Estimation of stature by Nasion - Inion head length in South Indian population - A cross sectional study

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Abstract

Background: Establishment of individuality is an imperative aspect in any investigating procedure. There are numerous means and ways to do so in human beings (alive or dead), when a human body is in its entirety, but very few when only a part of it is available. When only part of the body is available the calculation of stature place a vital role as far as the identity of an individual is concerned.

Aims and objectives : To correlate the Nasion-Inion head length with stature and to derive regression equations.

Material and Methods : A cross sectional study conducted on South Indian student population of JN Medical College, Belgaum, with their age above 18 years and sample size of 200 (100 males and 100 females).

Results: Based on the calculated average stature and head length in present study, we derived a regression equation which shows a positive correlation between stature measured by regression equation with that of actual height.

Conclusion : As there is a positive correlation between the head length (Nasion-Inion) with that of stature, the new set of derived regression equations of present study can be used upon South Indian population with reasonable degree of accuracy.

Key words: Anthropology, Stature, Head length, South Indians.

Introduction

Stature is one of the various parameters of identification for establishing individuality of the person. It is well known that there is a definite relationship between the height of the person and various parts of the body like head, trunk and lengths of upper and lower limbs. The assessment of height of an individual from measuring different parts of the body has always been of immense interest to the Anatomists, Anthropologists and Forensic experts [1].

Trotter and Gleser[2] in 1958 reported that each group of American white, Negroes, Mongolian and Mexican needed different formulae to derive the most precise estimate of stature. In 1996 Yayimyili[3] derived regression equations for estimation of stature for Turkish population. He also observed that application of formulae derived for African, European and Asian populations led to suboptimal values for Turkish population. Thus, race specific regressions are yet to be derived for the accurate stature reconstruction.

There is no universally acceptable formula to express relationship between stature and head length of an individual. Estimation of stature of an individual in India by using formulae given by western workers involves an error of 5-8%[3]. Various factors like race, sex, side of body, climate, heredity and nutritional status are attributed to variations in the ratios of length of different bones to that of stature[2,5,6].

South India comprises 20 % of total Indian soil and

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most of the people are of Dravidian decent. Hence the current study represents the anthropological data of Dravidian race.

Aims and Objectives

To correlate the Nasion-Inion head length with stature and to derive regression equations that can be applied for estimation of stature of South Indian population.

Material and Methods

a) Source: The South Indian students population (Karnataka, Andhra Pradesh, Tamil nadu and Kerala) of JN Medical College, Belgaum, with their age above 18 years.

b) Study design: Cross-sectional study.

c) Sample size: 200 (100 males and 100 females)

d) Methodology

Inclusion criteria:

1. Students hailing from Karnataka, Andhra Pradesh, Tamil Nadu, and Kerala.

2. Chronological age group above 18 years

Exclusion criteria:

1. Students unable to stand

2. Any pathological conditions of bones and limbs e.g., fractures, dislocations, poliomyelitis, osteoporosis, rickets, scoliosis and kypho-scoliosis etc.

3. Congenital anomalies.

4. Dwarfism and gigantism.

5. Steroidal therapy.

e) **Data collection:** The study was performed in adherence to the principles established with the declaration of Helsinki (2000) and written consent was obtained from every student and all female subjects were examined in the presence of female attender . Various socio-demographic factors and the following anthropometric data were entered in the pretested proforma. The measurements were taken at fixed time between 2 to 5 p.m. in order to eliminate discrepancies due to diurnal variation.

1. Standing height (Stature)

The subjects were made to stand bare foot on a base-board of a stadiometer in the Frankfurt plane where his/her head will be parallel to the floor with heels together and the weight evenly distributed between both feet. The height is measured in centimetres(cms) from the ground to the highest point of the head with the head piece of stadiometer firmly contacting the scalp.

2. Head Length:

Subjects were made to sit on a chair keeping head looking straight and measurement will be taken with spreading calipers between two points – from Nasion to Inion in cms.

Results

The average stature in the present study is 172.44 cms for males and 159.49 cms for females and the average head length from Nasion to Inion is 18.18 cm for males and 16.77cms for females. Head length from Nasion to Inion (N-I) shows a positive correlation (Karl Pearson's) with stature for male, female and combined with p-value < 0.001. A total of 3 simple linear regression equations were derived in the study for male, female and combined (Table 1)

Sex	Nasion – Inion (N-I)
Male $(Y = A+BX)$	Stature =125.69 + 2.571 N-I R= 0.507, R^2=0.257 SEE=4.632
Female $(Y = A+BX)$	Stature =124.2 + 2.104 N-I R= 0.440, R^2=0.193 SEE=5.588
Combined $(Y = A+BX)$	Stature = 93.995 + 4.118 N-I R=0.651, R^2 =0 .424, SEE = 6.6068

(Where, Y= Total body Height in cms, A = Constant, B = Regression coefficient, X = Head length(N-I) in cms, R = Correlation coefficient, R^2 = Coefficient of determination.)

Table 2. Coefficient of Correlation values from previous studies regarding stature and head length and correlation with current study

Workers and age of study group	Mean head length (Cm)	Correlation coefficient	Correlation with current study
Saxena7 (1981) 25-30 Yrs	18.464 Nasion – Inion	+0.2048	No
Jadhav & Shah[8] (2004) 17-22 Yrs	17.65 Glabella – Inion	+0.53	Yes
Present study (2012) 19-28 Yrs	18.18 (male) 16.77 (female) Nasion –Inion	0.507 (male) 0.440 (female) 0.651 combined)	----

Table 3. Regression formula worked out by various authors for Head length in different population and the present study

Sl No	Author	Population	Head Length	Male Equation (Y= A+Bx)	Female Equation (Y=A+Bx)	Correlation With Current Study
1	Saxena et al 7 (1981)	Agra, UP	N-I	Y=134.42+1.504X		No
2	Jadhav HR and Shah GV 8 (2004)	Gujarat	G-I	Y= (138.77) + (1.77)X	Y= (128.03) +(1.72)X	No, as the head length here is from glabella to inion
				Y= (78.92) + (4.93) X		
5	Shivanand and Manjulabai K H (2012) Present Study)	South Indian	N-I	Y=125.69+2.571(N-I)	Y=124.2+2.104 (N-I)	----
				Y = 93.995 + 4.118(N-I)		

Our study shows positive correlation between stature as measured by regression equations with that of the actual height amongst the South Indian population which is in accordance to observations as made by other similar studies done by Jadhav and Shah [8] but the head length measured in their study is from glabella to inion and not in accordance with the study done by Saxena [7] where the head length measured is similar to our study. (Table 2.)

The regression equations of our study are valid and applicable to the South Indian population. However the regression equations do not match with any other region of the India as these are individually different (Table 3), this finding substantiates views expressed by other workers that, state wise and population wise different regression formulae are required for estimation of stature.

Discussion

In present study, approximate stature has been estimated from head length (Nasion to Inion). There are only few studies available to correlate with our study results. We have observed positive correlation between head length and height in the age group of 18-29 years with correlation coefficient of 0.507 (N-I) in males and 0.440(N-I) in females.

Saxena et al [7] derived a regression equation between head length and height in Uttar Pradesh. Their correlation coefficient between head length (Glabella to Inion) and height was +0.2048. Similarly Jadhav et al [8] have shown positive correlation between head length and height with correlation coefficient +0.53. Trotter M et al [2,5] have stated that requirement of different regression equations among different races after studying different races for relationship between lengths of bones and stature.

Conclusion

There is a positive correlation between the head length (Nasion-Inion) with that of stature. We have come out with new set of regression equations i.e. [Stature = 124.20 + 2.104 (N-I)] for female and [Stature=125.69 + 2.571 (N-I)] for male. The regression equations of present study can be used upon the South Indian population with reasonable degree of accuracy.

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