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Glucose-6-Phosphate Dehydrogenase Deficiency in Danguria Tharu Settled in Baharaich District of Uttar Pradesh

Tej P. Sharma and Rajkumari

Department of Anthropology, University of Lucknow, Lucknow 226 007, Uttar Pradesh, India
Telephone: 091-9935480815, E-mail: tejpsharma20@yahoo.co.in

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ABSTRACT The present study reports the frequency of G6PD deficiency among the Danguria Tharus of Uttar Pradesh settled at Baharaich district in the tarai region where malaria is prominent. The analyses of data indicate that 23.21% Tharu males are G6PD deficient. In females the deficiency is partial and confined to 12.5% females only. The available literature on the subject reveals that prevalence of G6PD deficiency ranges among different Indian populations from 0- 27%. Danguria Tharus have a higher frequency of G6PD deficiency.

INTRODUCTION

Glucose-6-phosphate dehydrogenase is an enzyme, which acts on the substrate, Glucose-6-phosphate in human red cells. Glucose-6-phosphate dehydrogenase deficiency is the commonest red cell enzymopathy in humans and one of the inherited disorders. The G6PD deficiency in inherited as a sex- linked condition due to a single gene on the X- chromosome.

Motulsky (1960) reported that falciparum malaria confers a selective advantage on G6PD deficiency as well as sickle cell haemoglobin trait. The geographic distribution of G6PD deficiency led many workers to investigate and propagate the hypothesis that G6PD deficiency is a polymorphism that confers resistance to infection with falciparum malaria (Motulsky 1964; Beutler 1994) and this being known as G6PD/ malaria hypothesis. Studies of various populations throughout the world have shown, in general, a convincing correlation among the frequencies of G6PD deficiency and malaria. Some exceptions have been noted, particularly by Kidson and Gorman (1962), and these have been used as an argument against the basic hypothesis. However, Allison (1963) pointed out that the only convincing discrepancy would be the finding of frequent G6PD deficiency within populations known to have lived in non- malarious regions for many generations. According to Motulsky (1964), a remarkable feature of the enzyme defect is its high frequency in so many malarious areas, rather than its occasional absence from populations infested with malaria. In view of this present paper aims to report the G6PD deficiency among the Danguria Tharu group who are concentrated in the malarious region of Uttar Pradesh.

Address for correspondence:
Dr. Tej P. Sharma
7/4, Malviya Nagar Aishbagh, Lucknow 226 004,
Uttar Pradesh, India.

MATERIAL AND METHOD

The present study was conducted among Tharu population group of Uttar Pradesh. Tharu is a generic term, which designates the score of people who inhabit the tarai region of Uttar Pradesh. The tarai is a vast swampy forest- clad alluvial tract of sub- Himalayan region. The tarai- term used geographically on this part of the rain forested plains is a Hind word meaning "feverish land" (Kroushopff 1989). The Tharus are semi-Hinduised people having Mongoloid affinity. They are of average medium height with round head and medium broad face, their cheekbones tend to be high and flat. They speak *Tharuhati* language but can communicate in Hindi and write in Devnagari Script. Agriculture is their main stay. Tharus practices localized nature of endogamy. The Tharus are mainly concentrated in the tarai area from Maharajganj in the east to Udham Singh Nagar in the West, besides Lakhimpur- Kheri, Baharaich, Shravasti and Balrampur, are the others district of Tharu concentration situated in Uttar Pradesh and Uttaranchal (Table 1).

Danguria Tharus are a sub-division of the Tharus and inhabit the district Baharaich and Balrampur of Uttar Pradesh. Baharaich is situated in North-eastern part of Devipatan division. According to Census 2001, the total population of Baharaich is 2,384,239, which includes 858 total Danguria Tharu populations. They have adopted a patriarchal system. Generally Tharus are non-vegetarians, however Danguria eat pork and small Pila (*Pila globosa*). Their household settings are not very dispersed and are usually placed in a north-south direction. Their women frequently decorate the walls with bas-relief, painted in colour as well.

The study was conducted in the village Dharmapur of Baharaich on Danguria endo-gamous group of the Tharu. The blood samples were collected from the fifty- six Danguria Tharu individuals. Blood relatives were avoided because in testing the G6PD deficiency, the character, which is X- linked pass from parents to their off-springs.

After having the prior informed consent for the purpose of the study, the blood samples were randomly collected in duly cleaned blood collecting or eppendroph tubes with suitable (1mg/ ml to 3mg/ml) amount of Ethylene diamine tetra acetic acid (EDTA). About 7- 8 drops of the blood was obtained by puncturing the finger with the help of disposable needle. The subjects were largely drawn from the village Dharmapur. Samples were analysed within 48 hours.

For the present study the G6PD deficiency tests were performed by dichlorophenol indophenol (DPIP) decolourization method also known as Brilliant Cresyl Blue (BCP) dye test suggested by (Motulsky and Camphell-Kraut 1967) or Tris or Bernstein Method, which was found to be useful and suitable for routine use. Blood was incubated with glucose 6 phosphate, nicotinamide adenine phosphate (NADP), DPIP dye and PMS (phenazine metha- sulphate). The G6PD enzyme if present, converts NADP to NADPH, which cause the soluble DPIP dye to be reduced to insoluble formazan particles in the presence of phenozine metasulphate. Thus, normal individual shows a dark brown precipitate within 30 minutes. Deficient subjects or heterozygous females show little or no change or a tan color. It has another advantage that the heterozygote can be easily detected and a lot of samples can be processed together at the same time. Statistical significance was evaluated by using allele frequencies (Balakrishnan 1961). Vp =Vq = Gd± / G or pq / G, where p is number of normal individual, q is number of deficient individual G is total studied population.

RESULTS

A total of 56 blood samples were collected at random. Of these 32 are males whereas 24 belong to female Danguria Tharus. Table 2 gives the incidence of G6PD deficiency in males and females in unrelated samples of present study. The incidence of G6PD deficiency was significantly higher in males as compared to females. It is apparent that the G6PD deficiency was detected in 13 (23.21%) Danguria males. Out of 32 males 13 (40.63%) and of 24 females 0 (0.0%) were G6PD deficiency. Out of 24, females 3 (12.5%) were partial G6PD deficient (heterozygous deficient) which is the 5.36% of the total studied samples (Table 2).

This situation is further confirmed by an examination of the relative allele frequencies in the Danguria population (Table 3). It is clear from this examination that the Gd- (deficient allele) is preponderant in males (0.406) as compared to females. Variance is also calculated on the basis

Table1: Distribution of Tharu Division in various districts of Uttar Pradesh and Uttaranchal

States	*Districts*	*Tharu Divisions*
Uttar Pradesh	Baharaich	Danguria
	Balrampur	Danguria
	Lakhimpur- Kheri	Rana, Katharia
	Mahrajganj	Pacchimaha
Uttaranchal	Udham Singh Nagar	Jogia/ Gosain

Table 2: Gender- wise distribution of the incidence of G6PD deficiency

Sex	*Sample tested*	*Phenotypic frequency*		
		Gd+	*Partial*	*Gd-*
Male	32	19	0	13
%		59.38	0.00	40.63
Female	24	21	3	0
%		87.50	12.50	0.00
Total	56	40	3	13
%		71.43	5.36	23.21

Table 3: Allele frequency among the Danguria Tharu populations

	Allele frequency		
Sex	*Gd+*	*Gd-*	*Variance*
Male	0.594	0.406	4.410
Female	1.000	-	0.428
Total	0.768	0.232	9.982

of the distribution of G6PD and again males have higher value.

DISCUSSION

The frequency of *G6PD*def* is 4.5% (varies from complete absence to 27.1%) among Indian populations and it is high among scheduled tribes (5.5%) as compared to other ethnic groups. The frequency is comparatively higher in North and West India zones, which indicates considerable stability of this allele in these areas; whereas in South India it is uniformly low except in Andhra Pradesh and Tamil Nadu and from East India the studies are too few to evaluate. Among the speakers of different languages, the frequencies are high in Mon Khmer group, North-East Frontier group, Bodo group and Pahari group from Himalayan region and low among the speakers of Dravidian languages. The studies available from different ecological settings are not sufficient as yet to evaluate the distribution of this genetic marker in India, especially in connection with prevalence of malaria (Bhasin and Walter 2001).

The incidence observed in the present study compared with others studies reported from Uttar Pradesh show less frequency of *G6PD*def* among Rajput of Barkot (18.50%) reported by Dhingra (1975-76). Whereas among Bhotia-Marchha (Kapoor and Vaid 1977) and Rajput of Pithoragarh (Kapoor 1989) the frequency of *G6PD*def are quite low *i.e.*, 1.25% and 4.50%, respectively.

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