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Original Research Article.

An Institutional Based Prospective Study to Assess the Correlation and Regression Analysis of Stature in Relation to Head Length in Children

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ABSTRACT

Background: Anthropometry is the biologic science of human body measurement. The stature prediction occupies relatively central position both in forensic medico legal investigations and anthropologists. Estimation of stature using different measurements of the body of people belonging to different races and age groups has been attempted by many scientists with varying degree of accuracy. The estimation of height from various parameters has been done by many workers but not much data is available in literature regarding the estimation of stature from head length in children. In the present study an attempt has been made to find out correlation and derive a regression formula between head length and stature in children.

Materials & Methods: The study has been carried out on 100 students from government school Jhalawar, Rajasthan whose age is between 8 and 12 years studying from 3rd to 7th Standard. Among them 100 students (50 boys; 50 girls) were chosen randomly after a brief history and clinical examination on proforma for sound health. Weight was collected to calculate BMI and asses the nutritional status of the student to include in the study. For measuring comforts, head length (straight distance from Glabella to opisthocranion) was measured when subject was sitting on stool. Regression analysis has been carried out to find the exact relationship between total body height and head length using SPSS 22.0V package software.

Results: The height of boys (136.079± 9.324 cm) was statistically significant (P=0.001**) as compared to girl participants (131.246 ± 9.547 cm). The head length of boys (17.133± 0.735 cm) was statistically significant (P=0.001**) as compared to girl participitants (16.639 ± 0.702 cm). There is a positive correlation of 0.203 & 0.408 between Head length and height among boys & girls and is statistically significant. The relationship between head length and height is positive and with every unit increase in head length there is significant 2.514 in boys, 6.176 in girls and 5.124 in combined increases in body height.

Conclusion: We concluded that a strong association between height and head length. Simple regression equations generated from head length can be a supplementary approach for stature estimation when extremities are not available and will be useful for forensic scientists, anatomists, archaeologists and anthropologists.

Keywords: Head Length, Stature, Body Height, Correlation.

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INTRODUCTION

Anthropometry is the biologic science of human body measurement. Anthropometry constitutes the means of giving quantitative expression to the variations which different individuals or traits exhibit.[1] Anthropometry, the typical and the traditional tool of physical anthropology, provides the scientific methods and the techniques for estimating the various measurements and the observations on the living as well as the skeleton of man.

Growth the vital process is measured by measuring the height of a person, which itself is a sum of the length of certain bones and appendages of the body, represent certain relationship with form of proportions to the total stature. This relationship is very useful anthropologically to find racial differences and medicolegally, when only parts of the deceased body are available.[3]

Stature or height is a general accepted descriptor of the individual that the public, forensic experts and criminal justice system recognize and understand. Stature is one of the numerous data for identification. The stature prediction occupies relatively a central position both in the anthropological research and in the identification necessitated by the medical jurisprudence or by the medico-legal experts. Estimation of stature of an individual from the skeletal material or from the mutilated or amputated limbs or parts of limbs has obvious significances in the personal identification in the events of murder, accidents or natural disaster mainly concerns with forensic identification analysis. [4]

The stature is a measure of biological development and is determined by a combination of genetic and environmental factors.[6] It is sexually dimorphic and statistically more or less normally distributed.[7] It is fundamental in assessing growth and nutrition, calculating body surface area, and predicting pulmonary function in childhood.[8] Group specific works can be done when stature cannot be measured directly due to deformity like kyphosis, lordosis, scoliosis, contractures or missing leg.[9] Height estimation by measurement of various long bones and radiographic material has been attempted by several workers with variable degree of success.[10]

Dimensional relationship between body segments and the whole body has been the focus of scientists, anatomists and anthropologists for many years. It has been used to compare and highlight variations between different ethnic groups and to relate them to locomotor patterns, energy expenditure and lifestyle. Prediction of the dimensions of body segments is useful in many areas of modern science like in growth and development, assessment of normal growth as well as in specific syndromes. The relationship between body parameters varies from population to population and between ethnic origin to differences in nutrition and levels of physical activity.[12] Universally applicable formulae have not been derived because the relationship between height and long bones or other measurements differ according to race, age, sex and side of body. It is proved that each race ad age group require its own table.[1] Artists use dimensional relationships in depicting the ideals of beauty, and this has resulted in creation of the rules of body proportions.[13] Anthropologists observe and compare the relation between body and segments to highlight variations between their origins.[9] The estimation of height from various parameters has been done by many workers but not much data is available in literature regarding the estimation of stature from head length in children. In the present study an attempt has been made to find out correlation and derive a regression formula between head length and stature in children.

MATERIALS & METHODS

The study has been carried out on 100 students from government school Jhalawar, Rajasthan whose age is between 8 and 12 years studying from 3rd to 7th Standard. Consent of school headmaster was taken before collecting data after properly explaining the aims and objectives of intended study. Measurements were taken at fixed time of day between 1 pm to 3 pm to avoid diurnal variation. The place of study was department of Anatomy, Jhalawar Medical College, Jhalawar, Rajasthan, India.

Inclusion Criteria

1) Students aged 8-12 years verified from school records, after a brief history and clinical examination for sound heath.
2) Sample from both the sexes.

Exclusion Criteria

1) Subjects beyond the age group.
2) Subjects suffering from chronic diseases and malnutrition
3) Subjects with any congenital abnormality affecting the head.
4) Subjects with vertebral column deformity.

Methods

Among them 100 students (50 boys; 50 girls) were chosen randomly after a brief history and clinical examination on proforma for sound health. Consent of school headmaster was taken for the same.

Weight was collected to calculate BMI and asses the nutritional status of the student to include in the study. For measuring comforts, head length (straight distance from Glabella to opisthocranion) was measured when subject was sitting on stool. Standing height and head length of the student are measured by staturemeter and spreading calipers respectively in centimeter.

Statistical Methods

Pearson Correlation has been used to find the degree of relationship between total body height and head length. Student t test (Two tailed) for correlation has been used to find the significance of degree of correlation. Regression analysis has been carried out to find the exact relationship between total body height and head length using SPSS 22.0V package software.

Table 1: Demographic profile of study population

Demographic profile	Frequency (%) (N=100)
Age (yrs)	
8 years	20 (20%)
9 years	20 (20%)
10 years	20 (20%)
11 years	20 (20%)
12 years	20 (20%)
Gender	
Boys	50 (50%)
Girls	50 (50%)

Table 2: Comparison Of Study Parameters Between Boys And Girls

Study parameters	Boys	Girls	P value	Pearson Correlation of Head length and height
Height (cm)	136.079± 9.324	131.246 ± 9.547	0.001	0.203
Head length (cm)	17.133± 0.735	16.639 ± 0.702	0.001	0.408

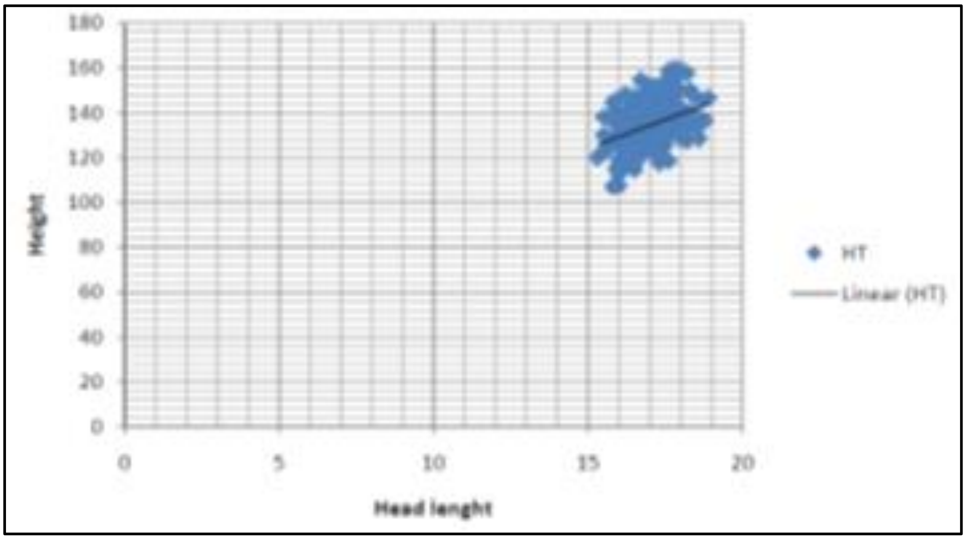

Figure 1: Correlation Between Head Length And Height

Table 3: Regression Analysis For Prediction Of Height Using Head Length (Y = A+Bx)

Variable	Formula	R^2
Boys	y=93.571+2.514(x)	4.2%
Girls	y=27.563+6.176(x)	17.5%
Combined	y=47.956+5.124(x)	15.8%

Y= height, X= head length

RESULTS

In the present study, the proportion of children in each age group 8 years, 9 years, 10 years, 11 years, 12 years was equal for all being 20% in each. The boys to girl's ratio was 1:1 (table 1).

The height of boys (136.079± 9.324 cm) was statistically significant (P=0.001**) as compared to girl participants (131.246 ± 9.547 cm). The head length of boys (17.133± 0.735 cm) was statistically significant (P=0.001**) as compared to girl participants (16.639 ± 0.702 cm). There is a positive correlation of 0.203 & 0.408 between Head length and height among boys & girls and is statistically significant (table 2 & figure 1).

The Regression analysis was carried out to find the strength of relationship between head length with body height. The relationship between head length and height is positive and with every unit increase in head length there is significant 2.514 in boys, 6.176 in girls and 5.124 in combined increases in body height (table 3).

DISCUSSION

The stature of an individual mainly being genetically predetermined is an inherent characteristic, the estimation of which is an important assessment in identification. Height has been estimated from measuring various parameters of body, refining formulae.

It can be observed from the tables and statistics that the independent variable (head length) is strongly related to the dependent variable (height) and a strong linear association between them. Boys and girls were considered both separately and as a whole. As observed from the table's correlation is significant in males and strongly significant in females and as a whole. Apparently normal, healthy children with no physical abnormality were chosen randomly for the study. If any sampling error is likely, its due to physiological variations that occur invariably in humans caused by different ages, sexes, regions, environmental, genetic, familial and racial factors besides unidentified ones. In present study, approximate stature has been estimated from head length. There are a few studies for estimation of stature from cephalometry or craniometry.

In 1981 Saxena et al derived a regression equation between head length and height for males aged 25-30 yrs in Uttar Pradesh. The correlation coefficient between height and head length being + 0.2048. Here head length was measured from nasion to inion.[22]

Similarly in 2004 Jadav et al showed positive correlation between head length and height with correlation coefficient + 0.53.[20] This study included both sexes aged between 17-22 years. Head length measurements were taken between glabella and inoin. In both the studies discussed above the correlation coefficient was not derived separately for males and females whereas in the present study it has been done so.

In present study, head length is measured from glabella to opisthocranion, in both the sexes between 8-12 yrs. The point opisthocranion is chosen to measure the head length, as it eliminates the human errors of judgement and therefore more accurate and inion is difficult to locate accurately.

Isurani Ilayperuma (2010) estimated stature from the cranial dimensions like head length, head height, head breadth and found that height versus cranial dimensions is a positive correlation and is highly statistically significant.[59]

Intorna et al performed somatometry on maximum antero posterior and lateral diameter of skull in 358 young males ranging from 17 – 27 years and reported the feasibility of obtaining estimation of stature from the skull through calculating correlation coefficients by multiple linear regressions.[60]

M Chiba and K Terazawa have estimated stature with head diameter in 124 Japanese cadavers with correlation coefficient of + 0.39 in males and + 0.003 in females. Head diameter in their study is similar to head length in present study. The correlation coefficient between head length and height increased after excluding subjects above 70 years.[61] Measurements in the present study are taken in the living subjects rather than cadavers. Head length is 1/8th of the total height of an individual according to Gleser but he fails to mention the age and sex of the individual included in his study. Trotter M et al have stated requirement of different regression equations among different races after studying different races for relationship between lengths of long bones and stature.[63]It is important to note that every race of particular age group and sex should have its own table for estimation of height using various parameters.

Maximum length of the skull used by Patil and Mody differ from the head length used in present study. They took measurements from radiographs whereas in present study measurements are taken directly.[62] As per principles of statistics, finding a multiplication factor by considering averages is not accepted as a sound and satisfactory method.

CONCLUSION

We concluded that a strong association between height and head length. Simple regression equations generated from head length can be a supplementary approach for stature estimation when extremities are not available and will be useful for anatomists, archaeologists, anthropologists and forensic scientists.

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