

**Research Article**

## **ESTIMATION OF STATURE FROM UPPER ARM LENGTH IN NORTH INDIANS – AN ANTHROPOMETRIC STUDY**

**\*Manpreet kaur, Anupama Mahajan<sup>1</sup>, Baljit Singh Khurana, Anterpreet Kaur Arora<sup>2</sup> and Arvinder Pal Singh Batra<sup>3</sup>**

<sup>1</sup>Department of Anatomy, Sri Guru Ramdas Institute of Medical Sciences and Research, Amritsar,

<sup>2</sup>Department of Forensic Medicine, Sri Guru Ramdas Institute of Medical Sciences and Research, Amritsar

<sup>3</sup>Department of Anatomy, BPS Govt. Medical College for women, Khanpur Kalan, Sonipat (Haryana)

*\*Author for Correspondence*

### **ABSTRACT**

Stature or standing height is defined as distance between head vertex and standing surface. Reconstruction of the stature is one of the important aspects of various parameters of identification for establishing the individuality of a person. The present study was done to estimate the stature from upper arm length of individuals having age group of 17-25. Authors have studied 200 male and 200 female, healthy subjects in Department of Anatomy, SGRD Institute of Medical Sciences and Research, Sri Amritsar. All individuals were measured for height and upper arm length. The data thus obtained has been subjected to statistical computation for deriving the regression equations. The results obtained concluded that upper arm length in male and female North Indians exhibit highly significant correlation. This conclusion will be of utmost importance to anthropologist and forensic experts in estimation of stature where mutilated, decomposed or fragmentary skeletal remains are recovered.

**Key Words:** *Upper Arm Length, Stature, Anthropology, North Indians*

### **INTRODUCTION**

Stature of victim can be estimated from part of body, such as long bone or hand and its prediction occupies relatively a central position in anthropological research and in identification necessitated by medical jurisprudence or by medico-legal experts. Estimation of stature of an individual from skeletal material or from mutilated or amputated limbs or parts of limb has obvious significance in personal identification in events of murders, accidents or natural disasters mainly concerning with forensic identification analysis. Ilayperuma et al (2009), Jasuja (2004)

Study of upper arm length for estimation of stature has been attempted by various workers. Study conducted by Nath, Garg and Krishan(1991)<sup>[5]</sup> for estimation of stature through percutaneous measurements of upper and lowers limbs among 160 male Rajputs of Dehradun in age group of 16-35 years and they were measured for upper arm length along with other parameters.

### **MATERIALS AND METHOD**

The present study comprised of 400 (200 males; 200 females) healthy medical students from various regions of North India between 17-25 years of ages. All measurements were taken from left side. The detailed medical history and clinical examination of the subjects were conducted to rule out any significant disease or deformity that could have affected the general or bony growth.

The subjects were measured for height and Upper arm length on left side.

- Stature- was measured as the projective distance between the standing surface and the highest point on the head (vertex) when the subject is standing in the standard standing position, using anthropometer.
- The Upper arm length- measured from marked inferior border of acromion to external superior border of head of radius using anthropometer.

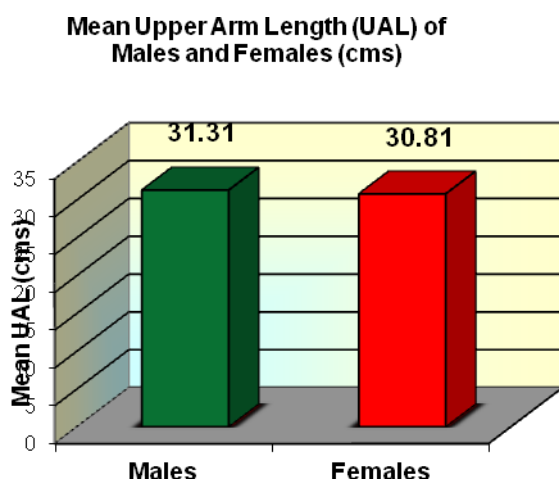
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To reduce subjective error readings were taken three times and then mean was calculated.

The data was subjected to statistical calculations using SPSS computer programmer to derive linear regression equations. The bar diagram was plotted taking measurements on x axis and number of cases on y axis

In bar diagram

1. Red colour indicate female cases
2. Green colour indicate male cases



**Figure 1.** Bar diagram representing the mean  $\pm$  SD value of upper arm length in male and females (cms). Green colour indicates the mean value of upper arm length in males and red indicates mean upper arm value in female North Indians.

## RESULTS

In male North Indians the mean value of stature was  $175.98 \pm 6.76$  and in North Indian females the mean value of stature was  $160.91 \pm 5.75$  as shown above in Table 1.

The variation in dimensions of upper arm length in North Indian males was  $31.31 \pm 2.281$  and for females it was  $30.81 \pm 1.813$  as given above in Table 2.

The multiplication factors for determination of stature from upper arm length in both males and females were 5.621 and 5.326 respectively and the regression coefficient for North Indian males and females was 0.660 and 0.474 respectively as displayed in Table 3.

The correlation coefficients between stature and upper arm length in both male and female North Indians were found to be positive and statistically significant ( $p < 0.001$ )

The linear Regression formulae from upper arm length for North Indian males:

$$S = 114.75 \pm 1.95 \text{ (UAL)}$$

The linear Regression formulae from upper arm length for North Indian females:

$$S = 115.50 \pm 2.57 \text{ (UAL)}$$

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**Table 1: Mean  $\pm$  SD and Range of Stature in male and female North Indians (in centimeters).**

Subjects	Range	Mean $\pm$ SD
Males	158-194	175.98 $\pm$ 6.76
Females	148-176	160.91 $\pm$ 5.75

**Table 2: Mean  $\pm$  SD and Range of upper arm length in male and female North Indians (in centimeters).**

Subjects	Range	Mean $\pm$ SD
Males	25-38	31.31 $\pm$ 2.281
Females	25-36	30.81 $\pm$ 1.813

**Table 3: The multiplication factors (M.F) and regression coefficient (r) derived in study for North Indian males and females**

Subjects	Males	Females
M.F	5.621	5.326
'r'	0.660	0.474

## DISCUSSION

The Forensic anthropologist and medical experts encounter difficulty while dealing with the dismembered bodies or those recovered in extremely decomposed form or in skeletonised form. To eliminate these difficulties, new methods are being developed for estimation of stature using regression formulae.

The present study was conducted in Department of Anatomy, Sri Guru Ramdas Medical College and Research, Amritsar on total of 400 (200 males and 200 females) asymptomatic, healthy medical students belonging to the different regions of North India. We devised the linear regression equations as well as multiplication factors for estimation of stature from upper arm length in North Indian males and females.

The linear regression equations derived from upper arm length for estimation of stature showed a statistically significant relationship ( $p < 0.001$ ) in both North Indian males and females.

Nath, Rajni and Chhibber(1990)<sup>[7]</sup> conducted a study on 302 Punjabi females of Delhi and derived regression formulae for estimation of stature from upper arm length,  $82.68 + 2.29$  (UAL) whereas in present study the regression equation for estimating stature from upper arm length in North Indian females was,  $115.50 \pm 2.57$  (UAL).

Nath and Krishan(1990)<sup>[6]</sup> formulated multiplication factors for reconstruction of stature from upper arm length in 276 Hindu (Baniya) females of Delhi, ranging from 15-22 years. The multiplication factor was 4.95 whereas in comparison in our study the multiplication factor in North Indian females was 5.32.

Nath, Garg and Krishan<sup>[5]</sup> conducted a study on 160 male Rajputs of Tehsil Chakrata; district Dehradun, Uttar Pradesh in age range of 16-35 years. The multiplication factor from upper arm length was 5.12 whereas in comparison in our study the multiplication factor from upper arm length in male North Indians was 5.62.

Anand and Nath(1991)<sup>[1]</sup> conducted a study on Rajput males and females of Pauri Garhwal and calculated multiplication factor for upper arm length to be 5.59 for males and 5.89 for females. In present study the multiplication factor for upper arm length came out be 5.62 for males and 5.32 in females.

Jain and Nath(1997)<sup>[4]</sup> conducted a study on 132 male Brahmins of Kumaon in age range of 17-19 years and the multiplication factor calculated was 5.44 whereas in comparison in present study the multiplication factor in North Indian males was 5.62.

In present study, the linear regression equations was also calculated for estimation of stature from upper arm length in North Indian males which was

$$S = 114.75 \pm 1.95 \text{ (UAL)}$$

In conclusion, the present study found that Male North Indians exhibit greater dimensions than the females for the upper arm length and the stature. The females exhibit greater mean Multiplication factor for upper arm length than North Indian males. Stature and upper arm length are positively and

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significantly correlated with each other ( $p < 0.001$ ). Linear regression equations were derived for estimation of stature reliably and accurately that would be of immense value in the field of crime detection. The regression equation derived in the study can be used accurately and reliably for estimation of stature in a diverse population group. In addition, the multiplication factors derived in the present study are quite handy for use by a lay public like police etc.

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