

Knowledge, Attitude, and Practice toward Glucose-6-Phosphate Dehydrogenase Deficiency among Mothers of Children in Saudi Arabia

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Abstract

Glucose-6-phosphate dehydrogenase deficiency (G6PD) also known as favism anemia is an enzyme deficiency condition caused by mutations in the G6PD gene that is a prevalent cause of hemolytic anemia in humans. This defect is an X-linked recessive illness, males are frequently affected while females are carriers of the defect. G6PD enzyme protects the red blood cell (RBC) against harmful substances that cause hemolysis. To assess mothers of children and pregnant women's knowledge, attitude, and practice toward glucose-6-phosphate dehydrogenase deficiency in Saudi Arabia. The study population was consisting of Saudi mothers n= 889 aged from 18 years to 55 years old. The cross-sectional online questionnaire was carried out from September 2022 to November 2023 in the Kingdom of Saudi Arabia. The study included 859 participants, 91.5% were females and 8.5% were males. 10.4% of participants have a family history of G6PD. 54.7% heard of G6PD. 18.2% of participants reported that the presence of G6PD in the family was a prerequisite for its occurrence. 39% reported that pallor is a sign of G6PD. 65% of participants had good knowledge scores and 35% had poor knowledge scores. Attitude score shows that 55% of participants had negative attitudes and 45% had positive attitudes. Practice score was reported as 15.8% had a good practice and 84.2% had bad practice. The study shows that the Saudi population had generally poor knowledge, attitude, and practice toward G6PD. Knowledge score of G6PD was significantly associated with gender, educational level, and residency region in Saudi Arabia.

Keywords: Glucose-6-phosphate dehydrogenase deficiency (G6PD), Knowledge, Attitude, Practice, Mothers of children, Saudi Arabia

INTRODUCTION

Glucose-6-phosphate dehydrogenase deficiency (G6PD) also known as favism anemia is an enzyme deficiency condition caused by mutations in the G6PD gene that is a prevalent cause of hemolytic anemia in humans [1]. Because this is an X-linked recessive illness, males are frequently affected while females are carriers of the defect [2]. G6PD enzyme is a highly conserved housekeeping enzyme and the first enzyme in the hexose monophosphate pathway [3]. This enzyme protects the red blood cell (RBC) against harmful substances that cause hemolysis [4]. This deficiency renders red blood cells more vulnerable to oxidants such as those present in raw beans, certain medicines, and infection-induced oxidative stress. When exposed to oxidants, clinical signs of G6PD such as acute hemolytic anemia, chronic hemolytic anemia, and hyperbilirubinemia occur and, in severe cases can lead to kernicterus [5].

Newborn screening (NBS) has been one of the most successful health programs in the state and should be made mandatory for all newborns [6]. Glucose-6-phosphate

dehydrogenase deficiency (G6PD) is the most common enzyme defect affecting males predominantly due to its transmission pattern, around 400 million people worldwide are affected [7]. The prevalence of G6PD deficiency among Egyptian neonates was 6.2% in males and 2.1% in females in a study performed in 2015 at Menoufia Governorate [8]. The incidence of genetic blood diseases in Bahrain is considered

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to be high as a screening study conducted on male blood donors showed that up to 26.4% suffered from G6PD deficiency [7]. It affects 17% of participants in a study carried out randomly on a population of Dammam, Eastern Province of Saudi Arabia, which showed it is more common in females than males. G6PD deficiency frequency varies worldwide among different ethnic groups with 6% in Saudi Arabia, 20 to 30% in Greece, and 5.5% in South China [1].

Several studies have been published on the knowledge, attitude, and practice toward glucose-6-phosphate dehydrogenase deficiency among mothers of children. In a 2019 study by Zeinab A. Kasemy, the mothers' perceptions of glucose-6-phosphate dehydrogenase (G6PD) deficiency were found to be low, with only 17.10 % reporting good knowledge of G6PD deficiency, 45 % reporting a positive attitude toward G6PD deficiency, and 19.9 % reporting good practice towards G6PD deficiency [7] In 2018, (42.1%) of the participants' information was acquired when their kid was free of Neonatal Jaundice (NNJ), compared to (34%) after their child developed NNJ. University graduates and healthcare professionals were the most knowledgeable, and there was a significant difference in warning indicators of knowledge based on career and degree of education ($p=0.01$) [9].

In another study in 2022, Interviews with 504 moms revealed that 428 (85.4%) had heard of NNJ and that 346 (68.7%) believed the initial symptoms were noticed in the eyes. According to 467 (93.7%) of those who suggested it, a jaundiced infant should be seen by a doctor, whereas 384 (76.2%) were aware that NNJ may be dangerous. Despite having undergone prenatal screening, none of the women was aware of G6PD or their G6PD status. The symptoms and indicators of severe NNJ were unknown to the majority. The most common perceived obstacle to getting healthcare among the 15 moms of infants with jaundice (8 out of 15) was cost. Mothers' age, educational attainment, and awareness of NNJ were significantly associated (p -value = 0.05) [10]. There are few studies conducted that measure the level of awareness of G6pd deficiency among Saudi mothers as well as the knowledge, attitude, and practice towards this disease. Our aim of this paper is to assess mothers of children and pregnant women's knowledge, attitude, and practice toward glucose-6-phosphate dehydrogenase deficiency in Saudi Arabia.

MATERIALS AND METHODS

Study Design

The cross-sectional questionnaire was carried out from September 2022 to November 2023 in the Kingdom of Saudi Arabia.

Subject

The study population consisted of Saudi mothers aged from 18 years to 55 years old. All Saudi mothers (aged 18-55 years) and their children (G6PD children or healthy children) were invited to participate in the study.

Inclusion and Exclusion Criteria

This study included Saudi mothers aged between 18 years and 55 years, mothers of G6PD children, mothers of non-G6PD children, prenatal mothers (pregnant), and married women without children. The Saudi non-married women, aged less than 18 years and age than 55 years were excluded.

Sample Size

The sample size was estimated using the Qualtrics calculator from the total population. Considering the standard deviation ($=1.96$) for a 95% Confidence interval and the maximum acceptable error ($=0.05$). Therefore, the calculated minimum sample size required for this study is $n = (1.96)^2 \times 0.50 \times 0.50 / (0.05)^2 = 384$ participants.

Method for Data Collection and Instrument

The instrument was a self-administered anonymous structured online questionnaire in Arabic conducted by Kasemy *et al.*, in 2020 [7]. The questionnaire consisted of 30 questions with four components including sociodemographic data, the question about the knowledge of mothers regarding G6PD deficiency, the question about the attitude of mothers regarding G6PD deficiency, and the question about the practice of mothers regarding G6PD deficiency. The answers score was given one point for each correct answer and zero points were given for each incorrect answer. The total score was calculated for each participant by summing the individual scores for each question to give a total score out of 19. For each section of knowledge, attitude, and practice, the questions were summed score from 0-59% was considered poor, and 60 or more was considered good.

Analyzes and Entry Method

Data was collected from a questionnaire developed by Google Forms to collect information. The statistical package of social science software SPSS version 26 was used to enter and analyze the data.

RESULTS AND DISCUSSION

The study included 859 participants, 91.5% were females and 8.5% were males. 57.5% of participants were 20- 30 years old and 21.9% were 31- 40 years old. 45.3% of participants were married while 49.5% were single. 94.8% were Saudi. 75% had a bachelor's degree. 43.4% have children (**Table 1**).

Table 1. Sociodemographic characteristics of participants (n=859)

	Parameter	No.	%
Age	less than 20	31	3.6
	20 - 30	494	57.5
	31 - 40	188	21.9
	41 - 50	108	12.6
	51 - 60	33	3.8
	more than 60	5	.6

Gender	Males	73	8.5
	Females	786	91.5
Marital status	Single	425	49.5
	Married	389	45.3
	Divorced	40	4.7
	widow	5	.6
	patio	6	.7
Region	Hollow	7	.8
	Riyadh	84	9.8
	Al-Qassim	11	1.3
	AL Madinah AL Munawwarah	22	2.6
	Eastern Province	58	6.8
	Tabuk	10	1.2
	Jizan	9	1.0
	Hail	87	10.1
Nationality	difficult	15	1.7
	Makkah	549	63.9
	Najran	1	.1
	Saudi	814	94.8
	Non-Saudi	45	5.2
Educational level	primary	4	.5
	middle	11	1.3
	secondary	137	15.9
	Bachelor's	644	75.0
Have children	Master's	39	4.5
	PhD	24	2.8
	Yes	373	43.4
	no	461	53.7
Married without children	pregnant	11	1.3
		14	1.6

As illustrated in **Table 2**, 10.4% of participants have a family history of G6PD. 54.7% heard of G6PD. 51.9% think that G6PD is a blood condition while 50.9% think it is a genetic condition. 18.5% of participants have a child who has a risk of G6PD. 18.2% of participants reported that the presence of G6PD in the family was a prerequisite for its occurrence. 39% reported that pallor is a sign of G6PD. 33.5% reported that diarrhea, loss of appetite, nausea, and vomiting are signs of G6PD. 38.5% reported that G6PD can cause dizziness. 37.8% reported that G6PD can cause shortness of breath. 21.7% reported that G6PD can cause jaundice. 45.1% reported that G6PD can cause diarrhea. 50.5% think that G6PD is a big problem. 15.9% reported that consanguineous marriage contributes to G6PD. 17% reported that premarital counseling is necessary. 32.4% of participants had a genetic test.

Table 2. Knowledge, attitude, and practice towards G6PD (n=859)

Parameter	Yes	No	Don't know
Family history of G6PD	89	770	0
Heard of G6PD	54.7%	89.6%	44 5.1%
G6PD is a blood condition	470 51.9%	345 6.9%	44 41.2%
G6PD is a genetic condition	437 50.9%	67 7.8%	355 41.3%
Your children have the risk of G6PD	159 18.5%	304 35.4%	396 46.1%
The presence of G6PD in the family is a prerequisite for its occurrence	156 18.2%	268 31.2%	435 50.6%
Some medications can cause an attack of G6PD	204 23.7%	98 11.4%	557 64.8%
Pallor is a sign of G6PD	335 39.0%	58 6.8%	466 54.2%
Diarrhea, loss of appetite, nausea, and vomiting are signs of G6PD	288 33.5%	76 8.8%	495 57.6%
G6PD can cause dizziness	342 39.8%	33 3.8%	484 56.3%
G6PD can cause shortness of breath	325 37.8%	55 6.4%	479 55.8%
G6PD can cause jaundice	186 21.7%	61 7.1%	612 71.2%
G6PD can cause diarrhea	387 45.1%	163 19.0%	309 36.0%
G6PD is a big problem	434 50.5%	100 11.6%	325 37.8%
Consanguineous marriage contributes to G6PD	137 15.9%	315 36.7%	407 47.4%
If one of the family's children already G6PD, subsequent pregnancies should be avoided	477 55.5%	76 8.8%	306 35.6%
A child with G6PD should be followed up for life	127 14.8%	732 85.2%	0 %0
Premarital counseling is necessary	146 17.0%	713 83.0%	0 %0
Had genetic test	278 32.4%	581 67.6%	0 %0

Figure 1 shows participants' knowledge scores of G6PD. 65% of participants had good knowledge scores and 35% had poor knowledge scores.

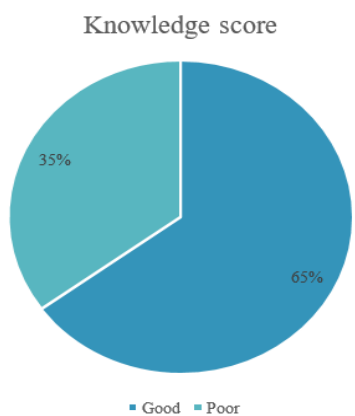


Figure 1. Participants’ knowledge score of G6PD

The attitude score illustrated in **Figure 2** shows that 55% of participants had negative attitudes and 45% had positive attitudes.

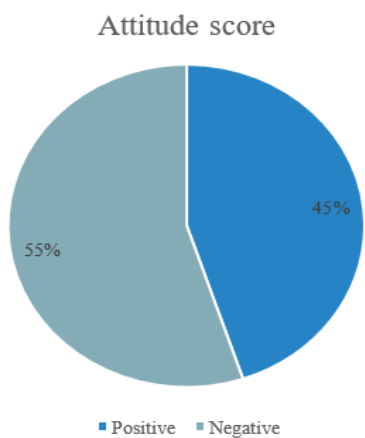


Figure 2. Participants' attitude score of G6PD

Practice score was reported in **Figure 3** as 15.8% had good practice and 84.2% had bad practice.

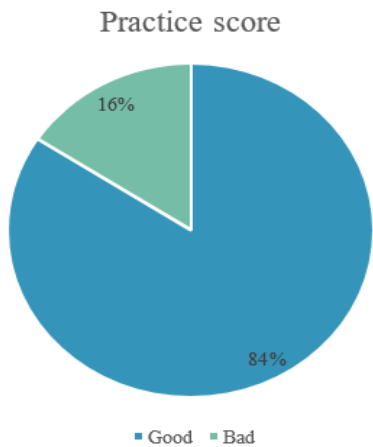


Figure 3. Participants’ practice toward G6PD

Tables 3-5 show that the knowledge score of G6PD was significantly associated with gender, educational level, and residency region in Saudi Arabia ($P < 0.05$). Attitude was significantly associated with age, marital status, and gender ($P < 0.05$). Practice score towards G6PD was significantly associated with marital status only ($P < 0.05$).

Table 3. Association between participants’ knowledge of G6PD with their sociodemographic characteristics (n=859)

		Knowledge of G6PD		Total (N=859)	P value
		Poor	Good		
Age	less than 20	22	9	31	0.258
		2.6%	1.0%	3.6%	
	20 - 30	315	179	494	
		36.7%	20.8%	57.5%	
	31 - 40	120	68	188	
		14.0%	7.9%	21.9%	
	41 - 50	72	36	108	
	8.4%	4.2%	12.6%		
51 - 60		27	6	33	
		3.1%	0.7%	3.8%	
		2	3	5	
more than 60		0.2%	0.3%	0.6%	
marital status	Single	275	150	425	0.609
		32.0%	17.5%	49.5%	
	Married	253	136	389	
		29.5%	15.8%	45.3%	
	Divorced	28	12	40	
	3.3%	1.4%	4.7%		
widow		2	3	5	
	0.2%	0.3%	0.6%		
Gender	Male	56	17	73	0.028
		6.5%	2.0%	8.5%	
	Female	502	284	786	
		58.4%	33.1%	91.5%	
Nationality	Saudi	534	280	814	0.093
		62.2%	32.6%	94.8%	
	Non-Saudi	24	21	45	
		2.8%	2.4%	5.2%	
Educational level	primary	3	1	4	0.011
		0.3%	0.1%	0.5%	
	middle	3	8	11	
		0.3%	0.9%	1.3%	
	secondary	92	45	137	
		10.7%	5.2%	15.9%	
Bachelor's		428	216	644	0.004
		49.8%	25.1%	75.0%	
	Master's	22	17	39	
		2.6%	2.0%	4.5%	
	PhD	10	14	24	
		1.2%	1.6%	2.8%	
	Baha	4	2	6	
		0.5%	0.2%	0.7%	
Region	Jouf	0	7	7	0.004
		0.0%	0.8%	0.8%	
		28	56	84	

Riyadh	3.3%	6.5%	9.8%
Al-Qassim	1	10	11
AL Madinah AL Munawwarah	0.1%	1.2%	1.3%
Eastern Province	9	13	22
Tabuk	1.0%	1.5%	2.6%
Jizan	30	28	58
Hail	3.5%	3.3%	6.8%
Aseer	5	5	10
Mecca	0.6%	0.6%	1.2%
Najran	5	4	9
	0.6%	0.5%	1.0%
	20	67	87
	2.3%	7.8%	10.1%
	4	11	15
	0.5%	1.3%	1.7%
	194	355	549
	22.6%	41.3%	63.9%
	1	0	1
	0.1%	0.0%	0.1%

Table 4. Association between participants' attitude towards G6PD with their sociodemographic characteristics (n=859)

		Attitude towards G6PD		Total (N=859)	P value
		Negative	Good		
Age	less than 20	10	21	31	0.001
		1.2%	2.4%	3.6%	
	20 - 30	195	299	494	
		22.7%	34.8%	57.5%	
	31 - 40	108	80	188	
		12.6%	9.3%	21.9%	
	41 - 50	54	54	108	
	6.3%	6.3%	12.6%		
more than 60		17	16	33	
		2.0%	1.9%	3.8%	
		2	3	5	
Marital status	Single	161	264	425	0.001
		18.7%	30.7%	49.5%	
	Married	194	195	389	
		22.6%	22.7%	45.3%	
	Divorced	29	11	40	
	3.4%	1.3%	4.7%		
widow		2	3	5	
		0.2%	0.3%	0.6%	
		47	26	73	
Gender	Male	5.5%	3.0%	8.5%	0.001
	Female	339	447	786	
Nationality	Saudi	39.5%	52.0%	91.5%	0.707
		42.7%	52.0%	94.8%	
	Non-Saudi	19	26	45	
Educational level	primary	2.2%	3.0%	5.2%	0.361
	middle	1	3	4	

		0.5%	0.8%	1.3%	0.001
	secondary	68	69	137	
		7.9%	8.0%	15.9%	
	Bachelor's	291	353	644	
		33.9%	41.1%	75.0%	
	Master's	12	27	39	
		1.4%	3.1%	4.5%	
	PhD	10	14	24	
		1.2%	1.6%	2.8%	
	Baha	1	5	6	
		0.1%	0.6%	0.7%	
	Jouf	7	0	7	
		0.8%	0.0%	0.8%	
	Riyadh	42	42	84	
		4.9%	4.9%	9.8%	
	Al-Qassim	7	4	11	
		0.8%	0.5%	1.3%	
	AL Madinah AL Munawwarah	10	12	22	
		1.2%	1.4%	2.6%	
	Eastern Province	18	40	58	
		2.1%	4.7%	6.8%	
	Tabuk	4	6	10	
		0.5%	0.7%	1.2%	
	Jizan	3	6	9	
		0.3%	0.7%	1.0%	
	Hail	58	29	87	
		6.8%	3.4%	10.1%	
	Aseer	8	7	15	
		0.9%	0.8%	1.7%	
	Mecca	228	321	549	
		26.5%	37.4%	63.9%	
	Najran	0	1	1	
		0.0%	0.1%	0.1%	

Table 5. Association between participants' practice towards G6PD with their sociodemographic characteristics (n=859)

		Practice towards G6PD		Total (N=859)	P value
		Poor	Good		
Age	less than 20	27	4	31	0.057
		3.1%	0.5%	3.6%	
	20 - 30	423	71	494	
		49.2%	8.3%	57.5%	
	31 - 40	145	43	188	
		16.9%	5.0%	21.9%	
	41 - 50	93	15	108	
	10.8%	1.7%	12.6%		
more than 60		31	2	33	
		3.6%	0.2%	3.8%	
		4	1	5	
Marital status	Single	0.5%	0.1%	0.6%	0.001
		395	30	425	
		46.0%	3.5%	49.5%	
	Married	292	97	389	
		34.0%	11.3%	45.3%	
Divorced	31	9	40		
	3.6%	1.0%	4.7%		

	widow	5	0	5	
		0.6%	0.0%	0.6%	
Gender	Male	60	13	73	0.629
		7.0%	1.5%	8.5%	
	Female	663	123	786	
		77.2%	14.3%	91.5%	
Nationality	Saudi	684	130	814	0.637
		79.6%	15.1%	94.8%	
	Non-Saudi	39	6	45	
		4.5%	0.7%	5.2%	
Educational level	primary	3	1	4	0.739
		0.3%	0.1%	0.5%	
	middle	11	0	11	
		1.3%	0.0%	1.3%	
	secondary	114	23	137	
		13.3%	2.7%	15.9%	
	Bachelor's	542	102	644	
		63.1%	11.9%	75.0%	
	Master's	32	7	39	
	3.7%	0.8%	4.5%		
PhD	21	3	24		
	2.4%	0.3%	2.8%		
Baha	2	4	6		
	0.2%	0.5%	0.7%		
Jouf	7	0	7		
	0.8%	0.0%	0.8%		
Riyadh	68	16	84		
	7.9%	1.9%	9.8%		
Al-Qassim	8	3	11		
	0.9%	0.3%	1.3%		
AL Madinah AL Munawwarah	21	1	22		
	2.4%	0.1%	2.6%		
Eastern Province	44	14	58		
	5.1%	1.6%	6.8%		
Region	Tabuk	9	1	10	0.010
		1.0%	0.1%	1.2%	
Jizan	8	1	9		
	0.9%	0.1%	1.0%		
Hail	68	19	87		
	7.9%	2.2%	10.1%		
Aseer	13	2	15		
	1.5%	0.2%	1.7%		
Mecca	474	75	549		
	55.2%	8.7%	63.9%		
Najran	1	0	1		
	0.1%	0.0%	0.1%		

According to our study results, 65% of participants had good knowledge scores and 35% had poor knowledge scores. Attitude score shows that 55% of participants had negative attitudes and 45% had positive attitudes. Practice score was reported as 15.8% had a good practice and 84.2% had bad practice. This was consistent with a prior study that indicated inadequate KAP towards the illness [7], which is in accordance with findings from Goodman *et al.* in Nigeria and Alfouwais *et al.* in Saudi Arabia. Al-Joborae [11] in Iraq and Al Arrayed *et al.* [6] showed that mothers had a fair amount of knowledge of G6PD deficiency, which is in contrast to the findings of this study. In contrast to Allahony *et al.*'s [12] report that only 18.9% of mothers had good knowledge,

48.0% had good attitudes, and only 25.3% had good practice towards NNJ, the results of the [7] study indicated some improvement in the level of knowledge. These findings reflect the impact of the health education provided to the mothers in their study and also demonstrate the urgent need for more thorough and targeted health education. The findings of this study, which concur with those of Saadat *et al.* [13] and Rabiepoor *et al.* [14] in Iran, indicated that infection, preterm, and ABO incompatibility were risk factors for hyperbilirubinemia. Hamali *et al.* [15] reported that the knowledge level was acceptable. Additionally, among the five regions of Saudi Arabia, the northern region's moms showed the highest level of knowledge (52%), while the western region's mothers demonstrated the lowest level of knowledge (21.4%) [16].

In this study, 54.7% of our participants heard of G6PD. According to a previous study, the majority of mothers (95.9%) were unaware of the phrase "G6PD deficiency" [7]. This contradicts the findings of Al-Joborae, who reported that roughly 91% of mothers in Iraq were aware of the condition. The most frequent word for fava bean anemia in Egypt is "Fava G6PD," hence in our study, 23% of moms had heard of the condition while only 4.1% were familiar with the phrase "G6PD deficiency anemia." According to a study conducted in Bahrain by Al Arrayed and Al Hajeri [6], all mothers were aware that fava beans can cause an incident of hemolysis due to G6PD deficiency. About 40% of mothers believed that medications may cause hemolysis in this study [7], which is contradictory to the findings of Almuahini *et al.* [17]. According to the current study, all moms have heard of NNJ, and over 70% of them said that prematurity is a contributing factor in its incidence. This outcome is congruent with research done in Saudi Arabia by Magfour *et al.* [18]. The fact that the disease is most frequently referred to as fava G6PD in Saudi Arabia can be explained by the fact that the majority of the mothers (71%) had never heard of the term G6PD deficiency while only 29% had never heard of the phrase fava G6PD [16]. This was also noted in a study carried out in the Jazan area by Hamali *et al.*, [15].

Males with a favorable family history or consanguineous parents are the only people who experience G6PD deficiency, an X-linked genetic disorder. In our study, 50.9% of participants believe it is a genetic disorder. Consanguinity and a family history of G6PD deficiency were reported in their sample population, respectively, by 21.1% and 29.6% of people, according to Kasemy *et al.* [7]. The same is true of the 510 newborns and kids who took part in the study conducted by Julien Didier Adedemy *et al.* [19], 20.4% of whom were born to consanguineous parents. According to the findings of Hamali *et al.* [15], 80% of the participants were uninformed of their risk factors, but around half of the mothers of participants denied knowing these risk factors. However, the majority of the mothers (54.8%) [16] and a comparable percentage (57.8%) [15] were found to recognize the consumption of fava beans as a trigger for the attacks. Al-Suwaid *et al.* [20] found that 87% of the participants were

sufficiently aware of the risk that beans could cause hemolysis in a person with G6PD deficiency. Unfortunately, only one-third of the participants were aware that exposure to an oxidative treatment can cause acute hemolysis. This percentage is slightly higher, at 43% and 40%, according to Alarrayed and AlHajeri [6] and Kasemy *et al.*, [7], correspondingly.

According to our findings, 39% of participants reported that pallor is a sign of G6PD. 33.5% reported that diarrhea, loss of appetite, nausea, and vomiting are signs of G6PD. 38.5% reported that G6PD can cause dizziness. Pallor was the most often reported symptom, followed by dizziness, shortness of breath, and jaundice, according to a prior study. Only a small percentage of people disagreed that diarrhea, loss of appetite, nausea, and vomiting were signs of G6PD [14]. These results are consistent with those of Hamali *et al.*, [15]. They also agree with Alarrayed and AlHajeri's [6] study on the order of signs and symptoms, even though their group had a better awareness level as shown by more significant percentages of those who were able to identify each sign and symptom. As opposed to Almuahini *et al.* [17] and Kasemy *et al.* [7], the majority of patients did not recognize pallor and other symptoms.

Our study indicates that 21.7% of participants reported that G6PD can cause jaundice. Knowledge score of G6PD was significantly associated with gender, educational level, and residency region in Saudi Arabia. According to a prior study, 68.6% and 25% of mothers, respectively, were able to find signs of jaundice in their newborns' skin and sclera [7]. These results support those discovered by Aggarwal *et al.* [21] in India. The study was conducted on a narrowly curated group of mothers to assess their KAP. The majority of the participants in the study were first-time moms of newborns who had jaundice, therefore it appeared to us that the group was representative of the general community. In addition, because the study was based on participant experience, the group effectively spread the health education message. Mothers demonstrated a somewhat more favorable impression of jaundice than G6PD deficiency [7]. This is consistent with the outcomes that Boo *et al.* [3] reported in Malaysia.

CONCLUSION

The study shows that the Saudi population had generally poor knowledge, attitude, and practice toward G6PD. Knowledge score of G6PD was significantly associated with gender, educational level, and residency region in Saudi Arabia. However, attitude was significantly associated with age, marital status, and gender while practice score towards G6PD was significantly associated with marital status only. To promote better and earlier detection, the appropriate time for treatment, and better prevention of the triggering factors, a broad health education program on both of these disorders is required.

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REFERENCES

1. Almutairi MKO, Alsayyid AAH, Abo El-Fetoh NM. Glucose-6-Phosphate Dehydrogenase Deficiency (G6PD) (Favism) in Dammam, Eastern Province of Saudi Arabia. *Egypt J Hosp Med.* 2018;70(5):713-7.
2. Gad El-Bastwese RM, Mahmoud Sabea MT, Elsamanoudy MI. Health Education Program for Mothers Their Children Diagnosed with Favism. *Assiut Sci Nurs J.* 2020;8(23):67-75.
3. Boo NY, Gan CY, Gian YW, Lim KS, Lim MW, Krishna-Kumar H. Malaysian mothers' knowledge & practices on care of neonatal jaundice. *Med J Malaysia.* 2011;66(3):239-43.
4. Gad Soliman Ebrahem G, Mustafa Abu Samra O, Abdelgawad Said D, Salah Shalaby Salama E. Effect of Family-centered Empowerment Model on Knowledge and Stress Level among Mothers of Children with Glucose-6-Phosphate Dehydrogenase Enzyme Deficiency. *Egypt J Health Care.* 2021;12(2):1019-32.
5. Patel S, Padhi P, Priya R, Naik T, Nanda R, Mohapatra E. A cross-sectional study on parental awareness for newborn screening and assessment of the burden of congenital hypothyroidism and glucose 6-phosphate dehydrogenase deficiency. *Indian J Community Med Fam Med.* 2020;6(2):132.
6. Al Arrayed S, Al Hajeri A. Public awareness of glucose-6-phosphate dehydrogenase (G6PD) deficiency. *Bahrain Med Bull.* 2011;33(3):147-9.
7. Kasemy ZA, Bahbah WA, El Hefnawy SM, Alkalash SH. Prevalence of and mothers' knowledge, attitude and practice towards glucose-6-phosphate dehydrogenase deficiency among neonates with jaundice: a cross-sectional study. *BMJ Open.* 2020;10(2):e034079.
8. Alfouwais NM, Seada LS, Alahmadi RY, Alassiri AA, Alenazi AA, Aljuaeed MS. Assessment of knowledge, attitude and practice of Saudi parents towards neonatal jaundice (NNJ): A cross-sectional study. *Egypt J Hosp Med.* 2018;70(9):1686-94.
9. Seneadza NAH, Insaideo G, Boye H, Ani-Amponsah M, Leung T, Meek J, et al. Neonatal jaundice in Ghanaian children: Assessing maternal knowledge, attitude, and perceptions. *PLoS One.* 2022;17(3):e0264694.
10. Goodman OO, Kehinde OA, Odugbemi BA, Femi-Adebayo TT, Odusanya OO. Neonatal jaundice: knowledge, attitude and practices of mothers in Mosan-Okunola community, Lagos, Nigeria. *Niger Postgrad Med J.* 2015;22(3):158-63.
11. Al-Joborae SF. Extent of knowledge of mothers of neonates with G6PD deficiency in Hilla City. *High Educ.* 2015;60(114):114.
12. Allahony DM, Hegazy NN, Kasemy ZA, Bahgat EM. Mothers' perception toward neonatal jaundice in Kafr El-batanon village, Menoufia, Egypt. *Menoufia Med J.* 2016;29(3):743.
13. Saadat SH, Naderi S, Zare S, Khalili S, Darban B, Goodarzi R. Epidemiologic study of jaundice in newborns with jaundice in the first 24 hours of birth in children's hospital and Shariati hospital of Bandar Abbas in 2010-2014. *J Res Med Dent Sci.* 2018;6(1):113-7.
14. Rabiyeepoor S, Gheibi S, Jafari S. To study the knowledge and attitude of postnatal mothers on neonatal jaundice in Motahari Hospital, Iran. *Clinical Med Res.* 2014;3(3):1-5.
15. Hamali HA, Muasbil AA, Otaif TH, Qahtani MK, Saboor M, Dobie G, et al. Public knowledge and awareness toward glucose-6-phosphate dehydrogenase deficiency in Jazan region. *King Khalid Uni J Health Sci.* 2022;7(1):52-8.
16. Alqahtani T, Alzahrani A, Alhasawi R, Alqarehi R, Alamer LA, Alotiby A. Saudi mothers' knowledge, attitude and practice towards glucose 6 phosphate dehydrogenase deficiency: A cross-sectional study. *Med Sci.* 2022;26(129):1-9.
17. Almuahini MS, Alruzayhi MK, Alwassel AI. Public awareness of glucose-6-phosphate dehydrogenase (G6PD) Deficiency Causes and Prevalence Factors. *J Middle East North Afr Sci.* 2018;20(2):15-8.

18. Magfour H, Aqeel A, Maashi A, Maghfuri N, Jarad R, Kathiah AA, et al. Mothers' perception of neonatal jaundice in Jazan region, KSA. *J Clin Neonatol.* 2019;8(2):116-9.
19. Adedemy JD, Gomina M, Agossou J, Noudamadjo A, Yerima EM, Adeothy-Koumakpaï S. Prevalence of glucose 6 phosphate dehydrogenase deficiency among infants and children of Parakou, Benin. *Curr Pediatr Res.* 2015;19(1&2):58-65.
20. Al-Suwaid HA, Darwish MA, Sabra AA. Knowledge and misconceptions about sickle cell anemia and glucose-6-phosphate dehydrogenase deficiency among adult sickle cell anemia patients in al Qatif Area (eastern KSA). *Int J Med Public Health.* 2015;5(1):86. doi:10.4103/2230-8598.151269
21. Aggarwal B, Agrawal A, Chaudhary P, Gupta G, Rana S, Gupta S. Neonatal Jaundice: Knowledge, attitude beliefs, and practices of postnatal mothers in a tertiary care hospital in Uttarakhand, India. *Indian J Child Health.* 2017;4(4):603-8.