Original Research Article

Comparative Study: Stature and Facial Measurements in Both Genders

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Abstract

The imperative for pinpointing a person's identity arises in various scenarios, including mass disasters, cases involving unidentified bodies, and both civil and criminal investigations. Given that any part of the human body can serve as potential evidence, a comprehensive study is essential to explore the noteworthy correlation between stature and facial dimensions within the human body.

A comprehensive investigation was undertaken on a sample of 400 medical students of South Indian origin, revealing a substantial correlation between facial measurements and stature. This correlation not only enhances our understanding of the intricate interplay between various physical features but also underscores the significance of such studies in forensic and medical contexts. Correlation of facial measurements with stature in males was 0.633 where as in females coefficient was 0.754. Females were more correlated than males.

KEY WORDS: Anthropology, Facial measurements, Identity, Stature.

Introduction

Craniofacial anthropology is a specialized branch of anthropology dedicated to the biological analysis and interpretation of the skull and face, particularly for identification purposes[5,9]. While numerous studies have explored the relationship between stature and various percutaneous measurements of body parts such as arms, legs, feet, and hands, there is a limited body of research specifically addressing the correlation between stature and the skull alone.

One of the pioneering studies in this field, conducted by Sarangi and colleagues in 1981 on Indian cadavers, failed to identify a significant correlation between stature and skull measurements. Additional investigations have utilized radiographic measurements of the skull, with some Indian studies establishing equations for estimating stature based on percutaneous cephalofacial measurements in the north Indian population[2].

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However, there remains a scarcity of studies examining percutaneous cephalofacial dimensions and their correlation with stature, particularly in the South Indian population. Given that any part of the human body can serve as evidence, it is crucial to conduct a comprehensive study to elucidate the significant correlation between stature and cephalofacial dimensions[6]. The primary objective of the present study is to enhance the precision and accuracy of identification methods by estimating and establishing the relationship between stature and cephalofacial measurements. This research aims to fill the existing gaps in understanding and contribute valuable insights to the field of craniofacial anthropology.

AIMS:

1. To ascertain the comparison between facial measurement and stature.
2. To determine the relationship between facial measurements and stature in male and female participants.

Materials and Methods

After obtaining the ethical clearance from Institutional ethics committee,informed written consent was obtained from the study participants and cross sectional study was done on 400 medical students & others who are of South Indian origin. Study was conducted by getting ethical clearance from Yenepoya University Ethics Committee *(YUEC 276/17/12/2014)*. Materials used were measuring tape, digital vernier caliper, spreading caliper and stadiometer.

SAMPLE SIZE FORMULA:

Sample size was derived by the formula $n = 1+2C(s/d)^2$.

Where C = (za+z1-b)2 . If we take d = 1, then n = 391.18, n approximated to 400.

INCLUSION CRITERIA:

Healthy subjects in the age group of 18 to 25 those who are of south Indian in origin& who have signed the consent form.Age and place of origin was confirmed from validated Government Identityproof.

EXCLUSION CRITERIA:

1. Participants who have underwent any cranial or facial interventions.
2. Participants with any congenital or acquired cranio facial defects.
3. Participants with deformity in lower limbs.
4. Participants who have deformity in vertebral column.

METHODS OF COLLECTION OF DATA:

All measurements were consistently recorded by a single researcher to ensure uniformity. To mitigate diurnal variation, all measurements were taken simultaneously. To minimize measurement errors, the average of two measurements was calculated. The recorded parameters included stature, as well as five cephalo-facial measurements: Maximum head length, Maximum head breadth, Horizontal circumference, Bigonial breadth, and Morphological facial length.

DATA ANALYSIS

Regression modeling was used for estimation. Data analysis was performed by SPSS (version 17) for windows. Alpha value was set as 0.05. Microsoft excel, word was used to generate graph and tables.

Results

Total of 400 students actively participated in the study, evenly divided between 200 males and 200 females. These participants fell within the age range of 18 to 25 years. Analysis revealed that the percentage of male participants was higher in the 22-year age group (29%) and lower in the 25-year age group (2%). Conversely, the percentage of female participants was higher in the 19-year age group (26%) and lower in the 23-year age group (4%).Statistical examination of the mean ages for the study subjects indicated significant differences between genders (males: 21.42±1.71; females: 20.62±1.90), with a p-value of less than 0.0001. The corresponding t-value was 4.447.

In terms of mean height, a substantial and statistically significant difference was observed between males (171.66±5.75) and females (153.55±11.22) with a p-value below 0.001. The associated t-value was calculated as 20.314.

Further exploration of gender disparities in morphological features unveiled significant differences in Bigonial Diameter (males: 11.62±1.43; females: 9.89±1.29), and Morphological Facial Length (males: 11.45±0.68; females: 10.47±1.16). These differences were statistically significant with a p-value less than 0.0001.

The recorded stature exhibited a notable difference between males (184.20) and females (175.50), with males having a higher stature. Notably, morphological facial length (13.30) was higher in females, while in males bigonial breadth (14.30) was greater.

All correlations between these morphological features and stature were found to be statistically significant, with p-values less than 0.0001. Specifically, the correlation coefficients between Bigonial diameter measurements with stature is 0.613 in males & 0.731 in females. The correlation coefficients between facial length measurements with stature is 0.673 in males & 0.728 in females.

TABLE 1: FREQUENCY OF MALES ACCORDING TO AGE.

MALES	FREQUENCY
18 Year	8
19 Year	26
20 Year	38
21 Year	10
22 Year	58
23 Year	44
24 Year	12
25 Year	4

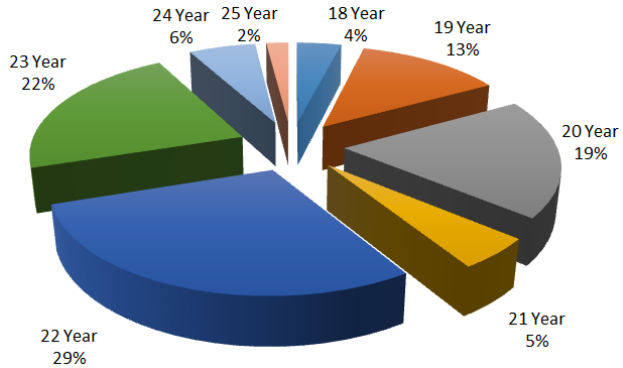

FIG 1: FREQUENCY OF MALE PARTICIPANTS ACCORDING TO AGE.

Percentage of male participants where more in age group of 22 years (29%) and less in 25 years (2%).

TABLE 2: FREQUENCY OF FEMALES ACCORDING TO AGE.

FEMALES	FREQUENCY
18 Year	20
19 Year	52
20 Year	30
21 Year	45
22 Year	22
23 Year	8
24 Year	13
25 Year	10

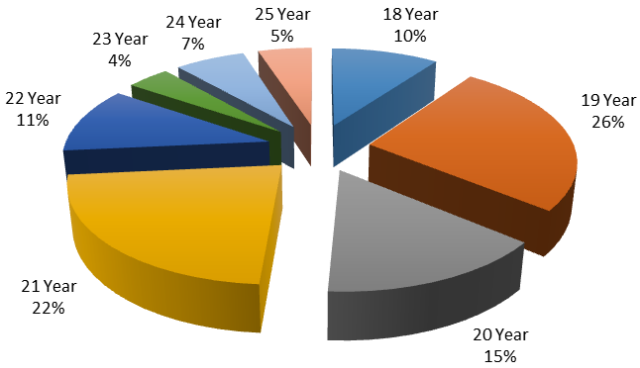

FIG 2: FREQUENCY OF FEMALE PARTICIPANTS ACCORDING TO AGE.

Percentage of female participants where more in age group of 19 years (26%) and less in 23 years (4%).

TABLE 3: COMPARISION OF MALES AND FEMALE AGE GROUP.

AGE	MALES	FEMALES
18 Year	8	20
19 Year	26	52
20 Year	38	30
21 Year	10	45
22 Year	58	22
23 Year	44	8
24 Year	12	13
25 Year	4	10

Male participants were more in number in age groups of 20 years, 22 years, and 23 years. Rest all age group females were more in numbers.

TABLE 4: DESCRIPTIVE STATISTICS FOR AGE, STATURE, CEPHALIC AND FACIAL MEASUREMENTS.

Variables	Gender	Minimum	Maximum	Mean	Std Dev	S.E. Mean	t value	p value
Age	Male	18.00	25.00	21.42	1.71	0.12	4.447	< 0.0001
	Female	18.00	25.00	20.62	1.90	0.13		
Stature	Male	158.00	184.20	171.66	5.75	0.41	20.314	< 0.0001
	Female	138.10	175.50	153.55	11.22	0.79		
Bigonial diameter	Male	8.10	14.30	11.62	1.43	0.10	12.623	< 0.0001
	Female	8.10	13.80	9.89	1.29	0.09		
Morphological Facial length	Male	9.80	12.80	11.45	.68	0.05	10.261	< 0.0001

TABLE 5: CORRELATION COEFFICIENT BETWEEN STATURE WITH CRANIAL & FACIAL DIMENSIONS

Parameter	Male		Female	
	Corr. Co-eff.	p value	Corr. Co-eff.	p value
Stature Vs Bigonial diameter	0.613	< 0.0001	0.731	< 0.0001
Stature Vs Morphological facial length	0.673	< 0.0001	0.728	< 0.0001

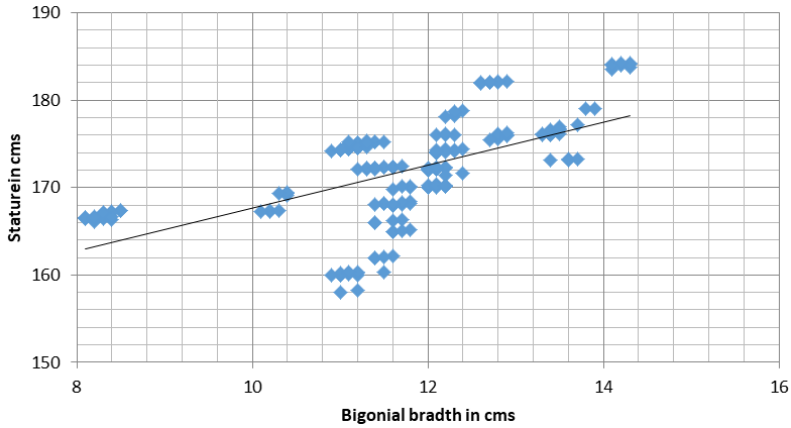

FIG 3: STATURE & BIGONIAL BREADTH MALES (r = 0.613).

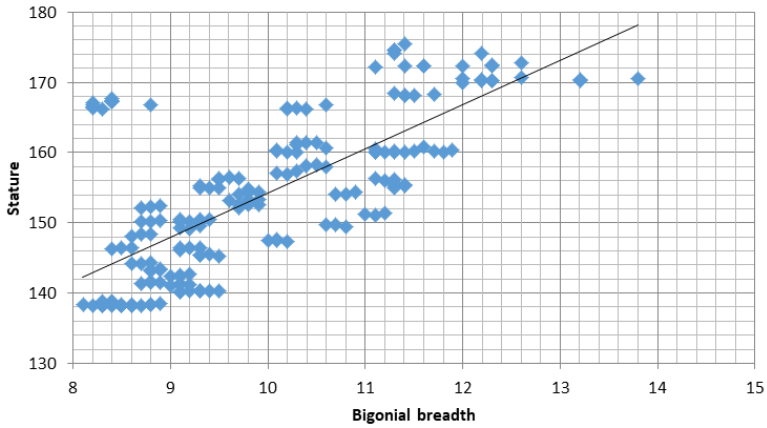

FIG 4: STATURE & BIGONIAL BREADTH IN FEMALES (r = 0.731).

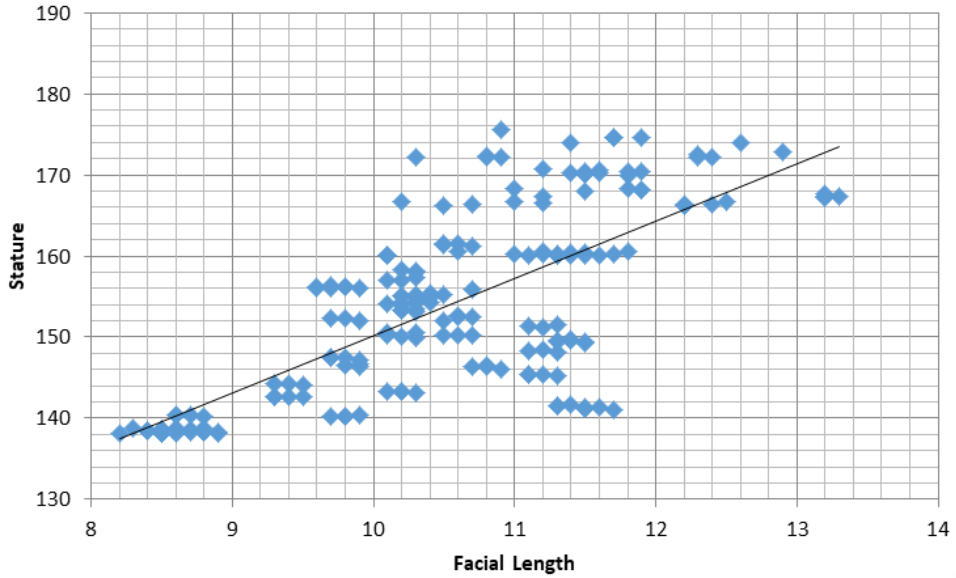

FIG 5: STATURE & FACIAL LENGTH IN MALES (r = 0.673).

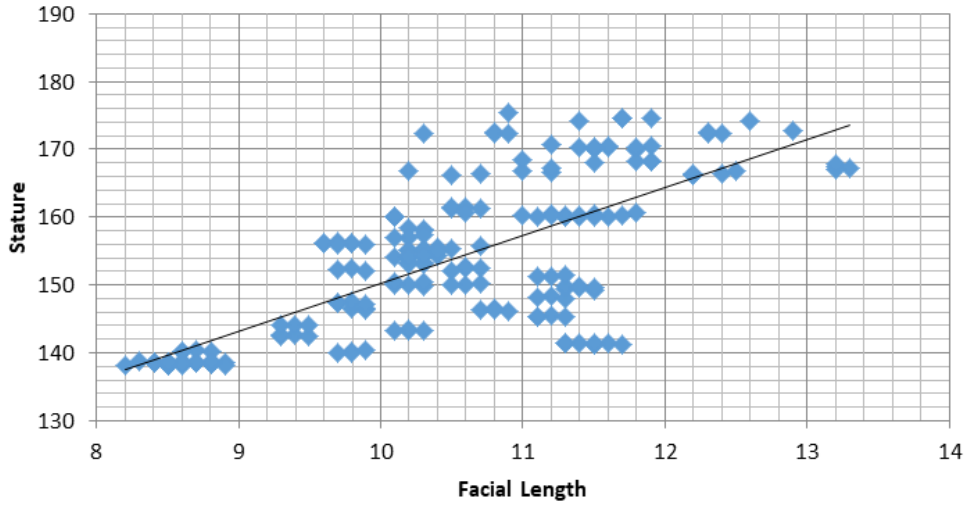

FIG 6: STATURE & FACIAL LENGTH IN FEMALES (r = 0.728).

SUMMARY OF REGRESSION EQUATIONS

1. Regression equation for prediction of stature from bigonial diameter:
   - For male: 142.99 + 2.466 x bigonial diameter
   - For female: 91.067 + 6.314 x bigonial diameter
2. Regression equation for prediction of stature from morphological facial length:
   - For male: 106.825 + 5.664 x facial length
   - For female:79.439 + 6.082 x facial length

Discussion

The primary objective of this study was to establish a comprehensive comparison between facial measurements and stature, aiming to identify and quantify correlations between these variables. A total of 400 samples were meticulously examined, and measurements, including stature, Bigonial Diameter, and Morphological Facial Length, were diligently recorded. To ensure accuracy and minimize potential errors, all measurements were conducted by the same researcher at a consistent time, and the averages of two measurements were taken for each parameter.

The mean ages of the study subjects were consistent between males (21±) and females (21±), and the statistical analysis indicated no significant difference between the two genders. However, the mean height of the study population displayed a noteworthy and statistically significant difference ($p<0.001$) between sexes, with recorded stature being higher in males. When examining specific measurements, Morphological Facial Length was observed to be higher in females, while in males, Bigonial Breadth exhibited greater values. Importantly, both males and females demonstrated significant correlations for all measurements with stature, emphasizing the relevance of these morphological features in understanding and predicting stature variations within the study population.

Although coefficient correlation was varying, study was consistent with other live percutaneous studies done by studies done by, Patil KR[22] (2005), Jibonkumar[13] (2008), Krishan K[16] (2008), Akhter Z[4] (2009), Ilayaperuma I[12] (2010), Singh R[27] (2013), Mounika S[20] (2015), Khan MA[15] (2015) and Garg P[10] (2016). Females had higher coefficient correlation than males which was consistent with the study done by Garg P[10] (2016) on medical students of Jaipur, Rajasthan. But study done by Colmenares GG[28] (2015) on Colombian population showed that female measurements had no correlation with stature.

In present study, morphological facial length was found to have more correlation with stature. This finding was consistent with study done by Colmenares GG[28] (2015) on Colombian population. But study done by Krishan K[16] (2008) on Gujjar population in India, showed facial length had the least correlation to stature. Study done by Jibonkumar[13] (2006) on male Kabuis from Imphal, Manipur showed low correlation between facial length and stature. These divergent results underscore the importance of considering population-specific variations in the relationship between morphological facial features and stature, highlighting the need for region-specific studies to capture the nuances in such associations.

Conclusion

This study makes a significant contribution to forensic anthropology by elucidating the correlation between specific facial measurements and stature. It addresses the crucial question of the feasibility of estimating stature from the cranium in the South Indian population. In situations involving incomplete remains, each identified factor becomes a pivotal indicator of an individual's identity. Stature, in particular, emerges as a key determinant capable of offering circumstantial or presumptive identification, ultimately leading to a positive and conclusive identification. This insight enhances the forensic toolkit, providing valuable implications for cases where comprehensive identification is imperative.

For the accuracy of the equations, further study should be conducted on a larger population. This would also help in determining to what extent the equations may overestimate or underestimate the shortest and tallest individuals in the population, respectively, and whether new equations need to be calculated for use at these extremes.

Conflict of Interest: Authors do not have any conflict of interest

Sourse of Funding: No funding Provided

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