Correlation of the hand length and stature in adult Musahar females of Nepal; an anthropometric study

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ABSTRACT

Stature of a person is one of the most important and useful anthropometric parameter for establishing identification of unknown living or a dead person. A descriptive cross sectional study was done on 165 Nepalese adult Musahar females of Aurahi Village of Mahottari district, Nepal to predict the stature from their hand length.[1] Measurement of stature and the length of both right and left hands taken with a standard standing height measuring instrument and a slide caliper respectively showed significant ($p<0.001$) positive correlation between the stature and hand lengths. The multiplication factor which was obtained by dividing the height of the subject by the respective hand lengths was found appropriate parameter to calculate the stature of a questioned person. The importance of the hand length alone will be of a great value for anthropologists and forensic experts. As an alternative method, the coefficient of regression and intercept which were obtained from the measured height and hand length were also proved to be equally valuable to estimate the height of a questioned person.

Keywords: Anthropometric measurement, hand length, Musahar, anthropologist, multiplication factor, standing height measuring instrument.

INTRODUCTION

Musahar, a Bhojpuri speaking Hindu scheduled caste is found mainly in the central and eastern Terai region of Nepal and neighbouring Bihar and Uttar Pradesh of India. They are traditionally indulged in catching rat for their meal. Because of this unusual practice they are isolated from the other communities. Hence, they are not accepted by other ethnic groups for social interaction like marriage etc. They are mainly landless agricultural labourers. The present study was done among them for being one of the indigenous ethnic groups of Nepal.

Reconstruction of the height of a person from skeletal dismembered remains is not new for anthropologists and forensic experts.[1-6] Various works on this matter had been undertaken by deriving various multiplication factors and regression equations have been developed to reconstruct stature from long bones throughout the world.[7]

All the human being of the world belonging to a same species i.e. Homo sapiens is not alike in their measurable traits. Such traits keep on changing from birth to death, health and illness, and are also influenced by environmental and genetic factors.

There were long records of discussion on the issue of human variation in anthropometric research. Anthropologists observed and compared the relationship between various body segments to highlight variations between sexes, races, the geographical time period and even ethnic origin etc.[8] Stature can be defined as the natural height of a person in an upright position but its evaluation becomes difficult when the body is mutilated, burnt or fossilized. Anthropologists had suggested that an approximate measure of stature could be estimated from the hand length of a person as it is not affected by deformities like kyphosis, lordosis and scoliosis, contracture or missing legs.[1] Many workers had worked to reconstruct stature of a subject by using the dry bone length, the record of obtaining the stature from segment of body is less.[9] Thus the relationship of the length of different parts of human body to the stature has become useful in forensic science to obtain the height of a questioned subject from the obtained mutilated piece of hand. Personal identification is an integral part of the investigation in cases of mass disasters where disintegrated and amputated body organs are found very frequently. In such circumstances, the original stature of those people can be estimated by multiplying the length of hand by respective multiplication factor which had been obtained already by making a ratio of the stature to the hand lengths of a particular ethnic group.

A fact which is especially familiar not only to anatomists but also to artists is that the trunks and limbs exhibit consistent ratio among them and relative to total height. The ratios were linked to age, sex and race.[10]

Table-1: Showing Stature and measurement of the hand length and the multiplication factors for estimating stature from the measurements of hand length.

	Range	Mean	SD	MF
Age (yrs)	30-45	36	4.1	
Height(cm)	144.8-176.9	154	7.4	
Rt.Hand(cm)	13.9-18	15.3	1.2	10
Lt.Hand(cm)	13.9-16.6	15	0.9	10.26

Many of the previous authors have worked on the skeletal remains for the reconstruction of stature.[9] Opinions differed as to whether the cadaveric length and the height in the living are same. All these shortcomings in cadaveric material, led the author to study this problem by taking measurements in the living subject. Atallah and marshal had also tried to evaluate the accuracy of the estimation. They had also discussed the applicability of the method on both living person and cadaver.[11] The aim of this investigation was to obtain a correlation between the lengths of hand and the stature in the living subjects, by using certain intermediate correlations. A specific ethnic group was chosen, since both stature and its relation to different body parts differ in different gender and race.[10]

MATERIALS AND METHODS

The present cross-sectional study was done among 165 Musahar females of approximately 30-45 years of age. The hand length is referred to as the distance between the tips of middle finger to the tip of the radial styloid process. The length of both right and left hand were taken independently of left and right sides of each individual using a Vernier slide caliper. Similarly the height of the individual was measured between the vertex and the floor in anatomical position using standing height measuring instrument.[7] To measure the hand length, the subject was asked to place her pronated hand on a table with the fingers together and thumb abducted and the measurement was taken from the level of the tip of the styloid process of radius to the tip of middle finger.[9] All the measurements were measured in centimeters to the nearest 0.1 cm.

The obtained measurements were tabulated. The mean and standard deviation of the height and the length of right and left hand of the subjects were calculated. From these measurements the multiplication factors for the right and left hand were derived by dividing the height of the subject by the respective hand lengths. Then, the height of a person was estimated by multiplying the mean hand length by the multiplication factor. The measured heights and the estimated heights of the subject were compared by student's t test.

As suggested by earlier researchers, the alternative method for reconstruction of the height was by obtaining the regression equation, in which the coefficient of regression and intercept are obtained from the measured height and hand length.[12] The coefficient, thus obtained is used to estimate the height of a questioned person.

$y=a+bx,$

y=height, x=hand length, a= intercept, b=coefficient of regression

In the current study, both methods for estimating height were adopted and the results were compared.

RESULTS

The mean stature and mean length of the right and left hand were found to be 154±7.4 cm, 15.3± 1.2 cm and 15±0.9 cm respectively. The mean multiplication factor for right and left hands were 10 and 10.26 respectively (Table-1). The mean estimated stature by multiplication factor was found 153.45cm which was almost same to the actual height of the person. On comparing by student's t test, statistically significant difference was not found between the actual and estimated measures (Table-2). Therefore, a positive correlation between the hand length and height of a person was established (Fig. 1).

Similarly, using the regression formula the mean height was estimated 153.98cm whereas the actual mean height was 154cm. Again, no significant difference was found between estimated and measured height. This also proved the correlation between hand length and height of a person (Table-3).

DISCUSSION

The males of this particular income generating age group were not available during day time as they were busy with their agricultural work in the field. Considering this fact the present study was undertaken among the females.

Table-2: Showing the comparison of measured and estimated height from right and left hands

	Estimated Height (Hand length X MF) cm	Measured Height(cm)	Comparison of estimated and measured height(cm)
Mean Rt. Hand length	15.3x10=153	154	153.45
Mean Lt Hand length	15x10.26=153.9	154	

In the present study, the mean stature was 154±7.4 cm and the mean length of the right and left hand was 15.3±1.2cm and 15±0.9 cm respectively. The height was estimated from hand length of 165 Mushar females between 35-45

Table-3: Regression table showing the estimated and observed height

b = coefficient of regression	2.936470291	Estimated height (cm)	Observed height (cm)
a = intercept	109.3861458	153.98	154
y= a+bx	109.38+2.93x15.22=153.98		

years by deriving regression equations.[13] This particular age group was chosen so as to get a real adult measure of height and hand length because this is the fully grown up age which is also not affected by senile atrophy.[14] The multiplication factor of right side was 10 and left side was 10.26. Multiplying this multiplication factor with the hand length we found the estimated statures, which were nearly equal to the measured stature. All the measurements in this study were positive as well as a statistically significant correlation with the stature. Similar observations were made by others.[15] Therefore it can be explained that the hand length can be used to estimate the height of a questioned person.

As the ratios between body segments are age, sex and race dependent alternative methodologies and formula should be applied to derive the stature of a person belonging to a particular race or ethnicity.[16]

From the present study the multiplication factor of Musahar adult Nepalese females for estimation of stature from respective hand lengths was discovered. As suggested by previous researchers both the multiplication factor and the regression equation were found to be equally sensitive and specific parameters for reconstructing the height of a questioned subject.

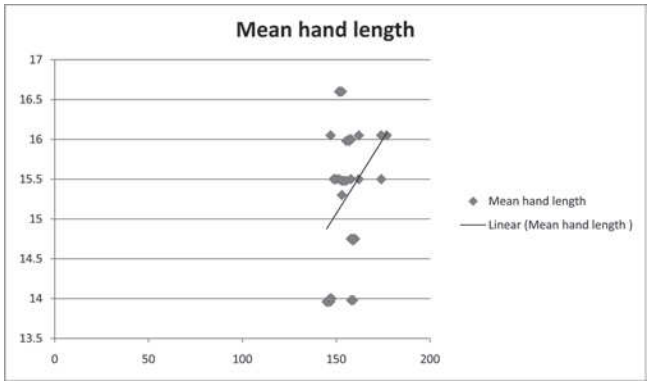

Fig. 1. Scatterogram showing the relationship of hand length and height

For the reconstruction of the height of a subject, the necessity of the multiplication factor or coefficient of regression for the particular ethnic group of person remains the main constraint.

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