

Glucose-6-Phosphate Dehydrogenase Deficiency Among the Jats and Brahmins of Sampla (Haryana)

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INTRODUCTION

Metabolic diseases are diagnosed through the detection of specific enzyme defect in red blood cells. One among them is the sex-linked glucose-6-phosphate dehydrogenase (G-6-PD) deficiency. The deficiency predisposes subjects to neonatal jaundice, drug or infection mediated haemolytic episodes, favism and infrequently, to chronic nonspherocytic anaemia.

Over 400 G-6-PD variants have been reported, differing in severity, clinical expression and biochemical properties (Beutler and Yoshida, 1988; Beutler, 1990). Among class 3 types with 10 percent to 60 percent enzyme activity (Yoshida et al., 1971), relatively mild variants, such as the A- type common in Africans, render red cells susceptible to oxidative damage. In Mediterranean, Southern Chinese and Southeast Asians, class 2 moderately severe variants with < 10 percent activity are important causes of neonatal jaundice (Beutler, 1990, 1991), and of drug induced or fever induced haemolytic anaemias (Beutler, 1991; Missiou Tsagaraki, 1991). The more severe class 1 variants, which cause debilitating chronic haemolytic anaemia, are uncommon; the most severe variants, which also cause chronic granulomatous disease, are very rare (Hsia et al., 1993). Recent advances in the molecular biology of G-6-PD suggest that diverse point mutations may cause phenotypic heterogeneity (Vulliam et al., 1988; Beutler, 1991; Chao et al., 1991; Chin et al., 1991). Motulsky (1960) observed that there is a correlation between the high frequency of G-6-PD deficiency with malaria endemicity.

In India, a number of investigators have reported varying incidences of this deficiency in different population groups (Bhasin et al., 1992, 1994; Bhasin and Walter, 2001 for excellent syntheses). The present paper reports the incidence of glucose-6-phosphate deficiency among the Jats and Brahmins of Sampla, Haryana.

MATERIALS AND METHODS

Blood samples were collected by finger prick

method in sterile stoppered tubes containing EDTA from both males and females of the age group between 7-72 years. Jat sample consists of 87 males and 49 females, whereas 96 males and 56 females comprise the Brahmin sample. Screening for G-6-PD deficiency was performed by employing methaemoglobin reduction test (Brewer et al., 1960).

RESULTS AND DISCUSSION

Gender wise distribution of G-6-PD deficiency among the Jats and Brahmins of Sampla has been set out in Table 1. Males being hemizygous, the allele frequencies are the same as their percentile phenotype frequencies. Thus, for Jat males *G6PD*def* frequency is 0.1149 and for Brahmins it is 0.1042. Chi square comparison of both the populations with respect to the allele frequencies showed that there is a significant difference between the males and females of both the Jats ($\chi^2 = 5.5756$; $p = 0.0182$) and Brahmins ($\chi^2 = 5.8401$; $p = 0.0157$). Therefore, the gene frequencies were calculated separately for males and females.

The incidence status of G-6-PD deficiency revealed a high percentage among the Jats and Brahmins of Haryana; the Jat males having the higher percentage (11.49%) than their Brahmin counter parts (10.42%), though the chi square comparison shows non significant differences ($\chi^2 = 0.5$, $df1$; NS). On the contrary, Jat females have a lower incidence of the deficient allele (6.13%) than the Brahmin females (7.14%). The heterozygous status shows that the Jat females have a higher percentage (10.20%) than that of their Brahmin counterparts (8.93%).

According to Bhasin and Walter (2001) the frequency of *G6PD*def* among Indian populations as a whole ranges from complete absence to 0.271. It is higher among the scheduled tribes as compared to other ethnic groups. *G6PD*def* frequency is comparatively higher in North and West India zones, which indicates considerable stability of this allele in this region (Bhasin and Walter, 2001). The results of the present study tend to agree with the above statement.

Table 1: Distribution of G-6-PD deficiency among the Jats and Brahmins of Sampla

Population	Sex	No. tested	Normal		Heterozygotes		Deficient		G6PD*def frequency in males
			No.	Per centile	No.	Per centile	No.	Per centile	
Jats	Male	87	77	0.8851	-	-	10	0.1149	G6PD*def = 0.1149
	Female	49	41	0.8368	5	0.1020	3	0.0612	
Brahmins	Male	96	86	0.8958	-	-	10	0.1042	G6PD*def = 0.1042
	Female	56	47	0.8393	5	0.0893	4	0.0714	

KEYWORDS G-6-PD. Deficiency. Variation. Jats. Brahmins. Haryana

ABSTRACT The present study was conducted to find out the incidence of G-6-PD deficiency among the Jats and Brahmins of Sampla, Haryana. The incidence status of G-6-PD deficiency revealed a high percentage among the Jats and Brahmins of Haryana; the Jat males having the higher percentage (11.49%) than their Brahmin counter parts (10.42%), though the chi square comparison shows non significant differences ($\chi^2 = 0.5$, df 1; NS). On the contrary, Jat females have a lower incidence of the deficient allele (6.13%) than the Brahmin females (7.14%). The heterozygous status shows that the Jat females have a higher percentage (10.20%) than that of their Brahmin counterparts (8.93%).

REFERENCES

- Beutler, E.: The genetics of glucose-6-phosphate dehydrogenase deficiency. *Semin Hematol.*, **27**: 137 (1990).
- Beutler, E.: Glucose-6-phosphate dehydrogenase deficiency. *N. Engl. J. Med.*, **324**: 169 (1991).
- Beutler, E. and Yoshida, A.: Genetic variation of glucose-6-phosphate dehydrogenase: a catalog and future prospects. *Medicine*, **67**: 311 (1988).
- Beutler, E., Vives-Corrons, J.L., Hirono, A., Prachal, J.T., Crader, W.: The molecular biology of variation in glucose-6-phosphate dehydrogenase. *The Red Cell: Seventh Arbor Conference*, New York, N.Y. Liss. p. 39 (1989).
- Bhasin, M.K. and Walter, H.: Glucose-6-phosphate dehydrogenase deficiency and abnormal haemoglobins (S and E in people of India). *J. Hum. Ecol.*, **9**: 339 (1998).
- Bhasin, M.K., Walter, H. and Danker-Hopfe, H.: *The Distribution of Genetical, Morphological and Behavioural Traits among the Peoples of Indian Region*. Kamla-Raj Enterprises, Delhi (1992).
- Bhasin, M.K., Walter, H. and Danker-Hopfe, H.: *People of India. An Investigation of Biological Variability in Ecological, Ethno economic and Linguistic Groups*. Kamla-Raj Enterprises, Delhi (1994).
- Bhasin, M.K. and Walter, H.: *Genetics of Castes and Tribes of India*. Kamla-Raj Enterprises, Delhi (2001).
- Census of India 1981. *Series I. India. Paper 1 of 1982 Final Population Totals*. Controllor of Publication, Delhi (1983).
- Chiu, D.T.Y., Zuo, L., Chen, E., Louie, E., Lubin, B., Liu, T.Z., Du, C.S.: Two commonly occurring nucleotide base substitutions in Chinese G-6PD variants. *Biochem. Biophys. Res. Commun.*, **180**: 988 (1991).
- Chiu, D.T.Y., Zuo, L., Chao, L., Chen, E., Louie, E., Lubin, B., Liu, T.Z. and Du, C.S.: Molecular characterization of glucose-6 phosphate dehydrogenase (G-6PD) deficiency in patients of Chinese descent and identification of new base substitutions in the human G-6PD gene. *Blood*, **81**: 2150 (1993).
- Chao, L., Du, C.S., Louie, E., Zuo, L., Chen, E., Lubin, B., Chiu, D.T.Y.: A to G substitution identified in exon 2 of the G6PD gene among G-6PD deficient Chinese. *Nucleic Acids Res.*, **19**: 6056 (1991).
- Hsia, Y.E., Miyakawa, F., Baltazer, J., Ching, N.S.P., Yuen, J., Westwood, B., Beutler, E.: Frequency of glucose-6 phosphate dehydrogenase (G6PD) mutations in Chinese Filipinos and Laotians from Hawaii. *Hum. Genet.*, **92**: 470 (1993).
- Missiou-Tsagaraki, S.: Screening for glucose-6-phosphate dehydrogenase deficiency as a preventive measure: prevalence among 1,286,000 Greek newborn infants. *J. Pediatr.*, **119**: 293 (1991).
- Vulliam, T.J., D'Urso, M., Battistuzzi, G., Estrada, M., Foulkes, N.S., Martini, G., Calabro, V., Poggi, V., Giordano, R., Town, M., Luzzato, L., Persico, M.G.: Diverse point mutations in the human glucose-6 phosphate dehydrogenase gene cause enzyme deficiency and mild or severe haemolytic anaemia. *Proc. Natl. Acad. Sci., USA*, **85**: 5171 (1988).
- Yoshida, A., Beutler, E., Motulsky, A.G.: Table of glucose-6-phosphate dehydrogenase variants. *Bull. World Health Organ.*, **45**: 243 (1971).

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