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ORIGINAL PAPER

Blood pressure profile and nutritional status of pupils benefitting from the National Home-Grown School Feeding Programme in southwest Nigeria

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ABSTRACT

Introduction and aim. Childhood hypertension is an important precursor to adult hypertension. This study was used to investigate blood pressure level and nutritional status of pupils in public primary schools that were benefitting from the National Home Grown School Feeding Programme in southwest Nigeria.

Material and methods. A cross-sectional study conducted among randomly selected 40 public primary schools where feeding programme was on-going in Oyo and Ogun States. Pretested semi-structured questionnaire was used to obtain information from the pupils. Anthropometric measurements and blood pressure readings were assessed using relevant tools.

Results. Some of the pupils (129; 41.6%) aged 10-15 years ($p<0.0001$) were stunted compared to those aged 5-9years (60; 11.3%). Undernutrition among pupils aged 10-15 years was 47.7%, which was significantly higher than ($p<0.0001$) among pupils aged 5-9 years, 18.5%. Overall, prevalence of hypertension among the pupils was 6.0%. No significant difference between male and female groups with regards to MUAC ($p=0.115$), blood pressure ($p=0.302$) and BMI-for-age ($p=0.100$). A significant association found between blood pressure and BMI-for-age ($p=0.004$).

Conclusion. Prevalence of blood pressure among the pupils assessed suggests more presence of high blood pressure in the population of primary school pupils. School feeding programme could be an avenue to improve nutritional indices among the pupils.

Keywords. anthropometric measurements, blood pressure, nutritional status, public primary school pupils, school feeding

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Introduction

Child malnutrition, especially undernutrition has profound health consequences in later life of the children including their future economic potentials.[1] School-age children are growing fast physiologically and depend mainly on the nutrients supply from the family foods. If the level of nutrients intake is below the requirements, the nutritional status will be negatively affected and this could be reflected in the level of stunting, wasting and under-weight.[2] Nutritional status of school-age children, especially stunting, which reliably indicates past nutritional insults due to poor dietary intake, infection and low socio-economic indices over long period of time is being used as a gauge to measure child's health and development potentials.[3] Nigeria has the second highest burden of stunted children in the world with a national prevalence rate of 32% of children under five.[4] Stunting (height-for-age z-score of <-2SD) is a major public health problem in low and middle-income countries because of its association with increased risk of mortality during childhood.[5,6] Apart from causing significant childhood mortality, stunting also leads to significant physical and functional deficits among survivors.[5-7] The prevalence of stunting among school children and adolescents 5-19 years in Ogun State was reported to be 17.4%.[8] The prevalence of underweight for school age children was 24.4%.[9] This indicates a problem of child undernutrition in southwest Nigeria.

The Federal Government of Nigeria with the assistance of the New Partnership for Africa's Development (NEPAD) launched the School Feeding Programme in 2016 named- The National Home-Grown School Feeding Programme (NHGSFP). This programme is a federal government-led ₦70 (0.167US dollars) per day school feeding programme that aims to improve primary school attendance and possibly, the nutritional status of public primary school pupils.[10]

The design was to provide one meal per school day to primary school pupils in Nigeria, so as to increase enrolment, improved health and nutrition of pupils in schools as an added advantage.[11] Healthy school meal contributes to the nutritional status, cognitive development and the general well-being of school children.[12] Adverse health consequences during childhood have been reported to be significantly associated with childhood malnutrition which is responsible for half of the in-hospital mortalities and morbidity.[13] Double burden of malnutrition, which is the co-existence of undernutrition and over-nutrition among young children, overweight and obesity among older children, adolescents, and adults have been reported.[14-16] The International Obesity Task Force estimated the global prevalence of overweight in children and adolescents to be 10%.[17] In Nigeria, the prevalence of obesity and overweight among school-age children was reported as 8.3% and 10.3% for male and 10.3% and 16.8% for female, respectively.[18] More than 60% of overweight children generally have at least one additional risk factor for cardiovascular disease, such as raised blood pressure, hyperlipidaemia or hyperinsulinaemia.[19] Higher blood pressure in childhood together with other risk factors causes target organs and anatomical changes that are associated with cardiovascular risk.[19]

Risk of chronic diseases such as diabetes, hypertension, renal disease and cardiovascular disease that may appear later in life are increased by early malnutrition, which will in turn lead to high adult health care costs.[20] Childhood malnutrition leads to poor school readiness and performance, resulting in fewer years of schooling and reduced productivity. It also diminishes adult intellectual ability and work capacity, causing economic hardship for individuals and their families.[20] Childhood hypertension is an important precursor to adult hypertension, it begins early in childhood and progresses into adulthood.[21,22] Children with high blood pressure tends to maintain such level of blood pressure even as they grow into adulthood. In Nigeria, prevalence of hypertension among children aged 5-18 years ranged from 1.6-17.5% between year 2000 and 2016.[22] To reduce the burden of hypertension in adulthood, timely intervention against childhood hypertension is urgently required.[23] Children with good nutritional and health status tend to learn better and become healthier and more productive adults in the future.[24]

Aim

Few studies exist, focusing on blood pressure of pupils under the national home-grown school feeding programme in south west Nigeria. Hence, the purpose of this study was to investigate the blood pressure level and nutritional status of pupils in public primary schools benefitting from the NHGSF programme in southwest Nigeria.

Material and methods

Ethical approval

Ethical approval for the study was obtained from the Health Research Ethics Review Committee of the Oyo State Ministries of Health (Ref. No. AD 13/479/1645[B]) and Ogun State (Ref No. HPRS/381/332) respectively. Permission was obtained from the Ministry of Special Duties and Ministry of Education in Ogun and Oyo States, respectively and was complemented by consent from parents and guardians of the pupils.

Study design and setting

This was a cross-sectional design study that analyzed data of variables collected using a quantitative instrument at one given point in time across samples of pupils from randomly selected public primary schools in Oyo and Ogun States.

This study was carried out in public primary schools where NHGSF programme is currently on-going in two States in southwestern Nigeria (Oyo and Ogun States). Currently, only pupils in primaries one to three were being fed school meals under the NHGSF programme.

Study population

Pupils attending public primary schools where NHGSF programme was currently on-going in Oyo and Ogun States were studied. These included children with no obvious health challenges in primary 3 classes, the highest class included in feeding programme and judged to be able to respond to the interview. However, where the sample size could not be achieved among primary 3 pupils in a school, pupils who could respond to the questionnaire were selected from primary 2 classes. Pupils who did not participate in the school meals programme (by parental preference) were excluded from the study. Rural and urban primary schools representing each of the three senatorial districts in the two States were included. Pupils without obvious health challenges were recruited.

Sample size and sampling procedure

The sample size required for this study was the higher of the two calculated samples using reported prevalence of hypertension among children aged 5-18 years in Nigeria (17.5%) and stunting among primary school pupils in Ogun State (17.4%), at 5% tolerable error, 95% confidence and adjusting for 10% non-response.[5,19] A minimum sample size of 407 and 410 was calculated for Oyo and Ogun State, respectively.

A multistage sampling technique was used to select 20 schools from each of the States.

In Oyo State, the three Senatorial Districts (SD) were stratified into two based on the size and cosmopolitan indices. The largest SD was classified into one stratum while the remaining two constituted another stratum. The LGAs in each of the stratum were grouped into urban and rural LGAs, using the State parameters to designate a local government area as rural or urban. Two LGAs were randomly selected from the largest SD where one was an urban settlement and the other a rural settlement. One LGA each was randomly selected from each of the two remaining SD; and each of the LGAs consisted of both the urban and rural settlements, making a total of four LGAs selected in Oyo State. This made up the two smaller SDs forming another sub-total of 12 public primary schools. The overall number of selected public primary school was 20.

In Ogun State, 2 LGAs (one rural, one urban) were selected from each of the three senatorial districts in the State to make a total of 6 LGAs. The six LGAs were stratified into 2 based on the size and population. One stratum had four LGAs while the other stratum had 2 LGAs. Three public primary schools were randomly selected through balloting from each of the 4 LGAs in one stratum (making a sub-total of 12 public primary schools) while 4 public primary schools were randomly selected from each of the remaining 2 LGAs in the other stratum (making 8 public primary schools). This also summed up to 20 public schools in Ogun State.

The sample size was allocated equally to the schools and 20 pupils were selected randomly among the primary 3 pupils of each school through balloting in the two States. For schools that had more than one arm for the primary 3 pupils, the research assistants divided the sample size for each school among the arms and randomly selected equal number of pupils across the arms and for schools where the sample size could not be achieved among the primary 3 pupils, primary 2 pupils who could respond to the questionnaire were randomly selected by balloting.

Data collection

Ten interviewers who were graduates of tertiary institutions with experience in conducting community-based surveys in each of the two States were trained to take anthropometric measurements - weight, height, mid upper-arm circumference, and blood pressure as well as collect information on the socio-demographic characteristics of the pupils. All interviewers were fluent in English and Yoruba. Nutritional status is assessed using anthropometric, biochemical tests, clinical and dietary methods, among others. Anthropometric measurements used to determine nutritional status include the assessment of the body physiological parameters based on the height and weight. Body Mass Index (BMI) is the most popular and common method for nutritional status assessment.[25] It is defined as the ratio of weight (kg) to squared height (m^2). BMI is dependent on age and gender for children and referred to as BMI-for-age. Mid upper arm circumference (MUAC) is also another method for measuring nutritional status of children and adults. It measures in millimeters/centimeters on the arm using MUAC tape or Shakir stripe. It is cheap and very easy to compute with different colours to suggest the nutritional status of the child e.g. green colour indicates good nutritional status, yellow is a warning sign of poor nutritional status and red confirms undernutrition.[26] MUAC has been reported as the best case-detection method for severe malnutrition.[27] Weights were measured to the nearest 0.1 kg with newly purchased portable bathroom scales (Harson Emperor™) which were validated with a known weight object. They were also regularly checked and adjusted to zero point after every 10th measurement. The pupils were weighed wearing light clothing and without shoes. Heights were measured with a mobile stadiometer placed on a level ground, with pupils standing erect without shoes and

with the eyes looking horizontally and the feet together on a horizontal level. Heights were recorded to the nearest 0.1 cm. Standardization checks on the height boards were done periodically during the study period. The height and weight were measured according to the international procedure.[28] Systolic and diastolic blood pressure were measured using an automated digital blood pressure monitor (OMRON M3) after each child had rested for at least 5 minutes, well seated with the back rested on the chair and feet on the ground. Blood pressure was measured twice, with an interval of two minutes, in the left arm and with an appropriate size cuff for the child's arm. Talking was not allowed during the processes of taking measurements.

Statistical analysis

Data were analyzed using the IBM SPSS 25.0 (Armonk, NY, USA) software statistical package for descriptive statistics, such as means and standard deviation to summarise continuous variables while categorical variables were presented using frequency and proportions. Proportional differences between the rural and urban location were explored and tested for significance using Chi-square test with the p-value set at ≤ 0.05 considered statistically significant.

The body mass index for age (BMI-for-age) was classified based on the World Health Organization reference tables (BMI percentile-for-age from five to 19 years) as normal weight, overweight and obese.

Blood pressure (BP) was classified using the standard BP charts developed by the National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents, United States of America[29] as normal, prehypertension and hypertension.

Mid upper arm circumference (MUAC) was classified as ≥13.50cm as normal, 12.50-13.49cm as mild malnutrition and ≤12.49cm as moderate to severe malnutrition.

The z-scores < - 2.0 was used to classified stunted and undernourished children based on their height-for-age and weight-for-age, respectively according to WHO child growth standards.[29]

Results

A total of 847 pupils were studied in the two States (381 in Oyo State; 466 in Ogun State). Out of the 847 pupils, 426 (50.3%) were males and the others females, 365 (43.1%) lived in the rural area and 708 (84.0%) were in primary 3. The mean age of the pupils was 9.0±1.5 years. The mean age of the male pupils was 9.1±1.4 years while female was 8.9±1.5 years. Table 3 shows that the majority of the pupils (331; 68.7%) aged 5-9 years were living in the urban area than in rural area 203 (55.6%), which was statistically significant (p<0.000). Five hundred and thirty (63.0%) lived with both parents (Table 1).

Table 1. Frequency distribution of socio-demographic characteristics of respondents by location of school

Variable	Rural		Urban		Total		p
	n	%	n	%	n	%	
Age (in years)							<0.001*
5-9	203	55.6	331	68.7	534	63.2	
10-15	161	44.2	149	30.9	310	36.7	
Sex							0.525
Male	179	49	247	51.2	426	50.3	
Female	186	51	235	48.8	421	49.7	
Class							<0.001*
Pry 2	20	5.5	119	24.7	139	16.4	
Pry 3	345	94.5	363	75.3	708	83.6	
Who respondents lived with							0.039*
Both Parents	244	66.8	286	59.3	530	62.6	
Mother	47	12.9	88	18.3	135	15.9	
Grandparent	45	12.3	58	12.0	103	12.2	
Father	13	3.6	21	4.4	34	4	
Auntie	8	2.2	15	3.1	23	2.7	
Uncle	1	0.3	8	1.7	9	1.1	
Siblings	1	0.3	4	0.8	5	0.6	

* Chi-square test with the level of significance set at p≤0.05

Table 2. Distribution of anthropometric parameters and blood pressure by location of school

Variables	Rural		Urban		Total		p
	n	%	N	%	n	%	
MUAC							0.324
Normal	360	98.6	468	97.1	828	97.8	
Mild malnutrition	3	0.8	9	1.9	12	1.4	
Severe malnutrition	2	0.5	5	1	7	0.8	
Height for age classifications							0.306
Normal	276	75.8	379	78.8	655	77.5	
Stunted	88	24.2	102	21.2	190	22.5	
Weight for age classifications							0.058
Normal	246	67.4	353	73.4	599	70.8	
Undernourished	119	32.6	128	26.6	247	29.2	
BMI-for-age Classifications							0.925
Normal	355	97.3	469	97.5	824	97.4	
Overweight	6	1.6	8	1.7	14	1.7	
Obese	4	1.1	4	0.8	8	0.9	
Blood pressure classifications							0.244
Normal	339	92.9	456	94.8	795	94	
Hypertension	26	7.1	25	5.2	51	6	

* Chi-square test with the level of significance set at p≤0.05

The overall prevalence of hypertension was 6.0%. In the rural area, the prevalence of high BP was (7.1%) but this was not significantly higher than that of the urban area (5.2%), (p=0.398). The majority (97.4%) of the pupils studied were in the normal BMI-for-age category. The prevalence of overweight and obesity group in the study population were 1.7% and 0.9%, respectively. There was no significant difference between the rural and urban groups in relation to BMI-for-age (p=0.925) and MUAC (p=0.324). The prevalence of stunting

among the pupils in the rural area was 88 (24.2%) and this was not statistically different from those in the urban area 102 (21.2%). (p=0.306). The overall prevalence of undernutrition among the school pupils was 29.2%. Twelve (1.4%) and 7(0.8%) of the pupils had mild and severe malnutrition, respectively as shown in Table 2.

Table 3 shows that there was no significant difference between the male and female group as regards MUAC (p=0.115), blood pressure (p=0.302), BMI-for-age (p=0.1) and height-for-age (p=0.129). However, more females were wasted 148 (35.2%) than their male counterpart 99 (23.2%), which was statistically significant (p<0.0001).

Table 3. Distribution of anthropometric and blood pressure measurements by sex

Variables	Male		Female		Total		p
	n	%	N	%	n	%	
MUAC							0.115
Normal	418	98.1	410	97.4	828	97.8	
Mild malnutrition	3	0.7	9	2.1	12	1.4	
Severe malnutrition	5	1.2	2	0.5	7	0.8	
Blood pressure classifications							0.844
Normal	401	94.1	394	93.8	795	94	
Hypertension	25	5.9	26	6.2	51	6	
BMI-for-age Classifications							0.1
Normal	416	97.7	408	97.1	824	97.4	
Overweight	4	0.9	10	2.4	14	1.7	
Obese	6	1.6	2	0.5	8	0.9	
Height for age classifications							0.129
Normal	321	75.4	334	79.7	655	77.5	
Stunted	105	24.6	85	20.3	190	22.5	
Weight for age classifications							<0.001*
Normal	327	76.8	272	64.8	599	70.8	
Undernourished	99	23.2	148	35.2	247	29.2	

* Chi-square test with the level of significance set at p≤0.05

Almost all the pupils in the age category 10-15 years had normal BMI 309 (99.7%), which was significantly different (p=0.008) from those in the 5-9years age category 514 (96.3%). More pupils (129; 41.6%) aged 10-15 years (p<0.0001) were stunted compared to those aged 5-9years 60 (11.3%). The prevalence of wasting among pupils aged 10-15 years was 47.7%, which was significantly higher than (p<0.0001) among pupils aged 5-9 years 18.5%.

Fourteen (10.1%) and 37 (5.2%) pupils in primary 2 and primary 3, respectively had high blood pressure (p=0.028). There was a significant association between blood pressure and BMI-for-age (p=0.004). Forty-six (5.6%) of the pupils who were of normal weight had hypertension; 3 (21.4%) of overweight and 2 (25.0%) of the obese also had high blood pressure. The results of MUAC measurement also showed a significant difference in blood pressure assessments (p=0.012). However, age, sex, location, height-for-age and weight-for-age did not show any significant association with blood pressure as shown in Table 4

Table 4. Relationship between the pupils' characteristics and blood pressure status

Variable	Normal		Hypertension		P
	n	%	N	%	
Age (in Years)					0.474
5-9	500	93.6	34	6.4	
10-15	294	94.8	16	5.2	
Sex					0.844
Male	401	94.1	25	5.9	
Female	394	93.8	26	6.2	
Class					0.028*
Pry 2	125	89.9	14	10.1	
Pry 3	670	94.8	37	5.2	
Location					0.244
Rural	339	92.9	26	7.1	
Urban	456	94.8	25	5.2	
BMI-for-age Classification					0.004*
Normal	778	94.4	46	5.6	
Overweight	11	78.6	3	21.4	
Obese	6	75.0	2	25	
Height for age classifications					0.059
Normal	610	93.1	45	6.9	
Stunted	184	96.8	6	3.2	
Weight for age classifications					0.724
Normal	564	94.2	35	5.8	
Undernourished	231	93.5	16	6.5	
MUAC					0.012*
Normal	780	94.3	47	5.7	
Mild malnutrition	10	83.3	2	16.7	
Several malnutrition	5	71.4	2	28.6	

* Chi-square test with the level of significance set at p≤0.05

Discussion

The prevalence of overweight and obesity reported in this study was lower than that reported in some similar studies among children in Nigeria. Adegoke et al. reported prevalence of 2.8% overweight and 0.3% obesity among school children in Ile-Ife.[30] Adebimpe reported prevalence of overweight and obesity among children aged 6-10 years to be 2.1% and 1.7%, respectively and Ajayi et al., in a population based study reported 4.7% and 15.0%, respectively among children less than 10 years residing in an urban city in Ibadan.[31,32] The differences in prevalence may be due to location of the study as affluence of the city may be responsible for the higher figure. In this study, BMI-for-age in boys was not significantly different from girls, which was contrary to a study that reported a higher prevalence of overweight in girls than in boys while the prevalence of obesity was higher in boys than in girls.[33]

Stunting and undernourishment reported in this study were higher than that reported in other similar studies in Nigeria. Akor et al. reported prevalence of stunting and wasting among primary school pupils in Jos, Nigeria as 11.1% and 2.4%, respectively.[34] Another study carried out to assess the physical growth and nutritional status among pupils in Enugu, Nigeria also reported the

prevalence of 0.4% stunting and 9.3% wasting. The lower prevalence reported in these other studies could be due to the difference in location in that the studies were carried out in another region in the Country. In Abeokuta, Ogun State, one of the States where this study was carried out, Senbanjo et al. reported stunting prevalence of 17%, which is also high though not as high as in this study.[8] However, a higher prevalence of stunting and wasting was reported in a study carried out in Makurdi, Nigeria as 52.7% and 43.4%, respectively.[35] It was reported that children attending primary school in that region were from relatively low socio-economic backgrounds, which could affect the quality of food they eat.[35] This study found that more female pupils were wasted compared to the male pupils, which was contrary to some studies where more male were wasted than female.[36,37] However, no significant difference in stunting was found by gender and this was contrary to finding in the study carried in Abeokuta, where the prevalence of stunting was higher among young female children aged 5-9 years while the reverse was the case among children aged 15-19 years.[8] This was adduced to possible increased access to food at the older age when the females are culturally involved in the cooking of family-food, and hence, their better nutritional state compared to the male counterparts. Explanation proffered for more boys aged 15-19 years stunted than girls was that poor, stunted girls dropped out of school leaving behind better-nourished girls.[8] The higher prevalence of stunting among younger female children and high prevalence of wasting among females could be due to the effect of extension of cultural preference for boys at birth.[38,39] In another study among primary school pupils in Ethiopia, older age and male sex were significantly associated with stunting.[8] This could be due to older children being in the transition life stage to adolescence when several unique challenges, including an increased body requirement for nutritional need are observed.[40] Another plausible reason for males being more at risk might be that males' growth and development is more influenced by environmental and nutritional stress than females and thus, making males more likely to be affected by stunting.[41]

The high prevalence of malnutrition generally reported in Sub-Saharan Africa has also been ascribed to poverty, poor environmental conditions, and overpopulation which might predispose children to inadequate food intake or intake of foods of poor nutritional quantity and quality.[42] Only a few of the pupils were severely malnourished according to their MUAC, which was slightly lower than that reported in a study carried out in Jos, Nigeria among primary school children partaking in the school feeding programme.[43] This could be due to differences in study locations, feeding and child care practices and probably differences in the socio-economic parameters. Seasonal variations in food availability and utilization could also be another possible reason for the differences observed.

The overall prevalence of high BP found in this study was higher than some other studies carried out with populations of the same age group in Nigeria. A study carried out among primary school pupils in Port Harcourt Nigeria reported the prevalence of hypertension as 4.7%.[44] Similarly, Sadoh et al. reported prevalence of hypertension as 2.6% among pupils aged 5-15 years in midwestern Nigeria.[45] A report from a study among children and adolescents in Uyo metropolis stated the prevalence of hypertension as 2.5%.[46] The lower prevalence reported in these studies could be due to difference in location as the reported studies were carried out in South-South region of Nigeria where the prevalence of overweight and obesity has been reported to be higher than in this study. This could also be a reason why the prevalence of hypertension recorded in this study is higher. However, a population based study carried out in urban part of Ibadan, Southwest Nigeria reported the prevalence of hypertension to be 12.8% among children less than 18 years, 16.9% among those ≤ 10 years and 8.0% among 11-17 years, which were higher than that reported in this study.[47] The high prevalence reported in this study calls for intervention because hypertension in children is an indicator to morbidity and mortality in adulthood, which can place enormous burden on the healthcare system. Change in lifestyle has been reported in studies as the cause of the increasing prevalence of hypertension in sub-Saharan Africa. This could also be responsible for the high blood pressure reported in the urban area; although this study did not show a significant association between location of schools and blood pressure, which was contrary to findings from a study carried out among school children in India where hypertension was reported to be higher in children from urban area than those in the rural area.[20]

Findings from this study, which showed increase trend of hypertension with increasing BMI-for-age was in agreement with report from Ajayi et al., Okoh et al. and Thangjam et al.[20,44] This reaffirms the positive correlation of overweight and obesity with hypertension. The effect of BMI on high blood pressure has been demonstrated in other studies.[44,46] Ledwaba et al. reported that MUAC was significantly associated with blood pressure in a study among children aged 6-13 years, which was in agreement with findings in this study.[48] This implies that blood pressure of the pupils can be controlled if much attention is paid to their nutritional status. Gender was not significantly associated with blood pressure as shown by the Mokola initiative study (Ajayi et al.), but which is contrary to a study which reported that girls were more hypertensive than boys because of the puberty-induced growth spurt and psychosocial stress in females.[20]

Study strength and limitations

One main strength of this study is that it was conducted among children in an age group that has the potential for catch-up growth and therefore could benefit from targeted interventions.[49] One key limitation, was that we could not establish the cause-and-effect relationships; because of the cross-sectional nature of the study design. The findings from this study may not be generalizable to other States implementing the NHGSF programme but it has highlighted key nutritional and blood pressure issues to be attended to in improving the health of the pupils and forestall development of diseases such as high blood pressure in the future. A larger multistate study is recommended.

Conclusion

High blood pressure was observed among pupils benefitting from the National Home-grown School Feeding programme. Nutritional status of the pupils was found to be related to high blood pressure. This suggests the need to monitor the nutritional status of the pupils and educate them on the health implications of their nutritional status. Intervention should be focused on the nutritional status of the pupils as it plays a major role in determining their blood pressure. The high prevalence of stunting underscores the fact that school feeding should be a primary target of programmes aiming at preventing stunting. The continuation of the school feeding programme should be encouraged as the programme can be used as a platform to promote good nutritional status and reduce morbidity and mortality in older age.

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Declarations

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Author contributions

Conceptualization, M.F.O., O.E.O., I.O.O.A. and O.O.O.; Methodology, O.E.O., I.O.O.A. and M.F.O.; Software, M.F.O.; Validation, O.E.O., I.O.O.A., O.O.O. and M.F.O ; Formal Analysis, O.E.O., I.O.O.A., O.O.O. M.F.O. and O.S.; Investigation, O.E.O., I.O.O.A., O.O.O. M.F.O. and O.S..; Resources, I.O.O.A., O.E.O., O.O.O. M.F.O. and O.S..; Data Curation, M.F.O., O.E.O., I.O.O.A. and O.O.O.; Writing – Original Draft Preparation, O.E.O. and M.F.O.; Writing – Review & Editing, O.E.O. and M.F.O.; Visualization, O.E.O., I.O.O.A., O.O.O. M.F.O. and O.S.; Supervision, I.O.O.A., O.E.O., O.O.O. M.F.O. and O.S.; Project Administration, I.O.O.A., O.E.O., M.F.O. and O.S..; Funding Acquisition, O.E.O. and I.O.O.A.

Conflicts of interest

The authors declared no potential conflicts of interest.

Data availability

Data are available upon request through the corresponding author.

Ethics approval

Participation in the study was voluntary, assent was obtained from the pupils and consent from their parents or guardians. The study posed no risk to the pupils. Ethical approval for the study was obtained from the Health Research Ethics Review Committee of the Oyo State Ministries of Health (Ref. No. AD 13/479/1645[B]) and Ogun State (Ref No. HPRS/381/332), respectively.

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