

## Red Cell Glucose-6-Phosphate Dehydrogenase Deficiency and Haemoglobin Variants Among Ten Endogamous Groups of Maharashtra and West Bengal

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**Summary.** Over 900 individuals from ten endogamous groups in the Indian states of Maharashtra and West Bengal were studied for G-6-PD deficiency and haemoglobin variants. The incidence of G-6-PD varied from nil to 17.3%, while that of Hb-S varied from nil to 22.3%. In general, the tribal populations of Maharashtra are characterized by the presence of a high incidence of both Hb-S and G-6-PD deficiency. The caste Hindus showed an absence of Hb-S and rather low G-6-PD deficiency. Immigrant Parsis possessed the highest incidence of G-6-PD deficiency (17.3%).

### Introduction

During the period November 1974 through January 1975, a multidisciplinary anthropo-genetic project was undertaken jointly by a team of Indian and Soviet scientists among ten populations of the two Indian states of Maharashtra and West Bengal.

In this paper we report the results of analysis of G-6-PD red cell enzyme deficiency and haemoglobin variants among the ten populations studied.

### Materials and Methods

A sample of 993 male subjects was drawn randomly from ten endogamous populations representing different hierarchical social groups. The nine groups studied in the state of Maharashtra included two upper caste Brahmin groups (Deshastha Rgvedi and Chitpavan), two middle caste groups (Chandra Seniya Kayastha Prabhu and Marathas), one scheduled caste<sup>1</sup> (Nava Budha), a migrant group (Parsis), and three tribal groups, namely, Bhils, Pawras, and

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<sup>1</sup> Formerly called 'untouchables'

Table 1. G-6-PD deficiency and haemoglobin variants among ten endogamous groups

Endogamous groups	G-6-PD		Hb variants <sup>a</sup>	
	Number tested	Number deficient	Number tested	AF
		%age	No.	%age
<i>Maharashtra State</i>				
<i>Caste Hindus</i>				
1. Chitpavan Brahmin	81	1	81	0
2. Deshastha Regvedi Brahmin	76	1	76	0
3. Chandra Seniya Kayastha Prabhu	96	2	96	0
4. Maratha	13	0	45	0
5. Nava-Budha	51	0	51	0
<i>Tribal groups</i>				
6. Bhils	215	16	186	0
7. Pawras	87	3	122	2
8. Katkaris	77	6	131	0
<i>Immigrant group</i>				
9. Parsis	133	23	133	0
<i>West Bengal</i>				
10. Santhals	164	23	164	0

<sup>a</sup> No homozygous Hb SS were detected

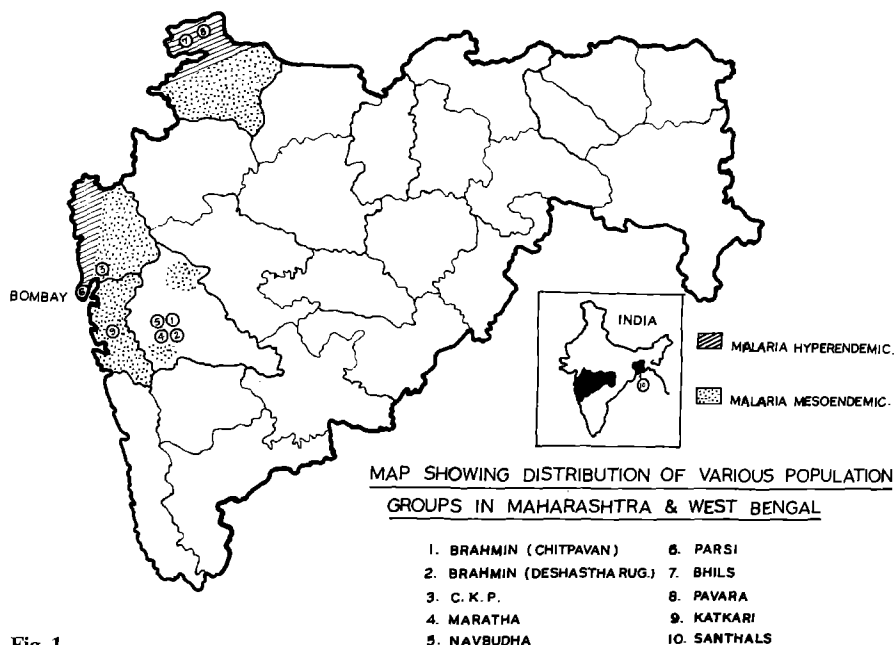


Fig. 1

Katkaris. A tribal population, the Santhals, of West Bengal was also studied. The number of individuals studied for each group are given in Table 1, and the geographical location of the populations is shown in Figure 1.

The red cell G-6-PD deficiency was determined using dye decolourisation test of Motulsky and Kraut (1961). Haemoglobin variants were detected using electrophoresis on cellulose acetate membrane after Kate et al. (1976). All those samples where electrophoretic bands additional to the normal ones were detected were further subjected to alkaline denaturation and sickling and solubility tests.

## Results and Discussion

**G-6-PD.** The incidence of G-6-PD deficiency varies from nil among the Marathas and Nava-Budha to 17.3% among the Parsis (Table 1). It is noteworthy that all the caste Hindus show a strikingly low incidence (nil—2.08%), while each of the four tribal groups shows a relatively high incidence. The most striking results are those found in the Santhals of West Bengal. None of the earlier studies in this region detected such a high incidence. The present incidence recorded in the Parsis is in keeping with earlier reports of Baxi et al. (1961); these authors reported 19%. It may, however, be pointed out that Kate et al. (1975) detected about 2% deficiency among the Marathas and Nava-Budhas. In the present study, however, no deficiency was detected; this may be due to the small sample sizes in the present series.

**Haemoglobin Variants.** The haemoglobin variants detected in these groups were all Hb-S. Interestingly enough, as with G-6-PD deficiency, no haemoglobin

variants were detected among the caste Hindus; nor did the Parsis or the Santhals reveal any variants. Chaudhari et al. (1964), however, reported 1.7% Hb-S among the Santhals. The three tribal groups from Maharashtra, however, revealed a high incidence of Hb-S; it varied from 6.1% among the Katkaris to 22.3% among the Pawaras. Despite the high frequency of HbAS encountered, no homozygous HbSS cases were detected; this may be due to the elimination of homozygous individuals at an early age. Foetal haemoglobin was detected in two (1.64%) of the Pawras. The presence of this may be due to  $\beta$ -thalassemia or to the Hb-F persistence gene. No further studies were possible in these two individuals. It is also worth noting that some sort of relationship seems to exist between the incidence of G-6-PD deficiency and Hb-S; Bhils Pawaras and Santhals, with a high incidence of G-6-PD deficiency, have a comparatively low incidence of Hb-S; and, conversely, the Pawras, in whom the incidence of G-6-PD deficiency is only 3.45%, have the highest incidence of Hb-S (22.13%). This observation, however, needs to be confirmed in other populations.

Our findings further confirm the earlier observations of Sukumaran et al. (1956), Vyas et al. (1962), Das et al. (1967), and Negi (1970), among others, that the tribal population of central and southern India generally show a high incidence of Hb-S as well as of G-6-PD (for the later trait, however, the data are insufficient), while the caste Hindus, except for some of the scheduled castes like Nava-Budha, almost completely lack Hb-S. The G-6-PD deficiency among the caste Hindus is usually below 2% (possible exceptions are, however, Pubjabis and Sindhis).

The distribution of both these traits among the groups, when viewed in terms of their habitat, reveals that groups with a high incidence of G-6-PD and Hb-S inhabit hilly tracts which are infested with malaria (the Parsis are, however, an exception to this pattern), while groups with low incidence of both these traits are found chiefly in villages and urban areas. The present findings thus lend support to the hypothesis that both these traits provide protection against malaria.

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