ANTHROPOMETRIC MEASUREMENTS OF HAND LENGTH FOR ESTIMATION OF STATURE IN NORTH INDIANS

Manpreet Kaur[1], Bikramjeet Singh[2,] Anupama Mahajan[3], B.S Khurana[4], Anterpreet Kaur[5], APS Batra[6]

[1]Manpreet Kaur, Post graduate, Department of Anatomy, Sri Guru Ramdas Institute of Medical Sciences and Research, Sri Amritsar, Punjab, India

[2]Bikramjeet Singh, Post graduate, Department of Forensic medicine, Maharishi Markendeshwar Institute of Medical Sciences and Research, Mullana, Ambala, Haryana

[3]Anupama Mahajan, Professor and Head, Department of Anatomy, Sri Guru Ramdas Institute of Medical Sciences and Research, Sri Amritsar, Punjab, India

[4]B.S. Khurana, Professor and Head, Department of Forensic medicine, Sri Guru Ramdas Institute of Medical Sciences and Research, Sri Amritsar, Punjab, India

[5]Anterpreet kaur Arora, Professor, Department of Forensic medicine, Sri Guru Ramdas Institute of Medical Sciences and Research, Sri Amritsar, Punjab, India

[6]APS Batra, Associate Professor, Department of Anatomy, BPS Govt. Medical College for women, Khanpur Kalan, Sonipat (Haryana)

ABSTRACT : Stature or body height is one of the important and useful anthropometric parameter that determines the physical identity of an individual. The present study was done in department of Anatomy, Sri Guru Ramdas Institute of Medical Sciences and Research, Amritsar on 400 (200 males and 200 females) healthy, asymptomatic medical subjects belonging to various regions of North India. The subjects were measured for stature and hand length of left side with standard anthropometer and a sliding caliper respectively and data was subjected to statistical analysis for deriving regression equations. The regression equations were derived both for male and female North Indians separately by means of which living stature can be accurately estimated when fragmentary or mutilated portion of upper extremity is recovered. The present study showed significant (p< 0.001) positive correlation between stature and hand length.

Key words: stature, anthropometric measurements, hand length, north Indians, regression equations

INTRODUCTION

Stature is one of the criteria for establishing identification of the person/ dead body (Pearson, 1899). It is usually measured as standing height of the individual but evaluation of stature is difficult when dead bodies are mutilated, burnt or skeletonized (Trotter and Gleser, 1952, 1958). Estimation of stature from incomplete skeletal and decomposing human remains is particularly important in personal identification (O.P. Jasuja, 2004). The relationship between specific body dimensions or proportions can be used to help solve crimes in absence of complete evidence, for example, it has been proved that stature can be estimated from imprints of hand, foot or footprints or from a shoe left at scene of a crime (Saxena, 1984). Similarly the stature of a victim can be estimated when a part of body, such as a long bone, or hand, is all that remains (Ozaslan et al, 2003). Despite the relationship between body parameters that have been determined, it has been emphasized that these vary from population to population and ethnic origin due differences in nutrition and levels of physical activity (Malina, 1994). Keeping this in mind this study was carried out to estimate stature from hand length in male and female North Indians.

MATERIAL AND METHODS

The present study was conducted in department of Anatomy, Sri Guru Ramdas Institute of Medical Sciences and Research, Amritsar on 400 (200 males and 200 females) asymptomatic, healthy medical subjects belonging to various regions of North India in age range of 17- 25 years.

All the readings were taken from left side. A written valid informed consent was taken from each of the participants. A small group of 20 subjects were taken for measurements each day at fixed time to avoid diurnal variations. The measurements were taken three times to avoid error. The subjects were measured for:

(a) Stature (S): It is obtained as a distance between floor and the highest point on the head when subject is standing in standard standing position, using anthropometric rod.

(b) Hand length (HL): is taken as distance between middle point of line connecting the styloid processes and tip of digit III. The subjects were asked to place their hand supine on flat horizontal surface with fingers extended and adducted.

Statistical Analysis:

Complete data has been analyzed using SSPS package (version 17.3) for computation of Multiplication factors (M.F.) and regression equation for estimation of stature from hand length.

OBSERVATIONS AND RESULTS

Table 1 presents the mean value of calculated stature and hand length in North Indian males and females. It was observed that North Indian males exhibit higher values for stature and hand length compared to North Indian females as summarized in table 1 and figure I and II. It also shows the Multiplication Factor (M.F) for calculating stature and value of regression coefficient 'r' for hand length and it was observed that males exhibit higher value of Multiplication Factors and 'r' value as compared to North Indian females

Table1- Mean stature, hand length, correlation coefficient and multiplication factors of North Indian males and females

	Male (n= 200)	Female (n=200)
Mean Stature ± S.D (S)cm	160.91 ± 5.75	175.98± 6.76
Mean Hand length (HL)cm	18.80 ± 1.09	18.54± 10.72
Multiplication factor	9.361	8.679
Correlation coefficient	0.589	0.550

Regression equations for stature were derived according to formula

$S = a + bx$ where

a - intercept point of the regression line and the y- axis

b - slope of regression line regression coefficient

For males: $S = 130.90 + 2.398$ (hand length)

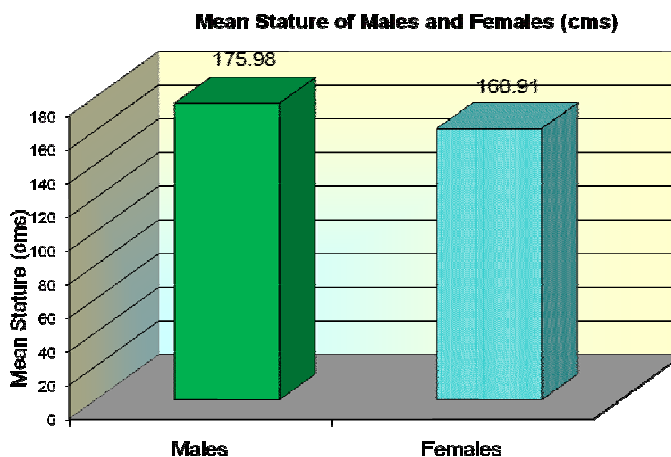For females: $S = 160.41 + 0.027$ (hand length)

Figure 1 showing the mean stature of North Indian males and females. The green colour indicated male cases and blue colour indicates female cases.
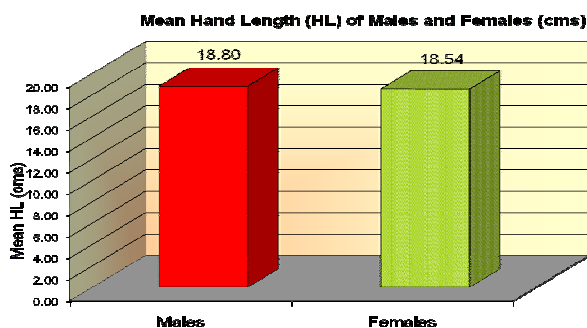
Figure 2 showing the mean hand length of North Indian males and females. The red colour indicated male cases and green colour indicates female cases.

Table 2 summarizes the work done by various authors on hand length along with the mean values compared with the present study on North Indians.

Author	Parameters	Males	Females
Ilayperuma, Nanayakkara and Palahepitiya, 258 (140 males and 118 females) of Sri Lanka	1. Height 2.Hand length 3. Correlation coefficient 4. Regression equation	170.14± 5.22 19.01± 5.22 0.58 S= 103.732+ 3.493(HL)	157.55± 5.75 17.62± 0.93 0.59 S= 93.689+ 3.625(HL)
Sunil, Dikshit, Aggarwal and Rani, 150 (75 males and 75 females) of Delhi	1. Height 2.Hand length 3. Correlation coefficient 4. Regression equation	169± 7.8 19.5± 1.2 0.6 S= 85.84+ 4.32 (HL)	158± 5.8 18.1± 1.0 0.7 S= 80.94+ 4.40 (HL)
Laila et al, 150 Bengali Muslim females	1.Height 2.Hand length 3. Correlation coefficient 4. Multiplication factor	-	156.02± 6.12 16.34± 0.80 0.68 9.28
Nath, Rajni and Chhibber, 302 Punjabi females of Delhi	1.Height 2.Hand length 3. Correlation coefficient 4. Multiplication factor 5. Regression equation	-	153.58± 5.35 16.84± 0.78 0.59 9.12 S= 85.22+ 4.05 (HL)
Nath and Krishan, 276 Hindu Baniya females of Delhi	1.Height 2.Hand length 3. Correlation coefficient 4. Multiplication factor 5. Regression equation	-	151.66± 5.67 16.64± 0.77 0.67 9.11 S= 68.96+ 4.96 (HL)
Nath, Garg and Krishan, 160 male Rajputs of Dehradun	1.Height 2.Hand length 3. Multiplication factor	164.4± 9.22 17.9± 1.11 9.16	-
Sethi and Nath, 204 Punjabi females of Delhi	1.Height 2.Hand length 3. Correlation coefficient 4. Multiplication factor 5. Regression equation	-	155.87± 5.13 17.344± 0.53 0.59 8.99 S= 88.04+ 2.95 (HL)
Present study, 400(200 males and 200 females) of North India	1.Height 2.Hand length 3. Correlation coefficient 4. Multiplication factor 5. Regression equation	175.98± 6.76 18.80± 1.09 0.589 S= 130.90 + 2.398 (HL)	160.91± 5.75 18.54± 10.72 0.550 S= 160.41 + 0.027 (HL)

DISCUSSION

Estimation of stature of an individual is important parameter in forensic examinations and anthropological studies and Morphometry of hand provides important evidence in crime scene investigation which helps in estimation of stature of a criminal (Bhatnagar et al, 1984). With this view the present study was conducted in department of Anatomy, Sri Guru Ramdas Institute of Medical Sciences and Research, Amritsar on 400 (200 males and 200 females) subjects of North India was carried out.

CONCLUSION

The procedure of measuring hand length, to use in appropriate regression equation for determining the stature is simple and important tool in mass disasters or accidents where fragmented or mutilated remains are recovered. The male North Indians exhibit greater dimensions than the females for all the upper and lower limb parameters and present significant correlation with the stature (p <0.001).The Multiplication factors formulated in preset study for North Indians show variation from that of the multiplication factors on other Indian population. The present study also indicates that regression equations are statistically better and more reliable method than multiplication factors for stature estimation.

ACKNOWLEDGEMENT

The authors are thankful to staff of Anatomy department and all the subjects for their patience and cooperation since without their cooperation this project would not have seen the light of the day.

REFERENCES

Pearson K. Mathematical contribution to the theory of evolution (1899). On the reconstruction of stature of pre-historic races. Phil Trans Roy Soc London, 192: 169-224.

Trotter M, Gleser GC. Estimation of stature from long bones of American Whites and Negroes (1952). The Am J Phys Anthropol, 10: 463-514.

Trotter M and Gleser GC. A re-evaluation of estimation of stature based on measurements of stature taken during life and of long bones after death (1958). The Am J of Phys Anthrop, 16: 79-123.

Jasuja.O.P. and Singh G. Estimation of stature from hand and phalange length (2004). J Indian Acad Forensic Med, 26(3): 100-106.

Saxena SK (1984). A study of correlation and estimation of stature from hand length, hand breadth and sole length. Anthropology Anz, **42**: 271-276.

Ozaslan A, Iscan MY, Ozaslan I, Tugcu H, Koc S (2003). Estimation of stature from body parts. Forensic Sci Int, 132: 40-45.

Malina RM (1994). Physical activity and training: effects on stature and adolescent growth spurt. Medicine Science and Sports Exercise, **26**: 759-766.

Bhatnagar DP, Thapar SP, Batish MK (1984). Identification of height from somatometry of the hand in Punjabi males. Forensic Sci Int, 24: 137-141

Ilayperuma I, Nanayakkara G, Palahepitiya N (2009). Prediction of personal stature based on the hand length. Galle Med J, 14(1): 15-18.

Sunil, Dikshit P.C, Aggarwal A, Rani M (2005). Estimation of stature from Hand length. J Indian Acad Forensic Med, 27(4): 219-221.

Laila S.Z.H, Ferdousi R, Nurunnobi A.B.M, Islam A.T.M.S, Holy S.Z.H, Yesmin F (2009). Anthropometric Measurements of the hand length and their correlation with the Stature of Bengali adult Muslim females. Bangladesh J Anat, 7(1): 10-13.

Nath S, Rajni and Chhibber S (1990). Reconstruction of stature from percutaneous length of upper and lower extremity segments among Punjabi females of Delhi. Indian J Forensic Sci, 4: 171-181.

Nath S and Krishan G (1990). Determination of stature using percutaneous measurements of upper and lower limb bones among Hindu (Baniya) females of Delhi. J Anthrop Surv India, 39: 151-166.

Nath S, Garg R, Krishan G (1991). Estimation of stature through percutaneous measurements of upper and lower limbs among male Rajputs of Dehradun. J Indian Anthrop Soc, 26: 245-249.

Sethi V and Nath S (2000). Estimation of stature through Hand and Foot lengths among Punjabi females of Delhi. South Asian Anthropologist, 21(2): 67-71.