RELATIONSHIP BETWEEN NUTRITIONAL STATUS AND ACADEMIC ACHIEVEMENT OF PUBLIC SCHOOLS CHILDREN IN SEMI-URBAN AND RURAL COMMUNITIES IN IMO STATE

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[1]OPARA, D. C. AND [2]OPARA, K. A.
[1]Community Health Department, University Of Uyo
[2]Biochemistry Department, University Of Uyo

ABSTRACT

Developing countries have a higher dropout rate of primary school pupils than their counter parts in developed countries. This has been ascribed to many factors including improper feeding. This study was conducted to establish the factors associated and to investigate the relationship, if any between the nutritional status and academic achievement of public schoolchildren in semi urban and rural communities in Imo State. All the pupils in the four selected schools were enrolled in the study; (370 males and 316 females). Their personal characteristics, height, weight and last promotion examination results were obtained. Analysis of the results show that 26.6% were stunted (≤ - 2SD). About 50% were underweight (≤ - 2SD) and 4.3% were obese (≥ + 2SD). However, the differences in stunting, underweight and obesity were not statistically significant by gender ($P > 0.05$) in all cases. Factors associated with anthropometric parameters were mother's occupation, age and location of school. Boys obtained higher scores in mathematics and English language while girls obtained higher scores in mean overall scores. Factors that had a statistically significant relationship with academic achievement were stunting (P, 0.000) and age ($\chi^2 = 95.9$, $P = 0.000$). Body Mass Index (BMI) for age z-score had a statistically significant relationship with mother's occupation, location of school and age of pupil ($P < 0.05$). This study provides evidence of the high levels of stunting and underweight among the school age children investigated. It also provides evidence of the negative impact of stunting on academic achievement of pupils.

INTRODUCTION

The observation that many children in developing countries did not complete primary school and those who completed, did not do as well as children in developed countries, has kindled researchers' interest in the relationship between nutritional status, health and educational achievement of school aged children in developing countries (Wicherts *et al.,* 2009). This poor performance led the noble Laureate James Watson to express gloom about the future of Africa, in the light of the finding that sub-Saharan Africans have lower average test scores than the people in other parts (Wicherts *et al.,* 2009), though this seemingly poorer performance of Africans on test scores has been attributed to culturally unfair test instruments (Sternberg, 2004; Singh, 2010).

A growing concern about the Nigerian educational system is that it is failing to meet the national need for a competitive work force. Evidence exists that for any nation to develop a competitive work force, school children need to be in optimal health and nutritional status (Osisioma, 2010). Nutritional status has been referred to as the best global indicator of the wellbeing of children. Although the global level of stunting in many developing countries is falling, Nigeria is one of the countries that present little progress in this regard (Ajieroh, 2010; De Onis *et al.,* 2000). As such, child malnutrition remains a major public health problem in developing countries, including Nigeria (De Onis *et al.,* 2000). The double burden of malnutrition exacerbates the nutrition problems in developing countries (Martorell *et al.*, 2000;

Gales-Camus *et al.,* 2006; Kelishadi, 2007). Obesity and stunting can co-exist in the same nation, community or household (Uaiy and Solomons, 2006). In the case of a malnourished young child, there can be a quick transition from wasting to obesity within a matter of weeks or a few months. Moreover in many cases these children remain stunted, making them more vulnerable in an urban setting to obesity and diabetes. Rapid shifts in weight without concurrent gains in height is now recognized as particularly increasing the risk of later diabetes, central obesity and cardiovascular diseases (Uaiy and Solomons, 2006)

There is strong association between increasing severity of anthropometric deficits and mortality. Empirical data points to the association of poor growth status with delayed mental development, poor school performance, reduced intellectual achievement, reduced work capacities and ultimately reduced economic productivity (De Onis *et al.,* 2000; Jukes, 2007; Bird, 2007; Boyden and Dercon, 2012).

Studies have shown that for every 10% increase in stunting, the proportion of children reaching the final grade of primary school, dropped by 7.9% (Gratham-McGregor *et al.,* 2007). Also millions of children under 5 years, fail to reach their potential in cognitive development because of poverty, poor health, malnutrition and deficit care (Gratham-McGregor and Ani, 2001).

Nutritional and health status are not the only variable affecting educational achievement. Biological, psychological, socioeconomic and cultural factors etc directly or indirectly affect individuals' academic achievement (Shariff *et al.,* 2000; Best *et al.,* 2010; Olagunju *et al.,*2011; Aliyu *et al.,*2012). It is therefore difficult to isolate the effect of malnutrition alone.

However, National statistics on school children's cognitive or social-emotional development are not available in most developing countries (Gratham-McGregor and Ani, 2001). There is growing concern about the poor academic achievement of all students in public schools in Nigeria. This study was carried out to investigate the relationship between nutritional status and educational achievement among primary school children in semi-urban and rural public schools in two LGAs contiguous to Owerri, capital of Imo State, Nigeria.

MATERIALS AND METHODS

The Study Setting

The study was carried out in January, 2014. The study sites were Emekukwu town in Owerri North LGA and Upe and Umunam towns in Ngor-Okpalla LGAs. Emekukwu is a typical semi urban setting while Upe and Umunam towns are rural settings. Both towns are inhabited by indigenous people. Farming is the predominant occupation of the people, some engage in petty trading. Informal interactions with pupils from this study population, suggested poor academic performance resulting in high rate of school dropout and inability of most youths in the rural communities to gain admission into universities, or to gain meaningful employment.

Sampling

There are 1274 public schools in Imo state, 29 of which are in Owerri municipal council, while the others are either in semi urban or rural communities. Four schools were randomly selected for this study. Two of the schools were in semi urban and two in rural areas. All the children in the four schools were enlisted in the study.

Ethical Considerations

Ethical approval was obtained for the study from the ethical committee of the Imo State Ministry of Education. Written consent was obtained from the head teachers in all the schools. Exclusion criteria included children whose dates of birth were not found in the school register, as the schools are required to sight the birth certificates of children before school enrolment. Also excluded were children with limb deformity, those who were sick at the time of the study and those girls who had observable breast development or boys who had their voices cracked. In the end, 686 pupils (370 boys and 316 girls) participated in the study.

Measurement

The weight of the children was taken with the children wearing minimal clothing using an electronic scale (Health-0-Meter model HDM 691 D-01-95). The height of the children was measured using a portable adult measuring unit, to the nearest 0.1cm. The age of each child was deduced from the date of birth and recorded in months. The height for age Z- score, weight for height Z-score and BMI for age Z-score were calculated using WHO Anthro Plus software. Each child was then categorized into height for age and BMI for age.

Stunting = ≤ -2SD of height for age Z-score

Underweight/thinness = ≤ -2 BMI for age Z-score

Overweight = ≥ +2SD weight for height/ BMI for age Z-score. (28)

Evaluation of Educational Achievement

The children's end of year examination average scores/position in class, mathematics scores and English language scores were obtained from their school's academic records. The scores were divided into 3, namely; high score, medium score and low score by dividing the range of scores into the upper 33.3%, middle 33.3% and lowest 33.3% respectively. Although all the test schools followed the same curriculum approved by the state primary education board and State Ministry of Education, examinations were conducted at different locations, and school environment.

Statistical Analysis

This was done using SPSS version 20. Data processing included chi square, Pearson correlation coefficients and percentages. Test of significance was set at 95% ($P<0.05$).

RESULT

Description of Pupils

There were 686 children 370 (53.9%) males and 316 (46.1%) females. Majority, 268 (39.1%) were aged 10 – 13 years, 6-9 years olds were 258 (37.8), 2 –5 year olds were 129 (18.8%) while only 31 (4.5%) were 14 years or more. Most of the pupils were 3^{rd} – 4^{th} birth order (41.1%), 1^{st} – 2^{nd} birth order made up about 39% of the pupils, 19% were 5^{th} – 6^{th} birth order, while almost 9% were 7^{th} or more in birth order. With respect to their mother's occupation, 88(13.3%) were housewives, 185 (27.9%) were traders, 164 (24.7%) were farmers, 96 (14.5%) were civil servants, 5.4% and 5.3% were health workers and businesswomen respectively. Majority of the pupils (51.5%) were from semi-urban school 1, 11.7% from semi-urban school 2, while 18.6% and 9.2% were from rural school 1 and rural school 2 respectively, (Table 1)

Table 1: Characteristics of pupils by age, gender, birth order, location of school and mother's occupation, Owerri, 2014.

	Male	Female	Total %	
Age (years)				
2 – 5	65	64	129 (18.8)	$\chi^2 = 0.399$
6 – 9	138	120	258 (37.6)	NS
10 – 13	153	115	268 (39.1)	$P > 0.05$
14 – 17	14	17	31 (4.5)	
	370 (53.9%)	316 (46.1)	686	
Birth order				
1 – 2	55	46	101 (39.1)	$\chi^2 = 4.02$
3 – 4	50	56	106 (41.1)	$P > 0.05$
5 – 6	31	24	55 (19.2)	
7 – 10	17	8	25 (8.7)	
			287	
Location of school				
Semi-urban 1	195	153	348 (51.5)	
Semi-urban 2	51	28	79 (11.7)	$\chi^2 = 1.24$
Rural 1	63	63	126 (18.6)	$P > 0.05$
Rural 2	61	62	123 (9.2)	
			676	

Mother's occupation				
Housewife	41	47	88 (13.3)	
Farmer	83	81	164 (24.7)	
Teacher	31	24	60 (9.0)	$\chi^2 = 52.2$
Trader	97	88	185 (27.9)	$P < 0.05$
Civil servant	41	55	96 (14.5)	
Health worker	34	2	36 (5.6)	
Businesswomen	33	2	35 (5.3)	
			664	

Prevalence of Stunting, Underweight/Thinness and Obesity

Table 2 shows that more girls (5.3%) were severely stunted than boys (4.7%), while more boys (9.2% and 17.6%) than girls (7.4% and 14.1%) were either moderately stunted (-2 SD) or mildly stunted (-1 SD). However, the differences are not statistically significant ($\chi^2 = 4.2$; P=0.650). A higher proportion of female pupils were underweight than males. More males were of normal weight (21.9%) than females (15.0%). In all, 9 (1.3%) and 24 (4.2%) of the children were obese (≥ + 2SD). The difference in BMI for age Z- score by gender was not statistically significant ($\chi^2 = 4.2$; P= .054).

Table 2 also shows that the proportion of boys (7.8% and 11.2%) who obtained high or medium scores were slightly more than girls (7.1% and 10.1%) in Mathematics and English language respectively. More girls (14.3%) than boys (13.6%) obtained high overall Average scores for all the subjects. These differences were not statistically significant.

Table 2: Prevalence of stunting, underweight, obesity, and high and low academic scores

	Male n (%)	Female n (%)		
Height for age Z score				
-3	32 (4.7)	36 (5.3)	68 (10.1)	
-2Sd	62 (9.2)	50 (7.4)	112 (16.6)	
-1Sd	119 (17.6)	95 (14.1)	214 (31.7)	$\chi^2 = 4.2$
Median	96 (14.2)	84 (12.4)	180 (26.6)	P = 0.650
+ 1	42 (6.2)	30 (4.4)	72 (10.7)	
+ 2	12 (1.8)	9 (1.3)	21 (3.1)	
+ 3	7 (1.0)	2 (0.3)	9 (1.3)	
	370 (54.7)	306 (45.3)	676 (100)	
BMI for age Z score				
-3	12 (1.8)	6 (0.9)	18 (2.7)	
-2	45 (6.7)	32 (4.7)	77 (11.4)	$\chi^2 = 12.4$
-1	123 (18.2)	113 (16.7)	249 (36.9)	P = 0.48
Median	148 (21.9)	101 (15.0)	249 (36.9)	
+ 1	25 (3.7)	32 (4.7)	57 (8.4)	
+ 2	6 (0.9)	3 (0.4)	9 (1.3)	
+ 3	10 (1.5)	19 (2.8)	29 (4.3)	
	369	306	675	
Math score(20-100%)				
20 - 47%	55 (20.5)	36 (13.4)		
48 – 74%	73 (27.2)	64 (23.9)		r = 20
75 – 100	21 (7.8)	19 (7.1)		
English score(23-98%)				
23 – 48%	42 (15.7)	30 (11.2)		
49 – 74%	77 (28.7)	62 (23.1)		r = 0.235
75 – 98%	30 (11.2)	27 (10.1)		
Mean score ; all subjects (36-85%)				
36-51(low)	82 (18.6)	55 (12.5)		
52-65(med)	99 (22.4)	82 (18.6)		r = 0.92
66-85(high)	60 (13.6)	63 (14.3)		

Factors Associated With Stunting, Underweight and High Examination Scores

Results on Table 3, show that there is a statistically significant relationship between stunting and location of school, and stunting and age (χ^2 = 82.8; P= 0.000; χ^2 = 95.9; P= 0.000). The differences in stunting by mothers occupation, birth order and gender were not statistically significant respectively (χ^2 = 50.2; P= 0.058; χ^2 = 21.8; P= 0.242 and χ^2 = 4.2; P= 0.650).

The differences in BMI for age Z-score by mother's occupation, location of school and age were statistically significant (χ^2 = 76.3; P= 0.000; χ^2 = 82.8; P= 0.000 and χ^2 = 161.0; P= 0.000). The difference in BMI for age Z-score by birth order and gender were not statistically significant.

The mean overall score obtained by pupils was statistically significantly different by mother's occupation, location of school and gender (P <0.05 in all cases). While the differences in scores obtained by the different ages and birth orders were not statistically significant (χ^2 = 6.8; P= 0.337; χ^2 = 3.7; P= 0.155). (Table 3)

Table 3: Characteristics of pupils associated with stunting, underweight and academic achievements

Variables	χ^2	P < 0.05	
Stunting			
Mother's occupation	50.2	0.058	NS
Birth order	21.8	0.242	NS
Location of school	82.8	0.000	Significant
Gender	4.2	0.650	NS
Age	95.9	0.000	Significant
Underweight			
Mother's occupation	76.3	0.000	Significant
Birth order	26.1	0.009	NS
Location of school	82.8	0.00	Significant
Gender	12.4	0.054	NS
Age	161.0	0.000	Significant
Mean of overall score			
Mother's occupation	43.9	0.00	Significant
Birth order	6.8	0.337	NS
Location of school	69.5	0.000	Significant
Gender	14.9	0.020	Significant
Age	3.7	0.155	NS

Relationship between Nutritional Status to Academic Achievement

The results on table 4 show that of the pupils that had severe underweight and thinness (-3 SD), 38.5% obtained low scores and 38.5% had medium scores, while only 23.1% obtained high scores. Among the pupils with moderate underweight and thinness (-2 SD), 33.3% had low scores, 40.1% medium and 25.9% obtained high scores. Of those who were mildly underweight (-1SD), 22.3% obtained low scores, 45.2% obtained medium, while 32.5% obtained high scores all in English languages.

In Mathematics, 30% of those who were severely underweight (-3SD) obtained high scores, while 20% of them obtained low scores. The difference in scores obtained in Mathematics by the different categories of underweight was statistically significant.

The proportion of those who had severe stunting (-3SD) and obtained low scores is the highest (42.9%). This is followed by 35.9% of those who were moderately stunted (-2SD) and 29.0% of those pupils who had mild stunting (-1SD), showing a step wise increase in proportion of those who obtained low scores as level of stunting increased.

Also, in Mathematics, more than half (52.3%) of pupils who were severely stunted obtained low scores, 42.9% of them obtained medium scores, while only 4.8% obtained high scores in Mathematics. Of the pupils who were moderately stunted (-2SD), 46.9% obtained low scores, 41.0% obtained medium scores and only 12.8% obtained high scores in mathematics. The

differences in the scores obtained in Mathematics and English language by the different categories of height for age was statistically significant respectively (P = .001 and P = 0.024). (Table 4). The results further shows that the differences in the mean scores obtained in all the subjects were not statistically different for the different categories of height for age Z-scores.

Table 4: The relationship of BMI for age Z-score, height for age Z-score to academic achievement, Owerri, 2014

	BMI for age z-scores						
%Scores	-3SD	-2SD	-1SD	median	+1SD	+2SD	+3SD
% Scores English *(23-98%)							
23-48(low)	5(38.5)	18(33.3)	37(22.3)	55(35.3)	17(38.6)	2(50.0)	1(50.0)
49-74(med)	5(38.5)	22(40.1)	75(45.2)	59(34.6)	18(40.9)	1(25.0)	1(50.0)
75-98(high)	3(23.1)	14(25.9)	54(32.5)	42(26.9)	9(20.5)	1(25.0)	0(0.0)
Total	13(100)	54(100)	166(100)	156(100)	44(100)	4(100)	2(100)
% Scores Mathematics *(20-100%)							
20-47(low)	2(20.0)	4(14.3)	21(23.9)	23(29.5)	9(20.9)	2(18.2)	0(0.0)
48-74(med)	5(50.0)	18(62.3)	41(46.6)	43(55.1)	27(62.8)	6(54.5)	4(80.0)
75-100(high)	3(30.0)	6(21.4)	25(28.4)	12(15.4)	7(16.3)	3(27.3)	1(20)
Total	10(100)	28(100)	88(100)	78(100)	43(100)	11(100)	5(100)
Mean score ; all subjects *(36-85%)							
36-51(low)	11(36.7)	28(37.3)	40(28.4)	40(33.1)	13(25.0)	3(21.4)	0(0.0)
52-65(med)	12(40)	26(34.7)	58(41.1)	52(43.0)	22(42.3)	5(35.7)	6(100.0)
66-85(high)	7(36.1)	21(28.0)	43(40.5)	29(23.9.0)	17(32.7)	6(42.9)	0(0.0)
Total	30(100)	75(100)	141(100)	121(100)	52(100)	14(100)	6(100)
Height For Age Z-Scores							
% Scores English *(23-98%)							
23-48(low)	9(42.9)	14(35.9)	20(29.0)	23(29.5)	3(4.8)	2(18.2)	0(0.0)
49-74(med)	10(47.6)	19(48.7)	34(49.3)	37(47.4)	25(59.5)	4(36.4)	3(60.0)
75-98(high)	2(9.5)	6(15.4)	15(21.7)	18(23.0)	14(33.30	5(45.5)	2(20.0)
Total	21(100)	39(100)	69(100)	78(100)	42(100)	11(100)	5(100)
% Scores Mathematics *(20-100%)							
20-47(low)	11(52.3)	18(46.9)	24(33.8)	23(29.3)	9(19.6)	2918.2)	0(0.0)
48-74(med)	9(42.9)	16(41.0)	38(53.5)	43(55.1)	27(62.8)	6(54.50)	4(80.0)
75-100(high)	1(4.8)	5(12.8)	9(12.7)	12(16.9)	7(16.3)	3927.3)	1(20)
Total	21(100)	39(100)	71(100)	78(100)	43(100)	11(100)	5(100)
Mean score ; all subjects *(36-85%)							
36-51(low)	11(33.7)	28(37.3)	40(28.4)	40(33.1)	13(25.0)	3(21.4)	0(0.0)
52-65(med)	12(40)	26(34.7)	58(41.1)	52(43)	22(42.3)	5(35.7)	6(100)
66-85(high)	7923.3)	21(28.0)	43(30.5)	29(23.9)	17(32.7)	6(42.9)	0(0.0)
total	30(100)	75(100)	141(100)	121(100)	52(100)	14(100)	6(100)

*range of scores (%)

DISCUSSION

The research findings have shown that less than 50% of all the pupils had normal or above normal standards for height for age Z-score. This is very disturbing because it has been stated that the best global indicator of children's wellbeing is growth (De Onis *et al.,* 2000). There is also a relationship between impaired growth status, poor school performance, reduced intellectual achievement, significant functional impairment in adulthood, reduced work capacity and ultimately, reduced economic productivity (De Onis *et al.,* 2000; Jukes, 2007; Bird, 2007). It has been observed that for every 10% increase in stunting, the proportion of

children reaching final grade of primary school dropped by 7.9%. .It has been previously reported that millions of children under 5 years in developing countries fail to reach their potential in cognitive development because of poverty, poor health, malnutrition and deficient care (Engle *et al.,* 2009; Gratham-McGregor *et al.,* 2007; Gratham-McGregor and Ani, 2001). In addition, childhood stunting has been linked to adult obesity and diet related chronic diseases (Barker *et al.,* 2005; WHO/FAO, 2003). Similar high levels of stunting were reported in a study of 285 pupils in Enugu, Nigeria, only 26% of the children in that study had normal height for age Z-scores (Abidoye and Eze, 2000). The prevalence of stunting reported in this study, is also higher than that found in school aged children in public schools in Uyo, Nigeria (Opara *et al.,* 2010) and the national prevalence in Nigeria (FMOH, 2005).

This study has revealed that underweight and obesity co- existed in the same population of children, similar findings had been reported elsewhere (Opara *et al.,* 2010). The prevalence of underweight and thinness found in the present study is similar to levels reported elsewhere in Nigeria (Ajieroh, 2010).

The findings that mother's occupation, age of child and location of school were statistically significantly associated with underweight has been reported elsewhere (Opara *et al.,* 2010) and our analysis has shown that the differences in BMI Z-scores by gender were not statistically significant, even though a higher proportion of males had lower scores, is in agreement with the findings of other authors (Dabone *et al.*, 2011; Mahgoub *et al.*, 2006; Doris *et al.,*2012).

In a study to investigate the relationship between nutritional statuses of 399 primary school children in poor households in Kuala Lumpur, it was found that nutritional status was associated with household income (Shariff *et al.*, 2000). It is possible that cultural values and norms may be an explanation for this concordance. More studies into this phenomenon will proffer a valid explanation. More than 24% of the children in this study had mothers who were farmers and 27.8% was from rural schools. Dabone *et al.,*(2011) reported that malnutrition was worse in semi-urban schools, in boys and in older children.

Results from this study have shown that BMI for age Z-score had no significant statistical relationship with academic achievement of pupils. In contrast, Abidoye and Eze (2000) reported that underweight for age Z-scores significantly affected school performance. However, strong evidence exists that stunting is associated with poor intellectual attainment, decreased productivity in adulthood and ultimately, poor economic development. It has also been posited that stunted children do poorly in school, subsequently have low income, thus contributing to inter-generational transmission of poverty. (Gratham-McGregor *et al.,*; Gratham-McGregor, and Ani, 2001). Furthermore, childhood stunting increases the likelihood of adult chronic diseases, (Barker *et al.,* 2005).

Currently, Nigeria's Human Capital Index is ranked 116 out of 122 countries in Education and also 116 out of 122 in Health and wellness (NHDR, 2014).

CONCLUSION

This study has shown that levels of stunting and underweight in public schools have a strong relationship with the poor academic achievement in Nigeria. Policies and strategies to reduce health risk and enhance a competitive work force need to be put in place urgently.

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