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The Tai-Phake of Assam, India – A Morphometric Study and Population Comparison with Neighbouring Groups

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A B S T R A C T

Morphometric characters of the adult males of the Tai-Phake and the nature and extent of morphometric variation among five neighboring mongoloid groups of Assam have been examined in the present study. For the sake of investigation 12 anthropometric measurements have been taken and five indices have been calculated. In order to obtain the distance values size, shape and biological distance are calculated. It revels that the Tai-Phake maintains a far distance with other five neighboring groups (Ahom, Deuri, Chutia, Mishing and Moran). The Ahom also maintain far distance with other five groups. While, the Mishing and Moran, and Deuri and Chutia maintain close distance among themselves.

Key words: *anthropometrics, Tai-Phake, neighbouring populations*

Introduction

The Tai-Phake are one of the branches of the Tai groups who entered Assam in the later half of the 18th century. They are of mongoloid origin. Language of the Tai-Phake belongs to the Siamese-Chinese branch of the Sino-Tibetan linguistic group. They profess Buddhism and Lord Buddha is their supreme god. Their main occupation is agriculture. Among the Tai-Phake marriage must not take place within same clan and marriage outside the community is not allowed. Monogamy is the prevailing practices, while polygamy is rare.

The object of this paper is to present the results of an anthropometric survey undertaken among the Tai-Phake population. Chief concern of this study is therefore to reveal the physical characteristics of the people. Side by side, the most important aspect of it is to assess the nature and extent of biometrical variation among other five neighbouring endogamous mongoloid groups inhabiting in Assam, namely the Ahom, Deuri, Chutia, Mishing and Moran.

Materials and Methods

Anthropometric measurements

Material of the present study contains a collection of anthropometric data of 104 adult Tai-Phake males, aged between 21 to 55 years. The investigation was carried out by the first author (T.B.), during the month of November, 2003 to January, 2004 in two villages namely, Tipam Phakial and Nam Phakial situated in Dibrugarh district of Assam State. Average age of their subjects is 33.68±1.38. Altogether 12 anthropometric measurements were taken according to the definition and technique of Martin[1]. These are stature (St.), sitting height (S.H.), head length (H.L.), head breadth (H.B.), bizygomatic breadth (B.B.), head height (H.H.), nasal height (N.H.), nasal breadth (N.B.), total facial height (T.F.H.), upper facial height (U.F.H.), circumference of head (C.H.), and girth of thorax (G.T.). The abbreviations put within the brackets are used in the Tables. From these 12 anthropometric measurements 5 indices were calcu-

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lated following the technique of Martin and Saller[2] and Singh and Bhasin[3]. To find out the variability data of the present study were compared with the data of adult males from five neighboring mongoloid groups of Assam namely the Ahom, Deuri, Chutia Mishing and Moran. For this purpose data were taken from Das et al.[4].

Statistical consideration

Size and shape distance:

To find out the size and shape distances the measures of Penrose[5,6] have been followed. Its mathematical formula is as:

$$\text{Size distance} = c_q^2 = \left[(d_1 + d_2 + d_3 + \ldots + d_m) / m \right]^2$$
$$= \left[\sum_1^m (d) \right]^2 / m^2$$

$$\text{Shape distance} = c_z^2 = \sum_1^m (d)\, 2/m - \left[\sum_1^m (d) \right]^{2/m^2}$$

Where, d_1, d_2, d_3,…….d_m represent the difference between standardized means for m characters in two populations.

Biological distance:

The biological distances have been obtained according to the formula of El-Najjar[7] and its mathematical formula is as:

Biological distance (co-efficient of divergence)

$$\text{C. D.} = \sqrt{\frac{(a_1 - b_1)^2 + (a_2 - b_2)^2 + \ldots (a_k - b_k)^2}{K}}$$

$$\text{Where } a_1 = \frac{Ai}{Ai + Bi},\ b_1 = \frac{Bi}{Ai + Bi}$$

Ai – the mean of the i^{th} measurement in population 'A'
Bi – the mean of the i^{th} measurement in population 'B'
K – number of measurements

Results and Discussion

Descriptive statistics of 12 anthropometric characters of the Tai-Phake have been shown in Table 1. It reveals that the characters do not represent distinct physical polytypes. This justifies treating the material of the present study as a single breeding population. Exceptional cases in this respect are head height (13.65), nasal height (8.93), and total facial height (7.99). However, such departures from the general trend may be due to small sample size of the present study. Nevertheless, there are some determining differences of variation in greater or lesser order in the measurements. Considerably higher variation is noticed in case of nasal breadth (7.40) and girth of thorax (7.18). Upper facial height (6.98), Bizygomatic breadth (6.24) and circumference of head (5.59) also show a moderately high variation. Such a variation in these measurements, as explained by Pearson and Davin[8] is possible due to the spanning of cavities between the space of corresponding measuring landmarks and the varying degrees of thickness of the involved soft tissues of the subjects. In a normally distributed sample of a given population, however, the observed variability in different body measurements are not unexpected. Thus, on the whole, the Tai-Phake population represented by the present sample is homogenous.

In Table 2 percentage frequencies of different types of stature, cephalic index, length-height index, breadth--height index, total facial index and nasal index are presented. It appears that majority of the Tai-Phake have short stature (36.84%), followed by below medium stature (20.17%). In case of cephalic index hyperbrachycephalic head (40.35%) is found in the majority and in the latter brachycephalic head (28.95%) is found in the next highest frequency. Frequency of length-height and breadth-height indices occurs highest in hypsicephalic (89.47%) and acrocephalic head (77.19%) respectively. In case of total facial index the hyperleptoprosopic face (46.49%) and in nasal index the mesorhinae nose (50%) occurs in highest frequencies.

TABLE 1
BIOMETRIC DATA OF THE TAI-PHAKE MALES (n=104)

Measurements (cm)	Range	X±SE	SD±SE	CV±SE
Stature (St.)	137–180.0	162.54±0.81	8.26±0.57	5.08±0.35
Sitting height (S.H.)	63–99.0	84.73±0.41	4.21±0.29	4.97±0.54
Head length (H.L.)	16–19.9	17.94±0.06	0.58±0.04	3.23±0.22
Head breadth (H.B.)	11–17.9	15.15±0.04	0.41±0.03	2.71±0.19
Bizygomatic breadth (B.B.)	10–14.9	12.66±0.08	0.79±0.05	6.24±0.45
Head height (H.H.)	11–16.9	12.82±0.17	1.75±0.12	13.65±0.95
Nasal height (N.H.)	3–7.9	5.26±0.05	0.47±0.03	8.93±0.62
Nasal breadth (N.B.)	3–6.9	4.19±0.03	0.31±0.02	7.40±0.51
Total facial height (T.F.H.)	8–14.3	12.01±0.09	0.96±0.07	7.99±0.55
Upper facial height (U.F.H.)	5–8.9	7.73±0.05	0.54±0.04	6.98±0.48
Circumference of head (C.H.)	50–65.9	56.02±0.31	3.13±0.22	5.59±0.39
Girth of thorax (G.T.)	70–99.9	84.30±0.59	6.05±0.42	7.18±0.50

SE – standard error, CV – coefficient of variation

TABLE 2
DIFFERENT TYPES OF ANTHROPOMETRIC CHARACTERS IN THE TAI-PHAKE MALES (%)

Class	(%)
Stature	
Short	36.84
Below medium	20.17
Medium	14.91
Above medium	13.15
Tall	14.93
Cephalic index	
Hyperdolicocephalic	0.88
Dolicocephalic	1.75
Mesocephalic	28.07
Brachycephalic	28.95
Hyperbrachycephalic	40.35
Length-height index	
Chamaeocephalic	6.14
Orthocephalic	4.38
Hypsicephalic	89.47
Breadth-height index	
Tapeinocephalic	11.40
Metriocephalic	11.40
Acerocephalic	77.19
Total facial index	
Hypereuryprosopic	13.16
Euryprosopic	1.75
Mesoprosopic	14.91
Leptoprosopic	23.68
Hyperleptoprosopic	46.49
Nasal index	
Leptorhinae	17.54
Mesorhinae	50.00
Platyrhinae	32.46

Variability and classification of populations

It is rather difficult to assess the inter-group relationships based on univariate analysis of the data. In such case we face the problem of biological taxonomy. Multivariate distance analysis helps us in understanding such problem. For population classification it is necessary to find out the morphological affinities and differences between and among the groups. Thus, in estimating the numerical taxonomy and group divergence of some particular groups it is needed to perform the analysis of overall distance differences and mutual relationships among all possible pairs from a matrix of all multivariate distance between the groups obtained by utilizing a suitable measure of taxonomic distance[9].

Mean and standard deviation values of 12 anthropometric measurements of six mongoloid populations are shown in Table 3, while in Table 4, the means in terms of pooled standard deviation unit are presented. Size and shape distance values between any two groups are shown in Table 5 and 6 respectively. This has been performed for an overview on the size and shape factors used to find out the divergence among groups. Computed mean values for size and shape distance is 0.04 and 0.55 respectively between 15 pairs. This implies that the six mongoloid groups show a tendency to differ more in shape distance than in size distance. Thus, here, the shape distance plays a more important role than the size distance because of the morphological dissimilarity and differences.

On the basis of 12 anthropometric measurements biological distances (C.D.) are calculated among the 6 population groups. The distance values are furnished in Table 7. In Table 8 the values of biological distance are shown among these groups in an increasing order of magnitude. It reveals that the Mishing and Moran maintain a lowest distance (1.08). Side by side, the Deuri and Chutia also maintain a minimum distance (1.15). The Ahom and Tai-Phake in turn, maintain a far distance with those

TABLE 3
MEANS AND STANDARD DEVIATIONS OF ANTHROPOMETRIC CHARACTERS OF SIX MONGOLOID GROUPS

Measurements (in cm.)	Ahom (n=100)		Deuri (n=99)		Chutia (n=83)		Mishing (n=100)		Moran (n=100)		Tai-Phake (n=104)	
	X	SD	X	SD	X	SD	X	SD	X	SD	X	SD
Stature (St.)	162.83	6.20	163.86	4.78	164.11	5.01	161.13	5.00	162.97	6.20	162.54	8.26
Sitting height (S.H.)	84.72	4.00	83.95	3.18	84.13	3.28	84.05	2.90	84.59	3.30	84.73	4.21
Head length (H.L.)	18.24	0.80	18.38	0.50	18.38	0.64	18.63	0.60	18.80	0.60	17.94	0.58
Head breadth (H.B.)	14.88	0.70	14.63	0.50	14.68	0.64	14.78	0.68	14.46	0.50	15.15	0.41
Bizygomatic breadth (B.B.)	13.65	0.50	13.54	0.50	13.44	0.55	13.65	0.60	13.39	0.60	12.66	0.79
Head height (H.H.)	12.65	1.40	13.69	1.49	13.63	1.64	13.77	1.30	13.55	1.30	12.82	1.75
Nasal height (N.H.)	5.27	0.40	5.21	0.50	5.04	0.45	5.28	0.40	5.39	0.40	5.26	0.47
Total facial height (T.F.H.)	11.46	0.60	11.44	0.60	11.59	0.73	11.97	0.60	11.98	0.70	12.01	0.96
Upper facial height (U.F.H.)	8.98	0.50	7.00	0.60	6.76	0.55	7.19	0.50	7.29	0.50	7.73	0.54
Circumference of head (C.H.)	55.45	1.80	55.71	1.59	55.16	1.91	55.94	1.50	55.81	1.50	56.02	3.13
Girth of thorax (G.T.)	86.36	5.10	87.51	3.98	84.78	3.46	87.70	4.00	87.85	4.50	84.30	6.05

TABLE 4
MEANS OF ANTHROPOMETRIC CHARACTERS OF SIX MONGOLOID GROUPS (MALES) IN TERMS OF POOLED STANDARD DEVIATION UNIT

Population	St.	S.H.	H.L.	H.B.	B.B	H.H.	N.H.	N.B.	T.F.H.	U.F.H.	C.H.	G.T.
Ahom	26.78	24.00	28.95	26.57	22.75	8.49	11.98	13.50	16.14	16.94	27.59	18.61
Deuri	26.95	23.78	29.17	26.12	22.57	9.19	11.84	13.57	16.11	13.21	27.72	18.86
Chutia	26.99	23.83	29.17	26.21	22.40	9.15	11.45	13.50	16.32	12.75	27.44	18.27
Mishing	26.50	23.81	29.57	26.39	22.75	9.24	12.00	13.18	16.86	13.57	27.83	18.90
Moran	26.80	23.96	29.84	25.82	22.32	9.09	12.25	13.57	16.87	13.75	27.77	18.93
Tai-Phake	26.73	24.00	28.48	27.05	21.11	8.60	11.95	14.96	16.91	14.58	27.87	18.17
Pooled SD	6.08	3.53	0.63	0.56	0.60	1.49	0.44	0.28	0.71	0.53	2.01	4.64

St. – Stature, S.H. – Sitting height, H.L. – Head length, H.B. – Head breadth, B.B. – Bizygomatic breadth, H.H. – Head height, N.H. – Nasal height, T.F.H. – Total facial height, U.F.H. – Upper facial height, C.H. – Circumference of head, G.T. – Girth of thorax

TABLE 5
SIZE DISTANCES (C_Q^2) BETWEEN GROUPS

Population	Ahom	Deuri	Chutia	Mishing	Moran	Tai-Phake
Ahom	–	0.07	0.16	0.05	0.01	0.02
Deuri		–	0.02	0.02	0.01	0.01
Chutia			–	0.07	0.08	0.06
Mishing				–	0.00	0.00
Moran					–	0.00
Tai-Phake						–

TABLE 6
SHAPE DISTANCES (C_Z^2) BETWEEN GROUPS

Population	Ahom	Deuri	Chutia	Mishing	Moran	Tai-Phake
Ahom	–	1.17	1.41	0.16	1.06	0.96
Deuri		–	0.05	0.09	0.08	0.73
Chutia			–	0.14	0.18	0.73
Mishing				–	0.08	0.79
Moran					–	0.69
Tai-Phake						–

four populations. The distances between the Tai-Phake and the Moran, Mishing, Deuri, Chutia and Ahom are 2.53, 2.89, 2.99, 3.20 and 3.34 respectively. While, the distances between the Ahom and Tai-Phake, Moran, Mishing, Deuri and Chutia are 3.34, 3.38, 3.68, 3.78 and 4.64 respectively. For a clear view of the situation, the distance values of the Moran, Mishing, Deuri, Chutia and Ahom in relation to the Tai-Phake are plotted in Figure 1.

Following the methodology of Mardia et al.[10] a dendrogram has been computed (Figure 2) on the basis of the data given in Table 7. It appears that there are two distinct clusters. Cluster I: Mishing and Moran. Cluster II: Deuri and Chutia

The Tai-Phake and Ahom found to be maintaining a far distance with these clusters.

Interesting corroboration between anthropometric measurements and inter-group relationships has already been reported while dealing with numerical taxonomy and group divergence among some population groups of Assam and Meghalaya State of India[9, 11,12].

It may be mentioned that all these six populations are living in upper part of Assam for a long period of time. They came to Assam at different periods. Though all of them are mongoloid, each has its own identity. They differ with respect of their dialects/languages and many other cultural traits. The Deuri, however, form a sub-division of the Chutia, who are considered to be the priestly section of this population[13]. A close distance between the Deuri and Chutia corroborate this finding. The Mishing

TABLE 7
BIOLOGICAL DISTANCES (C.D.) BETWEEN GROUPS (%)

Population	Ahom	Deuri	Chutia	Mishing	Moran	Tai-Phake
Ahom	–	3.78	4.64	3.68	3.38	3.34
Deuri		–	1.15	1.65	1.53	2.99
Chutia			–	1.85	1.94	3.20
Mishing				–	1.08	2.89
Moran					–	2.53
Tai-Phake						–

TABLE 8
BIOLOGICAL DISTANCES (C.D.) BETWEEN ANY TWO GROUPS ARRANGED IN INCREASING ORDER OF MAGNITUDE

Ahom	Deuri	Chutia	Mishing	Moran	Tai-Phake
3.34 Tai-Phake	1.15 Chutia	1.15 Deuri	1.08 Moran	1.08 Mishing	2.53 Moran
3.38 Moran	1.53 Moran	1.85 Mishing	1.65 Deuri	1.53 Deuri	2.89 Mishing
3.68 Mishing	1.65 Mishing	1.94 Moran	1.85 Chutia	1.94 Chutia	2.99 Deuri
3.78 Deuri	2.99 Tai-Phake	3.20 Tai-Phake	2.89 Tai-Phake	2.53 Tai-Phake	3.20 Chutia
4.64 Chutia	3.78 Ahom	4.64 Ahom	3.68 Ahom	3.38 Ahom	3.34 Ahom

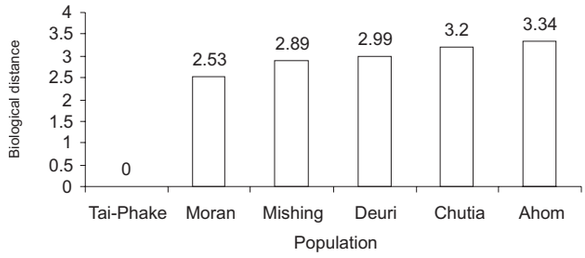

Fig. 1. Biological distance of five mongoloid groups in relation to the Tai-Phake.

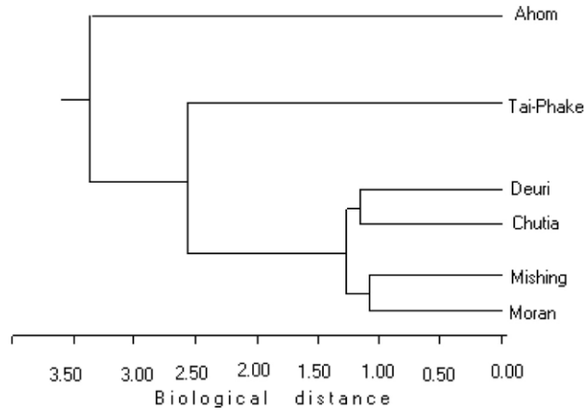

Fig. 2: Dendrogram based on biological distance of six mongoloid groups.

and Moran also speak a dialect belong to the Assam--Burma branch of the Tibeto-Burman family, like the Chutia and Deuri, though they form a separate cluster. The Ahom and Tai-Phake seem to be merely peculiar populations in this regard. They revealed remarkably higher biological distance among themselves, as well as with other four populations. It is interesting to note that linguistically, both the Ahom and Tai-Phake belong to the Siamese-Chinese branch of the Sino-Tibetan family. Thus, it may be the pattern of variability among the six mongoloid population groups of Assam. From the analysis of biological distance, however, it seems to be difficult to arrive at any conclusion regarding their inter-group relationship.

REFERENCES

1. MARTIN, R.: Lehrbuch der Anthropologie. (Gustav Fischer Verlag, Jena, 1928). — 2. MARTIN, R., K. SALLER: Lehrbuch der Anthropologie. Band. I und II. (Gustav Fischer Verlag, Stuttgart, 1957). — 3. SINGH, I. P., M. K. BHASIN: Anthropometry. (Kamla-Raj Enterprises, Delhi, 1989). — 4. DAS, B. M., P. B. DAS, R. DAS, H. WALTER, H. DANKER-HOPFE, Anthrop. Anz., 43 (1985) 193. — 5. PENROSE, L. S., Ann. Eugen., 13 (1947) 228. — 6. PENROSE, L. S., Ann. Eugen., 18 (1954) 337. — 7. EL--NAJJAR, M. Y., Amer. J. Phys. Anthrop., 48 (1978) 151. — 8. PEARSON, K., A. G. DAVIN, Biometrika, 16 (1924) 328. — 9. ADAK, D. K., B. M. DAS, J. Hum. Ecol., 7 (1996) 181. — 10. MARDIA, K. V., J. T. KENT, J. M. BIBBY: Multivariate Analysis. (Academic Press, London, 1979). — 11. ADAK. D. K., B. M. DAS, J. Hum. Ecol., 5 (1994) 179. — 12. DUTTA, P. C., D. CHOWDHURY, D. K. ADAK, J. Indian Anthrop. Soc., 29 (1994) 22. — 13. DAS, B. M., P. B.DAS, R. DAS: Biosocial Profile of Five Mongoloid Populations of Assam. (Department of Anthropology, Gauhati University, Assam, India, 1980).

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TAI-PHAKE IZ ASSAMA, INDIA – MORFOMETRIJSKO ISTRAŽIVANJE I POPULACIJSKA USPOREDBA SA SUSJEDNIM GRUPAMA

SAŽETAK

U ovom istraživanju proučavane su morfometrijske značajke odraslih muškaraca Tai-Phake grupe te priroda i obim morfometrijske varijacije među pet susjednih grupa mongolskog podrijetla iz Assama. Za istraživanje je uzeto 12 antropometrijskih mjera i izračunato pet indeksa. Kao mjere udaljenosti, uzete su udaljenosti veličine, oblika i biološka udaljenost. Ustanovljeno je da Tai-Phake grupa pokazuje veliku udaljenost od pet susjednih grupa (Ahom, Deuri, Chutia, Mishing and Moran). Ahom skupina je također udaljena od ostalih pet grupa. Za razliku od toga, grupe Mishing i Moran te Deuri i Chutia pokazuju manju međusobnu udaljenost.