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RESEARCH ARTICLE

SECULAR TREND IN HEAD DIMENSIONS AND CEPHALIC INDEX OF MEITEI MALE POPULATION OF MANIPUR, INDIA

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ABSTRACT

Secular changes have been taking place in the growth pattern of different body dimensions of different populations of the world during the last few generations. This trend of secular change is not an exception to human cephalo-facial dimensions. The present study is one which attempts to examine the secular trend if any in the cephalo-facial features viz. Maximum Head Length, Maximum Head Breadth and Cephalic Index of the Meitei population of Manipur. The findings of the study is based on the comparison of primary data collected from randomly selected 100 male adults of Bishnupur district, Manipur, and secondary data of Singh (1992) representing the Meitei Male population of previous generation. Overall findings of the present study reveal that a secular trend of increasing Head Length and Head Breadth, whereas, a decreasing trend Cephalic Index is taking place where in the present generation shows significant difference from the previous generation with regards to head length and head breadth. Even though there is no significant difference between the present and past generation as regards to frequency percent distribution of Cephalic Index, a tendency towards debrachycephalization is clearly observed in the present generation. Influence of exogenous factors like changed climatic conditions, better health and living condition and more particularly improved nutrition and dietary habit on the pre-established constitutional hereditary factors may probably be the cause leading to such a secular trend.

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INTRODUCTION

Study of morphological and anatomical features of man**,** a concern of the anthropologist and anatomist have played a major role in understanding the morphological and anatomical variation from evolutionary and racial point of view of human mankind both at individual as well as population level. As far as biological understanding of personal, ethnic and racial identity is concerned, cephalo-cranial part is the most important dissected component of human body. It is true that cephalo-facial anthropology is an important tool for determining the morphological and anatomical features of the head and face which can steer the anthropological, anatomical and forensic investigations (Cvetkovic *et al*., 2014). At the same time cephalo-facial dimensions and indices are the simplest and most efficient tool for studying racial differences (Chaturvedi and Harneja, 1963), population variations and sexual dimorphism (Ilayperuma, 2011) identification of race, ethnicity, gender, age etc. (Del Sol, 2005). Cephalo-facial dimensions experience change during growth and development period and reach its peak growth between 16-20 years of life (Kondu *et al*., 1999; Knutson *et al*., 2001) and finally attains maturity thereafter. The interaction of both genetic and environmental factors determines the phenotypic expression of inter and intra population variations in cephalo-facial dimensions (Kasai *et al*., 1993; Mehta and Gupta, 2008; Cvetkovic *et al*., 2014), though hereditary factor mainly affects the head shape while environmental factors have lesser influence (Golalipour, 2006; Sanna *et al*., 2015). Changes in the head dimensions can be more influenced by climate, nutrition, sleeping pattern in infancy, migration, and socio economic status (Hoppa and Garlie, 1998; Bharati *et al*., 2001; Weninger, 1979; Kouchi, 2000). Again variation in head and face depend on many factors such as ethnicity, genetic

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influence, traditions, nutrition, certain pathological conditions, environment and climate (Rexhepi and Meka 2008). Cephalic index which explains the relationship of maximum head breadth and maximum head length simply describes the head shape of an individual and also at the population level. Cephalic Index is very frequently used cephalo-facial parameter for studying secular trend (Larsen, 1997; Kouchi, 2000). Cephalic Index can be used for identifying sexual differences (Williams *et al*. 1995) and also for racial variations (Shah and Jadav, 2004). In one of the study among Japanese immigrants in Hawai, it was observed that they had increased head breadth and decreased head length and as a result higher cephalic index than their parents (Heravi and Zieaee, 2002). Findings of Koh *et al*. (2001) says that from the beginning of 20th century brachycephalization has been taking place. Similarly head shape can also change from one generation to the next (Eroje *et al*. 2010). However, change in head form and shape in subsequent generation of a population takes place over a long period of time (Nakashima, 1986).

Though quite a number of scholars have worked on secular trend in cephalo-facial measurements on different population groups of the world, report from Indian population is comparatively very few. Such a scanty nature of data on Indian population more particularly among the populations of North East India calls for undertaking a pioneering research on the Meitei male Population of Manipur steered by the hypothesis that the population might have experienced a secular trend in Head Length, Head Breadth and Cephalic Index from earlier generation to the present generation.

Material and Methods

For the purpose of present study, data were collected from randomly selected unrelated 100 Meitei male adults of Bishnupur district, Manipur. Meiteis are the most populous community inhabiting in the valley districts of Manipur. The age of the subjects ranges between 20 to 60 years. Only two head measurements viz. Maximum Head Length (*glabella to opisthocranion*) and Maximum Head Breadth (*euryon to euryon*) were measured with the help of blunted knob Martins spreading calliper following the techniques laid down by Weiner and Lourie (1969). Relevant index i.e. Cephalic Index was calculated using the formula $\frac{Maximum\ Head\ Breadth}{Maximum\ Head\ Length}$ X 100 and classified based on the conventional categories of Saller. Appropriate statistical treatment was given for a systematic and scientific presentation of the data.

RESULTS AND DISCUSSION

It has been observed that Maximum Head Length and Maximum Head Breadth (Table 1) of the Meitei population have experienced a secular change towards increasing size from the last generation to the present generation. On comparing Maximum Head Length of the present Meitei population with that of Singh (1992), it is observed that the present generation have longer head length than the earlier generation. As revealed by the findings, the Meiteis of last generation (Singh, 1992) generally have short (31%), medium (43%) and long head (20%) in contrast to short (6%), medium (41%) and long head (43%) of the present generation (present study).With this variation in frequency percent distribution, the two generations show significant difference in Maximum Head Length when examined statistically (χ^2 = 34.27, d.f.= 3). As stated above Meiteis of present generation have longer head ($\bar{X}$=18.65±0.06 cm) than previous generation ($\bar{X}$ = 18.05±0.06 cm) which display a statistically significant difference (t = 7.06, Table 3).

Similar pattern of increase in Maximum Head Length holds true for Maximum Head Breadth as well. It is clearly evident from table 3 that Meiteis of present generation have a broader head ($\bar{X}$ = 15.32±0.06cm) than the previous generation ($\bar{X}$ = 14.99±0.06 cm) which reveals a significant difference (t =3.88, table 3) thereby displaying a positive secular trend towards an overall increase in head breadth. Again considering the frequency percent distribution (Table 1) based on different conventional categories, it is observed that as many as 35% of the population of earlier generation had narrow head as compared to only 12% of the present generation. Though medium size head occur highest in both the populations (49% for earlier generation and 52% for present generation), the frequency of broad head is found to occur almost double time higher in the present study (31%) as compared to earlier generation (16%). In short, more number of people (84%) of earlier generation had narrow to medium head, while more number of people (83%) of present generation have medium to broad head, thereby showing statistically significant difference (χ^2 = 12.32, d.f.= 1) in the frequency percent distribution.

Looking into the cephalic index, the Meitei population of present generation have lower mean value ($\bar{X}$ = 82.23±0.41) than the previous generation ($\bar{X}$ = 83.25±0.43) showing a negative secular trend, though no statistically significant difference (t=1.72, Table 3) is observed. This decrease in the mean value of cephalic index in the present generation of Meitei population from the previous generation by 1.02 is mainly because of greater increase in head length (0.60 mm) as compared to head breadth (0.33mm). This finding is in agreement with those reported by Sanna *et al*. (2015) among the Sardinian, but contrasting to that of Korean adults among whom there is greater increase in Head Breadth as compared to Head Length (Koh *et al*., 2001) and among Japanese children (Kouchi, 2000). The reason for decreasing cephalic index may possibly be because of better nutrition, improved socio-economic conditions, nutrition, better health care and changing living conditions of the present Meitei population, as similarly described by Cvetkovic (2014) who worked among the Serbian school children. Therefore as a result of decreasing cephalic index, the population is gradually experiencing debrachycephalization. Similar findings were also reported among the Sardinian Children (Sanna and Soro, 2000; Sanna and Palmas, 2003); among the Hungarian (Gyenis, 1994; Magyar *et al*. 2006); among the Zena children (Zellner *et al*., 1998); among the Croatian (Buretic *et al*., 2007) among Russian children (Gordina *et al*., 2011) and among Ogbia tribe of Bayesla State (Eroje *et al*., 2010). However, the mean values of cephalic index of both the Meitei populations indicate that their head shape fall under the brachycephalic category (Table 2).

Table 1. Distribution of Maximum Head Length and Maximum Head Breadth of Meitei Males of Manipur (following Conventional categories of Lebzelter and Saller)

Parameter	Conventional category	Range (in mm)	Singh (n=100, 1992)	Present study (n=100, 2016)	Chi Square Value
	Very short	≤ - 169	4	0	
Maximum	Short	170 - 177	31	6	
Head Length	Medium	178 - 185	43	41	$\chi^2 = 34.27$*
(in mm)	Long	186 - 193	20	43	
	Very long	194 - ≤	2	10	
	Very narrow	≤ - 139	--	2	
Maximum	Narrow	140 - 147	35	12	$\chi^2 = 12.32$*
Head Breadth	Medium	148 – 155	49	52	
(in mm)	Broad	156 – 163	16	31	
	Very broad	164 - ≤	--	3	

Table 2. Distribution of Cephalic Index of Meitei Males of Manipur (following Conventional categories of Saller)

Cephalic Index	Range	Singh (n=100, 1992)	Present study (n=100, 2016)
Dolichocephalic	71.0 – 75.9	3	3
Mesocephalic	76.0 – 80.9	29	39
Brachycephalic	81.0 – 85.4	41	38
Hyperbrachycephalic	85.5 – 90.9	24	30
Ultrabrachycephalic	91.0 - ≤	3	0

$\chi^2 = 1.83$

Table 3. Obtained Mean and Standard Deviation of Head Length, Head Breadth and Cephalic Index of Meitei Males of Manipur

Source	Maximum Head Length		Maximum Head Breadth		Cephalic Index	
	Mean	SD	Mean	SD	Mean	SD
Singh (n=100, 1992)	18.05±0.06	0.63±0.04	14.99±0.06	0.50±0.04	83.25±0.43	4.31±0.31
Present study (n=100, 2016)	18.65±0.06	0.58±0.04	15.32±0.06	0.61±0.04	82.23±0.41	4.07±0.06
t value	7.06*		3.88*		1.72	

Again, the frequency percent distribution of different head form reveals no statistical significant difference between the populations as evidenced from chi square value ($\chi^2 = 1.83$, Table 2). In short, the population is experiencing a secular trend towards increasing head length and head breadth but decreasing cephalic index because of greater increase in head length than head breadth. Even though the size of the head i.e. head length and head breadth increases, head shape remains more or less unchanged in both the populations because of the fact that head shape or form depends more on pre-established constitutional hereditary factors and less on environmental factors as compared to head size for which environmental factors has a great influence on genetic factor.

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