Journal of Population Therapeutics & Clinical Pharmacology

"ESTIMATION OF STATURE HEIGHT FROM THE FACIAL DIMENSION"

Dr. Vandana Tewari[1], Nilesh Sharma[2*], Dr. Rahul srivastava[3]

[1]Professor Department of anatomy Rama medical college Kanpur
[2*]M.Sc. Scholar Department of anatomy Rama medical college Kanpur
Email id (nileshsharma091999@gmail.com)
[3]Assistant professor Department of anatomy Rama medical college Kanpur

*Corresponding authors: Nilesh Sharma
*M.Sc. Scholar Department of anatomy Rama medical college Kanpur
Email id (nileshsharma091999@gmail.com)

Abstract
Background
Facial parameters play a crucial role in determining the shape of the face, which can be classified into various types such as Hypereuryprosopic (very broad face), Euryprosopic (broad face), Mesoprosopic (round face), Leptoprosopic (long face), & Hyperleptoprosopic (very long face). These facial parameters are influenced by several factors such as environment, sex, age, culture, ethnicity, and food habits. The morphological facial characteristics also play an important role in orthodontic treatment

Material and Method:- The study was meticulously conducted in the Department of Anatomy, RAMA Medical Sciences Kanpur, Uttar Pradesh. It encompassed 400 subjects, evenly distributed between males and females, aged 18 to 25. The research commenced after obtaining institutional and ethical committee clearance, and written consent was secured from all the subjects, ensuring the study's integrity and adherence to ethical standards.

Result:- The facial length is significantly longer in males than in females. The mean facial length is 10.85 cm in males and 10.04 cm in females.
The facial breadth is also higher in males than in females. The mean facial breadth is 12.30 cm in males, whereas it is 12.04 cm in females.

Conclusion:- the study derived a regression formula for calculating an individual's height from facial length and breadth for both males and females. Additionally, the study found that both facial length and breadth are higher in males than in females.

Keywords:-
Facial height, forensic, identification, stature height

Introduction
Facial parameters play a crucial role in determining the shape of the face, which can be classified into various types such as Hypereuryprosopic (very broad face), Euryprosopic (broad face), Mesoprosopic

(round face), Leptoprosopic (long face), & Hyperleptoprosopic (very long face). These facial parameters are influenced by several factors such as environment, sex, age, culture, ethnicity, and food habits.[1]

The morphological facial characteristics also play an important role in orthodontic treatment.[2] The change in facial parameters between parents, offspring, and siblings can be a sign of genetic transmission of inherited characteristics.[3] Facial parameters have significant importance in various techniques, especially in the process of facial reconstruction. These precise measurements can assist forensic artists in reconstructing an accurate and detailed facial structure.[4]

Anthropometry plays a crucial role in identifying individuals in the field of forensic science, especially in cases of natural calamities such as earthquakes, landslides, and accidents like aircraft crashes, road traffic accidents, and railway incidents. The science behind anthropometry helps in accurately identifying deceased individuals based on various body measurements and physical characteristics, aiding in the process of investigation and justice.[5]

Several studies have been conducted to estimate the height of individuals from facial dimensions in different population groups across India[6]. However, there has been a dearth of such studies in the North Indian population. To address this gap, a new study was conducted to investigate the correlation between height and facial parameters in North India.

Material and Method
The study was meticulously conducted in the Department of Anatomy, RAMA Medical Sciences Kanpur, Uttar Pradesh. It encompassed 400 subjects, evenly distributed between males and females, aged 18 to 25. The research commenced after obtaining institutional and ethical committee clearance, and written consent was secured from all the subjects, ensuring the study's integrity and adherence to ethical standards.

Inclusion criteria:
•Healthy subject of 18 to 25 years age.
•No history of facial trauma.

Exclusion criteria:
•Subjects with spinal deformities like kyphosis, lordosis and scoliosis.
•Subjects with craniofacial deformities (Congenital or acquired).
The following Instruments were used Stadiometer, Digital Vernier caliper

Landmarks:-
Zygion (Z):- The lateralmost point on the zygomatic arch.
Nasion (N):- It is the point where frontonasal and internasal sutures meet.
Gnathion (GN):- It is a lowermost median point on the lower border of the mandible.
Vertex (V):- The highest point of the head, in the mid-sagittal plane.

METHODS:-
Written consent was taken from each subject. Height and facial parameters were measured with anatomical landmarks, keeping the head in the Frankfurt plane.

Height:- Height was measured from the vertex to the heel with the help of a Stadiometer in centimeters. (Fig-1)

Facial length:- It is the distance between nasion to gnathion measured in centimeters. The

measurements were taken with the help of a digital vernier caliper with the subject sitting on a chair in a relaxed condition. (Fig-2)

Facial breadth:- It is the distance between the region of both sides of the face measured in centimeters, with the help of a digital vernier caliper. (Fig-3)

Result

Table- 1 shows that the correlation coefficient (r) between height and facial length in males is 0.186. The mean value with a standard deviation of height is 170±6.39, and the mean facial length is 10.85±0.69. There is, thus, a positive correlation between height and facial length in males.

S. NO	PARAMETERS	NO OF SUBJECTS	MEAN±SD	CORRELATION COEFFICIENT (r)	INFERENCE
1	Height	200	170±6.39		
2	Facial Length	200	10.85±0.69	0.186	Positive

Table- 2 shows that the correlation coefficient (r) between height and facial breadth in males is 0.097. The mean value with a standard deviation of height is 170.55±6.39, and the mean facial breadth is 12.30±0.71. There is thus a positive correlation between height and facial breadth in males

S. NO	PARAMETERS	NO OF SUBJECTS	MEAN±SD	CORRELATION COEFFICIENT (r)	INFERENCE
1	Height	200	170.55±6.39		
2	Facial breadth	200	12.30±0.71	0.097	Positive

Table 3 shows that the correlation coefficient (r) between height and facial length in females is 0.023. The mean height value with a standard deviation of height is 156.98±6.21, and the mean facial length is 10.04±0.59. Thus, there is a positive correlation of height with facial length in females.

S. NO	PARAMETERS	NO OF SUBJECTS	MEAN±SD	CORRELATION COEFFICIENT (r)	INFERENCE
1	Height	200	156.98±6.21		
2	Facial Length	200	10.04±0.59	0.223	Positive

Table-4 shows that the correlation coefficient (r) between height and facial breadth in females is 0.154. The mean value with standard deviation of height is 156.98±6.21 and mean facial breadth is 12.04±0.64. There is thus a positive correlation of height with facial breadth in females.

S. NO	PARAMETERS	NO OF SUBJECTS	MEAN±SD	CORRELATION COEFFICIENT (r)	INFERENCE
1	Height	200	156.98±6.21		
2	Facial breadth	200	12.04±0.64	0.154	Positive

Table 5 Regression formulae for calculating the Height from facial length in males and females

Males	$Y_1 = 7.416 + 0.20x_1$
Females	$Y_2 = 6.709 + 0.021x_2$

Where Y_1 is estimated height in males Y_2 is estimated height in females x_1 is facial length in males x_2 is facial length in females

Table 6- shows derived regression formulae for Height from facial breadth in males and females.
$Y_3 = 1.466 + 0.11x_3$ $Y_4 = 9.558 + .016x_4$

Where, Y_3 is estimated height in males Y_4 is estimated height in females x_3 is facial breadth in males x_4 is facial breadth in females

Males	$Y_3 = 1.466 + 0.11x_3$
Females	$Y_4 = 9.558 + .016x_4$

Where,
Y_3 is estimated height in males Y_4 is estimated height in females x_3 is facial breadthin males
x_4 is facial breadth in females

Table 7 shows the sexual dimorphism of height with facial parameters. The average height of males is significantly higher than that of females. The mean height in males is 170.55 cm, and the mean height in females is 156.98 cm.

S.NO	PARAMETERS	GENDER	NO OF SUBJECTS	MIN –MAX (cm)	MEAN ±SD	p- VALUE
1	HEIGHT	MALE	200	153.1-185.2	170.55±6.39	
		FEMALE	200	138-176	156.98±6.21	<0.0001
2	FACIAL LENGTH	MALE	200	8.85-12.3	10.85±0.69	
		FEMALE	200	8.025-11.92	10.04±0.59	<0.0001
3	FACIAL BREADTH	MALE	200	10.125-14.275	12.30±0.71	
		FEMALE	200	9.67-14.65	12.04±0.64	<0.0001
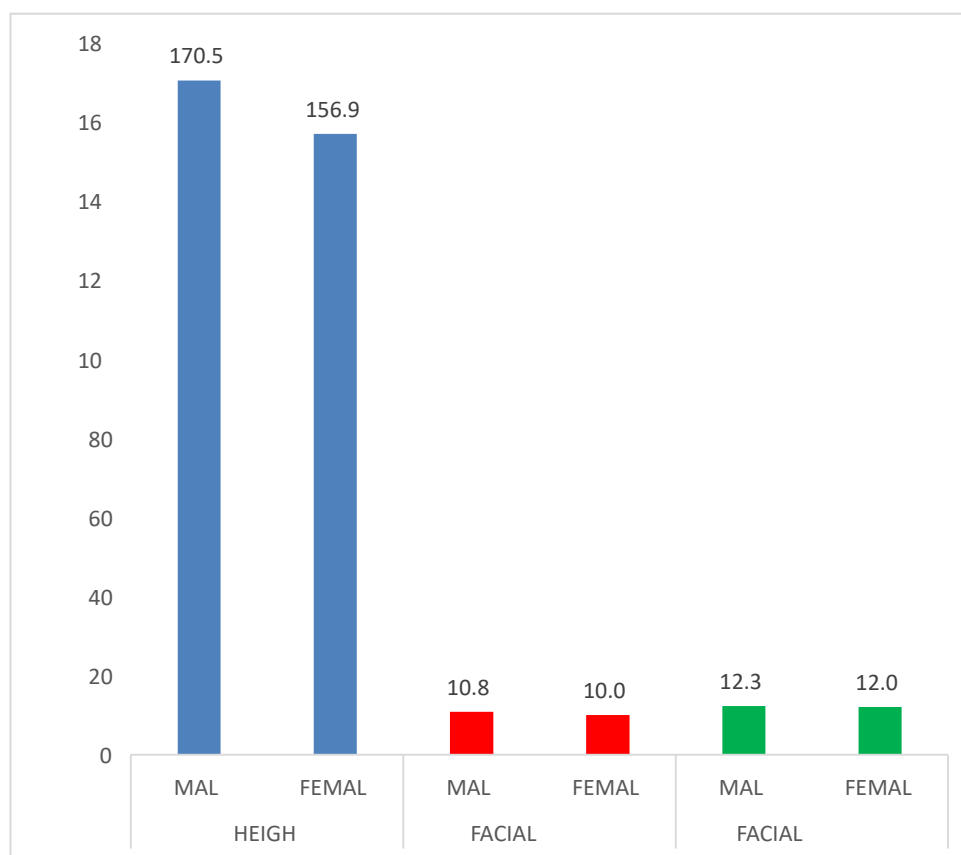
Bar diagram showing sexual dimorphism of height with facial parameters
he result of the present study entitled **"Correlation of height with facial parameters"** is as follows:
The facial length is significantly longer in males than in females. The mean facial length is 10.85 cm in males and 10.04 cm in females.

The facial breadth is also more in males as compared to females. Mean facial breadth is 12.30 cm in males, whereas it is 12.04 cm in females.

The above result proves that there is a positive correlation between facial parameters and height of an individual.

Discussion

The study, "Correlation of height with facial parameters in North Indian population," was conducted at Rama medical college Kanpur on individuals aged between 18 and 25. It established a statistically significant positive correlation between facial parameters, namely facial length and facial breadth, and an individual's height.

In the study, the mean facial length of males was compared with the mean facial length of the Gujjars, Gujrat, and Kattunayakan populations. Results showed that the facial length in the Gujjars, Gujrat, and Kattunayakan populations was higher than the study's findings, whereas the facial length in the Nepalese, Haryanvi, and Sangali populations was greater.

Similarly, the mean facial length of females was compared with the mean facial length of the Gujrat and Kattunayakan populations. Results showed that the facial length in the female population of

Gujrat and Kattunayakan was higher than the study's findings, whereas the facial length in the Mumbai, Nepalese, Haryanvi, and Sangali female populations was greater.

Additionally, the study compared the mean facial breadth of males with the mean facial breadth of the Mumbai and Mauritius male populations.

Results showed that the facial breadth in the Mumbai and Mauritius male populations was higher than the study's findings, whereas the facial breadth in the Nepalese and Sangali male populations was greater.

Lastly, the mean facial breadth of females in the present study was compared with the mean facial breadth of the Mumbai & Mauritius populations. It is observedhat their facial breadth was higher than in our study but smaller than in the Sangali and Nepalese female population.

Table 8 Comparison of facial length and facial breadth of the present study with various studies.

S. NO	AUTHORS	POPULATION	HEIGHT (cm)		FACIAL LENGTH (cm)		FACIAL BREADTH (cm)	
			MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
1	K. Krishan 2008 7	Gujjars	172.31		10.81			
2	Kamil Khan et al.2018[34]	Sitapur		158.93		10.38		
3	Shah T et al.2015[3]	Gujarati	164.3	150.56	9.85	8.54		
4	Jaiswal A et al.2016[9]	Kattunayakan	165.66	151.04	5.72	5.54		
5	SinchaL Datta et al.2017[11]	Mumbai	166.57	156.41	11.19	10.34	12.90	12.09
6	C Pokhrel et al.2018[1]	Nepales	167.42	155.18	12.14	11.53	12.04	11.36
7	Swami et al.2015[2]	Haryanvi	168.71	155.18	11.07	10.21		
8	Agnohotri et al.2011[40]	Mauritius	173.40	157.36	11.58	11.00	14.39	14.01
10	**Present study**	North India	170.55	156.98	10.85	10.04	12.30	12.04

Several studies have been conducted to investigate the relationship between stature and cephalofacial dimensions. A study conducted on the Mauritius population by Gnihotri et al. found a weak positive correlation between stature and cephalofacial dimensions. On the other hand, a study conducted by Datta et al. on the Mumbai population concluded that there was no significant correlation between the two. Similarly, a study conducted on the Gujrat population by Shah et al. also found no significant correlation between cephalofacial dimensions and stature.

However, Swami et al. found a statistically significant positive correlation between stature and facial measurements. Another study by Khan et al. also found a positive correlation between stature and facial height. Pokhrel et al. also concluded that there was a statistically significant positive correlation between facial parameters and stature.

Table No-9 Comparison of correlation coefficient of facial parameters with height: a present study with other studies

AUTHORS	SAMPLE SIZE	GENDER	FACIAL LENGTH		FACIAL BREADTH		CORRELATION WITH HEIGHT
			r- value	p- value	r- value	p- value	
Datta et al.2017[11]	503	MALE	0.1669	<0.01	0.2502	<0.001	Negative
		FEMALE	0.2721	<0.001	0.2495	<0.001	
Shah T et al.2015[3]	901	MALE	0.044	0.00	0.032	0.00	Negative
		FEMALE	0.032	0.00	0.048	0.00	
		FEMALE	0.164	0.164	0.276	0.017	
Khan K et al.2018[12]	43	MALE					Positive
		FEMALE	0.93	<0.001			
Swami et al.2015[2]	800	MALE	0.177	<0.01	0.164	<0.01	Positive
		FEMALE	0.15	<0.01	0.119	<0.01	
C. Pokhrel et al.2018[1]	312	MALE	0.327	<0.001	0.175	<0.001	Positive
		FEMALE	0.205	<0.001	0.255	<0.001	
Mane et al.2018[8]	518	MALE	0.387	<0.001	0.208	<0.001	Positive
		FEMALE	0.427	<0.001	0.272	<0.001	
Present study	400	MALE	0.186	<0.0001	0.097	<0.0001	Positive
		FEMALE	0.223	<0.0001	0.154	<0.0001	

Thus, it is concluded that in the **present study** there is a statistically significant positive correlation between facial length, facial breadth and height of an individual.

CONCLUSION

he study titled "Correlation of height with facial parameters" was conducted on a sample of 400 subjects (200 males and 200 females) aged between 18 to 25 years at Rama Medical College & Research, Kanpur, Uttar Pradesh, after obtaining ethical clearance and consent. The study used a Stadiometer to measure height and a Digital Vernier Caliper to measure facial parameters. The study derived a regression formula for calculating an individual's height from facial length and breadth for both males and females. Additionally, the study found that both facial length and breadth are higher in males than in females.

Reference

1. Pokhrel, C., Jha, C.B., Niraula, S.R., Pokharel, P.R. Reliability of stature estimation from facial anthropometric parameters. International Journal of Therapeutic Applications.2018;35:1-6.
2. Swami, S., Kumar, M., Patnaik, V.V.G. Estimation of stature from facial anthropometric measurements in 800 adult Haryanvi baniyas. International Journal of Basic and Applied medical Science.2015;5(1): 122-132.
3. Shah, T., Patel, M.N., Nath, S., Bhise, R.S., Menon, S.K. Estimation of Stature from Cephalo-Facial Dimensions by Regression Analysis in Gujarati Population. Journal Indian Acad Forensic Medicine 2015; 37(3):253-257.
4. Krishan, K. Anthropometery in forensic medicine and forensic science- forensic anthropometry. International Journal of Forensic Science. 2007;2:1-8.
5. Patil, K.R., Mody, R.N. Determination of sex by discriminate function analysis and stature by regression analysis; a lateral cephalometry study. Forensic Science International.2005;147(3):175-180.
6. Mounika, S., Yuvarajbabu, K. Estimation of Stature from the Facial Width among South Indians. Journal of Pharmaceutical Sciences and Research.2015;7(6):353-354.
7. Krishan, K. Estimation of stature from cephalo-facial anthropometry in North Indian Population. Forensic Science International.2008;18(52):1-
8. Mane, V.A., Patil, A.D., Mane, A.Y. Realibility of stature estimation from Facial Parameters among Sangali District Population. International Journal of Scientific Research & Review. 2018; 7: 99-104.
9. Jarvas, E., Anibeze, C.I.P., Uloneme, G.C., Anyanwu, G.E. Stature Estimation Using Cephalofacial Anthropometry in Igbos population of Nigeria. Journal of Forensic Research.2015;6(4):295-299.
10. IIayperuma, I. On prediction of personal stature from cranial dimensions.

11. Int. J. Morphol.2010; 28(4):1135-1140.
12. Datta, S., Sawant, V.G. Correlation of Stature with facial measurements of Maharashtrian adults. Indian J of Basic and Applied Med Res.2017;6:305-311.
13. Khan, K., Alam, T., Srivatava , R.K., Purohit, K., Raheel, S. Adult stature reconstruction from cephalo-facial dimension in Indian Females. International journal of Anatomy Research. 2018;6(2.1): 5104-09.