

FACIAL MORPHOLOGY AND FACIAL INDEX: A STUDY ON SECULAR TREND OF MEITEI MALE POPULATION OF BISHNUPUR DISTRICT, MANIPUR, INDIA

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ABSTRACT

Knowledge of facial dimensions is important in evaluation of age, sex, and racial differences, in clinical application and in forensic applications. Therefore facial measurements have been used by numerous researchers particularly anatomists, forensic scientists, plastic surgeons, physical anthropologists to establish standardized mean values for skeletal, dental and soft tissue structures as well as for classification of facial morphology of different populations. So the present study aims at studying the morphology of face and its indices of Meitei Male population with a view to find out the secular trend if there be any. The study was conducted on 100 Meitei Males of Bishnupur District, Manipur whose age ranged from 20-60years. Overall findings of the present study show that the present generation is experiencing a secular trend of increasing Morphological Facial Height and decreasing Breadth of Bizygomatic Arch. As for the Facial Index, a positive secular trend is observed in both Morphological Facial Index and Morphological Upper Facial Index, thereby showing a significant difference in frequency percent distribution of facial index between the present and past generation. A tendency from mesoprosopic towards leptoprosopic is observed in the present generation. This study has established the mean facial dimensions of Meitei male adults of Bishnupur District, Manipur.

KEY WORDS: Facial Dimensions, Morphological Upper Facial Height, Morphological Facial Height, Breadth of Bizygomatic Arch, Leptoprosopic (Long Face), Bishnupur.

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Access this Article online

Quick Response code



DOI: 10.16965/ijar.2016.461

Web site: International Journal of Anatomy and Research
ISSN 2321-4287
www.ijmhr.org/ijar.htm

Received: 18 Oct 2016
Peer Review: 19 Oct 2016
Revised: None

Accepted: 13 Dec 2016
Published (O): 31 Dec 2016
Published (P): 31 Dec 2016

INTRODUCTION

Human face is a biological masterpiece of form and functions [1]. Face is that anterior part of the head lying transversely between the ears

and longitudinally from the chin to the hairline and includes the forehead, eyes, nose, mouth and chin [2]. Facial features differ among different races and ethnic groups [3]. Facial forms are classified according to facial index [4] which

is the ratio of facial height to facial breadth. Facial index is anatomically classified as Hyper- euryprosopic face (very broad face, range <79.9), Euryprosopic face (broad face, range, 80-84.9) Mesoprosopic face (round face, range, 85-89.9), Leptoprosopic face (long face, range, 90-94.9) and Hyper leptoprosopic face (very long face, range, >95) [4]. This craniofacial area of the body is subject to changes more particularly during growth and development period [5]. Facial development occurs mainly between the fourth and eight weeks of gestation, five facial primordia appear early in the fourth week around the large primordial stomodeum, the single frontonasal prominence, the paired maxillary prominences and the paired mandibular prominences, the five facial prominences are active centres of growth in the underlying mesenchyma [6]. The average width of the face has been found to increase slightly during adulthood [7]. Genetics and environmental factors are responsible for the variations in craniofacial dimensions [8] and heredity may be responsible for the phenotypic expression of the biological variability observed in the craniofacial complex [9]. The type of head and face depends on many factors such as ethnicity, genetic influence, traditions, nutrition, certain pathology conditions, environment and climate [10]. It is now known that secular change is not restricted to stature, but encompasses the axial, appendicular and facial skeletons [11]. In short secular change is not ceasing [12], as each population faces its own unique combination of evolutionary force.

India is a nation with such a complex and varied ethnic composition of its population. Indian population is classified on the basis of anthropometric data collected from various populations. Human face curve has been an interesting topic for anatomists, anthropologists, forensic scientist, etc. The facial index of the North Indian population is mainly Leptoprosopic as compared to other zones from where it mainly falls under mesoprosopic class. However, a few exceptions have been observed from Manipur, Mizoram and Tripura where the value of index is about 88 (leptoprosopic) which may be due to smaller number of studies reported from these states [13,14]. Very few reports, hardly one or two only are available on the studies

relating to face and facial dimensions of Meitei male population. Hence driven by the need necessitates studies on the secular trend in the facial dimensions and facial index and Meitei male populations.

MATERIALS AND METHODS

The present cross sectional study on the facial anthropometric measurements of Meitei male population were measured on hundred subjects belonging to 20-60 years of age. All the subjects with no facial deformity or scar were selected randomly from Bishnupur District Manipur. For this study, Ethical Clearance and written consent were obtained from the subjects. The measurements were taken using the techniques laid down by Weiner and Lourie (1969) [15] with the help of Martin's sliding and spreading caliper. The following are the measurements:

1. Morphological Facial Height (MFH)-(distance between nasion and gnathion)
2. Morphological Upper Facial Height (MUFH)-(distance between nasion and prosthion)
3. Breadth of Bizygomatic Arch (BBA)-(distance between two zygia points).

From the above measurements the following two relevant indices were calculated by using the formula.

1. Morphological Upper Facial Index

$$= \frac{\text{Morphological Upper Facial Height} \times 100}{\text{Breadth of Bizygomatic Arch}}$$
2. Morphological Facial Index =

$$\frac{\text{Morphological Facial Height} \times 100}{\text{Breadth of Bizygomatic Arch}}$$

The subjects were measured in a sitting position, relaxed with the head oriented in eye ear plane. All the measurements and indices were classified according to Conventional Categories of Labzelter and Saller (1968) [16]. Appropriate statistical treatment was given for a systematic and scientific presentation of the data.

RESULTS AND DISCUSSION

The value of the facial measurements of the present study has been subjected to comparison with the findings of the earlier workers (Singh 1992) [17] who have studied on Meitei males who belong to mongoloid group [18] inhabiting in different parts of Manipur, including four valley

districts of Manipur and Meitei males of Assam. The findings on facial configuration from the present study shows variation from the findings of Singh (Table 1,2). It has been observed that Morphological Facial Height and Breadth of Bizygomatic Arch (Table 1,2) of the Meitei male population in common have experienced a changing pattern of frequency distribution from last generation to present generation. Interestingly Morphological Upper Facial Height has not shown such a changing pattern as observed for Morphological Facial Height and Breadth of Bizygomatic Arch (Fig. 1). On comparing Morphological Facial Height of the present Meitei male population with that of Singh (1992) [17], it is observed that the present generation have a longer face length. Based on the findings of Singh (1992) [17], the Meitei males of last generation generally have Very low (46%), Low (33%), Medium (18%), High (3%) in contrast to Very low (24%), Low (39%), Medium (29%), High (7%) of the present generation. In short majority (79%) of Meitei males of previous generation have very low to low facial height while low to medium (68%) for the present generation Table 1. With this variation in frequency present distribution the two generation show significant difference in Morphological Facial Height when examined statistically ($\chi^2 = 12^*$, d.f. = 3). As stated above Meitei males of present generation have longer face ($\bar{X} = 115.8 \pm 0.6$ mm) than previous generation ($\bar{X} = 112.4 \pm 0.6$ mm) which display a statistically significant difference ($t = 4.00^*$, table 5)

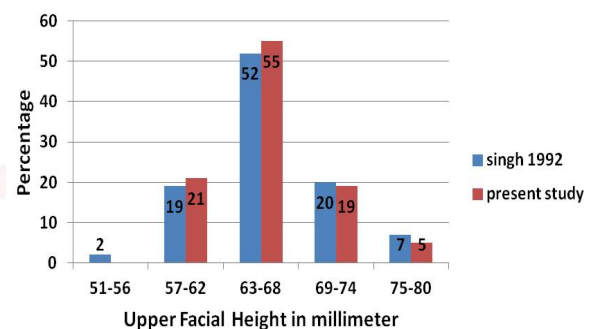
Table 1: Frequency Percent Distribution of Morphological Facial Height according to Conventional Categories of Labzelter and Saller.

Conventional Categories	Range (mm)	Singh 1992	Present study
Very low	∞-111	46	24
Low	112-117	33	39
Medium	118-123	18	29
High	124-129	3	7
Very high	130-∞	--	1
	Total	100	100
$\chi^2 = 12^*$, d.f. = 3			

Unlike Morphological Facial Height, the Morphological Upper Facial Height (table 5), the Meitei males of present generation have a similar Upper Facial Height ($\bar{X} = 65.9 \pm 0.5$ mm) with

the previous generation, there by revealing no significant difference ($t = 0$, table 5) thus displaying no change in Morphological Upper Facial height. Again considering the frequency percent distribution (figure 1) it is observed that majority of both the Meitei population (previous generation, (52%); present generation (55%) have Upper Facial Height in the range of 63-68 mm. Again when compared statistically, no significant difference in the frequency percent distribution is observed ($\chi^2 = 0.5$, d.f. = 3).

Fig. 1: Frequency Percent Distribution of Morphological Upper Facial Height.



$\chi^2 = 0.5$, d.f. = 3

Table 2: Frequency Percent Distribution of Breadth of the Bizygomatic Arch according to Conventional Categories of Labzelter and Saller.

Conventional Categories	Range (mm)	Singh 1992	Present study
Very Narrow	∞-127	10	18
Narrow	128-135	34	54
Medium	136-143	48	19
Broad	144-151	8	9
	Total	100	100
$\chi^2 = 19.46^*$, d.f. = 3			

Again comparing the Breadth of Bizygomatic Arch (Table 2) of the present Meitei male population with that of Singh (1992) [17], it is observed that the present generation have comparatively narrower facial breadth than the earlier generation. As revealed by the findings that as many as 44% of Meitei males of previous generation Singh (1992)[17] have very narrow to narrow bizygomatic arch while the present generation have 72%. With this variation in frequency percent distribution, the two generations show significant difference in Breadth of Bizygomatic Arch (BBA) when examined statistically ($\chi^2 = 19.46^*$, d.f. = 3). As stated above Meitei's of present generation have narrow facial breadth ($\bar{X} = 132.4 \pm 0.7$ mm) as compared

to the previous generation ($\bar{X} = 135.6 \pm 0.7\text{mm}$) which display a statistically significant difference ($t = 3.23^*$, table 5).

Table 3: Frequency Percent Distribution of Morphological Upper Facial Index according to Conventional Categories of Martin and Saller.

Conventional Categories	Range	Singh 1992	Present study
Hypereuryen	≤ 42.9	4	1
Euryen	43.0-47.9	38	31
Mesen	48.0-52.9	46	48
Lepten	53.0-56.9	9	17
Hyperlepten	≥ 57.0	3	3
$\chi^2 = 3.76$, d.f. = 2			

Regarding Morphological Upper Facial Index (table 3), the Meitei male population of present generation have higher mean value ($\bar{X} = 49.83 \pm 0.35$) than the previous generation ($\bar{X} = 48.87 \pm 0.35$) thereby showing a negative secular trend, and a statistically significant difference ($t = 1.96^*$, table 5) This increase in the mean value of morphological upper facial index in the present generation of Meitei male population in comparison with the previous generation by 0.96 is mainly because of decrease in breadth of bizygomatic arch by 3.2mm. Another study (Kanan Uttakar et al., 2012) [19] on facial index of adult males between 18-25 years age group residing in Gujarat state reported that the dominant face type was euryprosopic (42.96 %) followed by hypereuryprosopic (35.10 %) as per Banister, 2000 [4] classification. Since only the males of younger age group were measured in their study, our results might vary with that of Gujarat (76%) with hypereuryprosopic face type Twisha et al. (2015) [20]. The reason for increasing morphological upper facial index may possibly be because of better nutrition, improved socio-economic conditions, better health care and changing living conditions of the present Meitei population which also agrees with the view of Burston et al. (1963) [21] who worked among American Black and White populations. Therefore, as a result of increasing morphological upper facial index the population is gradually experiencing towards the longer face. However, the mean value of the morphological upper facial index of both the Meitei male populations indicate that their face shape fall under the Mesen category (table 3). Even though it

comes under the Mesen category a trend of increasing mean value has been noted. Again the frequency percent distribution of different facial form reveals no statistical significant differences between the populations as evidence from chi-square value ($\chi^2 = 3.76$, Table 3).

Table 4: Frequency Percent Distribution of Morphological Facial Index according to conventional categories of Martin and Saller*.

Conventional Categories	Range	Singh 1992	Present study
Hypereuroprosopic	≤ 78.9	20	8
Euryprosopic	79.0 - 83.9	42	18
Mesoprosopic	84.0 - 87.9	25	31
Leptoprosopic	88.0 - 92.9	9	31
Hyperleptoprosopic	≥ 93.0	4	15
$\chi^2 = 37.7^*$, d.f. = 4			

*(Martin and Saller 1957)

In the case of Morphological Facial Index (table 4), it has been observed that the Meitei population of present generation have higher mean value ($\bar{X} = 87.56 \pm 0.51$) than the previous generation ($\bar{X} = 83.04 \pm 0.48$) showing a positive secular trend through significant difference ($t = 6.46^*$, table 5). This increase in the mean value of morphological facial index in the present generation of Meitei population from the previous generation by 4.52 is mainly because of greater increase in the facial height by (0.34mm) as compared to Morphological Upper Facial Height (0.00mm) and to breadth of bizygomatic arch by 3.2mm. This finding is in agreement with the findings of Gyenis and Joubert (2004) [22]; Angel (1982) [23] and Cole (2000) [24] who worked on Croatian population, the reason for increasing morphological facial index may possibly be because of better nutrition, improved socio-economic conditions, better health care and changing living conditions of the present Meitei population. Therefore a result of increasing morphological facial index the population is gradually experiencing a changing trend from Mesoprosopic to Leptoprosopic as such the mean value of morphological facial index of both the Meitei population indicate that their facial shape fall under the Leptoprosopic category (Table 4). Again, the frequency percent distribution of different facial form reveals statistical significant difference between the population as evidenced from

chi-square value ($\chi^2 = 37.7$, Table 4).

Table 5: Comparative Account of Facial Dimensions of Past and Present Generation Meitei Males of Manipur.

Parameter	Population	Range	Mean	Std Deviation	T- value
Morphological Facial Height	Singh, 1992	100-129 mm	112.4±0.6 mm	6.0±0.4 mm	4.00*
	Present Study	101-135 mm	115.8±0.6 mm	6.0±0.4 mm	
Morphological Upper Facial Height	Singh, 1992	56-77 mm	65.9±0.5 mm	4.6±0.3 mm	0
	Present Study	57-78 mm	65.9±0.5 mm	4.4±0.3 mm	
Breadth of Bizygomatic Arch	Singh, 1992	110-149 mm	135.6±0.7 mm	6.9±0.5 mm	3.23*
	Present Study	120-145 mm	132.4±0.7 mm	5.9±0.4 mm	
Morphological Upper Facial Index	Singh, 1992	41.30-60.50	48.87±0.35	3.48±0.25	1.96*
	Present Study	41.61-59.08	49.83±0.35	3.71±0.26	
Morphological Facial Index	Singh, 1992	72.66-97.45	83.04±0.48	4.76±0.30	6.46*
	Present Study	76.30-98.59	87.56±0.51	5.07±0.36	

*Significant difference at 5% level

CONCLUSION

According to the findings of the present study, the population is experiencing a secular trend towards increasing morphological facial height and decreasing facial breadth and increasing morphological upper facial index because of decrease in the breadth of bizygomatic arch. On the other hand increasing Morphological Facial Index is because of greater increase in the Morphological Facial Height than Facial Breadth. Such a secular trend observed may be because of the impact of many exogenous factors like better nutrition, improved socio-economic conditions, better health care and changing living conditions acting on intrinsic genetic factors. It would be most useful to determine whether this finding is replicated in other samples and whether the trend towards longer and narrower face is a general one operating in all the populations needs to be investigated. Knowledge of facial dimensions is of practical importance in evaluation of age, sex and racial differences from the point of view of micro-evolutionary dynamics as well as in clinical and forensic application.

Conflicts of Interests: None

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