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Nutritional Status of Boarding and Non-Boarding Children in Selected Schools in the Accra Metropolis

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Abstract
Malnutrition is highly prevalent in developing countries. Children are at high nutritional risk of being malnourished because of their physiological demands at this age. However, the nutritional status of school age children is poorly documented in Ghana. The aim of this study was to assess and compare the nutritional status of boarding and non-boarding pupils aged 8 to 10 years in the Accra Metropolis, Ghana. A cross-sectional study was conducted among 124 children in three private schools which have boarding facilities (optional) in the Accra Metropolis, Ghana. Dietary intakes of children between the ages of 8 and 10 years were assessed using a two-day 24 hour recall. Weight and height measurements were taken. WHO Anthroplus software was used to determine WAZ, HAZ and BAZ. Ghanaian food composition tables were used to calculate the nutritional components of foods eaten by subjects. T-tests were used to analyse differences between variables. The prevalence of stunting, underweight, overweight and obesity among the children were 0.8%, 0.8%, 12.1% and 11.3% respectively. The total energy and nutrient intake of calcium among children (both boarders and non-boarders) was inadequate. There was no significant difference in the nutritional status and mean nutrient intake between boarding and non-boarding children. Nutritional status between boarders and non boarders were found to be similar.
Key words: School children, boarders, non-boarders, Ghanaian, nutritional status

1.0 Introduction

Malnutrition is a condition that has adverse impact on children. Its negative impact on child's physical and cognitive development cannot be overemphasized. Malnutrition could either be due to under nutrition or over nutrition. It is also the most important cause of illness and death worldwide among children (Muller and Krawinkel, 2005). Under nutrition particularly contributes substantially to all child deaths (Black, et al., 2003). Micronutrient deficiencies especially of iron and iodine account for adverse educational and cognitive effects as well as high rates of illness which may persist into adulthood (Scrimshaw, 1998).

Children in low and middle income countries have been known to be at increased risk of under nutrition due to poverty and lack of food. However, recent research has now revealed that these children are also at risk of becoming overweight or obese due to the rise of low-cost, high calorie and energy dense foods that have poor nutritional profiles, coupled with decreased physical activity (WHO, 2011). The co-existence of these two nutritional problems in these countries creates a double-burden of nutrition-related ill health among children (WHO, 2011).

Stunting, underweight, iron deficiency anaemia, iodine and vitamin A deficiency constitute the main nutritional challenges faced by children of school-going age (Drake et al., 2002, Jukes et al., 2004). These deficiencies in the school-age child may result in reduced cognitive development and learning ability with their nutritional status worsening during their school years (Jukes et al., 2002; Drake et al., 2002; Hall et al., 2000). A large number of nutrition research and intervention strategies involving developing countries have focused on poverty and under nutrition. Studies now indicate a shift toward overweight and obesity in developing countries. However few policies have focused on improving the trend among older children and adolescents worldwide. For children living in developing countries, overweight and obesity add to the nutritional problems they face (Drake et al., 2002). Current research to investigate trends of the nutrition situation of school age children is therefore necessary to inform and drive efficient policies that would migrate the effect of malnutrition in Ghana.

Children in boarding schools may be at higher risk of developing nutrient deficiencies compared to those in non-boarding school, probably due to financial constraints in running boarding facilities. A study carried out in a boarding school in Nigeria to assess the nutritional status of forty students between the ages of 10 to 19 years showed that students in that boarding school were generally malnourished with inadequate energy intake especially among students of younger ages (Akinyemi and Ibraheem, 2009). On the other hand, Owusu et al., (2007) in measuring the nutritional intake of adolescents in Ghana discovered that adolescents in senior high schools in Greater Accra Region and Eastern Region made bad food choices but were fed with nutritionally

adequate meals in their boarding schools.
School age children are at high nutritional and health risks of under nutrition and over nutrition. However, the nutritional status of school age children in Ghana is poorly documented. The state of nutrition in school age children has a short-term and long-term impact on cognitive ability, academic performance and productivity in adulthood. Research into this area could provide evidence based information as to the dietary habits that determine the state of nutrition of school-age children attending boarding and day schools. Such information could be factored into intervention strategies by parents, caretakers, school authorities and the government to address the issue of malnutrition. The objective of this study was to assess and compare the nutritional status of school-age children fed at boarding schools to those in non-boarding schools.

2.0 METHODOLOGY

2.1 Study design and population

A cross-sectional survey was carried out in three private elementary schools with boarding facilities for pupils in the Accra Metropolis. This study was focused on boarding and non-boarding pupils between the ages of 8 to 10 years. One hundred and twenty four (124) children of both sexes aged 8 to10 years participated. Ninety four (94) of them were non-boarders and 30 of them were boarders. Systematic sampling was used in selecting children from the schools

2.2 Ethical consideration, Inclusion/ Exclusion criteria

Ethical approval for the study was obtained from the Ethics Review Board of the School of Allied Health Sciences before the commencement of the research. Permission was sought from the administrative bodies of the various schools to carry out the research. The parents/guardians of eligible children gave their consents by signing a consent form which clearly explained the objectives and protocols of the study. The children also gave their consent by writing their initials on the same form. Children who did not satisfy these criteria were excluded in the study.

2.3 Data collection

A structured questionnaire was used to obtain information on the background characteristics of the children.

2.3.1 Anthropometry

Height and weight of the children were measured following instructions on the National Health and Nutrition Examination Survey (NHANES) procedure manual, (2007). Determination of height-for-age z-score (HAZ), Weight for age z-score (WAZ) and Body mass index for age z-score (BAZ) was done using WHO AnthroPlus Software.

2.3.2 Dietary Intakes Assessment

A two-day 24- hour dietary recall of usual dietary intake was carried out for all participants by well-trained interviewers. The children were made to recall foods that they had taken for the past 24 hours. Food models were used in aiding the children to estimate portion sizes. The estimated quantities were converted to energy and nutrients using Ghanaian food composition tables.

2.3.3 Statistical analysis

Analysis of data was done using the Statistical Package for Social Sciences (SPSS, version 20.0). Descriptive statistics of frequency distributions, mean, and percentages were used to represent the prevalence of malnutrition among school age children. Differences in the various indicators were tested for statistical differences using independent T-tests. All tests were two-tailed and statistical significance was set at $p < 0.05$.

3.0 RESULTS/DISCUSSIONS

3.1 General observations

Table 1 provides information on the age distribution of the children and the occupation of their parents/guardians. The children were categorized into two main age groups, i.e eight to eight years, eleven months (8-8:11) and nine to 10 years (9-10 years). This categorization was done in order to aid easy comparison of the children to their specific Estimated Average Requirement (EAR) recommendations. Majority of the children (75.8%) were non boarders and (24.4%) were boarders.

3.2 Mean energy and nutrient intakes of pupils.

The mean energy and mean nutrient intakes of all children are shown in table 2. This gives a general overview of all the energy and nutrient intakes of all the children (boarders and non boarders). Tables 3, 4 and 5 describe the nutrient intakes between boarders and non boarders. The mean energy and nutrient intakes of children aged 8:0-8:11years is compared between boarders and non-boarders (table 3). The non-boarders had higher intakes in fat, vitamin B1 and vitamin C. Despite the difference in the intakes, majority of children met the EAR. The higher intakes of the non boarders with regards to fat and the vitamins C and B1 can be attributed to the fact that they are able to assess foods outside the school compared to the boarders. Because of this, non boarders are exposed to other sources of food from home and the outside environs which are likely to be high in fat. Also they are

likely to be exposed to a variety of fruits which those in the boarding house will not be exposed to due to restrictions that usually characterize boarding schools.

For the age group 9-10 years, comparisons were done according to gender because the EAR has been set in that regard. For the boys (table 4), no differences were observed between nutrient intakes of the boarders and non boarders. The same observation was made among the girls of the same age group (table 5). However in terms of meeting their EAR, 100% of boys met requirements for protein, carbohydrates and iron. On the contrary none of the age groups met their requirements for calcium. Energy requirements were also poorly met (boarders 27.3%, non boarders 19.2%). Among the girls aged 9-10 years (table 5), protein, carbohydrates and iron needs were also met by 100% of the children with a low percentage (boarders 20%, non boarders 33%) meeting the needs of energy.

Iron deficiency is one of the commonest nutrient deficiencies in the world and the commonest cause of anaemia (WHO, 2011). The requirements of iron was met by all the age groups both borders and non boarders. This observation is consistent with another work carried out by Egbi (2012) among Ghanaian children. However there were concerns over the bioavailability of the iron and the contribution of other infections to the development of iron deficiency anaemia when 72% of the children were found to be anaemic. This in effect calls for the need to ensure that iron sources provided to these children are bio available and also the reduction of infections such as worm infestations and malaria. These can contribute largely to the development of anaemia.

Calcium, one of the major micronutrients is needed especially in the developing years for strong bone formation. In agreement with other studies carried out in Ghana, no child was able to meet the calcium requirements (Intiful and Lartey, 2006; Osei Boadi et al, 2012). This can be attributed to the low consumption of milk and milk products among Ghanaian children (Intiful and Lartey, 2006). However even though other sources of calcium were consumed, they were in small quantities and therefore could not meet the required recommendations. Also Damastuti et al., (2011) reported 0% of children meeting their calcium requirements among Indonesian children. Furthermore, only about 22% of the children met average requirements. On the contrary, Davy et al (2004), reported 62% of school age children meeting calcium requirement recommendations in rural Mississippi.

Intakes of the various vitamins analysed were found to be encouraging even though not all children met recommendations of EAR. This was observed both among the boarders and non boarders. In light of the protective roles these vitamins play in disease prevention (Begun, 2010), it is important that pupils are adequately provided with these nutrients. Higher intakes of vitamin C and B1 among the non boarder males in the 8-8:11 group could be attributed to intakes outside the school.

3.3 Anthropometric Assessment

Table 6 gives a summary of weight for age, height for age and body mass index z-scores of all the children. The percentage of children found to be underweight and stunted were 0.8% and 0.8% respectively. A substantial percentage of pupils (96.8%) were of normal height. Prevalence of overweight and obesity were found to be 12.1% and 11.3% respectively. A greater percentage of the pupils (75.8%) were of normal BMI.

WAZ, HAZ and BAZ gives indication of the long term impact of nutrition on the growth of the children. Stunting and underweight are conditions that are widely spread in developing countries. In a study that was carried out in 5 developing countries including Ghana, stunting and underweight ranged between 48-56% and 34-62% among these countries respectively (PCD, 1998). Compared to this, the children in this current study have better nutritional status. This suggests good socioeconomic status of these children. In Ghana private schools tend to be usually patronized by those in the high socioeconomic status. Therefore it would account for the type of meals served to them at home. They are likely to enjoy nutritious food which could account for the low prevalence of stunting and underweight seen among these children. Also the high prevalence of overweight and obesity can be explained by increased consumption of high fat and sugary foods coupled with low physical activity that can be characteristic of school age children when they are not properly monitored in that regard.

The Pearson Chi square test was used to test the differences in the z scores between boarders and non-boarders. No significant difference was found in the WAZ, HAZ and BAZ scores between the boarding and non-boarding pupils as shown in table 7. Also, it was observed that a good number of the pupils showed good anthropometric indices. Contrary to the findings of the current study, Lou et al., (2009), showed that boarding school children (23%) were found to be worse off than non-boarding school children (11%) in terms of stunting. They attributed their findings to the poor living conditions and nature of meals served in the boarding school. Studies also conducted by Monarrez-Espino et al., (2004) among boarding school children 6 to 12 years saw a prevalence of stunting, underweight and overweight to be 22.3%, 3.2% and 0.6% respectively.

4.0 CONCLUSION

The nutritional status of children, both boarders and non boarders did not vary significantly. Calcium and iron intakes were also below recommendations. Consideration should be given to ways to enhance both intake and bioavailability of these nutrients though approaches such as fortification and diversification. Prevalence of both

stunting and underweight were relatively low compared to previous studies. The potential for increased prevalence in childhood overweight and obesity among this group is also evident. Urgent strategies to address this canker are crucial to prevent early onset of obesity related chronic diseases.

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Table 1: Background information of children

Characteristic	Non – boarding (N=94) N (%)		Boarding (N=30) N (%)		Combined (N=124) N (%)
Age(years:months)	**Boys**	**Girls**	**Boys**	**Girls**	
8:0 – 8:11 N=59	22(44.0)	28(56.0)	7(77.8)	2(22.2)	59 (47.6)
9:0 – 10:0 N=65	26(59.1)	18(40.9)	11(47.6)	10(52.4)	65 (52.4)
Occupation of guardian					
Trading	23(24.5)		6(20.0)		29(23.4)
Artisan	15(16.0)		4(13.3)		19(15.3)
[1]Other	36(38.3)		13(43.3)		49(39.5)
Don't know	20(21.2)		7(23.3)		27(21.8)

[1]= pastors, engineers, bankers, teachers

Table 2: Mean energy and nutrient intakes for all pupils (N=124)

Nutrient	Mean (±) Standard deviation
Energy(kcal)	1782±446
Protein(g)	66.99±44.74
Fat(g)	44.72±20.22
Carbohydrate(g)	294±78
Vitamin A(ug RE)	623±456
Vitamin B1(mg)	1.00±0.41
Vitamin B2(mg)	0.77±0.27
Vitamin C(mg)	48.9±31.2
Iron (ug)	19.7±7.2
Calcium (mg)	359±137

Table 3: Nutrient intakes for pupils aged 8:0-8:11years

		BOARDERS (n=9)		NON-BOARDERS (n=50)		
Nutrients	**EAR**	**Mean intake ±SD**	**% who met EAR**	**Mean intake ±SD**	**% who met EAR**	**P – Value**
Energy (kcal)	2000	1687±346	11.1	1805±509	36	0.405
Protein (g)	15	70.83±17.39	100	72.69±66.50	100	0.867
Fat (g)	-	35.28±11.01	-	45.60±18.76	-	0.035*
Carbohydrate (g)	100	287±62	100	298±86	100	0.638
Vitamin A (ug RE)	275	448±397	55.5	681±501	72	0.145
Vitamin B1 (mg/d)	0.5	0.75±0.15	100	1.02±0.47	98	0.002*
Vitamin B2 (mg/d)	0.5	0.66±0.20	88.8	0.77±0.30	90	0.175
Vitamin C (mg/d)	22	34.8±8.2	100	49.9±32.7	84	0.007*
Iron (mg/d)	4.1	19.0±3.4	100	20.4±7.9	100	0.496
Calcium (mg/d)	800	365±116	0	335±132	0	0.410

*significant at $p<0.05$

Table 4: Mean energy and nutrient intakes for boys aged 9:0 to 10:0 years (boarders and non boarders)

BOYS 9-10		BOARDERS (n=11)		NON-BOARDERS (n=26)		
Nutrients	**EAR**	**Mean intake±SD**	**% who met EAR**	**Mean intake±SD**	**% who met EAR**	**P - Value**
Energy (kcal)	2000	1737.82±348.11	27.3	1785.92±327.56	19.2	0.700
Protein (g)	27	63.02±18.78	100	60.97±17.69	100	0.761
Fat (g)	-	35.67±14.16	-	52.43±26.03	-	0.017
Carbohydrate (g)	100	309.00±59.31	100	279.28±66.88	100	0.194
Vitamin A (ug RE)	445	511.16±519.71	36.4	635.67±374.32	65.4	0.483
Vitamin B1 (mg/d)	0.7	0.860±0.305	81.9	1.061±0.451	84.6	0.128
Vitamin B2 (mg/d)	0.8	0.743±0.293	27.3	0.790±0.269	50	0.650
Vitamin C (mg/d)	39	35.61±12.62	36.4	48.41±30.79	65.4	0.082
Iron (mg/d)	5.9	17.21±4.19	100	20.76±6.84	100	0.198
Calcium (mg/d)	1100	341.82±122.02	0	407.83±172.42	0	0.063

Table 5: Mean energy and nutrient intakes for girls aged 9:0 to 10:0 years (boarders and non boarders)

GIRLS 9-10		BOARDERS (n=10)		NON-BOARDERS (n=18)		
Nutrients	**EAR**	**Mean intake±SD**	**% who met EAR**	**Mean intake±SD**	**% who met EAR**	**P - Value**
Energy (kcal)	2000	1687.45 ±455.12	20	1838.78±531.10	33.3	0.436
Protein (g)	28	59.93±17.70	100	64.26±23.51	100	0.587
Fat (g)	-	36.91±16.81	-	45.73±19.78	-	0.226
Carbohydrate (g)	100	294.15±75.01	100	293.78±92.30	100	0.991
Vitamin A (ug RE)	420	824.18±525.78	70	486.07±347.58	44.4	0.090
Vitamin B1 (mg/d)	0.7	0.856±0.248	80	0.998±0.385	72.2	0.246
Vitamin B2 (mg/d)	0.8	0.717±0.174	30	0.814±0.262	55.6	0.253
Vitamin C (mg/d)	39	65.66±40.19	60	52.39±34.31	55.6	0.391
Iron (mg/d)	5.7	17.90±5.50	100	18.94±8.86	100	0.958
Calcium (mg/d)	1100	361.16±105.92	0	363.54±124.19	0	0.704

TABLE 6: Percentage WAZ, HAZ and BAZ distribution among all pupils (N=124)

		FREQUENCY	PERCENTAGE
WAZ	<-2SD Underweight	1	0.8
	-2 to 1 SD Normal	88	71.0
	>1SD Above normal	35	28.2
HAZ	<-2SD Stunted	1	0.8
	-2 to 3 SD Normal	120	96.8
	>3 SD Above normal	3	2.4
BAZ	<-2 SD Thinness	1	0.8
	-2 to 1 SD Normal	94	75.8
	>1 SD Overweight	15	12.1
	>2 SD obese	14	11.3

Table 7: WAZ, HAZ and BAZ for boarding and non-boarding pupils (N=124)

		Boarding N (%)	Non-boarding N (%)	Combined N (%)	P value
WAZ	<-2 Underweight	0 (0)	1 (1.1)	1 (0.81)	0.674
	-2 to 1 Normal	20 (66.7)	68 (72.3)	88(71.0)	
	>1 Above normal	10 (33.3)	25 (26.6)	35(28.2)	
HAZ	<-2 Stunted	0 (0.0)	1 (1.1)	1(0.8)	0.517
	-2 to 3 Normal	30 (100)	90 (95.7)	120 (96.8)	
	>3 Above normal	0 (0.0)	3 (3.2)	3 (2.4)	
BAZ	<-2 Thinness	1(3.3)	0 (0.0)	1(0.8)	0.256
	-2 to 1 Normal	21(70.0)	73(77.7)	94(75.8)	
	>1 Overweight	5(16.7)	10 (10.6)	15(12.1)	
	>2 Obese	3(1.0)	11 (11.7)	14 (11.3)	