

# Assessment of Body Weight, Body Mass Index and Waist-hip Ratio on Academic Performance of Female Students in Akanu Ibiam Federal Polytechnic Unwana, Afikpo, Ebonyi State, Nigeria

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**Abstract** Most parents and teachers unscientifically believe that the overweight persons are sluggish, lazy and sleepy therefore would not do well in academic performance. This study investigated the association of Body Mass Index (BMI) and Waist-hip ratio (WHR) on academic performance of some few selected students of Akanu Ibiam Federal Polytechnic, Unwana Afikpo Ebonyi State, Nigeria. BMI, WHR were calculated and Cumulative Grade Point Average (CGPA) scores were used to collect data from 300 female students from six different Departments (50 students each Department). NDII and HNDII students were considered for this research. Their age range was between 19-28 years. Descriptive Body Mass Index analysis found 20 students underweight, 246 students with normal weights, 25 students were overweight, and 16 students were obese while on academic performance, 31 students had distinction, 87 students had upper credit, 152 had lower credit and 50 students had pass. Descriptive waist-hip ratio analysis found 32 students underweight, 174 students had normal weights, 74 students were overweight and 20 were found to be obese, while on academic performance, 1 student had distinction, 86 students had upper credit, 156 students had lower credit and 37 students were on pass category respectively. Multivariate analysis revealed no statistically significant ( $P > 0.05$ ) differences in body mass index, waist-hip ratio and C.G.P.A. There was no significant association between body mass index, waist-hip ratio and academic performance. Body mass index ( $f = .579$   $r = 0.34$   $R^2 = 0.31$   $t = .283$   $p = 69 > .05$ ), waist hip ratio on academic performance ( $f = .182$   $r = .007$   $R^2 = .004$   $t = .477$   $p = .141 > 7.05$ ) was observed. Therefore no basis to judge a student generally by body mass profile rather conducive learning environment, genetic and mental endowments would continue to influence academic performance of a student.

**Keywords** Body Mass Index, Waist Hip Ratio, Cumulative Grade Point Average, Obesity, Underweight

## 1. Introduction

The body mass index (BMI) or Quetelet index is a value derived from the mass (weight) and height of an individual [1]. The BMI is defined as the body mass divided by the square of the body height, and is universally expressed in units of  $\text{Kg/m}^2$ , resulting from mass in kilograms and height in meters [2, 3]. The BMI is an attempt to quantify the amount of tissue mass (muscle, fat and bone) in an individual, and then categorized that person as underweight, normal weight, overweight, or obese based on that value. However, there are some debates about the BMI scale, therefore the

dividing lines between categories should be placed. Epel et al. [4] commonly accepted BMI ranges are under weight under  $18.5 \text{ kg/m}^2$ , normal weight  $18.5$  to  $25 \text{ kg/m}^2$ , overweight  $25$  to  $30 \text{ kg/m}^2$ , obese over thirty  $30 \text{ kg/m}^2$ .

Waist to hip ratio (WHR) is a measurement that compares the size of your waist in inches and the size of your hips in inches. The WHR has been used as an indicator or measure in health and risk of developing serious health conditions. Research shows that people with apple-shaped bodies (with more weight around the waist) face more health risks and because of this it affects the academic performance of that person. WHR is used as measurement of obesity, which in turn is a possible indicator of other core serious health conditions. The WHO states that abdominal obesity is defined as a waist-hip ratio above 0.85 for female or a body mass index (BMI) above  $30 \text{ kg/m}^2$  [5, 6].

A sedentary life-style plays a significance role in obesity

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[7]. Worldwide there is a large shift towards less physically demanding work both in the school (Ness-Abram and Aprozian, 2006), and currently at least 30% of the world's population gets insufficient exercise; hence, it affects the young women in their academic performance [9, 10]. It is primarily due to increasing use of mechanized transportation and a greater prevalence of labour-saving technology in the school [11, 12].

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have a negative effect on health. People are generally considered obese when their body mass index (BMI), a measurement obtained by dividing a person's weight by the square of the person's height, over  $30\text{kg/m}^2$ , with the range  $25\text{--}30\text{kg/m}^2$  is defined as overweight [13]. Obesity increases the likelihood of various diseases, particularly heart disease, type 2 diabetes obstructive sleep apnea. Obesity is most commonly caused by a combination of excessive food intake, lack of physical activity, and genetic susceptibility [14]. A few cases are caused primarily by genes, endocrine disorders, medications or mental illness [15]. Evidence to support the view that obese people eat little yet gain weight due to a slow metabolism is not generally supported [16]. On average, obese people have greater energy expenditure than their thin counterparts due to the energy required to maintain an increased body mass [17]. Obesity is mostly preventable through a combination of social changes and personal choices changes diet and exercising are the main treatments [18]. Diet quality can be improved by reducing the consumption of energy dense foods such as those high in fat and sugars and by increasing intake of dietary fiber. Obesity is a leading preventable cause of death worldwide. Obesity is more common in women. The present investigation was aimed at assessing the body weight, body mass index and waist-hip ratio on academic performance of female students in Akanu Ibiam Federal Polytechnic Unwana, Afikpo, Ebonyi State, Nigeria.

## 2. Materials and Methods

### 2.1. Materials

#### 2.1.1. Equipment Used /Model

Inelastic measuring tape (Butterfly model made in china), graduated in centimeter (0-150) was used to measure the waist and hip circumferences Height meter: A vertical wooden bar calibrated in centimeters (0-20) with a movable horizontal bar which could be adjusted to touch the vertex of the participants head was used to measure the height of the participants. A portable mechanical bathroom weight scale (module: BR) calibrated from 0-120kg was used to measure body weight to the nearest kilogram.

### 2.2. Methods

#### 2.2.1. Experimental Design

Participants for this study were drawn from a purposive sample of 300 students from six different Departments of Akanu Ibiam Federal Polytechnic, Unwana Afikpo Ebonyi State Nigeria, they include Office Technology Management (OTM), Science Laboratory Technology (SLT), Business Administration Management (BAM), Food Technology Management, Public Administration (PAD), Marketing Department, Hospitality Management and Tourism (HMT) and Accountancy Department. Fifty (50) female students with ages 19-28 years from each Department were selected for the study. Female students of NDII and HNDII students were recruited only and they were all Nigerians. A consent form was given to each student. The weighing scale (mechanical bathroom scale) was used for the measurement of the body weight of each student, while inelastic tape measure was used to measure the waist and hip circumferences and height meter was used to measure the height of the participants. The Cumulative Grade Point Average (CGPA) for each student was collected from the different selected Departments of Akanu Ibiam Federal Polytechnic Unwana, Afikpo result template. The template converts every examination score entered into CGPA.

#### 2.2.2. Data Collection

**Table 1.** Standard Body Mass Index

|             |               |
|-------------|---------------|
| 16.00-18.49 | Under weight  |
| 18.50-25.0  | Normal weight |
| 25.01-29.99 | Over weight   |
| 30.00-above | Obese         |

**Table 2.** Standard wait-hip ratio

|            |               |
|------------|---------------|
| 0.60-0.75  | Under weight  |
| 0.76-0.80  | Normal weight |
| 0.81-0.85  | Over weight   |
| 0.80-above | Obese         |

**Table 3.** Standard Cumulative Grade Point Aggregate (CGPA) from Akanu Ibiam Federal Polytechnic, Unwana, Afikpo Result Template

|           |              |
|-----------|--------------|
| 3.50-4.00 | Distinction  |
| 3.00-3.49 | Upper credit |
| 2.50-2.99 | Lower credit |
| 1.75-2.49 | Pass         |

Prior to the commencement of the study, ethical approval was obtained from Department of Science Laboratory Technology, Akanu Ibiam Federal Polytechnic, Unwana, Afikpo. The rationale behind the study, including the procedure were taken after removal of shoes, height was also measured without shoes in the standing position with the shoulders in relaxed position and arms hanging freely, and the two measures were used to calculate the Body Mass Index (BMI). The waist circumference was measured with a tape measure to within 1 (one) millimeter (WHO, 1998). Hip circumference was measured with the participant standing erect, feet together and on a horizontal plane at the level of the

greater trochanters. The waist-hip ratio was calculated by dividing the waist circumference by the hip circumference. The data collected were arranged in line with WHO (1998) body mass classification chart and waist-hip ratio, while the student academic performance as represented by CGPA were ranked according to Akanu Ibiam Federal Polytechnic result template.

### 2.3. Statistical Analysis

The mean and standard deviation were calculated for all parameters while the percentages for all treatment were also calculated. Analyses of variance were summed up using one way analysis of variance (ANOVA) and the significance level was set at  $p < 0.05$ .

**Table 4.** Body Mass Index of Students of Some Selected Departments in Akanu Ibiam Federal Polytechnic, Unwana, Afikpo, Ebony State

| Department                      | Academic classification | Under weight | Normal weight | Over weight | Obese | Total |
|---------------------------------|-------------------------|--------------|---------------|-------------|-------|-------|
| Office Tech & Management (OTM)  | Distinction             | 0            | 5             | 0           | 0     | 5     |
|                                 | Upper credit            | 0            | 6             | 0           | 0     | 6     |
|                                 | Lower credit            | 1            | 18            | 3           | 3     | 25    |
|                                 | Pass                    | 0            | 12            | 0           | 2     | 14    |
|                                 | Total                   | 1            | 41            | 3           | 5     | 50    |
|                                 | Percentage              | 22%          | 82%           | 6%          | 10%   | 100%  |
| Science Laboratory Tech (SLT)   | Distinction             | 2            | 4             | 0           | 0     | 6     |
|                                 | Upper credit            | 0            | 6             | 1           | 0     | 7     |
|                                 | Lower credit            | 2            | 20            | 4           | 1     | 27    |
|                                 | Pass                    | 0            | 8             | 2           | 0     | 10    |
|                                 | Total                   | 4            | 38            | 1           | 7     | 51    |
|                                 | Percentage              | 8%           | 76%           | 8%          | 8%    | 100%  |
| Food Science Tech (FST)         | Distinction             | 0            | 3             | 0           | 0     | 3     |
|                                 | Upper credit            | 0            | 8             | 0           | 0     | 8     |
|                                 | Lower credit            | 1            | 29            | 3           | 0     | 33    |
|                                 | Pass                    | 0            | 3             | 3           | 0     | 6     |
|                                 | Total                   | 0            | 3             | 3           | 0     | 6     |
|                                 | Percentage              | 2%           | 86%           | 12%         | 0%    | 100%  |
| Business Admin Management (BAM) | Distinction             | 0            | 3             | 0           | 0     | 3     |
|                                 | Upper credit            | 3            | 8             | 1           | 0     | 12    |
|                                 | Lower credit            | 3            | 25            | 1           | 2     | 31    |
|                                 | Pass                    | 1            | 2             | 0           | 1     | 4     |
|                                 | Total                   | 7            | 38            | 2           | 3     | 50    |
|                                 | Percentage              | 14%          | 76%           | 4%          | 6%    | 100%  |
| Public Administration (PAD)     | Distinction             | 0            | 2             | 2           | 0     | 4     |
|                                 | Upper credit            | 1            | 0             | 4           | 1     | 6     |
|                                 | Lower credit            | 2            | 15            | 9           | 2     | 28    |
|                                 | Pass                    | 0            | 3             | 9           | 0     | 12    |
|                                 | Total                   | 3            | 20            | 24          | 3     | 50    |
|                                 | Percentage              | 6%           | 40%           | 48%         | 6%    | 100%  |
| Marketing                       | Distinction             | 0            | 3             | 1           | 0     | 4     |
|                                 | Upper credit            | 1            | 26            | 1           | 0     | 28    |
|                                 | Lower credit            | 1            | 17            | 0           | 0     | 18    |
|                                 | Pass                    | 0            | 0             | 0           | 0     | 0     |
|                                 | Total                   | 2            | 46            | 2           | 0     | 50    |
|                                 | Percentage              | 4%           | 92%           | 4%          | 0%    | 100%  |

### 3. Results

From the results obtained, table 4 showed that, out of 50 students sampled in OTM Department (2%) were in the mild weight class, 41 students (82%) were in the normal weight class, 3 students (6%) were overweight, 5 students (10%) were in the obese class (Table 4). In SLT Department, (10%) were in the under weight class, 38 students (7%) were in normal weight class, 7 students (14%) were in over weight class and 1 student (2%) was mildly obese. In FST, (2%) were in underweight class, 43 students were in normal weight class, none was overweight. In BAM Department, 1 student (2%) was mildly under weight, 38 students (76%) were in normal weight class, 5 students (10%) were in over weight class, 2 students (4%) were in Obese weight class while in the Department of Public Administration, 3 student (6%) were mildly under weight, 20 (40%) were in normal weight class, 24 students (48%) were in over weight class, 3 students (6%) were in Obese weight class. In Marketing Department, 2 students (4%) were underweight, 46 students (92%) were in normal weight class, 2 students were in overweight class and none was obese (Table 5). In the overall, Body Mass Index, 246 students (82%) were in normal weight class, 25 students (8.3%) were mildly over weight and 9 students (3%) were obese (Table 5).

Results on (Table 6) revealed that in OTM Department, 6 students (12%) were in underweight 26 students were in normal weight class, 11 students (22%) were overweight, 7 students (14%) were under weight and 5 students (10%) were obese. In SLT Department, 6 students (12%) were under weight, 32 students (64%) normal weight, 11 students (22%) was overweight, 1 student (2%) was obese. In FST Department, 3 students (6%) were under weight, 20 students

(40%) were in normal weight 26 students (52%) was overweight, 1 student (2%) was obese. In BAM Department, 3 students (6%) were in the under weight class, 20 students (40%) were in normal weight class, 24 students (48%) were overweight, 3 students (6%) were obese. In Marketing Department, (66%) was overweight, 2 students (4%) was obese. In over all Departments, out of 300 students, 32 students (10.7%) was overweight, 174 (58%) were in normal weight, 74 student (24.7%) were mildly over weight, 20 students (16.6%) were obese (Table 7). The results also showed that there were significant differences in the body mass index and waist-hip ratio of the students; it also showed significant difference in the academic performance of the students.

Finally, additional test was conducted to see if BMI and waist Hip ratio could predict CGPA. The result showed no significant prediction effect of BMI on CGP ( $f = .579$   $r = 0.34$   $R^2 = 0.31$   $t = .283$   $p.69 > .05$ ), and the result also showed no significant prediction effect on waist-hip ratio on CGPA ( $f = .182$   $r = .007$ ,  $R^2 = .004$   $t = .477$ ,  $p = .141 > 7.05$ ).

**Table 5.** Cross Tabulation of Body Mass Index and Academic Performance of Some Students in Akanu Ibiam Federal Polytechnic, Unwana, Afikpo, Ebony State

| Academic Classification | Body Mass Index |               |             |       | total |
|-------------------------|-----------------|---------------|-------------|-------|-------|
|                         | under Weight    | normal weight | over weight | obese |       |
| Distinction             | 2               | 28            | 1           | 0     | 31    |
| Upper credit            | 5               | 78            | 4           | 0     | 87    |
| Lower                   | 11              | 121           | 14          | 6     | 1.52  |
| Pass                    | 2               | 19            | 6           | 3     | 30    |
| Total                   | 20              | 246           | 25          | 9     | 300   |

**Table 6.** Waist-hip ratio of Students of Some Selected Departments in Akanu Ibiam Federal Polytechnic, Unwana, Afikpo, Ebony State

| Department                     | Academic classification | Under weight | Normal weight | Over weight | Obese | Total |
|--------------------------------|-------------------------|--------------|---------------|-------------|-------|-------|
| Office Tech & Management (OTM) | Distinction             | 0            | 3             | 0           | 1     | 4     |
|                                | Upper credit            | 3            | 3             | 1           | 1     | 8     |
|                                | Lower credit            | 3            | 16            | 8           | 3     | 30    |
|                                | Pass                    | 0            | 4             | 2           | 2     | 8     |
|                                | Total                   | 6            | 26            | 11          | 7     | 50    |
|                                | Percentage              | 12%          | 52%           | 22%         | 14%   | 100%  |
| Science Laboratory Tech (SLT)  | Distinction             | 1            | 3             | 1           | 0     | 5     |
|                                | Upper credit            | 3            | 15            | 7           | 0     | 25    |
|                                | Lower credit            | 1            | 12            | 2           | 1     | 16    |
|                                | Pass                    | 1            | 2             | 1           | 0     | 4     |
|                                | Total                   | 6            | 32            | 11          | 1     | 50    |
|                                | Percentage              | 12%          | 64%           | 22%         | 2%    | 100%  |
| Food Science Tech (FST)        | Distinction             | 0            | 1             | 2           | 0     | 3     |
|                                | Upper credit            | 0            | 9             | 5           | 0     | 14    |
|                                | Lower credit            | 3            | 8             | 16          | 1     | 28    |
|                                | Pass                    | 0            | 2             | 3           | 0     | 5     |
|                                | Total                   | 3            | 20            | 26          | 1     | 50    |
|                                | Percentage              | 6%           | 40%           | 52%         | 2%    | 100%  |

| Department                      | Academic classification | Under weight | Normal weight | Over weight | Obese | Total |
|---------------------------------|-------------------------|--------------|---------------|-------------|-------|-------|
| Business Admin Management (BAM) | Distinction             | 0            | 2             | 2           | 0     | 4     |
|                                 | Upper credit            | 1            | 0             | 4           | 1     | 6     |
|                                 | Lower credit            | 2            | 15            | 9           | 2     | 28    |
|                                 | Pass                    | 0            | 3             | 9           | 0     | 12    |
|                                 | Total                   | 3            | 20            | 24          | 3     | 50    |
|                                 | Percentage              | 6%           | 40%           | 48%         | 6%    | 100%  |
| Public Administration (PAD)     | Distinction             | 0            | 1             | 1           | 0     | 2     |
|                                 | Upper credit            | 0            | 5             | 0           | 2     | 7     |
|                                 | Lower credit            | 6            | 17            | 8           | 3     | 34    |
|                                 | Pass                    | 1            | 6             | 0           | 0     | 7     |
|                                 | Total                   | 7            | 29            | 9           | 5     | 50    |
|                                 | Percentage              | 14%          | 58%           | 18%         | 10%   | 100%  |
| Marketing                       | Distinction             | 0            | 2             | 1           | 0     | 3     |
|                                 | Upper credit            | 5            | 16            | 4           | 1     | 26    |
|                                 | Lower credit            | 2            | 15            | 3           | 1     | 21    |
|                                 | Pass                    | 0            | 0             | 0           | 0     | 0     |
|                                 | Total                   | 7            | 33            | 8           | 2     | 50    |
|                                 | Percentage              | 6%           | 40%           | 48%         | 6%    | 100%  |

**Table 7.** Cross Tabulation of Waist hip ratio (WHR) and Academic Performance of Students of Akanu Ibiam Federal Polytechnic, Unwana, Afikpo, Ebony State

| Academic classification | Under weight | Normal weight | Over weight | Obese | Total |
|-------------------------|--------------|---------------|-------------|-------|-------|
| Distribution            | 1            | 12            | 7           | 1     | 21    |
| Upper credit            | 12           | 48            | 21          | 5     | 86    |
| Lower credit            | 17           | 97            | 31          | 11    | 156   |
| Pass                    | 2            | 17            | 15          | 3     | 37    |
| Total                   | 32           | 174           | 74          | 20    | 300   |

## 4. Discussion

The study was conducted on 300 regular female students of six different Departments which included: Office Technology Management (OTM), Science Laboratory Technology (SLT), Food Science Technology (FST), Business Administration Management (BAM), and Marketing Department of Akanu Ibiam Federal Polytechnic, Unwana, Afikpo, Ebony State, in which 50 students each from selected departments participated. There are no comparative studies in the past years in other department to compare and contrast body mass index and waist-hip profile findings obtained. Similar studies elsewhere outside Nigeria cannot be used since they are not homogenous to our subjects. There is no known comparative study from other Departments in Nigerian Polytechnics. Although females have been shown to possess more body fat, however, body mass index and waist hip ratio do not determine body fat percentage, but it places individual in the body mass index and waist-hip ratio chart as to the degree of fatness, over fatness, thinners and extreme thinners. Some females have increased BMI and waist-hip ratio as from 12 years as they

get into the pubertal age.

The important point noted in the study is that the BMI of students of OTM Department recorded the highest obese students (5) 10%, BAM Department recorded 3 (6%) obese students, while PAD recorded 2 (4%) obese students. All the departments had few over weight students and many normal students in all Departments especially Marketing Department; and this may be due to the less academic stress experienced by students of this Department. Also all the Departments recorded less underweight students who may need nutritional and body building exercise programme. This is in line with the procedure for beating up weight as provided by [19]. In waist-hip ratio all the Departments have less obese students with more over weight students, while few of the students were moderately underweight in all the Departments studied.

The findings of this study on effect of body mass index and waist hip ratio on academic performance were in conflict with the report of [20] whose findings showed that increased weight lowers test scores, though only for girls. However, it supports the findings of [21, 11] who found no significant differences on the effect of BMI on academic performance or productivity of workers. In conclusion, there was no strong association between basal metabolic index (BMI) and academic performance. Similarly, there was also no association between waist hip ratio and academic performance of students of some selected Departments in Akanu Ibiam Federal polytechnic Unwana, Afikpo, Ebony State, Nigeria. Therefore, there is no basis to judge a student generally by body mass profile rather conducive learning environment (Science and technology) and genetic (typology) and mental endowments would continue to influence academic performance of a student.

## 5. Recommendations

1. All Departments should include regular fitness exercises like jogging, gym work-out and aerobic training monthly or bi monthly programme as part of their extra-curricular activities.
2. Underweight students need to be counselled on how to improve their weight so as to avoid dropping down to severe underweight.

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