



ESTIMATION OF STATURE BY HAND ANTHROPOMETRIC MEASUREMENTS IN CHHATTISGARH REGION

Anatomy

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ABSTRACT

Introduction: Stature plays a crucial role in forensic investigations for identifying deceased individuals. When faced with situations like mass disasters where the entire body may not be available, it becomes essential to estimate stature using various body parts. **Material and Methods.** This research aimed to examine the relationship between hand length, hand breadth, and stature. The data was collected from 248 students enrolled at Pt. J.N.M. Medical College in Raipur. The male participants had an average age of 20.28 ± 1.40 years, while the female participants had an average age of 20.51 ± 1.33 years. Height, hand length, and hand breadth were measured using standard protocols with the help of an anthropometer, sliding caliper and vernier caliper. **Result:** In both male and female participants, all measured anthropometric parameters showed a high level of significance ($P < 0.003$). The study revealed significant associations between stature, hand length, and hand breadth for both genders. By conducting a multiple linear regression analysis of hand length and hand breadth, predictive equations were formulated, demonstrating a statistically significant ($P < 0.001$) ability to predict a person's height. **Conclusion:** The findings indicated a noteworthy connection between stature and hand anthropometric measurements for both males and females. Stature can be reliably predicted by considering a combination of these hand measurements. This knowledge holds significance in forensic investigations and medicolegal scenarios, especially in cases where there is a need to identify body parts.

KEYWORDS

Stature, Hand Length, Hand Breadth, Anthropometry

INTRODUCTION

Forensic anthropometry involves using physical and skeletal measurements to identify human remains and determine unique features at the time of death¹. The major challenges for forensic investigators are estimating and creating a biological profile for the "Big Four" factors: ancestry, sex, age, and stature of the unknown individual.

Estimating the stature of intact bodies is not difficult. However, it becomes highly challenging when dealing with incomplete skeletal remains, dismembered body parts, or decomposed bodies. Each part of the human body, including the head, face, trunk, and extremities, has a proportional biological relationship with stature. This relationship is crucial in forensic examinations to calculate stature from dismembered and mutilated body parts.³

In their research, Zhang et al utilized hand length and hand breadth through regression analysis to predict stature in a sample of 26,927 adults from the Hun Chinese population, comprising 13,221 men and 13,706 women. The study found that all hand measurements showed a significant correlation ($p < 0.01$) with stature, indicating that they can be reliably used to estimate a person's height.⁴ The aim of this study is to investigate hand anthropometric measurements, correlate it with stature and generate predictive equations with statistically significant ($P < 0.001$) ability for height prediction.

METHODOLOGY

Study Design: Cohort This study was carried out on a cross sectional sample of 248 students (110 males and 138 females) without any physical deformities or previous history of trauma to the hand with mean age of male participants being 20.28 ± 1.40 and while of females being 20.51 ± 1.33 years of the Pt.J.N.M. Medical college Raipur. Samples were drawn randomly across the student population, after giving informed consent to participate in the study.

The study collected data on the stature(S) of the participants as well as their hand anthropometric measurements namely, hand length (HL) and hand breadth (HB) following the description of Md. Asadujjaman, et al

Table 1 Anthropometric Measurements

Measured feature	Armamentarium used	Methodology
Stature(S)	Anthropometer	Participant made to stand on a horizontal platform with Heels together and to the ground Stretching upward to full extent Back as straight as possible Head adjusted to Frankfurt's horizontal plane Horizontal arm of anthropometer made in contact with the participant's head
Hand Length (HL)	Sliding caliper	Distance between the mid-points of the distal transverse crease of the wrist to the most anterior projection of the skin of the middle finger
Hand Breadth (HB)	Vernier caliper	Distance between the most lateral points on the head of the index finger metacarpal to the most medial point on the head of the little finger metacarpal

**Figure 1: Stature, Hand Length and Hand Breadth measurements (a) S, (b) HL, (c) HB**

The anthropometric dimensions were analyzed using SPSS Statistics v.19.0 (IBM, Armonk, NY, USA). The mean, standard deviation, and range were calculated for the anthropometric measurements, and comparisons were made between genders. Pearson's correlation coefficient was also used to analyze the data.

RESULT

The descriptive statistics for hand anthropometric measurements recorded in the sample are shown in the following tables. Hand anthropometric measurements showed significant correlation with stature ($P < 0.005$)

Table 2: Descriptive Statistics of Stature and Hand Length gender wise

Parameters	Stature	Hand length (right)	Hand Length (left)	Stature	Hand Length (right)	Hand length (left)
	Male	Male	Male	Female	Female	Female
Max	190.5	22	23	173.7	19	19
Min	155.4	15.5	16	124.9	15.5	16
Mean	171.46 ±7.28	18.55	18.45	156.70 ±7.05	16.82	16.94
Standard Deviation	7.2833	1.25	1.60	7.0516	1.11	0.85
P value	0.000 (significant <0.05)	0.000 (significant <0.05)	0.000 (significant <0.05)	0.000 (significant <0.05)	0.000 (significant <0.05)	0.000 (significant <0.05)

Table 3: Descriptive Statistics of Stature and Hand Breadth gender wise

Parameters	Stature	Hand Breadth (right)	Hand Breadth (left)	Stature	Hand Breadth (right)	Hand Breadth (left)
	male	male		female	female	
max	190.5	8.7	8.9	173.7	8	8.5
min	155.4	7	7	124.9	7	7
mean	171.46 ±7.28	8	8.25	156.70±7.05	7.25	7.23
Standard Deviation	7.2833	0.81	1.59	7.0516	0.71	1.21
P value	0.000 (significant <0.05)	0.000 (significant <0.05)	0.000 (significant <0.05)	0.000 (significant <0.05)	0.000 (significant <0.05)	0.000 (significant <0.05)

The following relationship derived from above data

1. S=9.26 HLR
2. S=9.28 HLL
3. S=21.24 HBR
4. S=21.51 HBL

Where (S= Stature of the person, HLR= Hand Length Right, HLL= Hand Length Left, HBR= Hand Breadth Right, HBL= Hand Length Left)

DISCUSSION

In forensic cases involving unidentified or mutilated remains, establishing the identity of the deceased is of utmost importance and a critical aspect of the investigation. Determining the sex and stature of the individual plays a crucial role in this process, as it contributes significantly to establishing their identity. When sex and stature are determined, half of the identity puzzle is already solved.

There exists a clear and consistent biological relationship between stature and various parts of the body. Anthropologists and forensic scientists utilize measurements of long bone lengths or other body parts to estimate stature. For over a century, anthropometric methods have been used to measure bone lengths or other body parts in both living and deceased individuals, aiding in the estimation of stature.

In the present study, the stature and hand anthropometric measurements were greater in males than females. The findings of this study are consistent with the past studies conducted by Jee SC et al⁵ (2015), Rastogi P et al⁶ (2008). This finding was also similar with the finding of study by Tang J et al⁷ (2012), Ishak NI et al⁸ (2012) and Sen J et al⁹ (2014).

In our study, mean right-hand length was 18.55 cm in male and 16.82 cm in female, whereas mean left-hand length was 18.45 cm in males and 16.94 cm in females. In 2009, Laila et al.¹⁰ have conducted a study on Bengali Muslim adult females and reported that an average right-hand length of 16.39 cm and left-hand length of 16.34 cm. In a study on West Bengal Bengalee women population¹¹, it was seen that the right-hand length was 16.3 cm and left-hand length was 16.31 cm in the study group. In Korean population⁵, it was found that the mean hand length was 18.30 cm for males and 17.10 cm for females. In this research, the mean value of right-hand breadth for male was 8.29 cm and for females 7.51 cm and the mean left-hand breadth was 8.24 cm for males and 7.48 cm for females.

In the present study the correlation between hand length with stature was positively correlated. ($r = 0.458$). These findings are consistent with the past research on the Hun Chinese population ($r = 0.310$ in males and 0.256 in females). A study by Jee and Yun⁵ in a Korean population revealed that the hand length was the most reliable estimator for both males and females ($R = 0.398$ in male and 0.285 in female); however, they used the mean value of right and left-hand measurement.

CONCLUSION

The present study was done to correlate the stature of an individual using data derived with hand anthropometric measurements using correlation coefficients.

The following deductions were drawn:

- Males exhibit greater dimensions for the hand anthropometric measurements and the stature.
- The parameters are significantly and positively correlated to the stature.
- The present study observed that there exists sexual dimorphism regarding stature and the parameters.
- In the present study, the best parameter to estimate stature in Hand measurements is Hand Length i.e., both right and left side ($r = 0.598, 0.560$) respectively.
- There exists a population-based difference in stature and body dimension proportions and thus necessity of estimation of equations for different regions should be noted.

Thus, it is concluded that correlation between hand anthropometric measurements were found to be statistically significant and these anthropometric measurements showed inter-regional and gender variations. All the variables showed positive correlation with the stature.

It is also concluded that all the parameters can be used to measure stature. These indices will be beneficial in forensic medicine, for estimating the stature and sex of an individual.

Competing Interests –

The authors declare that they have no competing interests

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