Section: Anatomy

Original Research Article

COMPARATIVE EVALUATION OF CANTHAL AND CEPHALIC MORPHOMETY AMONG MALES AND FEMALES

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Abstract

Background: Anthropometry is a branch involving morphometric study of living subjects. Measurement of different parts of human skull and face is called craniofacial anthropometry. Cephalic parameters can be used for investigating craniofacial abnormalities, systemic syndromes, racial or gender differences and growth pattern of children. The aim of this study was to compare canthal andcephalic parameters among the male and female participants. **Materials and Methods:** This cross-sectional study with 200 participants was conducted in the department of Anatomy…… The canthal parameters (medial canthal and lateral canthal distances) and cephalic parameters (maximum head length, maximum head breadth and cephalic index) were measured using vernier calliper and compared using students't -test. **Result:** The medial canthal distance, medial canthal distance and canthal index were significantly high in male participants. The mean head length, head breadth and cephalic index were also significantly high in male participants compared to female participants (P<0.001). **Conclusion:** This study showed high values of canthal parameters in male participants, thus exhibiting sexual dimorphism. Cephalic index also showed variation based on age and gender. The information from this study may be fruitful in craniofacial evaluation, forensic investigations forensic and genetic sectors.

INTRODUCTION

Anthropometry denotes metrical study of human body in order to understand diversity in human body make up.[1] Craniometry, one of the emerging branches of anthropometry, involves measurement of head and face dimensions.[2] Such measurements serve as integral part in evaluation of human growth, ethnic variation for clinical diagnosis, craniofacial surgical procedures and syndromology.[3]

Canthus is defined as an angle where eyelids (upper and lower) meet.[4] Canthal measurements are useful in identification of hyper telorism, naso-orbitoethmoid injury and traumatic telecanthism. Medical canthal distance is the measure of distance between medical canthi while distance from one lateral canthus to another lateral canthus comprises lateral canthus distance. Medical part of inferior and superior eyelids form of medical canthus while lateral part of inferior and superior eyelids form canthus.[5] Previous studies have shown that the canthal values of an individual vary with age and gender. The values become stable within 20-30 years of age.

From craniometric measurements, cephalic index can also be calculated. It is also known as cranial index, a percentage of skull width to skull length.[6] The breadth is the measure of distance between two eminence of skull, while the length of skull is the distance between glabella and inion (external occipital protuberance.[7]

Based on cephalic index shapes of head may be categorised as:

- Dilocephalic (CI ≤ 75): long head
- Mesocephalic (CI: 75 – 79.9): medium skull
- Brachycephalic (CI: 80-84.9): short skull
- Hyperbrachycephalic (CI: 85-89.9)

Abnormal cephalic indices are associated with pathological disorders such as primary microcephaly, hydrocephalus, craniosynostosis etc.[8] Accurate head measurement aids in close monitoring of child's growth and help clinicians to diagnosis any deviations from normal structure thus allowing for early intervention.[9] Cranial measurements are considered more easy and cost effective compared to more sophisticated techniques. Hence, the present study was aimed at evaluation of canthal and cephalic measurements in male and female participants of age 4-60 years.

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MATERIALS AND METHODS

This cross-sectional study included 200 participants of which 100 were males and 100 were females. The study was conducted in the Department of Anatomy, ……. After the ethical approval participants were enrolled for the study considering following inclusion and exclusion criteria.

Inclusion Criteria

- Male and female participants > 4 years of age.
- Participants with normal craniofacial structures.

Exclusion Criteria

- Participants with any craniofacial defects
- Participants with symptoms or presence of telecanthus or epi-canthus.

The participants were divided into two groups based on age. The canthal parameters assessed were medial canthal distance, lateral canthal distance and canthal index while cephalic parameters assessed were maximum head length, maximum head breadth and cephalic index. Measurement was done with Vernier caliper and care was taken to avoid the injury during measurements. The tip of the caliper sanitised with methylated spirit soaked after measurement of cranial parameters of each individual to prevent cross transmission.

Medial canthal distance: Distance between one medial canthus to the other.

Lateral canthal distance: Distance between one lateral canthus to the other.

Maximum head length: It is the distance between glabella (most prominent region in frontal bone above nose) and inion (most prominent part in occipital bone).

Maximum head breadth: It is the distance between the most lateral points of the parietal bone.

Canthus index (CTI)=

$$\frac{\text{Medial canthus distance X 100}}{\text{Lateral canthal distance}}$$

Cephalic index (CPI)

$$\text{CPI} = \frac{\text{Maximum head breadth X 100}}{\text{Maximum head length}}$$

All the values were documented. Statistical analysis was done with SPSS 20 version. students't test was applied to evaluate the difference of mean. A p value below 0.05 was statistically significant.

RESULTS

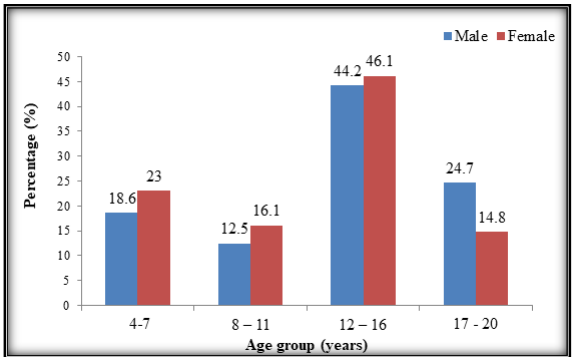

Figure 1: Distribution of participants in the age group of 4-20 years

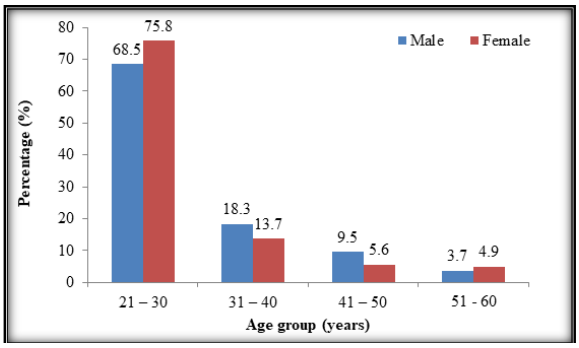

Figure 2: Distribution of participants in the age group of more than 20 years

Table 1: Comparison of Medial and Lateral canthal distance.

Canthal distance	Gender	N	Mean ± SD	P
Medial	Male	100	1.91 ± 0.21	0.004*
	Female	100	1.53 ± 0.27	
Lateral	Male	100	8.23 ± 0.52	<0.001*
	Female	100	7.22 ± 0.67	

Table 2: Comparison of head length and head breadth

Cephalic parameters	Gender	N	Mean ± SD	P
Head breadth	Male	100	18.3 ± 2.04	<0.001*
	Female	100	16.18 ± 1.81	
Head length	Male	100	33.5 ± 3.58	<0.001
	Female	100	30.11 ± 1.12	

Table 3: Comparison of canthal index and cephalic

Index	Gender	N	Mean ± SD	P
Canthal	Male	100	20.43 ± 2.14	<0.001*
	Female	100	18.55 ± 3.29	
Cephalic	Male	100	51.48 ± 7.88	<0.001*
	Female	100	44.72 ± 4.9	

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Table 4: Comparison of canthal index based on age and gender in the participants

Age (years)	Male		Female	
	N	Mean ± SD	N	Mean ± SD
4-7	10	17.14 ± 2.71	18	16.29 ± 1.42
8 – 11	6	19.1 ± 2.02	14	16.8 ± 2.25
12 – 16	21	20.3 ± 2.41	25	20.05 ± 2.21
17 - 20	13	19.9 ± 2.49	15	19.11 ± 3.27
21 – 30	35	21.24 ± 4.42	13	18.2 ± 3.11
31 – 40	9	20.44 ± 3.3	8	20.82 ± 3.37
41 – 50	3	18.9 ± 2.83	3	18.75 ± 2.68
51 - 60	3	19.3 ± 3.02	4	20.15 ± 3.16
Total	100		100	

Table 5: Comparison of cephalic index based on age and gender in the participants

Age (years)	Mean ± SD		Mean ± SD	
	N	Male	N	Female
4-7	10	39.17 ± 7.45	18	34.31 ± 1.21
8 – 11	6	49.59 ± 2.59	14	35.54 ± 4.73
12 – 16	21	45.51 ± 7.53	25	32.24 ± 2.17
17 - 20	13	34.11 ± 4.16	15	31.25 ± 1.58
21 – 30	35	54.03 ± 4.81	13	51.67 ± 4.14
31 – 40	9	53.1 ± 3.7	8	56.39 ± 2.11
41 – 50	3	50.65 ± 3.31	3	51.54± 2.38
51 - 60	3	50.27 ± 3.17	4	50.08 ± 2.1
Total	100		100	

The value of medial canthal distance and lateral and canthal distance was significantly different between male and female participants (table 1). The medial canthal distance and lateral canthal distances were significantly high in males compared to females. The cephalic parameters (length and breadth) were significantly high in males compared to females (table 2, $p<0.001$). Similarly, canthal index and cephalic index were significantly high in male participants (table 3). Table 4 shows comparative evaluation of canthal indexon the basis of gender and age respectively. Canthal index was high in age group 21-30 years in males and 31-40 years in females. Table 5 shows comparative evaluation of cephalic index on the basis of gender and age respectively. In males, cephalic index was high in age group of 21-30 years while in females it was high in age group of 31-40 years.

DISCUSSION

Morphometric analysis of craniofacial structures has diagnostic importance in assessment of facial defects, facial trauma post traumatic deformities, congenital malformations macrocephaly, hypotelorism, hypertelorism etc. In this study the canthal parameters (medial canthal distance, lateral canthal distance and canthal index) and cephalic parameters (maximum head length, maximum head breadth and cephalic index) were compared in the participants.

The mean medial canthal distance, lateral canthal distance and canthal index were significantly high in male participants compared to females. These results were in accordance with the study of Erica N et al,[10] Oladipo GS et al,[11] Osunwoke EA et al.[12] However, in contrast, a study conducted in undergraduate medical students in Nepal showed that medial canthal distance was high in females.[13]

The mean head breadth and head length in this study were higher in males. The values obtained for head breadth corresponded with that of Yagain VK et al for females.[14] The length measurements were also in accordance with that of onges study.[15] In this study the cephalic index was significantly high in males compared to females. The cephalic index obtained in this study was lower that observed (79.8) in Fawehinmi's study.[16] Likewise Olotu and Oladipo et al reported cephalic index of 80.98 for males and 78.24 for females which were higher than that observed in our study. Such alterations of cephalic index values in different studies may be attributed to environmental, racial, genetic and nutritional factors.[17] Factors that are involved in normal bone growth and suture potency, along with hormonal factors, hyperthyroidism and maternal smoking leads to early fusion of sutures.[18] The mean cephalic index is important for facial reconstruction and individual identification.[19]

The difference in length of canthal parameters indicate the presence of sexual dimorphism which was in accordance to the previous researches.[20,21] Such difference in craniofacial metrices may be attributed to inheritence pattern and the effects of male sex hormone testosterone. Testosterone increases dimensions and mass of bone and muscles, hence males possess higher craniofacial dimensions causing differences in male and female craniofacial measurements.[12]

CONCLUSION

The data generated in this study may be helpful in understanding differential orbitocranial growth patterns based on gender. It may be also helpful in

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the field of craniofacial surgery for the management of craniofacial deformities and diagnosis of craniofacial syndromes. It could be also be useful in determining stature and gender of an individual. However, further studies with larger sample size are needed to achieve broaderconcept.

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