AN APPRAISAL OF BODY'S HEALTH AND WELLNESS PARAMETERS ON THE STUDENTS ACADEMIC PERFORMANCE IN MATHEMATICS AND SCIENCES IN SOUTHWEST NIGERIA

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ABSTRACT

This study was carried out to appraise body's health and wellness parameters on students' academic performance in mathematics and sciences. The research design for this study was a descriptive research of the survey type A multi-stage sampling technique was used to collect information from 1800 school students within 3 states in Southwest, Nigeria.. Two instruments used for data collection were Mathematics Achievement Test (MAT) and Standardized Body Measuring devices (SBMD). The face, content and construct validity of the instruments were ascertained, this yielded inter-rater coefficient of 0.76. The reliability of the instrument was calculated using the test-retest which gives 0.78 reliability coefficient. A multi dimensional general question was raised and a multi dimensional hypothesis was postulated at 0.05 alpha levels. The result of the findings shows that the healthier the child the better the academic performance in mathematics. It also reveals that the healthy environment is a sure way for academic propagation in mathematics and science teaching. In light of these findings and considering their implications recommendations were made.

Keywords: Place; health; wellness; body parameters; academic performance; mathematics

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INTRODUCTION

Mathematicians are in constant search for holistic development, consciously or unconsciously, directly or indirectly, overtly or covertly, they attempt to discover the world around them through different means. It seems almost every field of human endeavour (health, biology, medicine and management) providing qualitative and quantitative techniques for planning, managerial decision making and economic, using Mathematics to fix the right peg in the right hole. Oginni (2013) asserted that individual characteristics such as health and physical statures are generally overlooked as underlying factors that undermine mathematical educational efforts in schools. Without eating good food, along with the proper amounts of protein, dairy, carbohydrates, and good fats, children may face a number of problems, including stunted growth, poor academic performance, susceptibility to disease and disrupted sleep patterns.

Documentation on health and wellness of children in the teaching of sciences and Mathematics in school setting was unacceptably low. Hunger is a psychological and physiological state resulting from insufficient food intake to meet immediate energy need (NCHST,1997) Hunger may affect learning by decreasing individual receptive and ability to profit from new experiences Health and wellness will require not only education regarding the amount of food intake but its influence on the body parameters (Body Mass Index (BMI), height, weight, head circumference, finger length, arm length, neck circumference, hip circumference and waist circumference) and also its effect on teaching and learning Mathematics and sciences in schools.

Scientific evidence shows that there are key areas in which schools can take action to improve the health and performance of students in mathematics. In fact, a structured maintenance of children wellness is a cornerstone of academic performance. Mendell (1993) affirmed that children are inherently more vulnerable to environmental hazards because their bodies are still developing. Substandard environmental conditions in schools, such as insufficient cleaning or inadequate ventilation, can cause serious health problems for children. The introduction of breakfast and lunch for the pupils in basic schools in Nigeria schools is a strategy to make an impact on pupil's health, wellness and academic performance in mathematics and sciences. Organizing school breakfast and lunch could make a difference in creating awareness about the benefit associated with body development. Health and wellness in children could enable the school teacher and psychologist predicts the level of stability of a child in the classroom. Pollitt et.al (1996) confirmed that children that are taken both breakfast and lunch in the classroom setting perform higher than those that taken lunch alone in arithmetic and verbal reasoning. According to Amao and Disu (2012) many factors contribute to poor performance on students' achievement. Among these are family values and climate, school environment, teachers' factors, society's view about mathematics, peer pressure, and test-taking anxiety. At another dimension, students' judgment of their capability to accomplish a task or succeed in an activity, or self-efficacy, is a key factor.

Every component of children body functions with respect to the amount of food intake and other health issues which had been contributing significantly directly or indirectly to Head sizes, weight, height, finger length, arm length among others as well as academic performance. A number of studies have assessed the effects of fasting on learning ability by examining classroom academic performance as well as the standardized test. According to Choa and Vanderkooy (1989) nutritious food during school hours affect school aged children in two ways; Firstly the morning or noon food contribute to both quantity and quality of balanced diet. Secondly, school meal initiative are generally believe to enhance the cognitive functioning of children especially in speed of accuracy, spatial and mathematical reasoning (Abdullah,2012).

Research Question

Is there any difference in the measures of body parameters of students in Mathematics and the academic performance?

Research Hypothesis

$HO_{1:}$ There is no significant difference between body health and wellness parameters and the academic performance of students in Mathematics.

METHODOLOGY

The population of this study consisted of all Senior Secondary School (S.S.S 3) students within southwest, Nigeria..The sample consisted of 1800 students selected from three states (OSUN, ONDO and EKITI) using multi stage sampling technique. The research design of the study was a descriptive research of survey type. The instruments used for the study were Mathematics Achievement Test (MAT) and Standardized Body Measuring Devices (SBMD) which are adapted by the researcher for the purpose of the study. The study made use of Mathematics Achievement Test (MAT) consisting of 50 multiple choice objective items. These items were made up of WAEC past questions, put together by the researcher. The MAT consisted two sections. (A and B). Section A sought to elicit information concerning personal data like name, gender and school name. Section B consisted of fifty multiple choice questions with five options labeled A-E with instruction to choose any of the options.

The measuring devices used include, tape rule (TR) mechanical personal scale (MPS) for Weight (nearest 0.1 kg), Stadiometer rule (SR) and *Tape rule* (TR) The instruments were used to take the diameter of the head, hips, waist and neck of the subjects. *Mechanical* personal *Scale* (MPS) was used to weigh the body mass of the subjects involved. *Long Meter Rule* and stadiometer rule (LMR/ SR) were used to measure the height of the subjects during the exercise. (nearest 0.1 cm) will be measured using a height board (RI Woonsocket, Short productions; New York, USA)*Record books* would be used to record vital information such as age, reaction time and other body parameters. This study employ diplomatic observation in selecting students, looking

into: How big or small the head is? The height of the student is? What the result of body mass and other relevant anatomy needed for this study is?

Face and content validity of the instruments were ensured by the curriculum experts, mathematics scholars and human kinematics educators. The inter-rating of the validity of the instrument yielded 0.76 coefficients. The reliability coefficient of the instrument for the study was determined by using test retest. The reliability coefficient for the instrument was found to be 0.78. The researcher employed the services of research assistants which are mostly Mathematics teachers. The general question raised and the hypothesis formulated was subjected to appropriate statistical techniques such as frequency counts, means, mode, median standard deviations, variances and percentages for descriptive statistics. Hypothesis was tested by using both ANOVA and Duncan Post Hoc analysis at every stage to discover the degree of variability of each parameter. The hypothesis formulated was tested at 0.05 level of significance

Research Question

Is there any difference in the measures of body parameters of students in Mathematics and the academic performance?

Table 1: Descriptive Statistics on body parameters and academic performance

Measure of descriptive		Weigh (BW)	Heig ht	Head	Neck	Waist	Finger	BMI	BAI	**Hip circu m**	Leg	Arm
Percentag e scores of the students in Mathemati cs test	0-9	49.94	1.59	34.86	19.67	46.17	5.81	17.94	52.94	61.19	46.28	23.76
	10-19	51.44	1.61	43.06	26.17	59.33	7.07	18.31	67.83	73.44	55.11	33.07
	20-29	51.65	1.61	43.97	27.28	60.94	7.11	18.67	70.98	78.79	58.71	33.79
	30-39	52.58	1.62	45.81	27.85	62.78	7.86	18.95	72.53	81.40	61.44	34.74
	40-49	53.89	1.64	48.50	29.56	65.83	8.39	19.93	76.44	87.54	65.98	36.96
	50-59	54.36	1.66	51.50	30.06	67.47	8.52	20.25	79.61	91.14	67.86	38.30
	60-69	54.89	1.67	52.50	31.44	71.67	8.64	20.64	81.72	94.11	68.67	38.97
	70-79	56.86	1.69	54.00	32.50	72.89	9.00	20.80	84.78	96.50	73.17	39.50
	80-89	57.39	1.70	54.44	33.03	73.94	9.26	21.28	85.92	97.81	73.86	40.09

a multiple mode exist, the smallest value is shown

Table 1 showed that the students with BW of 49.94 Kg scored between 0-9% in MAT, BW of 51.44kg scored between 10-19% in Mathematics, BW of 51.65kg between scored 20-29 % in MAT, BW of 52.58kg scored between 30-39% in MAT, BW of 53.89kg scored between 40-49 % in MAT, BW of 54.36kg scored between 50-59% in MAT, BW of 54.89kg scored between 60-69% in MAT, BW of 56.86kg scored between 70-79 % in MAT. Body weight of 57.39kg scored between 80-89 % in MAT. However, as the body weight increases the percentage score in MAT increases.

The table shows that the students with BH of 1.59m scored between 0-9% in the MAT, BH of 1.61m scored between 10-19% in the MAT, BH of 1.61m scored between 20-29% in the MAT, BH of 1.62m scored between 30-39% in the MAT, BH of 1.64m scored between 40-49% in the MAT, BH of 1.66m scored between 50-59% in the MAT. BH of 1.67m scored between 60-69% in the MAT, BH of 1.69m scored 70-79% in the MAT, BH of 1.70m scored 8--89% in the MAT, BH of 1.70m scored 80-89% in the MAT

Table 1 also showed that the students HC of 34.86cm scored between 0-9% in the MAT, HC of 43.06cm scored between 10-19% in the MAT, HC of 43.97cm scored between 20-29% in the MAT, HC of 45.81cm scored between 30-39% in the MAT, HC of 48.56cm scored between 40-49% in the MAT, HC of 51.56cm scored between 50-59% in the MAT, HC of 52.50cm scored between 60-69% in the MAT, HC of 54cm scored between 70-79% in the MAT, HC of 54.44cm scored between 80-89% in the MAT, HC of 55.25cm scored between 80-89% in the MAT. Therefore, as the HC increases the percentage score in MAT increases.

The table revealed that the students with NC of 19.67cm scored between 0-9% in the MAT, NC of 26.17cm scored between 10-19% in the MAT, NC of 33.03cm scored between 80-89% in the MAT However, as the neck circumference increases the percentage score in MAT increases.

Moreover, from the table 1, it was shown that the students with WC of 46.17cm scored between 0-9% in the MAT, WC of 59.33cm scored between 10-19% in the MAT, WC of 60.94cm scored between 20-30% in the MAT, WC of 62.76cm scored between 30-40% in the MAT, WC of 73.94cm scored between 80-89% in the MAT However, as the AWC increases the percentage score in MAT increases.

The result from table 1 further showed that the students with hip circumference of 52.94cm scored between 0-9% in the MAT, hip circumference of 67.32cm scored between 10-19% in the MAT, hip circumference of 70.98cm scored between 20-29% in the MAT, hip circumference of 72.53cm scored between 30-39% in the MAT, hip circumference of 76.44cm scored 40-49% in the MAT, hip circumference of 79.61cm scored 50-59% in the MAT, hip circumference of 81.72cm scored 60-69% in the MAT, hip circumference of 84.78cm scored 70-79% in the MAT. However, as the MHC increases the percentage score in MAT increases.

Table 1 also showed that the student with LL of 61.19cm scored between 0-9 % in the MAT. LL of 73.44cm scored between 10-19% in the MAT. LL of 78.59 cm scored 20-29% in the MAT. LL of 81.4cm scored 30-39% in the MAT, LL of 96.50cm scored 70-79% in the MAT By implication, as the percentage score in MAT increases the ALL also increases.

The table 1 also showed that the students with AL of 46.28cm scored between 0-9% in the MAT; AL of 55.11cm scored between 10-19% in the MAT, AL of 65.98cm scored between 40-49% in the MAT; AL of 67.66cm scored between 50-59% in the MAT. By implication, as the percentage score in MAT increases the AAL also increases.

The result of table 1 showed that the students with BMI of 17.94 scored between 0-9% in the MAT; BMI of 18.31 scored between10-19% in the MAT, BMI of 20.64 scored 60-69% in the MAT. By implication, as the percentage score in MAT increases the ABMI also increases. The table showed that the students with BAI of 23.76 scored between 0-9% in the MAT; BAI of 33.07 scored between 10-19% in the MAT, BAI of 38.98 scored between 60-69% in the MAT By implication, as the percentage score in MAT increases the ABAI also increases.

Testing of Hypothesis

$HO_{1:}$ There is no significant difference between body health and wellness parameters and the academic performance of students in Mathematics.

Table 2 *ANOVA summary on body weight and performance in the three states*

Source of var.	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.938	2	1.969	0.0105	.974
Within Groups	134654.5	1798	74.89		
Total	134658.4	1800			

Table 2 showed that the F_{cal} (0.0105) < F_{tab} (3.689) we have statistical reasons not to reject Ho and concluded that there is no significant difference between the means Body weight of the three states.

Table 3 ANOVA summary on body height and academic performance of the three states

Source of variation	*Sum of squares*	*Df*	*Mean square*	*F*	*Sig*
Between groups	1132.271	2	566.136	2.57173	.077
Within groups	395807.9	1798	220.138		
Total	396940.1	1800			

Table 3 showed that F calculated is 2.57173 < F_{tab}(3.689) at 0.05 level of significance, we have statistical reasons not to reject Ho and conclude that there is no significant difference in the means Body height of the three states and the students' academic performance in Mathematics.

Table 4 ANOVA summary on head circumference and academic performance of the three states

Source of variation	Sum of squares	Df	Mean square	F	Sig
Between groups	8785.400	2	4392.700	17.532	.000
Within groups	450499.4	1798	250.555		
Total	459284.8	1800			

Table 4 revealed that F calculated is 17.532 > F_{tab}(3.689) at 0.05 level of significance we have statistical reasons to reject Ho and conclude that there is significant difference in the means head Circumference of the three states and the academic performance in Mathematics.

Table 5 DUNCAN summary on head circumference and academic performance of the three states

SSTATE	N	Subset for alpha=.05		
		1	2	3
EKITI	600	46.22		
ONDO	600		47.99	
OSUN	600			50.54
SIG		1.000	1.000	1.000

Table 5 showed that the academic performance and the head Circumference for the students in the three states were not the same, with students from OSUN having the highest mean score of 50.54, follow by students from ONDO State 47.99 and students from EKITI state having the least mean score of 46.22

Table 6 ANOVA summary on neck circumference and academic performance of the three states

Source of variation	Sum of squares	Df	Mean square	F	Sig
Between groups	3151.765	2	1575.883	15.1771	.000
Within groups	186692.4	1798	103.833		
Total	189844.1	1800			

Table 6 showed that: F calculated is 15.1771 > F_{tab}(3.689) at 0.05 level of significance, we have statistical reasons to reject Ho and conclude that there is significant difference between the means Neck Circumference of the three states.

Table 7 DUNCAN summary on neck circumference and academic performance of the three states

STATE	N	Subset for alpha=.05		
		1	2	3
EKITI	600	27.96		
ONDO	600		29.97	
OSUN	600			35.40
SIG		1.000	1.000	1.000

Table 7 showed the neck Circumference and MAT of the three states for the students were not the same, with students from OSUN having the mean score of 35.40, follow by students from ONDO State with average score of 29.97 and students from EKITI state having the least mean score of 27.96.

Table 8 ANOVA summary on waist circumference and academic performance of the three states

Source of variation	Sum of squares	Df	Mean square	F	Sig
Between groups	15305.759	2	7652.880	15.9834	.000
Within groups	860887.6	1798	478.138		
Total	876193.3	1800			

Table 8 showed that: F calculated is 15.9834 > F_{tab}(3.689) at 0.05 level of significance, we have statistical reasons to reject Ho and conclude that there is significant difference between the means waist Circumference of the three states.

Table 9 DUNCAN summary on waist circumference and academic performance of the three states

STATE	N	Subset for alpha=.05		
		1	2	3
EKITI	600	55.18		
ONDO	600		65.57	
OSUN	600			75.96
SIG		1.000	1.000	1.000

Table 9 showed the waist Circumference and MAT of the three states for the students were not the same, with students from OSUN having the highest average score of 75.96, follow by students from ONDO State with average score of 65.57 and students from EKITI state having the least score of 55.18.

Table 10 ANOVA summary on hip circumference and academic performance of the three states

Source of variation	Sum of squares	Df	Mean square	F	Sig
Between groups	34323.645	2	17161.822	19.8958	.000
Within groups	1550927	1798	862.584		
Total	1585250	1800			

Table 10 showed that: F calculated is 19.8958 > F_{tab}(3.689) at 0.05 level of significance, we have statistical reasons to reject Ho and conclude that there is significant difference between the means waist Circumference of the three states.

Table 11 DUNCAN summary on hip circumference and academic performance of the three states

STATE	N	Subset for alpha=.05		
		1	2	3
EKITI	600	77.66		
ONDO	600		84.31	
OSUN	600			96.66
SIG		1.000	1.000	1.000

Table 11 showed the hip Circumference and SMAT of the three states for the students were not the same, with students from OSUN having the highest average score of 96.66, follow by students from ONDO State with average score of 84.31 and students from EKITI state having the least score of 77.66.

Table 12 ANOVA summary on leg length and academic performance of the three states

Source of variation	Sum of squares	Df	Mean square	F	Sig
Between groups	29921.518	2	14960.759	16.642	.000
Within groups	1616362	1798	898.978		
Total	1646283	1800			

Table 12 showed that: F calculated is 16.642 > F_{tab}(3.689) at 0.05 level of significance, we have statistical reasons to reject Ho and conclude that there is significant difference between the means performance of the three states.

Table 13 DUNCAN summary on leg length and academic performance of the three states

STATE	N	Subset for alpha=.05		
		1	2	3
EKITI	600	61.31		
ONDO	600		64.42	
OSUN	600			68.37
SIG		1.000	1.000	1.000

Table 13 showed the leg Length and MAT of the three states for the students were not the same, with students from OSUN having the highest average score of 68.37, follow by students from ONDO State with average score of 64.42 and students from EKITI state having the least score of 61.31.

Table 14 ANOVA summary on arm length and academic performance of the three states

Source of variation	Sum of squares	Df	Mean square	F	Sig
Between groups	15583.533	2	7791.767	13.415	.000
Within groups	1044343	1798	580.835		
Total	1059926	1800			

Table 14 showed that: F calculated is 13.414 > F_{tab}(3.689) at 0.05 level of significance, we have statistical reasons to reject Ho and conclude that there is significant difference between the means performance of the three states.

Table 15 DUNCAN summary on arm length and academic performance of the three states

STATE	N	Subset for alpha=.05	
		1	2
EKITI	600	32.88	
ONDO	600		36.19
OSUN	600		39.50
SIG		1.000	.082

Table 15 showed that the arm length and MAT of the three states for the students were not the same with students from OSUN and ONDO States having the same average score of 39.50 and 36.19 respectively, and students from EKITI state having the least score of 32.88.

Table 16 ANOVA summary on finger length and academic performance of the three states

Source of variation	Sum of squares	Df	Mean square	F	Sig
Between groups	332.743	2	166.372	3.798	.035
Within groups	93117.884	1798	51.7897		
Total	93450.625	1800			

Table 16 showed that: F calculated is 3.798 > F_{tab}(3.689) at 0.05 level of significance we have statistical reasons to reject Ho and conclude that there is significant difference between the means finger Length of the three states.

Table 17 DUNCAN summary on finger length and academic performance of the three states

STATE	N	Subset for alpha=.05	
		1	2
EKITI	600	8.55	
ONDO	600	8.87	8.87
OSUN	600		9.14
SIG		.519	.073

Table 17 showed that the finger Length and MAT of the three states for the students were not the same, with students from OSUN and ONDO States having the same average score of 9.14 and 8.77 respectively, and students from EKITI and ONDO states having the same average score of 8.55 and 8.77.

Table 18: ANOVA summary on BMI and academic performance of the three states

Source of variation	Sum of squares	Df	Mean square	F	Sig
Between groups	104.535	2	52.267	2.256	.105
Within groups	41662.354	1798	23.171		
Total	41766.889	1800			

Table 18 showed that: F calculated is 2.256 < F_{tab}(3.689) at 0.05 level of significance we have statistical reasons not to reject Ho and conclude that there is no significant difference between the means score of the three states.

Table 19 *DUNCAN summary on BMI and academic performance of the three states*

STATE	N	Subset for alpha=.05	
		1	2
EKITI	600	18.5925	
ONDO	600	19.9690	19.96901
OSUN	600		21.4085
SIG		.525	.151

Table 19 showed the BMI and MAT of the three states for students were the same, the Duncan Multiple Range Test show that the scores of the students from OSUN and ONDO state were the same and given as 21.4085 and 19.9690 respectively and the score of students from ONDO and EKITI are statistically equal and given as 19.9690 and 18.5925 respectively.

Table 20: ANOVA summary on BAI and academic performance of the three states

Source of variation	Sum of squares	Df	Mean square	F	Sig
Between groups	6846.853	2	3423.427	36.38499	.000
Within groups	169172	1798	94.08898		
Total	176018.8	1800			

Table 20 showed that: F calculated is 36.38499 > F_{tab} (3.689) at 0.05 level of significance we have statistical reasons to reject Ho and conclude that there is significant difference between the means score of the three states.

Table 21 DUNCAN summary on BAI and academic performance of the three states

STATE	N	Subset for alpha=.05		
		1	2	341
EKITI	600	70.8424		
ONDO	600		75.4028	
OSUN	600			81.8148
SIG		1.000	1.000	1.000

Table 21 shows the BAI and MAT of the three states for the students were not the same, with students from OSUN having the highest average score of 81.8148, follow by students from ONDO State with mean score of 75.4028 and students from EKITI state having the least mean score of 70.8424.

Table 22 DUNCAN analysis of the mean separation of performance in the three states

STATE	BW	BH	HC	FL	NC	WC	Hip C	LL	AL	BMI	BAI
ONDO	54.67[a]	2.2704[a]	47.99[b]	8.77[ab]	29.97[b]	65.57[b]	84.31[b]	64.42[b]	36.19[a]	19.9[ab]	75.40[b]
OSUN	54.85[a]	2.6736[a]	50.54[a]	9.14[a]	35.40[a]	75.96[a]	96.66[a]	68.37[a]	39.50[a]	21.41[a]	81.82[a]
EKITI	54.70[a]	2.3460[a]	46.22[c]	8.55[b]	27.96[c]	55.18[c]	77.66[c]	61.31[c]	32.88[b]	18.59[b]	70.84[c]

Table 22 showed the degree of variation in the mean, emphasizing the state with the high, medium and low mean variation with respect to the body parameters. In any column where the index (a, b, c) reads the same value, it simply means that there was no significant difference, but if otherwise there was significant difference. Thus, BW and BH of the three states show no significant difference. HC, NC, WC, Hip C, LL and BAI of the three states show that there was significant difference. In FL and BMI, there was no significant difference between ONDO versus OSUN and ONDO versus EKITI but no significant difference between OSUN versus EKITI.

Discussion

The results of this descriptive analysis demonstrated that children with a low HC had a decreased percentage score in MAT and vice-versa; The results also revealed that children with a low body height had a decreased percentage score in MAT and vice-versa; The results of this study demonstrated that children with a low body weight had a decreased percentage score in MAT and vice-versa; compared with their peers with higher HC, body height and weight values among others. The findings supported the views of Kolawole and Udeh (2012) who concluded that body parameters is significantly related to the academic performance of pupils in primary school in mathematics scholastic aptitude test.. The findings is in consonant with Kolawole and Oginni (2013) that the students having superior physique in terms of aforementioned parameters were strongly advice to tow the line of mathematically compliant courses as a result of their brilliant performance

Each of the state within Southwest, Nigeria exhibited a variation in their academic performance as a result of the differences in their body parameters On the whole, it was gathered that Osun state performed better than the Ekiti state and Ondo state in mathematics as a result of the noticeable difference in the learners body parameters, which culminated into their wellness. The study corroborated Coleman et al., (1966) who found that differences in school achievement reflected variations in family background, and the family backgrounds of student peers, concluding that "schools bring little influence to bear on a child's achievement that is independent of his background and general social context"

Recommendations

Based on the results of the findings, it is recommended that parents should be serious about the healthy living of their wards right from childhood. This may be achieved by providing good feeding and good environment for their wards. Attention should be placed on the provision of good food supplements that can improve the physical development of the children, since the physical fitness of a child influences positive performance of students in mathematics. Government should introduce breakfast and lunch system as part of the measure to improve the health and wellness of the students.

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