FREQUENCY OF GLUCOSE 6 PHOSPHATE DEHYDROGENASE DEFICIENCY AND RELATED HEMOLYTIC ANEMIA IN RIYADH, SAUDI ARABIA

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Background: Glucose 6 Phosphate dehydrogenase deficiency is present in over 400 million people world wide. It is more common iin tropical and subtropical countries and is one of the important causes of hemolytic anemia and neonatal jaundice. We studied the frequency of glucose-6-phosphate dehydrogenase deficiency and associated complications in Central Region (Riyadh) of Saudi Arabia. **Methods*:*** A total of 1740 subjects referred by Ministry of Interior and different hospitals in Riyadh were investigated for glucose-6-phosphate dehydrogenase deficiency. Glucose 6 phosphate dehydrogenase activity was determined by a screening test described by Beutler. **Results:** Out of these, 106 (6.09%) subjects were deficient. The subjects were divided into marriage and hospital groups. In marriage group deficiency was 4.1% while in hospital group it was 13.3%. In 54 glucose-6-phosphate dehydrogenase deficient patients red blood cell count and haemoglobin levels were determined to see the degree of anaemia. Sixty one percent (61%) had anaemia. In hospital patients 8% patients had severe anaemia while in marriage group no patients had severe anaemia. However mild anaemia was seen in 25% subjects in marriage group. **Conclusions:** In conclusion the study indicates that glucose-6-phosphate dehydrogenase deficiency is common in the central region of Saudi Arabia and a lot of patients present with haemolytic episodes. The haemolytic crisis however is not related to the intake of fava beans. The type of variant causing anaemia and suggestions for prevention in marriage group are outlined.

Key words: glucose-6-phosphate dehydrogenase, deficiency, anaemia, marriage

INTRODUCTION

The enzyme glucose 6 phosphate dehydrogenase is expressed in all tissues, where it catalyses the first step in the pentose phosphate pathway. Glucose 6 phosphate dehydrogenase deficiency is a common X-linked enzyme abnormality. It is prevalent throughout tropical and subtropical regions of the world because of the protection it affords during malaria infection. This deficiency is present in over 400 million people worldwide[1]. Glucose 6 phosphate dehydrogenase deficiency is found in tropical and subtropical countries and is one of the important causes of haemolytic anaemia and neonatal jaundice[2].

Although most affected individuals are asymptomatic, there is a risk of neonatal jaundice and acute haemolytic anaemia, triggered by infection and the ingestion of certain drugs and broad beans (favism). Many different variants of glucose 6 phosphate dehydrogenase have been described. The vast majority of these are caused by single aminoacid substitutions[3]. This study was undertaken to see the frequency of this deficiency and the degree of anaemia caused by this defect in Riyadh, Saudi Arabia.

MATERIALS AND METHODS

A total of 1740 subjects aged 5 to 30 years referred from different hospitals and the ministry of interior to the Central Laboratory Riyadh, Saudi Arabia for detection of glucose-6-phosphate dehydrogenase deficiency, in one year, were included in this study. This laboratory is a reference centre and receives samples from whole Riyadh region.

Blood was obtained by venipuncture (5–10ml) in EDTA tubes. Glucose 6 phosphate dehydrogenase activity was determined by a screening test as described by Beutler[2]. Five µL of blood sample was mixed with 0.1 ml reagent

solution containing NADP, oxidized glutathione and glucose 6 phosphate in a small test tube. After mixing well the sample was incubated for 10 minutes at 25 °C. Then 0.01 ml of the sample was applied in the form of a spot to the filter paper supplied along with the kit provided by Boehringer Manheim. After waiting for half an hour when the filter paper was dry, the blood spot was examined under a long wave UV-lamp in a darkened room.

Specimens obtained from patients with normal or just slightly depressed activity showed strong fluorescence. Lack of fluorescence after 10 minutes incubation suggested a total absence or marked deficiency of glucose 6 phosphate dehydrogenase. The anaemia was detected by doing RBC count and haemoglobin levels by SysMex 800 coulter machine. The cut off point for haemoglobin was 7 mg/dl. Out of a total of 1740 subjects 1365 (78.4%) were referred by the ministry of interior. As a routine, the Government of Saudi Arabia screens their subjects before marriage for the detection of glucose-6-phosphate dehydrogenase deficiency. Three hundred and seventy five subjects (21.6%) were referred from various hospitals. Therefore the subjects were basically two distinct groups, 'marriage group', and 'hospital group'.

RESULTS

The age range was 5 to 30 years. Among the 'marriage group' 878 (64.3%) were males while 487 (35.7%) were females. The 'hospital group' had 235 (60%) males and 144 (40%) females.

Out of total 1740 subjects that were screened for Glucose-6-phosphate dehydro-genase deficiency 106 (6.09%) were deficient. In the marriage group (4.1%) were deficient (56/1365). Out of these 70% (34/56) were males while 30% (17/56) were females. In the hospital group 13.3% patients (50/375) had glucose-6-phosphate dehydrogenase deficiency. Out of these 50 patients, 30 (60%) were males while 20 (40%) were females. The relative distribution of this data is shown in table 1.

Table-1: Distribution of Glucose-6-phosphate dehydrogenase deficient patients in marriage and Hospital group.

Groups	Total subjects	**Deficient**	**%**
Marriage Group	1365	56	4.1
Males	878	39	70
Females	487	17	30
Hospital Group	375	50	13.3
Males	235	30	60
Females	144	20	40
Grand Total	1740	106	6.09

In 54 glucose-6-phosphate dehydro-genase deficient subjects the red blood cell count and haemoglobin level was determined to see the degree of anaemia. Out of a total of 54 subjects studied 33 (61%) had anaemia. Eight subjects (14.8%) had severe anaemia, nine subjects (16.6%) were having moderate anaemia while sixteen (29.6%) had mild anaemia. The position of anaemia in these subjects is shown in table 2.

Month wise distribution of patients is seen in table 3. Maximum cases were recorded in the month of November, followed by decreasing number of cases in May, December and October respectively.

Table-2: Status of Anaemia in 54 subjects with glucose-6-phosphate dehydrogenase deficiency

	Marriage Group	Hospital Group
No. of Patients	26	28
Patients with Severe Anaemia	Nil	8
Percentage	0	28.6
Moderate Anaemia	1	8
Percentage	38	28.6
Mild Anaemia	9	7
Percentage	34.6	25

Severe anaemia =Hb <7.0g/dl.

Moderate anaemia = Hb 7-10g/dl

Mild anaemia = Hb 10-11g/dl

Table-3: Month-wise distribution of Glucose-6-phosphate dehydrogenase deficient subjects.

Month	Total Subjects	G6PD Deficient	Percentage
January	162	07	4.3
February	121	04	3.3
March	193	15	7.8
April	172	09	5.2
May	175	15	8.5
June	152	06	3.9
July	148	06	4.05
August	115	06	5.2
September	162	09	5.6
October	122	10	8.2
November	85	08	9.4
December	133	11	8.3

DISCUSSION

This study was conducted on Saudi population in the central capital region of Riyadh. The frequency of glucose-6-phosphate dehydro-genase deficiency varies in various areas of Saudi Arabia, which range from less than 5% in central area to 24% in Khyber. Our work has shown that the frequency of glucose-6-phosphate dehydrogenase deficiency in central area is 6.09%. This figure is higher than that reported by previous workers in the centre region[4].

It was observed that the frequency of glucose-6-phosphate dehydrogenase deficiency in marriage group (4.1%) was significantly higher than the hospital group (13.3%). The frequency was much higher in males than females in both the groups. Similar observations have been reported by Joshi *et al*. from Western India[5] and Sanpavat and his co-workers from Thailand[6].

The overall incidence of anaemia due to glucose-6-phosphate dehydrogenase deficiency was higher (61%) in our study as compared to one reported from Thailand by Sanpavat *et al*[6]. Pietrapertosa and his associates from Bari (Italy) reported that 59.2% of their glucose-6-phosphate dehydrogenase deficient subjects were asymptomatic[7]. We studied the same number (54) of glucose-6-phosphate dehydrogenase deficient patients and observed that 39% of our glucose-6-phosphate dehydrogenase deficient subjects were without symptoms.

The higher frequency of anaemia in this region is due to genetic polymorphism of glucose-6-phosphate dehydrogenase.

Table-3 shows monthly distribution of glucose-6-phosphate dehydrogenase deficient patients. Although the fava bean season extends from February to June, maximum cases in our study were recorded in other months of the year. The same observations have been reported by Yahya *et al*. from India[8] and Al-Ali from Dammam Saudi Arabia[4]. This study thus does not support causal relationship between the bean ingestion and haemolytic episodes in glucose-6-phosphate dehydrogenase deficient Saudis[8]. It has been documented by Warsy *et al*. that glucose-6-phosphate dehydrogenase Mediterran-ean variant was the type producing severe deficiency and causing haemolytic anaemia under oxidative stress[9].

The need for utilizing screening measures for early detection of glucose-6-phosphate dehydrogenase deficiency before marriage is apparent. Since glucose-6-phosphate dehydrogenase deficiency in marriage group exists, there is compelling need for introducing measures such as genetic counselling and public health education as part of the overall health and welfare services in the area.

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