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Stature Prediction from Foot Length in a Nigerian Population

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ABSTRACT

This study is aimed at establishing the reliability of estimating stature from foot length measurement in a Nigerian population. Two hundred and sixty-two healthy medical students of Imo State University Owerri, Nigeria were used for the study. The study yielded positive correlation coefficients of 0.698 and 0.70 for males and females respectively. The coefficient of determination was also positive. The regression formulae were Y = 4.145 + 0.133X for males and Y + 5/171 + 0.123X for females (where Y = foot length, X + height). Sexual dimorphism was observed whereby the foot length of the female was smaller than the male foot length for the same height.

Key words: Height, Foot length Sexual dimorphism

The height of a person is the sum of the length of certain bones and appendages of the body (Patel et al 2007). As a result of this, height estimation by measurement of various long bones has been attempted by various workers with variable degree of success. This relationship has been used for anthropological and medico-legal purposes (Krishan & Sharma 2007).

At the scene of an accident or a crime, all the evidence that may be available to identify either the victim or the criminal may be a piece of bone or a footprint. Therefore, it also became necessary to investigate the relationship between foot length and height.

In the course of investigation it was found that ossification and maturation in the foot occur earlier than in the long bones, and therefore, during adolescent age, height could more accurately be predicted from foot measurement than from long bones (Patel et 2007)

Much of the work involving relationship between foot length and stature has been among Caucasians and Asians (Fessler et a1 2005, Sanli et al 2005). However, some differences have been demonstrated in the body proportions of Caucasian and African athletes. Tanner (1974) showed that Africans have longer legs and shorter trunks than Europeans. Therefore it is necessary to carry out this study among Africans.

The first and perhaps the only study in Africa on the prediction of height from foot length was done by Rutishauser (1968) on children aged 6 years and under. None has been done among adults. Didia et al (2008) used tibial length to estimate height in a Nigerian population. It is the purpose of this paper to investigate the relationship between height and foot length in a Nigerian Population.

MATERIALS AND METHOD

Two hundred, and sixty- two healthy medical students of lmo State University Owerri, aged between 18 and 26 years were used for the study. The right foot was used (Ozden et al 2005). The foot dimensions were measured with a calibrated foot measure with a perpendicular end. The foot length was taken as the distance between the most posterior projection on the heel and the most anterior toe which may be either the big or the second toe (which ever is longer). The height was measured with the individual standing erect in the anatomical position using a standing height measuring instrument. All the measurement were done by one of the authors and recorded in centimeters. Correlation and regression coefficients were calculated for both male and female subjects.

RESULTS

Out of the 262 subjects used for the study, 133 were males and 130 females. Table 1 shows the analysis of the mean height and mean foot length for different levels of height ranges in the males. It will be observed that the highest number of the subjects was found in 170cm - 174.9cm height range (27.0%). This was followed by the height range 175cm] 175.179.9cm (24.2%). It also showed that as the mean height increased, the mean foot length also increased. Table 2 slows the mean height and mean foot length for the different levels of height ranges in the females. The highest number of females was found in 160cm -164.9cm height range (405) followed by the 165cm-169.9cm range (21.5%). It also shows that as the mean height increases, the mean foot length also increased.

A comparison of the two Tables reveals that for the same height ranges, both the mean height and mean foot length values for the males are higher than those for the females.

Table 3 shows various important parameters used to analyze the result. The man height for males is 174.8cm, while that of the females is 163.4cm. The male mean foot length is 27.1 cm while that of the females is 25.2cm. For both sexes the correlation coefficients between height and foot length are positive (0.698 and 0.70respectively) implying that the degree of association between height and foot length in both sexes is very strong. This relationship was found to be statistically significant at the 1% level. The regression equation for males is Y = 4.145 + O. 133x while the regression equation for females is Y = 5.171 + 0.123x where Y = foot length and X = height.

Table 1 Mean height and foot length in males subject

Height Rang	*No*	*MH*	*MFL*
160-164.9	9	163.4	24.9
165-169.9	21	167	26.2
170-174.9	37	171.8	27.3
175-179.9	32	177.4	27.8
180-184.9	23	181.1	28
185-189.9	6	186.2	28.5
190 and above	4	194.2	29.4

Table 2 Mean height and foot length in female subjects

Height Range	*No*	*MH*	*MFL*
150-154.9	8	153.1	24
155-159.9	21	157.7	24.4
160-164.9	52	162	24.7
165-169.9	28	166.8	25.5
170-174.9	16	170.9	26
175-179.9	3	176.4	27.3
180 and above	2	184.6	28

Table 3 Various parameters in th relationship between height and foot length

Parameter	Male	Female
Total numbeer	132	130
Height range (cm)	160-202	152-188.3
Mean height (cm)	174.8	163.4
SD of height (cm)	7.1	6.1
Foot range (cm)	25-29.7	23-28.1
Mean foot length (cm)	27.1	25.2
SD foot length	1.3	1.1
Correlation Coefficient Height and Foot Length	0.698	0.7
Coefficient of determination R^2	0.484	0.486
Value of constsnt (a)	4.145	5.171

Regresssion equation - Male - Y=4.145 + 0.133X

DISCUSSION

In medico-legal autopsies, establishing the personal identity of the victim is often required. Estimation of extremities and their parts play an important part in identifying the dead in forensic examination (Krishan 2008)

In the estimation of stature from dimensions of hand and feet in an Indian population, Krishan and Sharma (2007) found that the highest correlation coefficient and the lowest standard error of estimate was between stature and foot length. Therefore, they concluded that foot length provided the highest reliability and accuracy in estimating the stature of an unknown individual. In our study both the male and female figures had positive correlation coefficient and coefficient of determination. The regression line in the figures further confirmed the reliability of the findings of this

study. This means that using the regression equations, one of the variables can be calculated if the other is known. In some previous studies foot length was shown to be approximately 15% of height. (Robbins & Fowler 1994, Wright 2007). In our study the figures were 15.5% for males and 15.4% for females. They reasonable tally with previous findings.

However, in the study by Kanchan et al (2008) they opined that while foot length measurement was more reliable in estimating stature in males, foot breath measurement was more accurate in females. This needs to be further investigated.

It is interesting to note that our mean foot length for both males and females tallied with the findings of Obikili and Didia (2006). Our figures were 2.71cm and 25.2cm respectively; while theirs were 27.1 cm and 25.1 cm respectively. This further supports their observation that the mean foot- length in Nigeria is higher than that of the Caucasians. That makes it necessary for us to establish our own parameters, which is what this paper seeks to achieve. We also noted that proportionate to stature, the female foot length is consistently smaller than male foot length. This sexual dimorphism has also been reported by other workers (Fessler et al 2005, Write 2007).

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