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Prevalence and Socio-demographic Determinants of Stunting among School Age Children (SAC) in Gombe State, Nigeria

Mela Danjin[1*], Solomon O. Adewoye[2] and Henry O. Sawyerr[1]

[1]Department of Environmental Health Science, School of Allied Health and Environmental Science, Kwara State University, Malete, Nigeria.
[2]Environmental Biology Unit, Department of Pure and Applied Biology, Faculty of Pure and Applied Sciences, Ladoke Akintola University of Technology (LAUTECH), Ogbomoso, Oyo State, Nigeria.

Authors' contributions

This work was carried out in collaboration among all authors. Author MD designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors SOA and HOS managed the analyses of the study, corrected the manuscripts and managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Background: As one of the key indicators of malnutrition, stunting has been considered to be a very vital proxy for not only chronic nutritional deficit but for long term socioeconomic deprivation among children and the society at large.
Objective: This study was aimed at determining the prevalence of stunting and its association with socio-demographic factors among school children in Gombe state, Nigeria.
Methodology: The study employed a cross sectional survey design to assess school children aged 6 to 15 years in 12 public and 6 private schools from six selected Local Government Areas (LGAs) of the state. Data were collected on a structured pro forma from March to June, 2019. Analysis of the data was done using IBM SPSS version 21 and Chi square statistics was used to compare proportions, while alpha level of significance was set at 0.05.
Results: The mean age of the children was 9.96±2.26 and the overall prevalence of stunting among them was 22.5%. Children in public schools were found to be more stunted ($\chi 2$=20.342,

**Corresponding author: E-mail: danjin67@yahoo.com;*

df= 1, P=0.000) and more than twice at risk (OR=2.598, CI=1.699-3.974) of stunting than their counterpart in private schools (27.3% vs. 12.6%). Low academic performance was significantly associated with high prevalence of stunting (28.4% vs. 20.9% & 18.0%) among the subjects ($\chi 2$ = 7.443, df = 2, p=0.024). Other factors that were associated with stunting include; class of pupil, age group, LGA, tribe, religion, occupation of father, occupation of mother, SES and level of education of mother.

Conclusion: It is quite evident from the findings of this study that stunting is quite prevalent among school children in Gombe state. Hence, it is recommended that a multi-sectoral approach to addressing the problem be instituted by government and all stakeholders.

Keywords: Stunting; school children; public; private; academic performance.

1. INTRODUCTION

The discourse on malnutrition has over time devoted much concern and focus on children under five, with less attention on the critical age bracket of school-age children [1,2,3,4]. As an indicator of chronic malnutrition stunting is usually measured using the indices of low height-for-age among children and it normally reflects prolonged nutritional deprivation and/or illness [5,6]. In addition, stunting constitute a lifetime threat to children as they face learning difficulties in school, earn less as adults, and face barriers to participation in their communities [7]. Hence, over time substantial efforts have been made to bring this concern to the fore, with the intent of galvanizing action towards addressing the deleterious impacts of stunting on school aged children (SAC) [2,8]. However, it is agreed that there is a scarcity of research findings on malnutrition (stunting) among primary school children in especially low and middle income countries [9,10]. This is apparently true about the study area where little or none has been documented about this problem.

Globally, it is estimated that 22.2% (150.8 million) children under five are stunted and 3.62% (15.95 million) of them are both stunted and wasted, while 1.87% (8.23 million) experience both stunting and overweight [11]. Again, the joint UNICEF/WHO/World Bank Group [7] reports that stunting affected an estimated 21.9 per cent or 149 million children under 5 globally in 2018. And it is proven that these childhood nutritional derangements are often carried over into the adolescent and adulthood lives of these victims of "nutritional insults" [12,13]. And the fact that stunting is often associated with cognitive impairments such as delayed motor development, impaired brain function and poor school performance, underscores the need for more attention to the problem [2,11]. Furthermore, as an accurate marker of inequalities in human development, stunting continuous to assume a more critical position on most developmental agenda [14,15]. A cross country meta-analysis on how much economic growth contribute to child stunting reductions shows that a 10% increase in GDP per capita reduces child stunting prevalence by 2.7% [16].

Stunting is caused by a complex interplay between household, environmental, socioeconomic and cultural factors as illustrated in the WHO Conceptual Framework on Childhood Stunting [17]. It has been shown that socioeconomic status, maternal educational level, women's lack of awareness about the right diet and nutrition, poor drinking water quality, compromised health status, deficiencies in nutrients, parasitic diseases and infections; are associated with stunting [8]. In their findings Yeasmin & Islam [18] submitted that, "low educational level of parents, mud floor house, low meal frequency, poor hygiene practices were significantly associated with being underweight and stunted. Similarly, the risk of stunting increased significantly with an increased total family member and number of people living in a room. Children who belong to the family using wood as fuel and who had smoking behaviour were also likely to be stunted".

The developing countries bears the most brunt of malnutrition, especially stunting, among children [2,5,19-21]. And it is estimated that 20% to 80% of primary school children in the developing countries are suffering from nutritional deficiency [18,22]. Africa south of the Sahara is worst hit as it still remains home to about a third of the global burden of stunting – as more than one in three lived in SSA [4,12,14,15,18]. The estimated prevalence of stunting among school-age children aged 5–18 years of age in Africa in 2015 was 37% [23,24]. In Nigeria, it is reported that the prevalence of stunting among primary school

children ranges from 11.5% in Anambra (south-east Nigeria), 11.8% in Onitsha (south) to as high as 60% in Kebbi State (north-west) [25,26]. From Abeokuta, South West Nigeria Adenuga et al. [3], states that 467 (40.3%) pupils were stunted. Results showed that for both the rural and urban pupils, those aged 11-12 years were more likely to be stunted, compared to other age groups [15].

And despite all justification for more attention to under-fives, school-aged children who are often omitted from health and nutrition surveys or surveillance, remain a critical sub-population for further studies and programmatic interventions [4,21]. Available evidence has shown there is paucity of studies on School Age Children [27]. Hence, this study was aimed at documenting stunting levels among the school children in Gombe state, Nigeria. The study also intended to determine the socio-demographic determinants of stunting among the subjects.

2. METHODS

2.1 Study Design and Setting

Using a cross sectional study design, the prevalence of stunting was assessed among school aged children (SAC) selected from 12 public and 6 private primary schools in urban and rural areas of Gombe State, Nigeria.

2.2 Study Participants

The study participants comprised primary school children aged 6-15.

2.3 Eligibility Criteria

2.3.1 Inclusion criteria

All consenting pupils, 6 - 15 years, male or female who were registered in primary schools in Gombe state at the time of the data collection, and who had resided in the state for at least one year.

2.3.2 Exclusion criteria

All non-consenting pupils, outside the age bracket of 6 - 15 years, male or female who were not registered in primary schools in Gombestate at the time of the data collection, and who had resided in the state for less than one year.

2.4 Sample Size Determination

Sample Size determination was done using Pocock's sample size formula for comparing two proportions – also used by Ijarotimi et al. [28,29].

$$n = [P1\,(1-P1) + P2\,(1-P2)]\,(Z\alpha/2 + Z\beta)2\,/(P1-P2)2$$

Where:

n: required sample size
*P*1: estimated proportion of malnutrition in urban areas in the North East = about 20% [30,31]
*P*2: estimated proportion of malnutrition in rural areas (comparison group) in the North East = about 30% [30,31]
α: level of statistical significance
Zα/2: Represents the desired level of statistical significance (typically 1.96 for α = 0.05)
Z β: Represents the desired power (typically 0.84 for 80% power)
n for each group *2= total sample (i.e. for the 2 groups)

Calculations were done to detect a minimum difference of 10% in stunting levels between SAC in rural and urban areas, or in public and private schools.

The calculated minimum sample size for the study was 295 urban populations and another 295 rural population. These added up to a minimum Sample Size of 590. However, the sample size finally used was 745.

2.5 Sampling Technique

Out of the 1, 914 Primary Schools in Gombe state 1, 341 were public while 573 were private primary schools [32]. This gives a 1:2.3 private to public schools. Hence, 12 public and 6 private primary schools were selected from both urban and rural areas of the state. The subjects were selected using multistage sampling technique. In the first stage two LGAs were selected from each senatorial district using simple random sampling. In the second stage three primary schools; a public primary school from a rural area, and one public and a private primary school from an urban or suburban area; were selected per LGA. Overall, a total of 18 schools were selected. In stage three 4 classes were selected randomly from primary one to primary six and not more than one arm per class/set. In stage four a minimum of 40 pupils per school, were selected from primary one to primary six. And where there

was unwillingness to participate by a selected pupil, the next subject sequentially was selected.

2.6 Data Collection Methods

Anthropometric measurements on subjects were done using standard procedures as described by Jelliffe [33]. And the information gotten were entered on a predesigned structured pro forma/ questionnaire. Weighing scale, was used to measure weight in kilogram (kg) and were recorded with only light clothing. Mobile Stadiometer/Height rod was used for the measurement of height in centimeters (cm). Information on the children's socio-demographic and socioeconomic background were collected. Data collected was conducted between March and June, 2019.

2.7 Data Management and Analysis

The data collected were analyzed using IBM Statistical Package for Social Sciences (SPSS) version 21 (SPSS Inc. Chicago, IL, USA). The children's anthropometric data which includes; Height, ages and genders (sexes) of the subjects; were entered on Emergency Nutrition Assessment (ENA) software to generate key nutritional indicators such as Height for Age Z-score (HAZ) etc. The data were then exported to IBM SPSS software for further analysis alongside other variables' responses from the verbal (face-to-face) interview with the pupils. Descriptive and inferential statistics were used to summarize the data. Chi square (χ^2), odd ratio (OR) and Fisher's Exact were used to compare proportions, and findings were considered significant at P-values less than 0.05.

3. RESULTS

In regard to the study area (Table 1), the highest number of pupils sampled was from Akko LGA (131, 17.6%), while Billiri and Gombe LGAs had the lowest proportion (121, 16.2% each) of subjects that participated in this study. Overall, Gombe central senatorial district had the highest number of pupils selected (253, 34.0%). Public, urban and primary 3 school children (67%, 61.1% & 22.0% respectively) were in majority.

Table 1. Background information about the study area and sample size (n=745)

SN	Variable/Category	Frequency (n)	Percentage
1	**Number of children sampled per LGA in 3 schools each**		
	Billiri	121	16.2
	Shongom	122	16.4
	Akko	131	17.6
	YamaltuDeba	122	16.4
	Gombe	121	16.2
	Funakaye	128	17.2
	Total	745	100.0
2	**Senatorial districts**		
	Gombe South	243	32.6
	Gombe Central	253	34.0
	Gombe North	249	33.4
	Total	745	100.0
3	**Ownership status**		
	Public	499	67.0
	Private	246	33.0
	Total	745	100.0
4	**Place of residence**		
	Rural	290	38.9
	Urban	455	61.1
	Total	745	100.0
5	**Class of pupils**		
	primary 1	133	17.9
	primary2	134	18.0
	primary3	164	22.0
	primary4	140	18.8
	primary5	94	12.6
	primary6	80	10.7
	Total	745	100.0

Table 2. Socio-demographic background of school children

SN	Variable/Category	Frequency (n)	Percentage
1	**Tribe (n=745)**		
	Hausa/Fulani	325	43.6
	Tangale/Waja/ etc	173	23.2
	Tera/Kanuri/Bolewa	102	13.7
	Others-Yoruba/Igbo etc	145	19.5
	Total	745	100.0
2	**Birth description (n=744)**		
	Singleton	730	98.1
	Twin	14	1.9
	Total	744	100.0
3	**Source of parental care (n=745)**		
	Father and mother	598	80.3
	Father/mother/Guardians	147	19.7
	Total	745	100.0
4	**Birth order (n=745)**		
	< 3rd	314	42.1
	3rd-5th	310	41.6
	6th+	121	16.2
	Total	745	100.0
5	**Age group (n=745)**		
	<= 9	307	41.2
	10-12	333	44.7
	13+	105	14.1
	Total	745	100
6	**Gender (n=745)**		
	Male	379	50.9
	Female	366	49.1
	Total	745	100.0
7	**Religion (n=745)**		
	Christianity	335	45.0
	Islam	410	55.0
	Total	745	100.0
8	**Family size**		
	<= 7	399	54.0
	8+	340	46.0
	Total	739	100.0

Based on the spread of socio-demographic factors (Table 2), children of Hausa/Fulani extraction carried the majority of the subjects (43.6%). Only 1.9% of them were twins, while greater majority (80.3%) received parental care from both mother and father. Overwhelming majority (83.7%) of the pupils were within 5th birth order and below. Again, most (85.9%) of the children were 12 years and below. Male to female ratio was about 1:1. While there was a slight preponderance of children from Islamic faith background (55.0%). And slightly more than half (54.0%) of the subjects' family size were about less or equal to seven.

Table 3, shows that greater majority (83.8%) of the children's fathers were either farmers or civil servants, whereas their mothers were mostly (65.0%) housewives. Little above half (54.0%) of them fell within low socio-economic status (SES). A good proportion of the children's fathers have had secondary and tertiary education (39.3% and 37.6% respectively), while the mothers lagged behind with 36.8% and 21.7% respectively.

According to Table 4 higher proportions of pupils' from Shongom (33.6%) and Funakaye (32.8%) were stunted, while Billiri (15.7%) and Yamaltu Deba (5.7%) were least stunted ($\chi 2=43.73$, df=5, P=0.000). There were more stunted children in public schools (27.3%), who carried about twice (OR=2.598,CI: 1.699-3.974) the risk of stunting than their counterparts in private schools ($\chi 2=20.342$, df=1, P=0.000). Primary 1 school

children had the lowest proportion (13.5%) of stunting, while primary 6 children were worst hit (31.3%) at χ2=11.858, df=5 and P=0.037. Senatorial District and Place of residence appeared not to be related to stunting.

From Table 5, stunting appeared to be associated with tribe, age group and religion of pupils, while Birth description, Source of parental care, Birth Order, Gender and Family Size seemed not to be. Children of Hausa/Fulani extraction (26.5%) and "others" (25.5%) categories were more stunted than those of other tribal groups (χ2 = 16.573, df = 3, p=0.001). Children 13 years and above were more stunted (39.0%) than those from the lower age groups (χ2 =34.48, df=2, P=0.000). Children from Islamic faith leaning appeared to carry the highest burden (25.9%) of stunting (χ2 =6.195, df=1, P=0.013, OR=0.638, CI: 0.448-0.910).

Table 6, demonstrates the probability that stunting among the school children could be associated with occupation of father, occupation of mother, Socioeconomic Status (SES) and level of education of mother. Children of Farmers/artisans/Traders paternal background were mostly (27.2%) stunted (χ2 = 9.414, df = 2, p=0.009) than those of fathers in other occupational groups; while children of house wives (25.3%) and artisan/farmer (22.4%) maternal background had higher prevalence of stunting than those of mothers from other occupations (χ2 = 9.553, df = 3, p=0.023). Children from the lower SES were more mostly (26.6%) stunted than those from the other SES (stunted, χ2 = 11.872, df = 2, p=0.003). Children of mothers with only primary school or no education had higher prevalence (30.6%) of stunting than those of mothers with higher education (χ2 = 25.358, df = 2, p=0.000). Association between stunting and Childs level of performance. High prevalence of stunting (28.4%) among the children was associated with low academic performance (χ2 = 7.443, df = 2, p=0.024).

Table 3. Occupational and educational background of the parents/care giver

S/N	Variable/Category	Frequency	Percentage
1	**Occupation of father (n=737)**		
	Farmer/artisan/Trader/etc	334	45.3
	Civil Servant/Banker/etc	284	38.5
	Top Business man/etc	119	16.1
	Total	737	100.0
2	**Occupation of mother (n=742)**		
	Farmer/Artisan/Trader/ etc	116	15.6
	Civil servant/Banker/etc	127	17.1
	Top Business woman/erc	17	2.3
	House wife	482	65.0
	Total	742	100.0
3	**Socioeconomic status (SES) (n=745)**		
	Low	402	54.0
	Middle	252	33.8
	High	91	12.2
	Total	745	100.0
4	**Educational level of father (n=737)**		
	Primary School	170	23.1
	Secondary School	290	39.3
	Tertiary Institution	277	37.6
	Total	737	100.0
5	**Educational level of mother (n=741)**		
	Primary School	307	41.4
	Secondary School	273	36.8
	Tertiary Institution	161	21.7
	Total	741	100.0

Table 4. Association between malnutrition (Stunting) and study area

SN	Variable/ category	Malnutrition (Stunting) Yes (< -2)	No (-2+)	OR	CI	Chi Sq	df	P-value/ F-exact
1	**Pupil's LGA**							
	Billiri	19 (15.7%)	102 (84.3%)					
	Shongom	41 (33.6%)	81 (66.4%)					
	Akko	37 (28.2%)	94 (71.8%)					
	YamaltuDeba	7 (5.7%)	115 (94.3%)					
	Gombe	21 (17.4%)	100 (82.6%)					
	Funakaye	42 (32.8%)	86 (67.2%)					
	Total	167 (22.4%)	578 (77.6%)			**43.73**	**5**	**0.000***
2	**Senatorial district**							
	South	60 (24.7%)	183 (75.3%)					
	Central	44 (17.4%)	209 (82.6%)					
	North	63 (25.3%)	186 (74.7%)					
	Total	167 (22.4%)	578 (77.6%)			5.588	2	0.061
3	**School type/ Ownership status**							
	Public	136 (27.3%)	363 (72.7%)					
	Private	31 (12.6%)	215 (87.4%)					
	Total	167 (22.4%)	578 (77.6%)	2.598	(1.699-3.974)	20.342	1	0.000*
4	**Place of residence**							
	Rural	72 (24.8%)	218 (75.2%)					
	Urban	95 (20.9%)	360 (79.1%)					
	Total	167 (22.4%)	578 (77.6%)	1.252	(0.882-1.775)	1.588	1	0.208/0.209
5	**Class of pupils**							
	primary 1	18 (13.5%)	115 (86.5%)					
	primary2	26 (19.4%)	108 (80.6%)					
	primary3	38 (23.2%)	126 (76.8%)					
	primary4	35 (25.0%)	105 (75.0%)					
	primary5	25 (26.6%)	69 (73.4%)					
	primary6	25 (31.3%)	55 (68.8%)					
	Total	167 (22.4%)	578 (77.6%)			11.858	5	0.037*

4. DISCUSSION

This survey studied a sample of 745 school age children (SAC), 6-15 years in 12 public and 6 private primary schools in Gombe state Nigeria. The background information about the study area, socio-demographic background of school children and occupational and educational background of the parents or care givers were well captured as displayed in Tables 1, 2 and 3. The mean age of the children was 9.96±2.26 and gender wise there was a female: male sex ratio of 1:1.03 showing slight male preponderance. The overall prevalence of stunting among the study participants was 22.5%. This figure is higher than other findings in Nigeria – 11.1% by Akoret al. [34] and 10.5% by Adedeji et al. [4] in Jos, North central Nigeria; though Agbo et al. [35] reported higher findings from the same study area. As Goon et al. [36] also reported higher (52%) finding in Makurdi, also in North Central Nigeria. In south western Nigeria, Adenuga et al. [3] also reported higher (40.3%), while Sebanjo et al. [37] reported lower (17.4%) findings. And from South east Nigeria Onoja et al. [38] got lower (9.1%) while Ayogu et al. [39] reported as high as 41.6% prevalence of stunting among the SAC. And from other African countries such as Ethiopia there were findings as high as 46.1% [40] and in India high prevalence (42.63%) was reported by [41]. These differences and seeming paradoxes in findings of various studies may be due to differences in the study setting [8], methods, standards used for assessment, genetic, SES, and environmental variations [12,41,42]. Even in this study differences (P=0.000) in stunting prevalence were noted across LGAs (Table 4). All these differences could reflect variations in socio-demography and SES observed in various National surveys in the country [30,31,43,44]. The disparities might also be explained by variability of risk factors in different geographic regions as well as socioeconomic status and dietary diversity of SAC [40].

Table 5. Association between malnutrition (Stunting) and child's socio-demographic characteristics

SN	Variable/ category	Malnutrition (Stunting)		OR	CI	Chi Sq	df	P-Value
		Yes (< -2)	No (-2+)					
1	**Tribe**							
	Hausa/Fulani	86 (26.5%)	239 (73.5%)					
	Tangale/Waja/ etc	36 (20.8%)	137 (79.2%)					
	Tera/Kanuri/Bolewa	8 (7.8%)	94 (92.2%)					
	Others-Yoruba/Igbo etc	37 (25.5%)	108 (74.5%)					
	Total	167 (22.4%)	578 (77.6%)			**16.573**	**3**	**0.001***
2	**Source of parental care**							
	Father and mother	131 (21.9%)	467 (78.1%)					
	Father or mother only or Guardians	36 (24.5%)	111 (75.5%)					
	Total	167 (22.4%)	578 (77.6%)	0.865	(0.567-1.320)	0.453	1	0.501
3	**Birth order**							
	< 3	59 (18.8%)	255 (81.2%)					
	3-5	81 (26.1%)	229 (73.9%)					
	6+	27 (22.3%)	94 (77.7%)					
	Total	167 (22.4%)	578 (77.6%)			4.832	2	0.089
4	**Age group**							
	< 10	40 (13.0%)	267 (87.0%)					
	10-12	86 (25.8%)	247 (74.2%)					
	13+	41 (39.0%)	64 (61.0%)					
	Total	167 (22.4%)	578 (77.6%)			34.48	2	0.000*
5	**Gender**							
	Male	87 (23.0%)	292 (77.0%)					
	Female	80 (21.9%)	286 (78.1%)					
	Total	167 (22.4%)	578 (77.6%)	1.065	(0.755-1.503)	0.129	1	0.720
6	**Religion of pupil**							
	Christianity	61 (18.2%)	274 (81.8%)					
	Islam	106 (25.9%)	304 (74.1%)					
	Total	167 (22.4%)	578 (77.6%)	0.638	(0.448-0.910	6.195	1	0.013*
7	**Family size**							
	<= 7	80 (20.1%)	319 (79.9%)					
	8+	86 (25.3%)	254 (74.7%)					
	Total	166 (22.5%)	573 (77.5%)	0.741	(0.524-1.047)	2.898	1	0.089

When compared with an earlier work in Gombe metropolis among public primary school children aged 5-15 [45], this study reports a higher stunting rate (22.5% vs. 18.4%). From the findings of this study, children in public schools were found to be more stunted ($\chi2=20.342$, df= 1, P=0.000) and twice at risk (OR=2.598, CI=1.699-3.974) of stunting than their counterpart from private schools (27.3% vs. 12.6%). This is consistent with other findings by Akor et al. [34], Abah et al. [46] and Adedeji et al. [4] in Jos North Central Nigeria and Onoja et al. [38] in Enugu South beast Nigeria. However, in Lagos, South West Nigeria Kola-Raji et al. [47] had almost equal or even slightly lower prevalence rates for public vs. private schools (37.1% vs. 39.3%). Agbozo et al. [5] asserts that according to their findings the type of school (public vs. private) could be an indicator of socio-economic status that can be associated with nutritional status of students. Primary 1 school children had the lowest proportion (13.5%) of stunting, while primary 6 children were worst hit (31.3%) at $\chi2=11.858$, P=0.037. The higher prevalence among children in the higher classes is most likely explained by the fact that the mean age is higher and earlier studies have established a rise in prevalence of stunting with increase in age among adolescents [3,4,46,48]. Surprisingly, senatorial district and place of residence appeared not to be related to stunting (P>0.05).

Table 6. Association between stunting and parent's socio-economic background

SN	Variable	Malnutrition (Stunting)		Chi Sq	df	P-value/ F-exact
		Yes (< -2)	No (-2+)			
1	**Occupation of father**					
	Farmer/artisan/Trader	91 (27.2%)	243 (72.8%)			
	Civil Servant /Banker/ Military etc	48 (16.9%)	236 (83.1%)			
	Top Business man/Politician etc	27 (22.7%)	92 (77.3%)			
	Total	166 (22.5%)	571 (77.5%)	9.414	2	0.009*
2	**Occupation of mother**					
	Farmer/Artisan etc	26 (22.4%)	90 (77.6%)			
	Civil servant/ Banker/Military etc	16 (12.6%)	111 (87.4%)			
	Top Business woman/ Politician etc	3 (17.6%)	14 (82.4%)			
	House wife	122 (25.3%)	360 (74.7%)			
	Total	167 (22.5%)	575 (77.5%)	9.553	3	0.023*
3	**Socioeconomic status (SES)**					
	Low	107 (26.6%)	295 (73.4%)			
	Middle	50 (19.8%)	202 (80.2%)			
	High	10 (11.0%)	81(89.0%)			
	Total	167 (22.4%)	578 (77.6%)	11.872	2	0.003*
4	**Level of education of father**					
	Primary School or none	41 (24.1%)	129 (75.9%)			
	Secondary School	74 (25.5%)	216 (74.5%)			
	Tertiary Institution	51 (18.4%)	226 (81.6%)			
	Total	166 (22.5%)	571 (77.5%)	4.321	2	0.110
5	**Level of education of mother**					
	Primary School or none	94 (30.6%)	213 (69.4%)			
	Secondary School	56 (20.5%)	217 (79.5%)			
	Tertiary Institution	17 (10.6%)	144 (89.4%)			
	Total	167 (22.5%)	574 (77.5%)	25.358	2	0.000*
6	**Childs level of performance level**					
	Low/poor (<50)	69 (28.4%)	174 (71.6%)			
	Medium/Good (50-69)	63 (20.9%)	238 (79.1%)			
	High/Very good (=>70)	35 (18.0%)	159 (82.0%)			
	Total	167 (22.6%)	571 (77.4%)	7.443	2	0.024*

Stunting was found to be associated with tribe, age group and religion of pupils, while birth description, source of parental care, birth order, gender and family size seemed not to be (Table 5). This is in tandem with findings by Adenuga et al. [3] in South West Nigeria who also found no association between stunting and birth order, parental care (in urban area) and sex. Children of Hausa/Fulani extraction (26.5%) and "others" (25.5%) categories were more stunted than those of other tribal groups ($\chi 2$ = 16.573, p=0.001). This might not be unconnected with the prevalence of unfavourable levels of socioeconomic indicators among the ordinary Hausa/Fulanis which has been associated with stunting [31,43,44,49]. Children 13 years and above were more stunted (39.0%) than those from the lower age groups ($\chi 2$ =34.48, P=0.000). Again this has been shown to be an established trend [4,27,40,46,48]. Children from Islamic faith leaning appeared to carry the highest burden (25.9%) of stunting ($\chi 2$ =6.195, P=0.013, OR=0.638, CI: 0.448-0.910). The same rationale given for tribe applies here as overwhelming majority of Muslims in the study area are also Hausa Fulani by tribe.

This study also demonstrates that stunting among the school children could be associated with occupation of father, occupation of mother, Socioeconomic Status (SES) and level of education of mother (Table 6). Without mincing words this findings has been affirmed by previous studies [4,23,37,50,51]. Children of Farmers/artisans/Traders paternal background were mostly (27.2%) stunted ($\chi 2$ = 9.414, p=0.009) than those of fathers in other occupational groups; while children of house wives (25.3%) and artisan/farmer (22.4%) maternal background had higher prevalence of

stunting than those of mothers from other occupations ($\chi2$ = 9.553, df = 3, p=0.023). Children from the lower SES were more (26.6%) stunted than those from the other SES (stunted, $\chi2$ = 11.872, p=0.003). It is logical to infer that this might be due to the fact that households in the higher SES are more likely to afford better nutrition that those within the lower SES. Children of mothers with only primary school or no education had higher prevalence (30.6%) of stunting than those of mothers with higher education ($\chi2$ = 25.358, p=0.000). All these have been variously affirmed in a review of 49 studies in Sub-Saharan Africa by Akombi et al. [52]. Several other works are also in agreement with these findings [2,12,21,22,23]. Low academic performance was significantly associated with high prevalence of stunting (28.4% vs. 20.9% & 18.0%) among the subjects (p=0.024). This is also consistent with other findings in Nigeria, Africa and other parts of the world [15].

5. CONCLUSION

With an overall prevalence of 22.5%, it is quite evident that stunting constitute a major public health challenge among school age children (SAC) in the study area. The major determinants of the problem as identified in this study include; pupil's LGA, school type, class of pupils, tribe, age group, religion, occupation of father, occupation of mother, Socioeconomic Status (SES) and level of education of mother. All of these factors were shown to be associated with stunting which tended to have negative consequences on the overall academic performance of the children. Children with lower academic performance were found to be significantly more stunted (p=0.024). Hence, it is recommended that the design of nutritional intervention programmes should not only target SAC but should factor in some of the determinant factors identified in this study.

CONSENT AND ETHICAL APPROVAL

Ethical clearance was obtained from the Gombe State Ministry of Health Research and Ethics Committee (GSMoHREC) – Ref: MoH/ADM/S/658. Then official approval and consents for the research work was secured from the Gombe State Universal Basic Education Commission (UBEC), individual Schools and Parent Teachers Association (PTA) through the school management. Participation in the study by subjects was purely on voluntary basis.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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