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Comparative Anthropometric Circumferential Measurement of Yoruba and Igbo Ethnic Groups in Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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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.
Methods: The cross-sectional descriptive research design was adopted in this study. 800 subjects (400 Yoruba and 400 Igbo) were recruited between 18 and 40 years. Data analysis was done using the International Business Machine of the Statistical Package for Social Science (IBM version 23). Descriptive Statistics were presented, and an independent T-test was used to compare the mean among the ethnic groups. A probability less than 0.005 ($p<0.005$) was considered statistically significant, and 95% was the confidence level.
Results: The anthropometric circumferential differences between the both ethnic groups shows that neck circumference were (35.61±2.78cm, 31.69±2.37cm), mid-arm circumference were (27.87±3.28cm, 26.99±3.52cm), chest circumference were (85.64±5.74cm, 84.83±5.25cm), waist circumference were (75.99±7.49cm, 75.68±9.34cm), hip circumference were (89.86±5.25cm, 92.13±5.42cm), and mid-thigh were (49.05±5.58cm, 52.19±5.98cm) in Yoruba and Igbo respectively. It shows all parameters were statistically significant except chest and waist circumferences, which were not significant ($p<0.005$).
Conclusion: The Yoruba and Igbo ethnic groups show slight variations in body measurements. 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: Circumferential; anthropometry; genetic diversity; lifestyle.

1. 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 (Irozulike et al., 2024; Fawehinmi et al., 2025; Fawehinmi et al., 2024). Among the various anthropometric parameters, circumferential body measurements offer important insights into body composition, shape, and size variations within particular populations (Borga et al., 2018; Ogbu & Obeagu, 2024).

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 (Andreoli et al., 2016; Naimo et al., 2021). 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 (Pawlak et al., 2021). Additionally, industries such as fashion and ergonomics rely on these measurements to design well-fitting clothing and workplace equipment suited to specific body types (Sutton & Stewart, 2012). By analyzing circumferential measurements, researchers and professionals can make informed decisions that enhance health, performance, and overall well-being.

In Nigeria, over 250 ethnic groups, the Yoruba and Igbo populations are among the largest and most studied due to their cultural, historical, and demographic significance (Okoro, 2024). 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 (Capocasa & Volpi, 2019; Reed & Mberu, 2015). 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. By analyzing parameters such as neck, mid-arm, chest, hip, waist and mid-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. 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 Yoruba and 400 Igbo) between the ages of 18 and 40 made up the population. 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., (Adeline et al., 2024).

Using the Taro Yamane formula, the sample size for the study will be determined using the Taro-Yamane formula, Okoh et al., (2025)

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

Where n = minimum sample size,

N = total population and
e = margin of error = 0.05.

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

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 3,875,000 being the total population in Ibadan, Ariyo et al., (Hingorjo et al., 2012)

Applying the Taro Yamane formula

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

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 had damage or abnormalities on their hand morphology or stature were excluded.

2.2.1 Anthropometric landmarks

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

Neck Circumference: To measure neck circumference, wrap a flexible measuring tape around the neck at the level of the thyroid cartilage (just below the Adam's apple), ensuring the tape is horizontal and not too tight or loose.

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: The subjects maintain a 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.

Mid-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-structured 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 neck, mid-arm, chest, waist, hip, and mid-thigh circumferences were measured using a measuring tape, adopting the appropriate anatomical landmarks. The authors recorded and preserved the data readings.

2.4 Method of Data Analysis

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

3. RESULTS

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, mid-arm circumference was 27.44±3.43cm, chest circumference was 85.24±5.51cm, waist circumference was 75.84±8.45cm, hip circumference was 90.99±5.45cm, 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 chest and waist circumferences. Table 3 shows the mean value of the Igbo ethnic group, where neck circumference was 33.88±3.11cm, mid-arm circumference was 28.32±3.37cm, chest circumference was 87.55±5.58cm, waist circumference was 76.54±7.55cm, hip circumference was 90.93±5.29cm, and mid-thigh circumference was 52.34±6.38 cm. The general mean value of both ethnic groups shows that neck circumference was 33.77±3.11cm, 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). Table 6 displays Anthropometric Circumferential differences between the Yoruba and Igbo ethnic groups where chest circumference and waist circumference were not statistically significant.

Table 1. Descriptive statistics of the Yoruba ethnic group

Parameters	N	Minimum	Maximum	Mean	Std. Deviation
Neck Circumference	400	23.00	46.20	33.6739	3.17500
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
MAC (cm)	27.87±3.283	26.99±3.51	2.576	0.010	S
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, 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 the Igbo ethnic group

Parameters	N	Minimum	Maximum	Mean	Std. Deviation
Neck Circumference	400	21.00	49.00	33.8890	3.11273
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 differences of the 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
MAC (cm)	28.79±3.09	27.85±3.58	2.77	0.006	S
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	S
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, 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
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. Anthropometric circumferential differences between the yoruba and igbo ethnic groups

Parameters	Yoruba	Igbo	T-test	P-value	Inference
NC (cm)	35.61±2.78	31.69±2.37	16.159	0.000	S
MAC (cm)	27.87±3.28	26.99±3.52	2.576	0.010	S
CC (cm)	85.64±5.74	84.83±5.25	1.480	0.140	NS
WC (cm)	75.99±7.49	75.68±9.34	.354	0.072	NS
HC (cm)	89.86±5.25	92.13±5.42	-4.26	0.000	S
MTC (cm)	49.05±5.58	52.19±5.98	-5.41	0.000	S

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

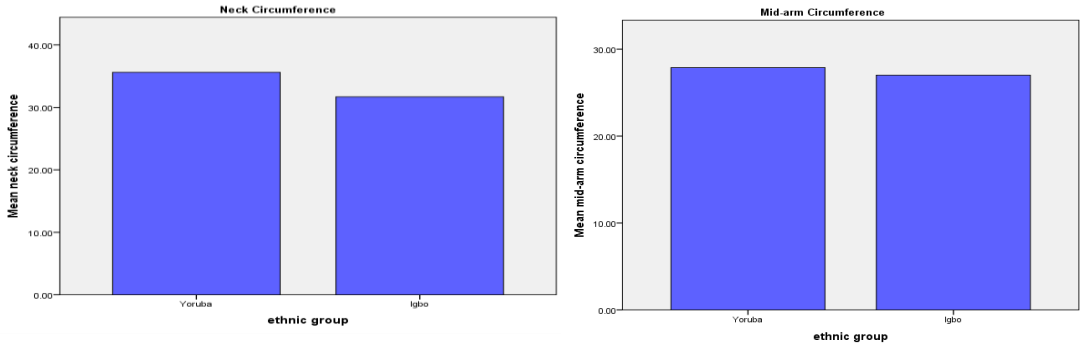

Fig. 1. Showing the graph of anthropometric parameters of the neck and mid-arm circumferences of Yoruba and Igbo ethnic groups

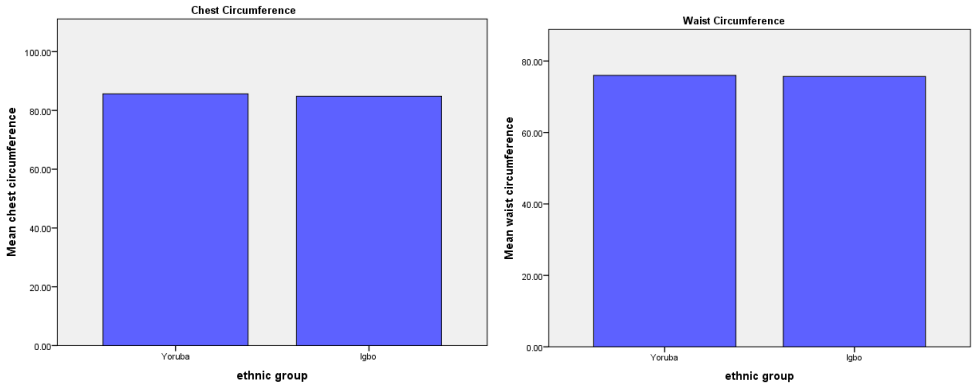

Fig. 2. Showing the graph of anthropometric parameters of the chest and waist circumferences of Yoruba and Igbo ethnic groups

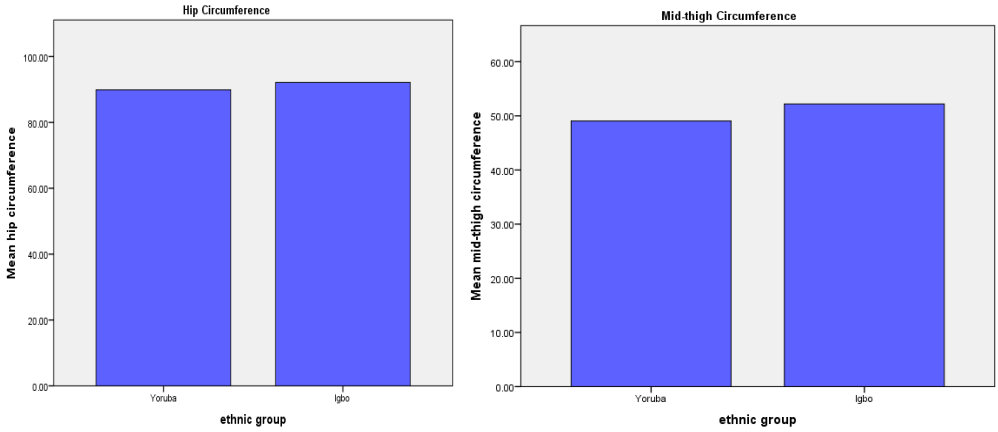

Fig. 3. Showing the graph of anthropometric parameters of the hip and mid-thigh circumferences of Yoruba and Igbo ethnic groups

4. DISCUSSION

The study evaluated comparative anthropometric circumferential measurement of Yoruba and Igbo ethnic groups in Nigeria by analyzing the neck, mid-arm, chest, waist, 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±3.17cm, and that of the Igbo group was slightly higher at 33.88±3.11cm, suggesting minimal differences in neck structure, which is in line with a study done by Hingorjo et al., (2012) among dental students, where the mean value of neck circumference was 35.56±2.77cm.

Mid-arm circumference showed a notable differences, with the Yoruba at 27.44±3.43cm and the Igbo at 28.32±3.37cm, which agreed with previous study of Okoh and Fawehinmi, (2020) on Ijaws of Southern, Nigeria where the mean value of mid-arm circumference was 27.24±2.26 and Omotayo et al., (2024) on medical students at the university of Lagos, Nigeria where the mean value of mid-arm circumference was 26.47±1.92cm which could be possibly reflecting slight variations in muscle mass or body composition due to differences in diet and physical activity, according to Hughes et al.,(2001).

The chest circumference was 85.24±5.51cm for the Yoruba and 87.55±5.58cm for the Igbo, which concur with Omotayo et al., (2024), where the mean value of chest circumference was 84.31±3.71cm, but it shows a bit higher in a study done by Okoh and Fawehinmi, (2020) (94.79±8.78cm). Therefore, 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., (2024) 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, which is in line with the studies of Irozulike et al., (2025), Omotayo et al., (2024), and Asiwe et al., (2023) but disagreed with Okoh and Fawehinmi, []. 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, which is in line with Irozulike et al., (2025), and Asiwe et al., (2023) but contradicts Omotayo et al., (2024).

However, mid-thigh circumference was larger in the Igbo group (52.34±6.38 cm) compared to the Yoruba (50.62±5.98 cm), and this agreed with Okoh and Fawehinmi (2020), 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.

Sexual differences were observed between the ethnic groups, except in chest and waist circumferences in Yoruba and chest circumference in Igbo, receptively. Anthropometric circumferential differences between the Yoruba and Igbo ethnic groups have shown that all parameters were statistically significant except chest and waist circumferences. This can be attributed to lifestyle, dietary habits, and physical activity. Additionally, genetic factors may play a role in determining body proportions, with certain traits being more conserved across ethnic groups despite overall morphological differences. Furthermore, cultural practices related to clothing, body image, and nutrition, such as in the Yoruba diet like amala, ewedu, and gbegiri and in Igbo diet like akpu, ede, and ofe onugbu might contribute to the observed similarities in chest and waist circumferences, as both groups share some common socio-cultural influences. Therefore, while anthropometric measurements highlight ethnic variations, some parameters remain consistent, likely due to genetic, environmental, and lifestyle factors.

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. 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 declare 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.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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