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Research Article

Description of Cephalic Index in Female Indian and Chinese Malaysian

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Abstract: Cephalic index is an important parameter in evaluating racial and sexual differences, is measured by establishing a ratio between the breadth and the length of the head calculated as 100 times the maximum breadth of the head measured at the greatest diameter of the cranial vault above the supramastoid crest divided by the maximum length of the head measured from the most prominent point on the glabella to the opisthocranion. The aim of the research was to differentiate the cephalic index between female Indian and Chinese Malaysian studying in Padjadjaran University. This research was a descriptive study with total samples are 35 comprise of 13 females Indian and 22 females Chinese. The sampling technique used was stratified random sampling. The subjects were measured for head length and head breadth by using a spreading caliper. The result of the research shows that 22 female Chinese surveyed has an average cephalic index of 85.861(hyperbrachycephalic) with a standard deviation of 3.717. Meanwhile, the 13 female Indian surveyed has an average of 81.768 (brachycephalic), with a standard deviation of 3.205. The conclusion of this research is that there is a significant difference of cephalic index between females Indian and Chinese Malaysian.

Keywords: Cephalic Index, Female Indian Malaysian, Female Chinese Malaysian

Introduction

Cephalic index is a craniofacial parameter that is often used as a tool to measure the length and breadth of the head.[1] It is important to determine the shape of the head because it can provide information related to the shape of the dental arch.[2] The cephalic index measurement which is one of the extra oral examinations has a function for orthodontic diagnosis and treatment planning.[3] Cephalic index is actually a ratio of width to head length is an important parameter in evaluating racial and sexual differences.[4] Recently, human physical variability has become a very interesting subject for scientists in anthroprometry in measuring human body dimensions including head dimensions measured through cephalometry techniques using lateral cranial radiographs or cephalograms. On the other hand, knowledge of cranial morphometry is also important in the study and differentiation of cranial shape from different races, geographical backgrounds and diets. In clinical practice, specific data of the cephalic index give an indication of individual growth and development and also abnormalities in the size and shape of the skull.[5] Cephalic index is considered as the single most important measurement of head dimensions.[6] The cephalic index provides a system for recording numerical sizes and proportions of skull features rather than subjective visualization because these indices produce numerical expressions, this is an important parameter in evaluating inter and intra-population crania comparisons and sexual dimorphism. Comparison of changes between parents, children and siblings can provide clues for genetic transmission of inherited characters.[7]

Cephalic index is determined by establishing a ratio between the breadth and the length of the head calculated as 100 times the maximum breadth of the head measured at the greatest diameter of the cranial vault above the supramastoid crest divided by the maximum length of the head measured from the most prominent point on the glabella to the opisthocranion. The greatest diameter of the cranial vault may also be able to be calculated by measuring two fetal biometric parameters which are the occipitofrontal diameter (OFD) meanwhile

the maximum length of the head can be determined by establishing the biparietal diameter (BPD).[8] The type of head and face that is literally marked by the cephalic index, is influenced by many factors such as racial and ethnical affiliation, genetic influence, traditions, gender, age, nutrition, environment and climate.[9]

A large number of reports have emphasized on the cephalic index of Caucasians. The data show a clear racial trend in the cranial dimensions and cephalic indices among different populations such as Caucasians, Indians, Turkman, Kosov, Albanians, Iranians, Japanese, Serbs, Greek, Bulgarians, Mapuche individuals in Chile and Nigerians.[10,11,12] The results of this study might be able to be used as an important basis in identification, head and face forensics, plastic surgery, oral and maxillofacial surgery, orthodontic clinical diagnosis and treatment planning.[2] Therefore, based on the information above there will be an assumption that there are differences in cephalic index between female Indian and Chinese Malaysian.

Method

This research was a descriptive study using the samples of female Indian and Chinese Malaysian who was studying in Universitas Padjadjaran, Bandung, Indonesia. The sample size determination technique used in this research is stratified random sampling. The sample was taken from population that was divided into smaller groups known as strata. The strata were formed based on members' shared characteristics. Eventually, a random sample from each stratum was taken to participate in this research. In order to obtain the minimum amount of samples based on the amount of population, Sloven's formula was used.[13] Subjects who were involved in the study was between 18-25 years' old, were geographically born in Malaysia, healthy, and no craniofacial deformity or trauma. Data collection were done by only one operator by utilizing same techniques each time during measurements.

The subjects were asked to sign the written informed consent before the research started and given brief explanation on the aims and procedures of the research. Next steps, the subjects were asked to sit on a chair, in a relaxed mood and the head in the anatomical position with the face facing forward using standard anatomical landmark. The measurement point, i.e. opisthocranion or inion, must be free from any obstructions that could interfere data collection. The caliper was used to measure the maximum skull width of the sample which was the maximum distance between the most lateral points of the parietal bone. This was measured by allowing both ends of the caliper to spread down along the lateral aspect of the parietal bone until the maximum width was recorded.

The maximum cranial length (glabella-inion length) of the sample was the straight distance between the most prominent point on the frontal bone above the nasal roof between the eyebrows (glabella) and the most prominent part of the occipital bone, was measured with the same caliper. This was measured by placing the tip of the anterior caliper on the glabella while allowing the posterior caliper tip to slide lower along the median plane of the occipital bone until the maximum length was reached. The measurements were done three times and the mean value was then calculated. The collected data were organized into tables and analyzed statistically.

Result

Table 1 shows the number of population of female Indian and Chinese Malaysian who was studying in Universitas Padjadjaran and the subjects who participated in this research consisted of 13 Indian Malaysian and 22 Chinese Malaysian.

To determine the total sample size from the total population:

$$n = \frac{N}{1 + N\, e^2}$$

Where, N=72; e= 10% (0.01)

$$n = \frac{72}{1+72\ (0.01)^2} = 35$$

To determine the sample size of each racial group by using stratified random sampling method:

$$n_i = \frac{Ni}{N} \text{ x } n$$

Chinese: $n = \frac{46}{72} \text{ x } 35 = 22$

Indian: $n = \frac{26}{72} \text{ x } 35 = 13$

Table. 1 The subjects who participated in the study

Race	*Population*	*No. of Subjects*
Indian	26	13
Chinese	46	22
Total	72	35

Tabel 2 below shows that the mean breadth found in female Indian students is 13.79 cm, whereas for female Chinese students as many as 14.83 cm. While for the head length, the mean value found in female Indian students is 16.87 cm and in female Chinese students is 17.28 cm. Then the data is analysed by using independent Student's t-test to see whether or not there is a difference in cephalic index between female Indian and Chinese Malaysian with $\alpha = 5\%$.

Criteria test:

1) The P value is not significant if P> 0.05
2) The P value is significant if $P \leq 0.05$

Table. 2 Data of Mean Breadth / Width, Mean Length, and Cephalic Index in Chinese and Indian Malaysian

Race		*Mean Breadth/Width*	*Mean Length*	*Cephalic Index*
Indian	N	13	13	13
	Mean	13,789	16,872	81,768
Race		*Mean Breadth/Width*	*Mean Length*	*Cephalic Index*
Chinese	N	22	22	22
	Mean	14,833	17,282	85,861

Table. 3 Differences of Cephalic Index between female Indian and Chinese Malaysian

Category	*Race*	*N*	*Mean*	*Standard Deviation*	*Sig. (2-tailed)*	*Conclusi-on*
Cephalic Index	Chinese	22	85,86	3,717	0,002	There is a difference
	Indian	13	81,77	3,205		

Table 3 is the result of processing the data using t test. The results show that there is a significant difference in cephalic index between female Indian and Chinese Malaysians. It is proven by cephalic index P-value of 0.002. Statistical analysis showed that the value of P (0.002) <0.05, significant. Therefore, this research can conclude that there is a difference in cephalic index between female Indian and Chinese Malaysian.

Discussion

Head width and head length of the research subject is different, in female Indian are considered narrow and short, while female Chinese are considered medium. According to the results of Shah and Jadhav's research (2004), the average head length in women was almost the same, but for this study it showed a higher value of 16.87 cm for female Indian and 17.28 cm for female Chinese than for Gujarati women who were 16,5 cm.[7] The size of the head in female Indian and Chinese is compared to that of Shah and Jadhav, is almost similar. This data may conclude that the dominant head shape in female Indian is brachycephalic and hyperbrachycephalic in female Chinese. This results were consistent with research result conducted by Siew, et.al (2006) showed that the cephalic index in Chinese had relatively broad skull (brachycephalic), whereas mid-skulls (mesocephalic) were common among Indian.[14]

The dominant head shape found in this research, regardless of race is hyperbrachycephalic. This result is not consistent with the results of research conducted by Isurani (2011) on the student population in Sri Lanka, where brachycephalic was the most dominant form of the head.[15] Likewise, the results of the study of Golalipour et al. (2006) conducted on Turkman also reported brachycephalic as the most common form of head.[2] The research conducted by Vojdani et al (2009) had also gained the result showing that brachycephalic and hyperbrachycephalic shape of the head was the most dominant.[16] Meanwhile, people of Bulgarian and Serbia had been discovered through research of Rexhepi and Meka of having dolichocephalic head shape.[11] This study demonstrated that hyperbrachycephalic is the most dominant head shape followed by brachycephalic and mesocephalic meanwhile dolichocephalic was not found.

Based on the findings of previous and this study, it is most likely that there is a tendency towards brachycephalization. This happen might be due to the evidence of continuous growth of brain towards lateral direction.[7] Some researchers also

report that progressive brachycephalization has existed since the Kamakura era (1192-1333), while Japanese adult cephalic index levels in the last hundred years have proven to be very high. Thus, it can be concluded that there is a tendency towards brachycephalization. There also was a statement stating that if head breadth increases and head length decreases, the head form (cephalic index) will become more rounded and this leads to higher incidence of brachycephalic and hyperbrachycephalic head shape.[17]

The variation of head shape may be influenced by hereditary and environmental factors.[2] Brachycephalization has also been thought to be a consequence of improvement in nutrition which causes increase in the head breadth in comparison with the head lenght.[17] So, it could be confirmed that diet might have an important influence on the dominant head shape. Besides, climate is also one of the factors that cause changes in the head form thereby affecting the cephalic index. Head form is longer (dolichocephalic) in tropical area, but in temperate area the head form is more rounded (mesocephalic or brachycephalic).[18] Nevertheless, head shapes might change from one generation to another.[19] Other than that, the soft-tissue structures overlying the cranial bones were changing in response to better nutritional level over time. Thus, the soft tissue components of head breadth are more differentially affected than the head length leading to brachycephalization.[3]

In this study brachycephalization has shown its effect on the study sample. This is because the current head shape classification shows a tendency to transform mesocephalic head forms into brachycephalic and hyperbrachycephalic. In addition, there are various possible influences of other external and internal factors. These include genetics, environmental factors, protein in the diet, psychological and physiological stress, medical facilities and care, as well as natural climate.

Conclusion

Based on the data collected, it can be concluded that there is a difference in cephalic index between female Indian and Chinese Malaysian who studying in Padjadjaran University. The average cephalic index of female Indian students is brachycephalic head shape and the average cephalic index of female Chinese students is hyperbrachycephalic head shape.

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