

# The study of nutritional status and academic performance of primary school children in Zaria, Kaduna State, Nigeria

## ABSTRACT

**Aim:** The present study was carried out to assess the relationship between nutritional status and academic performance of primary school children in Zaria, Kaduna State, Nigeria. **Materials and Methods:** School children from primary 3 to 6 were enrolled for the study and they were selected from three randomly selected primary schools within Zaria in Kaduna State, Nigeria. A total of 759 pupils made up of 385 girls and 374 boys were assessed. Ethical clearance was obtained from Ahmadu Bello University Teaching Hospital, Zaria, and self-administered questionnaires were completed by the parents or guardians of the children. Body anthropometrics such as height, weight, and mid-upper arm circumference were measured using a stadiometer and a measuring tape from which the body mass index (BMI) was calculated. The nutritional status of the children was determined using the Centre for Disease Control standard for BMI percentile, while the academic performance of the children was determined by finding the mean of five subjects taken during term examination. **Results:** The results of the present study showed that overweight children performed better academically when compared to the other children with a mean academic score of  $66.19 \pm 17.00$ ; underweight was observed to be more prevalent among the males than the females, while on the other hand, overweight was more prominent in females than males. **Conclusion:** The present study showed that a high percentage of the population has healthy weight, while only a small proportion was obese. This could be a result of imbalance in the food intake of the population, and from the results, it was observed that the total number of children who were overweight performed better academically than the others, which could mean that the children who were well fed and well nourished tend to do better academically than those who are not.

**Key words:** Academic performance, anthropometry, children, nutritional status, Zaria

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## INTRODUCTION

Nutrition is a fundamental pillar of human life, health, and development across the entire lifespan.<sup>[1]</sup> From the earliest stages of fetal development, at birth, through infancy, childhood, adolescence, and into adulthood and old age, proper food and good nutrition are essential for survival, physical growth, mental development, performance and productivity, health, and well-being.<sup>[2]</sup> Evidence has shown that physical growth and cognitive development in children are faster during the early years of life, and that by the age

of 4 years, 50% of the adult intellectual capacity has been attained, and before 13 years, 92% of adult intellectual capacity is attained.<sup>[3]</sup>

Poor nutritional status is one of the major causes of low academic performance and productivity in primary education which may affect the physical and cognitive development in children during their early years of life.<sup>[4]</sup> Identifying the variables that influence the achievement of school children is of great importance because it

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would serve as an essential tool for Nigerian Universal Basic Education Board and for other policymakers in the design of education policies. This would eventually lead to a rise in the quality of primary education and pupils nationally. Strong evidence exists that poor feeding practices are associated with stunted growth and delayed mental development<sup>[5,6]</sup> and that there is a relationship between impaired growth status and both poor school performance and intelligence quotient (IQ).<sup>[6]</sup> The relationship between timely and quality dietary intake, brain size, and academic performance has been documented,<sup>[7-9]</sup> and that a significant correlation exists between head circumference and IQ. This suggests that difference in human brain size could be relevant in explaining the differences in intelligence and academic performance although genetic and environmental factors such as socioeconomic, sociocultural, and psychological factors could be direct or indirect co-determinants of both intelligence and school performance.<sup>[9,10]</sup> Traditionally, family status variables such as socioeconomic status and parents' level of education have been regarded as predictors of children's academic achievement.<sup>[11,12]</sup> The aim of the present study was to investigate the relationship between nutritional status and academic performance of primary school children in Zaria, Kaduna State, Nigeria.

## MATERIALS AND METHODS

The study was conducted in Ahmadu Bello University Staff Primary School, Local Education Authority Primary School Samaru, Zaria and Jethro Academy Primary School Zaria, Kaduna State. Data on academic performance were calculated as the average from the total performance from the five basic subjects: Mathematics, English, Primary Science, Health Education, and Social Studies. A total of 759 pupils made up of 385 girls and 374 boys were assessed.

Nutritional status of the children was determined using the Centre for Disease Control (CDC) standard for body mass index (BMI) percentile by plotting the BMI values on the CDC BMI-for-age chart to obtain the percentile ranking of each child's BMI. When a child's BMI is less than the 5<sup>th</sup> percentile, it is underweight; from the 5<sup>th</sup> percentile to less than the 85<sup>th</sup> percentile, it is healthy weight; from the 85<sup>th</sup> to less than the 95<sup>th</sup> percentile, it is overweight; and while equal or greater than the 95<sup>th</sup> percentile, it is obese.

Ethical clearance certificate was obtained from the Health Research Ethics Committee, Ahmadu Bello University Teaching Hospital (ABUTH), Shika-Zaria, with Ethical Certificate number ABUTH/HREC/TRG/36. Permission to conduct the study was obtained from the relevant authorities governing the schools with the aid of an introductory letter obtained from the Department of Human Anatomy, Ahmadu Bello University, Zaria, which was presented to the headmasters of the schools where the study was carried

out. Only pupils whose parents or guardians gave informed consent participated in the study.

## Data collection

Data were collected from participants using a predesigned questionnaire. Sociodemographic statuses including age and sex were collected using the questionnaire while the academic performance was obtained from the mean score of the first, second, and third terminal examinations of the five basic subjects, namely, Mathematics, English, Primary Science, Health Education, and Social Studies. Anthropometric measurements taken include weight (kg), which was taken using a weighing balance in which the child was standing erect and facing forward with light clothing and without shoes. Height (cm) was measured by taking the maximum distance from the sole of the feet to the vertex of the head with child facing forward without shoes with feet together and arms by the sides. BMI was calculated as weight (kg)/height<sup>2</sup> (m<sup>2</sup>). The BMI in percentile was used for children and teens on the CDC BMI-for-age growth charts for the children to obtain a percentile ranking. The percentiles indicate the relative position of the child's BMI among children of the same sex and age. Mid upper arm circumference (cm) was measured with the bicep flexed and the measuring tape wrapped around the bicep, half way between the shoulder and the elbow. The condition of the equipment was verified before each measurement.

## Statistical analyses

Data were expressed as mean  $\pm$  standard deviation. Student's *t*-test was used to test differences in the mean of all variables of the participants based on sex. Chi-square test was used to test for association. Linear regression was used to predict equation for determining nutritional status and academic performance.  $P \leq 0.05$  was deemed statistically significant, and SPSS Version 20 (IBM, New York, USA) was used for the statistical analyses.

## RESULTS

A total of 759 primary school pupils in Zaria, Kaduna State, were enrolled in this study. The study comprised 374 boys and 385 girls. The age range of the study participants was 7–15 years, with mean age of  $10.81 \pm 1.42$  years. The mean age of boys and girls was  $10.86 \pm 1.46$  and  $10.76 \pm 1.39$  years, respectively. The results in Table 1 show that the mean weight of girls was  $32.94 \pm 6.54$  kg while that of the boys was  $32.22 \pm 6.76$  kg. The mean height of the girls was  $141.41 \pm 8.45$  cm while that of the boys was  $140.66 \pm 7.98$  cm. The results show that the girls have higher BMI value of  $16.40 \pm 2.46$  than the boys with a value of  $16.20 \pm 2.43$ . The results also show that the girls have higher academic performance of  $66.39\% \pm 16.05\%$  than the boys' academic performance of  $63.45\% \pm 17.45\%$ .

The nutritional status of the children was assessed using the CDC (2007) reference values. The results in Table 2 show that

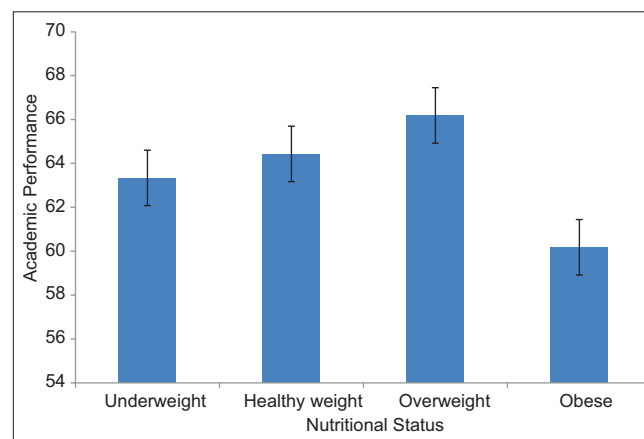
a total of 71 male children were underweight and 69 female children were underweight though the difference was not significant. On the other hand, overweight was more prominent in the females with a total of 26 children than in the males with a total of 12 children. The results show that overweight children performed better academically than others as shown in Figure 1.

The results from the present study show that weight together with height was a strong possible predictor of academic performance in children when compared to other variables as shown in Table 3. The  $R^2$  value obtained for predicting academic performance in children using weight and height was 0.01; likewise, BMI was a strong possible predictor of nutritional status in children when compared to other variables. The  $R^2$  value obtained for predicting nutritional status in children using BMI was 0.01.

## DISCUSSION

The results from the present study show that there was a relationship between nutritional status and academic

performance and the results showed BMI, weight, and height could be used to estimate academic performance of primary school children in Zaria Kaduna State of Nigeria. The nutritional status is one of the important indicators to determine a child's academic performance, which is often



**Figure 1:** The relationship between nutritional status and academic performance of primary school children

**Table 1: Descriptive statistics of anthropometric parameters of all the children (n=759) according to sex**

Parameters	All (n=759)		Boys (n=374)		Girls (n=385)	
	Mean±SD	Minimum-maximum	Mean±SD	Minimum-maximum	Mean±SD	Minimum-maximum
Age (years)	10.81±1.42	7.00-15.00	10.86±1.46	7.00-15.00	10.76±1.39	7.00-15.00
Weight (kg)	32.59±6.65	20.0-75.0	32.22±6.76	20.0-75.0	32.94±6.54	21.0-63.0
Height (cm)	141.04±8.23	1.18-1.69	140.66±7.98	122.0-169.0	141.41±8.45	118.0-166.0
BMI (kg/m <sup>2</sup> )	16.30±2.45	9.51-31.22	16.20±2.43	9.51-31.22	16.40±2.46	9.64-27.57
MUAC (cm)	20.81±4.21	14.80-76.0	20.98±5.30	15.0-76.0	20.66±2.81	14.8-33.0
AP	64.26±16.45		63.45±17.45		66.39±16.05	

$P=0.05$ . BMI=Body mass index; MUAC=Mid-upper arm circumference; AP=Academic performance; SD=Standard deviation

**Table 2: Sex and nutritional status**

	Male (n=374)	Female (n=385)	Total	$\chi^2$	P
Underweight (<5 <sup>th</sup> percentile)	71	69	140	5.88	0.12
Healthy weight (5 <sup>th</sup> -<85 <sup>th</sup> percentile)	287	283	570		
Overweight (85 <sup>th</sup> -95 <sup>th</sup> percentile)	12	26	38		
Obese (>95 <sup>th</sup> percentile)	04	07	11		
Total	374	387	759		

$P<0.05$

**Table 3: Regression equation of the population**

	Predictive equation	R	R <sup>2</sup>	SEE	P
AP	(76.15) + (0.36 × WT) + (-0.16 × HT)	0.13	0.01	14.08	0.00
	(39.77) + (1.12 × BMI)	0.14	0.02	20.05	0.00
	(51.07) + (0.34 × MUAC)	0.07	0.01	20.20	0.00
NS	(2.48) + (0.03 × BMI)	0.12	0.01	0.73	0.00
	(2.69) + (0.02 × MUAC)	0.10	0.01	0.73	0.01

AP=Academic performance; WT=Weight; HT=Height; BMI=Body mass index; MUAC=Mid-upper arm circumference; NS=Nutritional status; SEE=Standard error estimate

defined as the fundamental pillar of human life, health, and development across the entire lifespan.<sup>[1]</sup> Improved nutritional status has been shown to have a positive and direct impact on academic achievement of children.<sup>[11]</sup> Primary education is a vital stage in the development of consciousness and personality of the child as it is at this juncture that a whole new world of bright ideas and knowledge is opened up in front of the eyes of the children.<sup>[12,13]</sup> At this stage of development, children are extremely inquisitive and elementary education must encourage this tendency among the children from different ethnic, cultural, and socioeconomic background.

In the present study, there was a weak relationship between nutritional status and academic performance of the school children in Zaria, Kaduna State. Genetics and nutrition may be responsible to the variations that occur in early developmental abilities of children not minding their socioeconomic background.<sup>[14-16]</sup> According to the CDC chart, underweight was observed to be more prevalent among the males than females, while on the other hand, overweight was more common in the females than in the males though the difference was not significant. The results from the present study show that overweight children performed better academically compared to the other children, though if a child is overweight, it does not imply that the child is well fed.<sup>[1,15]</sup> There are some clinical symptoms and conditions that can cause overweight and consequently obese condition according to the work of Essien *et al.* who reported that when children's basic nutritional and fitness needs were met, they have the cognitive energy to learn and achieve higher grades academically.<sup>[11]</sup> A child that is well fed with a balanced diet will increase in weight and such child also involves in some kind of exercise to keep the body fit according to Ivanovic *et al.* and Fleet, who found that the easiest way to improve memory and boost focus in children is through exercise.<sup>[17,18]</sup> When a child is focused, it tends to perform better academically, and a child that is well fed or has good nutrition can focus better and thereby perform better academically.

The results from the present study also show that there were differences based on the sexes of the children in most of the variables studied, showing that the study population exhibits sexual dimorphism. The boys had higher values than the girls in only age and mid-upper arm circumference. The mean height of the whole population was 141.04 ± 8.23 cm, and from the study, it can be concluded that the female children had higher values in weight and height than the male children which may be due to the fact that the body physique is influenced by climatic, hereditary, nutritional, and racial factors, as reported by Rastogi *et al.*<sup>[14]</sup> Comparison of the BMI of the children showed that the girls had significantly higher values than the boys which may

be due to the age of the study population which is closer to the age of puberty.

## CONCLUSION

The present study has shown that a weak relationship exists between nutritional status and academic performance and the variation could be as a result of genetics and environmental factors such as a result of imbalance in food intake of the population. A high percentage of the population is of healthy weight, while only a small proportion was obese. Children who were overweight performed better academically than healthy weight, underweight, and obese children. The girls had higher grades academically than the boys though the difference was not significant.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

## REFERENCES

1. Food and Agricultural Organization. Nutrition and Development: A Global Assessment. International Conference on Nutrition, Rome; 1992. p. 23-5.
2. World Health Organisation. Nutrition for Health and Development. Geneva: World Health Organisation; 2000. p. 34-59.
3. Vernon PE. The development of cognitive process. In: Hamilton V, Vernon P, editors. Development of Intelligence. London Academic Press Inc. London. 1999. p. 507-41.
4. Ivanovic D. Does undernutrition during infancy inhibit brain growth and subsequent intellectual development? *Nutrition* 1996;12:568-71.
5. Mendez MA, Adair LS. Severity and timing of stunting in the first two years of life affect performance on cognitive tests in late childhood. *J Nutr* 1999;129:1555-62.
6. PAHO. Nutrition, Health and Child Development. (PAHO Scientific Publication No. 566). Washington, DC: Pan American Health Organization; 1998.
7. Strupp BJ, Levitsky DA. Enduring cognitive effects of early malnutrition: A theoretical reappraisal. *J Nutr* 1995;125 Suppl 8:2221S-32S.
8. Florey CD, Leech AM, Blackhall A. Infant feeding and mental and motor development at 18 months of age in first born singletons. *Int J Epidemiol* 1995;24 Suppl 1:S21-6.
9. Vernon PA, Wickett JC, Bazana PG, Stelmack RM. The neuropsychology and psychophysiology of human intelligence. In: Sterberg RJ, editors. Handbook of intelligence. Cambridge University Press, New York. 2000.
10. Wickett JC, Vernon PA, Lee DH. Relationship between factors of intelligence and brain volume. *Pers Individ Dif* 2000;29:1095-122.
11. Essien E, Harvna MJ, Emebu PK. Prevalence of malnutrition and its effects on the academic performance of students in some selected secondary schools in Sokoto metropolis. *Pak J Nutr* 2012;7:511-5.
12. Joan MT, Smrekar CW. Influence of parents' level of education, influence on child's educational aspirations and attainment. *Br J Med Res* 2009;3:1062-73.

13. Hall A, Khanh LN, Son TH, Dung NQ, Lansdown RG, Dar DT, *et al.* An association between chronic undernutrition and educational test scores in Vietnamese children. *Eur J Clin Nutr* 2001;55:801-4.
14. Rastogi P, Nagesh KR, Yoganasimha K. Estimation of stature from hand dimensions of North and South Indians. *Leg Med (Tokyo)* 2008;10:185-9.
15. Ivanovic DM, Leiva BP, Pérez HT, Almagià AF, Toro TD, Urrutia M, *et al.* Nutritional status, brain development and scholastic achievement of Chilean high-school graduates from high and low intellectual quotient and socio-economic status. *Br J Nutr* 2002;87:81-92.
16. Duyar I, Pelin C. Estimating body height from ulna length: Need of a population specific formula. *Euro Asian J Anesth* 2010;1:11-7.
17. Ivanovic DM, Leiva BP, Pérez HT, Olivares MG, Díaz NS, Urrutia MS, *et al.* Head size and intelligence, learning, nutritional status and brain development. *Head, IQ, learning, nutrition and brain. Neuropsychologia* 2004;42:1118-31.
18. Fleet, A. Ways exercise increase intelligence; *Neurobiology of learning and memory. A study from the Department of Neurology, University of Muensters, Germany, Concoursemedia* 2015;5:115-25.

