Comparative Study of Body Mass Index and Academic Performance among Primary School Pupils in Dutse Local Government Area, Jigawa State

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Abstract

The prevalence of obesity has significantly increased globally for individuals of all ages, leading to numerous health risks and lower health-related quality of life. Additionally, research has shown a correlation between obesity and academic performance, with inconsistent findings ranging from a strong negative correlation to a weak positive correlation. Factors such as grade level, gender, geographic region, subjects, and the assessment of academic achievement have been suggested as potential culprits for the observed inconsistency. The aim is to explore the relationship between Body Mass Index (BMI) and academic performance in various academic subjects and across different age groups. The research was utilized with a cross-sectional design, collecting data from a representative sample of students from primary educational institutions. BMI was calculated based on height and weight measurements, while academic performance was assessed through standardized tests in their offered subjects. Statistical analyses was conducted to determine the strength and direction of the association between BMI and academic performance, adjusting for potential confounding factors such as socioeconomic status, gender, and physical activity levels. 200 students participated in the study; with equal distribution of percentage (50% each) and age range of 9-12 and 5-8 years. The findings suggest that individuals with lower BMI may have higher academic scores and better school performance compared to those with higher BMI. The study found that both genders showed a significant decrease in BMI with age, with females having higher mean BMI values within each age group. The study also revealed a strong association between BMI and academic performance, with some studies suggesting that cognitive ability is influenced by obesity and the quality of nutrition.

Keywords: body mass index, academic performance, primary school pupils

Introduction

Globally, the prevalence of obesity has increased dramatically over the past few decades for children, adolescents and adults in both developed and developing countries. Given that it has become clear that obesity is closely linked to various physical and psychological health

risks and lower health-related quality of life, obesity has become a major global health challenge.[1-4] In addition to the well-known associations between obesity and the health-related outcomes, obesity has also been shown to be associated with students' academic performance.[5] Body mass index (BMI) has been widely used in research and project evaluations for weight status, and previous studies that aimed at exploring the relationship between obesity and academic achievement typically used BMI in their studies.[6]

In previous studies, several factors (e.g. grade level, gender, geographic region, subjects and the assessment of academic achievement) have been suggested to be culprits for the observed inconsistency between obesity and academic achievement. For instance, Mo-suwan et al[7] found that grade might be an important factor because their study showed that such association only existed among adolescents from seventh to ninth grade, but not among children from third to sixth grade. The aim of this research is to examine the relationship between BMI and academic performance in different academic subjects and across different age groups.

Materials and Methods
Study Location
The study was conducted in Dutse metropolis, Jigawa State, Nigeria
Study Population
The study was conducted in two (2) randomly selected primary (public and private) schools in Dutse Local Government Area of Jigawa State namely, Zai Primary School and Golden-Brown Academy.
Ethical Consideration
Ethical approval was obtained from Department of Human Anatomy, Federal University Dutse Research Ethics Committee and permission to conduct the study was only obtained from the authorities of participating schools. Only subjects who gave informed consent to participate with the research were included in this study.
Study Design Sampling Technique
A cross-sectional study design would be adopted in this study to compare the relationship between Body Mass Index (BMI) and academic performance of school children. Simple random sampling was be adopted to select samples. G-Power computer software was used to determine sample size, using an effect size of 0.5, α level of significance of 0.05, and statistical power of 0.84 were used which gave minimum sample size of 173 participants. Thus, a minimum number of 173 students would have to be used in this study in orderto draw valid conclusions from it. However, a total of 200 students were recruited for the purpose of this study.

Inclusion Criteria
1. A student of the participating schools
2. Mentally and physically fitted
3. Regularly school-attending individuals
4. Having complete academic records

Exclusion Criteria
5. A student from non-participating school
6. Subjects who declined to participate will be excluded
7. Subjects with physical deformity

Methods
The details and purpose of the study were explained to the school's authorities and oral consent were obtained from the participants. Data of participating students' academic records were collected from the concerned school authority and measuring different anthropometric parameters were performed as follows:

Height
Height was measured with a stadiometer, with the subject standing erect and without shoes. The height was measured and recorded to the nearest 0.1 cm

3Weight
The measurement was done using weighing scale. Participants were asked to remove all heavy objects including school bags and shoes. The weight was measured with minimum clothing and was recorded to the nearest 0.1 kg.

Body Mass Index
Body Mass Index (BMI) was calculated by dividing the individual's weight in kilograms by square of their height in meters {BMI = Weight (Kg) / Height (m^2)}. **All measurements taken were recorded in the SI units** (kg/m²).

Data Analysis
Data was collected and sorted out in Microsoft Excel before analysis. IBM Statistical Package (SPSS 20.0) was used to analyze the data. Results were presented as mean ± standard deviation (SD). The relationship between variables (BMI and academic performance) was compared using Independent sample t-test. The correlational analysis between the quantitative variables was determined using Pearson correlation. Value of $p<0.05$ was considered significant.

Results
The demographic characteristics of the participants as revealed from Table 1 below indicated that there were equal participants in the study with 100 male (50%) as there are females (50%). Participants of age range 9-12 years (72.8%) were more compared to younger age of 5-8 years (27.2%).

Table 1: Demographic characteristics of the participants

Characteristics	Frequency	Percentage (%)
GENDER		
Male	100	50
Female	100	50
Total	200	100
AGE		

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5-8	54	27
9-12	146	73
Total	200	100

Table 2 shows the mean value age for both subject sex (male and female) were 9 years with a minimum of 5 and maximum of 12 years in males and a minimum of 6 and maximum of 12 years in females. The body mass index of the subjects was 17.48 ± 1.93 and 18.34 ± 1.21 in males and females respectively, while the average academic performance expressed in percentage were 74.31 ± 11.50 in males and 68.82 ± 9.26 in females.

Table 2: Descriptive statistics of age, body mass index and academic performance

Sex		Minimum	Maximum	Mean	SD
Male	AGE	5	12	9.08	0.87
	BMI`	14	19	17.48	1.93
	AP	37	82	74.31	11.50
Female	AGE	6	12	9.99	1.39
	BMI	47	21	19.24	1.21
	AP	14	93	68.82	9.26

BMI=Body mass index   AP= Academic Performance   SD=   Standard Deviation

Table 3 revealed the results of independent sample t-test to reckon sexual dimorphism among the variables. There was significant difference in body mass index and academic performance of the mean groups in both males and females subjects ($P<0.05$) with 17.48 ± 1.93 in males and 19.24 ± 1.21 in females. Also, there was significant statistical difference ($P<0.001$) in the academic performance of males and females subjects with respective average score of 74.31 ± 11.50 and 68.82 ± 9.26 in males and females.

Table 3: Sexual dimorphism in body mass index and academic performance

Variables	Sex	N	Mean	SD	*t*-value	*p*-value
BMI	Male	100	17.48	1.93	-12.84	<0.05
	Female	100	19.24	1.21		
AP	Male	100	74.31	11.50	-14.13	<0.001
	Female	100	68.82	9.26		

BMI=Body mass index   AP= Academic Performance   SD=   Standard Deviation

Table 4: The result of Pearson's correlation analysis between body mass index and academic performance revealed a moderately strong positive correlation between body mass index and academic performance with r value 0.4 (P<0.01) in male and strong negative correlation in females (r= -3.11, P=0.31).

Table 4: Pearson's correlation of the study variables

Variables	Sex	N	R	R^2	P-value
BMI — AP	Male	100	0.4	0.16	<0.05
	Female	100	-3.11	9.672	0.31

AP= Academic Performance   N=Number of participant

Discussion

This study revealed that body mass index has positive and significant relationship with academic performance (p<0.05). The study shows that the mean body mass index of the subjects was 17.48 ± 1.93 and 18.34 ± 1.21 in males and females respectively, while the average academic performance expressed in percentage were 74.31 ± 11.50 in males and 68.82 ± 9.26 in females. The independent sample t-test to reckon sexual dimorphism among the variables shows that there was significant difference in body mass index and academic performance of the mean groups in both males and females subjects (P<0.05) with BMI of 17.48 ± 1.93 in males and 19.24 ± 1.21 in females. Also, there was significant statistical difference (P<0.001) in the academic performance of males and females subjects with respective average score of 74.31 ± 11.50 and 68.82 ± 9.26 in males and females. The Pearson correlation analysis of this study shows there is moderately strong correlation (r= 0.4, P<0.05) between body mass index and the mean academic performance.

The significant difference observed from this study when correlating body mass index with academic performance suggests that individual with lower BMI may possess higher academic score and be able to perform better in school than those with lesser BMI. According to Mika'il *et al.* [8] individual differences exist among human beings in terms of their reasoning, learning and the ability to comprehend complex ideals in order to adopt effectively to their environment. In this present study, the mean body mass index (BMI) of both genders showed a significant decrease with age. Between genders, females had higher mean BMI values with in each age group. The reason for this finding may be attributed to the fact that in children, BMI changes physiologically (substantially) with age and sex. Higher prevalence of obesity among adolescent girls may be linked to early attainment of puberty as compared to boys. Post pubertal adolescent girls in the socio-cultural milieu of developing countries like ours have very low levels of physical activity that is mainly restricted to household chores. Their participation in outdoor games and other health-enhancing physical activities are much less as compared to boys.

The present study results revealed a strong association between the Body Mass Index and Academic Performance. BMI or obesity is negatively associated with academic performance among schoolchildren in some studies. Some studies have demonstrated that cognitive ability is influenced by obesity and the likelihood of being obese is influenced by the quality of nutrition. Barness *et al.* [9] study in obesity has also proven to lead to mental and emotional problems, such as anxiety and depression. There is some potential explanation for reveres association between student grades average and BMI: firstly, as proven in previous studies, there is a significant correlation between high BMI and depression that could strongly affect student performance. Besides, obese students are mostly less physically activated which led them to experience lower school performance compared with normal BMI students.

Conclusion

The results of this study suggest that the relationship between BMI and academic performance is moderated by both socioeconomic status and gender. The findings indicate that the negative association between BMI and academic performance is more pronounced in individuals from lower socioeconomic backgrounds, highlighting the importance of addressing the impact of socioeconomic disparities on academic outcomes. Additionally, it's found that the relationship

between BMI and academic performance is stronger for females than males, suggesting that gender may also play a role in this association. These findings have important implications for educational interventions and policies aimed at promoting healthy lifestyles and academic success, as they should consider the potential moderating effects of socioeconomic status and gender.

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