

# Prediction of Cephalic Phenotype by Measuring Cephalic Index and to Study the Correlation between Cephalic Phenotype and Cephalic Index

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## ABSTRACT

**Background:** Dimensional relationship between body segments and stature has been the focus of scientists for many years. Therefore, prediction of stature from cranial remains is vital in establishing the identity of an unknown individual. The present study was conducted to predict cephalic phenotype by measuring cephalic index and to study the correlation between cephalic phenotype and cephalic index.

**Materials and Methods:** In this prospective observational study 600 patients attending in the Outpatient department of medical, dental and other college's students of age group 21-25 years in various colleges at Jaipur, India were selected for the study. Data regarding Head length and Head breadth was collected. A complete physical examination was carried out. The data collected was compiled, tabulated, analyzed and subjected to statistical tests. Analysis was done using SPSS.

**Results:** In the present study total sample size was 600 in which 300 were male and 300 were female. Mean age of females was found to be 22.82 and mean age of males was found to be 22.96. In our study age group selected was 21 to 25 years where 21 were the minimum age found in our study and 25 being the maximum. In present study result showed that of the Dolicocephalic Male was 7.66%, Mesocephalic Male was 82 %, Brachycephalic Male was 10.33%. Dolicocephalic

Female 25 was 8.33%, Mesocephalic Female was 84 %, Brachycephalic Female was 7.66% ,Dolicocephalic (Male & female) was 8%, Mesocephalic (Male & female) was 83 %, Brachycephalic (Male & female) 54 was. 9% .Significant difference was observed in cephalic index between males and females.

**Conclusion:** Our study concluded that cephalic index showed significant difference.

**Keywords:** Cephalic Phenotype, Cephalic Index, Brachycephalic.

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## Article History:

Received: 09-08-2019, Revised: 02-09-2019, Accepted: 30-09-2019

### Access this article online

Website: <a href="http://www.ijmrp.com">www.ijmrp.com</a>	Quick Response code 
DOI: 10.21276/ijmrp.2019.5.5.057	

## INTRODUCTION

Estimation of stature and cephalic phenotype has been considered as one of the parameters of forensic anthropology and will assist in establishing the biological profile of a person. Growth is measured by measuring the height of a person, which is a sum of the length of certain bones and appendages of the body, represent certain relation with form of proportions to the total stature & cephalic phenotype.<sup>1</sup> Estimation of stature and cephalic phenotype has a significant importance in the field of forensic anthropometry. Establishing the identity of an individual from mutilated, decomposed, & amputated body fragments has become an important necessity in recent times due to natural disasters like terror attacks, bomb blasts, mass accidents, wars, plane crashes etc. stature evaluation and phenotype based on the lengths of the limb bones and cephalic parameters, is the one of the oldest in the history of anthropology.<sup>2</sup> The estimation of height and cephalic index from various parameters has been done by

many workers. They have derived their own formulae for calculating stature from long bones.<sup>3</sup> Cephalic index also called as cranial index or Index of breadth is one of the important parameter that helps to differentiate between different human races. It can also be utilized to find out sexual differences. The cephalic index was defined by Swedish professor of Anatomy Anders Retzius (1796–1860) and first used in physical anthropology to classify ancient human remains found in Europe.<sup>4</sup> Now a days, cephalic index is commonly used to describe individuals' appearances and for estimating the age of fetuses for legal and obstetrical reasons. Comparison of changes in cephalic index between parents, offspring and siblings can give a clue to genetic transmission of inherited characters. Cephalic Index is the terminology used in Anthropology for having in easy identifying module or numerical to distinguish the given sample or individual, either into race or sex or even as identity of the individual.<sup>4</sup>

Cephalic index is computed by the following formula: Cephalic index = Maximum cranial breadth x 100/ maximum cranial length. The head shapes are classified according to cephalic indices as dolichocephalic (up to 74.9), mesocephalic (75-79.9) and brachycephalic (80-84.9).<sup>4</sup> The present study was conducted

- i. To predict the cephalic phenotype by measuring the cephalic index.
- ii. To correlate the cephalic index with cephalic phenotype.

**MATERIALS AND METHODS**

In this prospective observational study 600 patients attending in the Outpatient department of medical, dental and other college's students of age group 21-25 years in various colleges at Jaipur, India were selected for the study. Out of 600 patients 300 were females and 300 were males. The study was conducted over the period of 2 years. The study was approved by the Institutional ethical committee. An informed consent was obtained from each of the patients to examine the cases for inclusion in this study. Patients with similar socio-economic status, patients with age group of students ranged from 21 to 25 years, students of various colleges at Jaipur were included in the study. Measurements were taken at fixed time between 2 to 5 p.m. to eliminate the discrepancies due to diurnal variation. Patients with age above 25 and below 21 year, persons with abnormal gigantism and dwarfism were excluded from the study. Time other than between 2 to 5 p.m. excluded.

**Calculation of Sample Size**

- ▶ Population size (for finite population correction factor or fpc) (N): 100000
- ▶ Hypothesized % frequency of outcome factor in the population (p): 50% +/- 5
- ▶ Confidence limits as % of 100 (absolute +/- %) (d): 5%
- ▶ Design effect (for cluster surveys - DEFF): 1
- ▶ Simple size  $n = [DEFF * NP(1-p)] / [(d^2 / Z^2_{1-\alpha/2} * (N-1) + p(1-p))]$

**Data Collection**

1. Head length: Between two craniometric point – Glabella and Inion
2. Head breadth: Between the most lateral points on the Parietal bones.

Head length measures the straight distance between glabella and Inion.

Head breadth measured between the most lateral points on the Parietal bones.

A complete physical examination was carried out.

Cephalic Index = (Head Breadth/ Head Length) \* 100

On the basis of international anatomical descriptions<sup>5</sup> types of head were classified as:-

Head shape	Range of Cephalic index (CI) (%)
Ultra dolichocephalic	55.0-59.9
Hyper dolichocephalic	60.0-64.9
Dolichocephalic	65.0-74.9
Mesocephalic	75.0-79.9
Brachycephalic	80.0-84.9
Hyper brachycephalic	85.0-89.9
Ultra brachycephalic	90.0-94.9

The data collected was compiled, tabulated, analyzed and subjected to statistical tests. Analysis was done using SPSS.

**RESULTS**

In the present study total sample size was 600 in which 300 were male and 300 were female.

In current study mean age of females was found to be 22.82 and mean age of males was found to be 22.96. In our study age group selected was 21 to 25 years where 21 were the minimum age found in our study and 25 being the maximum.

In present study result showed that of the 600 samples 160 persons were aged 21 years i.e. 26.6%, 175 persons were aged 22 years i.e. 29.16%, 91 were aged 23 years i.e. 15.1%, 85 were aged 24 years i.e. 14.1% whereas 89 were aged 25 years i.e. 14.83%. In present study most common age group was found to be 22 years and 24 years was the least common age group.

In present study result showed that of the Dolichocephalic Male 23 i.e. 7.66%, Mesocephalic Male 246 i.e. 82 %, Brachycephalic Male 31 i.e. 10.33%. Dolichocephalic Female 25 i.e. 8.33%, Mesocephalic Female 252 i.e. 84 %, Brachycephalic Female 23 i.e. 7.66%, Dolichocephalic (Male & female) 48 i.e. 8%, (Mesocephalic Male & female) 498 i.e. 83 %, Brachycephalic (Male & female) 54 i.e. 9%.

Significant difference was observed in cephalic index between males and females.

**Table 1: Gender Distribution**

Gender	Number	%
Male	300	50%
Female	300	50%
Total	600	100

**Table 2: Demographic Characteristics of The Study Population**

Sex	Mean	N	SD	Min	Max	Median
Female	22.82	300	1.415	21	25	23.00
Male	22.96	300	1.419	21	25	23.00
Total	22.89	600	1.418	21	25	23.00

**Table 3: Age Distribution**

Age in years	Number (n=600)	%
21	160	26.6%
22	175	29.16%
23	91	15.1%
24	85	14.1%
25	89	14.83%

**Table 4: Comparison for Cephalic Phenotype among Male and Female**

Head Shape	Male (N=300)	Female (N=300)	Total (N=600)
Dolichocephalic	23	25	48
Mesocephalic	246	252	498
Brachycephalic	31	23	54

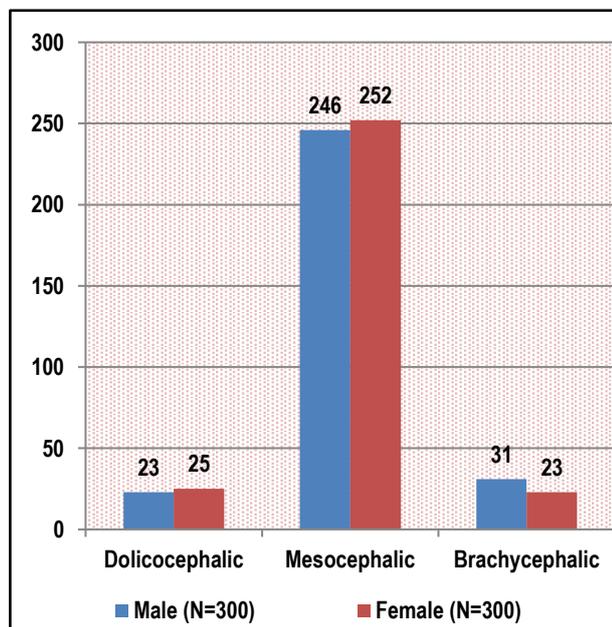
Table 5: Comparison for Cephalic Index among Male and Female

Cephalic index	Mean	P value
Male	77.89 ± 2.468	<0.001*
Female	77.77±2.019	

Table 6: Comparison of Study Parameters Between Male And Female And Total

SEX	Cephalic Index	Parameter
Female	Mean	77.77
	N	300
	Std. Deviation	2.019
	Minimum	70.53
	Maximum	84.43
	Median	78.02
	Variance	4.076
Male	Mean	77.89
	N	300
	Std. Deviation	2.468
	Minimum	74
	Maximum	87.69
	Median	78.04
	Variance	6.093
t test		1.81
p value		<0.001*
Total	Mean	77.83
	N	600
	Std. Deviation	2.253
	Minimum	70.46
	Maximum	87.69
	Median	78.33
	Variance	5.079

Graph 1: Comparison of Cephalic Phenotype between Male and Female



**DISCUSSION**

Cranial measurements have several advantages over others, as the anatomical landmarks are standard, well defined and easy to locate, making them highly predictable and reproducible. In present study 600 medical, dental and other college students, 300 male and 300 female was undertaken to predict the cephalic phenotype based on cephalic index. In present study 50% study population were males and 50% were females.

In our study mean age of females was found to be 22.82 and mean age of males was found to be 22.96. In our study age group selected was 21 to 25 years where 21 were the minimum age found in our study and 25 being the maximum. In present study result showed that of the 600 samples 160 patients were aged 21 years i.e. 26.6%, 175 patients were aged 22 years i.e. 29.16%, 91 were aged 23 years i.e. 15.1%, 85 were aged 24 years i.e. 14.1% whereas 89 were aged 25 years i.e. 14.83%. In present study most common age group was found to be 22 years and 24 years was the least common age group.

Chandimal Km et al studied 373(107 male & 206 female) Sri Lankan population with 20-37 yrs. age groups. This study results shown mean cephalic index male is 79.40±4.95 and female is 81.0±6.04. Study shown dolicocephalic male 20% & female 17%, mesocephalic male 41% & female 34%, brachycephalic male 29% & female 32%, hyper brachycephalic male 10% & female 17%. This study is observed statically significant (p<0.05).<sup>6</sup>

Ilayperuma et al. et al studied 400 (220 male & 180 female) Sri Lankan population with 20-23 yrs. age groups. This study results shown mean cephalic index male is 78.40 and female is 78.53. This study show dolicocephalic male 35% & female 23.07%, mesocephalic male 30% & female 23.07%, brachycephalic male 20% & female 46.15%, hyper brachycephalic male 15% & female 7.69%. This study is observed statically significant (p<0.05).<sup>7</sup>

Babatundeolayemi et al studied 700 (350 male & 350 female) Nigerian population with 11-20 yrs. age groups. This study results shown mean cephalic index male is 77.21±2.41 and female is 76.50±2.67. Study shown dolicocephalic 11.4%, mesocephalic 78.6%, brachycephalic 9 %, hyper brachycephalic 0.4%. This study is observed statically significant (p<0.05).<sup>8</sup> Oria et al. studied 500 (250 male & 250 female) Nigerian population with 18-45 yrs. age groups. This study results shown mean cephalic index male is 81.58±1.12 and female is 79.23±0.88. Study shown dolicocephalic male 4% & female 26%, mesocephalic male 24.8% & female 33.6%, brachycephalic male 31.2% & female 20.8%, hyper brachycephalic male 12.8% & female 12.8%. This study is observed statically significant (p<0.05).<sup>9</sup>

Anil kumar et al studied 80 (45 male & 35 female) Delhi population groups. This study results shown mean cephalic index male is 73.75±3.56 and female is 75.22±5.15. Study shown dolicocephalic male 53.33% & female 31.42%, mesocephalic male 42.22% & female 62.85%, brachycephalic male 2.22% & female 2.22%, hyper brachycephalic male 2.22% & female 2.22%. This study is observed statically significant (p<0.001).<sup>10</sup>

Mahesh Kumar et al studied 600(300 male & 300 female) Haryanvi population groups. This study results shown mean cephalic index male is 66.72±7.64 and female is 72.25±5.03. Study shown dolicocephalic male 85% & female 69.34%, mesocephalic male 10.67% & female 23.34%, brachycephalic male 3.33% & female 6.33%, hyper brachycephalic male 1% & female 1%. This study is observed statically significant (p<0.05).<sup>11</sup>

In present studies 600(300 male & 300 female) Jaipur, Rajasthani population with 21-25 yrs. age groups. This study results shown mean cephalic index male is  $77.89 \pm 2.468$  and female is  $77.77 \pm 2.019$ . study shown dolicocephalic male 7.66% & female 8.33%, mesocephalic male 82% & female 84%, brachycephalic male 10.33% & female 7.66%. This study is observed statically significant ( $p < 0.001$ ).

## CONCLUSION

Dimensional relationship between body segments and stature exhibit consistent ratios relative to the stature and these ratios are linked to age, gender and race. Racial characters are best defined in the skull. Therefore, prediction of stature from cranial remains is vital in establishing the identity of an unknown individual. However in our study cephalic index showed significant further.

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**Source of Support:** Nil. **Conflict of Interest:** None Declared.

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**Cite this article as:** Santosh Kumar, Chandrakala Agarwal. Prediction of Cephalic Phenotype by Measuring Cephalic Index and to Study the Correlation between Cephalic Phenotype and Cephalic Index. *Int J Med Res Prof*. 2019 Sept; 5(5):257-60. DOI:10.21276/ijmrp.2019.5.5.057