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HAPTOGLOBIN AND ACID PHOSPHATASE GENE DISTRIBUTIONS IN THE DHANGARS OF MAHARASHTRA, INDIA

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The Dhangars are a semi-nomadic people, with a total population of about 3.5 millions. They are found scattered over all the 26 districts of Maharashtra. They speak Marathi and are largely concentrated in the so-called "famine tracts" of Maharashtra, comprising the districts of Nasik, Poona, Satara, Kolhapur, Sangli and Ahmednagar. The average annual rainfall in this area is below 25 cm.

The Dhangars are not a single mating unit but consist of 22 endogamous groups, forming a caste cluster. These endogamous groups differ from one another in many respects. Their population figures vary from several lakhs to a few thousands. Again, some are restricted to a very small area, while others are scattered in several districts, thereby cutting across different ecological regions. Some of them have become settled hut dwellers and food growers, while others still live a more or less nomadic life. Of the latter some move only within a small territory, while a few travel far and wide covering hundreds of miles every year. Variations are also noticed in the occupations of the various groups. The Dange Dhangars found in the coastal strip are a pastoral people and practise shifting cultivation; the Hatkars and a few others are shepherds; the Sangars are weavers of woollen blankets; the Khatik Dhangars sell meat, but do not rear sheep, and the Khutekars rear sheep and weave. Some of the groups prefer consanguineous marriages, but others strictly prohibit it.

The presence of as many as 22 endogamous groups in contiguous areas, with different occupations, but a common name, stimulated the late Professor Iravati Karve of the Deccan College (Poona) and the authors to take up a detailed genetic survey of these people. Results on serum haptoglobin and red cell acid phosphatase are reported here.

MATERIALS AND METHODS

A total of 1241 blood samples were collected by finger pricks from 15 Dhangar groups, namely, Kande, Khutekars, Hatkars, Shegar, Kurmar, Unikankan, Dange, Hande, Ladshe, Hattikankan, Zede, Mendhe, Halmat, Sanger and Telangi living in the several districts of Mahararashtra already mentioned. The blood samples were preserved in an iced thermotlask in the tield until they reached the laboratory at Calcutta by air where the sera and haemolysates were prepared and deep frozen

at -20°C for storage. Whereas haptoglobin was studied in all the 15 groups of the Dhangars, acid phosphatase could be studied in only ten of them, leaving out Kande, Kumar, Dange, Ladshe and Talangi. The entire field work was organized by one of us (KCM).

Starch gel electrophoresis

For the analysis of haptoglobin phenotypes horizontal starch gel electrophoresis was done using a discontinuous buffer system (Poulik 1957). The test for the red cell acid phosphatase system used the buffer systems and reactive mixture described in Karp and Sutton (1967). The activity of acid Phosphatase enzyme was restored by adding I ml. of 2-mercaptoethanol to each gel after degassing. Each was placed between metal cooling plates maintained at 10-12°C during the electrophoretic runs.

Results and discussion

The distribution of the phenotypes and the gene-frequencies for haptoglobin among the groups are presented in Table 1, and those for acid phosphatase in Table 2. The Chi-square values for consistency are also included in these tables, these values indicated satisfactory agreement with the expected values in each case.

Haptoglobin :

The frequencies of the Hp^1 gene in the twelve of the 15 groups studied lie within the range, 0.0715-0.1913. The three remaining groups, namely, the Halmat, the Sangar and the Telangi (Table 1) show higher Hp^1 frequencies, in the range of 0.2727-0.3462. It is not clear if the apparently higher frequencies in these three groups can be attributed to sampling errors resulting from small sample sizes. Hp^1 gene generally shows a low frequency in Indian populations (5% to about 20%). The lowest frequency of 5% was found in the Naickers of Tamilnadu (Ananthakrishnan et al 1969), Kirk et al (1961) observed 34% Hp^1 gene frequency amongst the Todas of Nilgiris, which is very close to the frequencies observed in the Halmat, the Sangar and the Telengi. These three groups are homogeneous among themselves (x^2 = 3.375, 2 d.f.) with reference to haptoglobin gene counts. Two cases (0.16%) of ahaptoglobinaemia (Hp0) were noticed in this study. No rare Hp phenotype was found in the Dhangars. Among Indian populations a single case of Hp 'Johnson' was detected in a Bengali Hindu male by Mukherjee and Das (1970) in an earlier investigation.

The haptoglobin and the acid phosphatase gene distributions have been tested for homogeneity in contingency tables. The contingency tables were prepared not

T A B L E - 1

Distribution of Phenotypes and Genes for Haptoglobin in Dhangar caste Cluster of Maharashtra (India)

	Sub-caste groups		No Tested	Phenotypes 1-1	2-1	2-2	0	Hp[1] Gene Frequency	± S.E.	X^2 (1. D. F.)
1	KANDE	no	7	0	1	6	0			
		%			14.29	85.71		0.0714	± 0.0688	1.0801
2	KHUTEKAR	no	117	1	25	90	1			
		%		0.85	21.38	76.92	0.85	0.1164	± 0.0210	0.2659
3	HATKAR	no	246	5	52	189	0			
		%		2.03	21.14	76.83		0.1260	± 0.0149	0.4007
4	SHEGAR	no	84	0	22	62	0			
		%			26.19	73.81		0.1310	± 0.0260	1.1732
5	KURMAR	no	105	0	28	76	1			
		%			26.67	72.38	0.95	0.1334	± 0.0234	1.1893
6	UNIKANKAN	no	63	1	15	47	0			
		%		1.59	23.81	14.60		0.1350	± 0.0304	0.1530
7	DANGE	no	47	2	10	35	0			
		%		4.25	21.28	74.47		0.1489	± 0.0369	1.1110
8	HANDE	no	80	0	23	57	0			
		%			31.63	78.37		0.1582	± 0.0288	1.0850
9	LADSHE	no	85	3	21	61	0			
		%		3.53	24.71	71.76		0.1589	± 0.0280	0.4854
10	HATTIKANKAN	no	34	0	11	23	0			
		%		0.00	32.35	67.65		0.1618	± 0.0446	1.2029
11	ZADE	no	145	4	43	98	0			
		%		2.76	29.66	67.58		0.1759	± 0.0223	0.1366
12	MENDHE	no	149	7	43	99	0			
		%		4.70	28.86	66.44		0.1913	± 0.0241	0.3680
13	HALMAT	no	11	1	4	6	0			
		%		9.09	36.36	54.55		0.2727	± 0.0949	0.3329
14	SANGAR	no	55	6	21	28	0			
		%		10.91	38.18	50.91		0.3000	± 0.0436	0.3419
15	TELANGI	no	13	0	9	4	0			
		%			69.23	30.17		0.3462	± 0.0933	1.6410
	Total	no	1241	30	328	881	2			
		%		2.42	26.43	70.99	0.16	0.1564	± 0.0072	0.0158

The X^2 Values in the last column, however, show that the phenotype Frequencies agree with the hypothetical expectations

Homogeneity Chi-square test by 13 x 2 contingency table for the Hp gene count in the 15-group = 38.855, 12. D. F. $P < 0.001$ (12 single groups and 1 combined group of Halmat, Telangi and Sangar).

T A B L E - 2

Distribution of Phenotypes and genes for Acid Phosphatase in Dhangar caste cluster of Maharashtra (India)

Sub-caste groups	No Tested	Phenotypes A	AB	B	PHS^A gene frequency	± S.E.	X^2 (1.D.F.)
1 SHEGAR	no 99	1	19	79			
	%	1.01	19.19	79.80	0.1061	± 0.0218	0.1120
2 KHUTEKAR	no 58	3	10	45			
	%	5.17	17.24	77.59	0.1379	± 0.0310	2.0463
3 HATKAR	no 267	8	60	199			
	%	3.00	22.47	74.53	0.1424	± 0.0151	0.5718
4 HATTIKANKAN	no 35	1	9	25			
	%	2.86	25.71	71.43	0.1572	± 0.0435	0.1932
5 UNIKANKAN	no 63	2	16	45			
	%	3.18	25.39	71.43	0.1588	± 0.0325	0.3165
6 MENDHE	no 151	7	35	109			
	%	4.63	23.18	72.19	0.1622	± 0.0212	0.9655
7 HANDE	no 65	2	20	43			
	%	3.08	30.77	66.15	0.1847	± 0.0330	0.1250
8 ZADE	no 130	5	42	83			
	%	3.85	32.31	63.84	0.2001	± 0.0247	0.0496
9 SANGAR	no 40	2	13	25			
	%	5.00	32.50	62.50	0.2125	± 0.0457	0.1478
10 HALMAT	no 14	1	4	9			
	%	7.14	28.57	64.29	0.2143	± 0.0775	0.7536
Total	no 922	32	228	662			
	%	3.47	24.73	71.80	0.1584	± 0.0085	0.4695

Homogeneity Chi-square test by 10 x 2 contingency table for the PHS gene count in the 10 groups = 11.88, 9.D.F., $0.30 > P > 0.20$

with the phenotype numbers but with the gene counts. The Halmat, the Sangar and the Telangi sections, on a preliminary examination were found to be homogeneous among themselves. They possessed significantly higher Hp^1 gene frequencies than the others. Halmat and the Telangi are, however, only 11 and 13 respectively (too small). The sample sizes for these three groups have been merged together into a single combined group in the contingency table for the haptoglobin gene counts. The resulting table contained 13 rows corresponding to 12 single groups and 1 combined group, and 2 columns corresponding to the gene counts for the alleles, Hp^1 and Hp^2. The Chi-square value obtained was 38.855 with 12 d.f. ($P < 0.0001$). This is highly significant and the hypothesis of homogeneity is therefore rejected. On scrutiny of the analysis it may be seen that the combined group (Halmat, Sangar and Telangi) alone contributed 25.928 to the Chi-square value; on leaving out this combined group, the Chi-square value comes down to 12.934 with 11 d.f. which is not significant (P very near to 0.30). If Chi-square is recalculated omitting these three groups from the contingency table, a still smaller Chi-square value will be obtained. Larger samples of the Halmat, the Sangar and the Telangi groups should be studied before an explanation is offered for these unusual data.

However, the haptoglobin data suggest that twelve of the 15 Dhangar groups studied here are quite homogeneous, but the other three groups which are homogeneous among themselves differ significantly from the rest.

Acid Phosphatase :

Three common phenotypes of acid phosphatase A, AB and B, have been observed in all the Dhangar groups. PHS^A gene frequency in the ten Dhangar groups for this enzyme ranges from 0.1016 (Shegar) and 0.2143 (Halmat). The allele PHS^C is absent or rare in Indian populations. Two cases of CA phenotype were detected in Bengalis of Calcutta by Das et al (1970). The highest frequency (0.4153) of the PHS^A gene so far observed in India has been among the Arora, a caste in Punjab in northern India (Blake et al 1971).

Data from ten Dhangar groups which included the Halmat (14) and the Sangar (40) in whom acid phosphatase have also been studied for homogeneity by a Chi-square test on a contingency table. There were 10 rows for the 10 groups and 2 columns for the genes PHS^A and PHS^B. The Chi-square value of 11.88 with 9.d.f. obtained in this way was insignificant ($0.30 > P > 0.20$) The ten groups are, therefore, indistinguishable in respect of acid phosphatase.

Phosphatase gene frequencies :

The Halmat and the Sangar, which were differentiated from the rest (along with Telangi) in the Hp gene distribution, however, showed homogeneity with the other 8 groups in their acid phosphatase gene frequencies.

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SUMMARY

A total of 1241 blood samples from 15 Dhangar groups - a semi-nomadic population, were studied by starch gel electrophoresis for haptoglobin and acid phosphatase types.

The gene frequencies for Hp^1 in 12 of the 15 groups studied are between 0.0715 - 0.1913 and they are homogeneous among themselves, but significantly differ from the remaining three. The latter three groups show higher Hp^1 gene frequencies, in the range of 0.2727 - 0.3462, and suggest that they are also quite homogeneous.

A, AB and B phenotypes of acid phosphatase were seen among all the groups. Frequencies of the PAS^A gene ranges from 0.1016 to 0.2143 in the ten groups tested for this enzyme.

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