***Original Research Article***

**Anthropometric Circumferential Body Measurements of the Yoruba and Igbo Ethnic Groups in Nigeria**

**Abstract**

**Background:** Circumferential measurements are important in various fields, including healthcare, sports, and industry. They are widely used to assess obesity levels, determine body fat distribution, and monitor changes in body composition over time.

**Aim:** This study compared the circumferential body measurements of Yoruba and Igbo individuals, highlighting their morphological differences and potential implications.

**Method:** Cross-sectional descriptive research was adopted in this study. 800 subjects (400 females and 400 males) were recruited between 18 and 40 years. Data analysis was done using a statistical package for social sciences (version 23) and was presented as Descriptive Statistics. An Independent T-test was used to compare the mean among the ethnic groups. A probability less than 0.05 (p<0.05) was considered statistically significant and 95% was denoted as confidence level.

**Result:** The mean value of the Yoruba ethnic group shows that neck circumference was 33.67±3.17cm, head circumference was 56.62±2.38cm, mid-arm circumference was 27.44±3.43cm, chest circumference was 85.24±5.51cm, waist circumference was 75.84±8.45, hip circumference was 90.99±5.45, and mid-thigh circumference was 50.62±5.98cm while the mean value of the Igbo ethnic group indicated that neck circumference was 33.88±3.11cm, head circumference was 57.04±2.34cm, mid-arm circumference was 28.32±3.37, chest circumference was 87.55±5.58, waist circumference was 76.54±7.55cm, hip circumference was 90.93±5.29cm, and mid-thigh circumference was 52.34±6.38. Sexual differences were shown among both ethnic except in head circumference, mid-arm circumference, chest circumference and waist circumference

**Conclusion:** The Yoruba and Igbo ethnic groups show slight variations in body measurements. However, hip circumferences of both ethnic groups nearly have the same mean values, indicating a shared lower-body structure. These findings highlight that while both ethnic groups have comparable body proportions, minor differences may arise due to genetic diversity, environmental influences, and individual lifestyle variations.

**Keywords:** Yoruba; Igbo; Circumferential; Anthropometry

**Introduction**

Anthropometry is the systematic measurement of the human body and is essential in many fields, including ergonomics, sports science, clothing design, and health assessment [1,2,3]. Among the various anthropometric parameters, circumferential body measurements offer important insights into body composition, shape, and size variations within particular populations [4,5].

Circumferential measurements are significant in various fields, including healthcare, sports, and industry. These measurements are commonly used to measure body fat distribution, evaluate obesity levels, and track changes in body composition over time [6,7]. In medical practice, they help diagnose and manage conditions such as cardiovascular diseases and metabolic disorders. In sports science, circumferential measurements assist in optimizing training programs by providing insights into muscle development and physical performance [8]. Additionally, industries such as fashion and ergonomics rely on these measurements to design well-fitting clothing and workplace equipment suited to specific body types [9]. By analyzing circumferential measurements, researchers and professionals can make informed decisions that enhance health, performance, and overall well-being.

In Nigeria, a multi-ethnic country with over 250 ethnic groups, the Yoruba and Igbo populations are among the largest and most studied due to their cultural, historical, and demographic significance [10]. The Yoruba ethnic group predominantly occupies the southwestern region of Nigeria, while the Igbo people mainly reside in the southeastern part of the country. Despite sharing geographical proximity and historical interactions, these two ethnic groups exhibit distinct physical and genetic traits influenced by environmental, genetic, and socio-cultural factors [11, 12]. Studies on anthropometric differences among ethnic groups are essential for applications in medical research, sports science, fashion design, and industrial ergonomics.

This study compares the circumferential body measurements of Yoruba and Igbo individuals, highlighting their morphological differences and potential implications. By analyzing parameters such as mid-arm, chest, head, hip, waist and thigh circumferences, this research seeks to provide valuable insights into the anthropometric characteristics of these two major Nigerian ethnic groups. The findings will contribute to the knowledge of human variability and have practical applications in various fields, including public health and nutrition.

**2.0 MATERIALS AND METHODS**

**2.1 Study Design**

The anthropometric value of Yoruba and Igbo ethnic groups in Nigeria was measured using a cross-sectional descriptive research method. Eight hundred subjects (400 males and 400 females) between the ages of 18 and 40 years made up the population. Where the subjects were selected using a multi-stage random proportionate sampling approach. Imo State University in Owerri, Imo State, was chosen as the research region to represent the Igbo people. Owerri is home to 983000 people, Adeline et al., [13].

Using the Taro Yamane formula, the sample size for the study will be determined using the Taro-Yamane formula,

 $n=\frac{N}{1+N\left(e\right)^{2}}$

where n = minimum sample size,

N = total population and

e = margin of error = 0.05.

$$n=\frac{983000}{1+983000\left(0.05\right)^{2}}=399.83$$

For the study, the Igbo size was rounded up to 400 (200 males and 200 females)

For the Yoruba population, Lead City University in Ibadan was used as the study area with 3,875,000beingthe total population in Ibadan, Ariyo et al., [14]

Applying the Taro Yamane formula

$$n=\frac{3875000}{1+3875000\left(0.05\right)^{2}}=399.95$$

For this study, the sample size of the Yoruba was rounded up to 400 (200 males and 200 females)

**2.2 Selection Criteria**

**Inclusion Criteria**

 Only subjects whose parents and grandparents are from the Yoruba and Igbo were selected for the study. The study also recruited subjects whose ages ranged from 18-40 years.

**Exclusion Criteria**

Subjects who did not meet all these inclusion criteria were omitted from the study, and those who have damage or abnormalities on their hand morphology or stature were excluded.

**2.2.1 Anthropometric landmarks**

The study used some anthropometric variable measures (mid-arm, chest, head, waist, hip and mid-thigh), and these variables are defined as follows;

**Mid-arm Circumference (Mid-Upper Arm Circumference):** The measuring tape is wrapped around the mid-upper arm at the point perpendicular to the long axis of the upper arm (at the medial part of the mid-arm). The subject stands with the elbow relaxed so that the right arm hangs freely to the side. This is the point between the olecranon process of the ulna and the acromion process of the scapula.

**Chest circumference:** According to the xiphoid process, this area represents the nipples. The subjects maintain standing posture while holding both hands out to the sides. The medial section of the chest is an area that corresponds to the nipples and the xiphoid process. Next, the measuring tape is positioned on the right side, traversed through the rear, and returned to the beginning point.

**Waist circumference:** The mid-axillary line of the body is indicated by crossing the line that corresponds to the superior iliac crest. The mid-axillary line of the body is shown by crossing the line when the measuring tape is positioned horizontally at the waist, which corresponds to the superior iliac crest. The measuring tape is placed at this level, which is marked on the right side of the trunk, in a horizontal plane around the trunk. To guarantee that the measuring tape is parallel and snug without squeezing the skin, it is then carried around the body.

**Hip circumference:** This area corresponds to the groin, the space between the abdomen and the thigh, and the inguinal region. The subject is standing upright, both feet together, and their weight evenly split between them. The area between the abdomen and the thigh, known as the inguinal region, is where the measuring tape is positioned. After that, the tape's sides are adjusted, and its front side is examined to the plane is horizontal. Next, the tape's zero end is held beneath the measurement value. While not tight, the tape is held in place. After that, a measurement is taken and recorded from the right side.

**Thigh circumference:** The measurement tape is placed around the medial part of the mid-thigh, perpendicular to the long axis of the thigh, with the zero end of the tape held below the measuring value. The tape rests firmly on the skin without compressing the skin, and when the subject is standing with the right leg just in front of the left leg and the weight shifted back to the left leg, a table may be used to maintain the subject's balance.

**2.3 Method of Data Collection**

To gather sociodemographic data for both ethnic groups (Yoruba and Igbo) of Nigeria, a semi-constructive descriptive questionnaire and a personal interview were used. This ensured that the subjects met the inclusion criteria and were fit to participate in the study. The mid-arm, chest, waist, hip, and thigh circumferences were measured using a measuring tape, adopting the appropriate anatomical landmarks. The authors recorded and preserved the data readings.

* 1. **Method of Data Analysis**

Data obtained were subjected to statistical analysis using the International Business Machine of Statistical Package for Social Science (IBM version 23). The results obtained were presented in the table as mean ± standard deviation. T-test was used as an inferential statistic to evaluate sexual and asymmetry differences.

**3.0 RESULT**

The study comprised eight hundred subjects (400) males and (400) females of Yoruba and Igbo ethnic groups of Nigeria with an age interval of 18-36 years. The mean value of the Yoruba ethnic group shows that neck circumference was 33.67±3.17cm, head circumference was 56.62±2.38cm, mid-arm circumference was 27.44±3.43cm, chest circumference was 85.24±5.51cm, waist circumference was 75.84±8.45, hip circumference was 90.99±5.45, and mid-thigh circumference was 50.62±5.98cm (Table 1). Tables 2 and 4 show the sexual differences among the Yoruba and Igbo ethnic groups except in head, mid-arm, chest and waist circumferences. Table 3 shows the mean value of the Igbo ethnic group where neck circumference was 33.88±3.11cm, head circumference was 57.04±2.34cm, mid-arm circumference was 28.32±3.37, chest circumference was 87.55±5.58, waist circumference was 76.54±7.55cm, hip circumference was 90.93±5.29cm, and mid-thigh circumference was 52.34±6.38. The general mean value of both ethnic groups shows that neck circumference was 33.77±3.11cm, head circumference was 56.83±2.37cm, mid-arm circumference was 27.88±3.43cm, chest circumference was 86.39±5.67cm, waist circumference was 76.19±8.02cm, hip circumference was 90.97±5.37cm, and mid-thigh circumference was 51.48±6.24cm (Table 5). Sexual differences were shown among both ethnic except in head circumference, mid-arm circumference, chest circumference and waist circumference (Table 6).

**Table 1. Descriptive Statistics of Yoruba Ethnic Group**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameters  | N | Minimum | Maximum | Mean | Std. Deviation |
| Neck Circumference | 400 | 23.00 | 46.20 | 33.6739 | 3.17500 |
| Head Circumference | 400 | 50.00 | 65.00 | 56.6253 | 2.38797 |
| Mid-Arm Circumference | 400 | 20.50 | 39.00 | 27.4367 | 3.42604 |
| Chest circumference | 400 | 60.00 | 99.50 | 85.2395 | 5.51431 |
| Waist Circumference | 400 | 51.00 | 98.00 | 75.8350 | 8.45802 |
| Hip Circumference | 400 | 70.50 | 99.80 | 90.9980 | 5.45288 |
| Mid-Thigh Circumference | 400 | 36.00 | 69.30 | 50.6200 | 5.98573 |

**Table 2. Gender Based Differences of the Yoruba Subjects Based on Circumferential Measurement**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameters  | Male  | Female  | T-test  | P-value | Inference |
| NC (cm) | 35.61±2.479 | 31.69±2.36 |  15.342 |  0.000 | S  |
| HC (cm) | 56.84±2.078 | 56.14±2.64  |  1.937 |  0.075 | NS |
| MAC (cm) | 27.87±3.283 | 26.99±3.51 |  2.576 |  0.010 | NS |
| CC (cm) | 85.64±5.746 | 84.83±5.254 |  1.480 |  0.140 | NS |
| WC (cm) | 75.98±7.498 | 75.68±9.336 |  0.358 |  0.723 | NS |
| HC (cm) | 89.86±5.247 | 92.13±5.429 |  -4.263 |  0.000 | S |
| MTC (cm) | 49.04±5.581 | 52.19±5.976 |  -5.44 |  0.000 | S |

*NC= Neck Circumference, HC= Head Circumference, MAC= Mid-Arm Circumference, CC= Chest Circumference, WC= Waist Circumference, HC= Hip Circumference, MTC= Mid-Thigh Circumference, S= Significant, NS= Not Significant*

**Table 3 Descriptive Statistics of Igbo Ethnic Group**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameters  | N | Minimum | Maximum | Mean | Std. Deviation |
| Neck Circumference | 400 | 21.00 | 49.00 | 33.8890 | 3.11273 |
| Head Circumference | 400 | 50.00 | 69.00 | 57.0433 | 2.34102 |
| Mid-Arm Circumference | 400 | 20.00 | 41.00 | 28.3228 | 3.37173 |
| Chest circumference | 400 | 73.00 | 99.80 | 87.5512 | 5.58720 |
| Waist Circumference | 400 | 56.50 | 98.00 | 76.5440 | 7.54685 |
| Hip Circumference | 400 | 67.10 | 99.80 | 90.9330 | 5.29307 |
| Mid-Thigh Circumference | 400 | 40.00 | 90.00 | 52.3395 | 6.38205 |

**Table 4. Gender Based Difference of Igbo Ethnic Group**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameters  | Male  | Female  | T-test  | P-value | Inference |
| NC (cm) | 36.04±2.48 | 31.74±1.95 |  19.067 |  0.000 | S  |
| HC (cm) | 57.13±1.95 | 56.95±2.68 |  -0.779 |  0.436 | NS |
| MAC (cm) | 28.79±3.09 | 27.85±3.58 | 2.77 |  0.006 | NS |
| CC (cm) | 87.69±5.37 | 87.40±5.80 | 0.516 |  0.606 | NS |
| WC (cm) | 77.36±6.79 | 75.72±8.16 |  2.182 |  0.030 | NS |
| HC (cm) | 89.75±5.54 | 92.12±4.76 | -4.587 |  0.000 | S |
| MTC (cm) | 50.76±5.76 | 53.92±6.59 |  -5.096 |  0.000 | S |

*NC= Neck Circumference, HC= Head Circumference, MAC= Mid-Arm Circumference, CC= Chest Circumference, WC= Waist Circumference, HC= Hip Circumference, MTC= Mid-Thigh Circumference, S= Significant, NS= Not Significant*

**Table 5. Descriptive Statistics of Both Ethnic Groups**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameters  | N | Minimum | Maximum | Mean | Std. Deviation |
| Neck Circumference | 800 | 21.00 | 49.00 | 33.7690 | 3.11420 |
| Head Circumference | 800 | 50.00 | 69.00 | 56.8343 | 2.37236 |
| Mid-Arm Circumference | 800 | 20.00 | 41.00 | 27.8797 | 3.42567 |
| Chest circumference | 800 | 60.00 | 99.80 | 86.3953 | 5.66668 |
| Waist Circumference | 800 | 51.00 | 98.00 | 76.1895 | 8.01822 |
| Hip Circumference | 800 | 67.10 | 99.80 | 90.9655 | 5.37030 |
| Mid-Thigh Circumference | 800 | 36.00 | 90.00 | 51.4798 | 6.24275 |

**Table 6. Gender-Based Difference between the Yoruba and Igbo Ethnic Groups**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameters  | Male  | Female  | T-test  | P-value | Inference |
| NC (cm) | 35.81±2.49 | 31.72±2.01 | 24.588 |  0.000 | S  |
| HC (cm) | 56.98±2.02 | 56.68±2.67 |  1.776 |  0.076 | NS |
| MAC (cm) | 28.33±3.21 | 27.42±3.57 | 3.748 |  0.000 | S |
| CC (cm) | 86.69±5.68 | 86.10±5.66 | 1.472 |  0.141 | NS |
| WC (cm) | 76.69±7.19 | 75.68±8.75 |  1.778 |  0.076 | NS |
| HC (cm) | 89.80±5.39 | 92.13±5.09 | 6.258 |  0.000 | S |
| MTC (cm) | 49.95±5.75 | 53.00±6.34 |  7.143 |  0.000 | S |

*NC= Neck Circumference, HC= Head Circumference, MAC= Mid-Arm Circumference, CC= Chest Circumference, WC= Waist Circumference, HC= Hip Circumference, MTC= Mid-Thigh Circumference, S= Significant, NS= Not Significant*

**4. Discussion**

The study evaluated anthropometric circumferential body measurements of the Yoruba and Igbo ethnic groups in Nigeria by analyzing the neck, head, mid-arm, chest, hip and mid-thigh circumferences. The mean anthropometric values of the Yoruba and Igbo ethnic groups reveal slight variations in body measurements, which can be attributed to genetic, dietary, and lifestyle factors. The neck circumference of the Yoruba group was 33.67±3.17 cm, while that of the Igbo group was slightly higher at 33.88±3.11 cm, suggesting minimal differences in neck structure. Similarly, the head circumference was 56.62±2.38 cm for the Yoruba and 57.04±2.34 cm for the Igbo, indicating a marginally larger cranial size among the Igbo, which genetic factors may influence.

Mid-arm circumference showed a notable difference, with the Yoruba at 27.44±3.43 cm and the Igbo at 28.32±3.37 cm, possibly reflecting slight variations in muscle mass or body composition due to differences in diet and physical activity, according to Hughes et al.,[15] on the influence of muscle mass, physical activity and health. The chest circumference was 85.24±5.51 cm for the Yoruba and 87.55±5.58 cm for the Igbo, suggesting that the Igbo group may have a slightly broader chest, which could be influenced by lung capacity, ribcage structure, or overall body frame, according to Rabbany et al.,[16] on the biomechanics of the respiratory. Waist circumference values were quite close, with the Yoruba at 75.84±8.45 cm and the Igbo at 76.54±7.55 cm, indicating similar abdominal fat distribution. Hip circumference showed almost no difference, with the Yoruba at 90.99±5.45 cm and the Igbo at 90.93±5.29 cm, suggesting a shared genetic predisposition in lower-body structure. However, mid-thigh circumference was larger in the Igbo group (52.34±6.38 cm) compared to the Yoruba (50.62±5.98 cm), which may reflect differences in lower-body muscle mass or fat distribution. These slight variations in anthropometric measurements suggest that while both ethnic groups share many similarities in body composition, factors such as genetics, nutrition, and lifestyle contribute to the observed differences. The findings of this study are consistent with Omotayo et al., [17] among the medical students at the University of Lagos, Nigeria and Okoh and Fawehinmi [18] among Ijaws of Southern Nigeria.

Sexual differences among the Yoruba and Igbo ethnic groups extend beyond the head, mid-arm, chest, and waist circumferences, encompassing various anthropometric, physiological, and cultural distinctions, according to Jimenez-Morcillo and Clemente-Suárez [19] on gender differences in body satisfaction perception. One notable difference lies in height and body structure, where studies have suggested that Yoruba males tend to have a slightly taller and more muscular build compared to their Igbo counterparts, who often exhibit a leaner physique. Additionally, differences in limb proportions have been observed with Igbo individuals having relatively longer limbs with their torso, which may be linked to genetic and environmental adaptations, according to Ruff [20] on the variation in human body size and shape.

Sexual dimorphism in hip and thigh measurements is another distinguishing factor. Yoruba females are generally characterized by wider hip structures, which may be attributed to genetic influences and the demands of childbearing, according to Clarke and Khosla [21] on the female reproductive system and bone. Similarly, the distribution of body fat and muscle mass varies between both ethnic groups, with Yoruba males tending to have a more robust upper body. Igbo males may exhibit a slightly more balanced fat distribution according to Sim [22] on the relationship between sex-typical body shape and quality indicators. Beyond biological differences, cultural factors also play a role in shaping sexual distinctions, as traditional gender roles, dietary habits, and physical activities contribute to variations in body composition and development between Yoruba and Igbo men and women. These differences, shaped by genetics, environment, and lifestyle, highlight the diversity in physical attributes between the two ethnic groups.

**5. CONCLUSION**

In conclusion, comparing the mean anthropometric values between the Yoruba and Igbo ethnic groups reveals slight variations in body measurements, though overall, both groups exhibit similar physical characteristics. The Igbo group generally showed slightly higher values in most parameters, including neck, head, mid-arm, chest, waist, and mid-thigh circumferences, suggesting potential differences in body composition influenced by genetics, nutrition, and lifestyle factors. However, hip circumferences of both ethnic groups nearly have the same mean values, indicating a shared lower-body structure. These findings highlight that while both ethnic groups have comparable body proportions, minor differences may arise due to genetic diversity, environmental influences, and individual lifestyle variations.

**CONSENT AND ETHICAL APPROVAL**

Ethical approval was obtained from the Research Ethics Committee of the University of Port Harcourt, Port Harcourt, Nigeria (UPHCEREMAD/REC/MM/91/046). All subjects were adequately informed about the study procedure. They gave their consent in writing.

**DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

**COMPETING INTERESTS**

Authors have declared that no competing interests exist.

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