Original article:

Correlation of Stature with facial measurements of Maharashtrian adults

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ABSTRACT

Introduction: Stature has a correlation with every body parts i.e head, trunk, extremities etc. This correlation helps in estimation of stature, which is an important parameter required for identification of a person by forensic experts.

Aims and Objectives: The present study was aimed at correlating the Stature of both male and female Maharashtrian adults using with facial dimensions.

Materials And Methods – 241 data for males and 262 data for females of Maharashtrian origin, within age group 18-60 yrs were analysed. Height of the subject was measured by Anthropometer rod. Morphological facial height was measured using a Vernier calliper. Bizygomatic facial breadth was measured using a Spreading calliper. Statistical analysis was done to determine mean, standard deviation, maximum, minimum values, Pearson correlation coefficient and statistical significance of the correlation.

Observation & Results: Pearson correlation coefficient (r value) of stature with Morphological facial length for males / females was 0.1669/ 0.272 and with Bizygomatic facial breadth of males/females was 0.2502/0.2495. For females the correlation of stature with Morphological facial length and Bizygomatic facial breadth was statistically significant ($p<0.001$). For males also correlation of stature with Morphological facial length ($p<0.01$) and Bizygomatic breadth ($p < 0.001$) was statistically significant.

Conclusion: The correlation coefficient(r) both Morphological facial length and Bizygomatic facial breadth is <0.5, which means estimation of stature of Maharashtrian adults from facial dimension is not reliable. But can be used when other parameters are not available.

Keywords: stature, correlation, facial length, facial bread

INTRODUCTION

Anthropometry is the systematized art of measuring and recording human body parts, like skeleton, cranium, face etc, by the most reliable means and methods for scientific purpose [1]. It is used for identification of sex, stature and race of a deceased person from skeletal body parts e.g head, extremities, vertebral column etc by forensic experts and anthropologists. Stature or body height is a useful anthropometric parameter which is important for determination of identity of an unknown individual and without estimation of stature the identification of the unknown person always remains incomplete. The estimation of stature from different body parts involves specialized anthropometric techniques applied with great precision along with statistical methods of analysis.

When other samples like extremities or body parts are not available and only cephalo facial part of the body is brought to the forensic scientist to identify the deceased, then a supplementary approach is used for the estimation of stature from cephalo facial measurements. This is applicable in forensic identification even when the decomposed mutilated human remains are brought to a forensic expert due to decapitation , rail road accident cases etc. Stature

estimation by a forensic expert, from cephalofacial region can supplement the identification data collected by using the techniques of facial reconstruction and help in narrowing down the process of forensic investigation [6]. For such estimation, regression analysis is the best method as far as the accuracy or reliability of the estimate is concerned [7].

Studies concerning stature estimation from cephalo-facial dimensions are scanty; studies on determination of stature from cephalofacial dimensions of Maharashtrian adults are very limited. Studies on estimation of stature from cephalic dimensions of Maharashtrian adult by Priti Nemade (Khodke) [13] is available but no study has been conducted to determine the correlation of stature with facial parameters of Maharashtrian population. So the present study is conducted to find the correlation of stature with facial dimensions of Maharashtrian adults.

AIMS AND OBJECTIVES

The aim of this study is:-

- To measure the facial length and facial breadth of Maharashtrian males and females.
- To measure the height or stature of the same person.
- To compare and correlate the stature with facial height and facial breadth.
- To compare and correlate the findings of the present study with other studies performed previously.

MATERIAL AND METHODS

Materials – Spreading calliper, spreading calliper, Anthropometer, data sheet , consent form.

Study subjects are 241 male adults and 262 female adults of Maharashtrian origin, within age group 18-60 yrs. The subjects were from different districts of Maharashtra residing in NaviMumbai. Subject with normal pleasing face with no craniofacial abnormality, with no history of plastic, maxillofacial or reconstructive surgery and any accidental facial injury.

Every subject was explained with the procedure and written consent was taken from each subject on request.

Method:

Measurement of height (stature)- Height is the vertical distance from the vertex to the floor. During this measurement subject was asked to stand erect, barefoot on a level floor, the feet were parallel to each other and heel, buttock, and shoulder blades were touching the surface of the Anthropometer rod which was kept in the median saggital plane of the subject. The reading was taken when the cross bar was touching the vertex.

Measurement of facial height (morphological facial length)-Straight distance was measured from lowest point of the chin i.e. gnathion to the point of nasion by using Vernier calliper.

Measurement of facial breadth- Straight distance was measured between the most lateral points over the zygomatic arches of both sides of the subject by using Spreading calliper. The subject was in a comfortable and erect position with head in Frankfurt's plane.

1. Zygion (Z) – The lateral most point on the zygomatic arch.
2. Nasion (N) – It is the point at which a horizontal tangential to the highest points on the superior palpebral sulci intersects the mid-sagittal plane when the subject is looking straight ahead [14].
3. Gnathion (GN) – It is the lowest median point on the lower border of the mandible [14].
4. Vertex (V)-The highest point of the head, in the mid-saggital plane, when the head is held erectly or in the Frankfurt's plane.

Data were subjected to statistical analysis for determining Mean, Standard Deviation, Pearson's 'r'-value, and significance of correlation. Microsoft

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excel Data analysis pack was used for the statistical analysis.

OBSERVATION AND RESULTS

241 data for males and 262 data for females of Maharashtrian origin, within age group 18-60 yrs was analysed.

Table -1 displays the mean values with their respective standard deviations of the stature and the two facial parameters of Maharashtrian adult females. It is seen that the mean stature of the Maharashtrian females is 156.41 ± 7.75 and fall in the range 128cm to 179.8cm.

Table -3 displays the mean values with their respective standard deviations of the stature and the two facial parameters of Maharashtrian adult males. It is seen that the mean height of the Maharashtrian

males is 166.57 ± 7.71 and fall in the range 152.4cm to 189.0cm.

Table -2 and Table-4 shows that Pearson correlation coefficient (r value) of stature with Morphological facial length for males /females was 0.1669/ 0.2721 and with Bizygomatic facial breadth of males/females was 0.2502/0.2495. For females the correlation of stature with Morphological facial length and Bizygomatic facial breadth was statistically significant (p<0.001). For males also correlation of stature with Morphological facial length (p<0.01) and Bizygomatic breadth (p < 0.001) was statistically significant. The correlation coefficient was less than 0.5 hence it can be said that the stature has a weak +ve correlation with stature for Maharashtrian adults.

Female	Mean	Standard Deviation	Standard Error	Max	Min
Stature	156.41	7.75	0.48	179.8	128
Morphological facial height	10.34	0.92	0.06	18.21	8.27
Bizygomatic facial breadth	12.09	0.65	0.04	14.45	9.78

Table 1:Descriptive statistics in Female study group: (n = 262)

Female	Pearson correlation coeff, r	Significance, p
Morphological facial height	0.2721	<0.001
Bizygomatic facial breadth	0.2495	<0.001

Table 2;Pearson correlation coeff, Significance in female study group

Male	Mean	Standard Deviation	Standard Error	Maximum	Minimum
Stature	166.57	7.71	0.50	189.00	152.40
Morphological facial height	11.19	0.87	0.06	18.21	9.27
Bizygomatic facial breadth	12.90	0.74	0.05	14.46	9.93

Table 3: Descriptive statistics in male study group: (n = 241)

Male	Pearson correlation coeff, r	Significance, p
Morphological facial height	**0.1669**	<0.01
Bizygomatic facial breadth	**0.2502**	<0.001

Table 4: Pearson correlation coeff, Significance in male study group

DISCUSSION:

Generally the most common method of stature estimation is from anthropometric measurements of extremities, head, trunk, vertebral column etc [2,3,4,5]. Many studies have been conducted on stature estimation from isolated bones, or different body parts like arms, hands, feet etc for different ethnic groups [8,9,10,11]. Following studies have been done on ethnic Indian population for estimation of stature from cephalofacial measurements.

K Krishan [6] conducted a study on 996 adult male Gujjars of north India from age group 8 to 30 years. Five cephalo-facial measurements were taken and the results indicated that cephalo-facial measurements are strongly and positively correlated (p < 0.001) with stature. The measurements of the cephalic region had stronger correlation with stature than those of facial region.

K Krishan et al [7] conducted a study on 252 Koli male adolescents from North India . Stature and sixteen cephalo-facial measurements were taken. As per their findings all the cephalo-facial measurements were significantly correlated with stature (p < 0.001, p < 0.01) but cephalic measurements had stronger correlation with stature than the facial measurements. This was also supported by the regression analysis, which shows that the cephalic measurements gave better prediction of stature.

Priti Nemade [15] conducted a study on 300 Maharashtrian subjects (150 males and 150 females) in the age group of 18-25 years for correlating stature of Maharashtrian adults. There was strong positive and statistically significant (p < 0.001) correlation of anthropometric measurements of head with stature and head circumference having the strongest correlation.

Mahesh Kumar and Patnaik VV Gopichand [16] conducted a study on 800 Haryanvi adults comprising of 400 males and 400 females. The results showed a statistically significant but weak positive correlation between stature and all cephalo-facial measurements except for maximum head breadth which showed a insignificant correlation with stature in both sexes. The anthropometric measurement having highest correlation coefficient with stature among males is morphological facial length and among female is maximum head length. Maximum head breadth showed a insignificant correlation with stature in both sexes.

A. K. Agnihotri et al [17], studied 150 Indo-Mauritian students for stature estimation by using facial measurements. Pearson correlation coefficient (r) for horizontal head circumference (r=0.494), nasal breadth (r=0.380) and morphological facial length (r=0.328) showed better correlation with stature among males and among females physiognomic Facial length (r=0.382), Bizygomatic breadth (r=0.276) and horizontal head circumference (r=0.375) showed better correlation with stature.

Twisha shah et al [18] carried out a study of eight cephalo-facial dimensions of 901 Gujarati (676 male and 225 female). The study showed that when sex is unidentified, the correlation of stature with all facial measurements, except morphological facial length ,were found to be significant. Except Bigonnial width all other cephalo-facial measurements namely, maximum head length, maximum head breadth, bizygomatic breadth, morphological facial length, physiognomic facial length, total cephalo-facial

height and biocular breadth shows weak and statistically insignificant correlation with stature as p-value>0.05.

Jibonkumar et al [12] conducted a study to estimate stature of Kabui Naga of Imphal Valley, Manipur, using measurements of six different facial dimensions of 199 male Kabuis of the Imphal valley in the age group of 18 to 45 years. Six facial dimensions and stature of each subject had been measured. All the facial parameters show significant positive co-relation with stature (p <0.001). The highest co-relation of stature was with Bigonial Breadth with 'r' value of 0.365 followed by External

Bi-ocular Breadth (0.326)and the lowest correlation of stature was (0.185) with Breadth of Bizygomatic Arch.

From the various studies on stature estimation from facial parameters it is seen that Pearson correlation coeff is <0.5 which means that morphological facial length and bizygomatic facial breadth have a weak correlation with stature. The Pearson correlation coefficient is of the order 0f ~0.4 for north Indians as seen in studies by K Krishan, K Krishan and Kumar, Kharyal et al, other studies show a much lower Pearson correlation coefficient of ~0.2.

Sno			MFL (r)	p	BizyB(r)	p
1	K.Krishan (North Indian Gujjar)	M	0.455	< 0.001		
2	Kharyal et al (Himachal Pradesh)	M	0.39			
		F	0.35			
3	K .Krishan et al (North India kolis)	M	0.345	< 0.001	0.461	< 0.01
4	Agnihotri et al (Indo Mauritian)	M	0.32			
		F	0.16			
5	Jibonkumar et al (Naga of Imphal)	M	0.213	<0.001	0.185	<0.001
6	Kanchan kumar et al(central Indian)	M	0.19	<0.001		
		F	0.14	<0.002		
7	Mahesh Kumar (Haryanvi's)	M	0.177	0.0003		
		F	0.15	0.002		
8	Present study (Maharashtrian)	M	**0.1669**	< 0.01	**0.2502**	< 0.001
		F	**0.2721**	< o.oo1	**0.2495**	< 0.001

Table 5: Correlation Coefficients for various indian ethnic groups

CONCLUSION:

The Morphological facial length and Bizygomatic facial breadth has a statistically significant weak +ve correlation with stature for Maharashtrian females. Maharashtrian male's stature also shows a statistically significant weak +ve correlation with Morphological facial length and Bizygomatic facial

breadth. This is similar to the results of most of the studies done on many Indian ethnic groups where the Pearson correlation coefficient for stature with morphological facial length ranges from 0.455 to 0.14 and with Bizygomatic facial breadth ranges from 0.461 to 0.185.

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