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ORIGINAL ARTICLE

EVALUATION OF CEPHALIC INDEX IN FEMALES OF WESTERN UP REGION BY SIMPLE REGRESSION ANALYSIS

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ABSTRACT: Population can be classified by evaluation of cephalic index. Metric evaluation of cephalic index can be done generation of simple regression equation. In this study we evaluated horizontal cephalic index of females of western UP region, which forms a base line study of cephalic index of this region, and more so over it reflects the intelligence level, socioeconomic status, dietary adequacies (inadequacies) and any ailment of ill health, which is reflected in the values of cephalic index. This base line study will also help orthodontists, plastic surgeons and anthropologists in cranio-facial reconstruction. **AIMS & OBJECTIVE**: The aim of this study is to generate a simple regression equation for cephalic index of females of western UP region using two variables. **MATERIAL & METHODS**: This exploratory study was conducted on 400 female students (17-25yrs) of TMMC&RC, Moradabad, employing purposive sampling method, using Pearson's coefficient, and generating simple regression equation. Spreading caliper was the instrument used in this study. **RESULT:** Following Simple regression equation =133.71+(-2.96)17.53 was generated using maximum head breadth (143.20 mm). **CONCLUSION**: We concluded our study by generating the simple regression equation for evaluation of cephalic index of females of western up region (81.83%).(Brachycephalic).

KEYWORDS: PEARSON'S COEFFICIENT, SIMPLE REGRESSION EQUATION, CEPHALIC INDEX, & SPREADING CALIPERS.

INTRODUCTION: Human body dimensions are affected by ecological, geographical, racial, gender, and age factors [1, 2]. In order to achieve racial assessment, and discriminate among populations metrical studies have long been practiced. Cephalic index is an important parameter for classifying populations. Internationally accepted techniques of anthropometry have promoted a large number of comparable data for males and females [3]. This is supported by the great range of cranial indices and shapes in racial groups however sexual differences are minimal [4].

Anthropologists classified population on the basis of anthropometric data collected from various subcontinents of the world. [5]

Cephalometry is a branch of anthropometry in which the anatomical dimensions of head and face are measured. Cephalometry continues to be the most versatile technique in the investigation of the craniofacial skeleton because of its validity and practicality. [6]

On the basis of Horizontal cephalic index, head shapes group to four international categories, that including

Dolichocephalic,
Brachycephalic,
Mesocephalic
Hyper brachycephalic [4].

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(Williams et al, 1995) determined on the basis of international anatomical descriptions of cephalic index (CI) (%) [4]

Dolichocephalic <74.9
Mesocephalic 75-79.9
Brachycephalic 80-84.9
Hyper-brachycephalic 85-89.9

Dolichocephalic person have otitis media less often than brachycephalic persons [7]. It has also been reported that individuals with Alpert's syndrome are hyper- brachycephalic [8].Many studies have been conducted in various parts of India applying the techniques of anthropometry [9]. While there are many measures of association for variables which are measured at the ordinal or higher level of measurement, correlation is the most commonly used approach. Correlation summarizes the relationship between two variables in a single number called the correlation coefficient. A correlation coefficient close to plus 1 means a positive relationship between the two variables, with increases in one of the variables being associated with increases in the other variable. A correlation coefficient close to -1 indicates a negative relationship between two variables, with an increase in one of the variables being associated with a decrease in the other variable. Most commonly used correlation coefficient is Pearson's (r).

AIMS & OBJECTIVES: While many studies have been conducted on the estimation of stature from different body parts [10-16] including arms and legs, hands and feet, intact vertebral column, as well as head, face and trunk, no study has been conducted on assessment of cephalic index by just knowing one of its variable (maximum antero-posterior length), in the literature cited so far and, therefore we conducted this study to see whether, there exists a correlation between (maximum antero-posterior length), and (cephalic index) and if there exists a relationship, Pearson's coefficient r = (-1) or (+1) and then estimation of cephalic index by derivation of simple regression equation of 400 females of age group (18-25 yrs.) of western up region.

MATERIAL & METHODS:

Place of study: This study was conducted in department of Anatomy, Teerthankar Mahaveer Medical College & Research Centre, Teerthankar Mahaveer University, Moradabad. India.

Number of subjects: 400 students

Age group: 17-25 were chosen for study.

Sex: Female

Sampling method: Purposive sampling method. This sampling is best when we are studying a particular set of groups.

Statistical analysis: Using Pearson's coefficient, Descriptive statistical analysis and simple regression equation.

Study design: Exploratory study.

Exclusion criteria: Individuals with craniofacial anomalies

Measurements for maximum head length: Was taken from Glabella (a point above the root of the nose between the two superciliary arches) to Inion (a salient point of external occipital protuberance.

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Measurements for maximum head breadth: Was taken between two Porions (a point on the posterior root of the Zygomatic arch on the middle of the upper border of External acoustic meatus),

The data was calculated with Cephalic Index Formula as: C.I. = Maximum head breadth / maximum head length × 100 (Horizontal cephalic index).

Position of the Head: Head in anatomical position, using (Hrdlicka's method 1952), [17].

Instrument: Measurements were taken with the help of "SPREADING CALIPERS".

All measurements were taken in centimeters to an accuracy of 0.10.

Fig. 1: SPREADING CALIPERS

Fig. 2: Measurements for maximum head length

RESULTS:

DESCRIPTIVE ANALYSIS OF MAX LENGTH OF HEAD FEMALE	
Mean	17.53(cm)
Standard Error	0.03
Median	17.5
Mode	17.4
Standard Deviation	0.64
Sample Variance	0.41
Kurtosis	1.25
Skewness	-0.32
Range	5.1
Minimum	14.4
Maximum	19.5
Sum	6997.6
Count	400

Table-1

DESCRIPTIVE ANALYSIS OF MAX BREADTH OF HEAD FEMALE	
Mean	14.32(cm)
Standard Error	0.02
Median	14.3
Mode	14
Standard Deviation	0.53
Sample Variance	0.28
Kurtosis	0.82
Skewness	0.52
Range	3.4
Minimum	13.1
Maximum	16.5
Sum	5716.8
Count	400

Table-2

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DESCRIPTIVE ANALYSIS OF CEPHALIC INDEX FEMALE	
Mean	81.66(%)
Standard Error	0.170
Median	81.66
Mode	81.6
Standard Deviation	3.40
Sample Variance	11.601
Kurtosis	0.026
Skewness	-0.057
Range	18.19
Sum	32584.39
Count	400

Table-3

Regression Statistics	
Multiple R	0.558
R Square	0.311
Adjusted R Square	0.310
Standard Error	2.828
Observations	400

Table-4

Pearson's coefficient between maximum length of female head and cephalic index is -0.558. This shows that there is definite relationship between maximum length of head and cephalic index. This gives us a value by which we calculated the cephalic index of female by using simple regression equation, of western region of Uttar Pradesh by just using maximum length of head.

	Coefficients	Standard Error
Intercept (a)	133.71	3.88
x=17.53	(b) -2.96	0.22

Where (a) intercept= 133.71

(b) slope= -2.96

Simple regression equation Y= a + bx

=133.71+(-2.96)17.53

=81.83

So simple regression equation for evaluation of cephalic index from maximum length of head in females of western UP region is

=133.71+ (-2.96)17.4

=81.83

On the basis of above calculation the value of cephalic index in present study is **81.68%**, which falls in the group of brachycephalic group of skulls ranging from (80-84.9). In all three (max. head length, max. head breadth and cephalic index kurtosis is less than 3, which shows that The probability for extreme values is less than for a normal distribution, and the values are wider spread around the mean that is values show platykurtic distribution. In maximum head length and cephalic index values are less than 0 which shows most values are concentrated on the right of the mean, with extreme values to the left while in maximum head breadth it is more than 0, which shows most values are concentrated on left of the mean, with extreme values to the right.

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DISCUSSION: In the present study the mean values of maximum head length, maximum head breadth and cephalic index are 17.53±0.64 cm, 14.32±0.53cm and 81.66±3.40% respectively.

S.N.	Area of study	Authors	Year of study	Head length (mm)	Head breadth (mm)
1	Western UP	present study	**2013**	**175.30**	**143.20**
2	Lativa	Nagle E et al [18]	2005	183.3	145.8
3	Malaysian	Neglow WC [19]	2009	173.4	149.4
4	Nigeria (North-Eastern)	Raji JM [20]	2010	183.9	135.7
5	Nigeria (Ibibos)	Oladipo GS [21]	2010	188	147
6	Punjabi Students	Mahajan A [22]	2010	179	147.2
7	Nigeria	Maina MB [23]	2011	183.53	135.47
8	Japanese	Hossain MG[24]	2011	180.12	147.8
9	Sri Lanka	Ilayperuma [25]	2011	175	141.11
10	North India	Gupta et al [26]	2013	177.74	136.19

Table-5

Racial characters are best defined in the skull [27, 28].Cephalic index provides metrical recording of cranial features. [28] and cephalometric data provides diagnostic comparison between ill and the normal population [29]. Population, age and gender specific data on cephalic indices give an indication of development of an individual and also identifies craniofacial anomalies [30].The cephalic index value obtained in this study are valid for the age group (17-25 years). It has been stated that cranial dimensions varies with the age of the person. [31, 32]

On the basis of above calculation the value of cephalic index in present study is 81.68%, which falls in the group of brachycephalic group of skulls ranging from (80-84.9). In all three (max. head length, max. head breadth and cephalic index kurtosis is less than 3, which shows that the probability for extreme values is less than for normal distribution, and the values are wider spread around the mean that is values show platykurtic distribution. If max. head length and cephalic index values are less than 0, this shows most values are concentrated on the right of the mean, with extreme values to the left while if max. head breadth it is more than 0, which shows most values are concentrated on left of the mean, with extreme values to the right.

The mean cephalic index in different ethnic groups varies significantly in different zones[33] According to [34] in tropical zones head is (dolichocephalic), but in temperate zones head is (mesocephalic or brachycephalic).

From the above table it is clear that value of head length in our study is more than Malaysian and Sri Lankans and lower than other studies mentioned above, which is almost non-significant statistically.

The mean horizontal cephalic index observed in this study (81.68) is higher than those observed for the Turkman:80.4 [35], Mapuche individuals in Chile: 80.42 [36], European people in Mediterranean area: 81.19, North Europeans: 79.72 [37, 38] and lower than native Fars:84.8 [39] , Japanese: 87 [40] a finding that further reinforces the racial diversity in the cephalic index.

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In bio-statistics, linear regression is an approach to establish the relationship between a dependent variable y and one or more explanatory variables denoted X. The case of one explanatory variable is called simple linear regression.

This relationship helps an anthropologist to calculate stature from mutilated and dismembered body parts with the aid of linear regression equations [12, 15]

In the present study two parameters for evaluating cephalic index (maximum head length and maximum head breadth) are correlated with cephalic index as shown by evaluation of Pearson's coefficient (-0.557821 and 0.566172) respectively. This confirms that we can create simple regression equation using any of the two parameters. In this study we used the maximum head length for evaluation.

By applying the formula

Cephalic index= Maximum head breadth/Maximum head length*100, we find the value of cephalic index 81.66 and also by evaluation of simple regression equation we calculated the value 81.83 which is statistically non-significant and both values come in the category of brachycephalic index.

CONCLUSION: We concluded our study with the fact that if a correlation exists between two variables, the simple regression equation can be generated and that simple regression equation can be applied to that racial and geographical area. On the same principal of biostatistics we created the simple regression equation for cephalic index for females of western Uttar Pradesh, India, which was not taken into consideration before this study. We hope that this analytical study will help other researchers to generate new correlations for anthropometric studies.

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