

**“STUDY OF CEPHALIC INDEX IN NORTH INDIAN AND SOUTH  
INDIAN STUDENTS OF PHASE-I MBBS, SHRI B.M. PATIL MEDICAL  
COLLEGE, HOSPITAL AND RESEARCH CENTRE BIJAPUR”**

**BY**

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SUBMITTED TO THE BLDE UNIVERSITY  
BIJAPUR**



**IN PARTIAL FULFILLMENT  
OF THE REQUIREMENTS FOR THE DEGREE OF**

**DOCTOR OF MEDICINE  
IN  
ANATOMY**

**UNDER THE GUIDANCE OF**

**DR B.M BANNUR<sub>MS</sub>  
PROFESSOR**

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**B.L.D.E.U.'S  
SHRI. B. M. PATIL MEDICAL COLLEGE,  
HOSPITAL AND RESEARCH CENTRE, BIJAPUR -KARNATAKA  
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## LIST OF ABBREVIATIONS USED

BPD	-	Biparietal diameter
BC	-	Brachycephalic
CI	-	Cephalic Index
cm	-	Centimeter
CP	-	Cephalic phenotype
DC	-	Dolichocephalic
e.g.	-	Example
Etc.	-	Etcetera
eu	-	Eurion
F	-	Female
g	-	Glabella
HBC	-	Hyperbrachycephalic
HDC	-	Hyperdolichocephalic
i.e.,	-	That is
M	-	Male
MC	-	Mesocephalic
mm	-	Millimeter
No.	-	Number
OP	-	Opisthocranium
SD	-	Standard deviation
UBC	-	Ultrabrachycephalic
UDC	-	Ultradolichocephalic



## **ABSTRACT**

### **Background and objectives:**

Cephalic Index is an important parameter for deciding the race and sex of an individual. The present study was undertaken

1. To calculate the Cephalic Index in students of Phase-I MBBS, Shri B.M. Patil Medical College Hospital and Research Centre, Bijapur and to compare the Cephalic Index of male and female sex.
2. To compare the Cephalic Index in North Indian and South Indian students.

### **Methods**

The study was conducted on students of Phase-I, MBBS of Shri B.M. Patil Medical College Hospital and Research Centre, Bijapur. 300 students were taken for the present study. For the comparison of Cephalic Index between North Indian and South Indian students, they were categorized according to North Indian and South Indian states.

Maximum head breadth and maximum head length were taken using spreading caliper and Cephalic Index was determined.

### **Results and Interpretation:**

The mean Cephalic Index in study group was 76.65. In North Indian students mean Cephalic Index was 74.44. In South Indian students, mean Cephalic Index was 77.71.

The mean Cephalic Index in case of males was 76.57 and that of females was 76.63. Cephalic Index in North Indian males was 74.16 and females was 74.87. Cephalic Index in South Indian males was 78.26 and females was 77.24.

Dolicocephalic type of head shape predominated among North Indian students, where as mesocephalic type was predominant in South Indian students.

**Conclusion:**

Significant gender difference and geographical variation was observed in present study. The result of present study will be of utmost importance in Forensic Medicine, Anthropology and in Genetics.

**Keywords:** Cephalic Index; Head-length; Head-breadth; Dolicocephalic; Mesocephalic

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## INTRODUCTION

It is a fact that no two persons are ever alike in all their measurable characters. Every person tends to undergo change in varying degrees from birth to death, in health and in disease. Persons living under different conditions, and members of different ethnic groups and the offspring of unions between them, present interesting differences in bodily form and proportions frequently. Anthropometry constitutes the means of giving quantitative expression to the variations which different individuals or traits exhibit.

Presently anthropometry forms a good tool of evolutionary significance. It is used to assess nutritional status, measurement of human body at various ages based on the concept that an appropriate measurement should reflect any morphological variation occurring to significant functional or physiological change.

Cephalic Index is the terminology used in anthropology for having an easy identifying module or numerical to distinguish the given sample or individual, either into race or sex or even as identity of the individual.

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>1</sup>

A Professor of Anatomy and Physiology at Karolinske Medic Kiruugiska Institute, Stockholm (1824-60), he invented in 1842, the Cranial / Cephalic Index as convenient preliminary indication of the race to which an individual belonged.

As it has been learnt from the available literature, Cephalic Index is affected by geographical, racial, gender and age factors.

For several generations physical anthropologists measured skulls in the belief that thereby they were likely to obtain results which would enable them to trace the relationships between the races of mankind. It was believed that the form of the skull in particular remained constant in each race and that different races typically showed different cranial indices. Hence, all one had to do was to measure skulls, calculate the indices, and draw the more or less obvious conclusion.

In the first place, the form of head is now known to be subject to change through environmental influences.

In the second place, there are great differences in intragroup variability in all measurements and indices among the ethnic groups of mankind.

In the third place, closely related groups and individuals frequently exhibit considerable differences in cranial measurements and indices, while more distinctly related groups and individuals exhibit striking likeness.

Finally, the Cephalic Index of a whole group will change in the course of time as the trend towards brachycephalization in man abundantly shows.

Recently morphological methods have been employed for devising proper equipment for industry and defence forces. Combining with Physiologists, Psychologists and Engineers, Anthropologists have helped in designing the spaceship for convenience of astronauts. They have made valuable contribution in the designing of aircrafts, uniforms and other specialized equipments for defence personnel. Anthropometric surveys provide norms about the physique of national populations. Trends of change are studied by such consecutive surveys for number of years. Estimates for some physiological functions like basal metabolism, vital capacity,



nutritional requirements etc. can be estimated by means of anthropometric data. They help indicate the need for medical and public health programmes.

In view of this, the present study was undertaken to determine the Cephalic Index in students of Phase –I MBBS Shri B.M.Patil Medical College, Hospital and research centre, Bijapur in order to know the distribution and role of geographical and sexual factors on Cephalic Index.

The results of this study will be of utmost importance in Pediatrics, Forensic Medicine, Plastic surgery, and Diagnostic comprehension between patient and normal population.

## **OBJECTIVES**

1. To calculate the Cephalic Index in students of Phase-I MBBS, Shri B.M. Patil Medical College Hospital and Research Centre, Bijapur and to compare the Cephalic Index of male and female sex.
2. To compare the Cephalic Index in North Indian and South Indian students.

## **REVIEW OF LITERATURE**

### **ORIGIN OF ANTHROPOMETRY**

The word “Anthropometry” was first used in seventeenth century by the German Physician Johann Sigismund Elsholtz for his graduation thesis titled “Anthropometria”. He also invented the anthropometer.<sup>2</sup>

The scientific anthropometry, however, began with Johann Friedrich Blumenbach (1752-1840) who laid the foundations of Craniology. He classified mankind into different races on the basis of skull-form as seen from above (norma – verticalis). He distinguished three types (i) square, (ii) long, and (iii) laterally compressed.

Broca, Flower and Turner further developed the study of skull on the foundations laid by Blumenbach.<sup>3</sup>

In 1882 Alphonse Bertillon, a French criminologist used measurements of the body for identification of repeat criminals. His method was called as the Bertillon system.<sup>4</sup>

One of the first attempts in this direction was made by Collignon in 1892, but without much success. The next attempt was made in the same year at the XII International Congress of Prehistoric Anthropology and Archaeology held at Moscow. A Committee consisting of Virchow, Anntchine, Bogdanov, Chartre, Kollman, Sergi, Maliev and Zogarff was formed for standardizing the craniometric and somatometric techniques. Although the Committee arrived at some conclusions, nothing substantial was done towards the unification of craniometric methods.

However, at the XIII International Congress of Prehistoric Anthropology and Archaeology, which was held at Monaco in 1906 an ‘International Agreement on Craniometry’ was prepared and circulated widely.

. In 1932, the International Committee for standardization of Anthropological Techniques was established in London. The Committee ventured to suggest that a standardized anatomical nomenclature be used in definition and best instruments be used for specified purposes.

During the 1940s anthropometry was used by William Sheldon when evaluating somatotypes, according to which characteristics of the body can be translated into characteristics of the mind. Inspired by Cesare Lombroso’s criminal anthropology, he also believed that criminality could be predicted according to the body type. The use of this anthropometry is also outdated. Because of his extensive reliance on photographs of nude Ivy League students for his work, Sheldon ran into considerable controversy when his work became public.<sup>5</sup>

Further attempts were made to review the new techniques from time to time.

To Rudolf Martin goes the credit of making an attempt to produce a complete textbook on Anthropology.

In 1918, Wider published “A Laboratory Manual of Physical Anthropometry” in English.

Since World War I anthropometry has been employed to give standard sizes for different kinds of equipment in defence services and industry. They have been

specially used by the air force. Special measurements were devised suited to the particular needs. Mention may be made in this connection of Morant, Hooton, White and Hertzberg, who along with a number of other anthropologists have not only added new dimensions to the anthropometry, but also defined measurements, improved techniques and devised new instruments.

The search for new avenues continues. Anthropometrists working in different laboratories of the world on varied topics are continuously devising new measurements as well as improving the old ones. Roentgenographic and photographic methods have been developed.<sup>3</sup>

#### **DIVISIONS OF ANTHROPOMETRY**

Anthropometry may conveniently be subdivided into the following sections:

Somatometry - Measurement of living body including head and face.

Osteometry - Measurement of the skeletal long and short bones,

Craniometry - Measurement of the skeletal brain cavity (Neurocranium) and face (Splanchnocranium).<sup>3</sup>

## **ANTHROPOMETRY TODAY**

Presently anthropometry forms a good tool of evolutionary significance. It is used to assess nutritional status, measurement of human body at various ages based on the concept that an appropriate measurement should reflect any morphological variation occurring to significant functional or physiological change.

Anthropometry forms a very important tool in ergonomics (study of man in relation to his working environment). It is concerned with dimensions, shape, proportions and formulation of the standard sizes and design for various equipments, clothes and furniture as per the various sizes of human body.

Fetal anthropometry has direct bearing on the assessment of fetal age where ultrasound plays an important role.

Anthropometry has occupied a distinct place in the field of medicine, selection of military personnel, manufacture of defence equipments, industrial purposes, criminal investigations, sports, various scientific analysis and investigation etc.

A recent advance in the field is that now Anthropologists take help of newer techniques like three-dimensional scan to collect data of the subject's body rather than directly taking measurements from the body. This is beneficial because they can use this scan to extract any measurements at any time.

## **ANATOMICAL CONSIDERATION OF SKULL**

The skull is the bony skeleton of the head and is the most complex osseous structure in the body. It is protective, shielding the brain, the organs of special senses and the cranial parts of the respiratory and digestive systems, and also provides attachments for many of the muscles of the head and neck, thus allowing for movements; of particular importance is movement of the lower jaw (mandible) which occurs at the temporomandibular joint. The marrow within the skull bones is a site of haemopoiesis, at least in the young skull.

The skull is composed of 28 separate bones, of which most are paired, but some in the median plane are single. Many of the bones are flat bones, consisting of two thin plate of compact bone enclosing a narrow layer of cancellous bone containing bone marrow. In terms of shape, however, the bones are far from flat and can show pronounced curvatures. The term diploe is used to describe the cancellous bone within the flat bones of the skull. The inner table is thinner and more brittle; the outer table is generally very resilient. Many bones are so thin that the tables are fused, for e.g. the vomer and pterygoid plates. The skull bones vary in thickness in different regions, but tend to be thinner where they are covered by muscles. The skull is thicker in some races, but no relationship exists between this and cranial capacity which on average is 1400 ml. In all races, the bone is thinner in women and children when compared with adult males.

The majority of bones in the skull are held firmly together by fibrous joints termed sutures. In the developing skull sutures allow for growth. Fusion across sutures (Synostosis) commences at 30 years, although its variability precludes using this information to determine age of skulls. The process of fusion commences on the

internal surface of the cranium and the sagittal suture is one of the first affected. At 40 years of age the sphenofrontal, lambdoid and occipitomastoid sutures close. In the facial region, the posterior part of the median palatine suture starts to close at 30 years, followed by the sutures around the nose. The squamosal, zygomaticofrontal and anterior part of the intermaxillary sutures rarely exhibit synostosis. Premature fusion of sutures during the early growth phase of the skull will result in various cranial abnormalities.

For ease of navigation, the skull can be subdivided into cranium and mandible, based upon the fact that, whereas most of the bones of the skull articulate by relatively fixed joints, the mandible is easily detached. The cranium may then itself be subdivided into a number of regions. These are: the cranial vault, which is the upper dome-like part of the skull and includes the skullcap or calvaria; the cranial base, which consists of the inferior surface of the skull extracranially and the floor of the orbital cavities and the nasal fossae; the tooth-bearing bones or jaws; the acoustic cavities which contain the middle and inner ears; and the cranial cavity which houses the brain. Alternatively, the skull can be divided into neurocranium and viscerocranium. The neurocranium is defined as that part of the skull which houses and protects brain and the organs of special sense, while the viscerocranium is associated with the cranial parts of the respiratory and digestive tracts.<sup>6</sup>

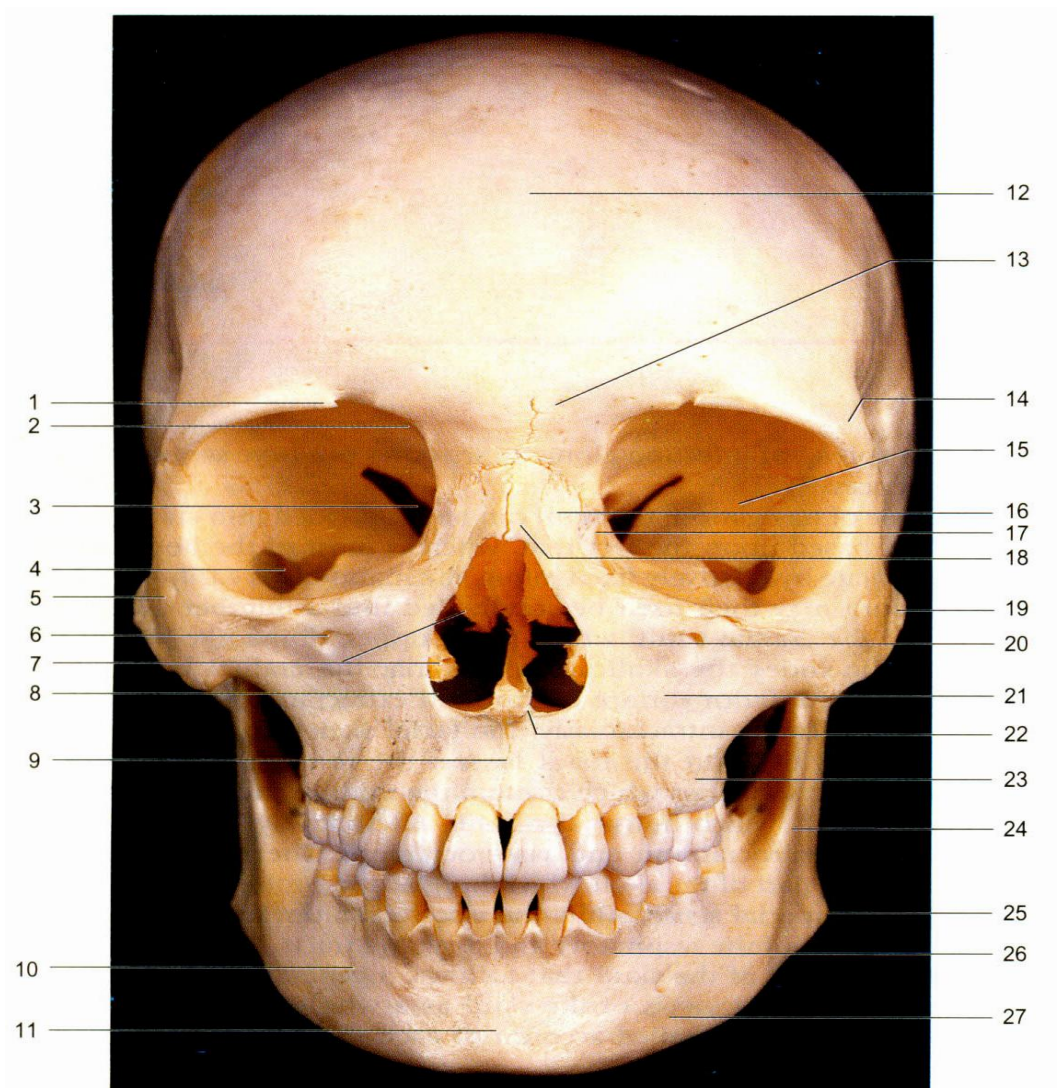


## **EXTERNAL APPEARANCE OF SKULL FOR MEASUREMENT OF CEPHALIC INDEX**

Anterior (Frontal) view: The upper part of the facial region is formed by the frontal bone. Supero-medial to each orbit is rounded superciliary arch, which is prominent in males. In between this there is a median elevation, which is called as glabella.

Glabella may show the remains of the interfrontal suture. This type of metopic frontal suture is present in about 9% adult skull, where it ascends to coronal suture, indicating that the frontal bone is the result of fusion of two halves that ossify independently.

Above each superciliary arch is slightly elevated frontal tuberosity. Just below the glabella where the nasal bones meet the frontal bone, is a depression at the frontonasal suture marking the root of nose.



- |                                        |                                       |
|----------------------------------------|---------------------------------------|
| 1. Supraorbital notch.                 | 15. Greater wing of sphenoid bone.    |
| 2. Frontal notch.                      | 16. Frontal process of maxilla.       |
| 3. Superior orbital fissure.           | 17. Lacrimal bone.                    |
| 4. Inferior orbital fissure.           | 18. Nasal bone.                       |
| 5. Zygomaticofacial foramen.           | 19. Zygomatic bone.                   |
| 6. Infraorbital foramen.               | 20. Nasal septum.                     |
| 7. Nasal conchae.                      | 21. Body of maxilla.                  |
| 8. Anterior nasal aperture.            | 22. Anterior nasal spine.             |
| 9. Intermaxillary suture.              | 23. Alveolus of maxilla (upper jaw).  |
| 10. Mental foramen.                    | 24. Ramus of mandible.                |
| 11. Mental protuberance.               | 25. Angle of mandible.                |
| 12. Frontal bone.                      | 26. Alveolus of mandible (lower jaw). |
| 13. Glabella.                          | 27. Body of mandible.                 |
| 14. Zygomatic process of frontal bone. |                                       |

**Fig. 1 : Frontal view of skull**

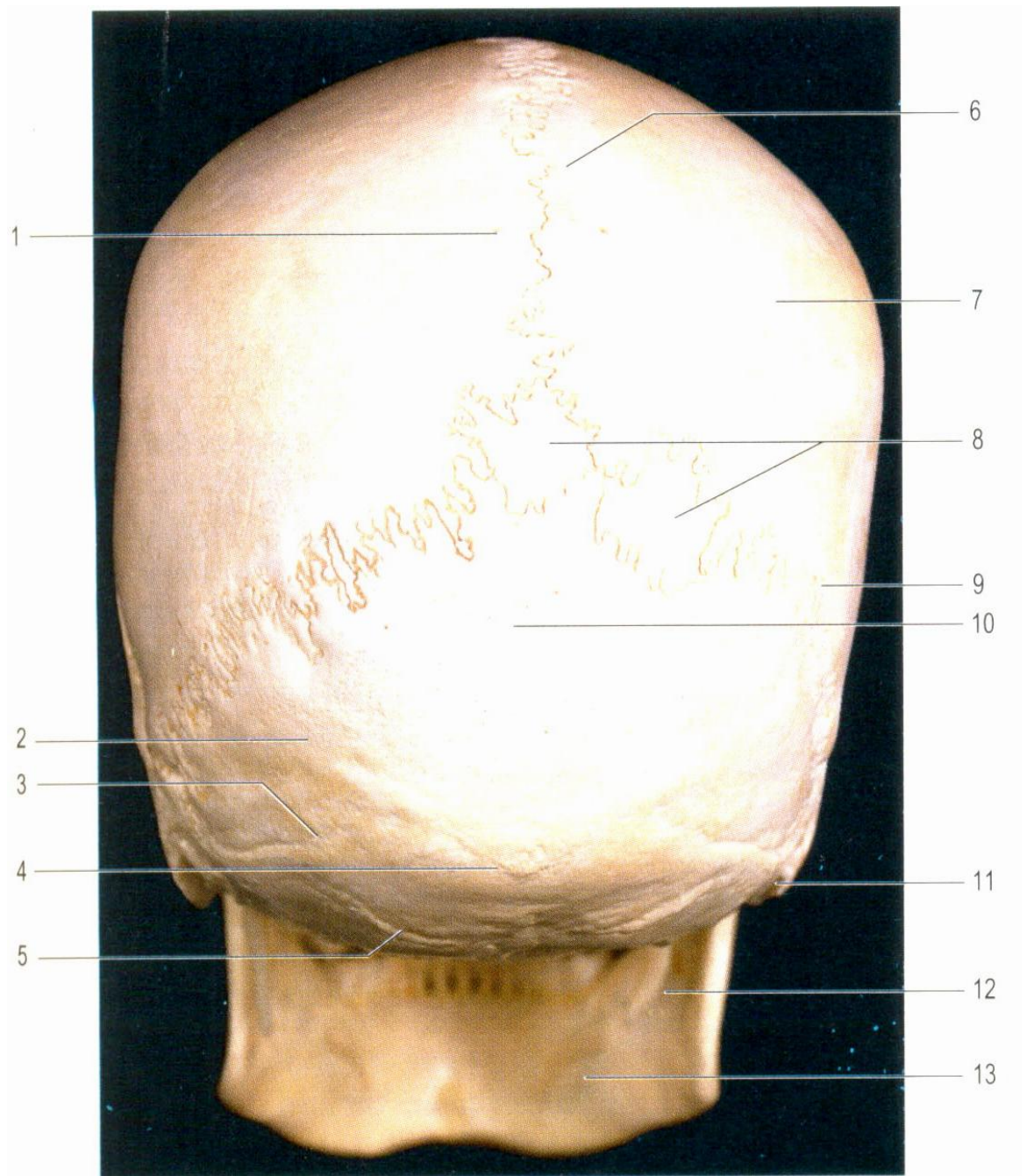
Posterior (occipital) view: The superolateral parts are formed by the parietal bones, while the temporal bones contribute the mastoid processes to inferolateral parts of the back of the skull. The parietal bones are separated from the occipital bone by the lambdoid suture.

The external occipital protuberance is a midline ridge or a distinct process on the occipital bone. Superior nuchal lines extend laterally, from the protuberance to a point above the mastoid process. Inferior nuchal lines run parallel to and below the superior nuchal lines, while supreme nuchal lines may sometimes be seen above the superior nuchal lines.

The external occipital protuberance, nuchal lines and roughened external surface of the occipital bone between the nuchal lines all afford attachment to muscles<sup>5</sup>

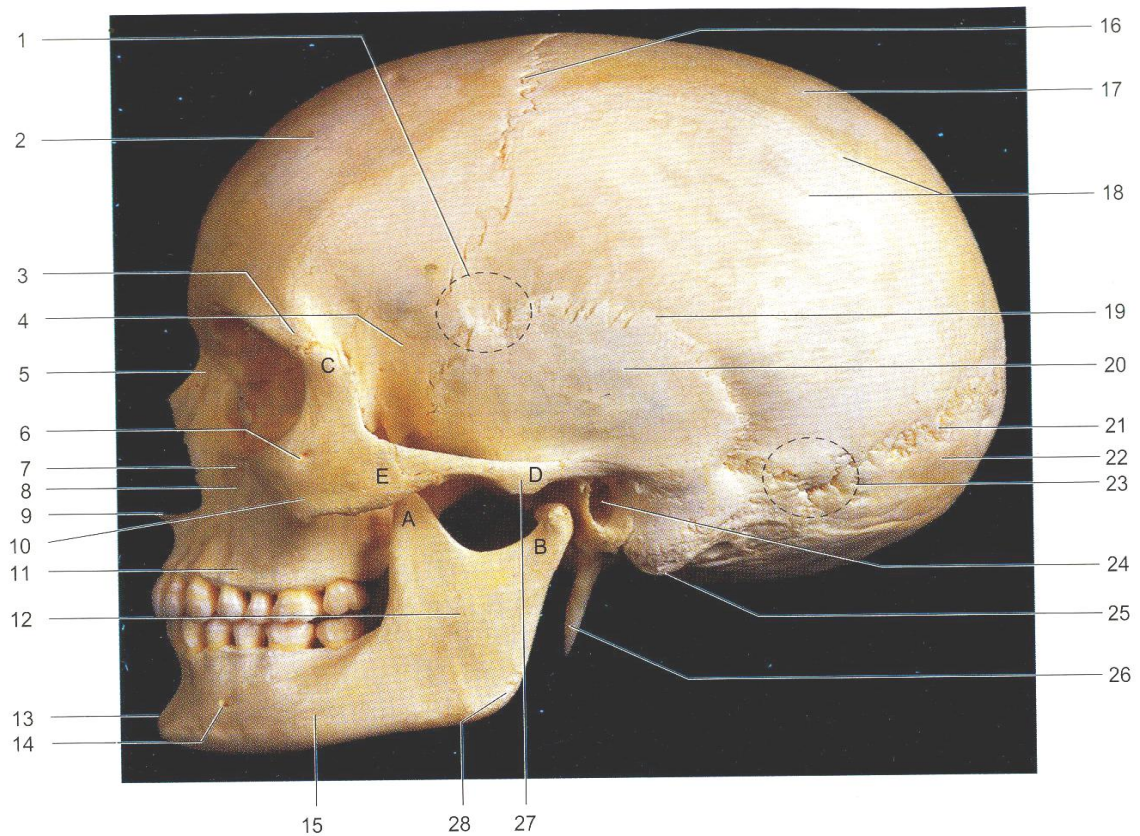
Lateral view: The skull, viewed from the side, can be subdivided into three zones : face (anterior); temporal and infratemporal fossae and zygomatic arch (intermediate); occipital region (posterior).

The two parietal bones form most of the cranial roof and sides of the skull. The external surface is convex and smooth, with a central parietal tuber (tuberosity).<sup>6</sup>



- |                                     |                                       |
|-------------------------------------|---------------------------------------|
| 1. Parietal foramen.                | 8. Sutural bones in region of lambda. |
| 2. Supreme nuchal line.             | 9. Lambdoid suture.                   |
| 3. Superior nuchal line.            | 10. Occipital bone (squamous part).   |
| 4. External occipital protuberance. | 11. Mastoid process of temporal bone. |
| 5. Inferior nuchal line.            | 12. Styloid process.                  |
| 6. Sagittal suture.                 | 13. Mandible.                         |
| 7. Parietal bone.                   |                                       |

**Fig. 2: Posterior view of skull**



- |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>1. Pterion.</li> <li>2. Frontal bone.</li> <li>3. Zygomatic process of frontal bone.</li> <li>4. Greater wing of sphenoid bone.</li> <li>5. Nasal bone.</li> <li>6. Zygomaticofacial foramen.</li> <li>7. Infraorbital foramen.</li> <li>8. Zygomatic process of maxilla.</li> <li>9. Anterior nasal spine.</li> <li>10. Zygomatic bone.</li> <li>11. Maxilla.</li> <li>12. Ramus of mandible.</li> <li>13. Mental protuberance.</li> <li>14. Mental foramen.</li> <li>15. Body of mandible.</li> </ul> | <ul style="list-style-type: none"> <li>16. Coronal suture.</li> <li>17. Parietal bone.</li> <li>18. Superior and inferior temporal lines.</li> <li>19. Squamosal suture.</li> <li>20. Squamous part of temporal bone.</li> <li>21. Lambdoid suture.</li> <li>22. Occipital bone.</li> <li>23. Asterion.</li> <li>24. External acoustic meatus and tympanic plate.</li> <li>25. Mastoid process of temporal bone.</li> <li>26. Styloid process of temporal bone.</li> <li>27. Zygomatic arch (zygomatic process of temporal bone).</li> <li>28. Angle of mandible.           <ul style="list-style-type: none"> <li>A. Coronoid process of mandible.</li> <li>B. Condylar process of mandible in mandibular fossa.</li> <li>C. Frontal process of zygomatic bone.</li> <li>D. Articular eminence.</li> <li>E. Temporal process of zygomatic bone.</li> </ul> </li> </ul> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Fig. 3: Lateral view of skull**

## **GROWTH OF THE SKULL**

It takes place in spurts, that means in discontinuous manner by three methods-

1. Cartilage replaced by bone;
2. Growth at the sutures;
3. Surface deposition of bone at the external surface associated with bony resorption at the internal surface.<sup>7</sup>

### **Growth of Vault**

Growth of vault is rapid during first year and slower towards the seventh, by which time it has reached almost adult dimensions. For most of this period, expansion is largely concentric: form is determined early in the first year, remaining thereafter largely unaltered. That shape of the vault is not directly related to cerebral growth but to genetic factors is supported by the great range of cranial indices and shapes in racial groups. During the first and early second year growth of the vault is mainly by ossification at apposed margins of bones, which possess an osteogenic layer accompanied by some acceleration and absorption of bone at surfaces to adapt to continually altering curvatures. Growth in breadth occurs at sagittal, sphenofrontal, sphenotemporal and occipitomastoid sutures and petro-occipital cartilaginous joints. Growth in height occurs at the frontozygomatic and squamosal sutures, pterion and asterion<sup>6</sup>.

### **Growth of Base of Skull**

Growth of base of skull is responsible for much of the cranial lengthening, mostly at the cartilaginous joints between the sphenoid and ethmoid, and especially between the sphenoid and occipital bones. Largely independent of cerebral growth, it continues at occipitosphenoid synchondrosis until 18-25 years. However, there are

some evidences that growth may cease at about 15 years. A pubertal growth spurt has been ascribed in both sexes, about 2 years earlier in females: considerable post pubertal growth up to 17.5 years in males has been described.<sup>6</sup>

## CEPHALIC INDEX

$$\text{Cephalic Index}^8 = \frac{\text{Maximum head breadth}}{\text{Maximum head length}} \times 100$$

Cephalic Index was studied by Franz Boas between 1910 and 1912 that most effectively challenged the value of the method. Franz Boas studied European born immigrants and their American born children and introduce the idea that environment could modify cranial morphology extensively<sup>9</sup>

Cephalic Index: is the maximum breadth of skull expressed as percentage of its maximum length. Maximum breadth is measured at 90<sup>0</sup> to the sagittal plane and is generally the distance between parietal eminences (eurion to eurion). Maximum length is measured from glabella (bony prominence between eyebrows and above the nasal depression) and most posterior point of the occipital bone (opisthocranium) in the mid sagittal line<sup>10</sup>.

Initially depending upon Cephalic Index, types of head and shapes were classified as follows<sup>10</sup>

**Table 1 : Classification of Cephalic phenotypes**

Head shape (Cephalic Phenotype)	Cephalic Index (CI) range in %
Dolichocephalic	CI < 74.9
Mesocephalic	75 < CI < 79.9
Brachycephalic	80 < CI < 84.9
Hyperbrachycephalic	85 < CI < 89.9 and CI < 89.9

According to Lebzelter and Saller<sup>10</sup>, head length and head breadth variants are as follows



**Table 2 : Head length variations**

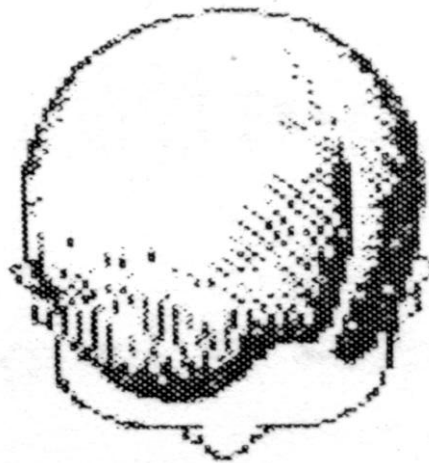
<b>Head type</b>	<b>Male (mm)</b>	<b>Female (mm)</b>
Very short	X-169	X-161
Short	170-177	162-169
Medium	178-185	170-176
Long	186-193	177-184
Very long	194-X	185-X

**Table 3 : Head breadth variations**

<b>Head type</b>	<b>Male (mm)</b>	<b>Female (mm)</b>
Very narrow	X-139	X-134
Narrow	140-147	135-141
Medium	148-155	142-149
Broad	156-163	150-157
Very broad	164-X	158-X

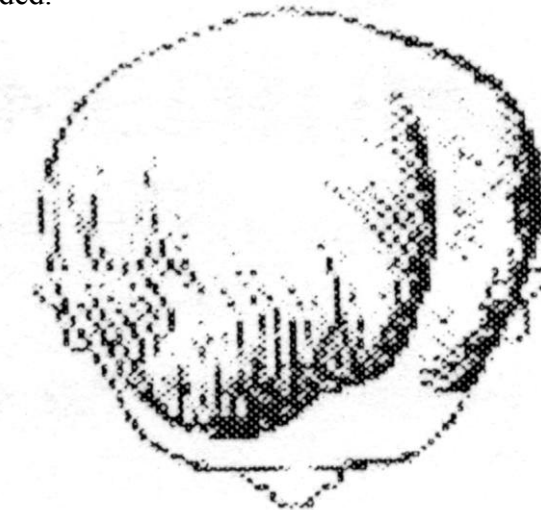
Variation of head shape in various races and geographical zones is due to hereditary factor primarily affecting the shape of head; however environment has secondary effect on it<sup>11</sup>.

Naturally the Cephalic Index is different for different people. People with Cephalic Index less than 75 have long, narrow skulls, as seen from above, since the width of the skull is less than three quarters of its length. People with skulls of this shape are called dolichocephalic which is simply Greek for “long headed.”



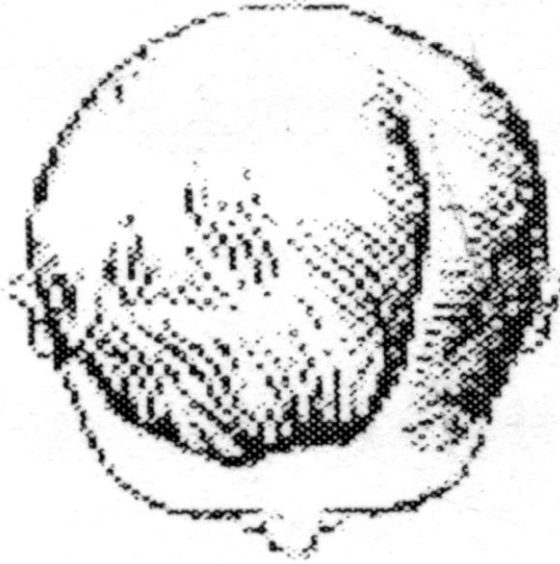
**Fig. 4 : Dolichocephalic head**

If the Cephalic Index is more than 80, the head appears to be short and broad, as seen from the above. People with skulls of this shape are called brachycephalic, which is the Greek for “short headed.”



**Fig. 5: Brachycephalic head**

A Cephalic Index between 75 and 80 makes a head mesocephalic, which is Greek for “medium headed.”<sup>12</sup>



**Fig. 6 : Mesocephalic head**

Francis Paul Broca<sup>13</sup> invented new ways of research into relationships of mankind to each other.

Broca's classification of Cephalic Index is as follows:

Dolichocephalic:	under 75
Sub-dolichocephalic:	75.01 - 77.77
Mesaticephalic:	77.78 – 80.00
Sub brachycephalic:	80.01 – 83.33
Brachycephalic:	83.34 and over

This was based on classification of skeletal skull.

Obviously, thickness of the skin and tissues covering the skull are bound to lead to a different set of figures from those obtained from a normal dried skull.

Thus Joseph Denicker<sup>13</sup> classified Cephalic Index based on living subjects.

Hyper dolichocephalic:	under 75.90
Dolichocephalic:	76 – 77
Sub dolichocephalic:	78 – 79
Mesaticephalic:	80 – 81
Sub brachycephalic:	82 – 83
Brachycephalic:	84 – 85
Hyperbrachycephalic:	80 and over.

Over thousands of years there has been extensive inter- racial admixation. Still, the primary racial types are recognized. They are easily recognized. They are (a) Caucasians or caucasoids, (b) Mongolians or Mongoloids (c) Negroes or Negroids.<sup>14</sup>

Some people have attempted to divide the “White Race” (Caucasians) into three sub races. Northwestern Europe are dolichocranic (Nordic) as are Southwestern Europeans (Mediterranean). The people of Central and Eastern Europe are Brachycranial (Alpine).<sup>15</sup>

As regards the skeleton, an attempt was made, in first place, to determine racial peculiarities by the study of the skull. The length, breadth and the height of the cranium were determined, and from these were calculated the length-breadth, length-height and breadth-height indices—that is, the breadth and height were expressed as percentages of the length or breadth.<sup>12</sup>

According to the Frankfort Agreement of 1982 skulls are divided into<sup>12</sup>

1. Narrow or dolichocephalic (up to 74.9),
2. Medium or mesocephalic (75.0-79.9), and
3. Broad or brachycephalic (over 80.0); and further into
4. Low or chamacephalic (up to 70.00)
5. Medium or orthocephalic (70.1 to 75.0) and
6. Hypsicephalic (over 75.0).

According to the International agreement of 1983 the following designations were added to those already in use<sup>12</sup>:

1. Ultradolichocephalic (55.0 to 59.9),
2. Hyperdolichocephalic (60.0 to 64.9),
3. Hyperbrachycephalic (85.0 to 89.9) and
4. Ultrabrachycephalic (90.0 to 94.9).

Blumenbach attempted to group the races of mankind on the basis of purely somatological peculiarities, selecting five typical forms of the cranium as the criteria of the five races of men. He took as the normal type of the skull of the Caucasian race, which is distinguished by harmony of the individual parts, none being unduly prominent; with roundness (mesocephaly) are united a massive high forehead, narrow cheek-bones, round alveolar arch and an orthognathous upper jaw.

To the Caucasian type belong European (except the Lapps and Finns), Western Asiatics and North Africans. Around this type are grouped the others, which are related both to it and another.

The Mongolian race includes most Asiatic, the Finnish tribes, the Lapps and Eskimo. It has an almost square skull (exceedingly brachycephalic), flat nose, flat projecting molar bone, somewhat broad alveolar arch and projecting chin.<sup>12</sup>

The American race has a higher forehead, highly developed superciliary arch, deeply sunken bridge of the nose, cheek-bones strongly projecting sideward and high broad and strong lower jaw. In this race Blumenbach included all aboriginal Americans except the Eskimo. Skull of the Malay race is brachycephalic; the parietal bones project strongly sideward, the nose and cheek bones are flat, and the upper jaws slightly prognathous. To this race belong the inhabitants of Malacca in Asia and the natives of the islands of the Pacific and Indian oceans.<sup>12</sup>

The Ethiopian race includes the inhabitants of Africa except the Caucasian Africans in the north. The skull is dolichocephalic; the forehead is full, the cheek bones are prominent, the nostrils are wide, the alveolar arch is narrow and prominent, the jaws prognathous and the lower jaw is large and strong. Blumenbach added to these craniological criteria others of a general somatological character, deducted from the observation of the members of the body, chiefly of the head and its parts.

Blumenbach's classification still has adherents, B.P Ehrenreich, for example, being a vigorous supporter of it. He adds to the classification, however, those races that have become known or at least better known since Blumenbach's time. These are mainly blacks of Asia and the aboriginal races of Australia and Oceania.

According to Ehrenreich the classification is

- 1) Caucasian- Mediterranean
- 2) African-Nigerian
- 3) Mongolian

- 4) American
- 5) Malay Polynesian
- 6) Australian.

7) The Papuans and blacks of Asia, including Dravidians and the Kolarian tribes of India, whose position in Ehrenreich's anthropological system must still be regarded as uncertain.<sup>12</sup>

Blumenbach's classification is based on observation and description. For the determination of the variations in the facial part of the skull Camper had already settled by measurement the facial angle, that is the angle made by the profile line and auriculo-subnasal line (the line from the ear orifice to the lowest part of the nose). A. Retzius introduced the word orthognathism to signify an almost right facial angle ( $90^0$ ) and called the more acute facial angle prognathy. Having noticed that in Sweden, the Germans had narrow skulls, while the skulls of Lapps were broad, Retzius sought to determine these shapes mathematically by the length-breadth index. He combined the groups of dolichocephalic and brachycephalic crania gained in this way with the groups of facial angles, and thus arrived at four main types of crania-Orthognathous dolichocephalic,

Orthognathous brachycephalic, Prognathous dolichocephalic and Prognathous brachycephalic.<sup>12</sup>

However this classification of the shapes of the cranium was unsatisfactory, even though mesocephalic crania were separated from the others, since the various forms appear within every race, although perhaps with varying frequency, Welcker's investigations proved that crania ranging from dolichocephalic to hyperbrachycephalic are found in the Mediterranean, Malayan and American races.

The Mongolians appear to be rather mesobrachycephalic and hyperbrachycephalic, while the black races incline more to dolichocephaly.<sup>12</sup>

J.Kollman also based his racial classification according to the shape of the skull and face. He supposed six sub species<sup>12</sup>

1. Chamaeprosopous dolichocephalic.
2. Chamaeprosopous mesocephalic.
3. Chamaeprosopous brachycephalic.
4. Leptoprosopous dolichocephalic.
5. Leptoprosopous mesocephalic.
6. Leptoprosopous brachycephalic.

A study of Cephalic Index was conducted in 1895 throughout India. In Tamilnadu among seven castes the head is mesocephalic in above 50%; in Kerala on the whole people are long-headed or dolichocephalic: in Karnataka people are predominantly mesocephalic. Among Gujaratis brachycephalic element is clearly numerous. In Maharashtra by and large people are mesocephalic. Rajasthan people are dolichocephalic. In Punjab majority are dolichocephalic to hyperdolichocephalic. People living in North –Western states of India i.e., Uttar Pradesh, Bihar and Bengal are predominantly dolichocephalic.<sup>16</sup>

In another study conducted in 1961 in Bhils from most important aboriginal tribe of Central India, the entire social and cultural pattern of the Bhils is directed towards maintaining racial status through endogamy. It is very likely that racial admixture with high caste Rajputs in particular was forced upon them during the Moghul Rajput wars. Consequent to this admixture, which continued for two to three



generations, these families who had a better share of this hypergamy got separated from the main Bhil tribe. Consequently the Bhil tribe got split into two main sub groups, the Bhils proper and the Bhils who had a racial admixture namely Bhilalas: Mankars, Patlias, Rathias, Nihals and Barelas. The maximum head length was 17.68 cm and head breadth was 13.36 cm averagely in case of Bhils with 76.98 Cephalic Index. In case of Barelas, the head length was 17.58 cm and maximum head breadth was 14.02 cm with 79.80 Cephalic Index on an average. The mean head breadth of Barelas was more than that of Bhil, while the head length was nearly same. Consequently, the mean Cephalic Index of Barelas was more than mean Cephalic Index of Bhil, showing a tendency towards brachycephaly. The Barelas showed some significant differences from the Bhils in their physical characters and measurements. Broadly speaking there was relative increase in head breadth and Cephalic Index. It seems more probable that racial hybridization with some Indo-Aryan type of high caste has contributed to a considerable extent in formation of such types. The complete picture of these tribes may be a composite result of all these factors. Barelas show a definite improvement over Bhils in relation to Cephalic Index.<sup>17</sup>

In a presentation “Anthropometry of the Kayasthas of Bengal with special reference to Vangaja Kayastha”, the maximum head length and head breadth average 184.13mm and 146.7mm respectively. The Cephalic Index gives rise to an average of 79.50, which is marginal case between meso and brachycephaly. The greater Index is apparently caused by increased head breadth, rather than shortening in head length. It is significant that the percentage of dolichocephalic is extremely low in comparison to mesocephalic and brachycephalic, which are 64% and 34% respectively. Comparison of the mean measurements and indices for Kayastha groups by different series of studies shows the following: According to Vangaja Kayastha study by Basu the

average head length is 184.10 mm and head breadth is 146.70 mm and the Cephalic Index in these cases is 79.50. And according to Guha (1935) in Dakshin Rarhiya Kayastha series the maximum head length is 185.25mm and maximum head breadth is 149.59 mm with 80.84 Cephalic Index. In another study by Chanda (1916) with Uttarrarhiya Kayastha people the maximum head length is 184.54 mm and head breadth is 141.44 mm with 76.61 as Cephalic Index. And in 1948 in Chattarjee series of work with Varendra Kayastha people, the Cephalic Index is 79.10. In Decca Kayastha series by Majumdar and Rao in 1960 the head length is 183.20mm and head breadth is 142.90 mm with 78.00 as Cephalic Index. The study by the same author in 1960 with Barisal Kayastha people shows the maximum head length 185.00mm and maximum head breadth 141.20mm and the Cephalic Index is 76.29.<sup>18</sup>

According to a study conducted in B.J. Medical College, Poona, in 1977, on the Cephalic Index in various caste people, it is found in Harijans, the maximum head breadth is 13.12cm and maximum head length 17.55cm on an average, whereas in other caste people the maximum head breadth is 13.34cm and maximum head length is 17.53cm on an average. In comparison study with Sickle cell anaemia in cases of normal Mahers (Karve 1951) the Cephalic Index is 73.89 and maximum cranial length is 18.37 cm and maximum cranial breadth is 14.32cm. He has studied sexwise comparison with normal Bombay persons where the maximum head length and breadth in case of males are 18.79cm and 14.63cm and the Cephalic Index is 77.9 whereas in case of female the maximum head length and maximum head breadth are 17.64cm and 14.05cm respectively, and the Cephalic Index 80.0.<sup>19</sup>

In 1978 multivariate analysis of head measurements was done in Punjabi families by taking four head measurements (Head length, Head breadth, Frontal breadth and Head height). These have been compared in relatives of different degrees from samples of 200 Punjabi and 125 Belgian families. A method of generalized distances was used which allows examination of the proportions of the head as a whole. The values of the generalized distances between concordant and discordant twins are compared with those between brothers, sisters, siblings, parents and children. The results strongly support the influence of genetic factors, but also demonstrate environmental influence.<sup>20</sup>

A case was observed in 1982 in which an abnormal and rapidly changing Cephalic Index from a high normal level of 83 to a definitely abnormal index of 63 was the earliest indicator of impending fetal death.<sup>21</sup>

A study was conducted in 1984 for the assessment of fetal bi-parietal diameter (BPD) during normal pregnancy by ultrasound in Nigerian women. The fetal BPD was measured on 1104 occasions in 552 Nigerian normal pregnant women and the range of BPD values for each week of pregnancy between 12 and 40 weeks was measured. Growth of BPD showed slightly higher values in comparison to Europeans. The mean weekly increase in the BPD between 13 and 30 weeks gestation was 4.9mm / week, between 30 and 36 weeks - 3.3mm / week and between 37 and 40 weeks- 1.7mm / week.<sup>22</sup>

In a study conducted on Reddy population in 1987 based on 750 males in age range of 20-50 years mesocephalic head predominated among Pokanti group and dolichocephalic head among the rest.<sup>23</sup>

In 1989, 1100 Harvard students were sorted into groups according to their Cephalic Indices in order to establish relation of the Cephalic Index to height, weight strength and mental ability. Dolichocephalic were found superior in mean height, mean weight, and mean strength than brachycephalics.<sup>24</sup>

The relationship between head form and climatic variation was investigated in different tribal and caste populations of India. The magnitude of the Cephalic Index varies significantly in different zones. In tropical zones head form is longer (dolichocephalic), but in temperate zones head form is more round (mesocephalic or brachycephalic), especially among scheduled tribes (ST) and schedule castes (SC) than among other castes. These trends possibly support a climatic adaptation model in head form differences among ST and SC in India.<sup>25</sup>

According to a thesis work done on Adikarnatakas of Mysore, in Karnataka, head length of males ranges from 15.8cm to 20.6cm with a mean value of  $18.64 \pm 0.05$ cm and female head length ranges from 15.0cm to 18.2cm with an average value of  $17.39 \pm 0.04$ cm. A higher proportion of Adikarnataka males (36.68 %) and females (58.82%) fall under long head length and medium head length categories respectively. The head breadth values of males range from 10.4 to 16.4cm with mean value of  $14.29 \pm 0.05$ cm and those of females range from 7.2 to 15.6cm with an average value of  $12.43 \pm 0.09$ cm. Majority of male and female individuals fall under narrow type (36.67 %) and very narrow type (79.10 %) respectively. Cephalic Index ranges from 60.4 to 88.2 units with a mean value of  $77.26 \pm 0.06$  among the males of Adikarnatakas revealing majority of males belong to dolichocephalic category (37.06%). The values of the female range from 47.3 to 82.3 units with an average

value of  $72.19 \pm 0.12$  showing higher proportion of females (62.89%) under hyperdolichocephalic category.<sup>26</sup>

In the year 2001 a study was conducted on 64 Manipuri foetuses ranging from 12 weeks to 40 weeks in the Department of Anatomy, Regional Institute of Medical Sciences, Imphal, Manipur. Standard bony landmarks were used to determine the maximum head breadth and maximum head length with standardized anthropometrical instruments. The study showed a mean Cephalic Index with a positive co-relation co-efficient value ( $r = 0.82$ ,  $p < 0.05$ ). This study revealed that foetal skull of the Manipuri population was mesocranial in the early weeks and brachycranial at term pregnancy.<sup>27</sup>

In 2003, a study conducted on 420 normal newborn males in South East of Caspian Sea revealed that hereditary factors primarily affects the shape of head, however environment has secondary effect on it.<sup>28</sup>

According to a study conducted in Gujarat state in 2004, the mean Cephalic Index in both sex is 80.81, ranging from 71.10 to 89.77. According to Stewart's classification (1935) Gujarati subjects can be called mesati-cephalic. The mean Cephalic Index for male is 80.42 and for female it is 81.20.<sup>29</sup>

A study conducted on Croatian medical students in 2004 divided into groups according to their year of birth revealed a significant increase of dolichocephalic and mesocephalic head shape and significant decrease of brachycephalic head shape in both sexes.<sup>30</sup>

In 2004 another study conducted in Gujarat region between age group of 17-22 years showed head length ranged from 11.70- 20.80cm.<sup>31</sup>

A study done in 2004, demonstrates that secular changes in the head form of Japanese adult females have occurred during the last eight decades. Findings suggest that the tendency towards brachycephalization in Japanese adult females may have ended.<sup>32</sup>

According to a study conducted on 267 subjects of Gurung village in 2005 the mean head length was 17.7cm and mean head breadth was 14.8cm. In males, mean head breadth was 14.9cm and mean head length was 18cm. In females, the mean head breadth was 14.7cm and mean head length was 17.4cm. The mean Cephalic Index was 83.7. The mean Cephalic Index for males was 83.1 and for females 84.6.<sup>33</sup>

The Cephalic Index is an important test for determining race. Skulls having the Cephalic Index between 70 and 74.5 as observed among the Aborigines and pure Aryans are called dolichocephalic or long headed skulls: denoting 75 to 79.9 Cephalic Index are called mesati cephalic and are characteristic of the Europeans and Chinese: while skulls with 80 to 84.9 Cephalic Index are termed brachycephalic or short headed as observed in the Mongolian race.<sup>34</sup>

A study was done on 200 Dangis(100 males and 100 females) and 177 Ahiwars (92 males and 85 females) of Madhya Pradesh in 2006 .A mean Cephalic Index of 74.8 and 75.7 in males and females respectively (age group 3-11 yrs) , 73.5 and 74.5 in males and females respectively(age group 12-20 yrs) ,71.6 and 71.9 in males and females respectively. (age group above 20 yrs) was found among Dangis. A mean Cephalic Index of 71.8 and 74.2 in males and females respectively (age group 3-11 yrs), 71 and 71.9 in males and females respectively (age group 12-20 yrs), 73.4 and 73.7 in males and females respectively (age group above 20 yrs) was found among Ahiwars.<sup>35</sup>

In 2006, a morphometric study conducted in Thai –Phake of Assam revealed hyperbrachycephalic head (40.35%) in the majority and brachycephalic head (28.95%) is found in the next highest frequency.<sup>36</sup>

In 2006 a study conducted in 17-20 yrs old females of North of Iran showed mean and S.D of Cephalic Index in Turkman and native Fars group to be 82.8+/- 3.6 and 85+/-4.5 respectively. The head shape of 53.6% of individuals was hyperbrachycephalic, and dolichocephalic type with 0.1% was rare in Fars females. The head shape of 58.1% of individuals was brachycephalic, and dolichocephalic type with 0.5% was rare in Turkman females .<sup>37</sup>

In 2007 a study was done to determine the anatomical type of head and face in children under 6 years in Ahwas, Iran, the most frequent anatomical type of head were brachycephalic (36.7%), mesocephalic (32.2%), hyperbrachycephalic (27.8%) and dolichocephalic (3.3%). There were no significant differences in anatomical types of head by sex ( $P > 0.05$ ).<sup>38</sup>

A study was carried out to determine Cephalic Index and head shape in 198 males of 17 to 20 years in Gorgan, North of Iran in2007. Mean and Standard deviation of Cephalic Index was  $80.4 \pm 4$ . The head shape of 42.4% of individuals was hyperbrachycephalic and dolichocephalic type (8.1%) was rare.<sup>39</sup>

A study was done in 2009 in Ogonis of Nigeria.The mean maximum head lengths in male and female Ogonis were found to be 18.55 cm and 17.86 cm respectively while the mean maximum head breadths were 20.39cm and 13.34cm respectively. The mean Cephalic Indices in male and female Ogonis were found to be 111.18 and 75.09 respectively. Thus Ogoni males had significantly higher Cephalic Index than Ogoni females ( $p < 0.05$ ). The Ogonis irrespective of the sex had mean

maximum head length, maximum head breadth and Cephalic Index of 18.20, 16.87 and 92.63 cm, respectively.<sup>40</sup>

In 2010, study of Cephalic Index of the students coming from different regions of India was conducted. The mean Cephalic Index in Northern India was 79.72, Eastern India 80.74, Western India - 81.63 and Southern India -81.99.<sup>41</sup>



## **METHODOLOGY**

### **Source of data**

The study was conducted on students of Phase-I, MBBS of Shri B.M. Patil Medical College Hospital and Research Centre, Bijapur.

### **Method of data collection**

Sample size: 300 students were taken for the present study. The study was carried out in one and half years, from November 2008 to April 2010 .Sample size was calculated by convenient sampling.

Head measurements are determined by Spreading caliper.

Measurements are taken with subject sitting in relaxed condition and head in anatomical position

### **Sampling procedure:**

Consent of the students was taken to measure the head length and head breadth, and they were asked to fill the proforma before taking the measurements.

College Ethical Committee clearance has been taken for the above study.

### **Data collected:**

- Maximum breadth of the head.
- Maximum length of the head.

### **Instrument:**

Spreading caliper with blunt ends (Fig: 7) is used for taking measurements of head. It consists of two long arms which are curved outwards and bounded at one end. It is having both side blunt ends, which is used for taking measurements from livings.

A meter scale is fixed to one of the arms, which passes through a socket on the other arm.

Instrument should be held in such a manner that the tips of the caliper are free to touch the head. Undue pressure should not be applied while taking the measurements.

Three measurements were taken to avoid measuring errors. Mean of three measurements was calculated and noted.

**Land marks taken to determine the maximum head breadth and maximum head length<sup>10</sup>:**

- Glabella: the most prominent point in the mid sagittal plane between the eyebrows.
- Opisthocranium: the point of most backward projection of the head in the mid plane.
- Eurion; the most lateral point on the side of the head.

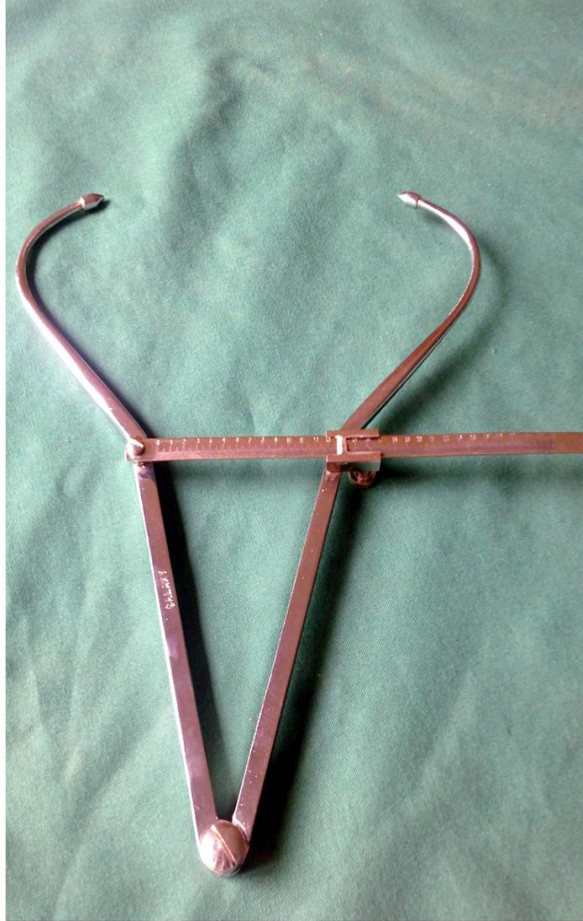
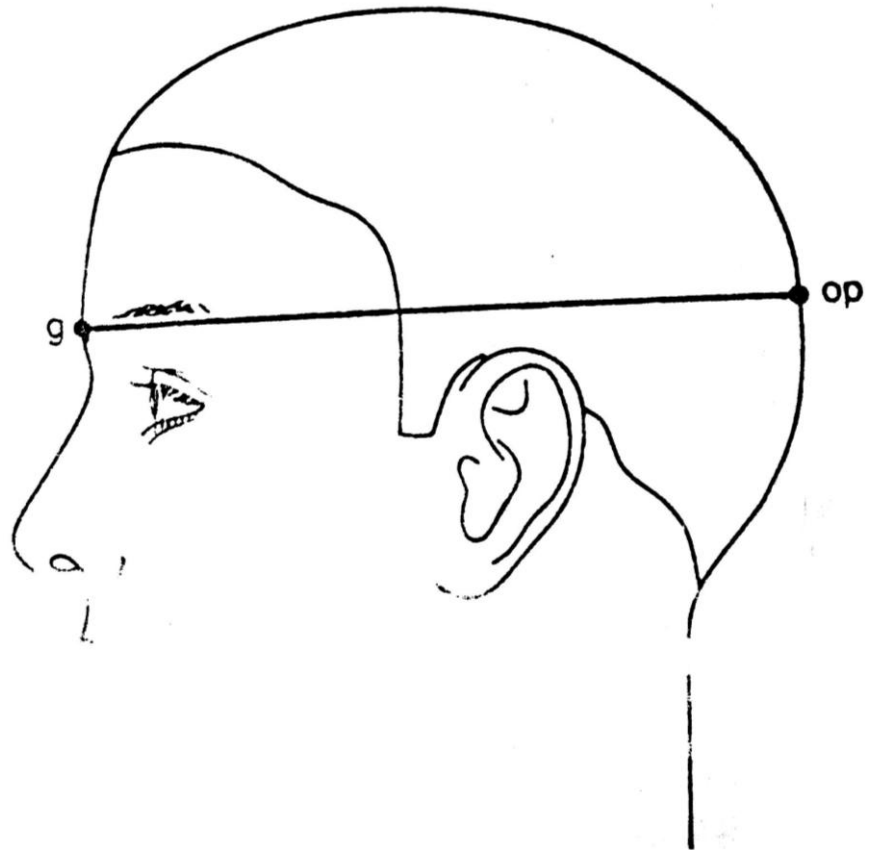


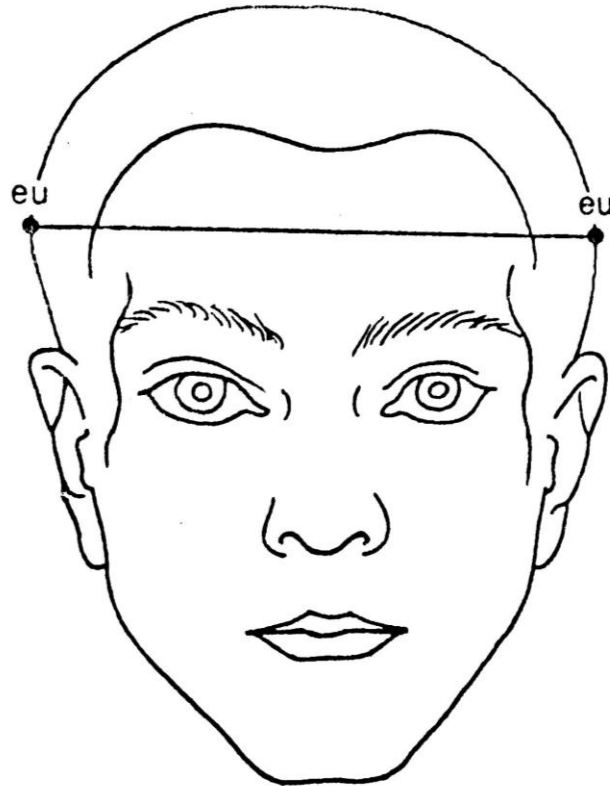
FIG:7 SPREADING CALIPER

**Maximum head length:** the distance between the glabella and the opisthocranium.



**Fig.8: Measurement of maximum length of head from g-glabella to OP-opisthocranium**

**Maximum head breadth:** the greatest transverse diameter of the head, this is usually found at a point over each parietal bone - Eurion



**Fig. 9: Measurement of maximum breadth of head from eu-(Eurion) to eu (Eurion)**



FIG:10 MEASUREMENT OF MAXIMUM HEAD LENGTH



FIG:11 MEASUREMENT OF MAXIMUM HEAD BREADTH

**Statistical Analysis:**

Data was analyzed using the following statistical methods:

1. Mean and standard deviation
2. Statistical tests like Z-test.
3. Diagrammatic representation

**Inclusion criteria:**

All the students of Phase –I MBBS (2008 -09, 2009-10 batches).

For the comparison of Cephalic Index between North Indian and South Indian students, they were categorized according to North Indian and South Indian states.

The states belonging to North India are <sup>42</sup>

1. Haryana.
2. Himachal Pradesh.
3. Punjab.
4. Rajasthan.
5. Uttar Pradesh.
6. Delhi.
7. Jammu-Kashmir
8. Uttarakhand
9. Bihar
10. Madhya pradesh
11. Chhattisgarh

The states belonging to South india are <sup>43</sup>

1. Andhra Pradesh
2. Karnataka.
3. Tamil Nadu.
4. Kerala
5. Puducherry
6. Lakshdweep



## **RESULTS**

The present study was conducted on Phase-I MBBS Students of Shri B.M.Patil Medical College Hospital and Research Centre, Bijapur.

The head length and head breadth of the students were measured and their Cephalic Index was calculated.

The data was analysed statistically with mean  $\pm$  S.D and Z-test.

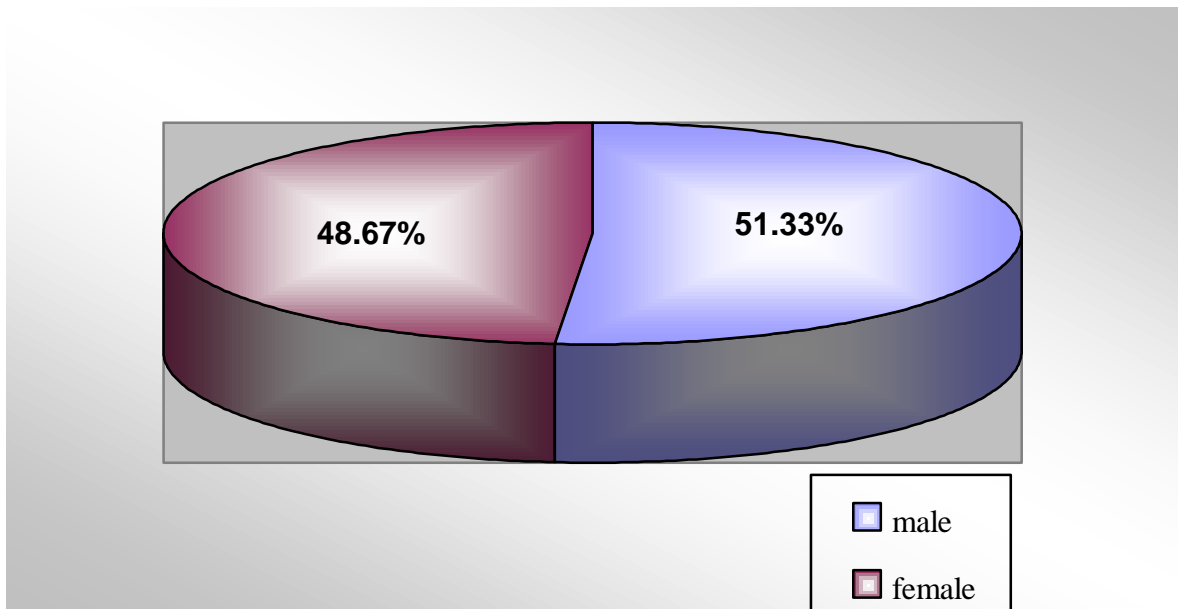
The Cephalic Index among males and females of the study group and Cephalic Index among North Indians and South Indian students were compared statistically.

Graphs and Tables were generated using Microsoft Office Word and Excel Software.

**Table 4: Gender distribution**

<b>Gender</b>	<b>Number</b>	<b>Percentage</b>
Male	154	51.33
Female	146	48.67
Total	300	100

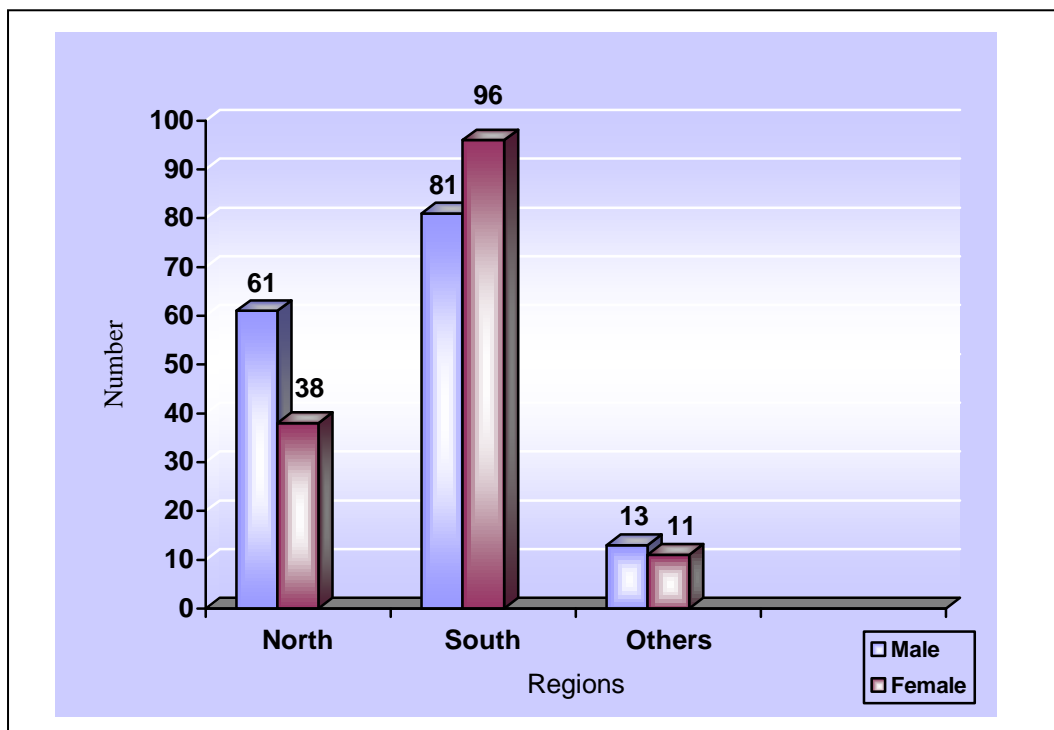
In the present study, the Male students are 51.33 % and Female are 48.67 %.



**Graph1: Pie Chart showing Gender distribution in present study**

**Table 5: Distribution of students by region**

Region	Gender	Number	Percentage
North	Male	61	61.62
	Female	38	38.38
	Total	99	100
South	Male	81	45.76
	Female	96	54.24
	Total	177	100
Others	Male	13	54.17
	Female	11	45.83
	Total	24	100



**Graph 2 – Bar Chart showing the distribution of students by region**

**Table 6**  
**Statistical constants of Head Length, Head breadth and Cephalic Index in study**  
**group**

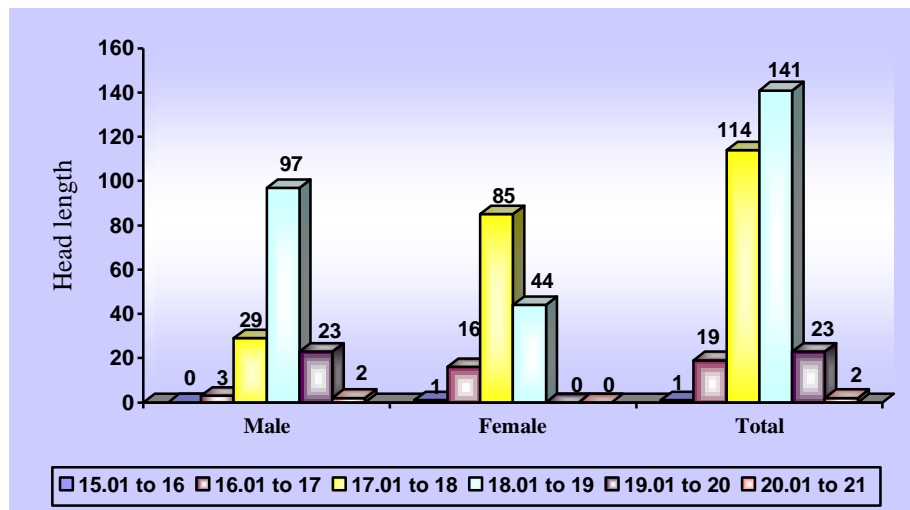
<b>Study Parameters</b>	<b>Mean ±S.D</b>	<b>Number</b>
<b>Head Length</b>	17.96± 0.76	300
<b>Head Breadth</b>	13.76 ± 0.89	300
<b>Cephalic Index</b>	76.65 ± 4.25	300

**Table7**  
**Statistical constants of Cephalic Index in North Indians and South Indians.**

<b>Region</b>	<b>M</b>	<b>F</b>	<b>Total</b>
<b>North</b>	Mean : 74.16 ± 3.21 N : 61	Mean : 74.87 ± 3.10 N : 38	Mean : 74.44 ±3.17 N : 99
<b>South</b>	Mean : 78.26 ± 4.29 N : 81	Mean : 77.24 ±4.05 N : 96	Mean : 77.71 ± 4.18 N : 177

**Table 8**  
**Maximum Head Length of males & females of study group**

Range of Head Length ( cm)	Male		Female		Total	
	No	%	No	%	No	%
15.01 to 16	0	0	1	0.68	1	0.33
16.01 to 17	3	1.94	16	10.95	19	6.33
17.01 to 18	29	18.83	85	58.21	114	38
18.01 to 19	97	62.98	44	30.13	141	47
19.01 to 20	23	14.93	0	0	23	7.6
20.01 to 21	2	1.29	0	0	2	0.66
Total	154	100	146	100	300	100

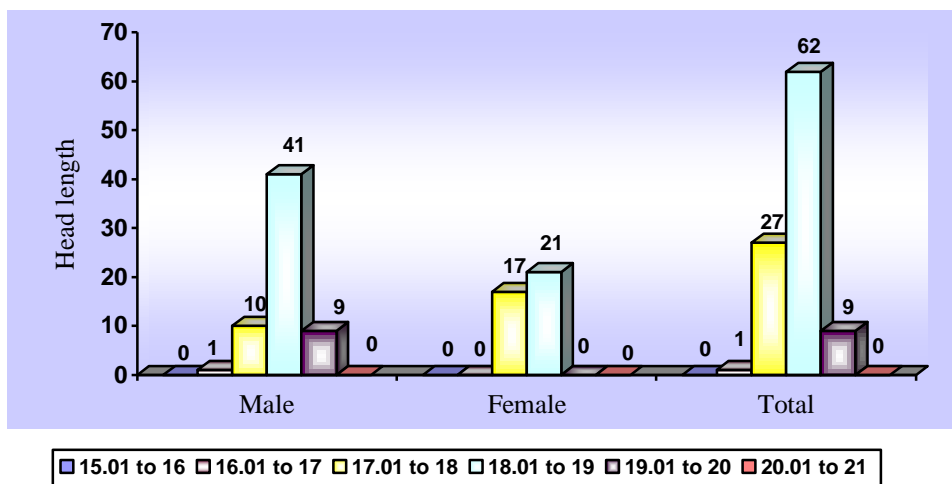


**Graph3: Bar Chart showing Maximum Head Length of males & females of study group**

The above table and graph shows majority of males (62.98%) have maximum head length in the range of 18.01 to 19 cm. 18.83 in the range of 17.01 to 18 cm, 14.93 % in the range of 19.1 to 20 cm, 1.94 % in the range of 16.01 to 17 cm and 1.29% in the range of 20.01 to 21 cm. In case of females, majorities (58.21%) were in the range of 17.01 to 18 cm, followed by 30.13% in the range of 18.01 to 19 cm, 10.95 % had head length in the range of 16.01 to 17 cm, 0.68% in the range of 15.01 to 16 cm.

**Table 9**  
**Maximum Head Length of males & females of North India**

Range of Head Length (cm)	Male		Female		Total	
	No	%	No	%	No	%
15.01 to 16	0	0	0	0	0	0
16.01 to 17	1	1.63	0	0	1	1.01
17.01 to 18	10	16.39	17	44.73	27	27.27
18.01 to 19	41	67.21	21	55.26	62	62.62
19.01 to 20	9	14.75	0	0	9	9.09
20.01 to 21	0	0	0	0	0	0
Total	61	100	38	100	99	100

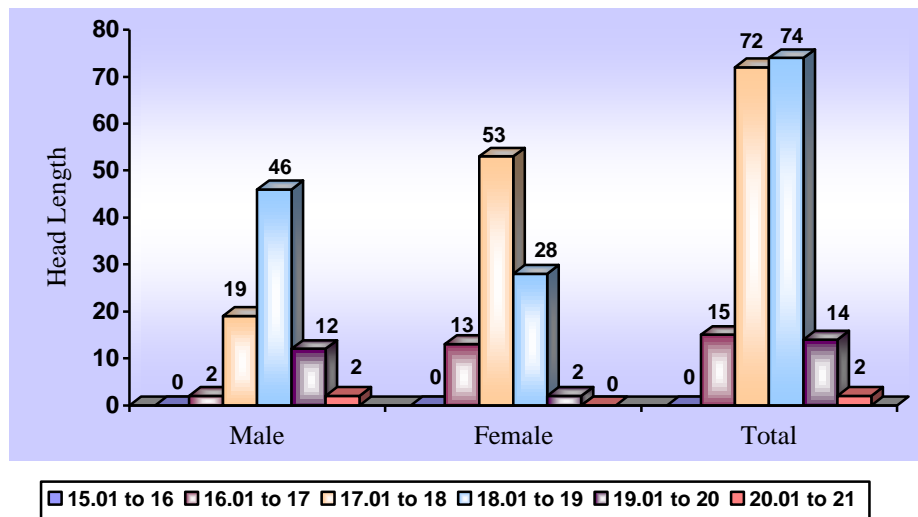


**Graph 4: Bar Chart showing maximum Head Length of males & females of North India**

The above table and graph show that the maximum head breadth in North Indian males was in the range of 18.01 to 19 cm in 67.21% students followed by 16.39% in the range of 17.01 to 18 cm, 14.75 % in the range of 19.01 to 20 cm and 1.63% in the range of 16.01 to 17 cm. In females 55.26% were in the range of 18.01 to 19 cm and 44.73 % in the range of 17.01 to 18 cm.

**Table 10**  
**Maximum Head Length of males & females of South India**

Range of Head Length (cm)	Male		Female		Total	
	No	%	No	%	No	%
15.01 to 16	0	0	0	0	0	0
16.01 to 17	2	2.46	13	13.54	15	8.47
17.01 to 18	19	23.45	53	55.20	72	40.67
18.01 to 19	46	56.79	28	29.16	74	41.80
19.01 to 20	12	14.81	2	2.08	14	7.90
20.01 to 21	2	2.46	0	0	2	1.12
Total	81	100	96	100	177	100



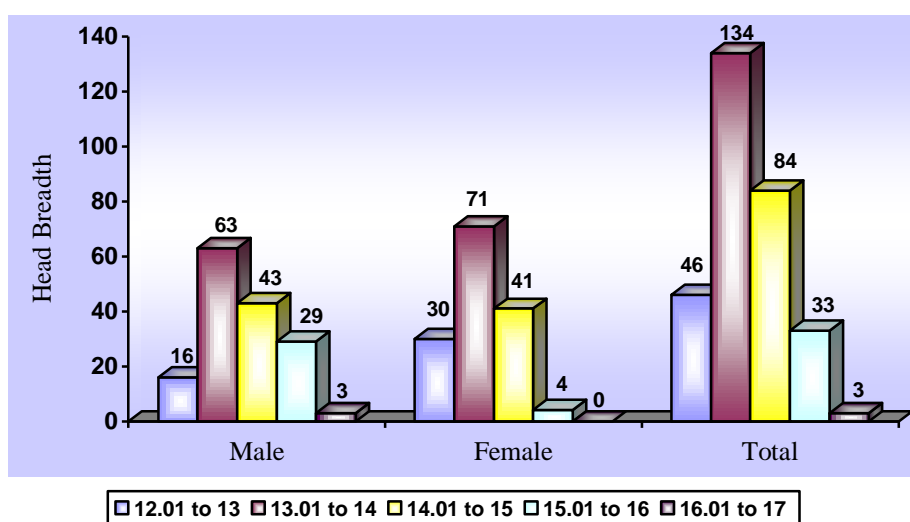
**Graph 5: Bar Chart showing maximum Head Length of males & females of South India**

The above table and graph show that the maximum head breadth in South Indian males was in the range of 18.01 to 19 cm in 56.79% students, followed by 23.45% in the range of 17.01 to 18 cm, 14.81 % in the range of 19.01 to 20 cm , 2.46% in the range of 16.01 to 17 cm and 20.01to 21 cm. In females 55.20% were in the range of 17.01 to 18 cm, 29.16 % in the range of 18.01 to 19 cm, 13.54% in the range of 16.01 to 17 cm and 2.08% in the range of 19.01to 20 cm.

**Table 11**

**Maximum Head Breadth of males & females of study group**

Range of Head breadth(cm)	Male		Female		Total	
	No	%	No	%	No	%
12.01 to 13	16	10.38	30	20.54	46	15.33
13.01 to 14	63	40.90	71	48.63	134	44.66
14.01 to 15	43	27.92	41	28.08	84	28
15.01 to 16	29	18.83	4	2.73	33	11
16.01 to 17	3	1.94	0	0	3	1
Total	154	100	146	100	300	100



**Graph 6: Bar Chart showing maximum Head Breadth of males & females of study group**

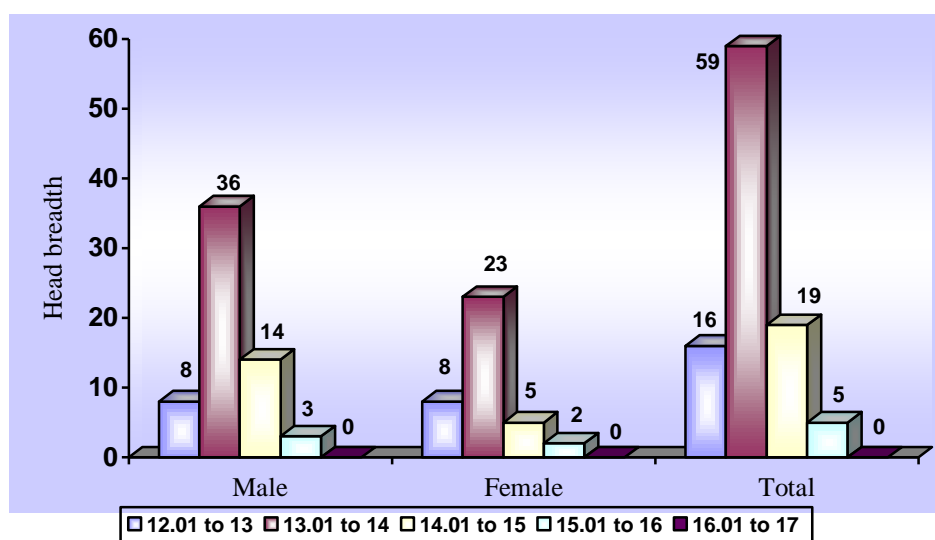
The above table and graph show that maximum head breadth in male students of present study was in the range of 13.01 to 14 cm in 40.9% students followed by 27.92% in the range of 14.01 to 15 cm, 18.83 % in the range of 15.01 to 16 cm, 10.38 % in the range of 12.01 to 13 cm and 1.94 % in the range of 16.01 to 17 cm. In females 48.63% were in the range of 13.01 to 14 cm, 28.08% in the range of 14.01 to 15 cm, 20.54 % in the range of 12.01 to 13 cm and 2.73% in the range of 15.01 to 16 cm.



**Table 12**

**Maximum Head Breadth of males & females of North India**

Range of Head Breadth(cm)	Male		Female		Total	
	No	%	No	%	No	%
12.01 to 13	8	13.11	8	21.05	16	15.16
13.01 to 14	36	59.01	23	60.52	59	59.59
14.01 to 15	14	22.95	5	13.15	19	19.19
15.01 to 16	3	4.91	2	5.26	5	5.05
16.01 to 17	0	0	0	0	0	0
Total	61	100	38	100	99	100

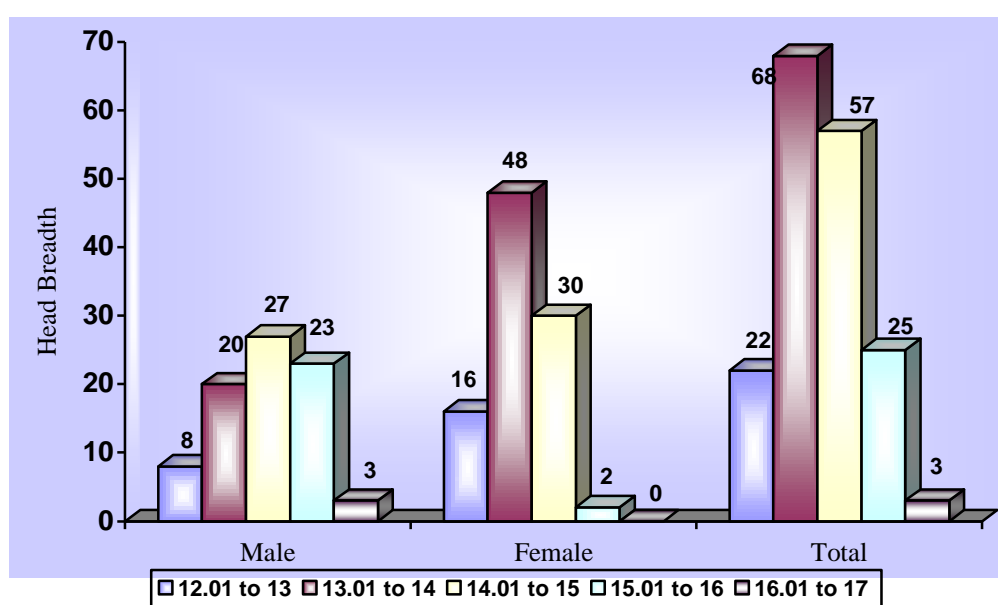


**Graph 7: Bar Chart showing maximum Head Breadth of males & females of North India**

The above table and graph show that maximum head breadth in male students of North India was in the range of 13.01 to 14 cm in 59.01% students followed by 22.95% in the range of 14.01 to 15 cm, 13.11% in the range of 12.01 to 13 cm, and 4.91 % in the range of 15.01 to 16 cm. In females 60.52 % were in the range of 13.01 to 14 cm, 21.05% in the range of 12.01 to 13 cm, 13.15% in the range of 14.01 to 15 cm and 5.26 % in the range of 15.01 to 16 cm.

**Table 13**  
**Maximum Head Breadth of males & females of South India**

Range of Head breadth(cm)	Male		Female		Total	
	No	%	No	%	No	%
12.01 to 13	8	9.87	16	16.66	22	12.42
13.01 to 14	20	24.69	48	50	68	38.41
14.01 to 15	27	33.33	30	31.25	57	32.20
15.01 to 16	23	28.39	2	2.08	25	14.12
16.01 to 17	3	3.70	0	0	3	1.69
Total	81	100	96	100	177	100

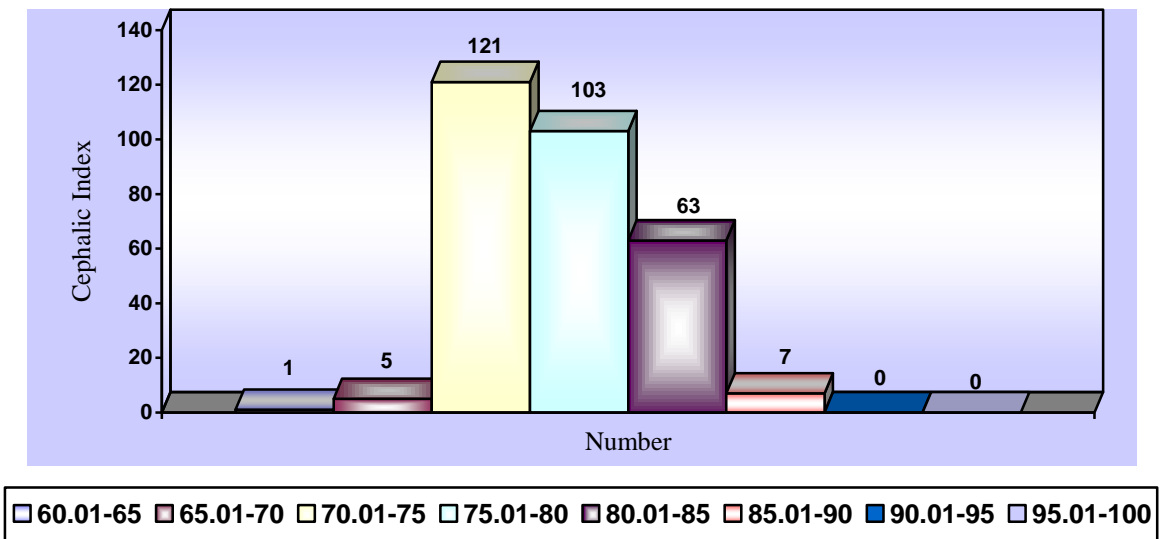


**Graph 8: Bar Chart showing maximum Head Breadth of males & females of South India**

The above table and graph show that maximum head breadth in male students of South India was in the range of 14.01 to 15 cm in 33.33% students followed by 28.39% in the range of 15.01 to 16 cm, 24.69% in the range of 13.01 to 14 cm, 9.87% in the range of 12.01 to 13 cm and 3.7% in the range of 16.01 to 17 cm. In females 50% were in the range of 13.01 to 14 cm, 31.25% in the range of 14.01 to 15 cm, 16.66% in the range of 12.01 to 13 cm and 2.08% in the range of 15.01 to 16 cm.

**Table 14**  
**Incidence of Cephalic Index in study group**

<b>Cephalic Index</b>	<b>No of Subjects</b>	<b>Percentage</b>
60.01-65	1	0.33 %
65.01-70	5	1.6 %
70.01-75	121	40.33 %
75.01-80	103	34.33 %
80.01-85	63	21 %
85.01-90	7	2.3 %
90.01-95	0	0 %
95.01-100	0	0 %
<b>Total</b>	<b>300</b>	<b>100 %</b>



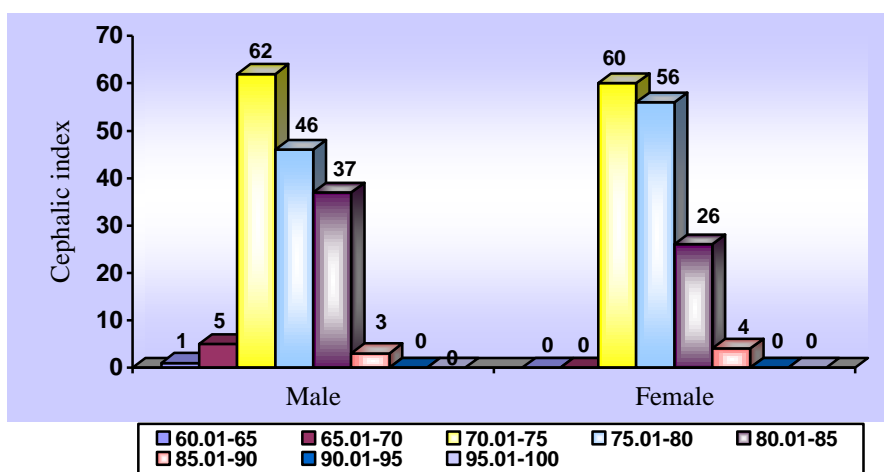
**Graph 9: Bar Chart showing incidence of Cephalic Index in study group**

The above table and graph show that the in 40.33% students of present study Cephalic Index was in the range of 70.01 to 75, followed by 34.33% in the range of 75.01 to 80, 21% in the range of 80.1 to 85, 2.3% in the range of 85.01 to 90, 1.6% in the range of 65.01 to 70 and 0.33% in the range of 60.01 to 65.

**Table 15**

**Incidence of Cephalic Index in study group by gender**

Cephalic Index	Male		Female	
	No of Subjects	Percentage	No of Subjects	Percentage
60.01-65	1	0.64 %	0	0 %
65.01-70	5	3.24 %	0	0 %
70.01-75	62	40.25 %	60	41.09 %
75.01-80	46	29.87 %	56	38.35 %
80.01-85	37	24.02 %	26	17.80 %
85.01-90	3	1.94 %	4	2.73 %
90.01-95	0	0 %	0	0 %
95.01-100	0	0 %	0	0 %
Total	154	100 %	146	100 %

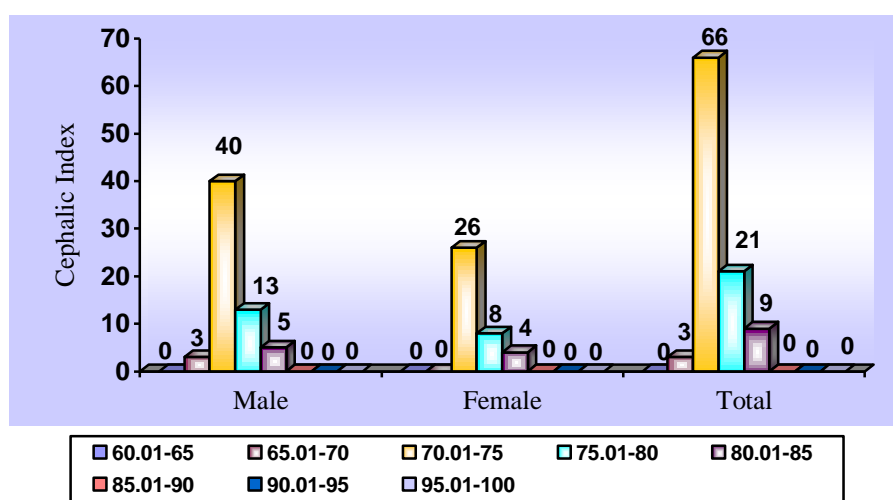


**Graph 10: Bar Chart showing incidence of Cephalic Index in study group by gender**

The above table and graph show that in males of present study , Cephalic Index was in the range of 70.01 to 75 in 40.25% of students , 29.87% were in the range of 75.01 to 80 , 24.02% in the range of 80.01 to 85 ,3.24% in the range of 65.01 to 70,1.94% in the range of 85.01 to 90 and 0.64% in the range of 60.01 to 65.In females ,41.09% were in the range of 70.01 to 75, 38.35% in the range of 75.01 to 80, 17.80 % in the range of 80.01to 85,and 2.73 % in the range of 85.01to 90.

**Table 16**  
**Incidence of Cephalic Index in North Indians**

Cephalic Index	Male		Female		Total	
	No	%	No	%	No	%
60.01-65	0	0	0	0	0	0
65.01-70	3	4.91	0	0	3	3.03
70.01-75	40	65.57	26	68.42	66	66.66
75.01-80	13	21.31	8	21.06	21	21.21
80.01-85	5	8.19	4	10.52	9	9.09
85.01-90	0	0	0	0	0	0
90.01-95	0	0	0	0	0	0
95.01-100	0	0	0	0	0	0
Total	61	100	38	100	99	100



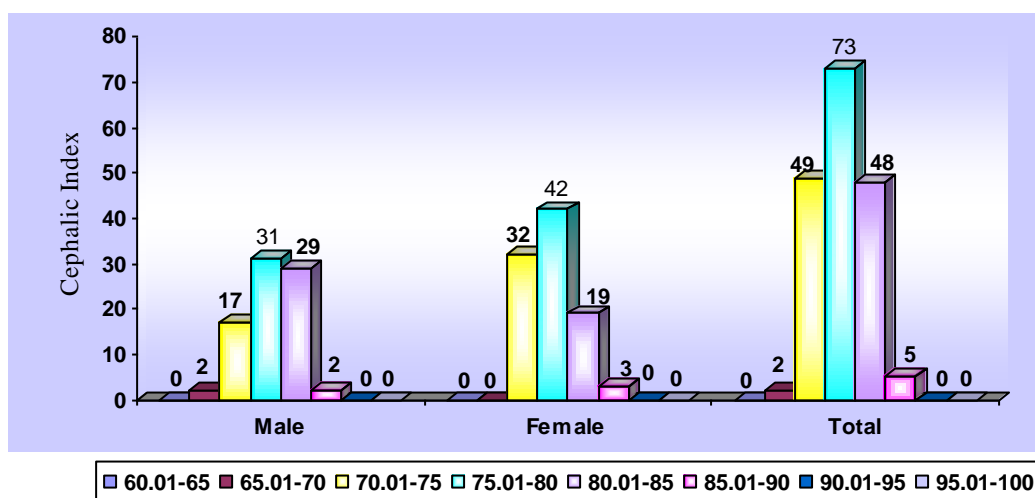
**Graph 11: Bar Chart showing incidence of Cephalic Index in North Indians**

The above table and graph show that in males of North India, Cephalic Index was in the range of 70.01 to 75 in 65.57% of students, 21.31% were in the range of 75.01 to 80, 8.19% in the range of 80.01 to 85, and 4.91% in the range of 65.01 to 70. In females, 68.42% were in the range of 70.01 to 75, 21.06% in the range of 75.01 to 80 and 10.52% in the range of 80.01 to 85.

**Table 17**

**Incidence of Cephalic Index in South Indians**

Cephalic Index	Male		Female		Total	
	No	%	No	%	No	%
60.01-65	0	0	0	0	0	0
65.01-70	2	2.46	0	0	2	1.12
70.01-75	17	20.98	32	3.33	49	27.68
75.01-80	31	38.27	42	43.75	73	41.24
80.01-85	29	35.80	19	19.79	48	27.11
85.01-90	2	2.46	3	3.12	5	2.82
90.01-95	0	0	0	0	0	0
95.01-100	0	0	0	0	0	0
Total	81	100	96	100	177	100



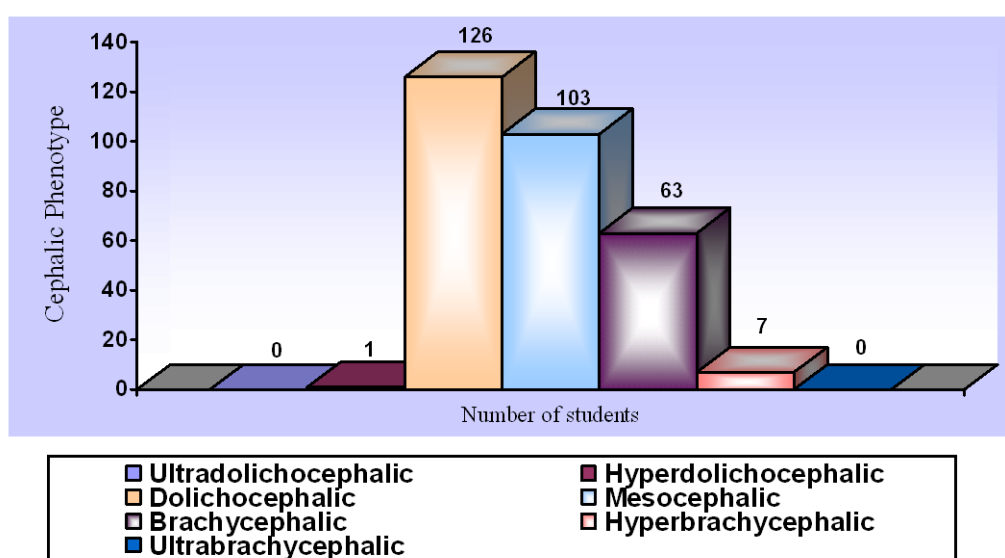
**Graph12: Bar Chart showing incidence of Cephalic Index in South Indians**

The above table and graph show that in males of South India, Cephalic Index was in the range of 75.01 to 80 in 38.27% of students, 35.80% in the range of 80.01 to 85, 20.98% in the range of 70.01 to 75 and 2.46% in range of both 65.01 to 70 and 85.01 to 90. In females 43.75% were in the range of 75.01 to 80, 19.79% in the range of 80.01 to 85, 3.33% in the range of 70.01 to 75 and 3.12% in the range of 85.01 to 90.

**Table 18**

**Different types of Cephalic Phenotype among study group**

<b>Cephalic Phenotype</b>	<b>Range of Cephalic Index</b>	<b>Number</b>	<b>Percent</b>
Ultradolichocephalic	55.0 to 59.9	0	0.00
Hyperdolichocephalic	60.0 to 64.9	01	0.33
Dolichocephalic	65 to 74.9	126	42.00
Mesocephalic	75 to 79.9	103	34.33
Brachycephalic	80 to 84.9	63	21.00
Hyperbrachycephalic	85 to 89.9	07	2.33
Ultrabrachycephalic	90 to 94.9	00	0.00



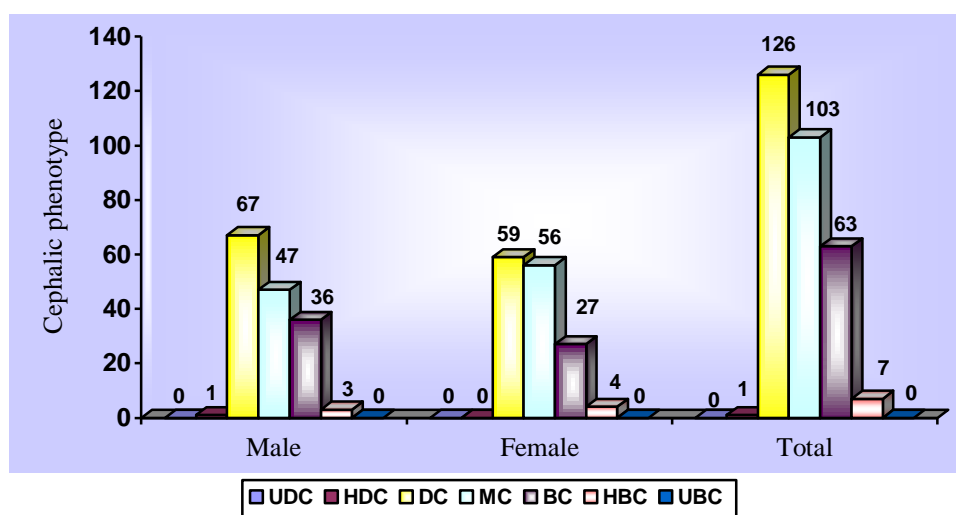
**Graph13: Bar Chart showing different types of Cephalic Phenotype among study group**

The above table and graph show that among 300 students dolichocephalic type of head predominated i.e. in 42% students, followed by mesocephalic in 34.33%, brachycephalic in 21%, hyperbrachycephalic in 2.33% and hyperdolichocephalic in 0.33% students.

**Table 19**

**Different types of Cephalic Phenotype among males and females of study group**

Cephalic Phenotype	Range of Cephalic Index	Male		Female		Total	
		No	%	No	%	No	%
Ultradolichocephalic	55.to 59.9	0	0	0	0	0	0
Hyperdolichocephalic	60 to 64.9	1	0.64	0	0	1	0.33
Dolichocephalic	65 to 74.9	67	43.50	59	40.41	126	42
Mesocephalic	75 to 79.9	47	30.51	56	38.35	103	34.33
Brachycephalic	80 to 84.9	36	23.37	27	18.49	63	21
Hyperbrachycephalic	85 to 89.9	3	1.94	4	2.74	7	2.33
Ultrabrachycephalic	90 to 94.9	0	0	0	0	0	0
Total		154	100	146	100	300	100



**Graph 14: Bar Chart showing different types of Cephalic Phenotype among males and females of study group**

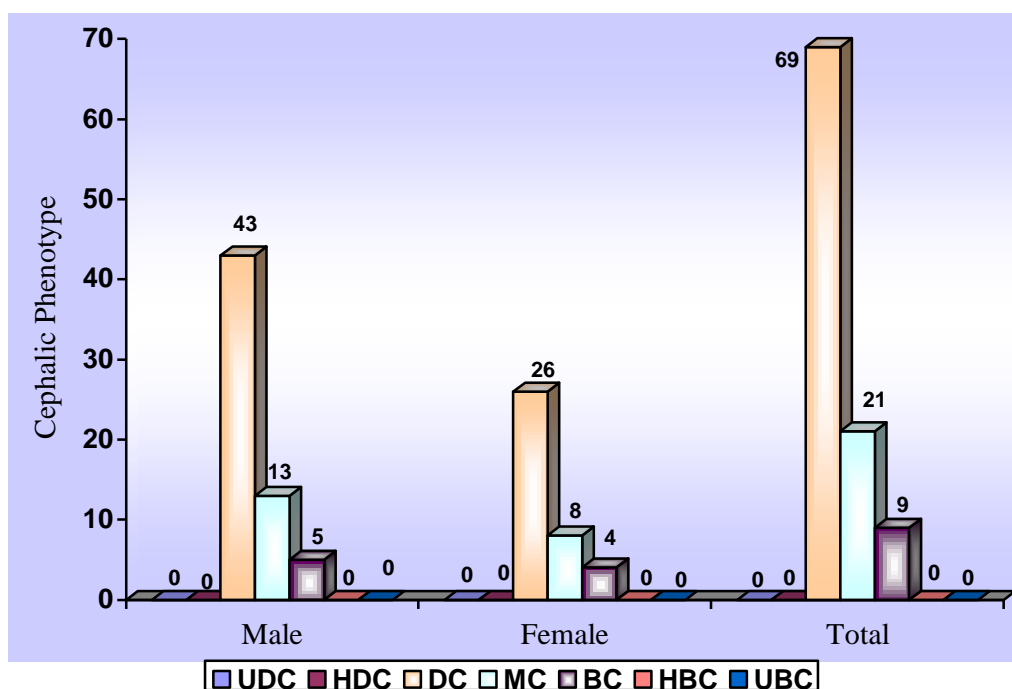
The above table and graph show that among 154 males of present study dolichocephalic head predominated in 43.50% students followed by mesocephalic type in 30.51%, brachycephalic in 23.37%, Hyperbrachycephalic in 1.94% and hyperdolichocephalic in 0.64%. Among 146 females, dolichocephalics were predominant in 40.41% students. 38.35% were mesocephalics, 18.49% brachycephalics and 2.74% were hyperbrachycephalic.



**Table 20**

**Different types of Cephalic Phenotype among North Indians**

Cephalic Phenotype	Range of Cephalic Index	Male		Female		Total	
		No	%	No	%	No	%
Ultradolichocephalic	55 to 59.9	0	0	0	0	0	0
Hyperdolichocephalic	60 to 64.9	0	0	0	0	0	0
Dolichocephalic	65 to 74.9	43	70.49	26	68.42	69	69.69
Mesocephalic	75 to 79.9	13	21.31	8	21.05	21	21.21
Brachycephalic	80 to 84.9	5	8.19	4	10.52	9	9.09
Hyperbrachycephalic	85 to 89.9	0	0	0	0	0	0
Ultrabrachycephalic	90 to 94.9	0	0	0	0	0	0
Total		61	100	38	100	99	100



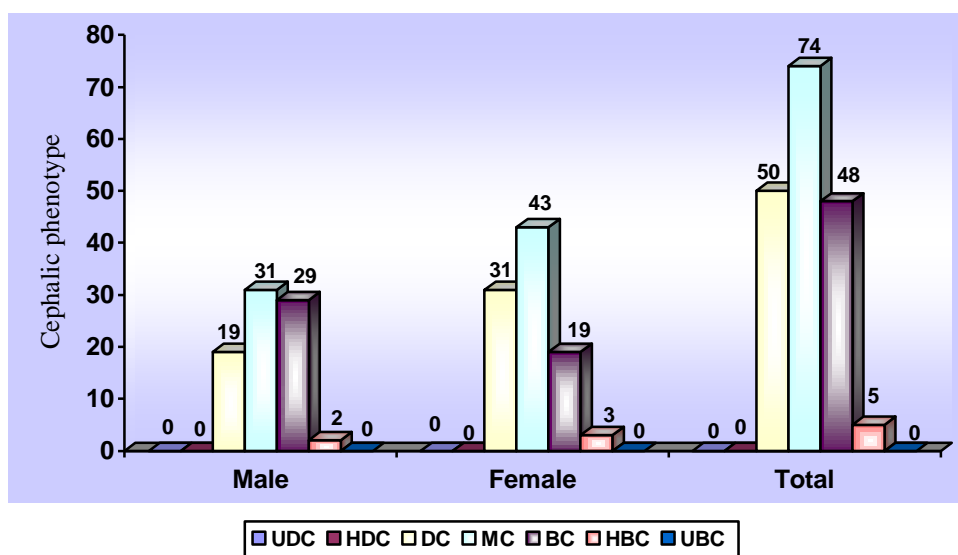
**Graph 15: Bar Chart showing different types of Cephalic Phenotype among North Indians**

The above table and graph show that out of 61 males of North India dolichocephalic head predominated in 70.49% students followed by mesocephalic type in 21.31%, brachycephalic in 8.19%. Out of 38 females, dolichocephalics were predominant in 68.42% students. 21.05% were mesocephalics, 10.52% were brachycephalics.

**Table 21**

**Different types of Cephalic Phenotype among South Indians**

Cephalic Phenotype	Range of Cephalic Index	Male		Female		Total	
		No	%	No	%	No	%
Ultradolichocephalic	55 to 59.9	0	0	0	0	0	0
Hyperdolichocephalic	60 to 64.9	0	0	0	0	0	0
Dolichocephalic	65 to 74.9	19	23.45	31	32.29	50	28.24
Mesocephalic	75 to 79.9	31	38.27	43	44.79	74	41.80
Brachycephalic	80 to 84.9	29	35.80	19	19.79	48	27.11
Hyperbrachycephalic	85 to 89.9	2	2.46	3	3.12	5	2.82
Ultrabrachycephalic	90 to 94.9	0	0	0	0	0	0
Total		81	100	96	100	177	100



**Graph 16: Bar Chart showing different types of Cephalic Phenotype among South Indians**

The above table and graph show that out of 81 males of South India mesocephalic head predominated in 38.27% students followed brachycephalic type in 35.80%, dolichocephalic in 23.45% and hyperbrachycephalic in 2.46%. Out of 96 females, mesocephalic head type was predominant in 44.79% students. 32.29% were dolichocephalics, 19.79% were brachycephalics and 3.12% were hyperbrachycephalic.

**Table 22**

**Comparison of Cephalic Index between males and females Students of study group**

<b>Gender</b>	<b>Number</b>	<b>Mean ±S.D</b>	<b>Z-Test</b>	<b>P-value</b>
Male	154	76.57±4.51	0.74	<0.001***
Female	146	76.73±3.97		

Statistical analysis is done by Z-Test

Not significant=  $P > 0.05$ , Significant = \*  $P < 0.05$ , Highly significant = \*\*  $P < 0.01$ ,

Very highly significant = \*\*\*  $P < 0.001$

**Table 23**

**Comparison of Cephalic Index between North and South Indian Students**

<b>Region</b>	<b>Number</b>	<b>Mean ±S.D</b>	<b>Z-Test</b>	<b>P-value</b>
North	99	74.44±3.17	0.0000417	<0.00001***
South	177	77.71±4.18		

Statistical analysis is done by Z-Test

Not significant=  $P > 0.05$ , Significant = \*  $P < 0.05$ , Highly significant = \*\*  $P < 0.01$ ,

Very highly significant = \*\*\*  $P < 0.001$

**Table 24:  
Comparison of Cephalic Index in males and females of North and South Indian Students**

Region	Gender	No. of subjects	Cephalic Index			Ref. Range (95% CI)	Male Vs Female		
			Min	Max	Mean $\pm$ SD		Mean Diff.	Z-value	P
North	Male	61	67.88	82.78	74.16 $\pm$ 3.21	73.36-74.96	1.43	0.000028	<0.000001***
	Female	38	70.61	81.35	74.87 $\pm$ 3.10	73.89-75.85			
	Total	99	67.88	82.98	74.44 $\pm$ 3.17	73.81-75.05			
South	Male	81	67.88	87.69	78.26 $\pm$ 4.29	77.32-79.19	1.29	0.00001	<0.00001***
	Female	96	70.06	86.40	77.24 $\pm$ 4.05	76.42-78.05			
	Total	177	67..88	87.69	77.71 $\pm$ 4.18	77.09-78.32			

Statistical analysis is done by Z-Test

Not significant = P value >0.05, Significant = \* P < 0.05, Highly Significant = \*\* P < 0.01, Very highly significant = \*\*\* P < 0.001

## DISCUSSION

Cephalic Index is an index used in anthropology to distinguish the given sample or individual, either into race or sex or even for personal identification of the individual.

It has been learnt from the available literature that Cephalic Index is affected by geographical, racial, gender and age factors.

It has value in Forensic medicine where cranial remains can be compared with existing photographic records in making identification. Anthropometrical surveys provide norms about the physique of national populations. Trends of change are studied by such consecutive surveys for number of years. Estimates for some physiological functions like basal metabolism, vital capacity, nutritional requirements etc. can be estimated by means of anthropometrical data.

The results of these measurements are used in Pediatrics, Forensic Medicine, anthropology, and Diagnostic comprehension between patient and normal population.

Thus this study was undertaken to determine the Cephalic Index of students of Phase –I MBBS of Shri B.M. Patil Medical College, Hospital and Research Centre, Bijapur.

The Cephalic Index of males and females were compared to know gender variation.

Comparison between Cephalic Index of North Indian and South Indian Students was done to know geographical distribution.

Total 300 students were included in the study belonging to Phase-I MBBS during the total study period of one and half years.

The head length and head breadth of the student was measured using spreading calipers with student sitting in a chair, head in anatomical position.

The Cephalic Index was calculated as the percentage of head breadth divided by head length.

### **Head Breadth:**

In present study, the head breadth varied from 12.06 to 16.6cm, the mean head breadth being 13.76cm. In males the head breadth varied from 12.38 to 16.6cm, the average being 14.06cm .In females the head breadth ranged from 11.53 to 15.06cm the mean being 13.45cm.

In a study done by Shah and Jadhav<sup>29</sup> the head breadth of males ranged from 12.7 to 16.4cm, the mean head breadth was 14.56 cm. In females the head breadth varied from 12.7 to 15.6cm, the mean being 14.1cm.

Among the North Indian students of present study the average head breadth was found to be 13.5cm. In males the head breadth varied from 12.33 to 15.46cm the mean was 13.62cm. In females the head breadth was in the range of 12.06 to 15.06cm with average of 13.31cm.

In a study by Bhargav and Kher<sup>17</sup> (Northern region) the average head breadth was 13.6cm.

Average head breadth among South Indian students of present study was found to be 13.9cm .In males the head breadth was in the range of 12.53 to 16.cm the mean being 14.4cm .In females it ranged from 11.53 to 15.1cm, mean being 13.5 cm.

In a study by Gangadhar and Reddy <sup>26</sup> (Southern region) the head breadth was in the range of 10.4 to 16.4cm in males, the mean head breadth was 12.43cm. In females head breadth ranged from 7.2 to 15.6cm with an average of 12.43cm.

### **Head Length:**

In present study the head length ranged from 15.13 to 20.1cm, the mean head length being 17.96cm. In males the head length varied from 16.63 to 20.1cm, the mean head length was 18.38cm. In females the range was between 15.13 to 18.93cm, the mean head length being 17.52cm.

According to study conducted by Shah and Jadhav <sup>29</sup>, in males head length varied from 16.5cm to 20.1cm, the mean head length being 18.26cm. In female the head length varied from 14.1cm to 18.9cm with mean head length being 16.5cm.

The mean head length in North Indian students of the present study is 18.14cm. In males it ranged from 16.93 to 19.96cm, the mean being 18.34cm. In females the head length is between 17.03 to 18.93cm, the mean being 17.82cm.

In a study by Bhargav and Kher <sup>17</sup> the average head length was 17.68cm.

The mean head length in South Indian students of present study is 17.89cm. In males it ranged from 16.63 to 20.1cm, the mean being 18.4cm. In females the range is between 16.13 to 18.86cm, the mean being 17.45cm.

The head length was in the range of 15.8 to 20.6 cm in case of males and 15.0 to 18.2 cm in case of females in study by Gangadhar and Reddy<sup>26</sup>. The mean head length was 18.64cm and 17.39cm in case of males and females respectively.

### **Cephalic Index:**

In present study minimum Cephalic Index was 64.13 and maximum was 86.8 units, the mean being 76.65. In males the Cephalic Index was in the range of 64.13 to 87.69, the mean being 76.57 and in females the range was between 70.61 to 86.8, the mean being 76.73.

In Shah and Jadhav<sup>29</sup> study, the minimum Cephalic Index was 71.10 and maximum was 89.77, the mean being 80.81. The mean Cephalic Index in males was 80.42 and that of females was 81.20.

In North Indian students of present study, the mean Cephalic Index was found to be 74.44. In males it ranged from 67.88 to 82.98, the mean being 74.16. In females, it ranged from 70.61 to 81.3, the mean being 74.87.

In Bhargav and Kher<sup>17</sup> study the mean Cephalic Index was 76.98.

In south Indian students of the present study, the mean Cephalic Index was 77.71. In males it ranged from 67.88 to 87.69, the mean being 78.26. In females, it ranged from 70.8 to 86.4, the mean being 74.87.

In study by Gangadhar and Reddy<sup>26</sup>, the average Cephalic Index was 77.79. Cephalic Index ranges from 60.4 to 88.2 with a mean value of 77.26 among the males and 47.3 to 82.3 with an average value of 72.19 in case of females.



In present study dolichocephalic type of cephalic phenotype predominated in both males (43.50 %) and females (40.41%).

In North Indian students, dolichocephalic type of head shape was predominant in case of both males (70.49%) and females (68.42%)

Study by Bhargav and Kher<sup>17</sup> showed tendency towards brachycephaly. .

Study conducted throughout India in 1895, <sup>16</sup> showed Rajasthan people are dolichocephalic. In Punjab majority are dolichocephalic to hyperdolichocephalic. People living in North –Western states of India i.e. Uttar Pradesh, Bihar and Bengal are predominantly dolichocephalic.

South Indian students of present study showed mesocephalic phenotype. 38.27% of males and 44.79% of females were mesocephalics.

In Gangadhar and Reddy<sup>26</sup> study, majority of males belonged to dolichocephalic category (37.06%) and higher proportion of females (62.89%) were under hyperdolichocephalic category.

Study was also conducted throughout India in 1895. <sup>16</sup> In Tamil Nadu among seven castes the head was mesocephalic in above 50%, in Kerala dolichocephalic and in Karnataka mesocephalic.

**Table 25:****Cephalic Index in different Indian groups compared with present study**

<b>Sl. No.</b>	<b>Population</b>	<b>Workers</b>	<b>Sample No.</b>	<b>Mean Cephalic Index</b>
1	KayasthaVangaja	Basu <sup>18</sup> (1963)	100	79.50
2	Barelas	Bhargav and Kher <sup>17</sup> (1961)	100	79.80
3	Gujarati	Shah GV and Jadhav HR <sup>29</sup> (2004)	302	80.42
4	North Indians	Anitha MR <sup>41</sup> (2010)	100	79.72
	South Indians		100	81.99
<b>Present study</b>				
5	Study group	Present study	300	76.65
6	Northern Indians	Present study	99	74.44
7	Southern Indians	Present study	177	77.71

## CONCLUSION

The present study was conducted on Phase-I MBBS Students of Shri B.M.Patil Medical College Hospital and Research Centre, Bijapur. Cephalic Index was calculated after measuring the head breadth and head length of the students using spreading calipers.

The mean Cephalic Index was 76.65.

In case of North Indian students mean Cephalic Index was 74.44.

In South Indian students, mean Cephalic Index was 77.71.

Dolichocephalic type of head shape predominated among North Indian students where as mesocephalic type was predominant in South Indian students. The population of temperate zone showed dolichocephaly and that of tropical zone showed mesocephaly. Thus geographical variation was observed in present study.

The mean Cephalic Index in case of males was 76.57 and that of females was 76.63.

In North Indian students: males 74.16 and females 74.87

In South Indian students: males 78.26 and females 77.24.

Thus there was significant gender difference in present study.

Thus the result of the present study may be useful in Pediatrics, Forensic Medicine, Plastic surgery, and Diagnostic comprehension between patient and normal population.

## SUMMARY

Cephalic Index is the terminology used since long time in anthropology for having an easy identifying module or numerical to distinguish the given sample or individual, either into race or sex or even as identity of the individual .They are useful in Forensic medicine where cranial remains can be compared with existing photographic records in making identification. Cephalic Index is affected by geographical, racial, gender and age factors.

Keeping the above facts in mind, the present study was undertaken to determine Cephalic Index and head shape in Phase-I MBBS Students of Shri B.M. Patil Medical College Hospital and Research Centre, Bijapur.

Maximum head breadth and maximum head length were measured with subjects sitting in anatomical position by using the spreading calipers. The Cephalic Index was calculated using the standard formula and depending on the unit values the subjects were categorized into different cephalic phenotypes.

The mean Cephalic Index among study group (N=300) was  $76.65 \pm 4.25$ .

The mean Cephalic Index among males of study group (N=154) was  $76.57 \pm 4.51$  and that of females (N=146) was  $76.73 \pm 3.97$ .

On comparison, Cephalic Index of females of total study group was found to be significantly higher than that of males.

The mean Cephalic Index among North Indians students (N=99) was  $74.44 \pm 3.17$ .

The mean Cephalic Index among North Indian males (N=61) was  $74.16 \pm 3.21$  and that among females (N=38) was  $74.87 \pm 3.10$ .

The mean Cephalic Index among South Indian students (N=177) was  $77.71 \pm 4.18$ .

The mean Cephalic Index among South Indian males (N=81) was  $78.26 \pm 4.29$  and that among females (N= 96) was  $77.24 \pm 4.05$ .

On comparison, Cephalic Index of South Indians was found significantly higher than North Indians.

On comparison, Cephalic Index of females of North Indians was found significantly higher than males.

On comparison, Cephalic Index of males of South Indian students was found significantly higher than females.

Dolichocephalic Type (42%) of cephalic phenotype predominated in the present study followed by mesocephalic (34.33%) , brachycephalic (21%), hyperbrachycephalic (2.33%) and hyperdolichocephalic 0.33%.

Majority of the males and females were dolichocephalics i.e. 43.50% and 40.41% respectively.

Among North Indians males 70.49% were dolichocephalic, 21.31% mesocephalic and 8.19% brachycephalic. Among females 68.42% were dolichocephalics 21.05% mesocephalic and 10.52% brachycephalic.

Among the South Indian males 38.27% were mesocephalic, 35.80% brachycephalic, 23.45% dolichocephalic and 2.46% hyperbrachycephalic. Among females 44.79% were mesocephalics, 32.29% dolichocephalic, 19.79% brachycephalic and 3.12% hyperbrachycephalic.

Thus significant geographical and gender variation was observed in the present study.

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## PROFORMA

S.No.

Date:

Name:

Sex:

Age:

Address

Measurements:

Maximum Breadth of Skull:

Maximum Length of Skull:

Cephalic Index: -----\* 100

Range of Head Length	Male		Female		Total	
	No	%	No	%	No	%

Range of Head breadth	Male		Female		Total	
	No	%	No	%	No	%

Cephalic Index	Male		Female	
	No of Subjects	Percentage	No of Subjects	Percentage

Signature of student:

Signature of PG:

Signature of guide:

## MASTER CHART

S No	NAME	SEX	STATE	Max Head Breadth (Cm)	Max Head Length (Cm)	Cephalic Index
1	A K	M	Bihar	14.26	19.96	71.4
2	S G	F	Bihar	13.3	18.36	72.4
3	S F A	M	Andhra Pradesh	14.13	18.06	78.2
4	A S	M	Uttar Pradesh	14.03	19.03	73.72
5	V S	M	Haryana	13.46	18.6	72.36
6	A G	F	Uttar Pradesh	12.53	17.06	73.4
7	D	M	Andhra Pradesh	14.56	19.46	74.2
8	M A	M	Bihar	13.53	18.23	74.2
9	S N	F	West Bengal	14.06	17.53	80.2
10	R U	M	Haryana	13.56	18.46	73.4
11	K S	M	Andhra Pradesh	14.66	18.5	79.2
12	N S	M	Rajasthan	13.03	18.66	69.82
13	R P	M	Andhra Pradesh	14.56	18.4	79.1
14	N V	F	Andhra Pradesh	13.13	17.73	74.05
15	R K	M	Bihar	13.46	19.13	70.36
16	M A P	F	Andhra Pradesh	15.06	17.53	86.4
17	D S	F	Andhra Pradesh	13.6	17.86	76.14
18	A D	F	Haryana	13.33	18.13	73.54
19	M P	M	Andhra Pradesh	15.33	19.13	80.1
20	S V S	M	Andhra Pradesh	15.06	20.1	74.92
21	S K	M	Karnataka	16.1	18.5	87
22	A R	F	Andhra Pradesh	14.06	17.36	80.9
23	S A A	M	Andhra Pradesh	14.5	17.46	83.04
24	V T	F	Andhra Pradesh	13.56	17.3	78.38
25	AV	M	Karnataka	15.5	20.1	77.1
26	AR	F	Andhra Pradesh	14.26	18.53	76.95
27	A R	F	Andhra Pradesh	14.63	17.23	84.49
28	S L	M	Karnataka	14.33	18.8	76.22
29	R S	F	Andhra Pradesh	14.13	16.63	84.96
30	A V	F	Tamilnadu	14.1	17.7	79.6
31	D K	M	Andhra Pradesh	15.63	19.56	79.9
32	A P	F	Chattisgarh	13.93	17.46	79.78
33	S S	M	Bihar	13.03	18.16	71.75
34	A C	M	Andhra Pradesh	15.23	18.06	84.33
35	A S	F	Andhra Pradesh	14.5	18.16	79.84
36	V S	M	Andhra Pradesh	15.53	18.56	83.67
37	D S	M	Karnataka	15.53	19.2	80.88
38	S P	M	Karnataka	14.66	17.53	83.62
39	P N	F	Chattisgarh	14.06	18.03	77.98
40	G P	F	Andhra Pradesh	14.13	18.23	77.5
41	S A	M	Andhra Pradesh	15.7	18.56	84.59
42	N B	M	Karnataka	15.16	18.76	80.81
43	A G	M	Andhra Pradesh	14.23	17.53	81.17
44	A R	M	Uttar Pradesh	14.56	18.43	79.08
45	C B	F	Assam	14.36	17.46	82.28

46	A S	F	Bihar	13.06	17.3	75.52
47	S S	M	Haryana	13.5	18.06	74.75
48	T D	M	Karnataka	15.13	18.56	81.51
49	S N	M	Karnataka	14.73	18.33	80.36
50	M M	M	Andhra Pradesh	14.26	17.06	83.58
51	V P	M	Karnataka	14.56	17.46	83.33
52	M K A	F	Andhra Pradesh	14.46	18.36	78.75
53	AKD	M	Bihar	13.53	18.43	73.41
54	D V	F	Andhra Pradesh	15.06	17.43	86.4
55	A A	M	Karnataka	14.56	18.13	80.3
56	A P N	M	Karnataka	15.53	18.53	83.81
57	S S	F	Bihar	14.63	18.4	79.5
58	S C	F	Maharashtra	14.53	17.26	84.18
59	T R	M	Andhra Pradesh	15.56	18.56	83.83
60	L T	F	Karnataka	14.03	16.53	84.83
61	S G	M	Andhra Pradesh	15.16	18.66	81.24
62	D A	F	Andhra Pradesh	14.76	18	82
63	A J	F	Karnataka	14.1	16.86	83.62
64	A K	M	Bihar	12.66	18.66	67.88
65	V P M	M	Karnataka	14.66	18.23	80.41
66	M S	F	Haryana	13.06	18.13	72.07
67	A I	F	Karnataka	14.36	18.86	76.13
68	A K	M	Karnataka	14.96	18.56	80.6
69	P O	F	Haryana	12.93	17.6	73.48
70	Y S	M	Andhra Pradesh	15.06	18.66	80.38
71	AKP	M	Orissa	15.36	19.16	80.16
72	N E	F	Bihar	15.03	18.93	79.39
73	P A	M	Andhra Pradesh	15.7	18.56	84.5
74	M H	F	Andhra Pradesh	14.3	18.56	77.04
75	G K	M	Jharkhand	14.53	18.03	80.58
76	A S	M	Andhra Pradesh	15.1	19.63	76.92
77	Cs	F	Andhra Pradesh	13.53	18.1	74.75
78	V A	F	Andhra Pradesh	14.66	18.16	80.72
79	S K	M	Andhra Pradesh	14.56	19.36	75.2
80	SVA	M	Karnataka	14.56	18.7	77.86
81	K P	F	Andhra Pradesh	13.83	18.13	76.28
82	S D	M	Orissa	13.8	18.26	75.57
83	AP	M	West Bengal	15.43	18.13	85.1
84	N S	F	J&K	13.83	17.16	80.59
85	A K G	M	Andhra Pradesh	13.73	18.7	73.4
86	M A	F	Delhi	14.06	17.33	81.3
87	C R K	M	Andhra Pradesh	14.63	18.33	79.81
88	R M	F	Andhra Pradesh	14.6	17.36	84.1
89	R V	M	Uttar Pradesh	15.13	19.13	79.09
90	R K	M	Bihar	15.16	18.86	80.38
91	M R	F	Andhra Pradesh	14.03	17.46	80.35
92	N M	F	Andhra Pradesh	13.2	18.43	71.62
93	T N	F	Andhra Pradesh	14.6	17.66	79.61
94	P J	F	Andhra Pradesh	13.56	17.36	78.11
95	B S	F	Andhra Pradesh	14.06	17.26	80.52
96	S R	M	Uttar Pradesh	14.63	19.2	76.19
97	TTP	F	Karnataka	14.13	18.06	78.23
98	I R K	M	Punjab	15.46	18.63	82.98

99	A S	M	Delhi	13.63	18.7	72.88
100	D M	F	Kerala	14.56	17.13	84.99
101	RVS K	M	Andhra Pradesh	15.13	19.16	78.96
102	S A K	M	Andhra Pradesh	13.53	17.13	79
103	D M	M	Uttar Pradesh	15.26	18.53	82.35
104	A S	M	Delhi	14.66	19.3	75.9
105	A G	F	Karnataka	14.36	17.56	81.8
106	S M	F	Andhra Pradesh	14.43	18.33	78.72
107	S P	M	Karnataka	14.33	18.8	76.24
108	A SY	M	Uttar Pradesh	12.56	16.93	74.22
109	S S	M	West Bengal	14.56	18.53	78.61
110	A L	F	Andhra Pradesh	13.63	17.83	76.46
111	V N T	F	Andhra Pradesh	14.43	17.33	83.28
112	M S	F	Bihar	12.56	17.03	73.79
113	P S	F	Karnataka	14.13	17.03	82.9
114	D A	M	Andhra Pradesh	16.6	19.7	81.5
115	G M	M	Andhra Pradesh	14.3	18.46	77.46
116	S S	F	Andhra Pradesh	14.23	18.03	78.94
117	A P	M	Madhya Pradesh	12.33	17.13	71.99
118	T D	F	Andhra Pradesh	14.53	17.33	83.86
119	S N	F	Bihar	14.36	17.06	81.35
120	G R N	F	Andhra Pradesh	14.63	17.1	85.57
121	HY	F	Andhra Pradesh	13.56	17.86	75.96
122	D S	M	West Bengal	15.36	18.83	81.6
123	K P	F	Andhra Pradesh	13.33	17.56	75.91
124	A S V	M	Karnataka	16.1	18.36	87.69
125	P K	F	Madhya Pradesh	13.43	18.16	73.97
126	S M	F	Karnataka	11.53	16.13	71.5
127	P G	F	Maharashtra	14.06	17.06	82.45
128	A S	F	Andhra Pradesh	13.36	18.33	72.92
129	NNH	M	Karnataka	15.1	19.06	79.22
130	V P R	M	Andhra Pradesh	14.13	18.66	75.74
131	N K	F	Madhya Pradesh	13.16	18.56	70.94
132	N K	F	Haryana	14.36	18.5	77.65
133	P K R	M	Andhra Pradesh	14.66	17.53	83.66
134	V P	M	Bihar	13.06	18.83	69.35
135	K S	F	Bihar	13.06	18.13	72.07
136	M T	F	Andhra Pradesh	13.33	17.7	75.32
137	V S B	F	Karnataka	13.53	17.03	79.46
138	K D	F	Karnataka	14.13	17.33	81.55
139	G R	M	Andhra Pradesh	15.06	18.36	82.06
140	M P	M	Karnataka	15.3	18.53	82.56
141	V K P	M	Karnataka	15.43	18.73	82.39
142	S P P	M	Uttar Pradesh	12.63	17.43	72.46
143	AK	F	Bihar	13.63	18.33	74.37
144	P K	M	Andhra Pradesh	13.16	19.06	71.35
145	A G	M	Bihar	14.43	17.06	81.72
146	S S	M	Haryana	13.33	18.5	72.05
147	A P	M	Karnataka	14.36	18.06	79.54
148	P M	M	Chattisgarh	12.53	17.36	72.19
149	N B	M	Andhra Pradesh	15.63	19.1	81.84
150	V K	M	Karnataka	14.56	18.8	77.48
151	M A H	M	Bihar	13.26	18.86	70.34

152	S K	M	Raxaul	13.13	17.53	74.91
153	A F	F	Delhi	13.1	17.56	74.6
154	P A	F	Delhi	13.26	17.23	76.99
155	M D	F	Andhra Pradesh	13.13	17.63	74.49
156	H K	M	Bihar	14.16	18.6	76.16
157	R S	F	Orissa	12.06	16.66	72.42
158	G D	M	Delhi	14.16	18.5	76.57
159	G J	M	Rajasthan	14.2	18.43	77.04
160	A C	M	Delhi	13.7	18.06	75.85
161	S S	M	Bihar	13.13	18.46	71.14
162	S K	F	Delhi	12.2	17.13	71.22
163	R K	M	Bihar	13.1	18.23	71.85
164	A B	M	Orissa	12.33	19.23	64.13
165	P	M	Maharashtra	13.16	17.56	74.98
166	R	F	Haryana	13.46	18.16	74.15
167	MMM	F	Jharkhand	13.5	18.06	74.75
168	S N	F	Rajasthan	13.53	18.43	73.41
169	K	M	Bihar	13.56	18.53	73.2
170	N M	F	Karnataka	12.46	17.56	70.95
171	A K D	M	Bihar	13.03	18.16	71.75
172	K V	F	Andhra Pradesh	11.53	16.13	71.5
173	DSSVB	M	Andhra Pradesh	12.56	18.16	69.19
174	S C	M	Haryana	13.13	17.16	76.53
175	U G	F	Jharkhand	13.06	17.3	75.52
176	V V	M	Andhra Pradesh	13.16	18.56	70.94
177	AG	M	Uttar Pradesh	13.6	18.06	75.3
178	T V	F	Andhra Pradesh	13.2	18.03	73.21
179	T S B	M	Jharkhand	13.43	18.03	74.5
180	R T	M	Assam	13.33	18.56	71.83
181	A U	F	Kerala	13.33	18.2	73.26
182	N A	M	Haryana	13.9	18.4	75.54
183	D S	F	Andhra Pradesh	12.36	16.6	74.49
184	R A	M	Kerala	14	18.43	75.96
185	N S	F	West Bengal	12.06	16.6	72.69
186	P K	F	Andhra Pradesh	12.96	18.03	71.91
187	T A	F	Andhra Pradesh	13.13	18.03	71.91
188	A K	M	Bihar	12.83	18.2	70.51
189	R Y	F	Delhi	13.43	18.16	73.97
190	A M	M	Karnataka	14.13	18.2	77.63
191	P D	F	Uttarakhand	12.06	17.03	70.85
192	B P K	M	Andhra Pradesh	13.06	18.13	72.07
193	D J	F	Kerala	12.83	18.03	71.17
194	A J	M	Uttar Pradesh	13.13	18.33	72.19
195	M H	M	Andhra Pradesh	12.53	17.36	71.64
196	R S	F	Andhra Pradesh	12.73	17.03	74.77
197	A S V	F	Andhra Pradesh	12.36	16.43	75.26
198	C M	M	Andhra Pradesh	12.93	18.13	71.33
199	S L	F	Andhra Pradesh	12.63	17.43	72.46
200	A G	M	West Bengal	13.96	17.56	79.53
201	S L	F	West Bengal	14.06	18.13	77.58
202	J R	M	Andhra Pradesh	12.66	18.66	67.88
203	R S M	M	Andhra Pradesh	14.4	18.96	75.94
204	R N T	F	Andhra Pradesh	14.13	17.96	78.69



205	G A R	M	Andhra Pradesh	12.56	17.13	73.32
206	Ad S	F	Bihar	13.13	18.06	72.72
207	B J	F	Karnataka	13.83	17.16	80.59
208	G S	M	Bihar	14.03	17.56	79.91
209	T A	F	Andhra Pradesh	13.76	17.13	80.36
210	H K	M	Jharkhand	13.1	18.06	72.53
211	S Ch	F	Karnataka	13.56	17.43	77.79
212	R S	F	Gujarat	13.06	17.56	74.41
213	S C	M	Madhya Pradesh	12.9	18.13	71.15
214	S S K	M	Andhra Pradesh	13.53	17.66	76.63
215	M S	F	Andhra Pradesh	12.76	17.4	73.37
216	M M	F	Andhra Pradesh	13.13	18.43	71.26
217	N K	F	Bihar	12.4	17.56	70.61
218	A B	M	West Bengal	13.4	18.2	73.62
219	N T	M	Rajasthan	14.06	19.06	73.8
220	D R	M	Andhra Pradesh	13.56	18.73	72.39
221	P S	M	Andhra Pradesh	14	17.66	79.27
222	S K	F	Karnataka	12.63	17.13	73.74
223	S J	F	Haryana	13.06	18.36	71.16
224	PT K	M	Andhra Pradesh	15.06	18.06	83.42
225	A B	M	Delhi	12.93	17.56	73.65
226	V B	M	Bihar	13.13	18.26	71.92
227	A B	M	Haryana	13.16	18.16	72.5
228	N K	M	Himachal Pradesh	14.93	18.86	79.17
229	D A	M	Andhra Pradesh	13.33	18.93	70.43
230	V P	M	Delhi	13.83	18.86	73.34
231	G R	F	Andhra Pradesh	13.06	17.63	74.11
232	A K	F	Andhra Pradesh	12.56	17	73.92
233	M K	F	Andhra Pradesh	12.43	17.56	70.8
234	R M R	M	Andhra Pradesh	14.36	17.46	82.28
235	B N	M	West Bengal	14.36	18.3	78.5
236	S F	M	Uttar Pradesh	13.43	17.96	74.79
237	S G	F	West Bengal	12.56	17.13	73.36
238	A D	F	Andhra Pradesh	13.56	17.1	79.33
239	A K	M	Bihar	13.03	17.63	73.92
240	S V	F	Andhra Pradesh	13.63	18.1	75.32
241	M I A	M	Andhra Pradesh	13.76	16.63	82.78
242	A A	M	Rajasthan	13.63	18.2	74.9
243	K S R	F	Andhra Pradesh	13.43	17.53	76.63
244	S G	F	Delhi	13.43	18.36	73.16
245	A A	F	Delhi	13.16	17.96	73.31
246	M G S	F	Andhra Pradesh	12.96	16.63	77.97
247	K T	F	Andhra Pradesh	13.43	17.06	78.74
248	R Y	F	Haryana	12.53	17.03	73.59
249	P S	F	Uttar Pradesh	13.13	18.03	72.84
250	A R	M	Andhra Pradesh	13.3	18.76	70.89
251	N Y	M	Uttar Pradesh	13.46	18.53	72.67
252	K M H	F	Andhra Pradesh	13.33	17.06	78.15
253	P C	M	Andhra Pradesh	13.43	18.13	74.09
254	K B	F	West Bengal	13.1	17.13	76.47
255	R C	M	West Bengal	12.63	17.93	70.45
256	KK J	M	Andhra Pradesh	13.4	18.56	72.19
257	L G	F	Rajasthan	12.46	17.03	73.2

258	S R V	F	Andhra Pradesh	13.06	17.33	75.39
259	K A	M	Andhra Pradesh	13.5	18	75
260	S S	F	Andhra Pradesh	13.03	17.43	74.77
261	A S	F	Madhya Pradesh	13.13	18.06	72.72
262	P V R	M	Andhra Pradesh	13.86	18.93	73.21
263	S M T	M	Andhra Pradesh	13.76	18.63	73.89
264	L P	F	Andhra Pradesh	13.33	17.5	76.19
265	K J R	F	Andhra Pradesh	13.13	17	77.25
266	S S	F	west Bengal	13.13	15.13	86.8
267	V S M	F	Andhra Pradesh	12.93	17.6	73.48
268	P L	M	Bihar	13.36	18.03	74.13
269	L S	F	Andhra Pradesh	13.26	16.63	79.77
270	S P	F	Andhra Pradesh	13.03	16.73	77.9
271	A S	M	Andhra Pradesh	13.86	18.06	76.78
272	M R R	F	Andhra Pradesh	13.33	16.63	80.17
273	S P	F	Andhra Pradesh	12.76	17.2	74.22
274	A S	F	Andhra Pradesh	12.33	17.13	71.99
275	R B	F	Maharashtra	13.46	17.46	77.12
276	V	M	Bihar	13.36	18.13	73.72
277	S K	M	Karnataka	13.96	18.16	76.9
278	V B K	M	Rajasthan	14.03	18.93	74.13
279	B S A	F	Andhra Pradesh	13.46	17.1	78.75
280	M G	M	Himachal Pradesh	13.93	19.03	73.21
281	T K	F	Karnataka	13.03	17.2	75.77
282	S R	F	Andhra Pradesh	13.83	17.46	79.22
283	K P	F	Andhra Pradesh	13.56	17.43	77.83
284	A V	F	Andhra Pradesh	13.13	17.26	76.09
285	T V S	F	Andhra Pradesh	12.63	17.03	74.18
286	M D	F	Chattisgarh	13.43	18.16	73.97
287	P V R	M	Andhra Pradesh	14.13	19.03	75.49
288	D A	M	Andhra Pradesh	13.43	17.13	78.41
289	S S	F	Andhra Pradesh	12.56	16.93	74.22
290	N G	F	Andhra Pradesh	13.26	17.53	75.67
291	M R	M	Andhra Pradesh	13.4	17.13	78.61
292	P S	F	Karnataka	12.56	17.03	73.79
293	N P	F	Karnataka	13.36	17.56	76.11
294	G R	F	Andhra Pradesh	13.36	17.06	78.35
295	B	M	Karnataka	13.43	17.13	78.41
296	P K	F	Karnataka	13	16.9	76.92
297	P R	M	Andhra Pradesh	13.73	18.56	73.99
298	N S	M	Haryana	13.33	19.03	70.06
299	K M	F	Andhra Pradesh	13.03	17.26	75.51
300	G S	F	Andhra Pradesh	12.93	17.03	75.94

B.L.D.E.A'S SHRI B.M,PATIL MEDICAL COLLEGE , BIJAPUR.  
INSTITUTIONAL ETHICAL COMMITTEE

Dr. Vijay Ganjoo  
Chairperson, I.E.C.  
B.L.D.E.A'S Shri B.M.Patil Medical college  
Bijapur-586103



INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

The Ethical Committee of this college met on -----  
22-09-2008

at -----03-15 pm-----to scrutinize the Synopsis / Research projects of post graduate student / undergraduate student / Faculty members of this college from ethical clearance point of view. After scrutiny the following original / corrected & revised version Synopsis of the Thesis/ Research project has been accorded Ethical Clearance.

Title Study of Cephalic index in north Indian and South Indian students of Phase-I MBBS Shri B.M. Patil Medical College, Hospital & Research centre Bijapur

Name of P.G / U.G student / Faculty member Pretty Rathnakar

Name of Guide Dr. B.M. Bannur Prof of Anatomy

  
Dr. Vijay Ganjoo  
Chairperson  
Institutional Ethical Committee

Date:

Following documents were placed before E.C. for scrutinization:

- 1) Copy of Synopsis / Research project
- 2) Copy of informed consent form
- 3) Any other relevant document/s