

Cephalic Index variation within an ethnic group and its correlation with socio - economic status and occupation of an individual : a preliminary study

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Abstract

Cephalic index study in different occupational groups, belonging to same ethnic group, showed variations suggestive of direct association of skull shape and size with the socio-economic status and nature of occupation practiced by the individual. Doctors group practicing a sedentary life style, having good nutritional status and high level of I.Q. showed mesocephaly (Dolichocephalic 30 %, Mesocephalic 56 %; Brachycephalic 14 %). Rickshaw pullers on the contrary with poor nutritional status and lower I.Q. but practicing physically stressful occupation showed deviation towards to dolichocephaly (Dolichocephalic 74 %; Mesocephalic 20 %; Brachycephalic 6%). Railway station Porters practicing still more physically stressful occupation also showed tendency towards dolichocephaly (Dolichocephalic 78 %; Mesocephalic 16 %; Brachycephalic 6 %). The present study revealed that the maximum head length did not show any significant differences ($p > 0.05$) among three groups. On the contrary maximum head width showed significant difference among the groups i.e. Medical practitioners vs Rickshaw pullers ($p < 0.001$), Medical practitioners vs Porters ($p < 0.001$). But Rickshaw pullers vs Porters did not show any significant differences ($p > 0.05$). It is concluded that there is a link between Cephalic Index and socio economic status of male individuals of Varanasi district in India.

KEYWORDS: Cephalic Index, Occupational groups, Socio-economic status, Nutrition.

Introduction

Both shape and structure of bone are affected by genetic, metabolic and mechanical factors. The skull shape is mainly influenced by genetic factor. Therefore the cephalic index (ratio of the maximum width of the head to the maximum length of the head multiplied by 100) can be used as a racial criterion¹. On the basis of cephalic index², divided the individuals into three broad categories: Dolichocephalic (long and narrow head), Mesocephalic (Medium), Brachycephalic (short or broad head) having the range 71 - 75.9, 76.0 - 80.9 and 81.0 - 85.0 respectively. Hyperdolichocephalic ($X > 70.9$) and Hyperbrachycephalic (85.5 - 90.9) are also known. Though head forms ranging from very long to very broad occur in all the three primary races namely negroids, caucasoid and mongoloid, it is seen that dolichocephaly is comparatively rare in mongoloids and is more predominant in Negroids. In the caucasoids none of the head forms appear to be very predominant¹. On the contrary the Cephalic

Index may differ among individuals as a result of various types of diseases³ or malnutrition⁴. In the present study an effort has been made to understand the impact of the socio-economic status (nutritional status) of an individual on his cephalic index ultimately influencing selection of the occupation adopted by him.

Materials and Methods

A total of hundred and fifty apparently healthy males of age ranging between 25-45 years, belonging to the district of Varanasi and adjoining Eastern Uttar Pradesh region from different occupational groups were randomly selected for the present study. The occupational groups selected were doctors, rickshaw pullers and porters. Each group consisted of 50 subjects who practised their particular occupation for more than 5 years. The details of the groups are summarized in Table 1

Four relevant head surface Landmarks were selected i.e. (1) glabella (g) (2) opisthocranium

(op) (3) right euryon (eu) and (4) left euryon (eu). The following projective measurements were taken (in mm) with the help of the sliding caliper, (graded upto 300 mm), i.e. (A) maximum head

The highest percentage (78 %) of subjects of dolichocephaly were in Porters group and next in Rickshaw Puller group i.e. 74 %. The least percentage (15 %) cases was seen in doctors group.

Group	No. of cases	Age	Sex	Daily income (Rs.)	Socio-economic condition	Health	Nature of Occupation
Doctors	50	25-45	Male	300 or more	Affluent	Good	Sedentary
Rickshaw Pullers	50	25-45	Male	40-90	Very poor	Good	Hard work
Porters	50	25-45	Male	70-80	Poor	Good	Very hard work

Table 1: Details of three groups

length (g-op) - summit of Ghebella to farthest occipital point (opisthocranion) (g-op) and (B) maximal cranial width - greatest width (eu-eu) at right angle to median plane (Fig. 2& 3).

While taking the measurements, each subject was asked to sit erect with his head oriented in the ear eye plane or frankfort plane. Maximum head length was measured as the straight distance between glabella (g) and opisthocranion (op) along the mid sagittal plane.

Maximum head width (eu-eu) was measured as the straight distance between the two eurya i.e maximum width taken at right angle to mid-sagittal plane wherever found. The Cephalic Index was calculated for each group i.e.

$$\frac{\text{Maximal Width of the Head}}{\text{Maximal Length of the Head}} \times 100$$

Relevant statistical analysis i.e student 't' test and cross tabs analysis were done to project the comparison among the three occupational groups.

Results

As shown in Table 2, the mean length of the head in the doctors group was found to be 188.72 ± 4.62 mm while in the rickshaw pullers it was 187.86 ± 6.15 mm. In the porters the mean value, however, was the highest as compared to doctors and rickshaw pullers i.e. 189.21 ± 6.59 mm. The P values did not show significant differences between the three groups. However, maximal width (Table 3) of the head in the three groups has shown significant differences i.e doctors vs rickshaw pullers P < 0.001, doctors vs porters P < 0.001 and porters vs rickshaw pullers P > 0.05.

	Doctors (N=50)	Rickshaw w Pullers (N=50)	Porters (N=50)
Mean (mm)	188.72	187.86	189.21
± SD (mm)	± 4.62	± 6.15	± 6.59
Range (mm)	172-198	172-202	175-202
		t value	P value
Doctors vs Rickshaw pullers		0.79057	> 0.05
Doctors vs Porters		0.43051	> 0.05
Rickshaw Pullers vs Porters		-1.05902	> 0.01

Table 2: Head length in the three groups

	Doctors (N=50)	Rickshaw Pullers (N=50)	Porters (N=50)
Mean (mm)	145.78	137.9	139.8
±SD (mm)	± 4.63	± 5.06	± 4.82
Range (mm)	137 - 155	119 - 146	130 - 154
		t value	P value
Doctors vs Rickshaw Pullers		8.1241	< 0.001
Doctors vs Porters		6.3287	< 0.001
Rickshaw Pullers vs Porters		-2.0236	> 0.05

Table 3: Showing head width in the three groups

Group	Range of Cephalic Index	Mean	S.D.
Doctors (N=50)	72.5 - 83.1	77.22	± 3.23
Rickshaw pullers (N=50)	66.59 - 82.55	73.81	± 3.46
Porters (N=50)	67.38 - 82.35	73.9	± 3.008
		t value	P value
Doctors vs Rickshaw Pullers		5.0941	< 0.001
Doctors vs Porters		5.28	< 0.001
Rickshaw Pullers vs Porters		0.1373	> 0.05

Table 4: Comparison of Cephalic Index in the three groups (in mm)

Mean values of the three groups also showed wide range differences i.e. doctors 145.78 ± 4.63 , rickshaw pullers 137.90 ± 5.06 and porters 140.80 ± 4.82 . Table-5 and Fig. 1 show the distribution of Head shape in the three groups. Mesocephaly and brachycephaly were more predominant in doctors group and showed the highest percentages i.e. 56 % and 14 % respectively. Rickshaw pullers and porters were

close to each other in respect of mesocephaly and percentage showed 20 % and 16 % respectively. The study revealed that brachycephaly was not dominant head shape in this particular ethnic group because only 8.7 % of subjects among 150 subjects showed Brachycephaly.

Cephalic Index Range for Male	Shape of the Head	Doctors (D)	Rickshaw Pullers (R)	Porters (P)	D + R + P
		(n=50)	(n=50)	(n=50)	(n=150)
61-75.9	Dolichocephaly	15 (30%)	37 (74%)	38 (76%)	91 (60.7%)
76-80.9	Mesocephaly	28 (56%)	10 (20%)	8 (16%)	45 (30.7%)
81-85.9	Brachycephaly	7 (14%)	3 (6%)	3 (6%)	13 (8.7%)

Table 5 : The distribution of Head shape i.e. Dolichocephaly, Mesocephaly and Brachycephaly in three occupational groups.

- Due to smaller number of cases, hyperdolichocephaly subjects were considered as Dolichocephaly and hyperbrachycephaly subject was considered as Brachycephaly. $X^2 = 29.98$; d.f. = 4 ($P \leq 0.01$)

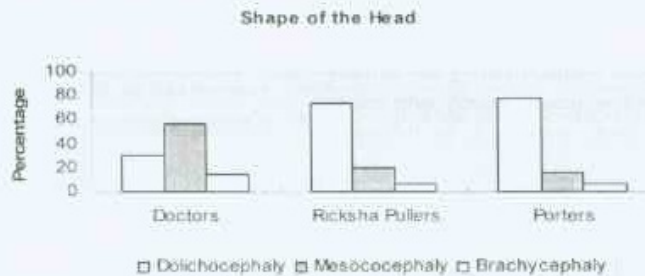


Figure 1: Shape of the head

Figure 2: Maximum cranial length (op - g)

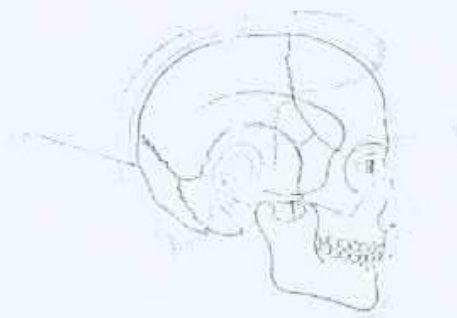
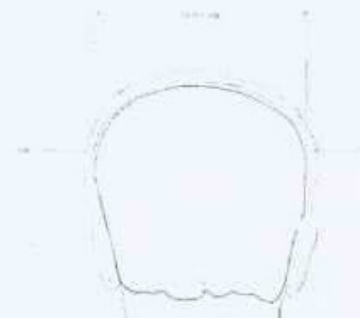


Figure 3: Maximum cranial width (eu - eu)



Discussion and Conclusion

Cephalic Index is an Index of relative length and width of the head. This index is expected to indicate the certain shape of the head classifying particular ethnic group as Dolichocephalic, Mesocephalic or Brachycephalic (Table 5).

The maximal length of the head did not show any significant difference ($p > 0.05$) among three groups (Table 2). On the contrary maximal width of the head showed significant differences among the groups i.e. doctors vs rickshaw pullers $p < 0.001$, doctors vs porters $p < 0.001$. But porters vs rickshaw pullers did not show any significant difference ($p > 0.05$). The preliminary study revealed that the head length is a very important criteria to find out the ethnic variation than head width. Cephalic Index variations within the ethnic group are not anticipated¹.

The present study, however, showed that the Dolichocephaly is more prevalent in groups of rickshaw pullers and porters and mesocephaly dominated in doctors group (Table 5 and Fig. 1). This difference within the same ethnic group can be ascribed to socio-economic status of the individuals. Good nutrition during the formative days in the doctors group, mostly with affluent family background, appears to be influencing development of the skull leading to Mesocephalic type of skull shape. Poor nutrition on the other hand reflected differently on the shape and size of skull in the rickshaw puller and porters groups exhibiting more cases of dolichocephaly. The shape of the skull subsequently appears to have influence in some way on the functioning of brain. The mesocephalic individuals had higher I.Q. level helping them to get better education to become doctors. On the contrary in the porters and rickshaw pullers groups dolichocephalic skull had different impact on the development of brain or I.Q. making them more dull mentally resulting in adoption of occupations not requiring high I.Q. level. Further a values of cross tabs analysis confirm that the occupational groups and skull shape are significantly associated (Table 5).

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