EVALUATION OF STATURE AND BODYWEIGHT USING ANTHROPOMETRIC ANATOMY OF HANDPRINTS IN NORTH INDIAN POPULATION: A FORENSIC APPROACH

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Abstract

Background: Estimation of stature and body weight is a fundamental step in forensic identification and biological profiling of human remains or suspects. Due to significant ethnic and geographic variability in body proportions, this study aimed to evaluate the correlation of various handprint anthropometric parameters with stature and body weight specifically in the North Indian population. Methods: Bilateral handprints were collected from 300 healthy adult subjects. Eight parameters were measured for both hands using a digital vernier caliper: Handprint Length (HPL), Handprint Breadth (HPB), Palm Print Length (PPL), and the lengths of the Thumb, Index, Middle, Ring, and little fingers (TPL, IPL, MPL, RPL, LPL). Stature and body weight were also recorded. Statistical analysis involved calculating Pearson's correlation coefficients to assess the relationship between handprint dimensions and the two biological parameters. Results: Several handprint dimensions showed strong positive correlations with stature. Specifically, the Left Handprint Length (LHPL) (r> 0.76, p < 0.001) and Right Ring Fingerprint Length (RRPL) (r> 0.73, p < 0.001) exhibited the strongest relationships, confirming the reliability of hand anthropometry. For body weight, the Right Handprint Breadth (RHPB) (r> 0.6, p < 0.001) and Left handprint breadth (LHPB) (r> 0.59, p < 0.001) demonstrated the most significant correlation. Conclusion: Handprint dimensions show statistically significant correlations with stature and body weight in the North Indian population. The findings underscore the need for developing population-specific prediction models based on handprint anthropometry to enhance forensic methodologies for accurate stature and weight estimation, thereby improving criminal investigations and unidentified body profiling.

Keywords: Anthropometry, Body Weight, Forensic Identification, Handprint, North Indian, Stature.

INTRODUCTION

Handprints have gained significant recognition as a unique biometric identifier in forensic investigations. Their value lies not only in establishing individual identity but also in revealing critical anthropometric characteristics that can aid in identifying victims and suspects. This project proposes a study focused on the anthropometric analysis of handprints within the North Indian population,

aiming to enhance forensic sciences through a deeper understanding of how handprint dimensions correlate with biological attributes such as body weight and stature.

<u>Importance of Body Weight and Stature Estimation in Forensics</u>

In forensic science, the ability to accurately estimate body weight and stature is vital for the identification and profiling of individuals involved in criminal activities or in cases of unidentified persons. Such estimations are essential for law enforcement agencies as they assist in narrowing down suspect lists, identifying victims, and facilitating investigations in scenarios where conventional identification methods are unfeasible. For instance, in cases involving decomposed bodies or when only partial remains are available, having reliable estimation methods becomes even more crucial. Despite the importance of these parameters, there is a notable research gap concerning the North Indian population. This region is characterized by its diverse genetic makeup and cultural heritage, which can influence physical attributes. Therefore, applying findings from other populations without adjustment may lead to inaccuracies in estimations. Recent studies have highlighted the utility of hand and handprint dimensions for estimating body weight and stature. For example, research conducted by Ishak et al. in Western Australia demonstrated that hand and handprint measurements could predict stature with a precision comparable to traditional skeletal measurements [1]. Such findings underscore the potential of handprints as reliable tools in forensic analysis. Furthermore, similar investigations in Egyptian populations support these results, emphasizing the effectiveness of handprint measurements in medicolegal contexts. These studies reveal the reliability of handprints in stature estimation [2,3]. Such correlations are crucial for developing region-specific regression models that can improve the accuracy of forensic analyses. In Sri Lanka and Malaysia, researchers have also underscored the importance of developing population-specific standards for estimations. These findings highlight that anthropometric characteristic can vary significantly across different ethnic groups, necessitating localized research efforts [4,5,9,10]. For instance, stature estimation from hand and handprint measurements in a monoethnic Maldivian population has shown promise in aiding crime scene investigations and disaster victim identification [6]. Moreover, studies in the Sharkia Governorate of Egypt and Croatia have similarly established that handprint measurements can effectively estimate stature [7,8]. Such insights reinforce the notion that handprint dimensions are not merely identifiers but also valuable metrics in forensic science. This study aims to connect anthropometric research with practical applications in forensic science, focusing on handprints within the North Indian population. By improving methodologies for estimating body weight and stature, the research intends to enhance the effectiveness of criminal investigations and judicial processes. As the field of forensic science evolves, the insights gained from this study will be vital in addressing the diverse challenges faced by law enforcement agencies. Ultimately, this research seeks to underscore the significance of culturally and regionally tailored approaches in the pursuit of accurate forensic identification, paving the way for more effective and reliable methodologies in the future. The overall aim of this study is to evaluate the Stature and Body Weight Using Handprint Anthropometry in the North Indian Population: A Forensic Approach. Specifically, the objectives are:

1. To correlate the stature of the subject with the anthropometric anatomy of handprints

2. To correlate the body weight of the subject with the anthropometric anatomy of handprints.

METHODOLOGY

Study Design

The present cross-sectional study was conducted in the Department of Anatomy, School of Medical Sciences and Research, Sharda University, Greater Noida.

Study Samples

This study was conducted on 300 normal subjects, including faculty members and students of the School of Medical Sciences and Research, Greater Noida, Uttar Pradesh. The sample comprised of healthy unrelated subjects with well-structured hands. All Individual were above 18 years of age and had North Indian origin. Individuals with persistent scars on their fingers or thumbs, with any hand defects due to injury, birth anomalies or disease, those having worn, extra, webbed or bandaged fingers were rejected from the study. Individuals who didn't have North Indian origin were excluded from the study.

Data Collection Technique This study was conducted on 300 normal subjects, living in the Greater Noida region of India aged 18 and above took part in the study. The purpose of the study was well explained to each subject before taking the data. The work will be carried out in the Dissection Hall, Department of Anatomy, after obtaining clearance from the Institutional Ethical Committee. Including both teaching and non-teaching members and MBBS students will be selected as per selection criteria and detailed bilingual consent will be taken before the conduction of the study. The Following parameters were measured after taking height, age, body weight and sex into consideration. (Figure 1)

1. Handprints Length (HPL)-X_3Y_3Z

2. Handprint Breadth (HPB)-VW

3. Palm print length (PPL)-Y_3Z

4. Thumbprint length (TPL)-X_1Y_1

5. Index Fingerprint length (IPL)-X_2Y_2

6. Middle Fingerprint length (MPL)-X_3Y_3

7. Ring Fingerprint length (RPL)-X_4Y_4
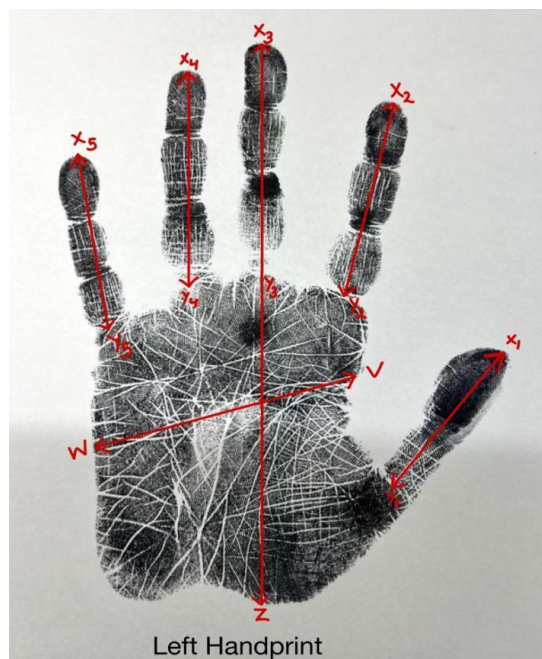
8. Little Fingerprint length (LPL)-X_5Y_5

Figure 1: Left handprint showing the parameters considered in the study

All hand measurements were taken using a digital caliper, while height was measured using a height measuring scale.

The handprint parameters were correlated with height and weight using Pearson's correlation coefficient. Statistical analysis was conducted using SPSS version 25, with a 95% confidence interval. Mean and standard deviation values were also calculated.

There is total 154 female and 147 males and all of them were between 18-25 years of age. (Table 1)

Table 1: Sex Distribution of Study Samples

		Gender			
		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	F	154	51.3	51.3	51.3
	M	146	48.7	48.7	100.0
	Total	300	100.0	100.0	

RESULTS

The analysis of data obtained from 300 North Indian participants revealed that all parameters had statistically significant correlations between several handprint dimensions and both stature and body weight.

Among the parameters measured, Left Handprint Length (LHPL) and Right Ring Fingerprint Length (RRPL) (Table 2 & 3) demonstrated the strongest positive correlation with stature *(r = 0.760 and r = 0.735, respectively), indicating their effectiveness as predictors of an individual's height.

Table 2: Correlation of Height with the Right-Hand Parameters

RIGHT HAND PARAMETERS	RPPL Y3Z	RMPLX3Y3	RHPLX3Y3Z	RHPBVW	RTPLX1Y1	RIPLX2Y2	RRPLX4Y4	RLPLX5Y5
Pearson Correlation	.651"	.667"	.317"	.596"	.510"	.596"	.735"	.699"

Table 3: Correlation of Height with the Left-Hand Parameters

LEFT HAND PARAMETERS	LMPLX3Y3	LPPLY3Z	LHPLX3Y3Z	LHPBVW	LTPLX1Y1	LIPLX2Y2	LRPLX4Y4	LLPLX5Y5
Pearson Correlation	.672"	.601"	.760"	.528"	.568"	.618"	.683"	.649"

On the other hand, Right Handprint Breadth (RHPB) and Left Handprint Breadth (LHPB) (Table 4 & 5) exhibited a strong correlation with body weight *(r = 0.604 and r=0.598), suggesting that broader hands are associated with higher body mass.

Table 4: Correlation of Weight with the Right-Hand Parameters

RIGHT HAND PARAMETERS	RPPL Y3Z	RMPLX3Y3	RHPLX3Y3Z	RHPBVW	RTPLX1Y1	RIPLX2Y2	RRPLX4Y4	RLPLX5Y5
Pearson Correlation	.536"	.343"	.186"	.604"	.212"	.318"	.399"	.413"

Table 5: Correlation of Weight with the Left-Hand Parameters

LEFT HAND PARAMETERS	LMPLX3Y3	LPPLY3Z	LHPLX3Y3Z	LHPBVW	LTPLX1Y1	LIPLX2Y2	LRPLX4Y4	LLPLX5Y5
Pearson Correlation	.343"	.483"	.507"	.598"	.317"	.309"	.363"	.369"

DISCUSSION

This study establishes handprint anthropometry as a reliable, non-traditional tool for forensic identification within the North Indian population. Strong positive correlations were found between specific handprint dimensions and stature, with Left Handprint Length (LHPL) and Right Ring Fingerprint Length (RRPL) emerging as robust height predictors [11,12,13]. These results reflect the anatomical linkage between extremity dimensions and overall body size [14].

For body weight estimation, Right Handprint Breadth (RHPB) showed a notable correlation, providing a useful supplementary indicator where full body data are unavailable [15]. Importantly, this study contributes region-specific anthropometric data, addressing inaccuracies that arise when generalized models are applied across diverse populations [16,17].

Overall, the findings highlight the forensic potential of handprint measurements in estimating stature and body weight, especially when traditional identifiers are missing. With appropriate standardization and the use of localized predictive models, handprint anthropometry can significantly aid identification in mass disasters, criminal investigations, and cases involving unidentified remains [18,19,20]. Future work should expand the dataset and incorporate sex-based analysis to enhance predictive precision.

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