Survey for glucose-6- phosphate dehydrogenase enzyme deficiency among premarital attendanceinniava

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Abstract

Glucose-6-phosphate dehydrogenase (G6PD) deficiency is considered the most frequent enzyme deficiency world wide, several reports have focused on its prevalence in different regions of Iraq. The current study was initiated to report on the frequency of G6PD deficiency among male attendance to premarital center in Ninava governorate in Northern Iraq. A total of 806 male individuals attending the Public Health Laboratory for routine premarital investigations were screened for G6PD deficiency using methemoglobin reduction test (MRT). The results were confirmed by quantitative enzyme assay for the cases that showed G6PD deficiency. A total (759) out of (806) were MRT negative , and (47) out of (806) were MRT positive with a prevalence of (5.8%).

Introduction

Glucose-6-phosphate dehydrogenase deficiency is the most prevalent enzyme deficiency in the world[1,2,3],affecting more than 400 million people worldwide[4,5]. G6PD catalyzes the first step of pentose phosphate pathway[6], which converts glucose into pentose sugars for glycolysis and other biological reactions[7].In this reaction, nicotinamide adenine dinucleotide phosphate (NADP) is reduced to reduced nicotinamide adenine nucleotide phosphate (NADPH), which is also used in the protective process against physiologically high levels of oxidative damage[8]. In red blood cells, pentose phosphate pathway is the only source of NADPH, making them more vulnerable than other cells to destruction by oxidative stress[9]. Although most of individuals with G6PD deficiency are usually asymptomatic, deficient subjects may suffer from neonatal jaundice, severe non-spherocytic hemolytic anemia or acute hemolytic anemia induced by infection, ingestion of fava beans or some drugs[10].

Subjects and methods

A total of 806 healthy male individuals attending the Public Health Laboratory for routine premarital investigations during a period of three months from December 2010 until March 2011,were screened for G6PD deficiency using methemoglobin reduction test (MRT). The results were confirmed by quantitative enzyme assay for the cases that showed G6PD deficiency. G6PD enzyme assay was done using U.V. Kinetic method (Biolabo-France) Reagent used for G6PD enzyme assay (EC 1.1.1.49) according to method of Beutler et al .[11]

Results

A total (759) out of (806) were MRT negative, and (47) out of (806) were MRT positive with a prevalence of (5.8%). Figure(1). Enzyme activities of all (47) MRT positive subjects and an equal number of MRT negative cases as controls were measured . Those who were MRT positive had an activity ranging between (0.03-0.46 IU/ml Erythrocytes) (0.11-1.38 IU/gm Hb) with a mean of (0.18 IU/ml Erythrocytes)(0.53 IU/gm Hb) while for MRT negative cases (controls) ranging between (3.43-5.07 IU/ml Erythrocytes)(10.1-14.9 IU/gm Hb) with the mean enzyme activity of (4.0463 IU/ml Erythrocytes)(11.90 IU/gm Hb). There were statistically significant difference between the two groups (p-value 0.001). Table (1)

Discussion

Since the seventies of the last century, researchers have observed that G6PD deficiency is quite common in Iraqis. Amin-Zaki and her colleagues (1972) reported an overall frequency of 8.9% (range 6-13%) among various ethnic groups in the country[12] . Almost a decade later Al-Hamamy and Saeed (1981), reported a higher overall frequency of 12.4% [13]. In the last few years however ,well organized studies reported frequencies of this deficiency in Baghdad (central Iraq), Basrah (southern Iraq) , Sulymania (Northern Iraq) and Arbil (Northern Iraq) [14,15,16]. The study from Baghdad was performed on male blood donors who were resident of the city Baghdad and revealed a frequency of 6.1% [14] ,while that from Basrah performed on premarital couples revealed the highest ever reported figure from the country at 15.3% [15] , the figures from Sulymania and Arbil, regions revealed a prevalence of 6.0% ,8.6% respectively[16] . Despite the high frequency of this disorder in Iraq, and the large numbers of cases presenting in acute hemolytic episodes as a result, particularly in the spring (the fava bean season), or as neonatal jaundice , no study has ever focused on to

determine the incidence of G6PD deficiency in Ninava governorate, the current study is the first to tackle such an issue. The prevalence of G6PD deficiency identified in the current study was (5.8%) , this figure is very close to that from Baghdad, but lower than that from Sulymania , Arbil , Dohuk and Basrah . These differences are mostly related to the different contributions of various ethnic groups in these studies, in the patient selection, and the sample size. Table(2) outlines comparison between G6PD deficiency in this study and in different parts of Iraq. Such figures throughout Iraq are not seen in isolation from surrounding Eastern Mediterranean countries, where the frequencies vary from the relatively lower figures reported in Lebanon 2.1% [22], to the 11% in United Arab Emirates[23], 18% in Bahrain[24] and up to 39.8% in some regions of Saudi Arabia[25,26,27] . Table (3)

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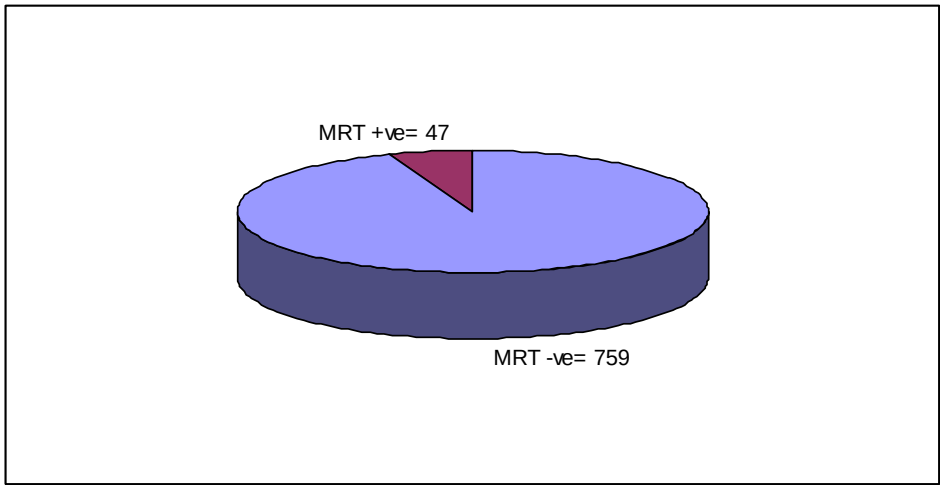

Total no.=806
Figure (1) Methaemoglobin reduction test result.

Table (1):- Comparison of G6PD enzyme activity between deficient subjects and non deficient subjects (control).

G6PD status	MRT +ve n =47		MRT –ve n=47		P-value
	Mean±SD.	Range	Mean±SD.	Range	
G6PD assay IU/ml Erthrocyte	0.18±0.091	0.03-0.46	4.04±0.492	3.43-5.07	0.001
G6PD assay IU/gm Hb	0.53±0.268	0.11-1.38	11.90±1.448	10.1-14.9	0.001

Table (2):- comparison between G6PD deficiency in this study and in different parts of Iraq

	Population surveyed	**G6PD deficiency%**	**Reference**
Baghdad(Central Iraq)	**758**	**6.1%**	**(17)**
Baghdad Among various ethnic groups	**563**	**8.6%(6-13)**	**(18)**
Basra (SouthernIraq)	**1064**	**15.3%**	**(19)**
Ninava(Northen Iraq)	**806**	**5.8%**	**Current**
Arbil(Northen Iraq)	**1000**	**8.6%**	**(20)**
Sulymania(Northen Iraq)	**835**	**6.0%**	**(16)**
Dohuk(Northen Iraq)	**580**	**10.86%**	**(21)**

Table(3):- Prevalence rates of G6PD deficiency in some of the surrounding countries in Eastern Mediterranean Region.

Country	**Prevalence (%)**	**Ref.**
Iran: Western (Kurds)	5.3	(28)
Jordan	3.6	(22)
Kuwait	5.5	(22)
Saudi Arabia	1-39.8	(25,26,27)
Syria	3.0	(22)
Turkey	0.5-20	(29)
Bahrain	18	(24)
Egypt	5.9	(30)
Lebanon	2.1	(22)
Oman	2-29	(31)
United Arab Emirates	11	(23)