

Correlation between Hand Length and Various Anthropometric Parameters

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ABSTRACT

Background: Estimation of stature is very important chapter in the field of Forensic anthropometry. The present study is a serious effort to establish correlation between Height of an individual and five parameters; Arm span, Hand length, Hand breadth, Foot length, and Foot breadth.

Method: Sample of 273 living cases (138 male and 135 female students) between the ages of 17 and 23 years with no obvious deformities or previous history of trauma to hands, feet, spine and limbs, were studied at Government Medical College, Bhavnagar. Sample represents the population of Gujarat.

Results: This study shows significant correlation between stature and all five parameters at different degrees. Mathematical formulas were used for estimation of stature from Arm span, Hand length, Hand breadth, Foot length, and Foot breadth. Arm span showed the highest correlation with stature ($r=0.908$) followed by Hand length, followed by foot length. Hand Breadth showed the lowest degree of correlation (0.467).

Conclusion: Present study will be definitely helpful to forensic experts and crime scene investigators in establishing identity of an unknown individual.

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► *Implication for health policy/practice/research/medical education:*

Stature of an individual can be calculated from available anthropometric parameters by using established mathematical formul-as.

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1. Introduction:

Stature is one of the most important elements of identification of an individual. Establishment of the identity of an individual is essential in cases when only fragmentary remains of human body found (1). Such need may arise from mass

disasters i.e. bomb blasts, aeroplane crash, stampede, tsunami, earthquake, flood, cyclones, Terrorist attack, close compartment fire, wars, public vehicle(train, bus, ship, plane *etc*) accidents etc. Mutilation of body could also be possible by humans, animals or by natural process of decomposition. Even, from hand print and foot print left at crime scene, identification and exclusion of a person involved in crime can be made (2). Different studies has been done in the past to establish correlation between Height and various anthropometric parameters i.e. hand length, hand breadth, foot length, foot breadth, arm span, knee-heel length, forearm length, skull height, toe length. Current study was done to establish anthropometric correlation of foot length, foot breadth, hand length, hand breadth and arm span with height of individual in population of Gujarat. Anthropometric parameters show variations in different populations according to genetics, geography, race, religion, nutrition, and socioeconomic condition of local population. So, the present use of current study is restricted to population of Gujarat (3).

2. Materials and Methods:

IRB committee permission was taken prior to study. Information sheet was given to all subjects and written informed consent was obtained.

Total of 273 living cases (138 male and 135 female) have been selected between the ages of 17 and 23 years with no obvious deformities or previous history of trauma to hands, feet, spine and limbs.

- For **foot length** left foot was selected for measurement as per recommendation of the international agreement for paired measurements at Geneva. Foot length was measured as a direct distance from the most prominent point of the back of the heel to tip of hallux or to the tip of the longest toe by spreading calliper.

- For measurement of **hand length**, left hand was placed on calibrated cardboard and length was measured from tip of middle finger or the longest finger to the centre point of inter styloid line.

- **Foot breadth and hand breadth** were measured at level of metatarsophalangeal and metacarpophalangeal joint.

- **Standing height** was measured with the individual standing barefoot on the platform of the stadiometer with the upper back buttock and heels pressed against the upright position of the instrument. Head was positioned in the Frankfort horizontal plane, and the head plate was brought into firm contact with the vertex.

- **Arm span** was measured with a flexible steel tape from the tip of the middle finger on one hand to the tip of the middle finger on the other hand with the individual standing with her back to the wall with both arms abducted to 90°, the elbows and wrists extended and the palms facing directly forward. The relationships between above described criteria were determined by using simple correlation coefficient with 95% confidence interval. A p-value less than 0.05 was considered significant. SPSS software and EPI info software were used for statistical analysis.

Table 1: Statistical data of anthropometric measurements (mean \pm SD, Correlation Coefficient(r), Regression coefficient (B), 95% confidence interval for B)

Parameters Assessed	Mean \pm SD	r (correlation coefficient)	B(Regression coefficient)	95.0% Confidence Interval for B
Height	164.59 \pm 9.192	-----	-----	-----
Arm Span	167.28 \pm 10.734	0.908	0.587	0.504 to 0.671
Hand Length	17.758 \pm 1.2517	0.806	0.863	0.143 to 1.582
Hand Breadth	7.917 \pm 0.7926	0.467	-1.466	-2.211 to 0.721
Foot Length	24.178 \pm 1.8094	0.767	0.689	0.259 to 1.118
Foot Breadth	9.28 \pm 0.865	0.665	1.379	0.667 to 2.091

Correlation is significant at the 0.01 level (2-tailed).

3, 4. Results & Discussion:

A study by Mohanty *et al* on 505 healthy women of 20-29 years shows significant correlation between arm span and height of individual (1). A study by Jitendarkumar *et al* on 103 subjects (52 male and 51 female) in age group of 21-32 years in Hariyana state shows significant correlation between height and left foot length ($r=0.969$) (3). A study by S. M. Patel *et al* on 502 students in age group of 17-22 years shows strong correlation between height and foot length ($r=0.6102$) in population of Gujarat (4). A study by Chikhalkar B. G. *et al* on 300 medical students (153 females and 147 males) in age group of 19-23 years shows significant correlation between stature and Hand length ($r=0.5902$), hand width ($r=0.6004$), Foot length ($r=0.6102$), Foot width ($r=0.4886$).

1. $y=34.46+0.7779x$ here x =Arm span
2. $y=59.52+5.9163x_1$ here x_1 =Hand length
3. $y=121.69+5.4188x_2$ here x_2 =Hand breadth
4. $y=70.37+3.8969x_3$ here x_3 =Foot length
5. $y=99.05+7.063x_4$ here x_4 =Foot breadth.

Forearm length showed the highest degree of correlation ($r=0.6558$) followed by foot length in population of Mumbai (5). A study by Mukta Rani *et al* on 300 subjects in age group of 18-22 years shows significant positive correlation between stature and foot length and foot breadth. study by Agnihotri *et al* on 250 students shows positive correlation with foot length ($r=0.769$) (6). A study by Krishnan *et al* on 246 subjects of age group of 17-20 years shows the highest correlation between stature and foot length among Rajputs of Himachal Pradesh. Hand length, Hand breadth, and foot breadth also show significant correlation (7). The present study on 273 living cases (138 males and 135 females) of ages of 17-23 years with

no obvious deformities or previous history of trauma to hands, feet, spine and limbs, shows definite significant correlation between stature of an individual and Hand length, Hand breadth, Foot length, Foot breadth, and arm span. The highest correlation was found between stature and Arm span ($r=0.908$) followed by hand length (0.806), followed by foot length (0.767). Hand Breadth showed the lowest degree of correlation (0.467). Stature of an individual can be calculated from available anthropometric parameters by using established mathematical formul-as. Usefulness of present study is restricted to population of Gujarat. Measurements applied to only healthy individual in both living and dead cases. Study can be extended further by increasing sample size, considering sex, race and religion variation, and broaden the geographic area of study beyond Gujarat.

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