

# A Cross Sectional Study on Estimation of Stature from Head length in the Population of Telangana

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## Abstract

Determination of stature from head length is equally significant like determining from other body parts. A cross sectional study on estimation of stature from head length was conducted in the population of Hyderabad, Telangana at Malla reddy institute of medical sciences. Study population consists of 154 members, who include 75 males and 79 females, participants were in the age group of 18-23 years. Data was collected from participants after obtaining informed consent. Measurement of head length was taken from the top of vertex to the bottom of the chin in centimeter (cm) scale. A linear regression formula was obtained to correlate head length and height. Linear regression equations for total study population is  $Y=77.59 + 4.135(HL)$ , male population is  $Y=118.5 + 2.46(HL)$  and female population is  $Y=159.71 + 0.062(HL)$ . Statistical results of the study,  $R^2 = 0.333$ , Standard error = 0.475 and P value <0.0001 reveals statistical significance of the study. Separate formulae for male and female individuals will give more accurate results.  $\pm 5$  cm difference in the stature was observed in the study population with the derived equation. Height is approximately 8 times the head length in Female population and 7.5 times in male population in the study group.

**Key words:** Stature, head length, regression equation.

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## Introduction

Stature is defined as height of an individual. It is more useful during crime investigation in identifying the individual when only body parts were available, in medico legal cases determination of stature from body parts is very much important, it has great significance because height has significantly correlated with different body parts like limb, head, trunk and vertebral column etc.

Stature has a key role in identification of unknown dead bodies, when mutilation of body parts occurs in mass disasters like bomb blasts, fire accidents, building collapse, train accidents and plane crashes. Identification of a person can be done by estimating the stature from dismembered body parts by using linear regression formulae. Stature varies at different times of the day by one and half to two cm, it is less in the afternoon and evening due to reduced elasticity of the inter vertebral disc and the longitudinal vertebral muscles. In advanced age and malnutrition stature is reduced, it is reduced after the age of 30 years due to the natural process of senile degeneration about 0.6mm per year. Stature is greater on lying down position. It increases after death by about 2cm due to relaxation of muscle and joints<sup>1</sup>.

In ancient times 'Vitruvius<sup>2</sup> says in his work on architecture that the measurement of human body are distributed by nature as follows, i.e., four fingers make one palm, four palms make one foot, six palms make one cubit and four cubits make a man's height, he concluded that the man's outspread hands are equal to his height.

The aim and objective of the study is to determine the height of an individual from the head length in the study population of Hyderabad Telangana and to establish a separate equation for male and female individuals. This study is very much useful for law enforcement agencies to determine the stature from head length more accurately in the population of Telangana.

## Materials and Methods

A cross sectional and prospective study was conducted for estimation of height from head dimensions in the population of Hyderabad, Telangana. Study was conducted from 1<sup>st</sup> September

2023 to December 31<sup>st</sup> 2023. Study population consists of 154 members, which include 75 males and 79 females in the age group of 18 years to 23 years of medical students of Malla reddy Institute of Medical Sciences, Hyderabad, Telangana. An informed consent was obtained from each participant before commencement of the study and names of the Participants were kept anonymous.

Healthy individuals in the age group of 18 to 23 years and willing to participate in the study were considered and individuals suffering from Nutritional, genetical, metabolic and skeletal abnormalities are not considered for this study. Materials used are stadio meter, scale and two planks.

Measurement for head length was taken from top of the vertex to the chin, this was measured on centimeter scale, a plank was placed on the top of the vertex and another plank was placed under the chin, the distance between these two planks was considered as head length. Participant's height was measured in standing erect position on centimeter scale by using stadio meter. The data was collected in to the excel sheet and statistically analyzed for the regression equation by using SPSS (version 21) software.



Fig-1: Head length measurement in cm

## Results

A cross sectional study on estimation of stature from head length was conducted at Malla reddy medical college hyderabad telangana. Study population consists of 154 includes 75 male and 79 females. The following results were found.

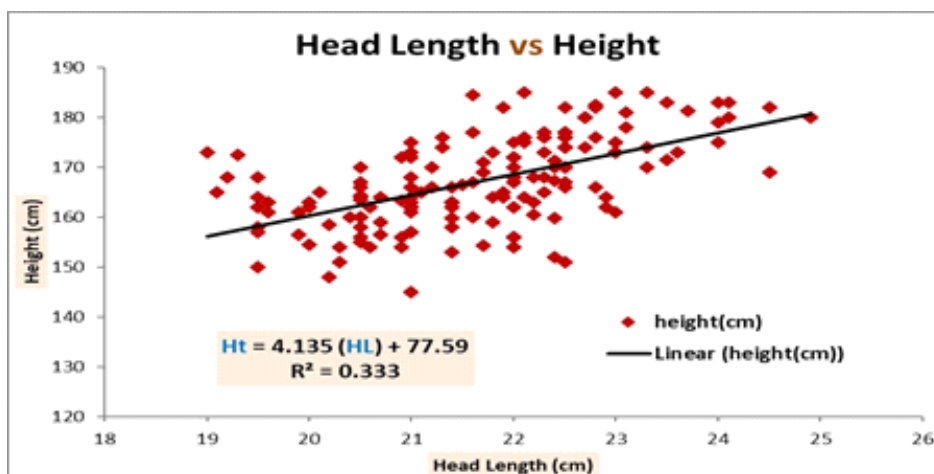
The linear regression formula for estimating the height is  $y = a + (bx)$ ,  $y$  = dependent variable (height),  $a$  = constant,  $b$  = independent variable coefficient,  $x$  = independent variable i.e. length of head.

**Table-1: Showing the details of regression statistics.**

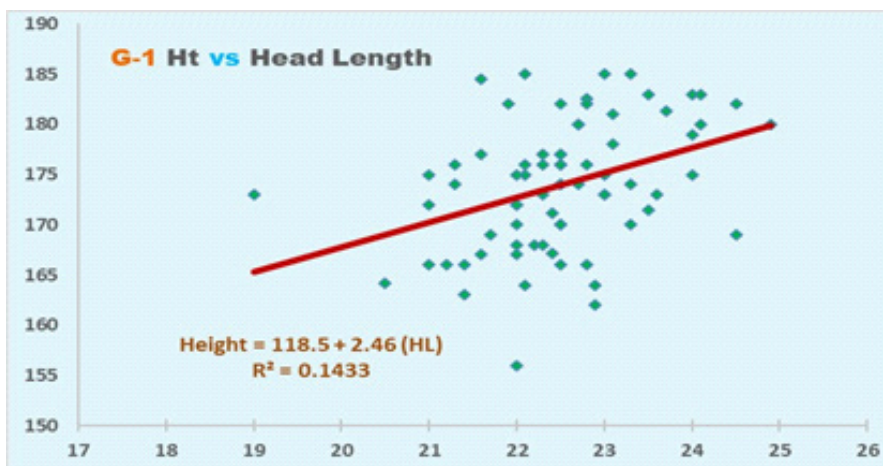
	Coefficients	Standard error	p-value	Lower 95%	Upper 95%
Intercept	77.593	10.304	4.1765E-12	57.236	97.950
Head length (cm)	4.135	0.475	4.93944E-15	3.197	5.074

**Table-2: Linear regression formula for total study population, male and female population.**

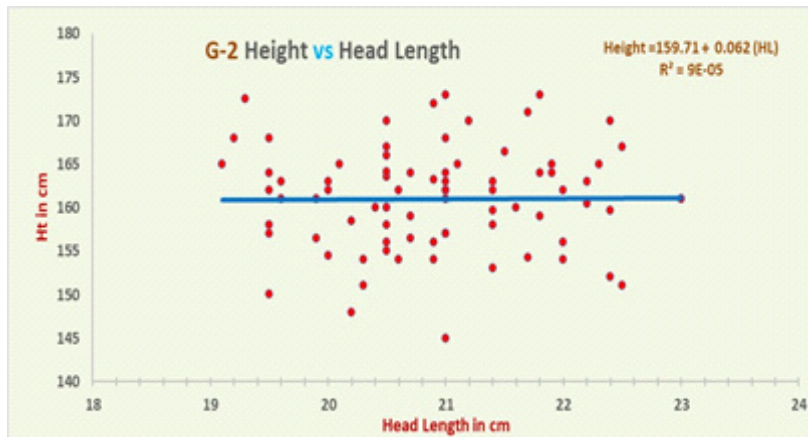
Regression statistics	Total Population equation	Male population equation	Female population equation
Height (Y)	$Y = 77.59 + 4.135(x)$	$Y = 118.5 + 2.46(x)$	$Y = 159.71 + 0.062(x)$
R <sup>2</sup>	0.333	0.1433	0.997
P Value	<0.001	<0.001	<0.001
95% Confidence interval	3.197 - 5.074	4.354 - 6.054	4.786 - 6.243



**Figure-2: showing the details of head length Vs height in total population and linear regression formula**



**Figure-3: showing the details of head length Vs height in male population and linear regression formula**



**Figure-4: showing the details of head length Vs height in female population and linear regression formula**

### Discussion

A cross sectional study on estimation of stature from head length was conducted at Hyderabad, Telangana. Total study population consists of 154 which includes 75 male and 79 females. Statistical analysis was done and results of the study reveal the  $R^2 = 0.333$ , Standard error 0.475 and P value  $< 0.0001$  shows statistical significance of the study. The 95% confidence interval showing the accuracy of the results obtained from linear regression equation for total population is 3.197 – 5.074, for male population it is 4.354 – 6.054 and for female population 4.786 – 6.243.

Linear regression equation for total study population is  $Y = 77.59 + 4.135 (HL)$ , coefficients of intercept is 77.59 and Head length is 4.135. Linear regression formulae for male population is  $Y = 118.5 + 2.46 (HL)$  and Linear regression formulae for female population is  $Y = 159.71 + 0.062 (HL)$ . Stature calculated with these equation is close to the normal height,  $\pm 5$  cm difference was observed in the study population.

Various studies were conducted in India and abroad on estimation of height from head length using linear regression equation and observed a definitive correlation. Studies conducted in Madhya Pradesh by Krishan K<sup>3</sup> and in Central India by Atul S Keche<sup>4</sup> and in Karnataka by Mohan Prasad<sup>5</sup> on estimation of stature from head length dimensions showed significant correlation. Study in South Nigeria conducted by Dennis E. O. Eboh<sup>6</sup> on height estimation from head dimensions also revealed significant correlation.

Determination of stature from head length is useful in crime investigation when the only body part that is head was available. Estimated stature as per the study formulae is approximately 8 times of the head length in female population and 7.5 times in male population. Separate equations for male and female population will yield better results because the mean height difference for male and female study population is about 13cm and the mean head length difference of 3 cm is observed.

### Conclusion

A strong correlation of stature from head length in the population of Hyderabad, Telangana was observed in our study. Separate equations for male and female population will give better results.  $\pm 5$  cm difference in the stature of an individual was observed in the study population with the derived equation. Height is approximately 8 times of head length in female population and 7.5 times in male population in the study group. Similar results were found in studies conducted in India and abroad.

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**Conflict of interest:** Nil

**Ethical clearance:** We obtained ethical clearance from institutional ethics committee on 20-7-23, Ref No: EC/NEW/INST/2023/TE/0235.

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