

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 Maharashtra already mentioned. The blood samples were preserved in an iced thermolask in the field until they reached the laboratory at Calcutta by air where the sera and haemolysates were prepared and deep frozen

at  $-20^{\circ}\text{C}$  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 1 ml. of 2-mercaptoethanol to each gel after degassing. Each was placed between metal cooling plates maintained at  $10-12^{\circ}\text{C}$  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  $\text{Hp}^1$  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  $\text{Hp}^1$  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.  $\text{Hp}^1$  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%  $\text{Hp}^1$  gene frequency amongst the Todas of Nilgiris, which is very close to the frequencies observed in the Halmat, the Sangar and the Telangi. These three groups are homogeneous among themselves ( $\chi^2 = 3.375$ , 2 d.f.) with reference to haptoglobin gene counts. Two cases (0.16%) of ahaptoglobinaemia ( $\text{Hp}^0$ ) 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					Hp <sup>1</sup> Gene Frequency	± S.E.	X <sup>2</sup> (I. D. F.)
		1-1	2-1	2-2	0				
1 KANDE	no % 7	0	1 14.29	6 85.71	0	0.0714	± 0.0688	1.0801	
2 KHUTEKAR	no % 117	1 0.85	25 21.38	90 76.92	1 0.85	0.1164	± 0.0210	0.2659	
3 HATKAR	no % 246	5 2.03	52 21.14	189 76.83	0	0.1260	± 0.0149	0.4007	
4 SHEGAR	no % 84	0	22 26.19	62 73.81	0	0.1310	± 0.0260	1.1732	
5 KURMAR	no % 105	0	28 26.67	76 72.38	1 0.95	0.1334	± 0.0234	1.1893	
6 UNIKANKAN	no % 63	1 1.59	15 23.81	47 14.60	0	0.1350	± 0.0304	0.1530	
7 DANGE	no % 47	2 4.25	10 21.28	35 74.47	0	0.1489	± 0.0369	1.1110	
8 HANDE	no % 80	0	23 31.63	57 78.37	0	0.1582	± 0.0288	1.0850	
9 LADSHE	no % 85	3 3.53	21 24.71	61 71.76	0	0.1589	± 0.0280	0.4854	
10 HATTIKANKAN	no % 34	0 0.00	11 32.35	23 67.65	0	0.1618	± 0.0446	1.2029	
11 ZADE	no % 145	4 2.76	43 29.66	98 67.58	0	0.1759	± 0.0223	0.1366	
12 MENDHE	no % 149	7 4.70	43 28.86	99 66.44	0	0.1913	± 0.0241	0.3680	
13 HALMAT	no % 11	1 9.09	4 36.36	6 54.55	0	0.2727	± 0.0949	0.3329	
14 SANGAR	no % 55	6 10.91	21 38.18	28 50.91	0	0.3000	± 0.0436	0.3419	
15 TELANGI	no % 13	0	9 69.23	4 30.17	0	0.3462	± 0.0933	1.6410	
Total	no % 1241	30 2.42	328 26.43	881 70.99	2 0.16	0.1564	± 0.0072	0.0158	

The X<sup>2</sup> 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).

## Haptoglobin and Acid Phosphatase genes

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

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  $PASA^A$  gene ranges from 0.1016 to 0.2143 in the ten groups tested for this enzyme.

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