Original article

Estimation of stature from different anthropometric measurements in Kori population of North India

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ABSTRACT

In medico-legal cases, most often the personal identity of the deceased is a mystery. The stature, sex and other parameters in such scenarios are ascertained using the physical evidence present at the crime scene. One of the key methods of ascertaining the sex and stature is by using the human bones. The method of achieving accuracy in estimation of stature from bones has been well established in past. There are several regression formulae for conducting such estimation. However, it must be kept in mind that these regression equations can vary depending upon the population and region. Thus, it is very necessary to study a particular population thoroughly before formulating regression equations for that specific population patch. In this paper, we have penned down the study of KORI POPULATION, who are native to Kanpur region of Uttar Pradesh state, in India. In this study, we have observed the statistics of 202 individuals (106 females and 96 males). In totality, eight bone dimensions including stature, total arm length, length of the middle finger, knee length, foot length, foot breadth, maximum head length and maximum head breadth have been recorded in this research paper. The regression formulae for females and males have been derived separately. Further, there are various parameters that have been compared to find which parameter provides the best results in terms of accuracy in stature estimation.

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1. Introduction

Anthropometry, which deals with expressing human form in numbers, has been widely used in forensic identification. Identification includes determining sex, age, race and stature of a person. Among these, the sex and stature are the most important.[1] In 1888, Rollet[2] was first to conduct a research in this field. He used measurements from 50 male and 50 female corpses to show the relationship between various body measurements and the stature. In 1899, Pearson,[3] a mathematician, used this data to derive the regression equations, which he suggested were population specific. Since then numerous advancements[3,4] have been made in this field, which are being efficiently applied in the identification process. As these measurements are population specific, it becomes imperative to collect data from more populations and make a comprehensive database.

Estimating stature is one of the "big four" (identifying age, sex, stature and ancestry or race) of forensic anthropology. Using stature estimation, a forensic scientist can narrow down the pool of possible victim matches in any ongoing investigation.[5] The stature is directly proportional to different body parts and hence, shows a definite biological and genetic relation with each other. In forensic cases, stature (or body height) is usually estimated using 'anatomical' and 'mathematical' techniques.[6] Researchers have established a relationship between stature and measurements of different body parts which are often represented using linear regression equation derived from them.[1]

Another important consideration here is the fact that often in forensic cases only a part of the skeletal framework is encountered. There exist many inherent population differences among the different population, thus, giving rise to the need for different formulae to be derived from different populations.[7] Forensic identification is most important in the case where parted bodies are encountered as in the natural disaster, traffic accidents, war, terror and bombing cases.[1] To counter this problem we must have regression equation for different bones for representatives of same populations. Many studies have been done for stature estimation using long bones,[8,9] foot dimensions,[10–12] hand measurements,[13–15] Radius Ulna Bone

measurements,[16] Head measurements,[17–20] etc. This study was conducted in Kori population of Kanpur region to identify whether a significant correlation exists between the stature and different parts of body namely arm length, middle finger length, knee length, foot length, foot breadth, head length and head breadth.

2. Material and methods

The present research was conducted on Kori population of Kanpur District in Uttar Pradesh in the northern region of India (Fig. 1). Kanpur is the largest industrial city of Uttar Pradesh. It is known as the Economic and Industrial Capital of Uttar Pradesh. It is also known as Leather City. The Kanpur city's coordinates are 26.4670° North and 80.3500° east respectively. The Kori population constitutes of traditional weavers of north India. The given population is homogenous in respect of culture and ethnicity. The male participants were mostly from an agricultural background and females were mostly housewives. This is an endogamous community, i.e. they marry only within their community. At times they are also endogamous at the subgroup level, as in Uttar Pradesh where they have twelve endogamous subgroups of equal status. In Madhya Pradesh, the Kori have six clans while in Orissa the number of clans is five. The study was conducted on 202 individuals (106 females and 96 males). To eliminate the effect of age on stature, anthropometric measurements were taken from individuals of age ranging from 20 to 40 years. The individuals participating in the study were healthy and without any physical deformity. The timings for measurements were fixed in morning from 7 to 11 AM to avoid any diurnal variation. The subject was instructed to stand on the plane surface and erect so that his/her buttocks and back touch to the wall. The subject's head was adjusted to Frankfurt Horizontal Plane. The instruments used were an Anthropometric rod, Rod campus, Sliding caliper, spreading calipers. Extremity readings were taken from the left side of individuals. Precision and reliability of anthropometric measurements have considerable importance in every forensic study thus; all measurements were taken by the same researcher to ensure the reliability of data. Different measurements taken are as follows:

2.1. Stature (total height):- It represents the vertical distance from the *vertex* to the floor (Fig. 2).

2.2. Total arm length:- It represents the straight distance between *acromion* and *dactylion* when the subject stands in the normal position with his arms hanging by his sides (Fig. 3).

2.3. Length of middle finger:- It represents the straight distance between *phalangion III* of the middle finger and *dactylion* of the same finger (Fig. 4).

2.4. Knee length or height:- It represents the vertical distance between *tibiale* of the lowermost point of the patella to the floor (Fig. 5).
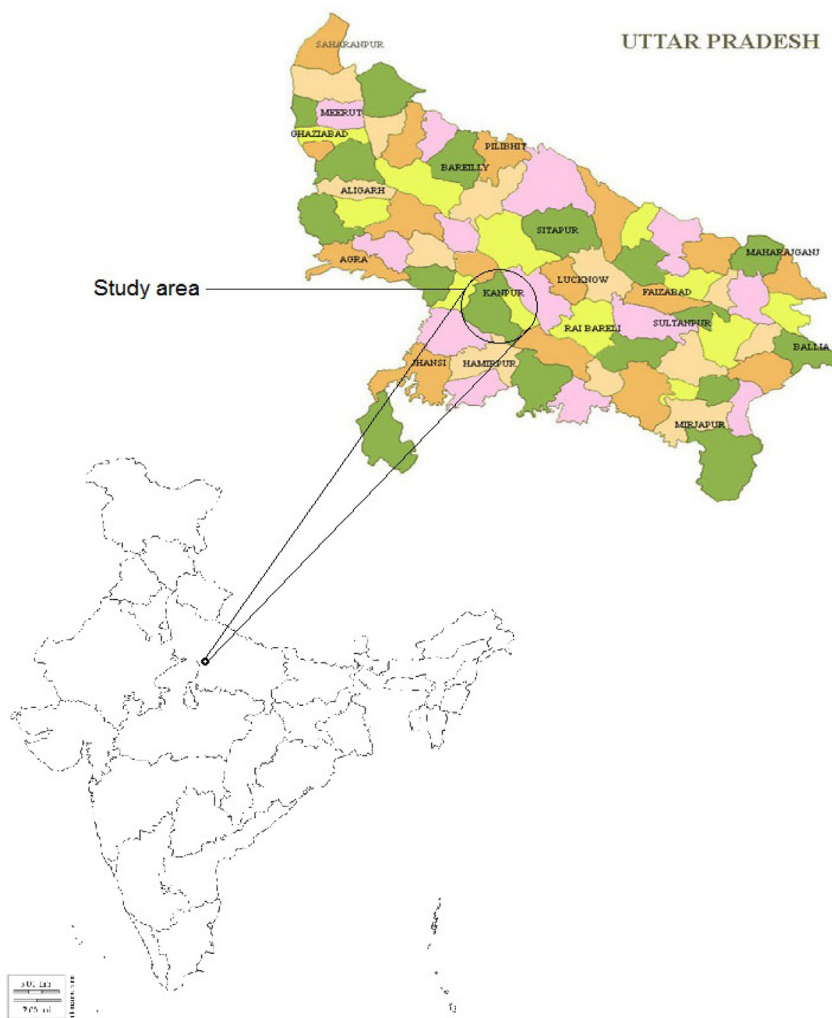

Fig. 1. Geographical location of the study area in India.