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RECONSTRUCTION OF STATURE USING HAND AND FOOT DIMENSIONS AMONG INDIAN POPULATION

Ankit Srivastava[1] and Vijay Kumar Yadav[2]
[1]Corresponding Author & Assistant Professor, Institute of Forensic Science & Criminology, Bundelkhand University, Jhansi (U.P.)- India – 284128
ankit_forensic81@rediffmail.com
[2]Assistant Professor, Institute of Forensic Science & Criminology, Bundelkhand University, Jhansi (U.P.)- India – 284128
vijayforensic01@gmail.com

ABSTRACT

In the present study an attempt has been made to reconstruct stature on the basis of hand and foot measurements among Kayastha Community of Bundelkhand region of India. A total of 223 Kayastha (100 males and 123 females) ranging in age 20 to 40 years were measured for the Stature, Hand length, Hand breadth, Foot length and Foot breadth by following the standard technique. Data demonstrates that the Kayastha males are taller than Kayastha females. The sex differences have been observed to be highly significant for hand and foot measurements. All the body dimensions exhibit a positive correlation with stature. Foot Length showed the highest correlation (r=0.71) with stature among both sexes. Followed by Hand Length (r=0.61) among males while Hand Breadth (r=0.31) among females whereas Hand Breadth (0.34) and Hand Length (r=0.30) showed least correlation with stature among males and females respectively. Sex specific regression equation and multiplication factor have been developed for all the measurement.

KEYWORDS: *Stature Estimation, Hand Length, Hand Breadth, Foot Length, Foot Breadth, Regression Equations, sex differences*

1. INTRODUCTION

Identification of human skeletal remains is an important aspect of forensic examination. It includes determining the species of origin, age, sex and stature from bones. Superimpositions of skull and photograph have to be carried out in many cases to establish identity.[1] Skeleton or bones and teeth are the hard parts of the bodies of animals and human being. Thus, they escape decay unlike other soft body tissues and get putrefied and fossilized after considerable lapse of time in nature when preserved under condition conductive to fossilization. Hence, even after millions of years we find fossilized bones teeth or whole skeletons, which are require identification.

Forensic Anthropologists, during the examination of skeleton remain attempts to answer the following questions: [2]

- Whether the bones are human or non-human?
- Whether they belong to one or more than one individual?
- What would be the age?
- What would be the sex?
- What is the ethnic group (race) of the individual?
- How tall the person would be?

In addition to identification of human remains, forensic anthropologist helps to interpret evidence pertaining to manner or cause of death. Marks on bones provide very important information as to how death occurred. With all evidence of skeletal trauma, it is imperative to recognized and distinguish among the ante mortem, perimortem (around the time of death) and postmortem (after death) trauma. A skull fracture may indeed reflect a blow that could have caused death. Because dried bones have

different fracture characteristic than the bone from living organism. It is possible to distinguish between perimortem and postmortem damage by studying details of skeletal lesions.

A considerable amount of work is available on the aspect related to determination of age and skeletal material. However, special techniques are also available regarding establishing origin of skeletal material as well as determining the number of individual involved. However, racial (ethnic) variation based on the skeletal morphology has been adequately highlighted by **Iscan (1988)** [3] in their classical book. Estimate of stature has been another important feature which attracted attention of numerous researchers the world over as the estimation height of the deceased obtained from the long bones do help in providing an idea of ante mortem height of the person. Since, 1888 onwards till date, numerous researchers have attempted to formulate mean of stature reconstruction from the skeletal remains and have succeeded as a high positive correlation exists between different long bones of the upper and lower limbs and the standing height of an individual. The researchers have formulated prediction equation, which provide estimate of stature that is quite close to the ante mortem height of an individual.

In a country like India, where due to the cultural practices pertaining to the disposal of dead bodies , the skeletal remains are rather scanty and thus only a few ethnic groups have been studied for this purpose due to non-availability of the skeletal remains. [4],[5],[6],[7],[8] To cover this gap, studies have been conducted on various living Indian population by measuring the bone lengths percutaneously to formulated regression equation for prediction of stature. Such equations based on the living are to a large extent applicable on the bones in skeletonized form belonging to the same ethnic groups as there exists a non-significant variation in the estimation stature obtained by using actual bones length and percutaneous length of the same bone.

In the Present study an attempt has been made to reconstruct stature among Kayasthas of Bundelkhand region, India using Hand and Foot Measurement.

2. OBJECTIVES

The present study aims to examine the following aspects:

- Assessment of Sex difference in Hand and foot Measurements among males and females Kayasthas of Bundelkhand region
- Formulation of Sex Specific Multiplication Factor (M.F) for stature estimation.
- Construction of Sex Specific linear regression equation for stature estimation.

3. MATERIAL AND METHODS

The present study has been designed to conduct measurements on male and female Kayastha inhabiting in different village or cities of Bundelkhand region in the age range of 20 to 40 years to formulate multiplication factor and regression equation for estimation of stature using Hand and foot measurements.

Thus following measurement has been obtained on each subject using the standard measurement techniques recommended by Martin and Saller (1959) [9] and Allbrook (1961).[10] All Measurement listed have been taken on the left side of the body except stature.

3.1 Stature: It is obtained as the projective distance between the standing surface and the highest point on the head (Vertex) in mid- sagittal plane when head is oriented in the eye- ear plane, using anthropometric rod.[11]

3.2 Foot Length (FOL): Subject stand erect with left foot twelve inches ahead of the right one with whole weight of body falling on left foot. Using rod, compass, measure the distance between acropodion and pterion when the foot is fully stretched. [13]

3.3 Foot Breadth (FOB): It is obtained as a distance between metatarsal tibiale and metatarsal fibulare using sliding caliper. [13]

3.4 Hand Length (HL): It is obtained as the distance between interstylion and dactyl ion III, using sliding caliper. Subject was asked to extend the left hand and place it on horizontal platform with palm facing upward with the bar of the sliding caliper lying along the palm; the distance from the proximal bracelet crease to the tip of the left middle finger is measured. [13]

3.5 Hand Breadth (HB): It is the straight distance between metacarpal radiale to metacarpal ulnare, using sliding caliper. Subject was asked to extend the left hand and placed it on a horizontal platform downwards .While the bar of the sliding caliper lying along the palm, the distance between metacarpal radiale to metacarpal ulnare is measured. [13]

4. RESULTS AND DISCUSSION

The data have been treated statistically using the standard program SPSS, to obtain mean, standard error of mean, test of significance and coefficient of correlation to assess the variation for all body measurements among male and female Kayastha of Bundelkhand region. Besides these, multiplication factors and linear regression equations have also been formulated for stature reconstruction. The results of analysis have been tabulated for interpretation

Table 1: Mean and Sex difference in Body Measurements among the Kayastha Males and Females

S. No	Measurement	Male (N=100)		Female(N=123)		
		Mean	S.E. of mean	Mean	S.E.of mean	Value of t
1.	Stature(S)	170.9	0.71	156.21	0.49	17.029*
2.	Hand Length(HL)	18.40	0.08	16.74	0.11	11044*
3.	Hand Breadth(HB)	8.177	0.04	7.26	0.10	16.78*
4.	Foot Length(FOL)	25.13	0.12	22.65	0.10	15.20*
5.	Foot Breadth(FOB)	9.36	0.06	8.36	0.05	11.66*

***significant at 1% level.**

It is observed that the Kayastha males exhibits greater mean values than females Kayastha for all the body measurement including Stature (Table – 1). On subjecting the data to test of significance (t-test) it is revealed that the Kayastha community exhibit highly significant sex differences all the body measurements. Owing to highly significant sex differences, male and female Kayastha have been dealt with separately for further analysis related to computation of multiplication factors and linear regression equations for estimation of stature.

TABLE 2: Multiplication Factor (M.F) for Stature estimation Among Male and Female Kayastha

S.NO	**Body Dimension**	**Males**	**Females**
1.	Hand Length(HL)	9.29	9.36*
2.	Hand Breadth(HB)	20.93	21.53*
3.	Foot Length(FOL)	6.80	6.90*
4.	Foot Breadth(FOB)	18.31	18.76*

*****Shows greater values of M.F. for different measurements

Table 2 using the proportion of four percutaneous length of Stature, Multiplication factor has been computed for males and female Kayastha. It is observed that the females show greater Multiplication Factor (M.F) for all four measurements i.e. Hand Length, Hand Breadth, Foot Length, Foot Breadth.

TABLE 3: Regression Equations for Estimation of Stature from Different Body Measurements among Male Kayastha

S.NO.	Regression Equation	Standard of Estimate (SEE)	Correlation co efficient (r)
1.	68.95+4.05(FOL)	±5.03	0.74
2.	74.47+5.24(HL)	±5.68	0.61
3.	122.48+5.17(FOB)	±6.30	0.48
4.	126.49+5.43(HB)	±6.74	0.34

TABLE 4: Linear Regression for Estimate of Stature from Different Body Measurements among Female Kayastha

S.NO	Regression Equations	Standard Error of Estimates (SEE)	Correlation value (r)
1.	82.43+3.98(FOT)	3.98	0.69
2.	121.44+4.78(HB)	5.24	0.31
3.	133.84+2.63(FOB)	5.26	0.30
4.	135.29+1.12(HL)	5.26	0.30

Table 3 and Table 4 showed the association between individual body measurements with Stature the data has been subjected to correlation analysis separately for males and female Kayastha, as the sex difference are highly significant for Hand and Foot measurements. The correlation value reveals that all the body measurements exhibits positive correlation with Stature. Males exhibits highest correlation for Foot Length (r = 0.71) and Least correlation is observed for Hand Breadth (r = 0.34) with Stature whereas female exhibits highest correlation for Foot Length (r = 0.69) and the least correlation is observed for Hand Length (r= 0.30) and Hand Breadth (r= 0.30). Linear regression equation formulation on the basis of correlation value for estimation of stature. It is apparent that the best estimate of stature would be obtained by using Foot Length for both male and female.

5. CONCLUSION

Personal identification is the most important part of the investigation and examination in cases of mass disasters, where disintegrated and amputated body organs are frequently found. The norms regarding determination of sex, age and race are well established but stature estimation requires much more research, as the data on stature estimation is scanty on Indian populations [14]. Due to extreme genetic diversity among the Indian population groups, each population group requires a separate study in this regard. Present study has provided the regression equation and M.F for four different hand and foot measurements that can be used for stature estimation in the Kayastha population of Bundelkhand region, India. Though both the method can be used but regression equation provides the greater reliability in estimation of stature [15]. These equations should not be used for other Indian population groups

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AUTHORS

Ankit Srivastava is working as a Assistant Professor, Institute of Forensic Science & Criminology, Bundelkhand University, Jhansi (U.P.), India from January, 2006. He has five years research and seven years teaching experience at undergraduate and post graduate level. He has received training on various modern instruments from Central Forensic Science Laboratory (CFSL), Chandigarh, CFSL, Hyderabad, GEQD, Shimla, NICFS, New Delhi and various other reputed laboratories of the country. He attended various conferences/Seminars/Workshops/Symposia in the country. He has a life member of different scientific organizations such as Indian Academy of Forensic Science, Kolkata, India and The Society for Police and Criminal Psychology, USA. He published a number of research papers in reputed national and international journals. In his carrier he visited and invited by number of countries like Singapore, Thailand, Netherland, United Kingdom, France and United States of America etc.

Vijay Kumar Yadav had completed his Masters in Forensic Science from Bundelkhand University, Jhansi (UP) in 2007. Presently he is working as Assistant Professor at Institute of Forensic Science & Criminology, Bundelkhand University Jhansi, India. He is continually engaged in various research programmes and teaching in the Department. He has guided more than 20 Masters Students dissertation thesis from 2008 onwards immediately after his joining in the institution. His work was also recognized at national and international platforms in the excellence of forensic academics as e.g Singapore.