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LINEAR ANTHROPOMETRIC BODY DIMENSIONS OF IGBOS OF NIGERIA

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ABSTRACT
The study aimed at investigating the linear body anthropometric dimensions of the Igbos of Nigeria. The research design was a non-experimental, cross-sectional design. The study utilized a total number of four hundred (400) participants randomly selected who ages ranged between 21 to 40 years and BMI range of 18.50 to <30.00. Minimum sample size was determined using the Taro Yamane's formula. BMI and linear body anthropometric measurements were taken using standiometer, calibrated flexible meter tape, meter rule and weighing scale. Statistical analysis was done using statistical package for the social science (SPSS version 25.0) and Microsoft Excel 2019. Continuous variables were presented as mean±SD; minimum and maximum. Age was categorized into two groups (21 – 30 and 31 – 40) years while Body Mass Index (BMI) was also categorized into two; normal weight (18.5 – 24.9 designated ≤ 25.0) and slightly overweight (25.0 – 30.0 designated ≥ 25.0). Independent sample t-test was therefore carried out to determine significant difference in the measured anthropometric variables across age and BMI groups. The confidence interval was set at 95%, therefore p< 0.05 was considered significant. Results were presented in tables. Age related changes and variations in BMI were also observed in the anthropometric parameters. These anthropometric values will find use in medical sciences and forensics.

KEYWORDS: Linear, body, anthropometric, dimensions, Igbo.

INTRODUCTION
The Igbo is a negriod race[1], who are an ethnic group of southern Nigeria directly indigenous to East and West of the lower Niger River, with very significant population found in the eastern side of the river.[2] They speak Igbo, which includes various Igboid languages and dialects.[3,4] Igbo people are one of the largest ethnic groups in Africa.[5] Human anatomy though describes the structure of the body as observed in most people and has traditional value in surgery, there exists a wide range of ethnic and racial variation in the physical appearance and body proportions of different populations.[7] Variation in human features exists across populations, and study of this physical variation relies on external measurements of the human body. Anthropometric measurements have been adopted as methods in clinical and public health works, as they are applicable to large samples and can provide national estimates and data for the analysis of secular changes.[8] Having in mind the existence of these racial variations in human anthropometric dimensions, this study was therefore embarked upon for a purposeful exploration of the anthropometric dimensions of the Igbos.

MATERIALS AND METHODS
The study was a cross-sectional study which investigated the linear body anthropometric dimensions of adult male Igbos of Nigeria.

The study made use of a total number of four hundred (400) participants randomly selected from amongst adult male Igbos resident in Owerri, Mbaitoli, Orlu and Okigwe in Imo State. Minimum sample size was determined using the Taro Yamane's formula which states that:

$n = \frac{N}{1+N(e)^2}$ where n = minimum sample size, N = population size, e = error margin = 0.05.

Only adult males between the ages of 21 and 40 years with BMI of 18.50 to <30.00 were included in this study. It was ascertained that recruited subjects had both parents and four grand parents from the same ethnic group. BMI range of >24.9 to ≤30.0 is considered overweight. However, among Africans, individuals who fall into this category look physically healthy. This is due to bone density. Therefore, subjects who fell into this category were considered normal but were however

designated slightly overweight to distinguish them from the other category.

Ethical clearance was sought and obtained from the Ethics Committee of the College of Health Sciences, University of Port Harcourt. Informed consent was obtained from all subjects.

Measurements were carried out by fifteen trained personnel. Using appropriate landmarks, the following linear body measurements were taken standing height, sitting height, arm span, biacromial breadth, upper limb length, elbow breadth, wrist breadth, bi-iliac breadth, thigh length, knee height and foot length. Measurements were taken with the aid of stadiometer, digital callipers, calibrated flexible meter tape, meter rule and weighing scale. Before each subject was measured, Body Mass Index (BMI) of the individual was determined.

Using the statistical package for the social science (SPSS version 25.0) and Microsoft Excel 2019 statistical analysis was done with continuous variables presented as mean±SD; minimum and maximum. Age was grouped into two (21 – 30 and 31 – 40 years) while Body Mass Index (BMI) was also categorised into two; normal weight (18.5 – 24.9) and slightly overweight (25.0 – 30.0). Independent sample t-test was therefore done to determine significant difference in the measured anthropometric parameters according to age and BMI. The confidence interval was set at 95%, therefore $p< 0.05$ was considered significant.

RESULTS AND DISCUSSION

Table 1 shows descriptive statistics of the measured linear body parameters among the Igbo subjects. The mean standing height was 178.88±10.12, sitting height (84.94±5.55), arm span (182.55±9.76), bi-acromial breath (40.29±3.11), upper limb length (80.73±7.40), elbow breadth (7.68±1.50), wrist breadth (6.45±1.09), bi-iliac breadth (30.53±2.27), thigh length (52.41±6.07, knee height (51.69±3.55), foot length (28.04±1.69). Independent sample t-test shows statistically significant difference in Upper Limb Length and Bi-iliac breadth ($\rho<0.00$), other parameters showed no statistically significant difference ($\rho>0.05$). Independent sample t-test shows that Sitting Height, Bi-acromial Breadth, Upper Limb Length, Elbow Breadth, Wrist Breadth, Bi-iliac Breadth, Knee Height and Foot Length on comparison among the age groups were statistically significant ($\rho<0.00$), the others were not significant ($\rho>0.05$).

Table 1: Descriptive statistics of the measured Linear Body Parameters (cm).

Linear Body Parameters	[N = 400]		
	Mean± SD	Min	Max
Standing Height	178.88±10.12	161.24	191.46
Sitting Height	84.94±5.55	73.22	98.87
Arm Span	182.55±9.76	151.90	196.90
Bi-acromial Breadth	40.29±3.11	35.20	47.45
Upper Limb Length	80.73±7.40	62.40	89.92
Elbow Breadth	7.68±1.50	5.30	10.80
Wrist Breadth	6.45±1.09	4.11	7.96
Bi-iliac Breadth	30.53±2.27	24.10	31.96
Thigh Length	52.41±6.07	43.50	60.40
Knee Height	51.69±3.55	43.90	59.20
Foot Length	28.04±1.69	23.00	31.70

SD = Standard deviation, Min = Minimum, Max = Maximum.

Table 2: Descriptive statistics of the measured linear body parameters according to age.

Linear Body Parameters	Age group	N	Mean	SD	*t*-test			
					df	*t*-value	*p*-value	Inference
Standing Height	21 - 30	350	178.90	10.17	398.00	0.06	0.95	NS
	31 - 40	50	178.80	9.83				
Sitting Height	21 - 30	350	85.18	5.38	398.00	2.34	0.02	**S**
	31 - 40	50	83.23	6.41				
Arm Span	21 - 30	350	182.75	9.70	398.00	1.10	0.27	NS
	31 - 40	50	181.13	10.13				
Bi-acromial Breadth	21 - 30	350	40.44	3.01	398.00	2.55	0.01	**S**
	31 - 40	50	39.25	3.62				
Upper Limb Length	21 - 30	350	80.40	7.27	398.00	-2.36	0.02	**S**
	31 - 40	50	79.03	7.96				
Elbow Breadth	21 - 30	350	7.60	1.41	56.83	-2.31	0.02	**S**
	31 - 40	50	8.25	1.92				

Wrist Breadth	21 - 30	350	6.54	1.08	69.66	4.84	0.00	**S**
	31 - 40	50	5.84	0.93				
Bi-iliac Breadth	21 - 30	350	28.74	2.07	56.04	3.85	0.00	**S**
	31 - 40	50	27.07	2.96				
Thigh Length	21 - 30	350	52.29	6.01	398.00	-1.02	0.31	NS
	31 - 40	50	52.23	6.49				
Knee Height	21 - 30	350	51.86	3.49	398.00	2.63	0.01	**S**
	31 - 40	50	49.46	3.71				
Foot Length	21 - 30	350	27.97	1.72	74.80	-2.83	0.01	**S**
	31 - 40	50	28.56	1.33				

S – significant, NS – not significant.

Table 3: Descriptive statistics of the measured linear body parameters according to BMI.

Linear Body Parameters	**BMI**	**N**	**Mean**	**SD**	***t*-test**			
					Df	***t*-value**	***p*-value**	**Inference**
Standing Height	Normal weight	249	176.15	10.35	331.79	0.69	0.49	NS
	Slightly overweight	151	175.44	9.74				
Sitting Height	Normal weight	249	85.14	5.53	314.23	0.94	0.35	NS
	Slightly overweight	151	84.60	5.58				
Arm Span	Normal weight	249	179.06	9.69	312.50	1.34	0.18	NS
	Slightly overweight	151	177.70	9.85				
Bi-acromial Breadth	Normal weight	249	40.38	3.05	398.00	0.68	0.50	NS
	Slightly overweight	151	40.16	3.22				
Upper Limb Length	Normal weight	249	75.97	7.12	398.00	-2.64	0.01	**S**
	Slightly overweight	151	77.97	7.71				
Elbow Breadth	Normal weight	249	7.67	1.45	398.00	-0.22	0.83	NS
	Slightly overweight	151	7.70	1.57				
Wrist Breadth	Normal weight	249	6.50	1.09	398.00	1.09	0.28	NS
	Slightly overweight	151	6.38	1.09				
Bi-iliac Breadth	Normal weight	249	28.72	2.18	296.80	2.10	0.04	**S**
	Slightly overweight	151	28.22	2.37				
Thigh Length	Normal weight	249	49.41	6.13	398.00	0.01	0.99	NS
	Slightly overweight	151	49.41	5.99				
Knee Height	Normal weight	249	49.84	3.62	398.00	1.09	0.28	NS
	Slightly overweight	151	49.44	3.43				
Foot Length	Normal weight	249	28.00	1.71	398.00	-0.57	0.57	NS
	Slightly overweight	151	28.10	1.66				

S – significant, NS – not significant

DISCUSSION

Estimation of human physical attributes, and its subsequent application in the classification of human populations have been undertaken by various researchers on the basis of age, sex, race, stature etc. Height is typically a major and instantly recognisable skeletal feature which is principally an inherited trait within hominoid species. It is however influenced by the interplay of factors such as diet, environment, genetics among others. In our study, mean standing height (178.88±10.12) on comparison was lower than those reported in Kosovo[9], Bosnia and Herzegovina[10], and Macedonia[11] but higher than that reported in India (165.96±6.33).[12] Sitting height (84.94±5.55) was lower than that of the Kosovans.[9] The length of limbs just like height varies between the different hominoid sub-species. Sub-saharan Africans tend to be associated with long arms (macrobrachion).[13] This is further strengthened by our finding as arm span (182.55±9.76) in our study was higher than those of Indians (166.40±7.20)[12] and Macedonians.[11] The African's long limb causes a high surface area - to - volume ratio which helps to dissipate heat, while the arctic hunter's bulky body for instance, conserves heat.[13] The length of limbs in hominoid species are subject to the temperature of the environment in which they are located according to the Allen and Bergmann's Rule.[14] The rule states that hominoid in warmer climes evolve longer and leaner body parts for greater heat loss while those in cooler climes evolve shorter stockier parts for increased heat conservation.[14] Bi-acromial breadth (40.29±3.11) was higher than that reported for the Turks[15] and slightly lower than the values obtained in a Turko-Mongolic population in Central Asia High Altitude Population (CAHAP); all CAHAP, High Altitude Kirghizs, Mid Altitude Kazakhs, Low Altitude Kirghizs and Low Altitude Uighurs.[16] Upper limb length (80.73±7.40) was higher than that reported in India.[17] Elbow breadth (7.68±1.50) was higher than those obtained in the Turko-Mongolic population; all CAHAP, High Altitude

Kirghizs, Mid Altitude Kazakhs, Low Altitude Kirghizs and Low Altitude Uighurs.[16] Wrist breadth (6.45±1.09) was higher than that of Turks.[18] Bi-iliac breadth (30.53±2.27) was higher than that of the Turks.[15] Knee height (51.69±3.55) was higher than that of the Kori[17] and lower than that reported for Caucasian Australians.[19] Foot length (28.04±1.69) was higher than that reported for a northern Indian population[12] and the Kori population.[17] These variations in the body dimensions of the different populations are a function of racial variation. As has been shown by various researchers, in addition to race, changes in body dimensions are a function of age as well as sex. Across the various age groups, significant difference was observed underlying age changes.[20] It was not so in the BMI groups as no significant difference was observed in the BMI groups.

CONCLUSION

The study demonstrated racial variation but sexual dimorphism was not made mention of as the study only utilized male subjects. Therefore, we recommend advancement of this study using female participants. The study could help future researchers in this area of anthropometry. It could also find use in forensic science and medicine.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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