Original Communication

Co-Relation between the Stature and Head Length in Medical Students from Southern Parts of India

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Abstract

Measuring the stature from cephalic length has been done innumerable times through a multitude of population. However there is a need for race, age, sex specific stature estimation formula for each population. We studied 305 medical undergraduate students (142 males and 163 females) who were born and brought up in Tamil Nadu, Pondicherry, Karnataka, Kerala and Andhra Pradesh (Southern part of India) and were between the age group of 18 to 22 years. In males, stature ranges from 154.7 cm to 188.0 cm with a mean value of 172.42cm. The stature in females ranges from 146.0 cm to 175.0 cm with mean value of 158.83cm. In males, head length varied from 16.4 cm to 22.0 cm with mean value of 18.49 cm. Whereas, in females, length of head varied from 15.7 cm to 19.7 cm with mean value of 17.45 cm. The regression equations were derived, separate for male and female subjects, as well as for the combined data. Highly significant correlation was observed between stature and head length ($p < 0.001$). The present research indicates that forensic experts can estimate stature from cephalic length in situations where only the cephalo-facial remains are available for forensic examination.

Key Words: Mother; Reproductive medicine; Infertility; Surrogacy.

Introduction:

Anthropometry is a scientific method of measurement of various parts of human body in which information is collected through observation & the data thus obtained is put to test through a number of statistical analysis leading to a conclusive observation, which can be applied on the corresponding field.[1]

The medico legal system challenges the skills of a forensic expert on skeletal analysis especially in cases of highly decomposed and dismembered bodies.[2] Establishing the identity in the victims of genocide and mass disasters (earthquake, cyclones, tsunamis) is a challenging task not only with routine techniques like dactylography, but also with advanced identification tools like facial reconstruction, superimposition and DNA fingerprinting, and moreover identification of the dead is both a legal and socio-moral responsibility of forensic experts who often work under seriously resource crunched situations.[2-5]

Calculating the stature of an individual from the bony remains is a complex task since stature may vary according to race, ethnicity, age, sex, dietary habits and may further be complicated by the presence of physical illness like vertebral column deformity.[6-8] Measuring the stature from cephalic length &cephalic breadth has been done innumerable times through a multitude of population. However there is a need for race, age, sex specific stature estimation formula for each population.[3,9,10.]

Stature estimation from various parts of dismembered and mutilated body is calculated using two methods i.e. regression method and multiplication method and it has been universally concluded that regression analysis provides better estimates for stature reconstruction.[4,5]

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Material and methods:

In this study we have included 305 medical undergraduate students (142 males and 163 females) who were born and brought up in Tamil Nadu, Pondicherry, Karnataka, Kerala and Andhra Pradesh (Southern part of India) and were between the age group of 18 to 22 years. Students with congenital or acquired skeletal deformities and those who did not belong to Southern parts of India were excluded from the study. Informed consent was obtained from each participant. Height (stature) was measured by making the subject stand barefoot on the board of a standard stadiometer with both feet in close contact with each other, trunk braced along the vertical board, and head oriented in ear-eye plane. The measurement was taken in centimeters by bringing the horizontal sliding bar to the vertex. Head length was measured between two eighboures points as glabella and inion. Inion is the most prominent projecting point of occipital bone at base of skull and glabella is the point on protuberance of lower forehead above nasal root and between the eyebrow ridges intersected by mid sagittal plane.[11] This was measured by placing the anterior caliper tip on glabella while allowing the posterior caliper tip to slide inferiorly along the median plain of the occipital bone until the maximum length was reached. Measurement of head length was taken using blunt ended spreading caliper, which was held in such a manner that the tips of the caliper were free to touch the head. Undue pressure was avoided while taking the measurement. The measurements were taken at fixed time between 2 to 5 p.m. and by same person to eliminate the discrepancies due to diurnal variation and personal error respectively.[12]The observations were tabulated and eighbou using MS Excel 2010 and regression equation was derived by linear regression analysis.

Results:

Table 1 shows the sex wise distribution of mean values and range, of the stature of the study population. In males, stature ranges from 154.7 cm to 188.0 cm with a mean value of 172.42cm. The stature in females ranges from 146.0 cm to 175.0 cm with mean value of 158.83cm.

As per the data shown in Table 2 in males, head length varied from 16.4 cm to 22.0 cm with mean value of 18.49 cm. Whereas, in females, length of head varied from 15.7 cm to 19.7 cm with mean value of 17.45 cm.

The regression equations as shown in the table 3 were derived, separate for male and female subjects, as well as for the combined data. Highly significant correlation was observed between stature and head length (p< 0.001). The coefficient of co-relation I was 0.441 for combined data. The values of coefficient of determination (r^2) were 0.003, 0.006 and 0.192 respectively for male, female and combined data.

Discussion:

In forensic examination of skeletal remains or dismembered body parts prediction of stature involves a vital role in establishing the identity of those remains. Keeping this in mind, many researchers across the globe have studied and established significant correlation between stature and measurements of different body parts like length of clavicle[13,14], forearm length[15], hand length[16], hand breadth[17], length of lower leg[18,19] and head length[2-12,20,21].

Table 1: Sex wise distribution of stature

Stature (in cm)	Male(n =142)	Female (n=163)	Total
Mean	172.42	158.83	165.62
Minimum	154.7	146	146
Maximum	188	175	188

Table 2: Sex wise distribution of Head length

Head length (in cm)	Male (n=142)	Female (n=163)	Total
Mean	18.49	17.45	17.97
Minimum	16.4	15.7	15.7
Maximum	22.0	19.7	22.0

Table 3: Regression equations for estimation of stature from head length

	Regression equation	S.E.E.
Male	Stature = 164.05 + 0.452 x Head length	6.255
Female	Stature = 145.83 + 0.752 x Head length	6.687
Combined population	Stature = 85.635 + 4.436 x Head length	8.38

The present study was undertaken to propose a suitable population and gender specific regression equation for stature estimation using head length measurement. The regression equation was derived as Stature = 85.635 + 4.436 x Head length with S.E.E. 8.38 and significant correlation was observed between stature and head length (p< 0.001).

Kumar et al[5] studied 300 medical students in Rajasthan to conclude with significant correlation between height and head length. They developed regression equation with 94% and 85% accuracy for male and female respectively. Khanapurkaret al[6] in Maharashtrian population of 1000 subjects, proposed regression equation as Height = 67.0 +5.5x Head length with p value less than 0.001. Similarly Wankhede et al[7] studied Central Indian population from Vidarbha region of Maharashtra, Sagar and Nath[8] in Jatavas of Delhi, Kumar and Gopichand[9] in Haryanvi population, Jadhav and Shah[11]on Gujarathi subjects, Agarwal et al[20] on North Indian population developed regression equations with significant association between stature and head length for the respective population.

Study on South Indian population of Belgaum, Karnataka by Kadagoudaret al[10] also revealed similar findings to our study with statistically significant association between stature and head length.

In studies conducted by Illaperuma[2] in Shri Lanka and by Ukohaet al[3] in Nigeria statistically significant correlation was observed between head length and stature.

All these researchers also opined that the formula for determination of stature for one population cannot be applied to other group of people.

Conclusion:

The present research indicated that forensic experts can estimate stature from cephalic length in situations where only the cephaliofacial remains are available for forensic examination. This study has been exclusively done on the subjects residing in South Indian region (i.e. Tamil Nadu, Pondicherry, Karnataka, Kerala and Andhra Pradesh). Similar studies with increased sample size, on the same population might be helpful for increasing the credibility of the findings.

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