

Glucose-6-Phosphate Dehydrogenase Deficiency among the Rajputs and Brahmins of Solan District, Himachal Pradesh

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KEYWORDS Pentose Phosphate Pathway. Enzyme Deficiency. Endogamous Population. Selection

ABSTRACT G6PD deficiency is a common hemolytic genetic disorder whose frequency varies from population to population. The present study aims at screening G6PD deficiency among the Rajputs and Brahmins of Kasauli Tehsil (Solan district), Himachal Pradesh and to compare the results with the available data of other neighbouring caste populations. 1.54 % of the Rajput males and 2.12% of the Brahmin males screened were found to be G6PD deficient. The *G6PD*def* allele frequency in the Rajputs and Brahmins was 0.015 and 0.021, respectively, which are within the frequencies range of reported from northern India.

INTRODUCTION

G6PD is a house keeping enzyme which catalyzes the first step in the pentose phosphate pathway (PPP). The G6PD gene is located on the telomeric region of the long arm of X-chromosome (Xq28) and is 18 kb long consisting of 13 exons, transcribed to a 2.269 kb mRNA with 1.54 kb of coding regions (Tripathy and Reddy 2007). The main physiological role of G6PD is to provide NADPH, a compound necessary for a number of detoxification and biosynthetic reactions, including fatty acid synthesis. Thus, lack of G6PD enzyme in the red blood cells is lethal and deficiency in the enzyme in case of oxidative stress is deleterious to the cell.

G6PD deficiency is a common hemolytic genetic disorder, particularly in the areas endemic to malaria. It causes a spectrum of diseases including neonatal nonspherocytic hyperbilirubinemia, acute hemolysis and chronic hemolysis. Individuals are generally asymptomatic and hemolytic anemia occurs when some anti-malarial drugs or other oxidizing chemicals are administered. It has been proposed that G6PD deficiency provides protection against malaria. Maintaining of G6PD deficient alleles at polymorphic proportions is complicated because of the X-linked nature of G6PD deficiency (Tripathy and Reddy

2007). The present study attempts to screen G6PD deficient among the Rajputs and Brahmins of Himachal Pradesh and also to compare the results with the available data of other neighbouring caste populations of North India.

MATERIALS AND METHODS

The present study was conducted in Garkhal, Kasauli and Nalwa villages of Kasauli Tehsil located in Solan district of the north Indian hill state of Himachal Pradesh. It is a mountainous state with elevation ranging from about 350 to 6000 m above the sea level, situated between 30°22' to 33°12' North Latitude and 75°47' to 79°04' East Longitude. The presently studied populations – the Rajputs and Brahmins belong to different caste groups of the Hindu society. Both the populations practise caste endogamy with gotra exogamy.

Blood samples were collected by finger prick method from 65 Rajput and 47 Brahmin unrelated male subjects in tubes coated with EDTA, after taking informed oral consent from each individual. Screening for G6PD deficiency was done through Fluorescent Spot Test (Beutler and Mitchell 1968). Allele frequencies were calculated by using the gene counting method and χ^2 contingency table was employed to compare the presently studied populations.

RESULTS AND DISCUSSION

The frequency distribution of G6PD deficient individuals among the Rajputs and Brahmins is given in Table 1.

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Table 1: Distribution of G6PD deficiency and allele frequencies among the Rajput and Brahmin males of Kasauli Tehsil, Himachal Pradesh

Population	Number tested	Normal		Deficient		Allele frequency <i>G6PD* def</i>	χ^2 -value
		No.	%	No.	%		
Rajputs	65	64	98.46	1	1.54	0.015	0.54
Brahmins	47	46	97.80	1	2.12	0.021	(p=0.816)

In the present study, the *G6PD* def* frequencies were found to be 0.015 and 0.021 among Rajputs and Brahmins, respectively. These frequencies are within the earlier reported range of northern India that is, 0.013 of Marcha Bhotia of Central Himalaya (Kapoor and Vaid 1977) to 0.18 of Rajputs of Manali, Himachal Pradesh (Dey and Seth 1986) (Fig. 1). Comparison between Rajputs and Brahmins showed non-significant difference in the frequency of *G6PD* def* (p=0.816).

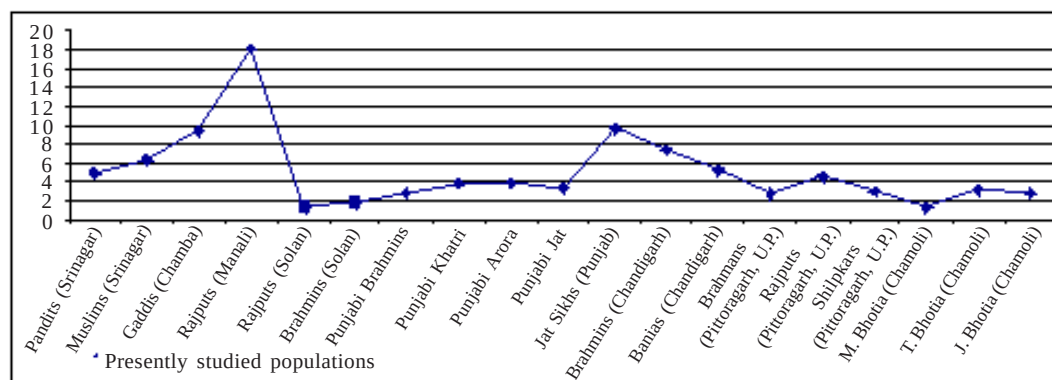
The presently studied populations were also compared with the some populations of North India which have been screened earlier for this genetic trait. The Rajputs of the present study show a significant difference (p=0.001) with the Rajputs of Manali, Himachal Pradesh (Dey and Seth 1986). However, it showed non-significant difference (p=0.295) with the Rajputs of Uttar Pradesh (Kapoor 1989). But in case of Brahmins, the present data is in agreement with the earlier reported data; no significant differences were observed with the Punjabi-Brahmins (p=0.825) of Punjab (Singh et al. 1974), Brahmins (p=0.174) of Chandigarh and Brahmins (p=0.870) of Uttar Pradesh (Kapoor 1989).

The significant difference observed in case of the Rajputs when compared with the earlier studied samples of the caste from Himachal

Pradesh is due to the decrease in the *G6PD* def* allele frequency showing a negative selection against *G6PD* def*. However, in case of Brahmins, there is not much difference in the frequency of allele with the neighbouring Brahmin populations studied earlier.

The distribution of G6PD deficiency in Indian population is population specific. The frequency is higher among the tribals than the caste populations (Tripathy and Reddy 2007). Recent studies in the last few years also support the trend. Warli and Dhodia, tribal populations in Dadra and Nagar Haveli have a frequency of 10.1% (Samtani et al. 2008) and 13.5% (Asghar and Sachdeva 2009), respectively, while Rajput, caste group from the same geographical region have low frequency of 2.1% (Devi and Sachdeva 2009). Saraswathy and Sachdeva (2008) have also reported the high frequency of G6PD deficiency among two tribal populations - Koyadoras (8.45%) and Nayakpods (10%) of Andhra Pradesh. Saraswathy and Shweta (2005) reported the frequency of G6PD deficiency low among Tamil Brahmin (4.4%).

In the presently study, the frequency of G6PD deficiency is low in both the studied caste population- Rajput (1.54%) and Brahmin (2.12%) - supporting the trend of low frequency found among the caste groups.

**Fig. 1: Graph showing the distribution of *G6PD*def* among North Indian populations groups**

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