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Original Research Article

CORRELATION OF HUMAN HEIGHT WITH HEAD LENGTH IN INDIAN INDIVIDUALS

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ABSTRACT

Introduction: One of the most important aspects in identifying the personal identity of an individual is stature which is influenced by genetic and environmental factors. Stature exhibits a definite proportional relationship with various parts of the body like head, face, trunk, vertebral column and extremities. Rules of body proportions exhibit consistent ratios among themselves and relative to the total body height and are age, sex and race dependent. They are also of great importance in Fine arts, Anatomy, Anthropology and Forensic medicine

Aims: To study the relationship of human height with head length

Materials and Methods: This is a Cross-sectional study carried out in Ramaiah Medical College, Bangalore in 225 individuals aged between 18 and 25 years of age in and around Bangalore. Descriptive statistics, Pearson's correlation coefficient and Linear regression were employed for the Statistical analysis of the data

Results: The mean head length was found to be 21.43±0.94 cm and ranged between 19.39 to 24.74 cms. The gender wise comparison revealed that there was no statistically significant difference in mean values of head length in in males and females. It was observed that there was a weak positive correlation between height and mean head length which was statistically significant($r = 0.27$, $P < 0.001$).

Conclusion: It was observed in the present study, that there was a weak positive correlation between height and head length in both males and females indicating that head length alone is not a reliable indicator in prediction of stature

KEY WORDS: Head length, stature, correlation, height, anthropometry, glabella, inion.

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INTRODUCTION

One of the most important aspects in identifying the personal identity of an individual is stature which is influenced by genetic and environmental factors. Stature exhibits a definite proportional relationship with various parts of the body like head, face, trunk, vertebral column and extremities[1].

This finds application in anthropometry where the data can be used for the estimation of variations between different individuals and is used for sizing in garment industry; in forensics for the identification of unknown human remains and in designing of the workplace ergonomically. Anthropometry, the standard tool of physical anthropology throws light on the scientific methods and techniques for estimation of various measurements [2]. Various studies have been conducted to determine stature from percutaneous measurements of different body parts, from bony skull, from radiographic lateral cephalograms of skull and cephalo-facial measurements. Some of them have shown positive correlation while others have failed to do so [1].

Stature of an individual is not constant and may show severe reduction with heavy load carrying by individual. However, the age and repeatability of the load carrying determines the decrease. The stature decreases by 6 mm per decade after 30 years of age. Rules of body proportions exhibit consistent ratios among themselves and relative to the total body height and are age, sex and race dependent. They are also of great importance in Fine arts, Anatomy, Anthropology and Forensic medicine[2].

The various anthropometric parameters used to study the pattern of growth in children are population specific and variables include age, weight, height, and cephalic variables such as head breadth, head length, head circumference and cephalic index. The nutritional status and environmental factors are key factors in complete expression of the genetic potential for growth[3]. The craniofacial anthropometric measurements guide surgeons in surgical repairs of anomalies associated with the head region [4].

Improvement in nutrition when it is suboptimal produces a parallel increase in height, head circumference and brain size leading to improved neurological development and functioning of brain and higher intelligence [5]. It has been reported that in the last century the brain growth has accelerated to a great extent with a decrease in the age at which adult brain size is attained without alteration in the size of adult brain which is probably responsible for shorter cranial length, accounting for greater growth laterally in Japanese and vertically in Europeans[6.]

AIM: To study the relationship of human height with head length.

MATERIALS AND METHODS

This is a Cross-sectional study carried out in Ramaiah Medical College, Bangalore in individuals aged between 18 and 25 years of age in and around Bangalore. Based on the previous studies conducted by Dr Parth M Pandya[7], Dr Seema[8] & Dr Sumita Agarwal[9], the correlation co-efficient varied from 0.3 to 0.5. Assuming the correlation co-efficient to be around 0.34 with the power of 85% and alpha error of 5, sample size was estimated to be 225.

Inclusion criteria: Individuals aged between 18 and 25 years in and around Bangalore

Exclusion criteria - Individuals with features suggestive of dysmorphic syndromes

Method: The measurements were taken three times and their mean value has been considered. Data so collected has been entered in a master chart in Microsoft® Excel and has been analyzed using the SPSS version 17.0. Informed consent has been taken from all participants. The ethical clearance has been obtained from the institution.

Parameters Studied were: Head length : Head length was measured with a spreading caliper from glabella to the inion. **Height**: The height of the participant was measured with the wall mounted height measuring device- Stadiometer.

Statistical Methods: Descriptive statistics such as mean and standard deviation has been computed for height and head length. Pearson's correlation coefficient has been used to find the correlation between stature and head length. Mutiple Linear regression has been used to predict height from head length of an individual. P value <0.05 has been considered as statistically significant. Data analysis was carried out using SPSS version 18.0.chicago SPSS Inc.

RESULTS

In this study, the sample size was 225 with 93 males and 132 females. The mean head length was found to be 21.43±0.94 cm and ranged between 19.39 to 24.74 cms. The gender wise comparison revealed that there was no statistically significant difference in mean values of

head length in in males and females (Tab. – 1).

It was observed that there was a weak positive correlation between height and mean head length which was statistically significant (r =0.27, P <0.001) (Table -2). The correlation of height with head length in males and females also revealed a weak positive correlation which was statistically significant (Table -3)

Table 1: Comparison of mean difference in head length among males and females.

	Males	Females
Head length	21.68±0.96	21.08±0.78

Table2: Correlation of height with head length.

	Correlations	Mean Head length
Height	Pearson Correlation	.276**
	P value	<0.001

Table 3: Correlation of height with head length in males and females.

Sex		Mean Head Length
Males	Pearson Correlation	.193*
	P value	0.026
Females	Pearson Correlation	.245*
	P value	0.018

DISCUSSION

Parth M. Pandya et al[7], Seema et al [8] and Jadav et al[10], have reported a definite correlation between head length and height of an individual. B Danborno et al [3] have shown that all the head dimensions namely the head length and breadth, head circumference and cephalic index correlates significantly with height in boys and girls. Arun Kumar Agnihotri et al[1] have reported that horizontal head circumference, nasal breadth and morphological facial length as major predictors for stature estimation among males, while among females, the stature was best estimated by physiognomic facial length, bizygomatic breadth and horizontal head circumference in descending order. Ese Anibor et al[4] have stated that the cranio-facial parameters may be useful in determining stature and identifying an individual's gender. Rajani Singh[11] has reported that a very high correlation exists between height and head length; and a moderately high correlation between height and head height in Indian male population; in females head height correlates with stature but not head length. Bansal Hansi et al[2] has reported a positive correlation between head length and height in age group 6 - 10 years. Svethalana et al [12] in the study on fetuses have found high correlation of head length with crown-lump length and with gestational age. Sumit Agrawal et al [9] have shown a significant positive correlation in both males and females for stature with head length and breadth.

Table 4: Various studies of correlation between head length and height.

Study	Sample size	Males	Females	Parameters
Jadav HR (2004) et al[10]	727	468	259	Height, head length,
B Danborno (2007) et al[3]	374	173	204	Height, weight, head length & breadth, head circumference and cephalic index
Arun Kumar Agnihotri (2011) et al[1]	150	75	75	Height, cephalo – facial dimensions
Ese Anibor (2011) et al [4]	200	100	100	Height, total cranial length, total craniofacial cranial base width, maximum cranial breadth and total head circumference, Mouth width, biocular width, minimum frontal breadth, supraorbital breadth,
Seema (2011) et al[8]	400	-	-	Height, head length
Parth M. Pandya (2012) et al[7]	500	370	130	Height, head length
Bansal Hansi (2013) et al[2]	100	50	50	Height, head length
Rajani Singh (2013) [11]	208	148	61	Height, head length, breadth and head height
Sumita Agarwal(2014) et al [9]	800	400	400	Height, head length and breadth
Svetlana et al, 2014[12]	300 foetuses	-	-	Height with foetal head parameters
Khan MA (2015) et al[13]	672	430	242	Height, Cranial length and breadth, auricular cranial length,
Neetu Purohit (2015) et al[14]	500	291	209	Height, head length and breadth
Sudeep Kumar Yadav(2015) et al[15]	140	-	-	Height, head length, facial height, Breadth of the bizygomatic arch
Vinitha G et al, 2015[16]	200	100	100	Height, head length
Present study(2016)	225	88	132	Height, head length

Khan MA et al [13] have shown a statistically significant correlation between the height and cranial length and breadth and auricular cranial length. Neetu Purohit et al[14] results show that two parameters head length and breadth correlated positively with stature except head breadth in females. Sudeep Kumar Yadav et al[15] have reported a statistically significant positive correlation between the height and the other cephalometric variables namely head length, facial height, breadth of the bizygomatic arch. Vinitha G et al [16] have found a strong association between height and head length in both boys and girls.

In the present study, the correlation of height with head length in males and females revealed weak positive correlation which was statistically significant.

CONCLUSION

It was observed in the present study, that there was a weak positive correlation between height and head length in both males and females indicating that head length alone is not a reliable indicator in prediction of stature

Conflicts of Interests: None

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