

## Original Article

# Determination of Stature from Head Length of People of Gujarati Origin

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### ABSTRACT

When a victim is unknown, anthropologist plays a key role in preparing biological profile. Developing such profile entitles studying remains noting genetic characteristic of shape and size, which allow estimation of age, sex, population and ancestry. Estimation of stature is considered as an important parameter in medico-legal and forensic examination. An attempt is made to find out correlation and to derive a regression formula between head length and body height in Gujarat region. The material consists of 239 students from Gujarat University. Students were selected as subject because of the easy. The age was in the range of 21 to 25 years. The length of head was measured between two craniometric points, glabella and inion. Spreading caliper was used to measure head length. Height of the subject was measured with standard height measuring instrument in anatomical position. Measurements were taken at fixed time to avoid diurnal variation. The result obtained was analysed and attempt was made to derive a formula between head length and total height of an individual. The result shows that there is a definite correlation between head length and height of an individual. In spite of the racial and ethnical variation, this formula may be a definite correlation between head length and height of an individual.

**Keywords:** Anthropometry, Correlation, Head length, Total height

### INTRODUCTION

Stature is estimated by measuring total body length or extrapolating from bone length. Estimation of height from the length of head has also attracted many workers to derive a formula, Saxena SK *et al.*,<sup>1</sup> but no significant formula has been derived to calculate the height from head length in Gujarat. Considering the importance of stature for personal identification and the work done in this regard for Gujarati people, an attempt has been made to find out the correlation (if any) between head length and body height in Gujarati population. Hence, first - time somatometric measurements, which are carried out to find out correlation and to derive a regression formula between head length and body height of people of Gujarati origin of the age group 21 to 25 years, were taken at fixed time

**Forensic anthropology** is the application of the science of physical anthropology and human osteology (the study of the human skeleton) in a legal setting, most often in

criminal cases where the victim's remains are more or less skeletonised. A forensic anthropologist can also assist in the identification of deceased individuals whose remains are decomposed, burned, mutilated or otherwise unrecognisable. The adjective "forensic" refers to the application of this subfield of science to a court of law. Anthropos- from the Greek for man, we extend this today to mean all of humanity, ology - (logos) the study of - Forensic anthropology is the application of the science of physical anthropology to the legal process. The identification of skeletal, badly decomposed, or otherwise unidentified human remains is important for both legal and humanitarian reasons. Forensic anthropologists use regression equations to determine sex, age, stature, and race of skeletal remains. Regression equations are mathematical equations developed from studies of bones of individuals of known sex, age, race, and stature, and are used to predict such things of even fragmentary skeletal remains.

### Measuring Instruments Used

ROUND HEADED SPREADING CALIPER



HEIGHT MEASURING INSTRUMENT



**GLABELLA** as defined :  
According to George (1993) most prominent point between the supra orbital ridges in the mid saggital plain.

GLABELLA

9

**INION** as defined : base of external occipital protubance

INION

HEAD LENGTH (measured from Glabella to Inion)

10

## MATERIAL AND METHOD

Total number of students participated in study was – 239, among them 114 were males and 123 were female. To measure head length of an individual, a fine calibrated round headed spreading caliper made in Germany was used and Head -length was measured with the help of spreading Calliper from Glabella toinion. Study carried out at Gujarat University campus- Ahmedabad.

### Precaution Taken While Taking the Measurement

During the measurement of height of an individual, shoes were asked to remove along with socks, to obtain accurate height. During the measurement of height of girls, they were asked to remove their hair bands and clips. While measuring head length, students were asked to sit on chair in straight posture. To remove error in measurements, the measurements were repeated thrice and their mean is taken in to consideration. All measurements, i.e., head length and height, were taken at fixed time between 2 to 5 pm. Giles and Hutchison<sup>2</sup> have reviewed the major sources of extraneous variation in attempting to determine a “true” stature. These include average variation of nearly an inch attributable to the time of day; gravity pulls down on the vertically oriented during the course of a normal day.

## RESULT AND DISCUSSION

In the present study we have observed the correlation of height (in anatomical position) with head length among Gujarat University students of various subjects.

Table 1 shows number of students from various department of Gujarat university.

Table 2 shows that the age ranges from 21 to 25 years, mean head - length from 17.02 to 18.58 cm and total mean height from 152 to 172.61 cm with a significant correlation between them.

Table 3 shows recorded observation values to obtain regression formula.

Table 4 shows the correlation coefficients between various parameters, such as between age and height, between age and head- length and between height and head- length. It is positive, suggesting that it is significant.

**Table 1: The study material consists of 239 students from different departments of Gujarat University**

Department	No of student
Mathematics	13
Forensic science	20
Environmental science	3
Life science	2
Chemistry (PhD)	2
B.K. School of Management	42
K.S. School of Management	23
Chemistry	18
Physics	10
Electronics	9
Rollwala College (MCA)	27
L.D. Engineering	19
B.COM	1
M.COM	2
Microbiology	1
Master of Labour welfare (MLW)	1
Language	8
Geography	3
Psychology	1
Master of Arts	5
M. Library	16
B. Library	16
Institute of Chartered Financial Analysts of India (ICFAI)	1
Saurashtra University	1
MPHIL (Social Science)	1
Working people	2
Biochemistry	2
Total	239

**Table 2: Age versus Head and Height Length**

Age (years)	Mean height (cm)		Mean head length (cm)	
	Male	Female	Male	Female
21	171.9697	155.6465	18.43030303	17.61627907
22	171.7273	155.617	18.24	17.28
23	169.5714	156.1111	18.36825397	17.38
24	170.0789	159.15	18.54	17.18
25	172.6125	152	18.58333333	17.02

**Table 3: Recorded observation values to obtain regression formula**

Parameter	Age (years)	Head length (cm)	Height (cm)
Range	21- 25	15.5 - 19.8	144 - 187.5
Mean	22.20921	17.79	162.52
Standard deviation	1.190896	0.862302923	13.433
Standard error	0.077033	0.8689	0.055777739

**Table 4: Correlation- coefficient**

Parameter	Co-efficient value
Age and height	+0.104882715
Age and head length	+0.101723551
Height and head length	+0.538274

Various workers have shown significant correlation between height and different parts of the body. Singh and Sohal<sup>3</sup>, Jit and Singh<sup>4</sup> have shown a significant correlation between height and length of clavicle. Charnalia<sup>5</sup>, showed the significant correlation between height and foot-length, where correlation coefficient was 0.46. Athawale<sup>6</sup> derived a regression equation between total height and forearm bones. Joshi<sup>7</sup> have derived regression equation between tibia and total height in Gujarati population. Suneel Qamra<sup>8</sup> made a study on height and foot length and derived a correlation coefficient for foot breadth (male 0.42 female .0.47) and foot length (male 0.69, female 0.70). Shroff<sup>9</sup> have also derived the height from the length of superior extremity and its segments But no data, available in the literature regarding the estimation of stature from the head length, except Saxena<sup>1</sup> who derived a regression equation between head-length and height in Agra population (U.P.). Their correlation coefficient between head -length and height was +0.2048. According to Glaister<sup>10</sup>, nasion-inion length (head-length) is 1/8 of the total height of an individual.

**CONCLUSION**

- The obtained data have been subjected to statistical computation and various regression equations for stature estimation are derived for individual of Gujarati origin within an age group of 21- 25 years.
- Regression equation for male of Gujarati community  
 $STATURE = 131.8103 + 2.141924 \times (HEAD LENGHT)$  (Error rate= ±4.254707)
- Regression equation for female of Gujarati community  
 $STATURE = 72.61486 +4.748918 \times (HEAD LENGHT)$  (Error rate= ±5.06813)
- Regression equation for both sexes( male and female)  
 $STATURE = 13.35136 +8.384971 \times (HEAD LENGHT)$

The co-relation coefficient values obtained for various parameters like age & height, age & head length, height and head length all are positive, suggesting that a significant relation exist between them (Error rate= ±5.56418 )

- Using average of head length from Glabella to Inion, including the standard error, one can arrive at a fairly accurate estimation of height. From the results obtained and discussed previously, it can be concluded that head-length is a function of stature determination.
- The correlation coefficient between head length and height is +0.538, which is the most significant (The correlation coefficient (worked out by one of the earlier worker Shah GV<sup>14</sup>) between head length and height is +0.53 in B.J. Medical college students of age group 17 to 22 years in Gujarat).
- It is clear that if either of the measurements (head length or total height) is known the other can be calculated and this fact may be of practical use in medico-legal investigation and in anthropometry.

**Significance**

- Remains are often incomplete. In those cases a forensic anthropologist will need to estimate stature by extra polating it from the length of individual bones or combination of long bones. This is done by using regression formulae developed for reference population of know stature.
- Here in present study the regression equation obtained can help in stature estimation of individual of Gujarati origin of age group 21-25 years
- Using regression equation, stature can be calculated for decomposed or skeletonised remains encountered from Gujarat region or suspected to be from Gujarati community.

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