



PREDICTION OF HEIGHT OF ADULTS OF THE ORON ETHNIC GROUP OF NIGERIA USING FOOT LENGTH

Ekemini Johnson, Uwemedimo G. Udoh* and Esther Eyo-Udo

Department of Anatomy Faculty of Basic Medical Sciences University of Uyo Nigeria.

***Corresponding Author: Uwemedimo G. Udoh**

Department of Anatomy Faculty of Basic Medical Sciences University of Uyo Nigeria.

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ABSTRACT

The study was carried out to determine the average value for height and foot length of the Oron ethnic group of Nigeria. The correlation between height and foot length and a formula for the estimation of height using the foot length of adults in the Oron ethnic group was established. Four hundred subjects (205 males and 195 females) between the ages of 18-50 of dual parentage up to the second generation were used for this study. Verbal consents were obtained from the subjects before conducting the research. The morphometric measurements of height and foot length were taken using standard anthropometric techniques. The mean and standard deviations of height for males and females were 172.05 ± 10.43 and 162.99 ± 7.64 respectively while that of foot length was 25.78 ± 1.88 and 24.47 ± 1.35 respectively. It was observed that Oron males had a significantly higher height and foot length value, thereby, showing sexual dimorphism. A positive correlation value of $R=0.64$ for males and $R=0.62$ for females was observed in this study between the height and foot length. A regression formula for height of both genders [$\text{Male height} = 80.16 + 3.56 \text{ foot length}$] and [$\text{Female height} = 76.75 + 3.52 \text{ foot length}$] was obtained.

KEYWORDS: Foot length, height, Oron and anthropometry.

INTRODUCTION

Stature or height is one of the most important and useful anthropometric parameter to determine the physical identity of criminals and victims including age, sex and race.^[1] It is the most often used anthropometric dimension and it is a quantitative measure of physique. It is indicative of physical growth and development of an individual is also useful for calculating body surface area and predicting pulmonary function during childhood.^[2] The correct measurement of height requires the maintenance of a certain posture. Foot length and height anthropometry have been applied in various fields to improve the quality of life amongst other things. Dimensions or measurements of the foot are important tools in prosthetic designs, fabrications and fittings.^[3] Foot length has also helped the prosthetists in the reconstruction of a missing foot from the available one and the orthotist in the construction of orthotic devices for the management of foot deformities like club foot as well as ankle sprain.^[3]

Height and foot length anthropometry are used in the fashion industry as they determine a range of sizes for clothing and other items. Measurements of the foot are used in the manufacture and sale of footwear. Foot and shoeprints also provide invaluable tools in forensic investigation. They can be used as an aid in criminal

investigation in order to develop biological profiles to find suspects or to associate with witness statement.^[4]

Oron is one of the three major ethnic groups in Akwa-Ibom State residing in the lower basin of Cross River estuary. The Oron people reside in a tropical region with a uniformly high temperature all year round. Despite the anthropological importance of foot length and height, there is no documented research carried out on the Oron ethnic group in Nigeria. This research is therefore embarked upon to give a report on the foot length and height of this ethnic group and to examine if foot length can be used to estimate height in an anthropological study for the Oron ethnic group.

MATERIALS AND METHOD

The study was carried out from July, 2017 to August, 2017 on four hundred (400) Oron indigenes. These subjects were made up of 205 Oron males and 195 Oron females between the age range of 18-50 years. Verbal consents were obtained from the subjects before any measurement was taken.

In the study, it was ascertained that all subjects had dual parentage and four grand parents from the same ethnic group. Male and female subjects were selected at random from two Local Government Areas in the Oron ethnic group (Oron and Okobo) and University of Uyo, Uyo.

The Slovens formula: $n = N/1+N (e)^2$ was used to calculate the minimum sample size of subjects where, n is the sample size, N is the population size = 415,935 (Federal Republic of Nigeria official gazette, 2006) and e is the significant level = 0.05. From the above, a sample size of 400 was calculated.

Measurement of height

This was measured as the vertical distance between the heel and vertex of a person in an upright posture.^[11] It was measured using a stadiometer with the subject standing erect with both feet kept close together and upper limbs hanging on the sides of the body. The heel, upper part of the back and the buttocks touched the vertical rule of the stadiometer and the head was held in a Frankfort horizontal plane. The measurement was done in centimeters (cm) and the sliding bar of the stadiometer was placed on the vertex of the head with little pressure applied.

Measurement of Foot length

It was measured as the distance from the most posterior point of the heel to the most anterior point of the longest toe. This measurement was done using the left foot as per the recommendation of the International agreement for paired measurements at Geneva (1912). It was measured using a plane sheet of paper and a pen with the subject's foot appropriately placed at the center of the paper and

traced out with the use of the pen. After the measurement was taken the traced foot length was measured at ease for the benefit of getting an accurate measurement.

All linear measurements were taken twice and the average found. These measurements were also taken to the nearest centimeter (cm) for each parameter and the data for each measured parameter was analyzed using z-test to determine sex difference. ($p < 0.05$) was taken as being statistically significant.

A correlation study between foot length and height of the subject was conducted and a regression analysis performed to estimate the height of males and females from their foot length.

RESULTS

The result of the mean and standard deviation of height and foot length of the Oron ethnic group are shown in tables 1-3. The mean and standard deviation of height of the males and females were 172.05 ± 10.43 and 162.99 ± 7.64 respectively. The mean and standard deviation of foot length for males and females were 25.78 ± 1.88 and 24.47 ± 1.35 respectively. The Pearson correlation coefficient for males and females were 0.64 and 0.62 respectively. It was observed that the males had a significantly higher height and foot length than the females ($p < 0.05$).

Table 1: Height and Foot Length for Oron Ethnic Group.

Parameters (cm)	Sex	Sample size (N)	Mean
Height	Male	205	$172.05 \pm 10.43^*$
	Female	195	$162.99 \pm 7.64^*$
Foot length	Male	205	$25.78 \pm 1.88^*$
	Female	195	$24.47 \pm 1.35^*$

Statistically significant at $*P < 0.05$.

Table 2: Minimum and Maximum Height and Foot length Parameters for Oron Ethnic Group.

Parameters (cm)	Sex	Count	Mean	Standard deviation	Minimum	Maximum
Height	Male	205	172.05	10.43	146.00	198.00
	Female	195	162.99	7.64	146.00	185.00
Foot length	Male	205	25.78	1.88	19.90	29.80
	Female	195	24.47	1.35	21.20	29.20

Table 3: Linear Regression Equation for Height of Oron Males and Females from Foot Length.

Variable	Regression equation
Foot length (Male)	Height = $80.16 + 3.56$ foot length
Foot length (Female)	Height = $76.75 + 3.52$ foot length

Table 4: Mean Height of Present and Previous Studies.

Researchers	Ethnic group	Males (cm)	Females (cm)
Iteire <i>et al.</i> , ^[5]	Itsekiri	184.02 ± 10.48	160.51 ± 0.53
Igwe and Akpuaka ^[6]	Igbo	171.00 ± 6.49	162.00 ± 7.56
Jyoti <i>et al.</i> , ^[7]	Jodhpur	170.71 ± 8.572	161.6 ± 7.627
Rademene <i>et al.</i> , ^[8]	Cross River state	168.49 ± 5.53	162.99 ± 5.91
Vineet <i>et al.</i> , ^[9]	Rajasthan	166.43 ± 7.72	160.91 ± 6.45
Udoh <i>et al.</i> , ^[10,11]	Annang	165.29 ± 9.98	160.36 ± 9.09
Rajeshwari <i>et al.</i> , ^[2]	Mahakaushal	159.21 ± 18.64	145.22 ± 18.02
Geetha <i>et al.</i> , ^[12]	Kerala	157.95 ± 6.42	148.70 ± 7.57
Present study	Oron	172.05 ± 10.43	162.99 ± 7.64

Table 5: Comparison of Mean Foot Length of Present and Previous Studies.

Researchers	Ethnic group	Males (cm)	Females (cm)
Giles and Vallandigham ^[13]	United States	26.78±1.30	24.32±1.25
Harsh and Naval ^[14]	Bihar	25.59±1.26	23.30±1.17
Rameswarapuet <i>al.</i> , ^[15]	Secunderabad	25.30±1.29	23.23±1.10
Rajeshwariet <i>al.</i> , ^[2]	Mahakaushal	24.62±2.75	22.24±2.46
Vineet et al., ^[9]	Rajasthan	24.71±1.63	23.56±1.37
Nor <i>et al.</i> , ^[16]	Malaysia	24.00±1.60	21.90±1.30
Present study	Oron	25.78±1.88	24.47±1.35

Table 6: Comparison of Regression Formulas for the Present Study and Previous Studies.

Researchers	Ethnic group	Males	Females
Rameswarapuet <i>al.</i> , ^[15]	Secunderabad	height=80.955+3.547foot length	height=79.83+3.349foot length
Vineetet <i>al.</i> , ^[9]	Rajasthan	stature=77.24+3.61foot length	stature=88.83+3.06foot length
Present study	Oron	height=80.16+3.56foot length	height=76.75+3.52foot length

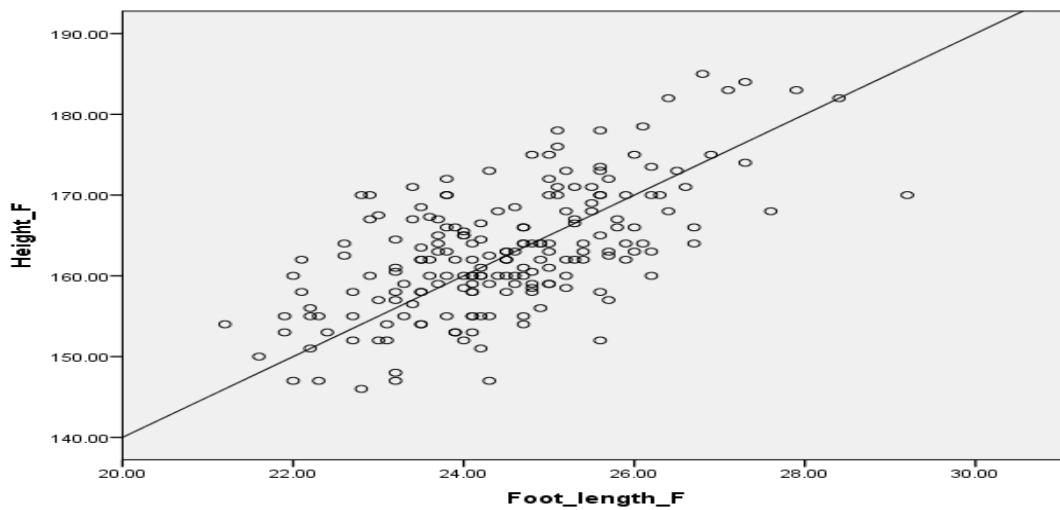


Figure 1: Pearson correlation of height and foot length for Oron females R=0.62.

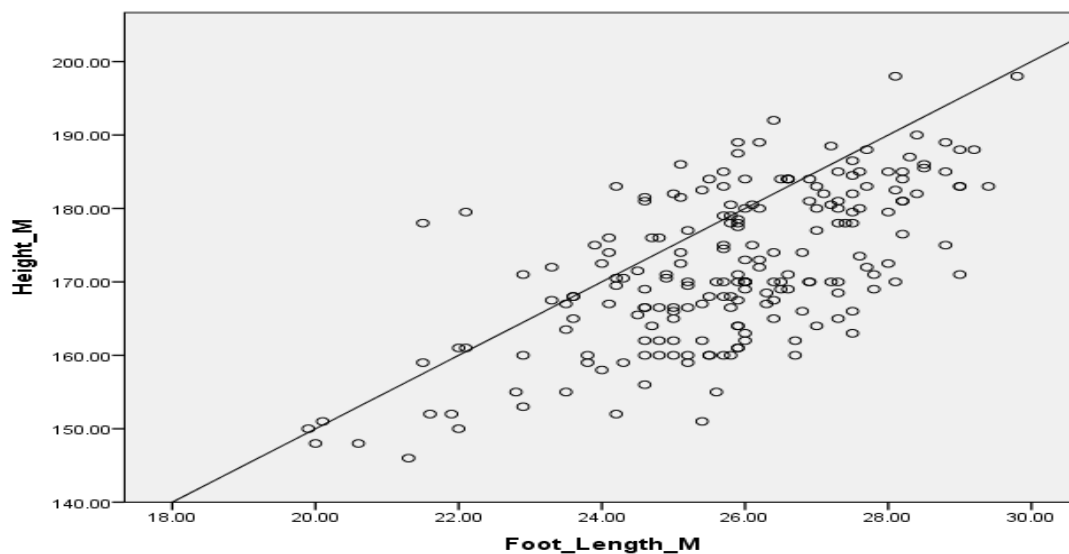


Figure 2: Pearson correlation of height and foot length for Oron males R= 0.64.

5.1 DISCUSSION

Many studies have been conducted on the estimation of height and many methods have been established in the estimation of height from the bones but one of the easiest

and reliable methods is by regression analysis.^[15] However, when the accurate measurement for height is unobtainable, it is computed using other surrogates like foot length.

The results of the present study show that the foot length has a statistically significant positive correlation with the height of both male and female individuals of the Oron ethnic group. The presence of a positive linear correlation between foot length and height enables the development of regression equations which can be used to predict the height of individuals from foot length in this ethnic group. This strong positive correlation between foot length and height is also evident in similar studies done in other ethnicities.^[2,9,13,15,17] The vertical height of a person needs an equally firm base to support it which is provided by the feet, thereby, implying that an increase in height is associated with an increase in foot dimensions.^[9]

In the present study males showed a significantly higher mean values in both height and foot length than females. It has been observed in various other studies that the males generally have higher anthropometric measurements than females^[4,5,6,10,11] thus this study confirmed the presence of such sexual dimorphism in height and foot length in the Oron ethnic group. When comparing the mean values for height and foot length between this ethnic group and other groups, it can be seen that there is significant racial and ethnic variations. The presence of this type of variation thus justifies the use of ethnic based values and regression equations in anthropometric measurements in order to increase the accuracy of data interpretation.

CONCLUSION

This study determined the mean height and foot length of adults of the Oron ethnic group of Nigeria. It also shows a positive correlation between the two values and established a regression equation to predict height from foot length in adults of this ethnicity. This values will be useful as racial markers, and be of clinical and forensic anthropological use as it concerns the Oron ethnic group.

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