

Study of the Body Mass Index and Waist to Hip Ratio of the Ogoni and Ikwerre Adults in Nigeria

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Abstract: The Body Mass Index (BMI) is an important anthropometric tool used in the determination of how much of the body is composed of fat. The BMI determines the caloric nutritional status of an individual by the consideration of the result of its ratio of weight in kilogram to the square of the height of in metres. The determination of the differences in nutritional status that exist between the Ogonis and Ikwerres using their body mass indices and Waist to Hip Ratio is the purpose of this research so as to inform us on the classification of the ethnic groups whether they are underweight, overweight, normal and/or obese. A sample size of 1000 was used for this study, 500 from each tribe. The sample collection was randomly selected from villages in Ogoni and Ikwerre respectively, all in Rivers State. The results obtained showed that the average mean value of BMI is 25.14 kg/m² for Ogoni females, 23.81 kg/m² for Ogoni males, 23.29 kg/m² for Ikwerre females and 21.51 kg/m² for Ikwerre males. Similarly, the average mean values of Waist to Hip Ratio (WHR) obtained showed 1.19 for Ogoni females, 0.88 for Ogoni males, 0.83 for Ikwerre males. The study also showed that amongst the males, 6% were underweight, 27.6% were overweight, 58.4% were normal and 6.8% considered obese while amongst the Ogoni females, 8% were underweight, 29.6% overweight, 45.6% were normal and 15.6% were obese. The results obtained from the male Ikwerre population indicated that 3.2% were underweight, 11.2% were overweight, 88.4% were normal and no case of obesity in this group category while the results obtained from the Ikwerre females showed 4.8% underweight, 13.2% overweight, 76.4% normal and 2.8% obese. There is therefore a clear indication from the result and data obtained that the Ogoni population show a greater percentage of obesity than the Ikwerres. This is important in the analysis and possible health remedy recommendation.

Key words: Body mass index, Ikwerre, Nigeria, Ogoni, waist to hip ratio

INTRODUCTION

Body mass index (BMI) by definition is an indicator of how much an individual's body is composed of fat (Durenberg *et al.*, 2008). It is also an anthropometric measurement, which is used to determine the caloric nutritional status of an individual by taking a ratio of the weight in kilogram to the square of the height in metres. It is important to note the following BMI values and its implications: When the BMI is 18.5 kg/m², the individual is said to be underweight. When the BMI is between 18-24.9 kg/m², the individual is said to have a normal weight and also healthy (Falkstedt *et al.*, 2007). According to the National Heart, Lung, and Blood Institute, a body mass index of 25-29.9 kg/m² is considered overweight. Also, a body mass index of 30 or greater is considered obese. This is associated with increased risks of health problem. He *et al.* (2001) determined the relationship between percentage body fat and Body Mass Index (BMI) in

Chinese population of Hong Kong and to investigate whether the newly proposed lower BMI cuts off for obesity. Also, Calle *et al.* (1999) concluded that the risk of death from all causes, cardiovascular disease, cancer, or other diseases increases throughout the range of moderate and severe overweight for both men and women in all age groups.

Waist circumference and waist-to-hip ratio are widely used as an indicator of abdominal obesity in population studies. It is increasingly clear that waist-to-hip ratio is a better reflection of the accumulation of intra-abdominal or visceral fat depot, because of the postulated role of visceral fat depot in health risk disease. Behavioural factors associated with a high waist circumference and waist-to-hip ratio (e.g., high alcohol consumption, physical inactivity and smoking) were attributed to both relatively large waist and relatively narrow hips (Jacob *et al.*, 2001). Waist-to-hip ratio shows a graded and highly significant association with myocardial

Table 1: Mean waist circumference, mean hip circumference, Mean BMI and Mean WHR

| Parameters | Ogoni males | Ogoni females | Ikwerre males | Ikwerre females |
|---|-------------|---------------|---------------|-----------------|
| Mean Waist Circumference (cm) ±SE | 85.41±3.20 | 83.89±0.77 | 78.67±0.40 | 78.96±0.52 |
| Mean Hip Circumference (cm) ±SE | 96.53±0.56 | 99.68±0.66 | 92.76±0.62 | 95.32±0.55 |
| Mean Body Mass Index (kg/m ²) ±SE | 23.81±0.33 | 25.14±0.38 | 21.51±0.16 | 23.29±0.74 |
| Mean Waist To Hip Ratio±SE | 0.88±0.03 | 1.19±0.32 | 0.83±0.00 | 0.82±0.00 |

SE: Standard Error of mean

Table 2: Mean waist circumference, mean Hip Circumference, Mean Body Mass Index and Mean Waist to Hip Ratio of the various age groups of male and female subjects from Ogoni

| Age group | Ogoni WC±SE | | Ogoni HC±SE | | Ogoni BMI±SE | | Ogoni WHR±SE | |
|-----------|-------------|------------|-------------|-------------|--------------|------------|--------------|-----------|
| | Male | Female | Male | Female | Male | Female | Male | Female |
| 18-21 | 84.69±9.30 | 72.04±0.72 | 91.08±0.51 | 92.43±1.02 | 21.75±0.73 | 21.37±0.31 | 0.82±0.00 | 2.27±1.34 |
| 22-25 | 84.44±1.30 | 80.61±1.26 | 100.34±1.12 | 95.79±1.15 | 24.23±0.36 | 24.04±0.95 | 0.80±0.04 | 0.81±0.02 |
| 26-29 | 76.04±0.63 | 83.85±1.26 | 91.33±0.67 | 100.23±1.33 | 21.80±0.27 | 25.93±0.71 | 0.83±0.00 | 0.83±0.03 |
| 30-33 | 88.94±1.01 | 91.96±1.56 | 102.11±1.04 | 105.69±1.03 | 25.30±0.44 | 28.35±0.75 | 1.04±0.17 | 0.87±0.01 |
| 34-37 | 81.25±3.97 | - | 92.13±3.98 | - | 23.68±2.23 | - | 0.88±0.00 | - |
| 38-41 | 101.14±1.98 | 94.96±2.15 | 110.14±1.39 | 111.07±1.60 | 30.01±0.00 | 26.91±0.97 | 0.91±0.00 | 0.85±0.03 |
| 42-45 | 103.33±2.67 | 97.84±1.52 | 112.00±2.00 | 105.96±1.66 | 31.88±0.92 | 29.40±1.09 | 0.92±0.00 | 1.26±0.34 |

Key: WC = Waist Circumference, HC = Hip Circumference, BMI = Body Mass Index, WHR = Waist to Hip Ratio, SE = Standard Error

infarction risk worldwide. Redefinition of obesity based on waist-to-hip ratio instead of Body Mass Index (BMI) increases the estimate of myocardial infarction attribution to obesity in most ethnic groups (Charles and Laurie, 2005). People with higher waist circumference and waist-to-hip ratio tend to be at higher risk of cardiovascular diseases than people who carry more weight around their hips (Krisha, 2005). Large waist circumference in men and woman was associated significantly with low High-density cholesterol (Low HDC-cholesterol) (Seidell *et al.*, 2001). High waist circumference in females is associated with hyperlipidemia and cigarette smoking (Gnasso *et al.*, 1994). High waist-to-hip ratio in men could be associated with environmental factors, nutritional factors, alcoholism and socio-economic factor (Yusuf and Ounpun, 2005). Waist circumference may be a better indicator of obesity related disease than Body Mass Index (BMI), especially among particular populations. The elderly, with less muscle mass, tend to have underestimated body mass index and body builders who are usually muscular could have a high body mass index. Certain ethnic groups are genetically predisposed to storing more fat in the abdomen, even at healthy weights (Mark *et al.*, 1999). Having a history of alcoholism can cause central obesity syndrome (Hans *et al.*, 1996). Waist-to-hip ratios are measures of obesity and are believed to be better predictors of coronary heart disease (Onat *et al.*, 2004). Waist-to-hip ratio analyses the relationship between the waist and hip measurement to help you understand your body type and current health status (Oladipo *et al.*, 2009). Most people store their fat in two distinct ways, often called “apple” and “pear” shape (Aronne, 2002). In spite of several reports on these important subjects on most populations of the world, reports on Nigerians are however scarce with no report on the ethnic groups under investigation hence the need for the present study.

MATERIALS AND METHODS

This study was conducted between July-November, 2008. 1000 subjects were randomly selected from Ikwerre

and Ogoni ethnic groups in Rivers State of Nigeria. 500 were Ikwerres and 500 were Ogonis. Out of the 500 subjects selected from Ikwerre ethnic group, 250 were males and 250 were females. Similarly, 250 of the 500 subjects selected from Ogoni ethnic group, were males and 250 were females. All the subjects were between the ages of 18 and 45 years.

The parameters measured included Weight, height, waist circumference and hip circumference. Weight of each subject was determined using weighing scale in Kg. Height measurement was done with the aid of height measuring tape in metre. Body Mass Index (BMI) was determined from the above parameters measured as

$$BMI = \text{Weight (kg)} / \text{Height (m)}^2$$

Waist Circumference (W) and Hip Circumference (H) were measured with the tailors tape in centimetres from where waist hip ratio was determined as W/H .

RESULTS

Table 1 show the mean values of Waist Circumference, Hip Circumference, Body Mass Index and Waist to Hip Ratio of Ogonis and Ikwerres. The Ogoni males showed a higher value for mean waist circumference while in Ogoni females, a higher value was observe for Mean Hip Circumference, Mean Body Mass Index and Mean Waist to Hip Ratio. Table 2 and 3 show Mean Waist Circumference (MWC), Mean Hip Circumference (MHC), Mean Body Mass Index (MBMI) and Mean Waist to Hip Ratio (MWHR) of the various Age Groups of male and female subjects from Ogoni and Ikwerre. The Ogoni males in Table 2 showed higher values in age groups 38-41 and 42-45 for mean WC, mean HC, mean BMI and mean WHR, except in mean HC and mean WHR where Ogoni females showed higher values. Higher values were also observed in mean HC and mean WHR of Ogoni females. In age group 18-21, Ogoni females showed higher values in mean HC and mean WHR. Furthermore, in Table 3, the Ikwerre age groups

Table 3: Mean Waist Circumference, mean Hip Circumference, Mean Body Mass Index and Mean Waist to Hip Ratio of various age groups of male and female subject from Ikwerre

| AGE GROUP | Ikwerre WC±SE | | Ikwerre HC±SE | | Ikwerre BMI±SE | | Ikwerre WHR±SE | |
|-----------|---------------|------------|---------------|-------------|----------------|------------|----------------|-----------|
| | Male | Female | Male | Female | Male | Female | Male | Female |
| 18-21 | 78.50±1.52 | 77.97±0.59 | 93.00±0.51 | 93.24±0.62 | 19.47±0.61 | 21.72±0.25 | 0.84±0.01 | 0.83±0.01 |
| 22-25 | 78.72±0.47 | 77.97±0.92 | 93.42±0.41 | 96.07±1.03 | 21.46±0.17 | 25.02±2.28 | 0.83±0.01 | 0.81±0.01 |
| 26-29 | 79.06±0.76 | 81.22±2.27 | 92.69±1.83 | 98.09±2.04 | 21.44±0.26 | 24.49±0.77 | 0.84±0.01 | 0.82±0.01 |
| 30-33 | 76.17±0.88 | 87.60±4.49 | 92.39±0.96 | 106.40±4.74 | 21.46±0.38 | 27.10±2.74 | 0.81±0.01 | 0.82±0.02 |
| 34-37 | 82.25±1.63 | 87.63±2.25 | 90.98±4.02 | 100.63±2.77 | 24.21±0.42 | 24.37±0.87 | 0.85±0.01 | 0.86±0.01 |
| 38-41 | - | - | - | - | - | - | - | - |
| 42-45 | - | - | - | - | - | - | - | - |

Table 4: Frequency of occurrence of underweight, normal, overweight, and obese individuals amongst the Ogonis and the Ikwerres of Nigeria

| BMI categories | BMI range | Ogoni male | Ogoni female | Ikwerre male | Ikwerre female |
|----------------|-----------|------------|--------------|--------------|----------------|
| Underweight | <18.5 | 15 | 20 | 8 | 12 |
| Normal | 18.5-24.9 | 146 | 114 | 221 | 191 |
| Overweight | 25-29.9 | 69 | 74 | 28 | 33 |
| Obese | >30 | 17 | 39 | - | 7 |

Table 5: Results obtained from hypothesis testing (Z-test-SPSS) of the various parameters under consideration

| | Ogoni HC | | Ikwerre HC | | Ogoni WC | | Ikwerre WC | | Ogoni BMI | | Ikwerre BMI | | Ogoni WHR | | Ikwerre WHR | |
|--------------|----------|-------|------------|-------|----------|--------|------------|-------|-----------|-------|-------------|--------|-----------|-------|-------------|-------|
| | M | F | M | F | M | F | M | F | M | F | M | F | M | F | M | F |
| Mean | 96.53 | 99.68 | 92.75 | 95.32 | 85.41 | 83.89 | 78.66 | 78.96 | 23.81 | 25.14 | 21.51 | 23.30 | 0.88 | 1.19 | 0.83 | 0.82 |
| Variance | 79.08 | 108.9 | 96.49 | 76.02 | 2562.32 | 149.16 | 40.14 | 69.00 | 27.49 | 36.11 | 6.15 | 137.78 | 0.26 | 26.77 | 0.004 | 0.005 |
| Z-calculated | 4.50 | 5.07 | 4.50 | 5.07 | 2.09 | 5.27 | 2.09 | 5.27 | 6.27 | 2.21 | 6.27 | 2.21 | 1.42 | 1.13 | 1.42 | 1.13 |
| P-value | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.03 | 0.00 | 0.00 | 0.03 | 0.00 | 0.03 | 1.156 | 0.26 | 1.156 | 0.26 |

M = Male, F = Female

26-29, 30-33 and 34-37 showed higher values for mean WC, mean HC and mean BMI except for mean WHR where males show high values in age group 18-21, 22-25, 26-29 and 34-37.

In Table 5, statistically significant values were observed in all the parameters measured in subjects of both ethnic groups.

DISCUSSION

The research investigated the comparison of BMI between the Ogoni and the Ikwerre tribes and their waist to hip ratios. The study was carried out on 1000 subjects, with 500 for each tribe by correlating the BMI with other parameters such as age.

Comparison of the body mass index of both tribes and their waist to hip ratios showed that the calculated mean value of body mass index was observed to be 23.81 kg/m² for Ogoni males, 21.51 kg/m² for Ikwerre males. For Ogoni females it was observed to be 25.14 and 23.29 kg/m² for Ikwerre females. This is related to the research done by He *et al.* (2001), comparing the BMI of the Caucasians and their percentage body fat, indicating that the BMI of the Caucasians population significantly under predicted the percentage body fat (%BF) by 1.1% in males and 3.4% in females and a predicted BMI of 25 and 30 kg/m² respectively.

Also, according to Janssen *et al.* (2004), men's waist circumference of 40 inches or greater increases the risk of heart diseases and strokes whereas in women it is a waist circumference of 35 inches. This can be inferred therefore that the Ogoni females have an unacceptable BMI because it falls outside 18.5-24.9 kg/m² and the Ogoni males have an acceptable BMI on the average.

The data obtained from this study was analyzed using the Z-test and the evaluated result that as shown in Table 3 showed that there was a significant difference between the BMI of the Ogonis and the Ikwerres. There is significant difference in waist to hip ratio for both males and females of both tribes at 5% level (p<0.05).

Furthermore, careful study of the two groups reveals that in 6% of Ogoni males was underweight, 27.6% was overweight, 58.4% was normal and 6.8% obese while in female population of Ogonis, 8% was underweight, 29.6% was overweight, 45.6% was normal and 15.6% obese. Similarly, in male population of the Ikwerres, 3.2% was underweight, 11.2% was overweight, 88.4% was normal and none was recorded for the obese category, while, in female population of same tribe, 4.8% was underweight, 13.2% was overweight, 76.4% was normal and 2.8% was obese.

CONCLUSION

The following conclusions can be drawn from this research work conducted amongst the Ogonis and Ikwerres of Nigeria. There is significant difference between the BMI of the Ogonis and the Ikwerres in general. There is also significant difference in the Waist to Hip Ratio of both groups at 5% level (p<0.05)

Significant differences were recorded for Waist Circumference and Hip Circumference of both tribes at 5% level (p<0.05). Based on the entire observation, it can be inferred that the Ogoni tribe has more of the obese subjects than the Ikwerre tribe. This data is recommended for nutritional survey in Public Health in Nigeria. This can also be use in enlightenment campaign on risk factors of cardiovascular diseases in Nigeria. The indices

obtained in this are a useful marker for the determination of individuals who are at risk of the aforementioned condition in Nigeria.

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