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ESTIMATION OF STATURE FROM UPPER ARM LENGTH AMONG THE HINDU AND SIKH POPULATION OF LUCKNOW REGION

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ABSTRACT

Forensic anthropological investigation utilizes the application of anthropological research and techniques in resolving the medico-legal issues; it focuses on human identification from unknown, highly decomposed, fragmentary and mutilated human remains found from the crime scene. Stature or body height is one of the most important and useful anthropometric parameter that helps in determination of the physical identity of an individual. The present study is based on 400 subjects (200 male and 200 female) aged between 20-40 years belonging to Sikh (n=200) and Hindu (n=200) communities in the Lucknow region of Uttar Pradesh, India. An attempt has been to estimate the stature from upper arm length among different populations and community of a area for the anthropological findings and identification in Lucknow region.

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INTRODUCTION

Stature of an individual from amputated, highly decomposed and fragmentary human remains plays significant role in the personal identification in the events of murders, accidents or natural disaster, especially mass disasters where comingled bones are found. The major biological characteristics, such as age, sex, stature, and possibly race or ethnicity of skeletonised human remains can be determined by the Forensic anthropologists. Stature of an individual increases from intrauterine life up to 20 to 21 years of age. According to Roche, at the age of 18, the stature is accepted as Adults; although after this age small increment in stature occurs. The accaccuracy of stature reconstruction as well as the adequacy of the method in relation to groups of probably different social

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and economic status is discussed (Anand, 1991). The study of upper Arm length has been attempted by many workers and researchers in various regions and parameters. 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) *(JLS Sonu)*

MATERIALS AND METHODS

The data of present study is based on 400 subjects (200 male and 200 female) aged between 20-40 years belonging to Sikh (n=200) and Hindu (n=200) communities in the Lucknow region of Uttar Pradesh, India. Data was collected from household survey, colleges and hospitals. To avoid growth factor before 20 years and aging process after 40 years,

subjects below 20 years and above 40 years of age were excluded. Subjects were grouped on the basis of their communities and sex.

Measurements- Only healthy subjects, without any physical abnormalities were taken in this study. The measurement was taken on both the upper arm of an individual in a proper light during day time

- For evaluation of the stature, the subjects were asked to stand on their heels joined together and back as straight as possible to get a projective distance between ground Surface and vertex of the head with the help of Anthropometer.
- The length of upper arm was taken by asking the subject to bend their elbow joint so that the bent surface of arm and forearm could make an angle of 90 degree. The distance between two points i.e. acromion end and lateral epicondyle was measured with the help of Anthropometer.

To minimize the risk of Progressive and subjective errors, readings were taken three times and then their means were calculated, all the dimensions and statistical measurements were calculated by SPSS software for accurate findings.
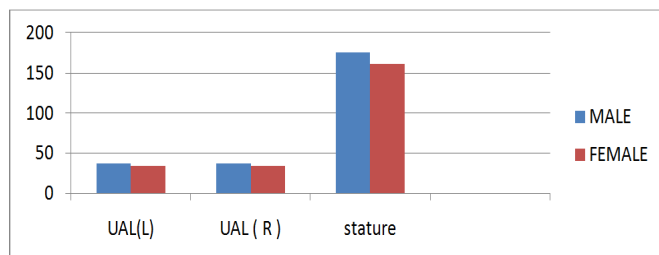
RESULTS

Table 1. Measures of mean, standard deviation and standard error of mean for different body measurements of Hindu Males and Females

Name of Measurement	Sex	Mean (cm)	SD ±	SEE ±
Stature	Male	175.46	5.76	0.57
	Female	161.85	5.41	0.54
UAL (L)	Male	37.58	2.71	0.27
	Female	33.56	1.42	0.14
UAL (R)	Male	37.61	2.70	0.27
	Female	33.60	1.41	0.14

UAL= Upper Arm Length

Table-1 represents the mean, standard deviation and standard error for different body measures of Hindu males and females of Lucknow. It is shown in the table that the mean value of stature for Hindu male is higher than females, i.e., 175.46 cm In case of upper arm length for left and right side, mean value of male is higher, i.e, 37.58 cm and 37.61 cm respectively. This is found that male have larger values for all the measurements than females.

Graph represents measures of mean, standard deviation and standard error of mean for different body measurements of Hindu Males and Females.

Table 2. Sex difference in different body measurements of Hindus (*t*-test)

Name of Measurement	*t*-Value
Stature	17.44*
UAL (L)	13.40*
UAL (R)	13.36*

UAL=Upper Arm Length
* Significant at the 0.01 level

Table 2 presents the sex difference in different body measurements of hindu males and females of Lucknow.
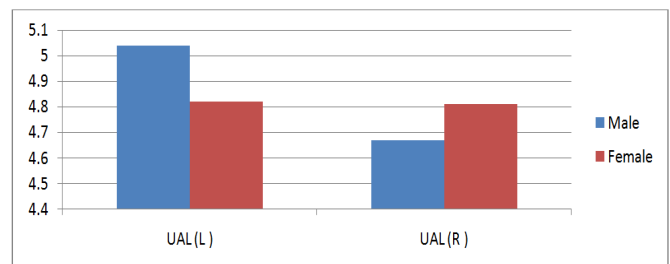It is shown in the table that the *t*-value of stature for Hindu is 17.44.

In case of upper arm length for left and right side, *t*- value is 13.40 and 13.36 respectively.

Table 3. Multiplication factor for different body measurements of Hindu Males and Females

Name of Measurement	Sex	Mf- Value
UAL (L)	Male	5.04
	Female	4.82
UAL (R)	Male	4.67
	Female	4.81

UAL= Upper Arm Length

Stature= M.F × UAL

Graph represents Multiplication factor for different body measurements of Hindu Males and Females.

Table 4. Correlation values of Upper Arm Length with Stature of Hindus

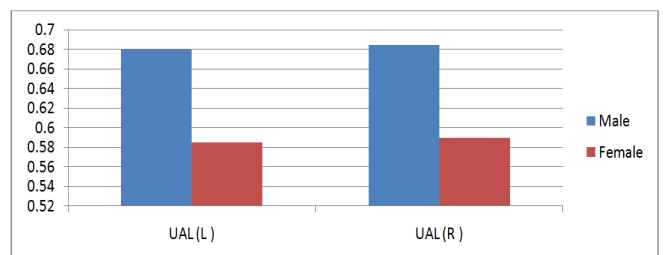| Name of Measurement	Sex	Correlation Value
UAL (L)	Male	0.680
	Female	0.585
UAL (R)	Male	0.684
	Female	0.590

UAL= Upper Arm Length

Table- 4 Represents the Correlation factor for different body measurements of Hindu males and females of Lucknow. It is shown in the table that Correlation value for left and right upper arm length of males is higher than the females, i.e, 0.680 and 0.684 respectively. This is found that male have larger

Correlation values for both upper arm length than females. Graph represents Correlation values of Upper Arm Length with Stature of Hindu males and females

Table 5. Regression equation (r) for different body measurements of Hindu males and females

Name of Measurement	Sex	'r'
UAL (L)	Male	0.680
	Female	0.585
UAL (R)	Male	0.684
	Female	0.590

UAL= Upper Arm Length

Table- 5 Represents the Regression equation for different body measurements of Hindu males and females of Lucknow. It is shown in the table that Regreesion equation for left and right upper arm length of males is higher than the females, i.e, 0.680 and 0.684 respectively. This is found that male have larger Regression equation for both upper arm length than females. The linear Regression formulae from left and right upper arm length for Hindu Males:
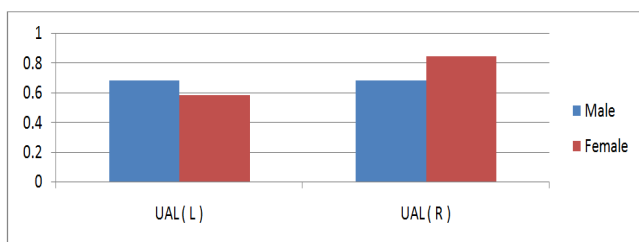
$$121.12 \pm 1.44 \times UAL\ (L)$$
$$120.58 \pm 1.45 \times UAL\ (R)$$

The linear Regression formulae from left and right upper arm length for Hindu Females:

$$86.68 \pm 2.24 \times UAL\ (L)$$
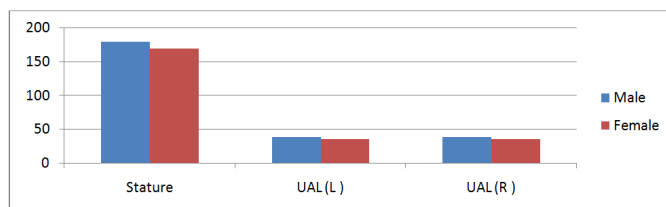$$85.77 \pm 2.26 \times UAL\ (R)$$

Graph represents linear regression from left and right UAL for Hindu males and females.

Table 6. Measures of mean, standard deviation and standard error of mean for different body measurements of Sikh males and females

Name of Measurement	Sex	Mean (cm)	SD ±	SEE ±
Stature	Male	178.42	3.78	0.37
	Female	168.74	4.46	0.44
UAL (L)	Male	38.81	2.79	0.27
	Female	35.82	1.58	0.15
UAL (R)	Male	38.87	2.79	0.27
	Female	35.82	1.59	0.15

UAL= Upper Arm Length

Table- 6 Represents the mean, standard deviation and standard error for different body measures of Sikh males and females of Lucknow. It is shown in the table that the mean value of stature for Sikh male is higher than females, i.e., 178.42 cm In case of upper arm length for left and right side, mean value of male is higher, i.e, 38.81 cm and 38.87 cm respectively. This is found that male have larger values for all the measurements than females.
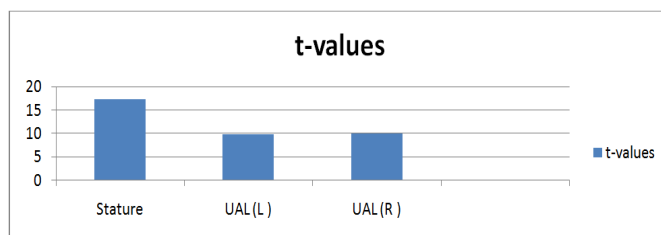

Graph represents measures of mean, standard deviation and standard error of mean for different body measurements of Sikh males and females

Table 7. Sex difference in different body measurements of Sikhs (*t*-test)

Name of Measurement	T-Value
Stature	17.28*
UAL (L)	9.77*
UAL (R)	9.96*

UAL=Upper Arm Length * Significant at the 0.01 level

Table-7 Represents the sex difference in different body measurements of Sikh males and females of Lucknow. It is shown in the table that the *t*-value of stature for Hindu is 17.28. In case of upper arm length for left and right side, *t*-value is 9.77 and 9.96 respectively.

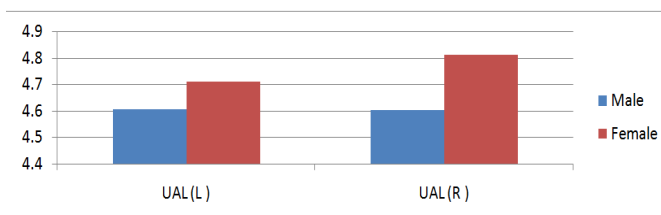Graph represents sex difference in different body measurements of Sikh population

Table 8. Multiplication factor for different body measurements of Sikh males and females

Name of Measurement	Sex	MF- Value
UAL (L)	Male	4.607
	Female	4.709
UAL (R)	Male	4.601
	Female	4.708

UAL= Upper Arm Length

Table- 8 Represents the multiplication factor for different body measurements of Sikh males and females of Lucknow. It is shown in the table that the Mf- Value for left and right upper arm length of female is higher than the males, i.e, 4.709 and 4.708. This is found that female have larger values for all the measurements than males. For calculating stature from upper arm length, the following formula can be used:
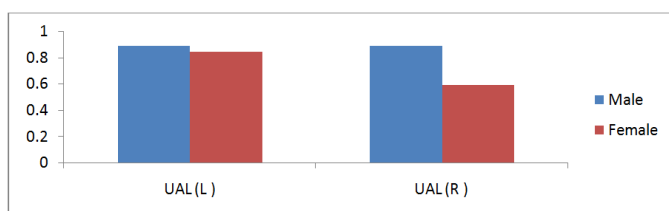
Stature= M.F × UAL

Graph represents Multiplication factor for different body measurements of Sikh males and females.

Table 9. Correlation values of Upper Arm Length with Stature of Sikh

Name of Measurement	Sex	Correlation Value
UAL (L)	Male	0.887
	Female	0.844
UAL (R)	Male	0.885
	Female	0.845

UAL= Upper Arm Length

Table- 9 Represents the Correlation factor for different body measurements of Sikh males and females of Lucknow. It is shown in the table that Correlation value for left and right upper arm length of males is higher than the females, i.e, 0.887 and 0.885 respectively. This is found that male have larger Correlation values for both upper arm length than females.

Graph represents correlation value of UAL with stature for Sikh males and females

Table 10. Regression equation (r) for different body measurements of Sikh males and females

| Name of Measurement	Sex	'r'
UAL (L)	Male	0.887
	Female	0.844
UAL (R)	Male	0.885
	Female	0.845

UAL= Upper Arm Length

Table- 10 Represents the Regression equation for different body measurements of Hindu males and females of Lucknow.
It is shown in the table that Regreesion equation for left and right upper arm length of males is higher than the females, i.e, 0.887 and 0.885 respectively. This is found that male have larger Regression equation for both upper arm length than females.

The linear Regression formulae from left and right upper arm length for Sikh Males:

$131.87 \pm 1.19 \times \text{UAL (L)}$
$131.86 \pm 1.19 \times \text{UAL (R)}$
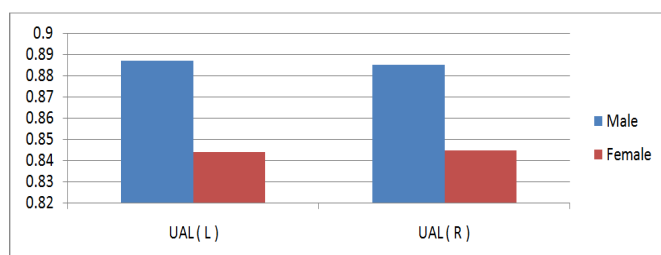
The linear Regression formulae from left and right upper arm length for Sikh Females:

$83.47 \pm 2.38 \times \text{UAL (L) AND } 84.11 \pm 2.36 \times \text{UAL (R)}$

Graph represents linear regression from left and right UAL for Sikh males and females

DISCUSSION

The present study was conducted on total of 400 people, including 200 Hindu population (100 males, & 100 females) and & 200 Sikh population (100 males & 100 females), aged between 20-40 years in Lucknow region. This study devised the Multiplication Factor (Mf), Correlation of Stature with left and right Upper Arm Length as well as Student *t*- Test Values for both male and female of Hindu and Sikh communities and the Regression equation (r) for different body measurements of Sikh males and females. Navid S *et al.* conducted his study on 100 Medical Science students (50 males and 50 females) aged between 19-21 years, from Tehran University, Iran, calculated Upper Arm Length for Male and Female is 33.72 ± 2.30 and 30.12 ± 2.29 respectively. In the present study, left Upper Arm Length for Hindu Male and Female is 37.58 ± 2.71 and 33.56 ± 1.42 respectively and for right Upper Arm Length, is 37.61 ± 2.70 and 33.60 ± 1.41 respectively. For Sikh Male and Female left UAL is 38.81 ± 2.79 and 35.82 ± 1.58 respectively and for right UAL is 38.87 ± 2.79 and 35.82 ± 1.58. Nath & Krishnan formulated Multiplication factor in 276 Hindu (Baniya) females of Delhi for the prediction of stature from UAL, aged between 15-22, where the Multiplication Factor was calculated as 4.95. in the present study Multiplication Factor of left and right UAL for Hindu Females is 4.82 and 4.81 respectively, and for Sikh Females, it is 4.709 and 4.708 respectively.

Conclusion

It has been concluded from the present study that, the length of Upper Arm can be used for estimation of stature when humerus bone is brought for forensic examination. The present study found that:

- Sikh Males and Females exhibit greater dimensions than the Hindu Males and Females
- Males of both the Communities exhibit greater dimension than the Females.
- The Females of both the communities exhibit greater mean Multiplication factor for upper arm length than the Males.
- Stature and Upper Arm Length are positively and significantly correlated with each other ($p<0.01$).
- The difference in Left Upper Arm and Right Upper Arm is very Less, so it can be neglected.
- The Linear Regression Formulae can be used for measuring the stature from UAL among the Hindu and Sikh population of Lucknow Region.
- This fact will be of practical use in Medico legal investigations and in anthropometry. Study would be useful for Anthropologist and Forensic Medicine experts.

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