

## ORIGINAL RESEARCH

# A Prospective Study to Estimate the Stature by Anthropometric Measurements of Head at a Tertiary Care Center

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## ABSTRACT:

**Background:** Stature or body height is one of the important and useful anthropometric parameters that determine the physical identity of an individual. The present prospective study was conducted to estimate the stature by anthropometric measurements of head at a tertiary care center.

**Material & Methods:** The present prospective study was conducted to estimate the stature by anthropometric measurements of head at a tertiary care center. The study was conducted among 200 healthy individuals for the period of one year. Measurements of head circumference and height were made directly on each subject. Data was analyzed using statistical package for the social sciences (SPSS) software version 26.0.

**Results:** In the present study, total subjects included were 200 in which 56% were males and 44% females. The mean of head circumference was more in males (56.32±2.45cm) than in females (55.23±2.32cm). The mean of height was maximum in males (174.52±3.98cm) than in females (159.40±4.32cm). The equation relating stature to the head circumference was derived as stature,  $Y=47.24+2.07x$  for females and  $Y=71.12+1.85x$  for males.

**Conclusion:** The study concluded that head circumference can be used to estimate stature using the regression equation with reasonable accuracy to estimate stature.

**Keywords:** Head Circumference, Stature, Regression Equation.

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## INTRODUCTION:

Estimation of stature has a significant importance in the field of forensic medicine and anthropometry. Anthropometry is a series of systematized measuring techniques that quantitatively estimates the dimensions of human body and skeleton.<sup>1</sup> The ultimate aim of using anthropometry is to help the law enforcement agencies in achieving "personal identity" in case of unknown human remains.<sup>2</sup> Different equations for the estimation of stature were established for whites and blacks, and for males and females. The equations that were derived by Trotter and Gleser in the early 1950 for Americans were being continuously revised using data from different sources.<sup>3</sup> Reconstruction of stature from various bones of the human skeleton has been achieved

by many scientists with varying degree of accuracy.<sup>2</sup> Establishment of alternative methodologies for personal height estimation is essential for a number of reasons. Firstly, in instances where height estimates needed to be made from fragments of bones in archaeological procedures or in forensic science after mass disasters or genocide.<sup>2</sup> Secondly, estimates of anthropometric parameters and evaluation status rely on accurate measurement of not only body weight but also height. In clinical practice, population height, and age specific data on cranial dimensions gives an indication of growth and development of an individual and also any abnormalities of cranial size and shape.<sup>4</sup> This information is of paramount importance to

anthropologists to find racial differences, forensic medicine experts to solve medico-legal problems when only parts of deceased are available and archaeologists to carry out archaeological procedures and may facilitate the process of sex determination. There are a few studies for stature estimation from skull alone. It is proved beyond doubt that each race requires its own formula for stature estimation. The climate and dietary habits of the people of different regions of India are variable. Racial and ethnic variations also exist in population of different geographical regions. Hence opinions based on the result of studies done in one population cannot be entirely applicable to other population.<sup>5</sup> Many studies have been conducted on stature from percutaneous measurements of various body part including arm, leg, feet, etc.<sup>6-9</sup> Considering this scenario there is a need of systematic study for stature estimation from fragmented and dismembered skull remains. The present prospective study was conducted to estimate the stature by anthropometric measurements of head at a tertiary care center.

#### MATERIALS& METHODS

The present prospective study was conducted to estimate the stature by anthropometric measurements of head at a tertiary care center. The study was conducted among 200 asymptomatic, healthy individuals at Government Medical College, Ratlam, M.P., India, for the period of one year. Informed consent was taken from the participants. Healthy subjects of age above 18 years with no obvious skull or body deformity and had consented for study was included in the current study. Subjects who were below 18 years of age and above 25

years age and/or refused to take part in this study were excluded from this study. Subjects with any craniofacial pathology, with history or clinical features suggestive of trauma or surgery of skull, pelvis, vertebral column, long bones, stature defects, and facial asymmetry were also excluded from the study. For stature measurement, standing height of each subject was recorded using standard anthropometric stadiometer mounted on the wall. The subject was asked to stand barefooted close to wall looking straight forward, with stable head, the measuring tape of stadiometer was slide down to make contact with the subject skull, the reading for stature was noted. Three readings were taken by same investigator at fixed time duration to avoid diurnal variation and average was recorded as final stature reading. Horizontal head circumference (HC) was measured from glabella to glabella by using non-stretchable plastic measuring tape, which passes through the opisthocranium (just above eye ridges). Data was analysed using statistical package for the social sciences (SPSS) software version 26.0; results were expressed as mean±standard deviation (SD).

#### RESULTS

In the present study, total subjects included were 200 in which 56% were males and 44% females. The mean of head circumference was more in males (56.32±2.45cm) than in females (55.23±2.32cm). The mean of height was maximum in males (174.52±3.98cm) than in females (159.40±4.32cm). The equation relating stature to the head circumference was derived as stature,  $Y=47.24+2.07x$  for females and  $Y=71.12+1.85x$  for males.

**Table 1: Distribution of the subjects according to gender**

Gender	N(%)
Male	112(56%)
Female	88(44%)
Total	200(100%)

**Table 2: Correlation coefficient between stature and head circumference measurements in study subjects.**

	Male	Female
Mean of head circumference (x in cm)	56.32±2.45	55.23±2.32
Mean of height (Y in cm)	174.52±3.98	159.40±4.32
Correlation coefficient (r)	0.48	0.45
a	71.12	47.24
b	1.85	2.07
Regression equation	$Y=71.12+1.85x$	$Y=47.24+2.07x$

$Y=a+bx$

where x= head circumference, Y= Height in cm, where, 'a' is the intercept and 'b' is the regression coefficient of the independent variable

## DISCUSSION

In forensic examinations and anthropological studies, prediction of stature from incomplete and decomposing skeletal remains is vital in establishing the identity of an unknown individual.<sup>10</sup> There are various methods to estimate stature from the bones but the easiest and the reliable method is by regression analysis.<sup>11</sup> In the present study, total subjects included were 200 in which 56% were males and 44% females. The mean of head circumference was more in males (56.32±2.45cm) than in females (55.23±2.32cm). The mean of height was maximum in males (174.52±3.98cm) than in females (159.40±4.32cm). The equation relating stature to the head circumference was derived as stature,  $Y=47.24+2.07x$  for females and  $Y=71.12+1.85x$  for males. Prenetha R, et al estimated the stature from head circumference and to derive a linear regression formula between them. The study concluded that head circumference is a moderately reliable parameter for stature estimation in both genders.<sup>12</sup>

Patil RA et al undertaken a study to reconstruct stature in males and females by using head circumference as a parameter. Highly significant correlation was found between height and head circumference. The equation relating stature to the head circumference was derived as stature,  $y=97.19+1.11$  HC for females and  $y=88.77+1.45$  HC for males. The above findings concluded that this provide reliable method of estimation of height from skeletal remains in the forensic setup.<sup>13</sup> Kanchan kumar P et al undertaken to determine stature from maxillo-facial anthropometry in central Indian region using head length and head breadth. Regression equation for stature of males using head length is  $122.32 + 2.63 \times HL$  and using head breadth is  $162.63 + 0.57 \times HB$ . The regression equation for stature in females using head length and breadth are  $133.76 + 1.49 \times HL$  and  $123.9 + 2.33 \times HB$  respectively. The study concluded that Regression equations are population specific and will not yield exact stature if applied to other population. Stature estimation can be possible with the help of these two parameters when only skull or remains of the skull are available for medico legal examination.<sup>14</sup>

## CONCLUSION

The study concluded that head circumference can be used to estimate stature using the regression equation with reasonable accuracy to estimate stature.

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