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GENETIC DISTANCES AMONG THE KOCH POPULATIONS OF ASSAM, INDIA

ABSTRACT — In the present study an attempt has been made to measure the genetic distances in respect of ABO blood groups and PTC taste sensitivity among five Koch samples of Assam. To measure the genetic distances Sanghvi's method of calculating genetic distance (G) has been applied.

KEY WORDS: Genetic distance — ABO blood group — Phenylthiocarbamide — Koch — Assam — India.

INTRODUCTION

The people under study are the Koch who form one of the largest caste groups of Assam within the Hindu social order. Today they are widely distributed in most of the districts of Assam with the heaviest aggregation in the western districts of the State like Goalpara and Kamrup.

In Assam, peoples of different tribal groups are known as Koch after conversion to Hinduism and are given a place in the castefold of Hindu society. Transformation from tribe to caste is perhaps possible in Assam by becoming a Koch. These converts are in fact the descendants of either the Garo, the Rabha, the Kachari, the Lalung or the Mikir (Gait 1905, Waddel 1901). Thus the Assamese Hindu society is assimilating gradually bio-cultural elements from tribal communities. It is not known at which time the process of conversion started, but it has not stopped. It is a continuing process. It is a fact that a major part of conversion took place following the preaching of Vaishnavite cult by Srimanta Sankardeva, a socio-cultural reformer and a religious preacher of the 15th century.

In the present study an attempt has been made to measure the genetic distances in respect of ABO blood groups and PTC taste sensitivity among five Koch samples of Assam, India.

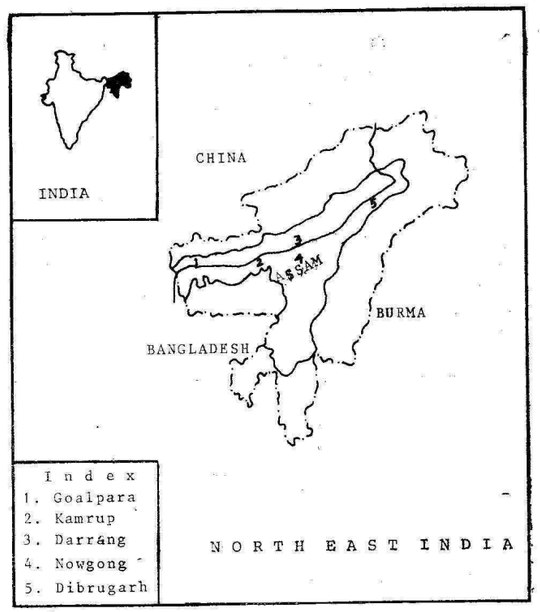

FIGURE 1. *Map showing the places of investigation.*

MATERIAL AND METHOD

Data for the present study on the five samples of the Koch were collected in six areas from five different plains districts (Goalpara, Kamrup, Darrang, Nowgong and Dibrugarh) of Assam. The number of subjects studied for each trait is indicated in relevant tables. While selecting the individuals every care has been taken to exclude closely related individuals.

Blood grouping test (ABO and Rh system) was done carefully by employing direct method following those cautions suggested by the manufacturer. For both the systems gene frequencies were calculated according to the formulae suggested by Mourant (1954) and necessary corrections were also made (Bernstein 1930). The technique used for determining the taste threshold for each individual is according to the method prescribed by Harris and Kalmus (1949). Sanghvi's (1953) G^2 test have been applied to measure genetical distances among five samples of Koch.

RESULTS AND DISCUSSION

With respect of ABO blood groups, the goodness of fit with 1 degree of freedom shows that all the Koch samples are homogeneous and are in agreement with Bernstein hypothesis. But the heterogeneity test between the ABO blood groups of five Koch samples by using 5×4 contingency table yielded the chi-square value (26.8184; 12 d.f.; $0.01 > p > 0.001$) which is significant at 1.0% level, indicating that the samples are differentiated and are heterogeneous in nature. This is expected. The heterogeneity is probably due to comparing together the samples of various mating groups who exhibit a considerable range of variations amongst them.

In respect of frequency distribution of ABO blood groups (*Table 1*) it appears that in the Koch of Goalpara, Kamrup and Darrang, gene q occurs more frequently than the p. The reverse is true in case of the Koch of Nowgong and Dibrugarh. The Koch of Goalpara and Kamrup are almost akin to each other. The Koch of Darring show low phenotype O and predominance of phanotype AB compared with other samples. The percentage of phenotype A is much higher in the Koch of Nowgong in comparison to that in other samples. Occurrence of phenotype B in them also occur in a marked lower frequency. The Koch of Dibrugarh show a very high incidence of phenotype O and least incidence of AB. Test of significance (*Table 6*) reveals that the Koch of Nowgong differ from each of the Koch samples except Dibrugarh. The chi-square value between Darrang $\times$ Dibrugarh is also significant at 1.0% level. The other results are statistically not significant.

To examine which of the sample deviates much from the Koch sample as a whole, chi-square test has been applied. The results reveal that only the Koch of Nowgong stand aloof from the pooled Koch sample. It may, however, be pointed out that the deviation of the Koch of Darrang and Dibrugarh from the pooled Koch sample is near the border line of significance.

The different Koch samples under consideration are overwhelmingly Rh+ (*Table 2*). Frequency of Rh— person is slightly higher in the Koch of Goalpara, Nowgong and Dibrugarh than in Kamrup and Darrang. However, chi-square results reveal that the variations existing in them are not statistically significant (*Table 6*). Heterogeneity test between the five Koch samples by using 5×2 contingency table yielded the chi-square value (2.8080; 4 d.f.; $0.70 > p > 0.50$) which is non-significant.

The threshold frequencies in each of the sample indicate a bimodal distribution with two modes corresponding to the two phenotypes with an antimode in between. The taster and non-taster frequency have been calculated after locating the antimodes.

The antimode lies between solution number 3 and 4 in Goalpara, Darrang and Nowgong males and also in Dibrugarh (both males and females). It falls between 5 and 6 in Goalpara and Kamrup females. The antimode is found to be in between solutions number 2 and 3 in Kamrup males and females of Darrang. When the two sex are combined together, it falls between 3 and 4 in all the samples (*Table 3*).

From the distribution of non-taster phenotype (*Table 4*) it is clear that the lowest percentage is found amongst males of Nowgong (8.75%) and Kamrup (9.64%) while the highest percentage (37.74%) is observed in Dibrugarh males. A geographical trend is found in the distribution of non-taster rate in females. The non-taster frequency and gene t register a rise if one proceeds from west to east (*Figure 1*) i.e. from Goalpara (0.5180) to Kamrup (0.5311) to rise to Darrang (0.5436) and then finally to Dibrugarh (0.5828). The males of Goalpara and Kamrup exhibit lower percentage of non-tasters than their female counterparts but reverse is the case in Darrang and Dibrugarh. Sexwise percentile occurrence of nontasters in the pooled sample closely approaches to that found in Goalpara and Kamrup.

The frequency of allele proportion of nontasters i.e. t gene in samples under consideration (*Table 4*) ranges between 0.2958 ± 0.053 (Nowgong) and 0.6143 ± 0.054 (Dibrugarh) in case of males. By contrast, amongst the females variation in this regard is comparatively less. Here the allele proportion ranged from 0.5180 ± 0.055 among Dibrugarh.

The females of all the samples show higher mean threshold value among tasters than the males in their respective groups except in the case of Darrang in which the males exhibit higher value (*Table 4*).

TABLE 1. *ABO phenotype frequencies*

District	Sample size	Percentage phenotype frequencies				Gene frequencies			Chi-square value
		O	A	B	AB	p	q	r	
Goalpara	114	37.72	26.32	31.58	4.38	0.1691	0.2017	0.6292	1.486
Kamrup	107	38.32	25.23	31.78	4.67	0.1640	0.2044	0.6316	0.987
Darrang	104	29.06	30.69	32.70	11.55	0.2294	0.2420	0.5286	0.354
Nowgong	100	37.00	41.00	15.00	7.00	0.2783	0.1166	0.6051	0.063
Dibrugarh	102	47.06	29.41	21.57	1.96	0.1731	0.1266	0.7003	1.886
Koch pooled	527	37.38	30.36	26.76	5.50	0.2004	0.1781	0.6215	2.996

TABLE 2. *Rh phenotype frequencies*

District	Sample size	Percentage phenotype frequencies		Gene frequencies	
		Rh(+)	Rh(−)	D	d
Goalpara	114	96.49	3.51	0.8127	0.1873
Kamrup	107	99.07	0.93	0.9036	0.0964
Darrang	104	99.04	0.96	0.9020	0.0980
Nowgong	100	97.00	3.00	0.8268	0.1732
Dibrugarh	86	97.67	2.33	0.8474	0.1526
Koch pooled	511	97.85	2.15	0.8534	0.1466

TABLE 3. *Phenylthiocarbamide taste threshold distribution*

District	Sex	Sample Size	PTC solutions numbers (threshold)													
			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Goalpara	Male	81	4	3	5	1	3	6	9	14	18	13	2	2	1	0	0
	Female	41	5	3	1	1	1	0	2	4	11	5	3	2	1	1	1
	M + F	122	9	6	6	2	4	6	11	18	29	18	5	4	2	1	1
Kamrup	Male	83	5	2	1	4	9	10	13	13	12	7	5	1	1	0	0
	Female	39	5	2	1	2	1	0	4	5	7	9	2	0	0	0	1
	M + F	122	10	4	2	6	10	10	17	18	19	16	7	1	1	0	1
Darrang	Male	77	17	4	2	0	2	5	8	9	12	10	6	2	0	0	0
	Female	44	8	4	1	2	3	3	5	7	6	1	4	0	0	0	0
	M + F	121	25	8	3	2	5	8	13	16	18	11	10	2	0	0	0
Nowgong	Male	80	4	0	2	1	4	7	13	22	15	8	2	2	2		
Dibrugarh	Male	53	13	4	2	1	5	6	6	11	2	1	0	1	1	0	0
	Female	53	11	2	3	2	4	9	10	5	2	1	1	0	2	1	0
	M + F	106	24	6	5	3	9	15	16	16	4	2	1	1	3	1	0
Koch (pooled)	Male	374	43	13	12	7	23	34	49	69	59	39	15	8	3	0	0
	Female	177	29	11	6	7	9	12	21	21	26	16	10	2	3	2	2
	M + F	551	72	24	18	14	32	46	70	90	85	55	25	10	6	2	2

TABLE 4. *Phenylthiocarbamide non-taster phenotype, gene frequencies and mean taste threshold values*

District	Sex	No	Non-taster phenotype (%)	Gene frequency	Taste threshold
				t ± S.E.	Mean ± S.E.
Goalpara	M	81	16.05	0.4006 ± 0.050	7.49 ± 0.20
	F	41	26.83	0.5180 ± 0.066	8.80 ± 0.34
	M + F	122	19.67	0.4435 ± 0.040	7.85 ± 0.19
Kamrup	M	83	9.64	0.3105 ± 0.052	6.65 ± 0.24
	F	39	28.21	0.5311 ± 0.067	8.21 ± 0.30
	M + F	122	15.57	0.3946 ± 0.041	6.97 ± 0.21
Darrang	M	77	29.87	0.5465 ± 0.047	7.63 ± 0.24
	F	44	29.55	0.5436 ± 0.063	6.74 ± 0.35
	M + F	121	29.75	0.5454 ± 0.038	7.41 ± 0.19
Nowgong	F	80	8.75	0.2958 ± 0.053	7.08 ± 0.18
Dibrugarh	M	53	37.74	0.6143 ± 0.054	6.39 ± 0.32
	F	53	33.96	0.5828 ± 0.055	6.51 ± 0.38
	M + F	106	35.85	0.5987 ± 0.038	6.46 ± 0.25
Koch (pooled)	M	374	18.98	0.4357 ± 0.023	7.14 ± 0.10
	F	177	29.94	0.5472 ± 0.031	7.28 ± 0.20
	M + F	551	22.50	0.4743 ± 0.018	7.26 ± 0.09

Most investigators have found that females are more sensitive to the taste of phenylthiocarbamide than males. Hartman (1939), Falconer (1947), Vyas et al. (1958) etc. in their researches also noticed higher taster-rate in the females than in the males, while a reverse picture has also come out from the research of Saldanha (1958) among the Japanese and Vyas et al. (1958) among the Kapil Vaniyas of Gujarat, India. The present study exhibit both the types. Therefore perhaps no far reaching conclusion should be drawn from it.

Significance test for sex homogeneity among five samples of Koch in respect of taster phenotype and taster mean threshold have been performed with the help of chi-square and Student's t test (*Table 5*). It is found that with regard to phenotype distribution only Kamrup and pooled sample of Koch differ from their female counterparts significantly, while regarding taster mean threshold, significant bisexual variation is observed in each of Goalpara, Kamrup and Darrang. There is no sexual difference found in Dibrugarh in respect of both the traits.

The phenylthiocarbamide distribution (*Table 4*) of the combined sexes (males + females) reveals that the Koch of Dibrugarh (35.85%) have the maximum percentile frequencies of non-tasters and the minimum is found among the Koch of Nowgong (8.75%). Between these two extremes lie Goalpara

TABLE 5. *Bisexual homogeneity test for the taste phenotype and taster mean threshold*

	Combination	Taster phenotype	Mean threshold (taster)
		X^2 value (1 d.f.)	t value (d.f. 120, & °C)
Goalpara	(Male × Female)	2.0027	3.3206*
Kamrup	(Male × Female)	6.9595*	4.0604**
Darrang	(Male × Female)	0.0015	2.0971*
Dibrugarh	(Male × Female)	0.1640	0.2415
Koch pooled	(Male × Female)	8.2754*	0.6261

Explanation of *, +, ++ sign are given at the end of Table 6.

TABLE 6. *Significance test for homogeneity*

Combination	ABO blood groups X^2 test (d.f.-3)	Rh factor X^2 test (d.f.-1)	Taster phenotype X^2 test (d.f.-1)	Mean taster threshold t test (d.f.-α)
Goalpara × Kamrup	0.0411	1.6522	0.6996	3.1073+
Goalpara × Darrang	4.5005	1.5850	3.3198	1.6375
Goalpara × Nowgong	10.2557**	0.0433	4.4380*	2.9423+
Goalpara × Dibrugarh	4.2955	0.2358	7.4978+	4.4268++
Kamrup × Darrang	4.4331	0.0002	6.9749+	1.5537
Kamrup × Nowgong	10.5589**	1.1688	2.0069	0.3977
Kamrup × Dibrugarh	4.4520	0.5967	12.4353++	1.5620
Darrang × Nowgong	10.1807**	1.1036	12.6344++	1.2610
Darrang × Dibrugarh	13.2125+	0.5598	0.9559	3.0255+
Nowgong × Dibrugarh	7.2022	0.0794	18.2584++	2.0123*
Koch × Goalpara	1.5310	0.7264	0.4671	2.8069
Koch pooled × Kamrup	1.7421	0.6917	2.8675	1.2691
Koch pooled × Darrang	6.1459	0 6415	2.8732	0.7136
Koch pooled × Nowgong	7.9662*	0.2693	8.0366+	0.8946
Koch pooled × Dibrugarh	5.1449	0.0108	8.5228+	3.0109+

* indicates statistically significant at 5.0% level of probability
** indicates statistically significant at 2.0% level of probability
\+ indicates statistically significant at 1.0% level of probability
++ indicates statistically significant at 0.1% level of probability

TABLE 7. *Values of Genetic distance of the five Koch samples*

	Goalpara	Kamrup	Darrang	Nowgong	Dibrugarh	Koch (pooled)
Goalpara	—	0.279 1	0.3904	0.4413	0.3836	0.1551
Kamrup	4.2173	—	0.3711	0.4494	0.4897	0.2460
Darrang	5.8991	5.6074	—	0.6414	0.4181	0.2832
Nowgong	6.6682	6.7906	9.6917	—	0.6618	0.4374
Dibrugarh	5.7963	7.3995	6.3176	10.00	—	0.3055
Koch pooled	2.3436	3.7173	4.2792	6.6092	4.6162	—

Values below the diagonal are standardised to the maximum value in the series (in this case G = 0.661 8) which is taken as 10.00.

(19.67%), Kamrup (15.57%) and Darrang (29.75%). Hence, of all the samples of Koch, Dibrugarh having maximum frequencies of non-tasters differ from each of Goalpara, Kamrup and Nowgong. Exception is limited to Darrang who have next higher frequency of non-tasters. On the other hand, the Koch of Nowgong occupying the position at other extreme, differ significantly from the Koch of Goalpara, Darrang as well as from Dibrugarh but are akin to Kamrup. However, variation between Kamrup and Darrang in this regard is also statistically significant. Both the Koch of Nowgong and Dibrugarh also show significant departures from the pooled Koch sample (*Table 6*).

While considering the mean threshold value for phenylthiocarbamide (*Table 4*), it is noted that the Koch of Dibrugarh (6.46) have the lowest mean and Goalpara (7.85) the highest among all the Koch samples. The mean values in Kamrup (6.97), Darrang (7.41) and Nowgong (7.08) are akin to each other. The table of test of significance (*Table 6*) shows that Goalpara and Dibrugarh are not significantly distinct from Darrang and Kamrup respectively (Goalpara × Darrang and Dibrugarh × Kamrup), but all other comparisons with them turned out to be highly significant. The deviations between the pooled Koch sample with each of Goalpara and Dibrugarh are also significant at 1.0% level (*Table 6*).

Now let us consider ABO genes and taster genes at a time to look at the relative position of the Koch of different areas on the basis of values obtained by applying G^2 test (Sanghvi 1953). The results have been included in *Table 7* and presented diagrammatically in *Figure 2*.

In respect of genetical distance Goalpara × × Kamrup (4.2) are very close to one another in one hand and Kamrup × Darrang (5.6) on the other. The distance is also small in Goalpara × Darrang (5.9). Conversely, greatest distance is observed between Nowgong × Dibrugarh (10.00) which is closely followed by Nowgong × Darrang (9.7) and Kamrup × × Dibrugarh (7.4). Distance between Nowgong × × Kamrup (6.8), Nowgong × Goalpara (6.6) and that of Darrang × Dibrugarh (6.3) are almost the same. Thus, in general, perhaps it could be said that Goalpara, Kamrup and Darrang show smaller distance values and form a sort of cluster. The two remaining samples i.e. the Koch of Nowgong and Dibrugarh stand apart by showing larger distance values with the former three samples.

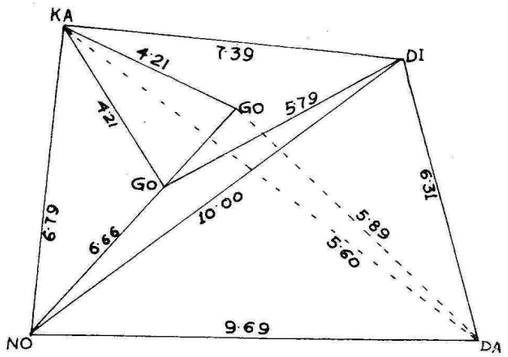

FIGURE 2. *Relative position of the five Koch samples with respect of genetical distance.*

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