



Implications of Demographic and Modifiable Risk Factors of Obesity in Municipal Adults of Enugu

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Authors' contributions

This work was carried out in collaboration between all authors. Author RNA designed and supervised the study. Author CCI performed the statistical analysis and wrote the protocol. Author EC managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Understanding the determinants of obesity in young adults is not only vital to its association with other chronic diseases but also for proper diagnosis and prognosis in clinical processes. This cross-sectional study assessed the demographic and modifiable risk factors that contribute to obesity amongst young adults of Enugu Metropolis. Four hundred and Nineteen (419) young adults (195 males and 224 females) were randomly selected. Demographic characteristics (age, gender and marital status) and modifiable risk factors (tobacco use, alcohol consumption, and dietary intake) were obtained. Weight, height and waist circumference (WC) were also measured and levels of Physical activity were assessed. Using descriptive and statistical measures of correlation (Pearson's correlation), result shows that age and marital status are positively correlated with Body Mass Index (BMI) with gender having no correlation with BMI and WC. Outcome of modifiable risk

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factors revealed that dietary intake ($p < 0.001$; $r = 0.343$), alcohol consumption ($p < 0.001$; $r = 0.320$) and tobacco use ($p < 0.001$; $r = 0.196$) had a positive, significant correlation with BMI and WC; while physical activity level had a negative, significant correlation. Therefore, chances of being obese increases with poor dietary intake, abnormal alcohol consumption, tobacco use and low Physical activity level.

Keywords: Body mass index; obesity; physical activity.

1. INTRODUCTION

Obesity and overweight have both been described as anomalous accumulation of excessive body fat which may be harmful to health [1]. In clinical practice, obesity is often defined by the Body Mass Index (BMI), a routine that divides subjects' weight (in kg) by their height squared (in meters - m^2). This is the most common method of classifying overweight and obesity. Though classification of this varies, most notable institutions categorize adults with BMI greater than 25 kg/m^2 as overweight and greater than 30 kg/m^2 as obese [2]. The WHO in 2008 confirmed waist circumference as one of the anthropometric changes in overweight and/or obesity, suggesting that the measurement should be made at the point between the lower end of the last touchable rib and the upper part of the iliac crest [3]. A 2016 World Health Organization (WHO) report estimated that over 1.9 billion individuals aged 18 years and above were overweight across the world. Of these, more than 650 million of them are obese [4].

Obesity has been thought of as a "new epidemic" both in children and in adult. Though it is an increase in body adipose tissue (fat tissue) mass; Practically, it is difficult to determine this directly and therefore, it is best assessed via BMI and in terms of its distribution, via the waist circumference [5]. In addition, the presence of obesity needs to be evaluated in the context of other risk factors such as medical conditions that could influence the risk of complications [6]. The BMI as an accurate reflection of body fat percentage in the majority of the adult population and it is a widely accepted scale to measuring obesity [7].

For several decades, obesity and overweight have been very common in most parts of the world, regardless of the various public health interventions. Physiologically, as age advances, the risk of obesity increases with it. It has also been confirmed that in the advanced world, prevalence of obesity is higher among the lower socio economic class than amongst the rich and

popular. Prevalence of obesity has been in a gradual increase in many countries over the past several decades. Throughout the world, in all age grades, it has been noted that women generally have a greater mean BMI and higher ranking of obesity than men. In general, the prevalence of obesity in men residing in advanced or Western societies is estimated to be 20% while that of women is observed to be a little higher in percentage. Several researches on the prevalence of obesity done in USA revealed that African-Americans have greater prevalence of obesity than people of European ethnicity [2].

Age and ethnic groups have also been found to be closely related to the prevalence of obesity [8]. About 25% of the population of the people of the Middle East has been found to be obese. The results obtained from some African countries were also of great concern as using current standards, 44% of the black female population residing in Cape peninsula, South Africa have been reported as obese which is in contrast with those in Ghana with only 0.8% of the population seen to be obese. Obesity is relatively rarer than overweight, though men in some countries surprisingly have greater ratings of overweight than women. An example is Australia where 20% of their population is obese, 62% of adult males and an estimated 50% adult females were found to be overweight. Also in china, using the BMI rating suitable for the European population, 31% of the women and 27% of the men are overweight [9].

A 2008 study on "obesity prevalence amongst undergraduate students of University of Nigeria" showed that obesity prevalence was rising with a greater percentage of obese females than males [10]. The study likened the cause to consumption of energy dense food and foods that were poor in nutrient to commercially marketed and readily available food items in the metropolis, with Lifestyle patterns, poor dietary habits, alcohol consumption, physical inactivity and smoking also contributing [11]. These lifestyle patterns also influence the prevalence of overweight and obesity in universities, and if they are not

identified and measures taken to address them, the prevalence of obesity will continue to increase. Lack of physical activity, alcohol consumption and tobacco use are modifiable risk factors that contribute to obesity while age, gender, marital status and genetic composition are non-modifiable risk factors [12]. There is a dearth of information on the modifiable factors that contribute to obesity among young adults. Therefore, this study sought to address that.

This study assessed the demographic (age, gender and marital status) and modifiable risk factors (diet, alcohol consumption, smoking or tobacco use and physical activity level) that contribute to obesity (using BMI and waist circumference as obesity measures) among young adults living in Enugu Metropolis. Specifically, the study assessed the relationship between age, BMI and waist circumference; gender, BMI and waist circumference; marital status, BMI and waist circumference; diet, BMI and waist circumference; alcohol consumption, BMI and waist circumference as well as tobacco use, BMI and waist circumference in young adults within Enugu Metropolis. This study also examined the relationship between physical activity levels, BMI and waist circumference among young adults in Enugu Metropolis.

2. METHODOLOGY

2.1 Scope of Study

This study was carried out at the Faculty of Health Science and Technology, Faculty of Law, university of Nigeria, Enugu, the Institute of Management and Technology (IMT) and the Enugu State University of Science and Technology (ESUT) business centres, where there is a rising and dense population of young adults. The Railway line at Ogbete main market, mostly populated with hair stylists and traders was also included in the study. The choice of these areas was made to create an avenue of assessing young adults that are exposed to different environments, level of literacy/education and varying occupation.

2.2 Study Design

This study utilized a cross-sectional design. A cross-sectional design offers information about a population at a given time. This design was dim appropriate for the study as it helps gather data at one point time exploring all necessary information with regards to the study objectives.

2.3 Sample and Sampling Technique

Study population comprised of male and female young adults who lived in Enugu Town and are aged 18-35 years. The accessible population encompassed those who were available and willing to participate in the study at the time of data collection. A total of four hundred and nineteen (419) participants were drawn for the study. The Yamane formula was used to calculate the minimum sample size required;

$$n = \frac{N}{1 + Ne^2}$$

Where:

N = minimum sample size required
N = population size (997,746)
e = margin of error (0.05)

With 10% addition to make provision for attrition, total sample size was raised to 440.

Selection Criteria:

Criteria for which participants were selected include;

Inclusion Criteria:

- i. Individuals that are aged between 18 to 35years. This age range is regarded as young adults (Unitarian Universalist Association, 2018)
- ii. Subjects residing in Enugu Town

Exclusion Criteria:

- i. Individuals below 18 and above 35 years of age
- ii. Pregnant or lactating females
- iii. Physically challenged individuals.

2.4 Instrument for Data Collection

The International Physical Activity Questionnaire (IPAQ) was used to access the physical activity level of participants on weekly basis. IPAQ comprised of questions on time spent performing vigorous, moderate and mild physical activity and was categorized as low (walking) physical activity with less than 600 MET, 600 to 3000 MET as moderate physical activity and above 3000 MET as vigorous (high) physical activity. The Lifestyle behavioural questionnaire [13] was also used to access the demographic characteristics, tobacco

use, diet and alcohol consumption levels of participants. Other instruments include the weighing Scale (Hana, model BR9011, China); which was used to measure the participants' weight (to the nearest 0.1 kg). Height Meter (Seca, 220 Measuring Rod), which was used to measure the participants' height to the nearest 0.1 m, and an inelastic tape rule (Butterfly, China); which was used to measure the waist and hip circumferences of participants to the nearest 0.1 cm.

2.5 Ethical Approval

Ethical clearance was obtained from the University of Nigeria Health Research Ethics committee. An informed consent form was obtained from participants before involving them in the study. With confidentiality of participants ensured, only the data collected in this study was analyzed and reported.

2.6 Procedure

First, the aim of the study and procedures were explained to the participants, after which the administration of informed consent form and questionnaire was done. Participants were then asked to fill the questionnaire by ticking the appropriate responses. Next, IPAQ was used to assess habitual Physical Activity (PA) level, with participants asked the number of days they did vigorous, moderate (not including walking) and walking PA, as well as the number of hour(s) and minutes per day they did the three types of activities in the last seven days respectively. These activity categories can be treated separately to obtain the activity pattern, or by multiplying by their estimated intensity in METs and summed to get the overall estimate of PA in a week. One MET represents the energy expended while sitting quietly at rest and is equivalent to 3.5 ml/kg/min of VO_2 . The MET intensities used to score IPAQ were vigorous (8METs), moderate (4METs) and walking (3.3METs).

Next, the Lifestyle behavioral Questionnaire [12] was used to assess subjects' demographic information and behavioral measurements such as tobacco use, alcohol consumption and diet. The questionnaire was used to determine the weekly dietary intake, alcohol intake and tobacco use of participants. Questions were framed to access the frequency of food and other items 7 times weekly. The questionnaire concentrated on diet (fruits, vegetables, type of oil or fat mostly

used and the number of meals eaten that are not prepared at home). Weekly alcohol and tobacco use score for each item and was calculated in percentage based on responses to the questions on frequency of consumption. Participants' heights were measured by instructing them to stand bare-footed and erect, looking straight ahead on the platform of the height meter. The height was read off to the nearest 0.1 cm from the height meter at the level of the vertex of the head. Body weights were measured with a weighing scale with the pointer of the scale at zero point before the reading. Participants were weighed in light clothing with no shoes or other heavy materials. They were asked to stand erect on the scale without touching or leaning on anything. The readings were taken to the nearest 0.1 kg.

BMI was obtained from the height and weight of participants, using the relation; weight/height^2 (kg/m^2). Participants were classified as underweight, normal, overweight and obese using cut-off points for age and gender. Waist Circumference was measured once with tape rule at the level of the umbilicus. The measurement of the waist circumference was taken with participants in standing position, the arms folded across the thorax, the feet together and the body weight evenly distributed. Hip Circumference was measured once with a tape rule at the widest point around the greater trochanter. The measurement of hip circumference was taken with participants in standing position. That is, with arms folded across the thorax, the feet together and the body weight evenly distributed.

In any case, Waist Hip Ratio was calculated based on values from waist and hip circumferences as participants were divided into non-overweight, overweight and obese categories using the cut-off points for age and gender [13].

2.7 Data Analysis

Statistical analysis was performed with the Statistical Package for the Social Sciences (SPSS) version 21, with statistical level of significant set at $P < 0.05$. The data was summarized with descriptive statistics of mean, standard deviation, frequency and percentages. Pearson (for parametric variables) and Spearman rank (for non-parametric variables) correlations were used to determine the association between the variables.

3. RESULTS

Results consist of quantitative data from 419 respondents who were involved in the study. Data was analysed using descriptive statistics for demographic data. Frequency distribution for the different variables, spearman correlation (for non-parametric variables) and Pearson's moment correlation (for parametric variables) were used to obtain association between variables.

4. DISCUSSION

This study explored the interrelationships among physical activity level, dietary intake, alcohol consumption, tobacco use and anthropometric indices among young adults in Enugu metropolis. A total of 419 (195 males and 224 females) participants took part in the study. The majority of the participants (194; 46.3%) were young adults between the ages of 18 to 25 years, 52.3% (219) and 47.7% (200) of the participants were students and business men/women respectively, with majority being unmarried (291; 69.5%).

Upon careful analysis, study found about 3.6% (15) of the participants to be underweight, 42.5%

(178), with 34.1% (143) and 19.8% (83) observed to be obese and overweight respectively. A good number of the participants (147; 35.1%) were within bother line food consumption. Interestingly, 59.7% (250) of them were of low alcohol consumption risk with 377; 90.0% being of low tobacco risk. Up to 49.4% (207) of the participants were of low physical activity level with about 29.5% (125) and 20.8% (87) being of moderate and high PA level respectively. Obesity prevalence in this study was high and concurs with the study on obesity prevalence by Kumah et al. 2008 [1], carried out among undergraduate students of University of Nigeria, Nsukka Campus.

Females in 2007 had shown an increasing prevalence of obesity and overweight among students from hometown of President Prudente of Brazil [11]. According to Kumah et al (2015) [1], there was a high prevalence of overweight and obesity based on BMI alone in Kumasi, Ghana. Amira et al. (2011) [14] also found a rising prevalence rate of overweight and obesity in Nigeria with the highest prevalence of overweight observed in Ilorin and the highest prevalence of obesity observed at Lagos respectively [14].

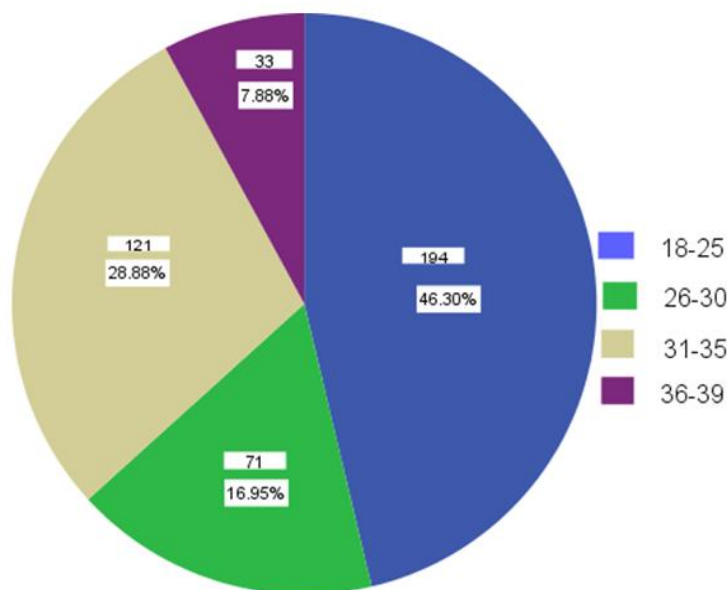


Fig. 1. Socio-demographic distribution of participants by age

From figure 1 (above), It is seen that 194 (46.30%) participants were between 18-25 years, with 71 (16.95%) being between 26-30 years and 121 (28.88%), 33 (7.88%) between 31-35 and 36-39 years respectively

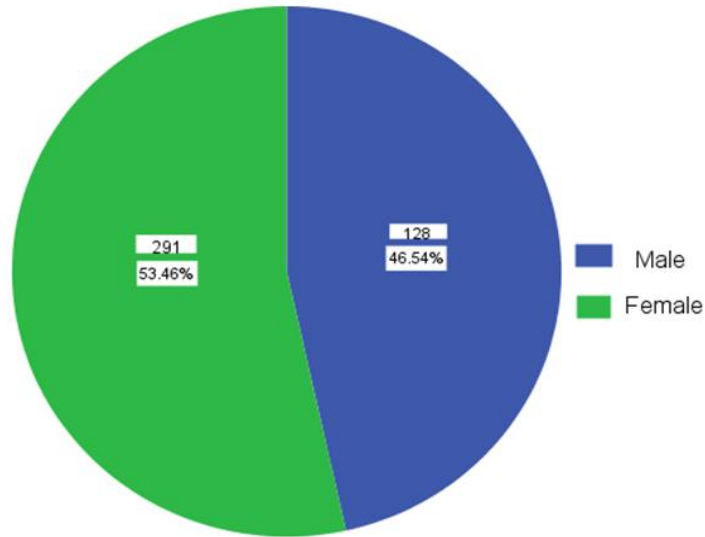


Fig. 2. Socio-demographic distribution of participants by gender

It is shown (from figure 11 above) that 128 (46.54%) respondents of the 419 participants were males with 291 (53.46%) being females.

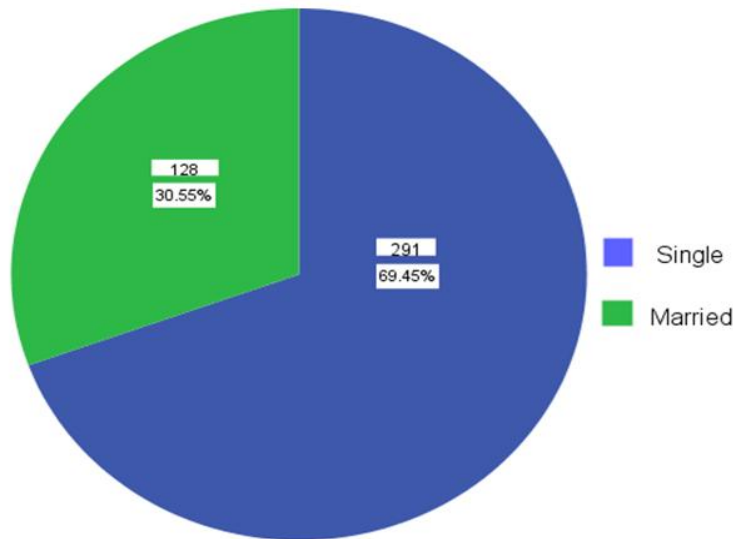


Fig. 3. Socio-demographic distribution of participants by marital status

Above figure shows that of the 419 participants, 128 (30.55%) were married and 291 (69.45%) were unmarried.

4.1 Relationship between Alcohol Consumption and BMI of Young Adults

This study showed that there was a significant and positive correlation between alcohol consumption and BMI ($r = 0.320$; $p < 0.001$). This means that alcohol consumption influences the BMI of young adults. This finding is in

concordance with those of Rahnama [15], who found that harmful use of alcohol was a contributing factor to overweight and obesity; posing as risk factor to many non-communicable diseases. Gregory and Jean-Philippe [16] also found that heavy alcohol intake is linked with adiposity gain while light or moderate drinking is not associated with weight gain.

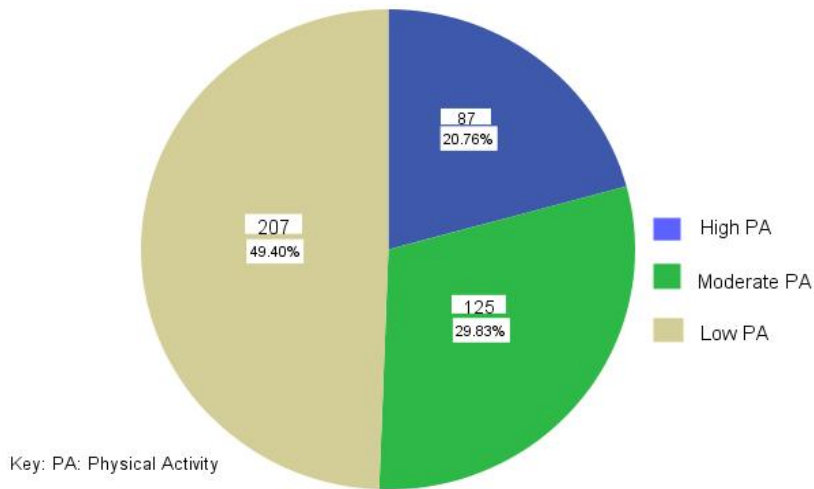


Fig. 4. Physical activity levels of respondents

It is revealed (from figure IV above) that 87 (20.76%) of sampled subjects were highly physically active, 125 (29.83%) were moderately active and 207 (49.40%) had low physical activity level

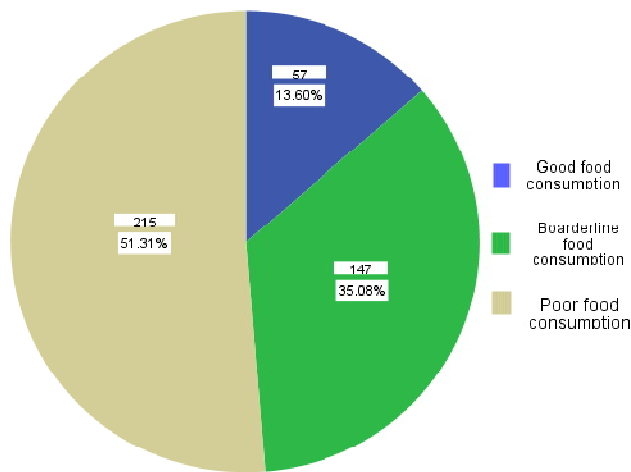


Fig. 5. Distribution of respondents by dietary intake

Above figure reveals that of the 419 participants, 57 (13.60%) had high dietary intake, 147 (35.08%) had moderate dietary intake and 215 (51.31%) had low dietary intake

Table 1. Spearman’s rank correlation between demographics and indices of obesity (BMI, WC)

	Age	Gender	Marital status	WC	BMI
Age	1				
Gender	r = 0.051 p = 0.296	1			
Marital status	r = 0.732** p = 0.000	r = 0.193** p = 0.000	1		
WC	r = 0.683** p = 0.000	r = 0.011 p = 0.824	r = 0.466** p = 0.000	1	
BMI	r = 0.754** p = 0.000	r = 0.021 p = 0.662	r = 0.569** p = 0.000	r = 0.833** p = 0.000	1

Keys: WC: Waist circumference, BMI: Body Mass Index. * Correlation is significant at the 0.05 level. There was a significant and positive correlation between age and BMI ($r = 0.754$; $p < 0.001$) and between age and waist circumference ($r = 0.683$; $p < 0.001$)

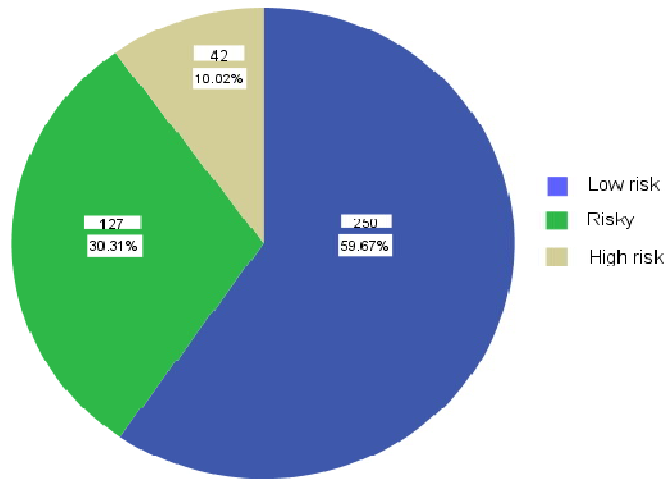


Fig. 6. Alcohol consumption distribution of respondents

Of the 419 participants (from figure VI above), 250 (59.67%) had low alcohol consumption risk, 127 (30.31%) had moderate risk with 42 (10.02%) having high risk

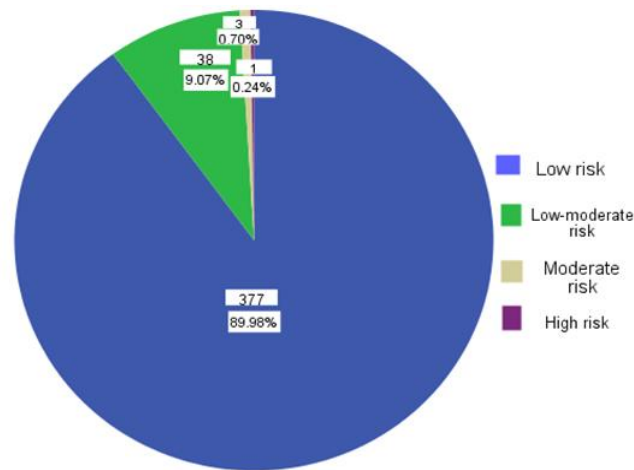


Fig. 7. Tobacco use distribution of respondents

Above figure shows that out of 419 participants, 377 (89.98%) had low tobacco use risk, 38 (9.07%) had low-moderate risk, 3 (0.70%) had moderate risk while only 1 (0.24%) had high risk

Table 2. Spearman’s Rank Correlation between Modifiable Risk Factors and indices of obesity (BMI, WC)

	Diet	Alcohol consumption	Tobacco use	WC	BMI
Diet	1				
Alcohol consumption	$r = 0.169^{**}$ $p = 0.001$	1			
Tobacco use	$r = 0.112^*$ $p = 0.021$	$r = 0.515^{**}$ $p = 0.000$	1		
WC	$r = 0.312^{**}$ $p = 0.000$	$r = 0.385^{**}$ $p = 0.000$	$r = 0.245^{**}$ $p = 0.000$	1	
BMI	$r = 0.343^{**}$ $p = 0.000$	$r = 0.320^{**}$ $p = 0.000$	$r = 0.196^{**}$ $p = 0.000$	$r = 0.833^{**}$ $p = 0.000$	1

Keys: WC: Waist circumference, BMI: Body Mass Index. * Correlation is significant at the 0.05 level. There was a significant and positive correlation between diet and BMI ($r = 0.343$; $p < 0.001$) and between diet and waist circumference ($r = 0.312$; $p < 0.001$).

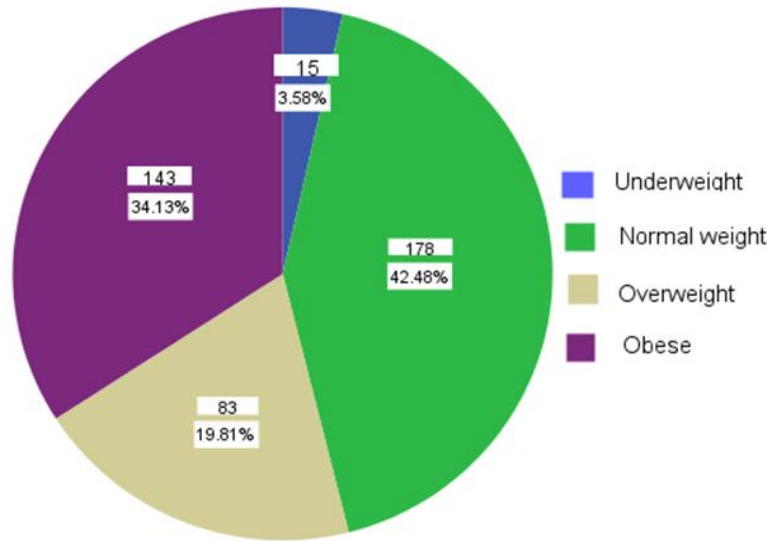


Fig. 8. Body mass index distribution of respondents
 Above figure reveals that 15 (3.58%) out of 419 participants were underweight, 178 (42.48%) had normal weight, 83 (19.81%) were overweight while 143 (34.13%) of them were obese.

Table 3. Pearson’s moment correlation between Physical Activity and indices of obesity (BMI, WC)

	WC	BMI	PA level
WC	1		
BMI	$r^2 = 0.843^{**}$ $p = 0.000$	1	
PA level	$r^2 = -0.413^{**}$ $p = 0.000$	$r^2 = -0.453^{**}$ $p = 0.000$	1

Keys: WC: Waist circumference, BMI: Body Mass Index, PA level: Physical Activity level

* Correlation is significant at the 0.05 level. There was a significant and negative relationship between physical activity and BMI ($r^2 = -0.453$; $p < 0.001$) and between physical activity and waist circumference ($r^2 = -0.413$; $p < 0.001$)

4.2 Relationship between Tobacco Use and BMI of Young Adults

This study showed that there was a significant and positive correlation between smoking and BMI ($r = 0.196$; $p < 0.001$). This means that smoking influences BMI of young adults. The result of this study is the same with the findings of Rahnama [15] who found out that tobacco use was a contributing factor to overweight and obesity which were risk factors to many non-communicable diseases. Addo et al., [17] also found a clear association between heavy smoking and increase in weight among men but no relationship between former smoking and increase in weight.

4.3 Relationship between Physical Activity and BMI of Young Adults

The study showed that there was a significantly and negative relationship between physical activity and BMI ($r^2 = -0.453$; $p < 0.001$). This means that physical activity level influences the BMI of young adults and is in view with the findings of Addo [17] who found that less physical activity had significant increase on obesity and overweight. In 2014, Farid et al. [13] also found that physical inactivity and sedentary behaviour are important contributing factors to overweight and obesity in young people. In addition, many studies found out that people who are physically active on a regular basis are less likely to gain weight.

5. CONCLUSION

Within the ambient of vulnerability to possible errors, this study has shown female population to have a higher number of obese individuals more than the males. It also found a more physically active male than female population with males having higher dietary intakes than females. This study also established by way of correlation, that gender has no relationship with BMI and waist circumference of young adults.

Similar studies with long term outcome and higher sample size is recommended. Interventional trials are strongly encouraged, as they would provide more definite findings.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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