THE FREQUENCY OF GLUCOSE-6-PHOSPHATE DEHYDROGENASE DEFICIENCY IN PUNJABIS AND PATHANS

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ABSTRACT

Objective: To find the frequency of Glucose-6-Phosphate Dehydrogenase (G6PD) deficiency in healthy young adult male population of various ethnic groups and sub-groups of Punjabis and Pathans.

Material and Methods: This Cross-sectional comparative study in Armed Forces Institute of Pathology, Rawalpindi, from Jan—Dec 2000. Eight hundreds apparently healthy unrelated adult males (Punjabis: 400 and Pathans: 400) were screened for G6PD deficiency by a commercial qualitative screening test kit.

Result: Out of 800 subjects, 47 (5.9%) were G6PD deficient (95% CI: 4.2-7.5%). The frequency in Pathans (8.3%) was significantly higher than in Punjabis (3.5%) (p=0.006). There were also differences in the frequency of G6PD deficiency among the sub groups of Punjabis and Pathans.

Conclusion: G6PD deficiency is a fairly common abnormality in Punjabis and Pathans. Such individuals are highly susceptible to develop acute haemolytic episodes by a variety of stimuli including some of the commonly used drugs.

Key words: Glucose-6-Phosphate Dehydrogenase Deficiency (G6PD).

INTRODUCTION

Glucose-6-phosphate dehydrogenase deficiency is the commonest disease producing enzyme disorder of human being. Although many other red blood cells (RBC) enzyme deficiencies are now known, G6PD deficiency still reigns as the most common of all clinically significant enzyme defects, not only in haematology, but also in human biology as a whole.[1,2]

In most patients with G6PD deficiency, there is no anemia in the steady state. Reticulocytes count is normal, but RBC survival may be slightly decreased. However episodic exacerbation of haemolysis accompanied by anemia occurs in association with the administration of certain drugs and with some infections.[3,4,5] G6PD deficiency results in neonatal jaundice[6], favism[7] and in some cases is associated with chronic non-spherocytic haemolytic anemia (CNSHA).[8,9] Also many non-hematological sequelae of G6PD deficiency have been reported.[2]

Although global in distribution, glucose-6-phosphate dehydrogenase deficiency is more prevalent in tropical and sub-tropical regions of the eastern hemisphere.[10] It has been estimated that about 400 millions peoples are affected by this enzyme deficiency worldwide.[9] A few studies in the past have described the frequency of this enzyme deficiency in healthy Pakistani population of different regions. The reported incidence varies between 2—3%.[2,11]

In Pakistan malaria and tuberculosis are endemic, neonatal jaundice is common, hepatitis and other infections are frequent and injudicious use of anti-malarial, anti-tuberculosis and antimicrobial drug, is rampant. Therefore it is of immense importance to identify G6PD enzyme activity of individuals at high risk in order to prevent undesirable and sometimes fatal acute haemolytic episodes. This population-based study was done to find the frequency of glucose-6-phosphate dehydrogenase deficiency in healthy young adult male population of various ethnic groups and sub-groups of Punjabis and Pathans.

MATERIAL AND METHODS

Eight hundred unrelated and apparently healthy adult males, from the two ethnic groups of Pakistan were screened for G6PD deficiency. The subjects included 400 Punjabis and 400 Pathans. The samples, from Punjabis were collected from different army units stationed at Rawalpindi and students of Rawalpindi Medical College. The samples from Pathans were collected from the students of Khyber Medical College, FF Regiment Stationed at Rawalpindi and Frontier Constabulary Training Center, Shabqadar. All the volunteers were thoroughly interviewed and examined after taking their consent. The relevant information regarding age, complete address, ethnic origin (caste and tribe) any history of recurrent jaundice and pallor were recorded. The caste of the mother was taken as caste of the subject.

Disposable bottle available from commercial sources (ALTO-ITLY) containing tripotassium EDTA (1.5 mg/ml of blood) was used for collection of blood. Using 10 ml disposable plastic syringe with 21 gauge needle, about 2.5 ml blood was taken from one of the cubital vein after cleaning the skin with 70% alcohol and letting it dry. The blood was mixed with anticoagulant in the bottle. The bottle was then labeled and a serial number endorsed on the Performa and the bottle.

The screening for glucose-6-phosphate dehydrogenase deficiency was performed by commercially available kit (Cat No. 400) including known glucose-6-phosphate dehydrogenase normal (Cat No. G-6888) and deficient (Cat. No. G-5888) controls from Sigma Chemical Co. Ltd. Fancy Road Pool, Dorset, England. The tests were performed at 37° C in subdued light. The test vials were observed at 15 minutes intervals up to one hour for a change of colour from its original deep blue to a maroon or reddish end point. The individual reactions were classified as normal or G6PD deficient based on their dye-decolorization time. Change of color within one hour indicated normal level of glucose-6-phosphate dehydrogenase. Sample that did not decolorize after 70 minutes were

DISTRIBUTION OF G6PD DEFICIENCY MAJOR ETHNIC GROUPS

Ethnic groups	G6PD deficient	%age	95% CI
Punjabi (n=400)	14	3.5	1.7——5.3
Pathans (n=400)	33	8.3	5.6——10.9
Both ethnic groups (n=800)	47	5.9	4.3 - 7.5

TABLE-1

designated as G6PD deficient. The statistical analysis for comparison between various categories was done by chi-square test.[7]

RESULTS

Out of eight hundred subjects forty-seven (5.8%) were found to be deficient in glucose-6-phosphate dehydrogenase in both the ethnic groups (95% CI 4.3 - 7.5%). The frequency of G6PD deficient individuals in the two ethnic groups is shown in table-1.

The overall frequency of G6PD deficiency among the Punjabis was 14 out of 400 (3.5%)(95% CI 1.7——5.3). In Pathans 33 out of 400 (8.3%) males were deficient in G6PD enzyme (95% CI 5.6—10.9). The frequency in Pathans was significantly higher than in Punjabis (p=0.006).

High frequency of G6PD deficiency was found in a sub-ethnic group of Punjabis known Niazi 2/13 (15.4%) (p=0.10) and Arain 3/22 (13.6%) (p=0.038), which were statistically insignificant.

DISTRIBUTION OF G6PD DEFICIENCY IN DIFFERENT SUB-GROUPS OF PUNJABIS (N=400)

Groups	Sub-groups	Cases	%age
Rajput	Janjua, Bhatti, Khokhar, Jarar, Rao, Sulehria	1/106	0.9
Mughal		0/23	0
Gujar	–	2/38	5.3
Jats	–	0/33	0
Malik	–	1/12	8.3
Sayyed	–	0/13	0
Awan	–	2/52	3.8
Arain	–	3/22	13.6
Niazi	–	2/13	15.4
Others	Chema, Dogar, Mehr, Qureshi, Sheikh	3/81	3.4
Total	–	14/400	3.5

TABLE-2

DISTRIBUTION OF G6PD DEFICIENCY IN DIFFERENT SUB-GROUPS OF PATHANS (N=400)

Groups	Sub-groups	Cases	%age
Khattak	–	2/80	2.5
Yousafzai	–	3/59	5
Mohmand	–	16/97	16.5
Orakzai	–	4/30	13.3
Bangash	–	0/10	0
Wazir	–	0/16	0
Shulmani	–	3/28	10.1
Swati	–	1/10	10
Sayyed	Pushto speaking	0/13	0
Others	Marwat, Banochi, Afridi, Babar, Shinwari, Qureshi, Kakakhel	4/57	7
Total	–	33/400	8.25

TABLE-3

Table – 3 shows a very high frequency of G6PD deficiency in a tribe known as Mohmand and its sub-tribe Khalil i.e. 16/97 (16.5%) which is statistically significant (p=0.001). In another tribe called Orakzai 4/30 (13.3%) were found G6PD deficient.

DISCUSSIONS

The frequency of G6PD deficiency was detected in 46/800 (5.8%) of randomly selected healthy adult male individuals of the two major ethnic groups. The racial origin of the two major ethnic groups is different and genetic disorders must therefore have unequal distribution. Significant difference was noted in the frequency of G6PD deficiency between Punjabis and Pathans in our study i.e. 14/400 (3.5%) in Punjabis (95% CI 1.7 –5.3%) and 33/400 (8.3%) in Pathans (95% CI 5.6 – 10.9%) p. value = 0.006.

High frequency of G6PD deficiency was found in a subgroup of Punjabis known as Arain 3/22 (13.6%) p=0.10 which coincides with a previous study[12]. Also high frequency was noted in another sub-group of Punjabis known as Niazi 2/13 (15.4%) p=0.038 but no definite conclusion can be drawn from this finding because of small number of subjects belonging to these groups and this has to be confirmed by a larger study. Although there appear to be differences between the subgroups of Punjabis, but none of these differences were statistically significant. The frequency of G6PD deficiency in Pathans was detected in 33/400 (8.3%) that coincides with some of previous studies [1,13] but markedly different from another study[12]. Very high frequency of G6PD deficiency was noted in a tribe of Pathans called Mohmand 16/97 (16.5%). The difference was statistically significant as compared to overall frequency in Pathans p=0.001. Another tribe of Pathans identified with high frequency was Orakzai 4/30 (13.3%). Both these tribes belong to tribal areas of NWFP and are difficult to approach. The groups reporting low frequencies in Pathans may have not included sufficient number of individuals from these tribal areas. The high frequency of G6PD deficiency in Mohmand and Orakzai could be due to the founder effect i.e. the founding members of the Mohmand tribe might have been deficient in G6PD and due to long standing tradition of consanguineous marriages as well as marriages within the same tribe, the present generation of this tribe have developed a higher frequency of G6PD deficiency.

A number of studies have been carried out to know the prevalence of G-6-PD deficiency in various ethnic groups of Pakistan. But in most of the studies either a very small number of individuals were screened[14,15] or the study was restricted to a particular area or city.[16,17] These studies were not truly population based and mostly included the patients attending the health centers.[15] The studies that were population based, had not included all the sub-ethnic groups/tribes.[12,13] The present study has an edge over the previous studies because it is population based and relatively large numbers of individuals (n=800) were screened. The comparison with other studies from Pakistan is highlighted in table-4

CONCLUSION

There is a need to emphasize that G6PD deficiency is a fairly common problem in Pakistan and such individuals are vulnerable to develop haemolytic anaemia following exposure to drugs and infections at any time. Their siblings are at risk of developing neonatal jaundice and kernicterus in infancy. In Pakistan injudicious use of anti-malarial, anti-tuberculosis and anti-microbial drugs is common. Therefore it is of immense importance to identify G6PD enzyme activity of individuals at high risk in order to prevent

COMPARISON OF RESULTS WITH VARIOUS STUDIES

S. No.	Author	Subjects	ME	Source	Method	Prevalence
1.	Ronald et al 1968[17]	456	269 187	Soldiers, Lahore students Lahore	Filter paper	2.6%
2.	Stern et al 1968[14]	114	Male	Male pathan NWFP	Dye test	8.6%
3.	McCurdy & Mehmood 1970[15]	221	200	Factory recruits employees and patient Wah Cantt.	Florescent spot test	2.8%
			21	Pakistan males residing in Washington		
4.	Hashmi et al 1976[16]	614	–	Young male Karachi	Dye test	7.5%
5.	Rollinger and Latif[18]	780	473, 307	Male Lahore female Lahore	Sigma test kit	2.5% 1.3%
6.	Khattak et al 1992[12]	500	326	Male, Punjabi and Pathan	Sigma test	4.3%
			174	Female Punjabi and Pathan		1.3%
7.	Saha N, et al, 1992[13]	500	326	Male, Punjabi and Pathan	Sigma test kit	4.3%
			174	Female Punjabi and Pathan		2.9%
		–	129	Pathan males	Dye test	10%
			104	Females		
			51	Pathan		
			21	Punjabi		
				Afghan		
				Refugees		
8.	Bouma MJ et al 1995[19]	–	–	Pathan male	–	7%
9.	Saleem 1966[11]	117	Male	Karachi	Sigma kit	6.2%
10.	Present study	800	400	Punjabi male	Sigma test kit	3.5%
			400	Pathan male		

TABLE–4

undesirable and sometimes fatal acute haemolytic episodes.

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