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Glucose-6-Phosphate Dehydrogenase Deficiency and Sickle Cell Hemoglobin among the Warli Tribe of Dadra and Nagar Haveli

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ABSTRACT Anthropologists have always used Glucose-6-Phosphate dehydrogenase (G6PD) deficiency and sickle cell haemoglobin to trace human evolution and migratory histories of populations. The present study deals with the screening of these markers among the Warli population of Dadra and Nagar Haveli. The study aims to enhance the knowledge in the realm of population genetics vis-à-vis these two loci. Of the 79 males studied, 8 (10.1%) were found to be G6PD deficient. Regarding the Sickle cell haemoglobin, the present sample showed no HbSS. However Heterozygotes (HbAS) constitute (12.7%) of the persons studied for the purpose. The population is in Hardy Weinberg equilibrium with respect to both selected loci.

INTRODUCTION

Tracing the human evolution and migratory histories using various genetic markers like that of G-6-PD deficiency and Sickle cell Hemoglobin has been the major focus of Anthropologists. Glucose–6-Phosphate dehydrogenase is one of the key enzymes of hexose mono phosphate shunt pathway, the deficiency of which is an X-linked recessive trait. Patients with G6PD deficiency are at a risk of hemolytic anemia in states of oxidative stress which could be because of various reasons like severe infection, medication and certain foods etc. On the other hand, Sickle cell Hemoglobin which is an autosomal recessive trait leads to a severe hemolytic disease, when the gene is in homozygous (HbSS) form.

Various studies have revealed strong interaction between G6PD deficiency and sickle cell genes on one hand and environment on the other. One may therefore expect changes in their frequencies over a period of time in the population. The present study is based on finding whether such a change has taken place in these characteristics among the Warlis of Dadra and Nagar Haveli over last three decades with respect to G6PD deficiency and HBS located on different chromosomes but having the same physiological effect i.e. heamolysis among the Warlis of Dadra and Nagar Haveli (Union Territory) and also to find the status of this population among the Western Indian population no with respect to these markers. A study on this population was conducted by (Joshi et al., 1978), who reported frequencies of 19.5% and 19.3% for G6PD deficiency and sickle cell trait (AS) respectively.

The Union Territory of Dadra and Nagar Haveli (DNH) is located on the western side of the foothills of Western Ghat and is situated between the two parallels of 20^0 and $20^025'$ of latitude north and between the meridian $72^050'$ and $73^015'$ of longitude. The vast stretch of the total geographical area of 491 square km is hilly terrain especially towards the northeast and east where it is surrounded by ranges of Sahyadri Mountains (Western Ghats). The Union territory has a population of 2.20 Lakhs as per the 2001 census, which had predominance of tribals forming a major chunk of 62% of the total population, the major tribes being Warlis, konkanas, Dhodia and Dubla.

The Warlis form a largest group (63 % of the total tribal population). They are a tribe of non-Aryan origin, who are concentrated in areas near the Vindhyas and Satpura. In Warlis, marriage outside the community is strictly prohibited. Generally marriage takes place outside the Gothra but they can marry within the same surname (aatak). The Warlis are principally monogamous but polygyny is also practiced Moreover, Warlis are a patrilateral community.

MATERIAL AND METHODS

Blood samples (through fingerprick method) were collected from 102 individuals (79 males and 23 females), age ranging from 11-18 years in eppendorfs coated with 10% EDTA.

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Every care was taken to avoid blood relatives' upto first cousin. Screening for G6PD deficiency was performed by employing Fluorescent Spot Test (Beutler et al., 1968) . For the screening of Sickle cell haemoglobin, Sodium metabisulphite test was performed as a preliminary test and later the zygosity was confirmed in the laboratory by carrying out Agar Gel Electrophoresis. (Daland and Castle, 1948).

Allele frequencies for G6PD deficiency and Sickle cell trait locus were calculated using gene counting method. Hardy-Weinberg equilibrium was tested using a χ^2 goodness of fit test.

RESULTS AND DISCUSSION

The study reveals 10.1% of the males to be G6PD deficient. Vast data on different Indian populations with respect to G-6-PD deficiency and HBS is presently available (Bhasin et al., 1992, 1994; Bhasin and Walter, 2001). To study the similarity and dissimilarity in the incidence of this enzymatic deficiency, the data when compared with other Indian populations of the same and neighboring regions, showed statistically non-significant differences with Bhils ($\chi^{2=}$2.79), Katkaris($\chi^{2=}$1.44), Naik gond ($\chi^{2=}$0.296), Pradhan($\chi^{2=}$3.06), Warli($\chi^{2=}$0.566), Rajgond ($\chi^{2=}$2.79), Madia($\chi^{2=}$0.168) of Maharashtra and Warlis($\chi^{2=}$1.11) and Dhodia($\chi^{2=}$2.06) of DNH. This showed that the frequency of G6PD deficient individuals among the Warlis population is quiet similar to that in other tribal populations of the adjoining areas.

For the screening of Sickle cell Hemoglobin using the sodium metabisulphite test and electrophoresis method, 12.7 % of the total individuals showed a positive test for sickle cell trait. Non- significant differences were observed when chi-square comparison was applied between Warlis of Dadra and Nagar Haveli and various populations of Western India among which are the Bhils($\chi^{2=}$1.92) , Dhodia ($\chi^{2=}$0.847), koli ($\chi^{2=}$0.598), Naika ($\chi^{2=}$0.279), Varli ($\chi^{2=}$0.583) of Gujarat, Korku ($\chi^{2=}$1.28), Gond ($\chi^{2=}$0.225), Rajgond ($\chi^{2=}$0.347), Naikgond ($\chi^{2=}$0.421), Warlis ($\chi^{2=}$0.280) of Maharashtra and Warlis ($\chi^{2=}$1.36) and Dhodias ($\chi^{2=}$1.74) of Dadra and Nagar haveli. This again suggests that , like with respect to G6PD deficiency , the distribution of Sickle cell trait among Warlis too is quite similar to that among the other tribals populations of the adjoining areas.

Table: 1. Distribution of G6PD deficients among Warli Males

		Normal		*Deficient*		*Allele frequency*
Sex	*No. tested*	*No.*	*Percentile*	*No.*	*Percentile*	*Gd*def*
Male	79	71	0.898	8	0.101	0.101

Table: 2 Distribution of sickle cell haemoglobin among Warli population

	Observed number	*Percentage*	*Allele frequency*	
Sickler (AS)	13	12.7	A	S
Normal (AA)	89	87.2	0.936	0.064
Total	102			

In the present study, G6PD deficiency and Sickle cell trait show a frequency of 10.1% and 12.7% respectively. The earlier studies done on this population on these genetic marker shows a frequency of 19.5% and 19.3 % for G6PD deficiency and Sickle cell trait respectively, which is higher than that of the present study. Furthermore, in the present study no single individual is found to have both G6PD deficiency and HBS. The decrease in the frequency of these genetic traits through subsequent generations could be due to selective disadvantage of the presence of the genetic traits in the same individual in the population leading to severe anemia due to heamolysis occurring through two differerent pathways (HbS and G6PD deficiency), and ultimately resulting in the lowering of the abnormal gene frequencies among the Warlis.

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