

Correlation OF Body Mass Index and Waist Circumference in Mumuye and Ichen Females of Taraba State, Nigeria

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Abstract: A study of body mass index (BMI) with correlation to waist circumference (WC) among Mumuye and Ichen females in Taraba state, Nigeria was carried out. The female subjects of the study were randomly selected from Jalingo and Kurmi Local Government Areas of Taraba States respectively. Overweight and obesity are the leading nutrition-related disorders of clinical and public health concern. Assessment and classification of these conditions are dependent on specific body mass index (BMI) cut-off points. The heights, weight, waist circumference of 320 females (160 Mumuye females; 160 Ichen females) were measured. Their BMIs were calculated from the heights and body weights. The results obtained showed a mean BMI of $23.3 \pm 0.279 \text{ kg/m}^2$ and $21.3 \pm 0.112 \text{ kg/m}^2$ for Mumuye female and Ichen female populations respectively. The waist circumference for Mumuye female was 74.4 ± 2.14 and for Ichen female population, it was 72.5 ± 0.0174 . Pearson correlation coefficient revealed statistically significant ($p < 0.05$) positive correlation between BMI and waist circumference in Ichen ($r = 0.64$) and Mumuye ($r = 0.74$) female populations. This study revealed that a strong positive correlation exists between the BMI and WC, and the BMI increases with an increase in the WC.

Keywords: Body mass index, height, waist circumference, weight.

I. Introduction

Body weight is used as an indicator of the health status of an individual, and can be described as a percentage of the ideal or desirable weight which thereby categorises individuals into health status as; underweight, overweight, or obese. The two very important anthropometric parameters which are useful in the measurement of the body fat of adults are the body mass index (BMI) and waist circumference (WC). Thus BMI is a practical anthropometric parameter generally accepted as the most useful way to measure the body fat of adults below the age of 70 years [1].

Body Mass Index: is a useful tool in the estimation of a healthy body weight based on the individual's height [2] (Mackey, 2004). BMI was also termed "Quetelet Index" which was first used by a Belgian polymath "Adolphe Quetelet" between 1830 and 1850 during the course of his developing "social physics". Mackey [2] defined body mass index as weight in kilograms (kg) divided by the square of the individual's height in metres (m^2). This has been adopted as a standard for universal use in medicine and for other anthropometric purposes. Since body mass index serves as a means of assessing how much an individual's body weight has departed from the normal, some values were suggested to place individuals into various weight groups such as follows: a BMI of 18.5-24.9 may indicate optimal weight, a number lower than 18.5 suggests the individual as underweight, while a number 25 and above may indicate overweight, one below 17.5 may indicate a related disorder, a number 30 and above suggests obesity, over 40 morbidly obese [3].

Waist Circumference:

The waist is the narrowest part of the body trunk. The waist circumference (WC) is measured midway between the inferior margin of the last rib and the crest of the ilium to the nearest centimeter. Values obtained from measurements of waist circumference are sex sensitive. The male collects fat more readily around the waist while in females collect fat more around the buttocks and hips. Therefore the values in males are higher than in the females. In males, values less than (<94) are normal, 94 - 101.9 suggest abdominal overweight, while values greater than (>102) indicate abdominal obesity. For the female, values less than (<80 cm), 80 - 87.9, and greater than (>88) may indicate normal, overweight and abdominal obesity respectively [3]. World health organization reports that one billion subjects (1 billion) are overweight and about three hundred million (300 million) obese [4]. Epidemiological data shows that prevalence rates are increasing not only in industrialized countries but also in developing countries and these conditions could probably be related to some risk factors

[4]such as high blood pressure, stroke, diabetes etc.In view of these problems, it is pertinent to determine the body mass index,waist circumference and also asses if there is correlation between these two parameters.

II. Methodology

Study population:

For this study, we recruited 320 females of the age group 18 to 65 years randomly from Jalingo and Kurmi Local Government Areas of Taraba States, Nigeria. Informed consent was obtained from the subjects who were participated in this study. The procedure to be performed was explained in detail in the local language to each subject. The materials used in this study for data collections are: Calibrated wooden metre rule, a stretch free tape rule, Bathroom scale with a 120kg capacity: model: BR9011 ISO 9001:2000.

Inclusion Criteria:

- i. The subject were all Mumuye and Ichen
- ii. The subjects were all within the age of 18 – 65 years.
- iii. The subjects were all female.

Exclusion Criteria:

- i. Non Mumuye or Ichen
- ii. Below 18 years of age

Parameters:

To ensure accuracy for all anthropometric measurements, the standard technique of measurements recommended by Lohman *et al*[5] was adopted.

i. Height:

To measure the height, subjects stood barefooted erect facing forward, their arms were held laterally by their sides with palms facing forward,feet closely apposed and straight, and eyes looking straight ahead with their backs against the metre rule. Standing heights were thus measured to the nearest metre.

ii. Weight:

The weight of each individual was measured using a bathroom scale to the nearest kilogram. The subject mounts the scale barefooted and as light as possible, standing erect with head straight forward and arms laterally positioned.

Waist Circumference:

Measurements for waist circumference were taken with the stretch free tape rule, wrapped around the subject's waist, mid way between the lowest part of the coastal margin (bottom rib) and the iliac crest. Measurements were taken to the nearest centimetre.

Body Mass Index:

Values for body mass index were obtained from the values of weight and height using the formula described by ADOLPHE QUETELET mathematically represented by the formula[2];

$$BMI = \frac{weight (kg)}{height(m^2)}$$

Statistical Analysis

The data were analyzed using instat3 data analysis software for anthropometric variables. The significance of differences in the means of the parameters and indices reported was determined using paired sample student t- test and a p value of <0.05 (two tailed) was considered as significant. Pearson correlation coefficient (r) was analyzed for understanding the overall relationship between the anthropometric variables (BMI, WC).

III. Results

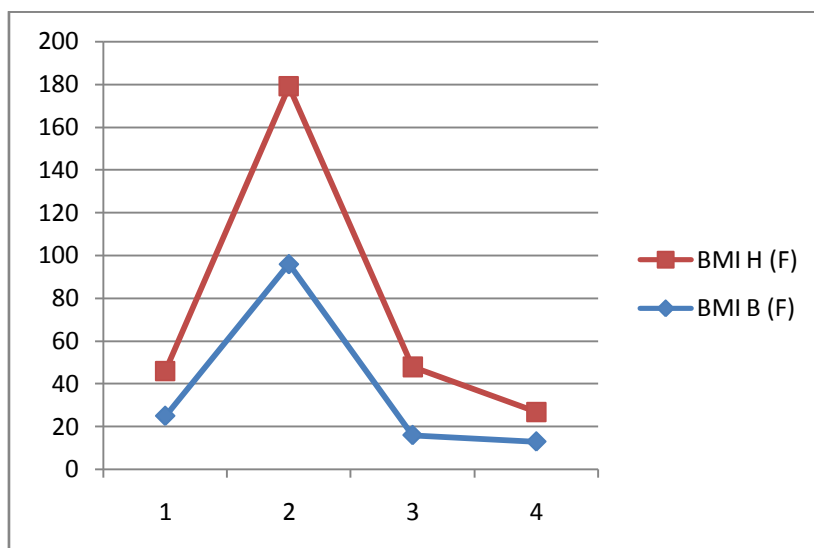
The results showed that BMI increases with an increase in the WC.The mean BMI and WC were lower in Mumuye female than Ichen female populations (table 1).Majority of the Nigerian post-pubertal Ichen females (about 62%) fall within the normal range of weight for height ratio (which is between 18.5kg/m² – 24.9kg/m²), about 17.7% of them are underweight (i.e. they have a BMI value below 18.5kg/m²), about 10.2% are overweight having a BMI value 25kg/m² and above. The remaining 10.1% are obese with BMI value 30 and above. Also, for the post-pubertal Mumuye population, majority (about 57.5%) are within the normal BMI

range, 13% are underweight, 20.2% are overweight while the remaining 9.3% are obese (figure 1). Pearson correlation coefficient revealed

Variables	Height(m)	Weight(kg)	BMI(kg/m ²)	WC(cm)
Mumuye Females	1.8± 0.105	68.3 ± 1.032	23.3 ± 0.279	74.4 ± 0.214
Ichen Females	1.7±0.106	70.1 ± 1.151	21.4± 0.112	72.5 ± 0.174

statistically significant ($p < 0.001$) positive correlation between BMI and waist circumference in Mumuye ($r = 0.74$) and Ichen ($r = 0.64$) female populations (table 2 and fig. 1).

TABLE 1: The mean values of BMI, WC, height and weight among Mumuye and Ichenfemales.



BMI I (F) = BMI Mumuye female; BMI I (F) = BMI Ichen Females.

Figure 1: Frequencies of underweight, normal weight, overweight and obesity among Bura and High.

Table 2: Pearson correlation coefficient between BMI and waist circumference in MumuyeandIchen female populations (*)extremely significant).**

POST PUBERTAL MUMUYE FEMALES			POST PUBERTAL ICHEN FEMALES	
	BMI(kg/m ²)	Waist circumference (cm)	BMI(kg/m ²)	WC (cm)
Mean	23.3	74.4	21.3	72.5
SEM	0.269	0.613	0.112	0.274
P value	p<0.001		p<0.001	
Correlation coefficient	+ 0.74***		+ 0.64***	

IV. Discussion

The World Health Organization has described obesity as one of today’s most neglected public health problem, affecting every region of the world [6]. The use of anthropometric data for assessing weight and nutritional status has been adopted internationally as a standard practice [3]. There was a reasonable correlation between BMI and waist circumference more specifically, women of all age groups showed greater correlation between BMI, body mass, and WC. Turconiet al, [4] also found that there was a positive correlation between BMI and WC. Also Vazquez et al[7] demonstrated consistently strong associations of BMI and WC, they noted that the statistical reality is such that WC and BMI are highly correlated and are likely to behave similarly in

diabetes prediction. In recent times Van Dis *et al*[8] correlated BMI and WC by establishing associations of one to the other as risk factors for heart disease through accurate anthropometric measurements.

Ziraheiet *al*[9] carried out research among post pubertal Nigerian subjects within Michika and Biu local government areas (Adamawa and Borno states respectively) and Adeyemiet *al*[1] did same work in Ilorin metropolis and obtained results, showed that BMI and WC in both males and females had a strong positive correlation. The combination of BMI and WC explains a greater variance in non abdominal, subcutaneous and visceral fat than did either BMI or WC alone [10]. BMI measurements were defined according to WHO recommendations in three categories: normal as 18.5-25 kg/m²; overweight as 25-29.9 kg/m²; and obese as 30 kg/m² or more. Similarly, waist circumference measurements in men were defined as normal (< 94 cm), overweight (94-101.9 cm) and abdominally obese (>102 cm); in women these measures were < 80 cm, 80-87.9 cm, and >88 cm respectively [8]. People who are overweight or obese have a greater chance of developing high blood pressure, high blood cholesterol or other lipid disorders, type 2 diabetes, heart disease, stroke, and certain cancers, and even a small weight loss (just 10 percent of your current weight) will help to lower your risk of developing those diseases [11].

The result of this study showed that the mean values of the anthropometric parameters obtained for the post-pubertal Mumuye females are greater than that obtained for the post-pubertal Ichen females. The indices calculated from these parameters have a higher mean value in post-pubertal Mumuye females than Ichen females. The present study observed that WC has shown significant correlation with BMI. Similar findings were reported by some authors [1][9].

A strong positive correlation was observed between the body mass index and waist circumference obtained for the post-pubertal Mumuye and Ichen female population. This implies that waist circumference is part of the major determinant of the BMI of an individual i.e. the BMI increases with an increase in the waist circumference of both the Mumuye and Ichen female population, with the Pearson correlation coefficient *r* between BMI and WC in Ichen as 0.69 and 0.78 in Mumuye. This is in close agreement with the previous work done by Adeyemiet *al*, [1] in which the correlation coefficient *r* of BMI with WC for both males and females were 0.67 and 0.74 respectively. Subjects who are overweight and do not have a high waist measurement, may need to prevent further weight gain rather than lose weight.

V. Conclusion

Our study proved the positive correlation between BMI and WC and shows that the BMI increases with an increase in the WC. So we concluded that excessive deposition of fat in women is associated with living habit and dietary values. It is necessary to have a good physical activity to avoid unnecessary overweight problems. In order to ensure good health simple exercise can be used to maintain normal weight. In conclusion, the results of this study showed that a strong positive correlation exist between the BMI and WC.

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