survey (rainy season) may have contributed to the high prevalence of asymptomatic malaria parasitaemia. Prevalence reported in this study was higher than 33.3% reported in Edo state, Nigeria (Osazuwa & Ayo, 2010), 40% in Sudan (Charchuk *et al*, 2015) and 13% in Kenya (Halliday et al, 2012). Most respondents who had asymptomatic malaria parasitaemia were 3.5 times more likely to be stunted similar to findings of Sumbele *et al*. (2015) and contrary to findings of Crookston *et al*. (2010).

Use of water cistern by most respondents is not surprising as the study was carried out in urban area of Nsukka, however, the pour flush water cistern was the type mostly used because Nsukka has irregular piped-borne water supply exposing children to food and water contamination especially if they do not wash hands properly after toilet use. It is, however, unexpected that bucket latrine and bush system type of toilet were used by respondents in Nsukka urban. These and the use of rain water, well water and sachet water (as sources of drinking water by some respondents) may explain the typhoid parasite infestation which existed among respondents. Unhygienic practices such as improper hand washing before meals and intake of contaminated water or food may also have contributed to this. Typhoid fever was earlier reported to be common in school children (Devaranavadagi & Srinivasa, 2017).

Prevalence of intestinal parasite infestation (IPI) reported in this study is higher than 34.2% reported in Ethiopia (Gelaw *et al*, 2013). This high prevalence is worrisome and could be attributed to little or no deworming programme targeted at school children. Intestinal parasite infestation is known to have a negative effect on health and nutrition of school children. Prevalence of IPI was, however, lower than 67.4% reported in Akwa-Ibom, Nigeria (Opara *et al*, 2012) and 61.7% reported in Ethiopa (Feleke, 2016). The most prevalent

species of intestinal parasite isolated from respondents was *Ascaris lumbricoides* similar to earlier reports (Kwenti et al, 2016; Osazuwa et al, 2011; Makoge et al, 2012). This was, however, contrary to findings of Gelaw *et al.* (2013) who reported *Hymenolepis nana* as the most prevalent (13.8%) in Ethiopa. *Ascariasis* existed among the school children probably because they usually come in contact with the soil while playing. *Entamoeba histolytica* whose prevalence was low among the respondents was reported by Ayogu *et al*. (2015) as the most prevalent IPI among school children. It is worrisome to note that more than half of the children were dewormed by their parents <1 – 3 months prior to the study, however, a high prevalence was recorded indicating continuous transmission of intestinal parasites. Inadequate access to healthcare, poor environmental sanitation and lack of awareness may probably have contributed to the high prevalence recorded. Polyparasitism existed in few of the subjects and this is a cause for concern. This is because polyparasitism appears to be an indicator of a lack of access to clean water, improved sanitation and inadequate hygiene (Ngui *et al*, 2012). Parasitic infections have detrimental impact on host nutritional status in several ways such as depressing appetite and food intake, competing for micronutrients, blood loss resulting in the loss of iron, diarrhoea, vomiting, dehydration, weight loss and growth retardation, and reduced school attendance and cognitive performance among school-aged children (Nokes & Bundy, 2015).

It is recommended that government should provide free daily nutritious school meals for school children to improve their anthropometric indices, ensure regular health and nutrition education, anthropometric assessment, deworming exercise and health supervision of school children so as to curb infections and enable children optimize their learning skills and health.

REFERENCES

Adekanmbi, V.T., Uthman, O. A. and Mudasiru, O. M. (2013): Exploring variations in childhood stunting in Nigeria using league table, control chart and spatial analysis. BMC Public Health. 13, 361.

Appiah, K. P. and Amos, L. (2014): Nutritional status of school-age children in the Nkwanta south district - Volta region of Ghana. EurSci J. 10 (30), 310 – 327.

Atsu, B. K., Guure, C. andLaar, A. K. (2017): Determinants of overweight with concurrent stunting among Ghanaian children**.** BMC Pediatr. 17, 177.

Ayogu, R.N. B., Okafor, A. M., Ene-Obong, H. N. (2015): Iron status of schoolchildren (6-15 years) and associated factors in rural Nigeria. Food Nutr Res. 59, 26223 -

Bello, B.,Ekekezie, O. and Afolabi, O. T. (2016): Dietary pattern and nutritional status of primary school pupils in a South Western Nigerian state: A rural urban comparison. Afr J Food Sci. 10(10), 203-212. doi: 10.5897/AJFS2016.1439.

Bose, K., Bisai, S., Chakraborty, J., Dutta, N. and Banerjee, P. (2008): Extreme levels of underweight and stunting among pre-adolescent children of low socioeconomic class from Madhyamgram and Barasat, West Bengal, India. CollAntropol. 1, 73–77.

Burgess, A. andDanga, L. (2008): Undernutrition in adults and children: causes, consequences and what we can do. South Sudan Med. J. 1(2),18-22.

Charchuk, R., Houston, S., Hawkes, M.T. (2015): Elevated prevalence of malnutrition and malaria among school-aged children and adolescents in war-ravaged South Sudan. Pathog Glob Health. 109(8), 395–400.

Chesire, E., Orago, A., Oteba, L. andEchoka, E. (2011): Determinants of under-nutrition among school age children in Nairobi peri-urban slum. East Afr Med J. 85 (10).

Collins, M. (2013): Persistence in the effect of birth order on child development: evidence from the Philippines. University of Oxford, Centre for the study of African Economies (CSAE).

Crookston, B.T., Alder, S. C., Boakye, I., Merrill, R. M., Amuasi, J. H., Porucznik, C. A., Stanford, J. B., Dickerson, T. T., Dearden, K. A., Hale, D. C., Sylverken, J., Snow, B. S., Osei-Akoto, A. and Ansong, D.(2010): Exploring the relationship between chronic undernutrition and asymptomatic malaria in Ghanaian children. Malar J. 9, 39. https:// doi.org/10.1186/1475-2875-9-39.

De Irala-Esterez, J., Growth, M., Johansson, L., Oltersdorf, U., Prattala, R. and Martinez, M. A. (2000): A systematic review of socio- economic differences in food habits in Europe consumption of fruits and vegetables. Eur J Clin. Nutr. 54, 706–714.

Devaranavadagi, R. A. and Srinivasa, S. (2017): A study on clinical profile of typhoid fever in children.Int J ContempPediatr. 4(3), 1067 – 1073.

Feleke, B. E. (2016): Nutritional status and intestinal parasite in school age children: a comparative cross-sectional study. Int J Pediatr. http://dx.doi.org/10.1155/2016/1962128.

Fernald, L. C. and Neufeld, L. M. (2007): Overweight with concurrent stunting in very young children from rural Mexico: prevalence and associated factors.Eur J ClinNutr. 61(5), 623–32.

Fetuga, M. B., Ogunlesi, T. A., Adekanmbi, A. P. and Alabi A.D. (2011): Nutritional status of semi-urban Nigerian school children using the WHO 2007 Reference population.WestAfr JMed. 30(5), 331-336.

Galgamuwa, L. S., Iddawela, D., Dharmaratne, S. andGalgamuwa, G. L. S. (2017): Nutritional status and correlated socioeconomic factors among preschool and school children in plantation communities, Sri Lanka. BMC Public Health. 17, 377.

Gelaw, A., Anagaw, B., Nigussie, B., Silesh, B., Yirga, A., Alem, M.,Endris, M. and Gelaw, B.(2013): Prevalence of intestinal parasitic infections and risk factors among school children at the University of Gondar community school, northwest Ethiopia: a cross-sectional study. BMC Public Health.doi 10.1186/1471-2458-13-304.

Girma, W. andGenebo,T. (2002): Determinants of nutritional status of women and children in Ethiopia. USA: ORC macro.

Halliday, K. E., Karanja, P., Tumer, E. L., Okello, G., Njaagi, K., Dubeck, M. M.,Allen, E., Jukes, M.C. and Brooker, S.J. (2012):*Plasmodium falciparum*, anaemia and cognitive and educational performance among school children

in an area of moderate malaria transmission: baseline results of a cluster of randomized trial on the coast of Kenya. Trop Med Int Health. 17(5), 532-49.

Jayachandran, S. andPande, R. (2013). Why are Indian children shorter than African children? Working paper.

Kwenti, T. E., Nkume, F. A., Tanjeko, A. T. and Kwenti, T. D. B. (2016): The effect of intestinal parasitic infection on the clinical outcome of malaria in coinfected children in Cameroon.PLoSNegl Trop Dis. 10(4), e0004673, doi: 10.1371/journal.pntd.0004673.

Makoge, V. D., Mbah, G. A., Nkengazong, L., Sahfe, N. E. and Moyou, R. S. (2012): Falciparum malaria, helminth infection, and anaemia in asymptomatic pupils in four villages in Cameroon.EurJ Zool Res.1(2), 54–59.

Mwaniki, E. W. andMakokha, A. N. (2013): Nutrition status and associated risk factors among children in primary schools in DagorettiNairobi, Kenya. Afr Health Sci. 13(1), 39–46.

Ngui, R., Lim, Y. A. L., Chong, K. L., Sek, C. and Jaffar, S. (2012): Association between anemia, iron deficiency anemia, neglected parasitic infections and socioeconomic factors in rural children of west Malaysia. PLoSNegl Trop Dis. 6, e1550.

Nokes, C. and Bundy, D. (2015): Compliance and absenteeism in school children: implications for helminth control. Trans R Soc Trop Med Hyg. 8(7), 148-152.

Obiakor- Okeke, P. N.(2014): Anthropometric indices of primary school children from different socio-economic classes in Owerri municipal.Eur J Prev Med. 2(5), 63-68. doi: 10.11648/j.ejpm.20140205.11.

Ochei, J. and Kolhatkar, A. (2008): Medical laboratory science: theory and practices. Tata McGraw-hill publishing company. 1177-1179.

Opara, K. N., Udoidung, N. I., Opara, D. C., Okon, O. E., Edosomwan, E. U. and Udoh, A. J. (2012): The impact of intestinal parasitic infections on the nutritional status of rural and urban school-aged children in Nigeria.Int J MCH AIDS. 1(1), 73–82.

Osazuwa, F., Ayo, O. M. and Imade, P. (2011): A significant association between intestinal helminth infection and anaemia burden in children in rural communities of Edo state, Nigeria. N Am J Med Sci. 3(1), 30–34.

Osazuwa, F. and Ayo, O. M. (2010): Contribution of malnutrition and malaria to anemia in children in rural communities of Edo state, Nigeria. N Am J Med Sci. 2(11), 532-536.

Parija, S. C., Shivaprakash, M. R. andJayakeerthi, S. R. (2003): Evaluation of lacto-phenol cotton blue (LPCB) for detection of Cryptosporidium, Cyclospora and Isospora in the wet mount preparation of stool. Acta Trop. 85(3), 349-354.

Parraga, I. (2006): Growth deficits in school age children in Brazil. Am J ClinNutr.50, 687–696.

Ross, A. G., Papier, K., Luceres-Catubig, R., Chau, T. N., Inobaya, M. T. and Ng, S. (2017): Poverty, dietary intake, intestinal parasites, and nutritional status among school-age children in the rural Philippines. Trop Med Infect Dis. 2, 49. doi:10.3390/tropicalmed2040049.

Shivaprakash, N. C. and Joseph, R. B. (2014): Nutritional status of rural school-going children (6-12 years) of Mandya District, Karnataka.Int J Sci Stud. 2 (2), 39-43.

Srivastava, A., Mahmood, S. E., Srivastava, P. M., Shrotriya, V. P. and Kumar, B. (2012): Nutritional status of school-age children- a scenario of urban slums in India. Arch Public Health. 70 (1), 8.

Sumbele, I. U. N., Bopda, O. S. M., Kimbi, H. K., Ning, T. R. andNkuo-Akenji, T. (2015): Nutritional status of children in a malaria *meso* endemic area: cross sectional study on prevalence, intensity, predictors, influence on malaria parasitaemia and anaemia severity. BMC Public Health. 15, 1099. DOI: 10.1186/s12889-015-2462-2.

Sunil, P. (2014): Malnutrition among primary school children in Hyderabad, India. International Journal of Technical Research and Application. 2(1), 36-39.

UNSCN. (2000): Progress in Nutrition: 6th Report on the World Nutrition Situation. Geneva, Switzerland.

Watson, B., Blitzer, M., Rubin, H. and Nachamkin, I. (1988): Direct wet mounts versus concentration for routine parasitological examination: are both necessary? Am J ClinPathol.89(3), 389-391.

WHO. (2007): Child growth standards.Growth reference 5 – 19 years.http://www.who.int/growthref/en/.

WHO. (2016): Children: reducing mortality. Fact sheet.http://www.who.int/mediacentre/factsheets/fs178/en/.