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Quatelete Equation and Percentage Body Fat as Determinant of Obesity among Male Adolescent Students of Secondary Schools, Mubi-North, Adamawa State Nigeria

Philemon Kikiwa Ndanda[1] Hudson Elijah Jatau [2]
Department of Physical and Health Education, School of Science, College of Education Hong, Adamawa State, Nigeria[1,2].

Correspondence: akimndanda606@gmail.com

Abstract
The focused of the study was on quatelete equition and percentage body fat as determinant of obesity among male adolescent students of secondary schools, Mubi-North, Adamawa State Nigeria. The objectives of the study is to determine the prevalence of obesity among male's students, causes, and the implications that overweight and obesity have in boys. Systematic random sampling was used to select schools while stratified sampling and simple random sampling were used in selecting students. Measurement of weights and height were done to determine Body Mass Index (BMI), measurements of skinfolds were also done to determine body fat percentage. Findings revealed a weak positive relationship exist between BMI and %BF, r=0.216(p<0.05). An average of 11.1% students were found overweight and obese. Nutrition and inactivity were causes of overweight and obesity. In addition, overweight and obese adolescent's boys were reported to underperform in physical activities. The study revealed that overweight and obesity were not friendly healthy conditions to adolescents, thus a need to work it out. The study recommend that exercise physiologist, sport and health should put a mechanism that will guide and develop all male child interest at school to participate in physical activities and sport. There is also a need to control the calories given to children in relation to activities they engage in.

Key words: Adolescents, Obesity, Body Mass Index, Skin-fold technique

Introduction

The human body is made up of many different components. Some of the major components are bone, muscles, organs and fats. Body composition is the proportion of fat and fats-free mass in the body. The amounts or percentage of fats components is of great interest. A healthy body composition is one that includes a lower percentage of body fat and a higher percentage of fat-free mass, which include muscles, bones and organs. Understanding the relationship between body density and body composition provide valuable insight into the major concepts and methodologies in determining body composition more especially, the percentage body fat of an individual and the population in general.

The prevalence of overweight continues to increase in many developing countries, although the prevalence of under-nutrition remains relatively high. Access to techniques allowing body composition analysis, such as dual energy x-ray absorptiometry (DEXA) or bioelectrical impedance (BIA), available in advance economics, is limited in many others, and assessment of those at risk of excess body fat generally relies on simpler and cheaper techniques, such as body mass index and skin-fold measurements (Eisenmann, Heelan & welk 2004).

Obesity worldwide has assumed a more worrisome dimension. It is an abnormal accumulation of body fat, usually greater or equal to 20 percent of an individual ideal body weight (Free Dictionary.Com, 2012). However, obese individuals may vary in the amount of excess fat they store which may likely, commensurate with their lifestyle habit, couple with the face of an increase in changing global food supply. Increase in body fat has become a serious and wide spread problem, thereby raising a high public health concern in our society today.

Body Mass Index (BMI) is the international standard that measures body size in adult. It is a statistical measure of an individual's weight scaled according to his/her height in meter square. It is widely used to classify adult as underweight, overweight and obese. Buowari (2010) conducts a study, in which students voluntarily participated (n=58), and their data was collected as follows; their mean age was 24.66 years, weight 67.28kg and height 1.73meters. The result indicates that two students were underweight, fourty-eight had ideal body weight, four overweight and four were found to be obese. Deshmukh (2006) reported the prevalence of overweight (BMI= 25 kg/m2) to be 2.2% and is in line also with the result obtained from Bowen university.

As obesity has increasingly become a major public health concern, the use of skin-fold measurement had been recommended for children and adolescents for an early identification of disease risk among the population (Power & Howley, 2001). In Nigeria, overweight and obesity in children and adolescent have become a growing health problem. However, estimates of prevalence rates of overweight and obesity among Nigerian adolescents are inadequate due to lack of representative data from different part of the country. Similar to other African developing nations, Nigeria is presently undergoing the double-burden of nutrition transitions in which under and over nutrition co-exist within the same population.

This study is primarily designed to determine the relationship between BMI and percentage body fat methods to estimate the prevalence of underweight and obese male's student of Secondary Schools, Mubi North.

Problem Statement

Overweight and obesity entail health risks with potential effects in social and economic wellbeing of an individual and community at large. Poor health condition resulting from overweight and obesity may act as a barrier to the development of good mind and thus pave the way for poor learning behavior and outcomes. From the foregoing, although genetic and some disorder cause obesity, most adolescent's obesity results from lack of physical activities and consuming of more calories than needed for activity level.

Despite the fact that overweight and obesity are identified as a serious health and social problem with economic and academic impacts all over the world, studies on their prevalence among adolescents students of secondary school Mubi North are unknown.

Therefore, it is necessary to periodically examine the current estimate of obesity in the various regions of the country, especially in the absence of national representative samples in order to tackle many diseases conditions that is seen in association with adolescent's obesity.

Research Questions

The following research questions were raised to guide the study;

1. What is the relationship between BMI (kg/m^2) and %BF among male adolescent students of Secondary School Mubi-North?
2. What is the relationship between BMI and age among adolescent students of secondary schools mubi-North?
3. What is the relationship between %BF and age among male adolescent students of Secondary Schools Mubi-North?

Research Hypotheses

The following hypotheses was formulated to guide the study;

1. There is no significant relationship between BMI and %BF in determining obesity among male adolescent students of secondary school student's Mubi-North.
2. There is no statistical significant relationship between age and BMI among male adolescent's students of secondary school, Mubi-North.
3. There is no statistical significant relationship between age and % BF among male adolescent's students of Secondary School, Mubi-North.

Scope and Delimitation of the Study

This study was delimited to investigation of prevalence of overweight and obesity among male secondary school students, age 13-19 years in Mubi-North; and further limited to the measurement of weight (kg), height (m^2), and assessment of triceps, biceps, abdominal, chest, thigh, iliac crest, supraspinale, and subscapular all in (mm) for percentage body fat. Again, during measurements of skinfolds to determine body fat percentage, the researcher experience difficult to access some sites on the students as some of them found it difficult to expose some part of their body for measurement.

Method and Materials

Participants

This study was conducted using a sample size of 72 adolescent boys of age 13-19 years old of government secondary schools in Mubi North.

A proportionate random sampling technique was employed to pick male students from each selected schools.

Procedure

The study adopted the Ex-Post-Facto research design. It is non-experimental research design in which pre-existed group are compared on some independent variables (Badia & Lammels, 2005). This design also, compared two or more group of individuals having similar background who are exposed to different condition as a result of their natural histories. Therefore, the design is suitable for this research study because, it is not possible to manipulate the characteristics of the participants. A procedure for the measurement of student anthropometry were preceded by the reading and signing of an informed consent by participants. An anthropometric data proforma were used by the researcher to record the height and weight values of each subject, in addition to eight site skin-fold values. Weight were measured with a bathroom weighing scale with to the nearest 0.1kg after the subjects have removed shoes, heavy clothes and objects. The measurements of height was taken by Cescorf ultra-portable stadiometer and a non-compressible flat surface which the subject will stand. The calibrations on the Cescorf ultra-portable stadiometer are at 0.1cm sensitivity and have the capacity to measure up to 190 cm. Skin-fold was measured according to the anthropometry procedure manual from national health and nutrition examination survey (NHANES) with the aid of a skin-fold caliper. All skin-fold of the subjects were measured on the right-hand side. On each site, three measurements was taken and the average of the three was recorded for each subject at the following site; triceps, subscapular, biceps, iliac crest, supraspinale, abdominal, front thigh and medial calf skin-fold. Sum of eight skinfold (SKFs) was used to predict percentage body fat of the subjects.

Research Instruments

The instruments used in collecting data for this study comprises of the Cescorf ultra-portable stadiometer, is an innovation design stadiometer that allow to quickly and easily take height measurement on the go. Is manufactured in Brazil by cescorf Manufacturer. Cescorf is the only Latin America manufacturer approved by ISAK.

Bathroom weighting scale, is a weighing device that is used to measure the mass force exertion and resistance of an object without the need of a power supply. It have an increased capacity to 130kg, using high precision strain gauge sensor that can measure weight division as low as

50gram. Slim Guide skinfold caliper (Accu-measure Fitness 3000 Body Fat Analyzer). Accu-measure personal body fat tools have a gold standard accuracy to within 1.1 % of underwater weighing results. The Accu-measure is manufactured with durable Delrin polymer, a thermoplastic polymer from DuPont. However, the reacher also subjected the instruments to Reliability test to establish its reliability for this study and the test yielded a Pearson Product Moment Correlation Coefficient of 0.05.

Results

Data generated in relation to the research questions raised and the hypotheses formulated for the study are analyses in table 1 to 4 in accordance with the research question and hypotheses. It presents the general characteristics of the subjects and difference in prevalence of overweight and percentage body fat of the boys. It also presented the results of analysis performed on the data collected accordingly. For the research questions first followed by test of hypotheses.

Table 1. Descriptive Statistics of Anthropometric Indices of Participants.

Variables	Sex	N	Mean	SD	SD Err
Age	Males	72	16.14	1.81	0.2113
Weight	Males	72	53.14	9.16	1.0800
Height	Males	72	2.55	0.34	0.0369
BMI	Males	72	20.90	3.33	0.3922
Triceps	Males	72	7.62	3.57	0.4205
Subscapular	Males	72	8.15	2.10	0.2409
Biceps	Males	72	7.10	2.54	0.2914
Iliac crest	Males	72	8.69	2.48	0.3260
Abdominal	Males	72	9.07	3.39	0.3889
Front thigh	Males	72	9.38	2.66	0.3056
Supraspinale	Males	72	10.02	3.40	0.3907
Medial calf	Males	72	8.04	2.95	0.3385
Body density	Males	72	1.05	0.01	0.0009
% body fat	Male	72	18.48	3.60	0.4134

Table 1 present the results of the physical characteristics of the volunteered participants in this study. These results indicate that the mean age of the boys is 16.14(S.d±1.81) years, mean weight

is 53.14(S.D±9.16) kg, mean height were 2.55(S.D±0.34) meters, mean BMI is 20.9(S.D±3.33) kg/m^2, mean triceps is 7.62(S.D±3.57) mm, mean of subscapular is 8.15(S.D±2.10) mm, mean biceps 7.10(S.D±2.54) mean iliac crest 8.69(S.D±2.48) mean abdominal 9.07(S.D ±3.39) mean front thigh for males 9.38(S.D±2.66) mean supraspinale 10.02(S.D±3.40), mean medial calf 8.04(S.D±2.95) mean body density 1.05(S.D±0.01), mean %BF is 18.48(S.D±3.60) .

Table 2. Frequency and Percentage Distributions of Subjects Based on Age.

Age	frequency	percentage	cum frequency	cum percentage
15	9	12.80	24	34.27
16	13	18.50	37	52.82
17	15	21.40	52	72.26
18	12	17.00	62	91.40
19	8	11.40	70	100

From table 2, age 13 years had the least number of participating subjects 6(8.50%) as majority of the students in this age group may still be in the Jss1 and Jss2 respectively. Age 17 years had the highest number of subjects 15(21.40%) of the total population. The mean ages of the subjects were 16.14(S.D±1.81) and 15.90(S.D±1.82) years, respectively.

Table 3. BMI Classification of Male Subjects.

BMI (kg/m^2)	Subjects	Grade
<14.5	-	grade 3 underweight
14.5-15.9	1	grade 2 underweight
16.0-16.9	10	grade 1 underweight
17.0-20.9	52	normal weight
21.0-25.9	6	grade 1 overweight
26.0-36.9	2	grade 2 overweight
>37	1	grade 3 overweight

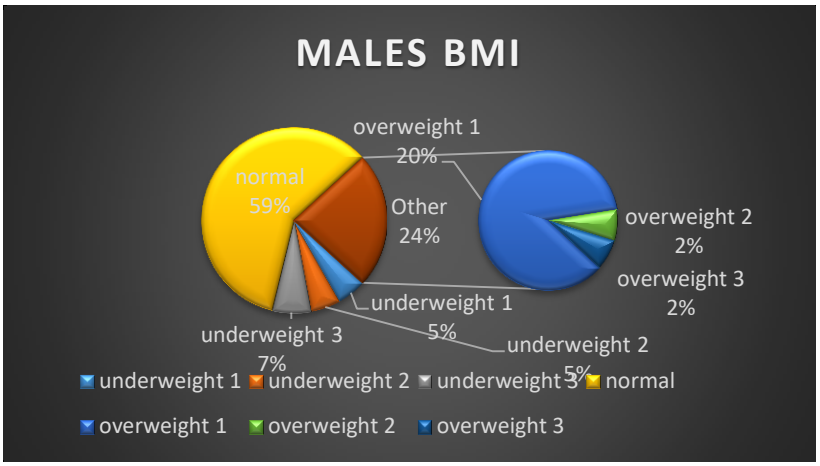

Figure 1: Male BMI Classification

Table 3 present the distribution of male subjects according to CDC adolescents BMI-range classification. The distribution of subjects in grade-3-underweight category (BMI<14.5) were null, this may be as a result of increase in age from 13years to 19 years respectively. Subjects in the normal range category (BMI 17.0-20.9) had the highest percentage BMI distribution (59%) in all the categories as shown in figure 3. Eight male subjects were found overweight in grade 1 &2-overweight while 1 have found obese with BMI>37.

Table 4. Percentage Body Fat Classification of Male Subjects.

%BF	Subjects	Grade
<8-17	31	low
18-19	21	normal
20-25	16	moderate
>25	4	high

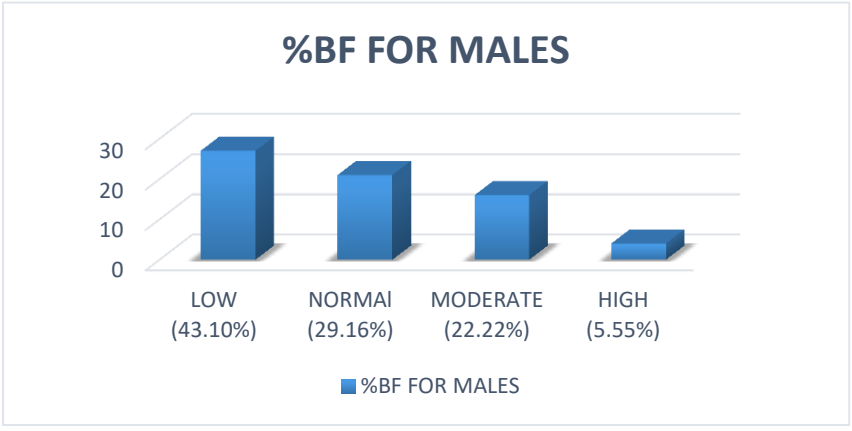

Figure 2: Percentage Body Fat for Male

From table 4 figure 2 above, study on percentage body fat classification on male subjects revealed that, 31males subjects BF<8(43.06%) have low body fat based on CDC male adolescents %BF classification aged 13-19 years old, 21 male subjects BF18-19(29.17%) have normal percentage body fat, 16 subjects 20-25%BF (22.22%) have moderate percentage body fat and 4 subjects BF>25(5.55%) have high percentage body fat.
Research Question One: What is the relationship between BMI and %BF among male adolescent students of secondary schools in Mubi?

Table 5: Summary of Relationship (r) Among BMI, %BF, and Age.

BMI	%BF	Age
1	0.216	0.306
0.216	1	-0.165

Table five above reveals that there is a very weak positive relationship existing between BMI and %BF of the male students (r = 0.216).

Research Question Two: What is the relationship between BMI and age among male adolescent students of secondary schools Mubi?

From Table five, result shows that the relationship between BMI and Age of male students is weak, but positive (r = 0.309).

Research Question Three: What is the relationship between %BF and age among male adolescent students of Secondary Schools Mubi?

%BF and Age male student from Table five were negatively and very weak (r = -0.165)

Hypothesis one: There is no significant relationship between BMI and %BF in determining obesity among male adolescent students of secondary school students.

Table 6: Summary of Relationships

	N	r	P	Remark
BMI and %BF	72	0,216	0.014	Significant
BMI and Age	72	0.309	0.000	Significant
BMI of Male and Female	72	0.172	0.175	Not significant
%BF and Age	72	-0.165	0.061	Not significant
%BF of Male and female	72	0.026	0.841	Not significant

Table six revealed that there is weak positive relationship between BMI and %BF (r=0.216, P < 05). The hypothesis is rejected, because the relationship statistically significant.

Hypothesis two: There is no statistical significant relationship between age and BMI among male adolescent's students of secondary school, Mubi.

From Table six above for BMI and Age, r = 0.309, P < 0.05. Hence, the null hypothesis is rejected. There is a weak but statistically significant positive relationship between BMI and Age of male students.

Hypothesis three: There is no statistical significant relationship between age and % BF among male adolescent's students of Secondary School, Mubi.

Table six shows that there is very weak negative relationship between %BF and Age of the males students. The relationship however is not statically significant (r = -.165, P > 0.05).

Discussion of Results

The study found 11(15.3%) males underweight, 52(59%) male's normal weight, and 8 (11.1%) male's overweight and 1 (1.4%) male obese using BMI measurement techniques. Percentage body fat from skinfold thickness measurement found 31 males (43.1%) have low body fat, while 21 males (29.2%) have ideal body fat, 16 males (22.2%) have moderate body fat, while 4 males (5.6%) have high body fat.

The finding is similar to Buowari (2010) which found 2 underweight, 48 ideal weight, 4 overweight and 4 obese among students.

There is a significant differences in underweight but no in ideal weight, overweight and obese were similar results. Quite number of boys (1.4-11.10%) in this study were overweight according to WHO/CDC cut off point, indicating that to some extent there is a prevalence of overweight among adolescent students living in Mubi. However, this finding is similar to that of Deshmukh (2006) who reported the prevalence of overweight (BMI=25kg/m^2) to be 2.2 % and is in line also with the result obtained from Bowen university. The skinfold measurements from all site were consistently higher in females in comparison with males ($p<0.05$). Findings on prevalence in this study revealed a significant difference in prevalence of obesity among males (5.55%) and according to CDC classification of %BF distributions.

Conclusion

The findings of this study showed a significant relationship in prevalence of overweight and obesity among male with (4%). Weight control is a rational task, and yet not an easy for everyone. Therefore, motivation and sufficient information are keys to successful weight control through physical activities and diet manipulations. Design and introduction of education programs that will address issues related to overweight and obesity is paramount for building a generation with a healthy body and healthy mind.

Recommendations

In view of the findings from this study, it is hereby recommended that; exercise physiologist, sports and health should put a mechanism that will guide all adolescents at schools to participate in physical activities. The policy statement should provide an open room for exercise physiology to come up with ideas on how to develop adolescent's interests towards physical activities and sports i.e. policies on education should view physical education and sports as a foundation stone towards adolescent with well-developed intellectual and physical capabilities.

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