

Reconstructing the vertical profile: estimation of stature from body circumferences among distinct two communities

Abstract

Identification is a fundamental pillar of forensic science and physical anthropology, with stature reconstruction serving as a primary biological profile component alongside age, sex, and ancestry. This study investigates the correlation between total body height (stature) and various anthropometric circumferences among two distinct ethnic groups in Lucknow, Uttar Pradesh: the Brahmin and Yadava communities. Utilizing a sample of 250 adult subjects aged 20–50 years, the research aims to establish population-specific multiplication factors and regression equations for stature estimation. Anthropometric measurements including head, neck, chest, waist, and limb circumferences are recorded using standardized landmarks. By analyzing these percutaneous dimensions, the study seeks to provide forensic experts with reliable tools for identifying victims from mutilated or fragmentary remains where long bones may be unavailable.

Keywords: forensic anthropology, stature estimation, anthropometry, body circumferences, Brahmin, Yadava, Lucknow

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Introduction

Forensic science is the critical application of natural and physical sciences to legal matters. Within this field, forensic anthropology utilizes skeletal and anthropometric data to identify individuals in criminal or humanitarian investigations. Stature, or standing body height, is one of the most vital parameters for establishing a person's physical identity. In cases involving mutilated, burnt, or decomposed remains, determining stature becomes a challenging yet essential task for forensic experts. While long bones have historically been the gold standard for stature reconstruction due to their strong mathematical relationship with total height, forensic scenarios often yield only fragmentary remains or isolated body parts. This necessitates the development of alternative methods to estimate stature from other body dimensions, such as facial measurements or various body circumferences. Given that human body proportions vary significantly across different ethnic and regional populations, there is a pressing need for community-specific data. This study focuses on the Brahmin and Yadava communities of Lucknow to fill a gap in the existing literature regarding these specific North Indian populations.

Methodology

Study area and population

The research is conducted in Lucknow, the multicultural capital of Uttar Pradesh. The study sample comprises 250 subjects (125 males and 125 females) representing the Brahmin and Yadava communities. Participants are selected within the 20–50 year age group, a period during which morphological features are fully developed. Subjects are chosen irrespective of their sub-castes, dietary habits, or socio-economic status.

Data collection

Both primary and secondary data sources are utilized, with a heavy emphasis on primary anthropometric measurements collected through intensive fieldwork. The following measurements are recorded:

- I. Stature:** Standing height from the vertex to the floor measured using an anthropometer.
- II. Body weight:** Recorded in kilograms.
- III. Circumferences:** A range of body circumferences are measured using a standardized steel anthropometric tape, including:
 - a) Head and Neck circumferences.
 - b) Chest circumference (at normal respiration).
 - c) Mid-upper arm and Wrist circumferences.
 - d) Abdominal, Waist, and Hip circumferences.
 - e) Thigh and Calf circumferences.
- IV. Derived indices:** Body Mass Index (BMI) and Waist-Hip Ratio (WHR).

Statistical analysis

The collected data will be subjected to rigorous statistical analysis to:

- I. Calculate mean values and observe sex differences in body dimensions.
- II. Determine the correlation coefficient between each circumference and total stature.
- III. Derive multiplication factors for both sexes in both communities.
- IV. Formulate linear and multiple regression equations for accurate stature reconstruction.

Review of literature

The relationship between body dimensions and stature has been extensively documented. Early studies by Mondal¹, Christian ejuiwa

et al.,² and Joshi, Jaiswal et.al,³⁻⁵ established a positive correlation between stature and long bone length. More recent work has expanded this to other parameters:

I. Hand and foot dimensions: Saxena⁶ and Sunil et al⁷ demonstrated significant correlations between stature and hand length. Krishan and Sharma⁸ confirmed the reliability of feet measurements for forensic stature estimation.

II. Facial and cephalic measurements: Jibon kumar found high correlations with bigonial breadth, while Krishan and Kumar⁸ utilized cephalo-facial dimensions for Hindu Gujjars.

III. Limb segments: Studies by Ilayperuma and Kaur et al.,⁹ have provided regression equations based on hand and upper arm lengths, respectively.

Despite these advancements, research specifically utilizing a wide array of body circumferences for stature estimation among the Brahmin and Yadava populations remains limited.

Results and discussion

Based on the established biological principles and existing literature, the study expects to find a significant positive correlation between most body circumferences and total stature.¹⁰ Initial observations in similar studies suggest that lower limb measurements and head circumference often show particularly strong ties to overall height.

The formulation of multiplication factors and regression equations will likely reveal sex-specific variations, reflecting the natural sexual dimorphism found in the Lucknow population. By comparing results between the Brahmin and Yadava groups, the study will determine if ethnic-specific equations are necessary or if a unified model for the Lucknow region is feasible. This comparative analysis is crucial for ensuring the “validity” of these forensic tools when applied to diverse Indian populations.¹¹⁻¹⁴

Conclusion

This research underlines the importance of a multifaceted anthropometric approach in forensic identification. By establishing reliable correlations between body circumferences and stature, this study provides a vital fallback method for forensic experts when primary skeletal remains are missing. The population-specific regression equations for the Brahmin and Yadava communities of Lucknow will significantly enhance the accuracy of biological profiling in North India. Ultimately, this work contributes to the broader goal of forensic anthropology: bringing certainty to the identification of the unknown.

Acknowledgments

None.

Conflicts of interest

The author declare that there is no conflict of interest.

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