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A Study of Numerical Taxonomy and Group Divergence in Five Mongoloid Population Groups of Assam

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ABSTRACT Anthropometric characters of five Mongoloid populations, namely, the Ahom, Chutia, Deuri, Mishing and Moran of Upper Assam have been examined to study the numerical taxonomy and group divergence using the methodology of Penrose (1947, 1954) and Rao (1952). The study reveals three distinct clusters, *viz.*, cluster I: formed by the Deuri and Chutia, cluster II: formed by the Mishing and Moran and cluster III: formed by the Ahom alone. It appears that the first two clusters maintain a short distance (*i.e.* distance between I and II is 1.5297), whereas the third cluster stands far apart from the former two (*i.e.* distance of cluster II form I is 4.1134 and distance of cluster III from II is 3.6332).

Reports on biological anthropology of five Mongoloid population groups of Upper Assam are available (Das et al., 1985 and Danker-Hopfe et al., 1988). Outcome of Das et al. (1985) is as follows: "the five Mongoloid population groups from Upper Assam – Ahom, Deuri, Chutia, Mishing and Moran show an obvious heterogeneity in the distribution of anthropometric, behavioural and dermatoglyphic traits as well as in the distribution of ABO blood groups and PTC taste sensitivity."

It is rather difficult to assess the inter-group relationships by utilising the data based on sample from univariate populations. In this case we face the problem of biological taxonomy. To understand such anthropological problem multivariate statistical analysis is required. The study of Das et al. (1985) lacks the multivariate statistical analysis.

The report of Danker-Hopfe et al. (1988) is based on multivariate statistical analysis among 13 Assamese populations. Among these, the said five Mongoloid populations are also included. But in this study no separate demonstration of five Mongoloid populations is available although these five populations possess a unique racial affinity *i.e.* they all belong to the same racial stock and inhabit Upper Assam.

To classify the Mongoloid populations and to find out their relationship we have to see the morphological affinities and differences between and among the groups. Therefore, in the present paper an attempt has been made to estimate the numerical taxonomy and group divergence of five Mongoloid populations of Upper Assam by the analysis of overall distance differences and mutual relationships between all possible Mongoloid pairs from a matrix of all multivariate distances between the groups obtained untilising a suitable measure of taxonomic distance.

MATERIAL AND METHODS

The present investigation is based on anthropometric data published by Das et al. (1985). Altogether 12 anthropometric characters (*i.e.* stature, sitting height, head length, head breadth, bizygomatic breadth, head height, nasal height, nasal breadth, total facial height, upper facial height, circumference of head and girth of thorax) for the Ahom, Deuri, Chutia, Mishing and Moran males of Upper Assam have been selected and one character (*i.e.* body weight) has been excluded to provide a uniformity to estimate the distance calculation.

Table 1: Mean and standard deviation (S.D.) of anthropometric characters of the five Mongoloid populations (after Das et al., 1985)

Measurements (in cm)	*Ahom (n = 100)*		*Deuri (n = 99)*		*Chutia (n = 83)*		*Mishing (n = 100)*		*Moran (n= 100)*	
(m = 12)	*Mean*	*S.D.*	*Mean*	*S.D.*	*Mean*	*S.D.*	*Mean*	*S.D.*	*Mean*	*S.D.*
Stature (St.)	162.83	6.20	163.86	4.78	164.11	5.01	161.13	5.00	162.97	6.20
Sitting height (S.H.)	84.72	4.00	83.95	3.18	84.13	3.28	84.05	2.90	84.59	3.30
Head length (H.L.)	18.24	0.80	18.38	0.50	18.38	0.64	18.63	0.60	18.80	0.60
Head breadth (H.B)	14.88	0.70	14.63	0.50	14.68	0.64	14.78	0.60	14.46	0.50
Bizygomatic breadth (B.B)	13.65	0.50	13.54	0.50	13.44	0.55	13.65	0.60	13.39	0.60
Head height (H.H.)	12.65	1.40	13.69	1.49	13.63	1.64	13.77	1.30	13.55	1.30
Nasal height (N.H.)	5.27	0.40	5.21	0.50	5.04	0.45	5.28	0.40	5.39	0.40
Nasal breadth (N.B.)	3.78	0.30	3.80	0.30	3.78	0.27	3.69	0.20	3.80	0.30
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
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
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
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

Table 2: Means of anthropometric characters of five Mongoloid population groups 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	29.66	25.29	28.50	25.22	24.82	8.91	12.25	13.50	17.91	16.94	33.40	20.22
Deuri	29.85	25.06	28.72	24.80	24.62	9.64	12.12	13.57	17.88	13.21	33.56	20.49
Chutia	29.89	25.11	28.72	24.88	24.44	9.60	11.72	13.50	18.11	12.75	33.23	19.85
Mishing	29.35	25.09	29.11	25.05	24.82	9.70	12.28	13.18	18.70	13.57	33.70	20.54
Moran	29.68	25.25	29.37	24.51	24.34	9.54	12.53	13.57	18.72	13.75	33.62	20.57
Pooled S.D.	5.49	3.35	0.64	0.59	0.55	1.42	0.43	0.28	0.64	0.53	1.66	4.27

The 'size' and 'shape' distances have been calculated following the measures of Penrose (1947, 1954). Common standard deviations for each character has been used, to estimate the distance. And the combined means are expressed in terms of pooled standard deviation unit. Value of "D_P^2" have been analysed following the method of Rao (1952), which has been done to see the intra and inter cluster average among the five populations.

RESULTS AND DISCUSSION

Mean and standard deviation value of 12 anthropometric characters of five Mongoloid populations have been shown in table 1. And in table 2 the means in terms of pooled standard deviation unit have been shown. Table 3 exhibits the differences between measurements and derived distances between any two Mongoloid populations. The results have been shown in tables 4–6.

The mean size and shape distances have been calculated again by mc^2_Q *and* $(m - 1)\, c^2_Z$ for each comparison (ten in number). It has been done, for an overall view about size and shape factors which are involved to find out the divergence of the population groups. The computed mean value for size distance between 10 pairs is 0.58 and for shape distance is 6.59. It shows that the value of shape distance is larger than size distance. So, it can be said that the five Mongoloid groups show a tendency to differ more in shape distance than in size distance. However, here, the shape distance plays more important role than size distance because of overall morphological dissimilarity and differences.

Table 3: Differences between measurements and derived distances between any two of Mongoloid populations

Character	*Difference*	*Ahom-Deuri*	*Ahom-Chutia*	*Ahom-Mishing*	*Ahom-Moran*	*Deuri-Chutia*	*Deuri-Mishing*	*Deuri-Moran*	*Chutia-Mishing*	*Chutia-Moran*	*Mishing-Moran*
1	d_1	-0.19	-0.23	0.31	-0.02	-0.04	0.50	0.17	0.54	0.21	-0.33
2	d_2	0.23	0.18	0.20	0.04	-0.05	-0.03	-0.19	0.02	-0.14	-0.16
3	d_3	-0.22	-0.22	-0.61	-0.87	0.00	-0.39	-0.65	-0.39	-0.65	-0.26
4	d_4	0.42	0.34	0.17	0.71	-0.08	-0.25	0.29	-0.17	0.37	0.54
5	d_5	0.20	0.38	0.00	0.48	0.18	-0.20	0.28	-0.38	0.10	0.48
6	d_6	-0.73	-0.69	-0.79	-0.63	0.04	-0.06	0.10	-0.10	0.06	0.16
7	d_7	0.13	0.53	-0.03	-0.28	0.40	-0.16	-0.41	-0.56	-0.81	-0.25
8	d_8	-0.07	0.00	0.32	-0.07	-0.07	0.39	0.00	0.32	-0.07	-0.39
9	d_9	0.03	-0.20	-0.79	-0.81	-0.23	-0.82	-0.84	-0.59	-0.61	-0.02
10	d_{10}	3.73	4.19	3.37	3.19	0.46	-0.36	-0.54	-0.82	-1.00	-0.18
11	d_{11}	-0.16	0.17	-0.30	-0.22	0.33	-0.14	-0.06	-0.47	-0.39	0.08
12	d_{12}	-0.27	0.37	-0.32	-0.35	0.64	-0.05	-0.08	-0.69	-0.72	-0.03
Sum of 'd' values $S_1{}^{12}(d)$		3.10	4.82	1.22	1.17	1.72	-1.57	-1.93	-3.29	-3.65	-0.36
1		14.92	18.91	13.44	12.98	0.99	1.51	1.83	2.76	3.34	1.00
2		0.07	0.16	0.01	0.01	0.02	0.02	0.03	0.07	0.09	0.00
3		1.17	1.42	1.11	1.07	0.06	0.11	0.12	0.16	0.19	0.08
4		1.24	1.58	1.12	1.08	0.08	0.12	0.15	0.23	0.28	0.08
Size = $mc_Q{}^2$		0.84	1.92	0.12	0.12	0.24	0.24	0.36	0.84	1.08	0.00
Shape = $(m-1)\,C_Z{}^2$		14.04	17.04	13.32	12.84	0.72	1.32	1.44	1.92	2.28	0.96
$D_P^2 = mc_H{}^2$		14.88	18.96	13.44	12.96	0.96	1.44	1.80	2.76	3.36	0.96

1. Sum of squares of 'd' values $S_1{}^{12}\ (d)^2$
2. Size Distance $c^2{}_Q = [S_1{}^{12}(d)]^2/12^2$
3. Shape distance m-1/m $c^2{}_Z = S_1{}^{12}{}_1\ (d^2)/12\text{-}[S_1{}^{12}{}_1\ (d)^2/144$
4. Mean square distance $c^2{}_H = S_1{}^{12}\ (d)^2/12$

Table 4: Value of size distance $(mc^2{}_Q)$ between any two Mongoloid populations

Population	*Ahom*	*Deuri*	*Chutia*	*Mishing*	*Moran*
Ahom	—	0.84	1.92	0.12	0.12
Deuri	—	—	0.24	0.24	0.36
Chutia	—	—	—	0.84	1.08
Mishing	—	—	—	—	0.00
Moran	—	—	—	—	—

Table 5: Value of shape distance $(m\text{-}1)\ c^2{}_Z$ between any two Mongoloid populations

Population	*Ahom*	*Deuri*	*Chutia*	*Mishing*	*Moran*
Ahom	—	14.04	17.04	13.32	12.84
Deuri	—	—	0.72	1.32	1.44
Chutia	—	—	—	1.92	2.28
Mishing	—	—	—	—	0.96
Moran	—	—	—	—	—

Table 6: Values of D^2_P (based on 12 characters) between any two Mongoloid populations arranged in increasing order of magnitude

Ahom	*Deuri*	*Chutia*	*Mishing*	*Moran*
12.96	0.96	0.96	0.96	0.96
Moran	Chutia	Deuri	Moran	Mishing
13.44	1.44	2.76	1.44	1.80
Mishing	Mishing	Mishing	Deuri	Deuri
14.88	1.80	3.36	2.76	3.36
Deuri	Moran	Moran	Chutia	Chutia
18.96	14.88	18.96	13.44	12.96
Chutia	Ahom	Ahom	Ahom	Ahom

Table 6 exhibits the values of D^2_P on all the 10 pairs in an increasing order of magnitude. It shows that the Deuri is closely related with the Chutia (*i.e.* 0.96) and the Mishing with the Moran. But the Ahom is distantly related with the Moran (12.96), Mishing (13.44) and Deuri (14.88). And the Chutia (18.96) is farthest apart in this regard. Thus, it appears that these might be the pattern of relationship among the five Mongoloid population groups.

Table 7 exhibits the values of D^2_P which have been analysed following the method of Rao (1952). This has been done to see the intra and inter cluster average among the five population groups. To draw a clear view of the situation figure 1 seems to be useful for the approximate configuration. Their mutual relationships represent the distance where, the square root of average D^2_P's have been used following table 7.

Table 7: Intra and inter-cluster average D^2_P

Cluster	*Population*	*A*	*B*	*C*
A	Deuri, Chutia	0.96	2.34	16.92
B	Mishing, Moran	2.34	0.96	13.20
C	Ahom	16.92	13.20	—

Rao (1952) says that, if the change is appreciable one, then the group added there, has to be considered as lying outside the cluster. Following this, further the change in average D^2_P within a cluster, an additional group has been computed based on the result of table 6, which has been shown in table 8.

It appears that, a sharp rise in D^2_P occurs in case of the Ahom when this population group is added with the other four population groups. The Deuri with the Chutia and the Mishing with the Moran are forming two clusters while, the Ahom is lying far apart from these two clusters.

CONCLUSION

Numerical taxonomy, group divergence and the inter-group relationships of five Mongoloid population groups of Upper Assam reflect that the Mishing and the Moran are placed in the same cluster. Similarly, the Deuri and the Chutia also form another cluster. These two clusters maintain a short distance. This suggests that they may be categorized taxo-

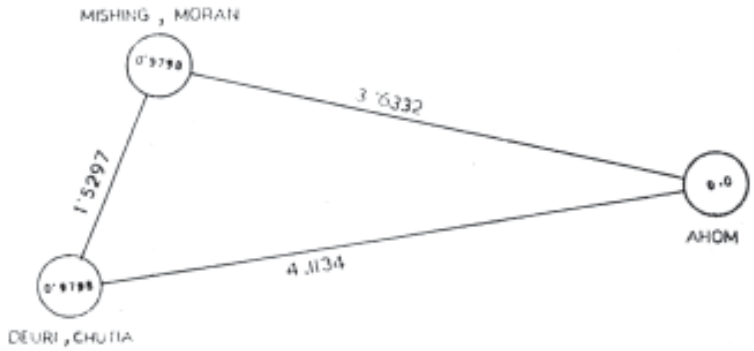

Fig. 1. Clusters and their inter-relationships

Table 8 : Computational scheme for finding cluster

Population added to cluster	D^2_p	*No. of terms(n)*	*Increasing* D^2_p / *Increasing in n*	*Average* D^2_p	*Cluster*
Deuri, Chutia	0.96	1	—	0.96	
Mishing	5.16	3	2.10	1.72	Deuri, Chutia (A)
Mishing, Moran	0.96	1	—	0.96	
Ahom	27.36	3	13.20	9.12	Mishing, Moran (b)
Ahom	—	—	--	—	Ahom (C)

nomically in the same class. The Ahom is widely apart from these two clusters which clearly exhibits that they maintain a distant position from the former four Mongoloid groups.

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