

## An ultrasonographic evaluation of foetal head types during second and third trimester of pregnancy at RIMS, RAIPUR, CHHATTISGARH



### Radiology

**KEYWORDS:** Foetus, Cephalic index, Gestational Age, Brachycephalic, Mesocephalic. Raipur

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### ABSTRACT

Among foetuses of different population, mesocephalic, brachycephalic and hyperbrachycephalic heads have been frequent. The present research was conducted to study various head types and its distribution among foetuses after first trimester up to full term of pregnancy by ultrasonography at RIMS, RAIPUR. Brachycephalic (5.2%) head was more frequent than hyperbrachycephalic (3.2%) during first four weeks of second trimester. During 16.1-20 weeks of gestational age, brachycephalic head type (6.4%) predominated over mesocephalic and hyperbrachycephalic. Mesocephalic head (4%) ranked next to brachycephalic (5.2%) during 20.1-24 weeks. But during 24.1-32 weeks, mesocephalic head predominated over brachycephalic head. During subsequent age interval, brachycephalic type (17.2%) outnumbered mesocephalic type (10.4%) and continued to dominate (11.2%) over mesocephalic head (2.8%) up to full term. Overall, brachycephalic foetal head type constituted the major chunk (54%; CI 82.11 ± 1.39) followed by mesocephalic (33.6%; CI 77.88 ± 1.36) and hyperbrachycephalic head (8.4%; CI 86.67 ± 1.16). Dolichocephalic head was noted to be the least (4%; CI 73.2 ± 3.16) among the foetuses during 12.1 – 40 weeks of gestation. The present study concluded that the commonest type foetal skull was brachycephalic followed by mesocephalic whereas dolichocephalic was the least common type in RAIPUR, CHHATTISGARH.

### INTRODUCTION

Cephalometry is an important tool for anthropologists and forensic experts used for identification of the racial differences, sexual differences, comparison of changes between parents, offspring and siblings towards their genetic transmission of inherited characteristics and also to a great extent for the facial reconstruction of disputed identity. Cephalic index is one of the parameters that help to differentiate between different human races. Various studies on cephalometry have been conducted in our country and accordingly human population has been categorised as different head types based on cephalic index in a particular population. Majority of these studies has been conducted on adult population. Only few studies have been conducted among foetuses so far in India with various conclusions as far as distribution of foetal head types is concern. Out of various head types, mesocephalic, brachycephalic and hyperbrachycephalic head has been shown to be frequent among foetuses of different population as far as gestational age group has been concerned. The aim and objective of the present research work was to study various head types and its distribution among foetuses after first trimester up to full term of pregnancy by ultrasonography. This study will serve as basis of comparison for future studies in the same as well as other geographical region population.

### MATERIAL & METHODS

The present study was conducted in the Department of Radiodiagnosis, RIMS, RAIPUR, CHHATTISGARH on pregnant women who were advised for ultrasonography with certain indications conforming the provisions and guidelines of the Pre-Conception and Pre-Natal Diagnostic Techniques (Prohibition of Sex Selection) Act, 1994. The data was collected from two hundred fifty healthy pregnant women during routine ultrasonography in the 2<sup>nd</sup> and 3<sup>rd</sup> trimester with a single live foetus after taking informed and understood consent. Pregnant women with diabetes mellitus, hypertension, renal disease, thyroid disease, tuberculosis, asthma, and with complications of pregnancy known at the moment of the ultrasound scan e.g. bleeding, pre-eclampsia, etc. were excluded from the study. Subjects with congenital anomalies including craniocephalic abnormalities and other foetal malformation, polyhydramnios & oligohydramnios, intrauterine growth retardation, etc. if detected during the examination were also excluded from the study. Biparietal diameter (BPD), occipito-frontal diameter (OFD) and femur length measurements was taken into consideration to calculate

average gestational age (in weeks) of each foetus. The foetuses after 12 weeks were categorised into groups with four weeks of age intervals up to full term. Both diameters i.e. OFD and BPD were measured from outer to outer margin using a gray scale real time ultrasonographic scanner, medison sonoace X-8, 3.5MHz sector transducer. Foetal bi-parietal diameter measurements were made in an axial plane at the level where the continuous midline echo is broken by the cavum septum pellucidum in the anterior third and that includes the thalamus. This transverse section should demonstrate an oval symmetrical shape. Measurement of BPD was from the outer edge of the closest temporo-mandibular bone to the outer edge of the opposite temporo-mandibular bone. The occipito-frontal diameter (OFD) was measured in the same plane between the leading edge of the frontal bone and the outer border of the occiput. The cephalic index (CI) was calculated as the ratio of the same two diameters multiplied by 100 (BPD/OFD × 100). Based on this CI value, the foetal heads were categorised as dolichocephalic, mesocephalic, brachycephalic and hyperbrachycephalic head with cephalic index value ≤ 74.9, 75.0 - 79.9, 80.0 - 84.9 and 85.0 - 89.9 respectively. The data was collected, compiled and analyzed, and Mean and standard deviation (SD) were calculated using computer software Microsoft Excel 2007 software.

### RESULTS

Out of 250 foetal heads, we observed more numbers of head shape being brachycephalic (5.2%) followed by hyperbrachycephalic (3.2%) whereas none of the heads was in dolichocephalic category during first four weeks of second trimester. During 16.1-20 weeks of gestational age, brachycephalic head type (6.4%) predominated over mesocephalic and hyperbrachycephalic (1.6 each). Mesocephalic head (4%) ranked next to brachycephalic (5.2%) during 20.1- 24 weeks. However, dolichocephalic head outnumbered (1.6%) during this age as compared to other gestational age intervals. But during 24.1-32 weeks, mesocephalic head predominated over brachycephalic head. Again during subsequent age interval, brachycephalic type (17.2%) reoccupied its position over mesocephalic head type (10.4%) and continued to dominate (11.2%) over mesocephalic head (2.8%) up to full term. However, we could not note any foetal head in dolichocephalic and hyperbrachycephalic category during the last gestational age interval. Overall, brachycephalic foetal head type constituted the major chunk (54%; CI 82.11 ± 1.39) followed by mesocephalic (33.6%; CI 77.88 ± 1.36) and hyperbrachycephalic head

(8.4%; CI 86.67 ± 1.16). Dolichocephalic head was noted to be the least (4%; CI 73.2 ± 3.16) among the fetuses during 12.1 – 40 weeks of gestation. [Table-2] Table 2: Classification of foetal head types during second & third trimester Foetal Head Type Mean ± SD Number (n = 250); (%) Dolichocephalic 73.2 ± 3.16 10 (04.0%) Mesocephalic 77.88 ± 1.36 84 (33.6%) Brachycephalic 82.11 ± 1.39 135 (54.0%) Hyperbrachycephalic 86.67 ± 1.16 21 (08.4%).

## DISCUSSION

Our study clearly indicates mixed types of foetal head with preponderance of a particular head type with increase in gestational age of the foetus. Predominance of brachycephalic head (mean range 82.85 – 81.74) in 12.1 – 24 weeks, mesocephalic head (mean range 78.58 – 77.37) in 24.1 – 32 weeks and again brachycephalic head (mean range 82.06 – 82.12) in 32.1 – 40 weeks of gestational age was noted among fetuses in this part of country. The study conducted by Rajlakshmi et al, revealed the foetal skull of the Manipuri population to be mesocephalic during 12 to 16 weeks, brachycephalic during 20 to 32 weeks and hyperbrachycephalic during 32 weeks to full term of pregnancy. In their study, they observed gradual change in cephalic index with increase in gestational age of the foetus and that was said to be attributed to the ethnic speciality of that particular race. A constant mesocephalic head type was observed by Tuli et al, and Hadlock et al, during second and third trimester without significant change with increase in gestational age among the fetuses. Mesocephalic head during 12-16 weeks of gestational age and hyperbrachycephalic head at full term was recorded by Gray et al. Present study reports the anthropometrical variations in cephalic index in fetuses. This may be because the growth of the human skeleton is under the influence of several factors; among them are hormones, nutritional status, cultural differences and environmental factors. According to Gopalipour et al, the variations of head shape may be due to hereditary factor or environmental which may act as secondary effect. It has been shown clearly and repeatedly that genetic variation within a population is greater than that between populations. Interaction of gene expression and cranial dimensions can make the gene expression differences in various racial and ethnic groups in geographical zones. Interestingly, Kasai et al, reported that dietary habits have been also shown to influence the craniofacial form of a population. Nutritional status of pregnant women could also play a role in influencing the dominant head shape. In India, poor nutritional status in the pregnant women is prevalent due to multiple reasons. As it is obvious from the present study that the dominant type skull with mean cephalic index is 82.11 ± 1.39 followed by 77.88 ± 1.36, hence the head shapes could be classified Brachycephalic as the commonest followed by mesocephalic heads. According to Bharati et al, in tropical zones head form is longer (dolichocephalic), but in temperate zones head form is more round (mesocephalic or brachycephalic). The present study shows that there is tendency towards brachycephalization near full term of pregnancy. The present study classifies the sample examined as brachycephalic and mesocephalic. Since India is partly in temperate and tropical zone and our part of country is in temperate zone. But, the human foetus develops in the internal environment of mother's womb where the temperature remains almost constant throughout pregnancy. Therefore, probably this factor may not have its influence over change in foetal cephalic index. In respect to the variation of head shape in various races and geographical zones, Yagain et al, believe that hereditary factor primarily affects the head shape; however environment has a secondary effect on it. It must be remembered that the reaction to a given environment represents the interaction of the genotype of the population being studied with the environment. Head shapes can also change from one generation to the other. For instance, in the first generation of Japanese immigrants in Hawaii it was noticed that they had an increased head breadth, a decreased head length and a higher cephalic index than their parents. However, we could not get any previous study in the literature in this region which could be used to compare change in cephalic index between the generations.

## CONCLUSION

The present study concludes that the commonest type foetal skull is brachycephalic followed by mesocephalic whereas dolichocephalic is the least common type in RAIPUR, CHHATTISGARH.

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