COMPARISON OF BODY HEIGHT AND FOOT LENGTH IN STUDENTS OF PGIMS ROHTAK IN HARYANA.

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Abstract
Foot length and body height have a direct relation with each other, although the exact calculation of this relation cannot be determined with precision. This relation between foot length and body height has been questioned time and again. In an attempt to put down such speculations scientific researchers and medical professionals all over the world have been studied, the results of one such study done in PGIMS Rohtak is presented. It may not only help us to predict one from the other but also whether the relationship between the two is significant or not.

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Introduction
Body growth is a vital process and is measured by measuring the height of a person, which itself is a sum of the length of certain bones and appendages of the body. It represents certain relationship in form of proportions to the total stature. This relationship is useful anthropologically to find racial differences and also medico-legally when only parts of the deceased body are available.

Height estimation by measurement of various long bones has been attempted by several workers with variable degree of success. Each worker has derived his own formula for calculating the stature from long bones. However, foot measurement has not frequently been used for this.

Review of literature
It was Rutishauser in 1968 that for the first time showed that reliability of prediction of height from foot length was as high as that from long bones [1]. Sen and Ghosh in 2008 established the relationship between stature and feet dimensions among Rajbanshi male and females of North Bengal on a sample of 350 adult Rajbanshi and 100 adult Meche individuals of 18-50 years residing in different villages located in the Darjeeling district of West Bengal. Stature, foot length and foot breadth were positively and significantly correlated to each other and among these foot breadth was found to be more accurate in estimating stature [2].

Ossification and maturation in the foot occurs earlier than the long bones and therefore height could be more accurately predicted from foot measurement as compared to that from long bones during adolescence age. Hence, an effort has been made to find out the correlation between foot length and body height in population of Haryana.

Material & Method
For present study, total 145 (80 male and 65 female) asymptomatic, healthy medical students belonging to various regions of Haryana were selected. Their age ranged between 18 to 25 years. The study was...
conducted from January to March 2013 in Department of Forensic Medicine, PGIMS, Rohtak.

The left foot was selected for measurement as per recommendation of the international agreement for paired measurements at Geneva in 1912. Foot length was measured as a direct distance from the most prominent point of the back of the heel to the tip of the hallux or to the tip of second toe, when the second toe was larger than hallux by spreading calliper. Height of the individual was measured in standing erect anatomical position with standing height measuring instrument. The measurements were taken at a fixed time between 2.00 to 4.30 p.m. to eliminate diurnal variation and by the same person to avoid personal error in methodology.

Discussion

The present study is based on the measurements of foot length and body height of total 145 students aged between 18 to 25 years of age. Obtained data was analysed and an attempt was made to find out correlation and to derive a regression formula between body height and foot length of an individual.

Charania in 1961 showed the significant correlation between height and foot length [3]. Regarding the estimation of height from foot length Qamra et al in 1979 derived a regression equation between foot length and height in North West India population. There correlation coefficient between foot length and height was +0.69 in male and +0.70 in female [4]. In a study in Gujarat by Patel et al the correlation coefficient between height and foot length was + 0.65 in male and + 0.80 in female [5]. Krishan in 2008 examined the relationship of stature to foot size of 1040 adult male Gujjars of North India aged between 18 to 30 years and the highest correlation coefficient were shown by the toe length measurements (0.79-0.86) [6].

No such type of study was carried out in Haryana. In the presence study the formula is derived as under.

In the present study also, as mentioned above a good correlation of body height was observed with foot length and it was highly statistically significant with statistical significance of 0.001 in males and 0.002 in females.

The correlation coefficient between height and foot length is + 0.36 in male and + 0.37 in female which is highly significant. It means there is a strong bond between height and foot length and if either of the measurement (foot length or total height) is known, the other can be calculated and this would be useful for Anthropologists and Forensic Medicine experts.

However, one has to be careful because these results and the regression equations in particular can only be applied to the population from which the data have been obtained. When means of foot measurements were compared with other studies [2, 7, 8], differences were found between the populations.

Observations & Result

Table below shows various important parameters in the present study conducted in PGIMS Rohtak. The correlation coefficient between height and foot length is positive (0.36 in males and 0.37 in females), suggesting that it is significant.

Table 1 showing Mean Height, Mean foot length, correlation coefficient®

<table>
<thead>
<tr>
<th>Total Number</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean height (cm)</td>
<td>172.75</td>
<td>159.10</td>
</tr>
<tr>
<td>S.D. of height</td>
<td>6.111</td>
<td>6.048</td>
</tr>
<tr>
<td>Mean foot length (cm)</td>
<td>25.27</td>
<td>23.62</td>
</tr>
<tr>
<td>S.D. of foot length</td>
<td>1.980</td>
<td>1.316</td>
</tr>
<tr>
<td>Correlation Coefficient (r) (Height and Foot Length)</td>
<td>0.36</td>
<td>0.37</td>
</tr>
</tbody>
</table>

Regression Equation

For Male: H = 111.93 + 0.37x FL
For Female: H = 76.44 + 0.14xFL
Where H = Total height
FL = Foot length

From a physiological standpoint, it also makes a sense that taller people need
longer feet to support a longer body and for increased balance. Foot size and height are both based on many factors such as gender, genetics, health and environment. Some of these factors are subject to change due to genetic abnormalities, disability, poor nutrition and hormonal imbalances and these variables can affect the relation of height to foot size.

Conclusion
The average mean foot length in male and female in all age groups from 17 years to 25 years is 25.27 cm and 23.62 cm respectively. Height of individual male is 6.83 and female is 6.73 times the length of his/her foot length. The estimation of height from various long bones, head length and hand length has been attempted by many workers. However, foot dimensions have not frequently been used for this. The present study deals with the observations on correlation of total standing height with foot length in students of Haryana.

The results of the present study show that foot and footprint dimensions can be used as predictive values for stature estimation in forensic and medical investigations. With this findings it is clear that by the measurement of either any (foot length or total height) the other can be calculated and this fact may be of practically use in Medico legal cases (M.L.C.) investigations. Thus the results of the present study will provide useful information to various Anthropologists and Forensic Medicine Experts.

Conflict of Interest
None Declared

References


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