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RESEARCH PAPER

BODY MASS INDEX AND WAIST-TO-HIP RATIO AMONG ADULTS OF OBOWO NATIONALITY IN IMO STATE, NIGERIA

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ABSTRACT

This study investigates the nutritional health status of adults in Obowo L.G.A. Imo State, Nigeria, as indicated by their BMI and WHR. 500 adults were recruited for the study and using standard procedures, their height, weight, and waist-hip circumference, were measured and recorded for BMI and WHR determination. Data were analyzed using SPSS for discrete statistics and test of significance. Results showed a non-significant difference ($P>0.05$) in the mean BMI between males ($26.45\pm0.73 kg/m^2$) and females ($24.65\pm0.16 kg/m^2$). Male subjects presented a greater degree of obesity and are at a higher risk for cardiovascular diseases as 1.6%, 42.8%, 28% and 27.6% of the males and 2.8%, 60.4%, 22.8% and 14% of the females were found to be underweight, normal, overweight and obese respectively. However, a significant difference ($P<0.05$) was observed in the mean WHR between the males (0.92) and females (0.80), and while the health condition of 2.4% of the males were good, that of 13.6% were better, with 58% and 36% at moderate and high risk respectively. Amongst the females, 6.8% and 32.4% had good and better health conditions respectively, with 36% of them at moderate risk. The results of this study are therefore, recommended for health counseling in Imo State.

Keywords: Body Mass Index, Waist-to-Hip Ratio, Hip circumference, Waist circumference, Obesity.

INTRODUCTION

Obesity and overweight, formally recognized as diseases of the rich, are on the increase everyday irrespective of people's socio-economic status. Mbada et al., (2009) reported that individuals in the lower socioeconomic class had a greater BMI and a higher prevalence of overweight and obesity. According to Kuczmarski (2000), 'overweight' is an excess of body weight compared to set standard and a BMI of 25-29 kg/m^2. On the other hand, WHO (1998) sees obesity as an abnormally high proportion of total body fat, and a BMI greater than or equal to $30kg/m^2$.

BMI is an indicator of how much an individual's body is composed of fat (Dunenberger et al., 2008). It is calculated by dividing weight in kilograms by height in meters squared (kg/m^2). While BMI is far more commonly used to define obesity and closely related to the degree of body fat in most settings, its limitations can result in the wrong classification of certain individuals with increased muscle mass (Uwaifo and Arioglu, 2004). In this regards, WHO (2011) highlighted the needs for other indicators to complement the measurement of BMI, to identify individuals at increased risk of obesity-related morbidity due to accumulation of abdominal fat.

Waist–hip ratio (i.e. the waist circumference divided by the hip circumference) was suggested as an additional measure of body fat distribution. The ratio can be measured more precisely than skin folds and it provides an index of both subcutaneous and intra-abdominal adipose tissue. Hence, waist circumference may be a better indicator of

health risk especially when used in combination with BMI. Waist circumference is particularly useful for individuals with a BMI of 25-34 kg/m^2 (Jacob et al., 2001). For example, according to Uwaifo and Arioglu (2004), an athlete with increased muscle mass may have a BMI greater than 25 - making him or her overweight on the BMI scale - but a Waist Circumference measurement would most likely indicate that he or she is, in fact, not overweight.

Waist-to-hip-ratio (WHR) is used as an indicator of abdominal obesity in population studies. It is increasingly clear that WHR is a better reflection of intra-abdominal/ visceral fat accumulation because of the postulated role of visceral fat depot in health risk disease (Jacob et al., 2001). WHR is the ratio of the circumference of the waist to that of the hips. It is calculated by measuring the smallest circumference of the natural waist usually just above the belly button and divided by the hip circumference at its widest part of buttock or hips. People with more weight around their waist are at greater risk of life style related disease such as heart disease and diabetes, than those with weight around their hips (Onat et al., 2004). According to Amole (2011), the prevalence of abdominal obesity was found to be particularly significant in women and was associated with hypertension, physical inactivity and consumption of high-energy diets.

The prevalence of obesity is quite high in industrialized countries, where as many developing countries are experiencing increase in the prevalence of obesity and its complications. Indeed it has been noted that one consequence of the nutrition transition in developing countries is a rapid increase in obesity in an association with a decline in under nutrition (Adeyemo et al., 2003). Thus obesity, which used to be regarded as a disease of affluent or industrialized countries, has become a major public health issue worldwide.

According to Kaufman et al., 1997, BMI increases with age and those with higher BMI have risk of developing hypertension. Obesity is one of the strongest predictor of hypertension among subjects (Kaufman et al., 1997). Despite the growing burden of obesity and hypertension in developing countries, there is limited information on the contribution of BMI to blood pressure in these populations (Tesfaye et al., 2007). Hence this study aims at determining the BMI and WHR of adults in Obowo, Imo State, Nigeria, so as to suggest possible remedies that can minimize health related problems associated with obesity, overweight and even underweight.

MATERIALS AND METHODS

Study area: This study was carried out on adults in Obowo Local Government Area of Imo State. The Local Government Area is a border area of Imo State with Abia State.

Sample size and inclusion criteria: A total of 500 subjects were recruited (250 males and 250 females). All the subjects were between the ages of 18 and 45 years. The parameters measured included weight, height for BMI and waist circumference and hip circumference for WHR. Materials used include: bathroom scale, carpenter's tape, tailor's tape, 30 centimeter plastic ruler, recording paper, writing pen, scientific calculator, human subjects (500).

Sample collection: The methods used in this study were the weight-height method in determining BMI and waist-hip circumference method in determining WHR. The following steps were observed.

The bathroom scale was placed on a hard and smooth ground and was set to the zero mark. The subjects removed their foot wears and other exogenous weight and stood erect, looking straight ahead and their weight readings were obtained. The height of the subjects was measured using the carpenter's tape placed at the heels of the subjects and drawn upwards to measure the height. The 30 centimeter ruler was used as a pointer to mark the height of the subjects. The results were obtained in meters and then squared. The waists of the female subjects were measured at the narrowest point between the bottom of their ribs and their hip bones. Also the female subject's hips were measured at the widest part of their buttocks. The male subjects waists were measured at their navel while their hip at the tip of their hip bones.

The weight and height in kilograms and meters respectively were used to calculate the BMI of each individual. The results of the subjects were gotten by dividing their weight by the square of their height. WHR'S were gotten by dividing their waist measurement by hip measurement (Oladipo et al., 2011).

Data analysis: Data analysis was done with the aid of discrete statistics involving simple calculation of mean, standard deviation, standard error of means and percentage. Test of significance was done with the aid of z test using SPSS 5.0 version at p=0.05.

RESULTS

Table 1 shows the mean values of weight, height, waist circumference (WC), Hip circumference (HC), Body Mass Index (BMI), Waist to Hip Ratio (WHR) of male and female adults of Obowo Nationality in Imo State. The male subjects showed a higher value for mean weight, height, waist circumference, waist-to-hip ratio ($p<0.05$) and body mass index ($p>0.05$). The female subjects showed a higher value of hip circumference ($p<0.05$).

Table 2 shows the mean of waist circumference, hip circumference, body mass index and waist-to-hip ratio of the various age groups of male and female subjects respectively. In the age group 18-21, the male showed a higher value of Waist circumference and waist-to-hip ratio ($p<0.05$), while the females showed a higher value of Hip circumference ($p<0.05$) and body mass index ($p>0.005$). In the age groups 22-25, 26-29, 30-33, 34-37, 38-41 and 41-45, the males showed a higher value of mean waist circumference, waist-to-hip ratio ($p<0.05$) and body mass index ($p>0.05$) while the females were observed to have a higher value in the mean Hip circumference ($p<0.05$).

Table 3 shows the percentage frequency of occurrence of underweight, normal, overweight and obese individuals among the female and male subjects. The females showed a higher percentage of underweight (2.8%) and normal weight (60.4%) of BMI categories than the males who had BMI percentage of 1.6% and 42.8% for underweight and normal respectively. While the males showed a higher percentage of overweight (28%) and obese (27.6%) than the females who had 22.8% and 14% for overweight and obese respectively. Though the frequency of BMI of overweight and obese is higher in males than that of the females, but, the difference in their BMI values are not statistically significant ($P>0.05$).

Table 4 shows the percentage frequency of occurrence of risk categories of WHR of male and female subjects respectively. From table 4, it was observed that among the males 2.4% has a good healthy condition (Good WHR of <0.85), 13.6% has a good healthy condition (Better WHR of 0.85-0.89), 58% has a moderate risk (WHR of 0.90-0.94) and 36% has a high risk (worse WHR of 0.95-1.00). While among the females, 6.8% has a healthy condition (Good WHR of 0.75), 32.4% has better healthy condition (Better WHR 0.75-0.79), 36% has a moderate risk (WHR of 0.80-0.84), 22% has a high risk (Worse WHR of 0.85-0.90) and 2.8% also has a high risk (Worst WHR of >0.90). From this result the males showed a higher WHR than the female ($p<0.05$), therefore, the males will be at a higher risk of cardiovascular disease than the females.

In table 5, statistically significant values were observed in all the parameters measured among the subjects (male and female). Lastly, bar charts were used to represent the results of BMI and WHR. Figure 1 shows the body mass index of male and female age groups. From the chart, it was observed that the BMI increases with advancing age in both male and female except in the age group 34-37 where a decline was observed and it rises afterward. Figure 2 shows the waist-to-hip ratio of both male and female age groups. While the WHR of the male was somehow age related, the female was not.

Table 1: Table showing the mean of weight, height, waist circumference, hip circumference, body mass index and waist-to-hip ratio of both male and female subjects.

Parameters	Mean ± SE Male	Mean ± SE Females
Weight (kg)	71.22±0.17	64.52±0.96
Height (m)	1.64±0.23	1.62±0.69
Waist circumference (cm)	90.99±0.09	82.10±0.45
Hip circumference (cm)	98.61±0.80	101.58±0.70
Body Mass Index (kg/m^2)	26.45±0.73	24.65±0.16
Waist-to-hip ratio	0.92±0.01	0.80±0.67

SE = Standard Error.

Table 2: Table showing the mean of Waist Circumference, Hip Circumference, Body Mass Index and Waist-to-Hip Ratio of the various age groups of both male and female subjects

AGE	MALE				FEMALE			
	WC (cm)	HC (cm)	BMI (kg/m^2)	WHR	WC (cm)	HC (cm)	BMI (kg/m2)	WHR
18-21	77.25	85.53	21.27	0.89	72.42	90.89	21.89	0.79
22-25	80.21	88.24	24.14	0.91	79.08	96.54	23.56	0.82
26-29	90.07	96.73	25.98	0.93	77.94	97.47	23.92	0.79
30-33	97.58	104.48	28.60	0.93	88.39	108.61	26.94	0.82
34-37	100.73	108.20	27.42	0.93	90.75	111.67	25.77	0.81
38-41	110.34	116.24	32.66	0.93	92.68	118.63	28.40	0.80
42-45	119.79	124.26	34.49	0.94	104.73	127.55	31.71	0.84

Table 3: Table showing the frequency and percentage frequency of occurrence of Underweight, Normal, Overweight and Obese individuals among male and female subjects

BMI Categories	BMI Range	Male		Female	
		Frequency	Percentage frequency (%)	Frequency	Percentage frequency (%)
Underweight	Below 18.5	4	1.6	7	2.8
Normal	18.5-24.9	107	42.8	151	60.4
Overweight	25-29.9	70	28	57	22.8
Obese	30 & above	69	27.6	35	14

Table 4: Table showing the frequency and percentage frequency of occurrence of risk categories of Waist-to-Hip Ratio of male and female subjects

Category	MALE			FEMALE		
	WHR value	Frequency	Percentage frequency (%)	WHR value	Frequency	Percentage frequency (%)
Healthy condition	Good (<0.85)	6	2.4	Good (<0.75)	17	6.8
	Better (0.85-0.89)	34	13.6	Better (0.75-0.79	81	32.4
Moderate risk	0.90-0.84	145	58	0.80-0.84	90	36
High risk	Worse (0.95-1.00)	65	26	Worse (0.85-0.90)	55	22
	Worst (>1.00)	0	0	Worst (>0.90)	7	2.8

Table 5: Table showing the results obtained from hypothesis testing (z-test) of the various parameters under consideration

Parameters	MALE				FEMALE			
	WC (cm)	HC (cm)	BMI (kg/m^2)	WHR	WC (cm)	HC (cm)	BMI (kg/m2)	WHR
Mean	90.99	98.61	26.65	0.92	82.10	101.58	24.65	0.80
Variance	12.40	10.76	1.29	0.00008	13.94	12.46	2.85	0.000
SD	3.52	3.28	1.14	0.009	3.74	3.53	1.69	1
z-calculated	5.05	5.71	0.157	1.79	4.27	6.00	0.173	0.01
p-value	0.00	0.00	0.90	1.16	0.00	0.00	0.90	1.80
								1.16

Note: WC= Waist circumference; HC= Hip circumference; BMI= Body mass index; WHR= Waist-to-hip ratio; SD= Standard Deviation

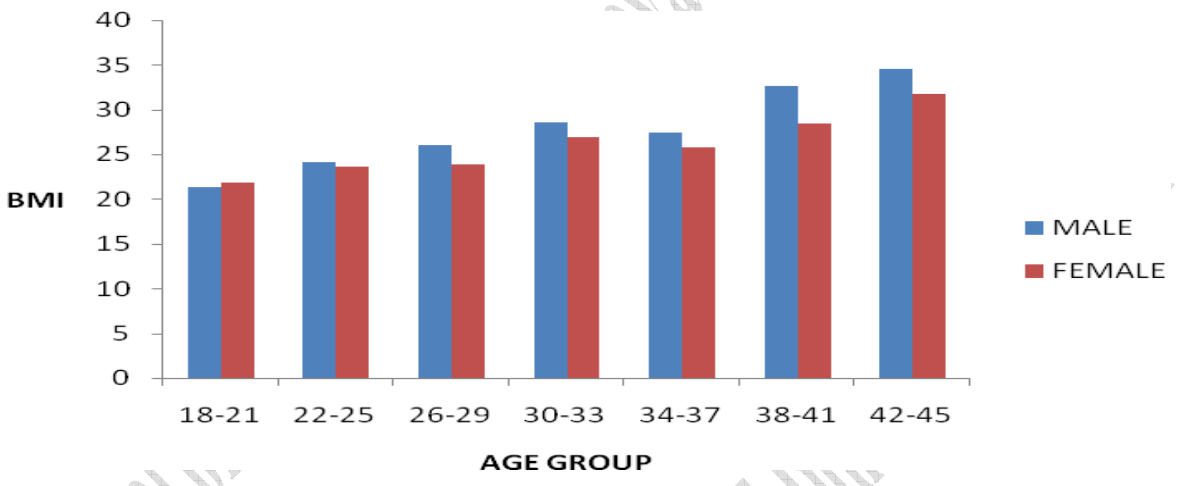

Fig 1: A bar chart showing the BMI of male and female age groups

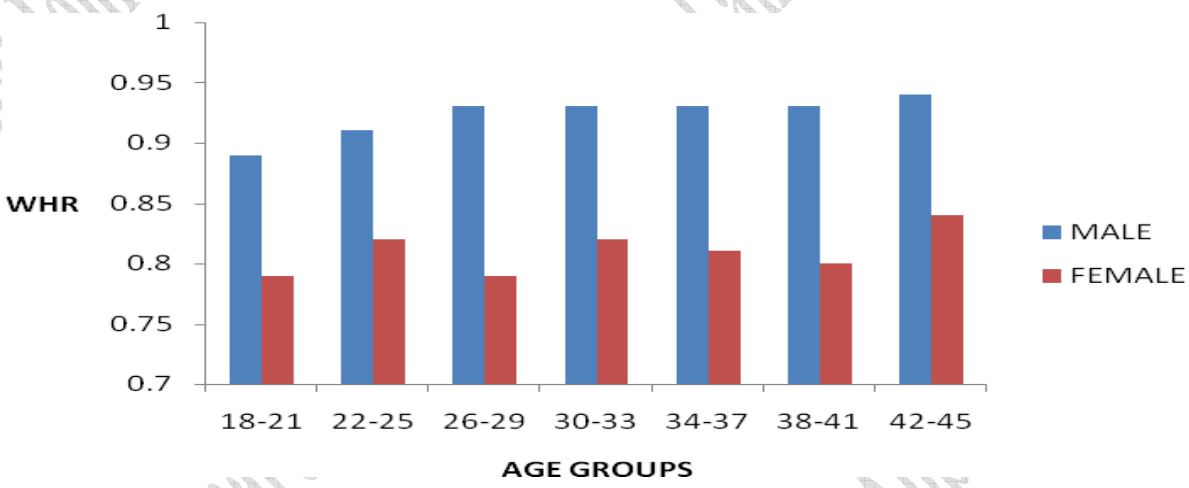

Fig 2: A bar chart showing the Waist-to-Hip Ratio of both male and female subjects

DISCUSSION

Our findings on mean BMI for both male and female agrees with that of Oladipo et al. (2011), whose work categorized both male and female as overweight but contradicts the studies by Anibeze et al. (2003), Amole et al. (2011), and Gordon and Margaret (2002), that females showed a higher obesity pattern than the males ($p<0.05$); implying therefore, that female are at higher risk for related disease than the males.

On the other hand, the assertion by Janssen et al. (2004), that men with waist circumference of 40 inches or greater, have an increased risk for diseases and strokes whereas, in women, it is a waist circumference of 35inchess, supports the inference that men with WHR greater than 0.95 are considered to be at high risk for cardiovascular disease, while women with WHR greater than 0.85cm are also considered to be at risk for heart related health problems (Charles & Laurin, 2005). In fact, the comparative gender risk status as noted in this study, is similar to the reports Oladipo et al. (2011), that males with 50% WHR or greater than 0.95 are at highest risk than females with 21.8% WHR greater than 0.85.

With the knowledge of BMI and WHR, individuals can be advised to maintain or adjust the degree of body fatness, abdominal fats, overweight and obesity, to the limits associated with optimal health and minimal heart risk, otherwise, an increase in the WHR could lead to obesity which will subject individuals to high risk of cardiovascular

related diseased if not properly managed. Of course, judging by the findings of this study, it is obvious that a larger percentage of Obowo people, most especially the females, are at high risk for obesity and related diseases. Thus, urgent medical counseling and enlightenment programmes are suggested as remedies in this area.

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AUTHOR(S) CONTRIBUTION

Dr. Oladipo, G.S. was involved in the conception and design of the research work that formed this article with assistance from Osaat, R.S., Orluwene, C.G. and Suleman, Y.A. Osaat, R.S. typed the first draft.