Mean values, normal limits and sex differences of anthropometry of young adults in a University Community in Nigeria

Oluwadare Ogunlade[*], Olusoji Adeola Adalumo

Department of Physiological Sciences, Obafemi Awolowo University, Ile-Ife, Nigeria

Email address:

oogunlade@oauife.edu.ng (O. Ogunlade), infosoj@gmail.com (O. A. Adalumo)

Abstract: This study assessed the weight, height, body mass index (BMI) and body surface area (BSA) of young adults at Ile-Ife with a view of determining the mean values, normal limits and sex differences in the anthropometric parameters. Four hundred and eighty four (242 males and 242 females) subjects aged between 18-41 years (inclusive) were recruited for the study. The participants were age and sex-matched (mean age: 22.81 ± 3.83years). The weight and height of the subjects were obtained using standard techniques while BMI and BSA were calculated as derivatives of height and weight. Data were analyzed using descriptive and inferential statistics. Normal limits for height, weight and BSA were determined using 5th and 95th percentiles while normal limits for BMI were determined using 5th and 85th percentiles. The mean $\pm$ SD and normal limits of weight, height, BMI and BSA for the 484 participants were 60.94 ± 9.60kg (47.00-79.75kg), 1.67 ± 0.85m (1.54-1.82m), 21.82 ± 3.02kg/ m^2 (17.80-24.83 kg/ m^2) and $1.68 \pm 0.15m^2$ (1.45-1.96 m^2). Among males and females respectively, the mean weight [63.43 ± 9.11kg and 58.46 ± 9.46kg ($p <0.001$, t =5.9)], height [1.72 ± 0.07m and 1.62 ± 0.07 m^2 ($p < 0.001$, t = 15.03)], BMI [21.43 ± 2.62 and 22.20 ± 3.33($p =0.01$, t = -2.83)] and BSA [$1.75\pm0.14m^2$ and $1.62 \pm0.13m^2$ ($p< 0.001$, t =10.34] showed significant statistical differences. The normal limits for weight, height, BMI and BSA in males and females respectively were; 50.56-82.00kg and 45.56-75.00kg; 1.61-1.85m and 1.53-1.73m; 17.80-26.90 and 17.80-28.79 and 1.53-$2.00m^2$ and 1.41-$1.87m^2$. BMI was significantly higher in females while other anthropometric parameters were significantly higher in males. This study provides data on anthropometric parameters among young adult Nigerians as reference values for physiological and pathophysiological evaluation and clinical management. Significant sex differences exist among young adult Nigerians with regards to weight, height, BMI and BSA. So, sex should be taken into consideration in classification of young adult Nigerians using anthropometry.

Keywords: Normal Limits, Mean Values, Anthropometry, Sex Differences, Young Adults

1. Introduction

Anthropometry is the study of the measurement of the human body in terms of the dimensions of bone, muscle and adipose tissue. Anthropometry provides the single most portable, universally applicable, inexpensive and non-invasive technique for assessing the size, proportions and composition of the human body [1]. Anthropometric parameters reflect both health and nutritional status and predict performance, health and survival. They are very useful in public health policy development, clinical decision making, health risk assessment profiling, drug prescription, fluid requirement and disease diagnosis. Anthropometry covers a wide range of body measurements such as height, weight, body mass index, body surface area, abdominal, waist and hip circumferences, waist-hip ratio, height, length, breadth and ratios of various body parts. However, the most commonly assessed anthropometric parameters are weight, height, body mass index (BMI) or Quetelex index, body surface area (BSA) and waist/abdominal circumference. An individual can be classified based on BMI into underweight, normal weight, overweight and obese. There are evidences to suggest that anthropometric parameters vary with age, sex, ethnicity and race [2, 3].The ethnic and racial diversity play significant role in influencing anthropometric dimensions. The measurements of anthropometry can be used to define population groups. Even in the same nation, anthropometric database among

different population groups such as athlete, military and students may differ. Given the level of usefulness and importance of anthropometric parameters, there is need to define normal values and normal limits for each category of population. Data is sparse with regards to reference values of anthropometry in young adult Nigerians. This study was an attempt to find out the mean values, normal limits and sex differences in the basic anthropometric parameters (weight, height, BMI and BSA) among young adult Nigerians resident in Ile-Ife, Osun State, Nigeria.

2. Methods

2.1. Participants

Four hundred and eighty four (242 males and 242 females) subjects aged between 18-41 years were recruited for the study. They were selected according to their age and sex. They were grouped into four age group categories (Table 1); 18-23 years (69.0%), 24-29 years (24.4%), 30-35 years (4.5%) and 36-41 years (2.1%). The study population was drawn from people within Ilé-Ifè, an ancient Yoruba town in South-Western Nigeria. Only healthy volunteers (absence of systemic diseases) after initial screening process participated in the study. The screening include clinical evaluation and blood pressure assessement. Exclusion criteria include; symptomatic diseases, pedal oedema, pregnancy, athlete and arterial blood pressure $\geq$ 140/90mmHg. The volunteers were assessed for anthropometric parameters; height and weight while their BMI and BSA were calculated.

2.2. Ethical consideration

Participation in the study was completely voluntary based on informed consent from the participants. Ethical clearance was sought and obtained from Ethics and Research Committee of Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife.

2.3. Height and Weight Measurements

The standing heights were measured using a stadiometer (ZT-120 Health Scale). Each participant were assessed while in good standing posture on the foot rest of the device with minimal clothing without shoes but with the head facing forward, shoulders relaxed, arms hanging loosely on both sides, palms facing forwards, feet together and knees straight. The height for each subject was taken when the movable headboard was lowered to touch the crown of the head. The measurements were taken to the nearest 0.5cm. The weighing scale was checked for zero balance before each use. Subjects were instructed to empty pockets and remove shoes and any apparel that could interfere with weight measurements. The subjects then stood on the scale looking straight ahead, relaxed and motionless without leaning on any object or the wall. Weight measurements were taken when the scale stabilized and recorded to the nearest 0.5kg while protecting the confidentiality of subjects.

2.4. Calculation of BMI and BSA

BMI was calculated as weight in kilograms divided by the square of height (in metres). BMI was expressed in kg/m^2. The BSA was calculated using Mosteller formula [4]: BSA (m^2) = (weight (kg) × height (cm)/3600)$^{1/2}$.

2.5. Statistical Analysis

The data obtained during the investigation was analyzed using SPSS 16.0 for Windows P.C. The descriptive statistics were expressed as a mean ± SD for each variable. Student t-test was carried out to detect the gender differences for each parameter: height, weight, body mass index (BMI) and body surface area (BSA). The lower and upper normal limits for height, weight and BSA were determined at 5th and 95th percentiles respectively while the lower and upper normal limits for BMI were determined at 5th and 85th percentiles respectively [1]. A p value < 0.05 was taken as statistically significant.

3. Results

3.1. Anthropometry

Four hundred and eight four (484) young adults participated in the study. The age range of the participant was 18-41years. The most frequent age group was 18-23years (Table 1). Among all participants (N= 484), the mean value (normal limits) for height, weight, BMI and BSA were 1.67 ± 0.09m (1.54 -1.82m), 60.94 ± 9.60kg (47.00-79.75 kg), 21.82 ± 3.02 kg/m^2 (17.80 - 4.83 kg/m^2) and 1.68 ± 0.15 m^2(1.45-1.97 m^2) respectively (Table 2)

Table 1. *Distribution of participants according to age group.*

Age Group(years)	Male (n = 242)	Female (n = 242)
18-23	167	167
24-29	59	59
30-35	11	11
36-41	5	5

Table 2. *Normal limits of anthropometric measurements irrespective of gender (N = 484).*

Variables	Minimum	Maximum	Normal Limits
Height (m)	1.45	1.93	1.54 - 1.82
Weight (kg)	37.50	95.00	47.00 - 79.75
BMI (kg/m^2)	16.10	37.10	17.80 - 24.80
BSA (m^2)	1.29	2.21	1.45 - 1.97

n - Number of subjects; BMI - body mass index; BSA-body surface area; Normal limits for height, weight and BSA were determined at 5th and 95th percentiles while the normal limit for BMI was determined at 5th and 85th percentiles.

3.1.1. Mean Values of Anthropometric Parameters according to Sex Distribution

The mean height, weight, BMI and BSA for male participants (N = 242) were 1.72 ± 0.07 m, 63.43 ± 9.11kg,

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