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Mid-Arm and Mid-Thigh Circumference: An Indicator of Fitness for Liposuction Surgery

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ABSTRACT

The prevalence of obesity in adolescents and children has risen to alarming level globally and this has led to serious public health consequences. The aim of this study was to determine the use of mid-arm circumference (MAC) and mid-thigh circumference (MTC) in the identification of obesity amongst Urhobos a of Delta State. The study was conducted in Eni Grammer School, Churches in Evwreni Delta State, Six. Six hundred subjects (300 males and 300 females) were recruited for the study between the ages 15 - 60 years. Results showed that MAC and MTC strongly correlated with Body Mass Index (BMI) as represented in a scatter plot. Statistical significant difference was observed between male and female MAC (26.61 ± 2.7) and MTC (44.74 ± 6.6). This indicates that there is a direct proportion between MAC, MTC and BMI.

INTRODUCTION

Mid-arm and mid-thigh circumferences have been used as an identifier of obesity (Basit et al., 2015). Obesity is an international issue related to many serious diseases like diabetes and cardiovascular disease¹. Obesity is most commonly caused by a combination of excessive food intake, lack of physical activities, and genetic susceptibility. A few cases are caused primarily by genes, endocrine disorder. Body Mass Index (BMI) is recommended internationally as a simple measure to identify obesity in adult². The most common symptoms that indicate an adult is obese are: large body frame, difficulty in doing daily activities, lethargy, breathlessness, disproportionate facial feature, breast region adiposity, sometimes marked with white or purple blemishes, male external genitalia way appear disproportionately small, flabby fat in the upper arms and thigh, and knock-knee is common.

Obesity puts people at an increased risk of several disease including diabetes, hypertension, heart and kidney ailments, low back pain, joint problem, and several cancers, which include uterus, breast, gall bladder, colon, rectum and kidney cancers. Men have consistent fat distribution during aging, which is always characterized with more visceral fat in the abdomen (apple shape), but women have more subcutaneous fat in the thigh (pear shape) before menopause and have more visceral fat in abdomen (apple shape) after menopause due to the dramatical decline of oestrogen³. The single best indicator of type 2 diabetes is obesity or being over – weight, and about ninety percent (90%) of the people who have diabetes are obese. Therefore, obesity is not a problem risk of other chronic ailments

especially diabetes and even heart disease.

In Rerk Suppaphol S. study, MUAC was suggested to be a simple and accurate parameter to identify overweight and obesity in their school age children⁴. In an observational multinational cross-sectional study with 7337 children age 9-11 years was shown to be a suitable method to detect obesity in children⁵. Moreover, Mazicioglu and his group have demonstrated that MAC could be a useful measurement in screening body fat distribution in children⁶. The aim of this study was to determine the use of mid-arm and mid-thigh circumferences in the identification of obesity among Urhobos of Delta State.

MATERIALAND METHODS

Research Design: In this study, the research design was cross sectional descriptive survey which involved measuring of: Height, weight, mid-arm circumference and mid-thigh circumference of Urhobos of Delta State.

Sample size and Sampling Technique: A sample of six hundred (600) were used in the study, amongst the six hundred (600) subjects, three hundred (300) are male while three hundred (300) are female. A total of six hundred which range from age of 15 to 50, the subjects were selected randomly from secondary school, church and people from the communities, both parents and ground parents. The mid-arm circumference, mind-thigh circumference, eight, weight of each subject were measured using a tailoring tape, digital weighing scale. Subjects with injuries, deformities and those that engage into exercise were excluded from the study.

Anthropometric Measures: Body researchers and weight were measured by the researchers and BMI was calculated as body weight (kg) divided by the square of the height (m). Mid-arm circumference (MAC) was measured at the mid-arm between the shoulder and the elbow⁷.

Mid-arm circumference Measurement (MAC+): Mid-arm circumference is the circumference of the left upper arm and is measured at the mid-point between the tips of the shoulder and elbow, to measure:

- (a) Bend the left arm, find and mark with a pen
- (b) Mark the mid-point between these two marks.
- (c) With the arm hanging straight down wrap a Mid-Arm Circumference (MAC) tape around the arm at the mid-point mark.
- (d) Measure to the nearest 1mm

Mid-thigh Circumference Measurement:

(1) Stand up right with your weight on both feet and thighs slightly apart, mark the mid-point between the top of the femur and the top of the tabia.

(2) Wap a flexible measuring tape around the thigh at the marked point.

Height measurement: When measuring eight, the patient should stand with his or her heels together and weight evenly distributed. Patient positioning should be with the shoulder blades, buttocks, and heels on the standiometers vertical backboard.

Weight Measurement: Weight measurement: body weight is measured in kilograms; body weight is the measurement of weight without items located on the person. Body weight may be measured with cloth on, but without shoes or heavy accessories such as mobile phones, and using digital weighing scales. Excess or educed body weight is regarded as an indicator of determining a person's health.

Body Mass Index (BMI): Body Mass Index (BMI) is a person's weight in kilograms divided by the square of height in meters. A high Body Mass Index (BMI) can be an indicator of high body fatness.

RESULTS

The following results were obtained from the measurements carried out on recruited subjects for this study. They are shown in the tables below.

Parameters	Size (n)	Mean	SD	Range		Variance
				Min.	Max	_
Age	600	23.75	8.23	14.0	50.0	67.74
Height	600	162.67	11.68	13.0	189.0	136.40
Weight	600	57.91	9.92	30.1	107.3	98.36
BMI	600	21.80	3.87	9.50	42.1	14.97
MAC	600	26.21	2.93	19.0	37	8.56
MTC	600	44.00	6.61	21.0	78	43.74

Table 1: Descriptive summary of all participants in the study

Table 2: Descriptive tests for male participants of the study

Parameters	Size (n)	Mean	SD	Range		Variance
				Min.	Max	_
Age	300	22.48	6.73	14.0	49.0	45.31
Height	300	163.19	11.81	15.0	189.0	139.52
Weight	300	58.87	10.99	30.1	103.9	120.93
BMI	300	21.97	3.87	13.4	40.9	15.0
MAC	300	26.61	2.75	19.0	33	7.58
MTC	300	44.74	6.66	30.0	78	44.36

Parameters	Size (n)	Mean	SD	Range		Variance
				Min.	Max	_
Age	300	25.02	9.36	14.0	50.0	87.17
Height	300	162.16	11.54	13.0	182.0	133.2
Weight	300	56.96	8.62	35.6	107.3	74.3
BMI	300	21.62	3.86	9.5	42.1	14.9
MAC	300	25.81	3.04	20	37.0	9.2
MTC	300	43.26	6.49	21	62.0	42.1

Table 3: Descriptive summary of female participants of the study

Table 4: Comparison of means of parameters among male and female subjects of the study

Parameters	Ger	t-test	p-value	
	Male Mean±SD	Female Mean±SD	_	
Age	22.48 ± 6.73	25.02 ± 9.36	3.812	0.0001*
Height	163.19 ± 11.81	162.16 ± 11.54	1.073	0.284
Weight	58.87 ± 10.99	56.96 ± 8.62	2.377	0.018*
BMI	21.97 ± 3.87	21.62 ± 3.86	1.096	0.273
MAC	26.61 ± 2.75	25.81 ± 3.04	3.392	0.001*
MTC	44.74 ± 6.66	43.26 ± 6.49	2.768	0.006*

Table 5: Z-test statistics of both genders for parameters of the study

Parameter	Ν	Male	Female	z-cal	p-value
MTC	600	44.74	43.26	0.1585	0.006
MAC	600	26.61	25.81	0.999	0.001
BMI	600	21.97	21.62	0.4962	0.273



Figure1: Scatter plot showing the relationship between BMI and MTC



Figure 2: A Scatter chart showing the relationship between BMI and MAC

DISCUSSION

The present study was carried out to ascertain the effect of anthropometric parameters such as age height, weight, body mass index (derived from weight and height) on parameters such as mid arm circumference and maximum thigh circumference. A convenient sample size of six hundred subjects were recruited for this study and it comprised of three hundred males and three hundred females. The results revealed significant differences as will be discussed below. From the descriptive summary noticed from table 1, the mean age of all participants of this study was 23.73, height was 162.67, weight was 57.91 and total mean body mass index was about 21.80 (normal). The mean MAC and MTC were 26.21 and 44.0 respectively.

Isolating the parameters of the male participants from the general pool, it was observed that the age of the male participants were slightly lower that the general mean age of the entire study population. Height and weight of the males were seen to be slightly higher than females. Body mass index was still in the normal ranges. The values of MAC and MTC were also slightly higher when compared with general non-gender group data (table 2). Data from table 4 were expressed as mean and standard deviation compared among both genders. The mean age of the females recruited for this study had a significantly higher value (p<0.0001) when in comparison with the males. Despite the difference being significant, it is not considered seriously because the subjects were randomly selected and hence it could explain the difference in age. From the same table 4, values obtained for height showed no significant difference for both genders. Height is also another parameter that is relatively consistent for adults. The weight on the other hand, was significantly higher among the male participants when compared with what was obtained from the female participants. A likely explanation for this could be that female participants are more sensitive to their weight and as such undergo more weight control/reduction activities, although, when used for the calculation of body mass index, no appreciable contrast was observed. The values for MAC (middle arm circumference) as seen in table 4 was statistically elevated in male participant than females (t-test=3.392, p=0.001). Judging from societal observation, male especially those in urban areas, who go for biceps and triceps expansion, tends to have larger MAC than females.

Similarly, the result of maximum thigh circumference among both groups also indicated a statistical increase (t-test=2.768, p=0.006) in male values when in comparison with what was obtained for the females (44.74 for males as against 43.26 for females). Diverse conditions and factors would have likely contributed to that increased. In a study conducted by Nuell *et al.*,^{τ}, in which the sex difference in thigh muscle volumes was analyzed, he concluded that males had larger hamstrings, this in line with what was obtained from this study. Several morphological characteristics, such as a taller frame, greater muscle mass, larger stride length and higher center of gravity contribute to the male performance advantage in many activities9. It has been suggested that faster top speeds are achieved with greater ground reaction forces; the larger absolute muscle mass that males possess represents an advantage when it comes to generation of speed.

From the chart, there was a positive correlation between both parameters which simply indicates that an increase in body mass index would likely lead to an increase in the maximum thigh concentration. This occurs because during the increase in body mass, there is a usually an increase in the amount of fats stored in the adipose tissue⁸. Since the thigh has large adipose tissue stores, it is among larger recipients of such fat deposition which leads to an increase in the maximum thigh circumference.

The same principle also applies to mid arm circumference, however fat depositions usually occurs at a much slower rate ^{7,10}, which is clearly seen in figure 2. A gradual increase in the slope is noticed and this denotes a positive correlation between body mass index and mid arm circumference⁹.

CONCLUSION

The present study elaborated on the relationship between body mass index and other anthropometric parameters. The maximum thigh circumference was seen to be significantly increased in males than in females. There was a positive correlation between body mass index and mid arm circumference, as well as maximum thigh circumference.

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