

# Influence of Home-Grown School Feeding on Nutritional Status of Schoolchildren: Findings from South-West Nigeria

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## ABSTRACT

**Background:** Improving the nutritional status of schoolchildren is one of the aims of home-grown school feeding programme (HGSFP) which has been implemented in some schools in Nigeria

**Objective:** The study assessed the prevalence of stunting, wasting and overweight amongst home-grown school-fed (HGSF) and non-HGSF (N-HGSF) elementary school children; identified the gender differences in the nutritional status of HGSF and N-HGSF children and compared the nutritional indices of HGSF children and N-HGSF children at baseline, 3 months and 6 months.

**Methods:** The study employed a longitudinal design and was conducted in South-west Nigeria amongst 500 elementary school children aged 5–7 years. The height and weight of each child were measured longitudinally at three waves (baseline, 3 months and 6 months). The data were analysed using the WHO AnthroPlus software and SPSS version 20. Statistical differences were determined using the repeated measures analysis of variance and paired-wise *t*-test.

**Results:** The mean age of the children was  $5.6 \pm 0.67$  and  $6.2 \pm 0.77$  for the HGSF and N-HGSF groups, respectively. At baseline, there were more stunted children in the N-HGSF children (44.4%) than the HGSF children (22%), but wasting (12%) and underweight (23.2%) were higher in the HGSF children. Furthermore, more males in the N-HGSF children were wasted (9.9%) and stunted (51.1%) compared to their female counterparts. However, there were no observable percentage sex differences amongst the children in the HGSF group, except that there were more females (12.8%) who were wasted compared to their male counterparts (11.3%). The findings for the wasting indicator revealed no statistically significant relationship between the HGSFP and wasting ( $P = 0.30$ ,  $F = 1.075$ ,  $\eta^2 = 0.002$ ). The findings showed a statistically significant relationship between HGSFPs and reduction in underweight ( $P = 0.001$ ,  $F = 23.847$ ,  $\eta^2 = 0.046$ ) and stunting ( $P = 0.04$ ,  $F = 4.083$ ,  $\eta^2 = 0.008$ ). Furthermore, the impact of feeding was observed in the HGSF children of both genders as there was an improvement in the nutritional status of both male and female children at 6 months.

**Conclusion:** There was an improvement in the nutritional status of the children in the HGSF group compared to the N-HGSF children at both 3 and 6 months. A significant improvement in underweight and stunting was observed at 6 months than at 3 months.

**Key words:** Age, height, home-grown school feeding, nutritional status, schoolchildren, weight

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## INTRODUCTION

Malnutrition is a serious public health problem affecting children of all categories leading to either morbidity or mortality of this age group. Recent global reports have shown that stunting affects approximately 149 million children

while wasting affects over 49 million children.<sup>1</sup> Over the years, malnutrition has been linked to poverty and it is one of the leading causes of morbidity and mortality amongst children in sub-Saharan Africa including Nigeria.<sup>2</sup> Besides the morbidity and mortality implication on schoolchildren, malnutrition also accounts for poor school attendance and

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academic performances.<sup>3,4</sup> According to UNICEF, Nigeria has the second-highest burden of stunted children in the world, with a national prevalence rate of 32% of children under five.<sup>5</sup> An estimated 2 million children in Nigeria suffer from severe acute malnutrition, but only two out of every ten children affected are currently reached with treatment.<sup>5</sup>

The school feeding initiatives have been introduced in many parts of the world to improve the nutritional status of schoolchildren and to encourage their school attendance.<sup>6</sup> One of the school feeding initiatives is the home-grown school feeding programme (HGSFP) which is an initiative of the World Food Programme. The global aim of the HGSFP is to improve nutrition of schoolchildren and boost local economies within a single policy.<sup>7</sup> The HGSFP has been documented to also contribute to the achievement of sustainable development goals 2 and 4 of reducing hunger in schoolchildren and improving education.<sup>8</sup> In 2004, the Federal Government of Nigeria piloted the implementation of HGSFP in 12 schools, of which one of the study states was inclusive. The national objectives of the HGSFP were to use locally available farm produce to meet government-led, cost-effective school feeding programme and to improve the economic status of local farmers, thereby increasing school enrolment and improving academic performances of schoolchildren.<sup>9</sup>

Efforts have been put in place in some African nations including Nigeria to determine the effectiveness of the school feeding programme. As far back as 2012, Falade *et al.* reported, in their experimental study in Osun State, the adequacy of the home-grown school (HGS) meals to improve the nutritional status of schoolchildren.<sup>10</sup> However, Agbon *et al.* reported that the HGS-fed (HGSF) bean meals were high in protein and carbohydrate, but all the dishes had very low zinc content, and did not meet 30% of the schoolchildren's daily zinc requirements.<sup>11</sup> Although studies have found a positive impact of HGSF on pupils' enrolment and retention, as well as regularity and punctuality in school attendance in Osun State, HGSF has not led to improved academic performances.<sup>12,13</sup> Studies done in other African countries, such as Kenya<sup>6</sup> and Ethiopia,<sup>14</sup> have shown a positive impact of HGSF on wasting and stunting amongst schoolchildren. However, in Ghana, Agbozo *et al.* discovered that there was no statistically significant differences in underweight, stunting, thinness and overweight between school-fed and non-school-fed children.<sup>15</sup>

Moreover, gender has been considered an important variable when evaluating the nutritional status of children. The study of Khan *et al.* found that male and female children of nuclear households have higher probability to be stunted and wasted, respectively, but the effect is more severe in female children.<sup>16</sup> In a meta-analysis study of Thurstans *et al.*, amongst under-five children, boys were reported to have higher odds of being wasted, stunted and underweight.<sup>17</sup> Furthermore, HIV-exposed male children may be at higher risk of malnutrition in low-resource setting countries than their female counterparts.<sup>18</sup>

Recently, in Osun State, anecdotal reports have shown that the quality of HGS meals being given to children has reduced and there are no recent empirical evidences showing the impact of these meals on nutritional status of schoolchildren. Furthermore, the impact of the feeding programme on male and female schoolchildren is scarcely explored. We, therefore, designed a study to compare the nutritional indices of children receiving HGS meals with those not receiving the meals in another state in Nigeria. We also made an attempt to compare the nutritional status of male and female schoolchildren who received and did not receive the HGSF meals. This was with a view to providing objective information on the impact of HGSFP on the nutritional status of schoolchildren.

## Research objectives

The objectives of the research were as follows:

1. Assess the prevalence of stunting, wasting and underweight amongst HGSF and non-HGSF (N-HGSF) elementary school children
2. Identify the gender differences in the nutritional status of HGSF and N-HGSF children
3. Compare the nutritional indices of HGSF children and N-HGSF children at baseline, 3 months and 6 months.

## METHODS

### Design

The study employed a longitudinal research design.

### Setting

It was conducted in two states (Osun and Ondo States) in South-west Nigeria. Osun State was one of the pilot states in Nigeria when the HGSFP commenced in 2004. Since then, the state has continued with the programme irrespective of the change in government. As at the time of conducting the study, Ondo State has not commenced the HGSF programme, hence, schoolchildren from the state served as the control for the study.

### Participants

Elementary school children between the ages of 5 and 7 years who were newly admitted in the study schools were recruited for the study. A total of 226 schoolchildren was obtained from the sample size formula for the comparison of groups ( $n = 2SD^2 (Z\alpha/2 + Z\beta)^2/d^2$ ).<sup>19</sup> After adding the attrition rate, a total of 250 children per state was obtained and recruited.

### Sampling

Multistage sampling procedure was adopted. A local government area (LGA) in each state was randomly selected, followed by random selection of ten elementary public schools in each of the LGAs. The selection of the schools was from Ife Central LGA of Osun State and Akure South LGA of Ondo State. In each school, 250 primary-one children who were newly admitted into the schools were purposively selected. Gender was put into consideration in the selection of the children, but it was found that there were more boys in the selected schools compared to girls, hence the selection of both

girls and boys was by proportion. The exclusion criteria for the children were as follows: children whose ages were below 5 years or above 7 years, those who were repeating the class and those who were clinically undernourished by assessing for signs of marasmus and kwashiorkor.

### Ethics

Ethical approval was obtained from the Health Research and Ethics Committee of the Institute of Public Health, Obafemi Awolowo University, Ile-Ife. Written informed consent and assent were obtained from the parents of each child and all the children, respectively, before the data were collected. Permission to conduct the study was also granted by the Education Board of each of the states that participated in the study.

### Data collection

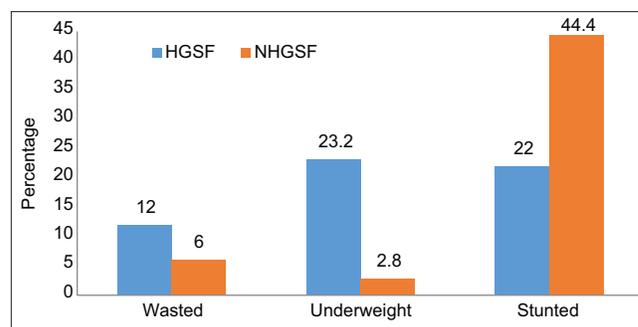
Data were collected over a period of 6 months (September 2017–February 2018). Visits were made on the agreed date for data collection, and anthropometric indices of children were measured in their various classrooms during the lunch break. The weight of each child was measured without shoe or heavy cloth to the nearest 0.1 kg, using a standard digital weighing scale in kilogram (kg). Height was measured to the nearest 0.01 cm using a portable stadiometer; the Frankfort horizontal plane was ensured and their legs were properly apposed. All measurements were carried out according to the WHO standard techniques (WHO, 1995).<sup>20</sup> The weight, height and age of the children in both the HGSF and N-HGSF were taken at baseline and after 3 months and 6 months.

### Analysis

The anthropometric indices (weight-for-height-wasting, height-for-age-stunting and weight-for-age-underweight) were analysed using the WHO AnthroPlus software (WHO, 1995).<sup>20</sup> Using z-scores, the indices were categorised as normal nutritional status ( $>-2$  z-score), moderate malnutrition ( $<-2$  z to  $\leq-3$  z-score) and severe malnutrition ( $<-3$  z-score). The data were then transported to SPSS software version 20.0 (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp) for descriptive and inferential statistical analysis. Paired-wise *t*-test and repeated measures analysis of variance were used to determine the effect of HGS feeding on the anthropometric indices of the children.

## RESULTS

The mean age of the children was  $5.6 \pm 0.67$  and  $6.2 \pm 0.77$  for the HGSF and N-HGSF groups, respectively. There were 133 males and 117 females in the HGSF group, while 131 males and 119 females were in the N-HGSF group. At baseline [Figure 1], there were more stunted children in the N-HGSF children (44.4%) than the HGSF children (22%), but wasting (12%) and underweight (23.2%) were higher in the HGSF children. Furthermore, more males in the N-HGSF children were wasted (9.9%) and stunted (51.1%)



**Figure 1:** Percentage distribution of nutritional status of the children at baseline

as compared to their female counterparts. However, there were no observable percentage sex differences amongst the children in the HGSF group, except that there were more females (12.8%) who were wasted compared to their male counterparts (11.3%) [Figure 2].

In general, findings from the study showed an improvement in the nutritional status of the children in the HGSF group compared to the N-HGSF children [Table I] at both 3 and 6 months. A significant improvement in underweight and stunting was observed at 6 months than at 3 months.

Analysing the means, standard deviations (SDs) and F-values for the nutritional indicators across three time points (baseline, 3 months and 6 months) amongst the HGSF group, the findings for wasting revealed that a higher level of wasting at baseline ( $M = -0.67$ ,  $SD = 1.60$ ) subsequently decreased slightly at 3 months ( $M = -0.57$ ,  $SD = 1.44$ ) and 6 months ( $M = -0.41$ ,  $SD = 1.35$ ). However, there was no significant mean difference in wasting  $F(2, 498) = 2.619$ ,  $MSE = 1.69$ ,  $P = 0.074$ ,  $\eta^2 = 0.01$ . The paired-wise comparisons indicated no significant mean differences in all pairs of scores between baseline, 3 months and 6 months. The results for underweight showed an increase in mean difference from baseline ( $M = -1.10$ ,  $SD = 1.43$ ) to a higher mean at 3 months ( $M = -0.43$ ,  $SD = 1.34$ ) and 6 months ( $M = -0.07$ ,  $SD = 1.14$ ). A significant mean difference was seen in underweight  $F(2, 498) = 75.939$ ,  $MSE = 0.91$ ,  $P < 0.001$ ,  $\eta^2 = 0.23$  with medium effect size, and the paired-wise comparison indicated significant mean differences in all pairs at three time points. The findings for stunting revealed a higher mean at 6 months ( $M = -0.73$ ,  $SD = 1.27$ ) when compared to the means at 3 months ( $M = -1.03$ ,  $SD = 1.30$ ) and baseline ( $M = -1.15$ ,  $SD = 1.49$ ). A significant mean difference in stunting  $F(2, 498) = 64.220$ ,  $MSE = 0.18$ ,  $P < 0.001$ ,  $\eta^2 = 0.21$  with medium effect size was seen across the three time points. Furthermore, the paired-wise comparisons indicated significant mean differences in all pairs.

Assessing the overall effect of a HGSFP on the nutritional indices of schoolchildren [Table II], the findings for the wasting indicator revealed no statistically significant relationship between the HGSFP and wasting ( $P = 0.30$ ,  $F = 1.075$ ,  $\eta^2 = 0.002$ ). The results for the underweight index showed

**Table I: Mean, standard deviation and repeated measures analysis of variance for the test of within-subject effects of home-grown school feeding programme**

Variables	Mean±SD		F	η <sup>2</sup>	P
	HGSF	N-HGSF			
<b>WHZ</b>					
Baseline	-0.67 (1.60)	0.35 (1.37)	79.622	0.138	<0.001
3 months	-0.57 (1.44)	-1.56 (1.04)			
6 months	-0.41 (1.35)	-0.17 (1.64)			
F (2, 498)	2.619	156.358			
η <sup>2</sup>	0.01	0.37			
P	0.074	<0.001			
<b>WAZ</b>					
Baseline	-1.10 (1.43)	-0.28 (0.95)	32.317	0.06	<0.001
3 months	-0.43 (1.34)	-0.34 (1.10)			
6 months	-0.07 (1.14)	0.33 (0.90)			
F (2, 498)	75.939	258.969			
η <sup>2</sup>	0.23	0.51			
P	<0.001	<0.001			
<b>HAZ</b>					
Baseline	-1.15 (1.49)	-1.82 (1.08)	200.681	0.29	<0.001
3 months	-1.03 (1.30)	-0.29 (1.03)			
6 months	-0.73 (1.27)	-1.44 (1.51)			
F (2, 498)	64.220	238.792			
η <sup>2</sup>	0.21	0.49			
P	<0.001	<0.001			

η<sup>2</sup>: Partial eta squared, WHZ: Weight-for-height Z-score, WAZ: Weight-for-age Z-score, HAZ: Height-for-age Z-score, SD: Standard deviation, HGSF: Home-grown school-fed, N-HGSF: Non-HGSF

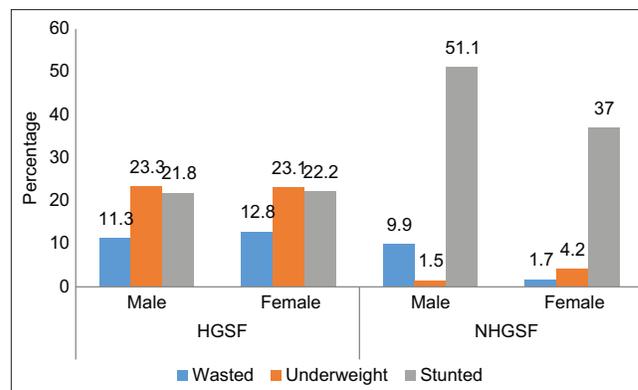
**Table II: Effects of home-grown school feeding programme on school children anthropometric indices**

Variables	Df	Mean squared	F	η <sup>2</sup>	P
WHZ	1	2.993	1.075	0.002	0.300
WAZ	1	71.512	23.847	0.046	0.001
HAZ	1	17.093	4.083	0.008	0.044

Df: Degree of freedom, η<sup>2</sup>: Partial eta squared, WHZ: Weight-for-height Z-score, WAZ: Weight-for-age Z-score, HAZ: Height-for-age Z-score

a statistically significant relationship between HGSFPs and reduction in underweight ( $P = 0.001$ ,  $F = 23.847$ ,  $\eta^2 = 0.046$ ). Approximately ~5% of the variance in underweight can be explained by the school feeding programme. Furthermore, the findings from stunting revealed a statistically significant relationship between the school feeding programme and reduction in stunting ( $P = 0.04$ ,  $F = 4.083$ ,  $\eta^2 = 0.008$ ). However, only ~1% variance in stunting can be explained by the HGSFP.

Assessing the nutritional status of the children by gender [Table III], the impact of feeding was observed in the HGSF children of both genders as there was an improvement in the nutritional status of both male and female children at 6 months. However, statistically significant gender differences were observed in underweight levels of both males and females at 3 months and 6 months ( $t_1 = 2.378$ ,  $p_1 = 0.018$ ;  $t_2 = 2.123$ ,  $p_1 = 0.035$ ), respectively. Furthermore, a statistically



**Figure 2: Percentage sex distribution of nutritional status of the children at baseline**

significant gender difference was observed in stunting level at 6 months ( $t = 2.152$ ,  $P = 0.032$ ). For the N-HGSF group, a statistically significant gender difference was observed for wasting at 3 months ( $t = -2.132$ ,  $P = 0.034$ ) and stunting at baseline ( $t = -2.345$ ,  $P = 0.020$ ). While underweight and stunting levels reduced in the males in the HGSF group, the levels of these nutritional indices increased negatively in males in the N-HGSF.

## DISCUSSION

The focus of this study was to determine the influence of HGSFP on the nutritional status of schoolchildren by identifying the differences in the nutritional indices of home-grown school-fed children and N-HGSF children. The findings showed a general improvement in the anthropometric measurements of the HGSF children as the number of children, who were stunted, wasted and underweight reduced at 6 months.

The anthropometric characteristics of the children in this study confirmed the reports of previous studies that malnutrition is prevalent amongst schoolchildren.<sup>4,21,22</sup> The prevalence of wasting, stunting and underweight amongst school-age children at baseline was more than what was reported in previous Nigerian studies.<sup>10,23</sup> However, the prevalence was lower compared to some studies conducted in other African countries.<sup>22,24</sup> A study in Madagascar reported stunting, underweight and thinness to be 34.9%, 36.9% and 11.2%, respectively, amongst schoolchildren.<sup>25</sup> The observed differences may be related to study instruments such as the reference indices used, secular/time trends and sociocultural factors. For instance, Akor *et al.*<sup>26</sup> used the National Center for Health Statistics/WHO reference values. Kovalskys *et al.*<sup>27</sup> used three different methods (Center for Disease Control Centile charts, International Obesity Task Force charts and WHO AnthroPlus based on z-scores) and recorded different rates of 3.5%, 2.1% and 2.1% for wasting, respectively in the same population. Wang and Chen<sup>28</sup> discovered variances linked to different measurement tools in their review of the use of percentile and z-score in anthropometry for the assessment of nutritional status.

**Table III: Gender differences in the nutritional indicators for home-grown school-fed children and non-home-grown school-fed children**

Variables	HGSF (mean±SD)		<i>t</i>	<i>P</i>	N-HGSF (mean±SD)		<i>t</i>	<i>P</i>
	Male	Female			Male	Female		
WHZ								
Baseline	-0.68 (1.53)	-0.66 (1.68)	-0.097	0.923	0.27 (1.53)	0.44 (1.16)	-0.972	0.332
3 months	-0.54 (1.21)	-0.60 (1.67)	0.363	0.717	-1.70 (1.06)	-1.42 (1.01)	-2.132	0.034*
6 months	-0.46 (1.32)	-0.35 (1.38)	-0.660	0.510	-0.16 (1.85)	-0.17 (1.39)	0.066	0.947
WAZ								
Baseline	-0.95 (1.55)	-1.27 (1.28)	1.767	0.078	-0.25 (0.94)	-0.32 (0.97)	0.600	0.549
3 months	-0.25 (1.32)	-0.65 (1.33)	2.378	0.018*	-0.32 (1.08)	-0.37 (1.11)	0.409	0.683
6 months	0.08 (1.19)	-0.23 (1.07)	2.123	0.035*	0.40 (0.93)	0.25 (0.87)	1.375	0.170
HAZ								
Baseline	-1.01 (1.57)	-1.30 (1.38)	1.496	0.136	-1.97 (1.03)	-1.65 (1.12)	-2.345	0.020*
3 months	-0.89 (1.38)	-1.19 (1.20)	1.833	0.068	-0.27 (0.98)	-0.32 (1.08)	0.379	0.705
6 months	-0.57 (1.34)	-0.91 (1.18)	2.152	0.032*	-1.53 (1.00)	-1.34 (1.93)	-1.008	0.314

\*Significant. SD: Standard deviation, HGSF: Home-grown school-fed, N-HGSF: Non-HGSF, WHZ: Weight-for-height Z-score, WAZ: Weight-for-age Z-score, HAZ: Height-for-age Z-score

As observed in this study, more females in the HGSF group were underweight and stunted. At baseline, there were more wasted and underweight females in the N-HGSF children compared to the males. In contrast, a number of studies in Africa and beyond affirmed that the rate of malnutrition amongst males is consistently higher than females.<sup>29-31</sup> The males in most countries tended to be more stunted and underweight compared to their female counterparts. These differences in findings may be due to study frame, family settings, gender issues and parental preferences for a male child in a certain cultural context in Nigeria. However, previous studies have reported that females of this age group are usually more nutritionally deficient compared to their male counterparts.<sup>32-34</sup> Such poor nutrition in females may be associated with inadequate dietary intake.

In this study, we observed a reduction in wasting, stunting and underweight amongst the HGSF children irrespective of their gender, although the improvement was more observed amongst males. In general, reduction in wasting was not observed amongst N-HGSF children, while a minimal reduction was observed for underweight at 6 months for the females and 3 months for males. Our results have supported previous assertion that HGSF programme improves the nutritional status of schoolchildren as documented in Ghana<sup>15,35</sup> and Kenyan studies.<sup>6</sup> We suggest that N-HGSF schools in Nigeria should commence the programme for better results of nutritional health. Those who have commenced should also intensify efforts to improve the programme for improved health of the children.

### Limitations of the study

The following limitations contribute to the inability to generalise the findings:

- Confounding variables, such as food eaten at home or outside school, illness and exercise, could not be accounted for in this study. More often, what the children

ate outside HGS food is a product of the economic status of the parents/guardian of the children

- Furthermore, since the study was conducted amongst children between ages 5 and 7, it was discovered that there were more 5-year-old children in the HGSF schools, compared to N-HGSF schools. Hence, complete matching of the children in the two study states could not be achieved.

### Implications for public health

Home grown school feeding meal is associated with improved nutritional status of schoolchildren. Enhancing and promoting this school feeding programme could have a positive effect in reducing the problem of malnutrition amongst school-age children. Hence, it becomes paramount for public health professionals to ensure that schoolchildren's nutritional status keeps improving by advocating for continuation of HGSFP in Osun State and also advocating for commencement of the programme in Ondo State and regular anthropometric measurement of schoolchildren to ascertain the impact of the HGSFP on the nutritional status of schoolchildren.

### Recommendations for future research

A randomised control trial can be conducted to ascertain the specific impact of the HGSFP on the nutritional status of schoolchildren. In such a study, confounding variables such as food eating outside the school environment and children illness can be controlled for.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

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