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Body Composition Differentials in Male and Female Adolescent Secondary School Students in Ibadan, Nigeria

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Abstract: ***Background: Understanding current body composition of an individual is a necessary requirement in exercise science. Body composition is the make up of the body in terms of muscle, bone, fat and other elements. It is widely suggested that there exists a marked difference in body composition between male and female of the same age bracket. The study therefore set out to establish whether difference existed in body mass index and percent body fat between male and female adolescent secondary school students in Ibadan. Two hypotheses were formulated for the study. Methods: The ex post facto research design was used. The study purposively sampled 172, (87 boys and 85 girls) adolescent secondary school students in Ibadan. Data were collected using height meter, weighing scale and skinfold calliper. Results: There was no significant difference between boys(X=19.94± 2.35) and girls, (X=20.09±2.75) in Body Mass Index,), (P>0.05). While there was a significant difference between boys (X=12.85±4.17) and girls (X=13.62±3.30) in percent body fat, (P<0.05). Conclusion: Contrary to the widely held opinion that adolescents differ markedly in body composition, the study therefore concluded that there was no significant difference in the body mass index of the participants.***

Keywords: Body composition, Percent body fat, Body mass index, Adolescent, Secondary School Students.

1. Introduction

Body composition is the make up of the body in terms of muscle, bone, fat and other elements, (Prentice, 1994). According to Amusa, Igbanugo and Toriola, (1998) there is need to know the composition of the body in terms of its components. The fat component of the human body is usually called the fat mass or percent body fat. The nonfat component of the body is termed lean body mass. Of particular interest to fitness experts and exercise physiologists are percentage of body fat, fat- free weight and total body weight, (Payne and Hahn, 1998). This interest is important because more people are becoming overweight and obese. Being overfat or overweight can result in a serious health concern. The third National Health and Nutrition Examination Survey (NHANES III) conducted from 1988 through 1991 revealed an alarming increase in prevalence of obesity in children and adolescents. Also during the last 30 years the prevalence of overweight in children and adolescents has increased from 15.2 – 22.3% in the USA, (Troiano, et al. 1995; Hoeger and Hoeger, 2005). The prevalence of obesity in Africa is also increasing, (Monyeki, Van Lenthe and Steyn. 1999).

Body composition may be influenced by a number of factors such as age, sex, diet and level of physical activity, (Williams, 2007). Age effects are significant during the developmental years as muscle and other body tissues are being formed. Also, during old age, muscle mass may decrease probably due to reduced level of physical activity. There are some minor differences in body composition between boys and girls up to the age of puberty, but at adolescence, the difference become fairly great. In general, girls deposit more fat beginning with puberty while boys develop more muscle tissues, (Williams, 2007). This supported the claim of McGlynn, (1999) that females have more fat than males of the same age bracket. This has been widely accepted. Many of the studies in this area of gender differences used data collected from older population to generalize their findings. Hands and Larkin, (1997), affirmed that research findings regarding gender differences have been inconsistent. One of the reasons for this inconsistency is the tested population. Populations are usually over generalized without considering wide differences in age and stage in life cycle. They recommended that gender differences should be examined in the context of a specific population. Hence, adolescent secondary school students were selected for this study. Especially, as it is widely suggested that there exists a marked difference in body composition between male and female of the same age bracket.

2. Hypotheses

The following hypotheses were formulated for the study:

1) There will be no significant difference in body mass index between male and female adolescent secondary school students in Ibadan.
2) There will be no significant difference in the percent body fat between male and female adolescent secondary school students in Ibadan.

3. Methodology

The ex-post facto research design was used for the study. The study purposively sampled 87 boys and 85 girls who were adolescent secondary school students. This gave a total sample of 172**.** A staid-o-meter` that was made locally was used to measure the heights of the participants in meters and centimeters. It was graduated from 00m to 2.00m. Hana portable weight measuring scale (RA9012) made in England was used to measure the weight of the participants in kilogram (kg). The Lange skinfold caliper, (non-metallic model 3003) made by Cambridge Scientific Industries

Incorporated, U. S. A., was used to measure skinfold thickness of the participants. The caliper is graduated from 0mm to 67mm, with a constant pressure of 10g/mm.

The instruments for this study were standardized instruments. They had the important characteristics of a standardized instrument, which are – specification, direction for scoring and interpretation, (Gay, 1980). The sum of skinfold fat had validity coefficients ranging from .70 to .90, (Baurmgartner & Jackson, 1999). The staid-o-meter had a reliability coefficient of 0.99, (Safrit & Wood, 1995). The weighing scale had 0.96, (Watson, 1993). The sum of skinfold fat was over 0.95 (Safrit & Wood, 1995). Baurmgartner and Jackson, (1999) estimated 0.99 for the sum of skinfold.

The ages of the participants were recorded in years to the nearest birthday. The height of the participants was measured with a locally made staid-o–meter. The participants were asked to take off their shoes and stand erect on the flat base of the height – meter, feet together with heels, buttocks and rear of the head in contact with the height – meter while looking straight ahead. The height was measured to the nearest 0.5cm. Total body weight was measured using Hana portable weighing scale. Each participant was weighted while in light sports dress and without foot wears and caps. Measurement was scored to the nearest 0.5kg.

Percent Body Fat – The skin fold thickness was measured to determine the percent body fat. The Lange Skinfold caliper was used to measure two skinfold sites as recommended by Baurmgartner & Jackson, (1999) and Safrit & Wood, (1995). They recommended the calf and triceps skin folds, where clothing does not need to be removed to measure the sites. Both measurements were taken on the right side of the body.

Triceps Skinfold Measurement: The procedures used in measuring the triceps skinfold tickness followed the guidelines provided by Amusa, Igbanugo and Toriola, (1998). The participants were asked to stand with the elbow slightly flexed. The mid point between the elbow and the acromion process of the scapula was determined and marked with the ink marker to ensure accuracy and consistency of measurement. The skin fold between the thumb and index finger was grasped firmly and gently lifted up. Place the jaw or contact surface of the caliper was placed 1 cm above or below the finger. The grip on the caliper was release slowly to enable the jaw to exert full tension on the skin fold. Read skin fold to the nearest 0.5mm after needle stops (1- 2 seconds after releasing grip on the caliper). Three measures were taken and the mean was recorded.

Calf skinfold measurement: Each participant was asked to place his/her right foot on a bench with the knee slightly flexed. The calf site was marked with the ink marker on the inside of the right lower leg at the largest part of the calf girth. The skin was grasped and gently lifted up slightly above the level of the largest part of the calf with the thumb and index finger. The jaw of the calipers was placed at the level of the largest part of the calf. See plate 4 for illustration. The readings were recorded to the nearest 0.5mm. Three trials were done out and recorded. The mean was calculated and recorded to the nearest 0.5mm. Lohman (1992) developed the skinfold equation that was used in this study to estimate percent body fat of male and female adolescents. They are – %Fat (Male) = [(0.735 x Triceps + calf) + 1.0]; % Fat (Female) = [(0.610 x Triceps + calf) + 0.5]. Heyward, (2002) agreed with these conversion formulas and said they are used to calculate percent body fat of both black and white boys and girls.

The descriptive statistics of range, mean and standard deviation were computed for age and height, body mass index, body weight, and percent body fat. The inferential statistics of the Independent t test was computed to compare the male and female BMI, and %body fat. The Independent t-test was set at 0.05 level of significance.

4. Results and Discussion

The results of the study are presented in tables 1, 2 and 3.

Table 1: Description of Physical characteristics of Participants

Variables	Range	Mean±Sd
Age (Years)	12-18	15±1.56
Height (m)	1.38-1.68	1.52±0.28
Body Weight (kg)	30-65	46.12±7.00

Hypothesis 1:
There will be no significant difference in body mass index between male and female adolescent secondary school students in Ibadan.

Table 2: Description and Summary of t test for Body Mass Index

Variable	Sex	N	MEAN ± Sd	t-value	SIG. of t
Body Mass Index (h/m^2)	Male Female	87 85	19.94±2.35 20.09±2.75	.786	.376

From table 2, the male student participants (n= 87) recorded a body mass index mean and standard deviation of 19.94 ± 2.33, while the female (n= 85) recorded 20.09 ± 2.75. The table also showed that the independent t test revealed a no significant difference in body mass index between male and female participants, $t_{(170)} = .786$, $P>0.05$. Therefore, the hypothesis that stated that there will be no significant difference in body mass index between male and female adolescent secondary school students in Ibadan was not rejected.

Hypothesis 2:
There will be no significant difference in percent body fat between male and female adolescent secondary school students in Ibadan.

Table 3: Description and Summary of t test for Percent Body Fat.

Variable	Sex	N	MEAN ± Sd	t-value	SIG. of t
Percent Body fat (%)	Male Female	87 85	12.85±4.17 13. 62±3.30	7.72	.006*

It was recorded in table 3 that male participants had a mean percent body fat of 12.85± 4.17 while female had 13.62±3.29. The independent t-test revealed a statistically significant difference in resting heart rate between male and female participants $t_{(170)} = 7.72$, $P<0.05$. Therefore, the hypothesis that stated that there will be no significant difference in percent body fat between male and female adolescent secondary school students in Ibadan was rejected.

5. Discussion

The adolescent phase of development is a widely recognized stag in human life cycle. The primary distinguishing figure in adolescent is that it is a transitional period of rapid physiological changes, (Crompton, Lamb & Veddlizt, 1979). This study investigated gender differentials in body mass index, and percent body fat among adolescent boys and girls.

The study found that BMI did not differ significantly between male and female adolescent secondary school students. It showed a comparable mean body mass index for males and females. These averages fell within the healthiest body mass index of 18.5 to 24.9kg/$m^{2,}$ (Robbins, Powess & Burgess, 1999). This showed that the participants in this study had low risk of diseases, (Heward, 2002). According to ACSM, (2000) BMI value of 30kg/m^2 and above is an indicator of a risk factor of coronary heart diseases, (CHDs).

The study found that a significant difference existed in the percent body fat between male and female participants. This was in support of Prentice, (1999), who found out that in percent body fat, male youths differ significantly from female youths. Westgate and Deurenberg (1989) in their study observed that percent body fat of adolescent girls differed significantly from that of the boys. In this study, the male participants had a mean percent body fat of 12.85% while female had 13.62%. These means are below the average percent body fat of 15% and 20% for males and females respectively, (Amusa, Igbanugo and Toriola, 1998; Prentice, 1999). However, they were within the ranges of 9% to 12.9% for male and 12% to 16.9% for female, which Prentice (1999), said is good for youths, (15-20 years).

The male participants mean percent body fat was not low. According to Lohman, (1999), percent body fat is considered to be low when it ranges between 6% to 10% in boys and 12% 15% in girls. In line with this, girls in this study had low percent body fat.

6. Conclusion

Contrary to the widely held opinion that adolescents differ markedly in body composition, the study concluded there was no significant difference in the body mass index of the participants. Body mass index is one of the indices of body composition. Granted, a marked difference was seen in percent body fat.

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