

3 ORIGINAL ARTICLE

4 Assessment of community knowledge
5 about G6PD deficiency in Madinah
6 Munawwarah, Saudi Arabia

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10 ABSTRACT

11 **Background:** Glucose-6-phosphate dehydrogenase (G6PD) deficiency is a common hemolytic enzyme disorder
12 posing a significant public health concern in Saudi Arabia. Despite inclusion in the national newborn screening
13 program, community awareness in Madinah Munawwarah remains underexplored.

14 **Objectives:** To assess community knowledge of G6PD deficiency in Madinah and identify factors associated
15 with low awareness.

16 **Methods:** A descriptive cross-sectional study was conducted among 436 adults in Madinah using a 24-item
17 validated electronic questionnaire. Knowledge was scored as good/fair (>50%) or poor (≤50%). Descriptive
18 statistics, chi-square tests, multivariate logistic regression, and stepwise regression were applied ($p < 0.05$).

19 **Results:** Knowledge levels were low, with 78.4% of participants having poor knowledge and 21.6% having
20 good/fair knowledge. Awareness of triggers was limited: henna (5.7%), naphthalene (12.6%), and menthol
21 (9.2%). Chronic fatigue was incorrectly identified as a clinical symptom (8.9%). Multivariate analysis identified
22 four predictors of higher knowledge: age 21-30 years (odds ratio [OR] = 2.25), female gender (OR = 2.10),
23 medical profession (OR = 5.15), and prior exposure to information on genetic blood disorders (OR = 3.96).
24 Education, income, nationality, marital status, and family history were not statistically significant predictors.

25 **Conclusions:** Community awareness about G6PD deficiency in Madinah is insufficient. While younger adults,
26 females, and medical practitioners demonstrate higher knowledge, the general population remains at risk.
27 These findings underscore the urgent need for structured educational programs and public health campaigns
28 to enhance awareness and reduce hemolysis complications.

29 **Keywords:** Glucose-6-phosphate dehydrogenase deficiency, G6PD deficiency, Community Knowledge,
30 Hemolytic anemia, public health awareness, Madinah Munawwarah.

31 Introduction

32 Glucose-6-phosphate dehydrogenase (G6PD) deficiency
33 is the most common red blood cell (RBC) enzyme
34 deficiency, affecting up to 400 million people worldwide
35 [1]. It is highly prevalent in Saudi Arabia [2], is included
36 in the national newborn screening program [3], and has a
37 reported prevalence of approximately 8.4% among Saudi
38 males [4]. G6PD deficiency is an inherited X-linked
39 recessive disorder with more than 400 biochemical
40 variants identified [5], including approximately 200
41 pathogenic variants, predominantly missense mutations
42 [6]. Males are affected when they inherit a pathogenic
43 variant from their mothers, while females typically require
44 biallelic pathogenic variants to manifest the disease;

45 hemolysis may also occur in some heterozygous females
46 due to lyonization [7]. G6PD is essential for maintaining
47 RBC integrity, particularly during oxidative stress [8].
48 Although most individuals with G6PD deficiency are
49 asymptomatic, neonates may develop jaundice [9],

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Received: 26 August 2026 | **Accepted:** 28 September 2026



54 and oxidative stress from illness or other exposures
55 can precipitate acute hemolysis [10]. Recognized
56 triggers include fava beans, certain medications, henna
57 compounds, pesticides, and other oxidative agents
58 [11]. Acute attacks following fava bean ingestion may
59 present with fever, chills, nausea, headache, jaundice,
60 and hemoglobinuria and may require hospitalization and
61 blood transfusion in severe cases [12].

62 Previous Saudi studies have documented important gaps
63 in awareness of G6PD deficiency. A cross-sectional study
64 conducted in three governmental hospitals in Riyadh
65 reported low knowledge and notable misconceptions
66 [13]. Shash et al. similarly described misconceptions and
67 disparities in parental awareness in the Eastern Province
68 [14], while Alblewi et al. reported regional differences in
69 parental knowledge across Saudi Arabia [15]. However,
70 these studies primarily focused on parents or selected
71 populations, leaving community-level knowledge in
72 Madinah Munawwarah underexplored.

73 Given the high prevalence and preventable complications
74 of G6PD deficiency, assessing local community
75 knowledge may help identify educational needs and
76 guide targeted public health interventions. Localized
77 data may also help healthcare providers tailor awareness
78 efforts to community needs. Therefore, this study
79 aimed to characterize community awareness of G6PD
80 deficiency in Madinah Munawwarah and identify key
81 factors influencing knowledge levels.

82 Methodology

83 Study Design and Sampling

84 This descriptive, cross-sectional study included 436
85 adults in Madinah, Saudi Arabia. We used an electronic
86 questionnaire containing 24 knowledge items to assess
87 community knowledge about G6PD deficiency among
88 residents. Our target population for this study was the
89 general population aged 18 years and older residing in
90 Madinah, Saudi Arabia. The electronic questionnaire
91 was distributed through various social media platforms,
92 including Twitter, Instagram, Facebook, and WhatsApp.
93 The questionnaire was developed from a literature
94 review, reviewed by experts in the field, and pilot-tested
95 with a small sample from the target population to ensure
96 clarity and appropriate timing. Minor modifications were
97 made based on the feedback received. We collected the
98 data from April 2025 to July 2025. The sample size was
99 calculated using a 5% margin of error, a 95% confidence
100 interval (CI), and an anticipated proportion of 50%. A
101 minimum sample size of 384 was estimated using the
102 formula $n = Z^2 p(1-p)/d^2$, where n represents the required
103 sample size, Z is 1.96 for a 95% CI, p is the anticipated
104 proportion (0.50), and d is the margin of error (0.05). The
105 final sample size with a 10% buffer was 422. A total of
106 436 participants were ultimately included in the analysis,
107 exceeding the minimum required sample size. A non-
108 probability convenience sampling method was used to
109 recruit eligible participants.

Assessment of knowledge

Knowledge was assessed using 24 questions with answer
options of “yes,” “no,” and “I do not know”. For analysis,
the “I do not know” responses were treated as incorrect.
Each correct answer was assigned a score of 1, and
each incorrect answer a score of 0. The total knowledge
scores were categorized into two levels: good/fair (>50%
correct) and poor (≤50% correct).

Statistical analysis

Data analysis was performed using the Statistical
Package for the Social Sciences (SPSS Inc., version
22.0, Chicago, IL). Descriptive statistics, including
frequencies and percentages, were used to summarize
the data. Participants’ knowledge of G6PD deficiency
was calculated and compared across demographic
characteristics using the chi-squared test. Multivariate
logistic regression was used to estimate odds ratios
(ORs) and 95% confidence intervals (CIs) for the
association between knowledge levels and the factors
studied. To identify the most important predictors of
good/fair knowledge among the participants, a stepwise
regression analysis was performed, with p-values of 0.10
for inclusion and 0.20 for exclusion. A p-value < 0.05
was considered statistically significant.

Results

The study analyzed data from 436 participants in Madinah
Munawwarah, Saudi Arabia. Their sociodemographic
and background characteristics are presented in Table
1. The age distribution shows that most participants
were between 21 and 30 years old (44.3%), followed by
those aged 18-20 years (16.7%), 41-50 years (14.0%),
over 50 years (13.5%), and 31-40 years (11.5%).
Most participants were female (80.0%) and of Saudi
nationality (92.4%). Regarding educational level, 65.4%
had a university degree or higher, while 34.6% had a
secondary level of education or less. In terms of monthly
family income, 40.1% earned between 8,000 and 15,000
SR, 31.0% earned less than 8,000 SR, and 28.9% earned
more than 15,000 SR. Over half of the participants were
single (53.2%), 43.3% were married, and 3.4% were
divorced or widowed. Nearly all participants resided
in Madinah Munawwarah City (96.6%), while small
proportions lived in other cities within the province.
Medical practitioners comprised 27.8% of the sample,
while 72.2% were non-medical practitioners. A family
history of genetic diseases was reported by 20.4% of
participants, and 52.5% reported having previously
received information about genetic blood disorders.

The prevalence of good/fair knowledge was 21.6%,
while 78.4% demonstrated poor knowledge (Figure 1).

Table 1. Characteristics of the studied participants

Characteristics	N = 436
Age in years	
18-20	73 (16.7%)
21-30	193 (44.3%)
31-40	50 (11.5%)
41-50	61 (14.0%)
>50	59 (13.5%)
Sex	
Male	87 (20.0%)
Female	349 (80.0%)
Nationality	
Saudi	403 (92.4%)
Non-Saudi	33 (7.6%)
Educational level	
Secondary and less	151 (34.6%)
University and higher	285 (65.4%)
Monthly family income (Saudi Riyal (SR))	
<8000	
8000-15000	135 (31.0%)
>15000	175 (40.1%)
	126 (28.9%)
Marital status	
Single	232 (53.2%)
Married	189 (43.3%)
Divorced/Widow	15 (3.4%)
Residence	
Madinah City	421 (96.6%)
Other Cities*	15 (3.4%)
Medical practitioner	
Yes	121 (27.8%)
No	315 (72.2%)
Family history of genetic diseases	
Yes	89 (20.4%)
No	347 (79.6%)
Ever received information about genetic blood diseases	
Yes	229 (52.5%)
No	207 (47.5%)

*Eight from Yanbu, two from Al-Hanakiyah, two from Al-Ais, two from Al-Mahd, and one from Khaybar

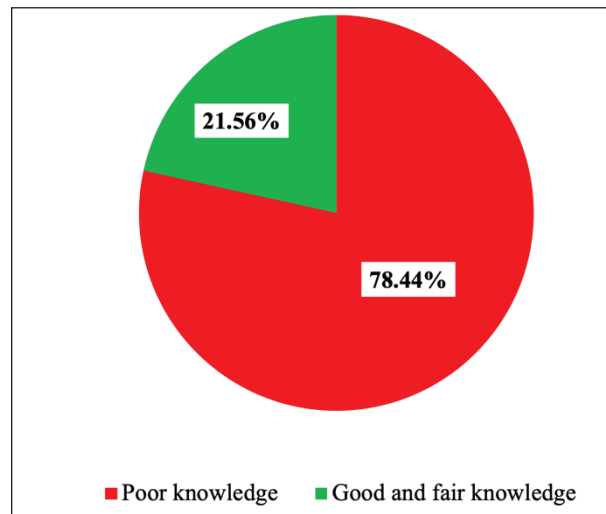


Fig. 1. Percent distribution of participants' knowledge about G6PD deficiency (n = 436)

Table 2. Frequency distribution of correct answers about G6PD deficiency among the studied participants (n = 436)

Questions	Correct answer n (%)
Ever heard of Glucose-6-phosphate dehydrogenase (G6PD) deficiency (favism)	247 (56.7)
G6PD deficiency (Favism) is an inherited genetic disorder.	197 (45.2)
G6PD deficiency is significantly more common in males than in females	108 (24.8)
Can G6PD deficiency affect females?	142 (32.6)
Is G6PD deficiency part of the Saudi newborn screening program?	108 (24.6)
Can G6PD deficiency be transmitted from one person to another through infection?	243 (55.7)
Is G6PD deficiency more common in certain ethnicities and families?	161 (36.9)
The physician may need to repeat the test for G6PD deficiency to confirm the diagnosis?	197 (45.2)
Can certain medications trigger hemolysis in individuals with G6PD deficiency?	203 (46.6)
Can fava beans (broad beans) trigger symptoms in people with G6PD deficiency?	199 (45.6)
Can infection worsen symptoms of G6PD deficiency?	119 (27.3)
Does a patient with G6PD deficiency have to cut all types of legumes, even in small portions?	51 (11.7)
Can some antibiotics like sulfonamides trigger symptoms in patients with G6PD deficiency?	102 (23.4)
Should individuals with G6PD deficiency avoid high doses of aspirin?	90 (20.6)
Does exposure to henna trigger symptoms in individuals with G6PD deficiency?	25 (5.7)

The frequency distribution of correct responses to questions assessing participants' knowledge about G6PD deficiency is shown in Table 2. More than half of the participants (56.7%) had heard of G6PD deficiency. Similarly, (55.7%) were aware that it is not transmitted through infection. Correct responses to several knowledge items ranged between 20% and 47%, including those related to its genetic nature (45.2%), the need for confirmatory testing (45.2%), the effect of certain medications (46.6%), and the role of fava beans as a trigger (45.6%).

A smaller proportion recognized that the disorder is more common in males (24.8%), that certain antibiotics may provoke symptoms (23.4%), and that individuals with the condition should avoid high doses of aspirin (20.6%).

Questions	Correct answer n (%)
Does repeated exposure to naphthalene trigger symptoms in individuals with G6PD deficiency?	55 (12.6)
Does menthol trigger symptoms in individuals with G6PD deficiency?	40 (9.2)
Is chronic fatigue a common symptom of G6PD deficiency?	39 (8.9)
Can the yellowing of the skin and eyes (jaundice) be a symptom of G6PD deficiency?	174 (39.9)
Can dark-colored urine be a symptom of G6PD deficiency?	148 (33.9)
Do patients with G6PD deficiency have chronic severe symptoms?	26 (6.0)
Can the condition lead to severe anemia during certain triggers requiring blood transfusion?	188 (43.1)
Do all people with G6PD deficiency require lifelong medication?	81 (18.6)
Is G6PD deficiency a life-threatening condition in all cases?	118 (27.1)

included avoiding all types of legumes (11.7%), the effect of henna exposure (5.7%), naphthalene (12.6%), menthol (9.2%), and chronic fatigue as a symptom (8.9%); and only 6.0% were aware that patients with G6PD deficiency do not experience chronic severe symptoms, while 18.6% identified that lifelong medication is not required.

The comparison of participants' levels of knowledge about G6PD deficiency by demographic and background characteristics is presented in Table 3. Participants aged 21–30 years represented the largest proportion among those with good/fair knowledge (32.1%), followed by those aged 31–40 years (22.0%) and 18–20 years (17.8%), with a statistically significant difference across age groups ($p < 0.0001$). Females accounted for 23.8% of those with good/fair knowledge, compared with 12.6% among males, indicating a significant association between knowledge level and sex ($p = 0.02$).

Regarding monthly family income, 28.6% of participants

Table 3. Comparison of the participants studied according to their level of knowledge and the associated factors

Factors	Good/ fair knowledge (n= 94)	Poor knowledge (n= 342)	P value
Age in years			
18-20	13 (17.8)	60 (82.2)	
21-30	62 (32.1)	131 (67.9)	
31-40	11 (22.0)	39 (78.0)	
41-50	5 (8.2)	56 (91.8)	
>50	3 (5.1)	56 (94.9)	<.0001*
Sex			
Male	11 (12.6)	76 (87.4)	
Female	83 (23.8)	266 (76.2)	0.02*
Nationality			
Saudi	88 (21.8)	315 (78.2)	
Non-Saudi	6 (18.2)	27 (81.8)	0.62
Educational level			
Secondary and less	40 (26.5)	111 (73.5)	
University and higher	54 (18.9)	231 (81.1)	0.06
Monthly family income (SR)			
<8000	28 (20.7)	107 (79.3)	
8000-15000	30 (17.1)	145 (82.9)	
>15000	36 (28.6)	90 (71.4)	0.05*
Marital status			
Single	68 (29.3)	164 (70.7)	
Married	25 (13.2)	164 (86.8)	
Divorced/Widow	1 (6.7)	14 (93.3)	<.0001*
Residence			
Madinah City	89 (21.1)	332 (78.9)	
Other Cities	5 (33.3)	10 (66.7)	0.26
Medical practitioner			
Yes	60 (49.6)	61 (50.4)	
No	34 (10.8)	281 (89.2)	<.0001*
Family history of genetic diseases			
Yes	24 (27.0)	65 (73.0)	
No	70 (20.2)	277 (79.8)	0.19
Ever received information about genetic blood diseases			
Yes	79 (34.5)	150 (65.5)	
No	15 (7.2)	192 (92.8)	<.0001*

*Significant

Notably, fewer than 20% of participants answered correctly on several items, indicating particularly low awareness of certain aspects of the disease. These

with higher income (>15,000 SR) demonstrated good/fair knowledge, compared with 17.1% among those with

middle income (8,000-15,000 SR) and 20.7% among those with lower income (<8,000 SR), with a significant difference ($p = 0.05$). Marital status was also significantly related to knowledge level ($p < 0.0001$), with single participants accounting for 29.3% of those with good/fair knowledge.

Nearly half of medical practitioners (49.6%) had good/fair knowledge, compared with 10.8% among non-medical practitioners, indicating a strong, significant association ($p < 0.0001$). Similarly, a significant relationship was observed between prior receipt of information about genetic blood diseases and knowledge level ($p < 0.0001$), with 34.5% of informed participants demonstrating good/fair knowledge, compared with 7.2% among those who had not received such information.

The results of the multivariate logistic regression analysis examining the factors independently associated with good/fair knowledge about G6PD deficiency among the studied participants are presented in Table 4. The results of the stepwise regression analysis identifying predictors of good/fair knowledge among the studied participants are shown in Table 5. In the multivariate

Table 4. Adjusted odds ratio for the association of good/fair knowledge with the participants' factors studied: The results of the multivariate logistic regression model

Factors**	OR (95% CI)	P value
Age in years		
18-20	1. (Ref.)	
21-30	2.25 (1.03-5.01)	0.04*
31-40	2.90 (0.75-11.0)	0.12
41-50	0.95 (0.20-4.45)	0.94
>50	0.57 (0.11-3.04)	0.50
Sex		
Male	1. (Ref.)	
Female	2.10 (1.01-4.69)	0.05*
Nationality		
Saudi	1.30 (0.62-3.21)	
Non-Saudi	1.00 (Ref.)	0.20
Educational level		
Secondary and less	1. (Ref.)	
University and higher	0.85 (0.45-1.60)	0.61
Monthly family income (SR)		
<8000	1. (Ref.)	
8000-15000	0.71 (0.35-1.45)	0.35
>15000	1.75 (0.85-3.60)	0.13
Marital status		
Single	1. (Ref.)	
Married	1.10 (0.40-2.90)	0.89
Divorced/Widow	0.18 (0.01-2.70)	0.21
Residence		
Madinah City	0.45 (0.13-1.53)	
Other Cities	1.00 (Ref.)	0.20
Medical practitioner		
Yes	5.15 (2.71-9.78)	<.0001*
No	1.00 (Ref.)	
Family history of genetic diseases		
Yes	1.80 (0.95-3.54)	0.08
No	1.00 (Ref.)	
Ever received information about genetic blood diseases		
Yes	3.96 (2.05-7.67)	<.0001*
No	1.00 (Ref.)	

*Significant.

**Each factor is adjusted by others in the table.

logistic regression model, significant associations were observed for age, sex, medical profession, and prior receipt of information about genetic blood diseases. In stepwise regression model, age, medical profession, and prior recipient of information about genetic blood diseases remained significant predictors, where sex was not statistically significant. Participants aged 21-30 years were significantly more likely to have good/fair knowledge compared with those aged 18-20 years (OR = 2.25, 95% CI: 1.03-5.01, $p = 0.04$). In multivariate logistic regression model, female participants also had significantly higher odds of good/fair knowledge than males (OR = 2.10, 95% CI: 1.01-4.69, $p = 0.05$).

The most pronounced association was found with professional background. Medical practitioners were more than five times as likely to demonstrate good/fair knowledge compared with non-medical participants (OR = 5.15, 95% CI: 2.71-9.78, $p < 0.0001$). In addition, participants who had previously received information about genetic blood diseases were nearly four times more likely to have good/fair knowledge (OR = 3.96, 95% CI: 2.05-7.67, $p < 0.0001$).

Other factors, including nationality, educational level, monthly family income, marital status, residence, and family history of genetic diseases, did not show statistically significant associations with knowledge level in the adjusted model.

The study's findings indicate that overall knowledge of G6PD deficiency among participants was low, with fewer than one-quarter demonstrating good/fair knowledge. Age, sex, professional background, and prior exposure to information about genetic blood diseases were significant factors associated with higher knowledge levels. Younger adults (particularly those aged 21-30 years), females, medical practitioners, and individuals who had previously received information about genetic disorders showed significantly greater awareness and

Table 5. Predictors of good/fair knowledge among the participants studied: The results of the stepwise regression model

Predictors	OR (95% CI)	P value
Age in years		
18-20	a. (Ref.)	
21-30	1.95 (1.14-4.10)	0.03*
31-40	2.20 (1.02-6.15)	0.04*
41-50	0.80 (0.24-2.64)	0.71
>50	0.50 (0.12-1.89)	0.29
Sex		
Male	1. (Ref.)	
Female	1.70 (0.80-3.60)	0.18
Medical practitioner		
Yes	4.80 (2.62-8.70)	<.0001*
No	1.0 (Ref.)	
Family history of genetic diseases		
Yes	1.70 (0.90-3.28)	0.10
No	1.0 (Ref.)	
Ever received information about genetic blood diseases		
Yes	3.90 (2.10-7.46)	<.0001*
No	1.0 (Ref.)	

*Significant

285	understanding of G6PD deficiency. In contrast, other	low awareness, with critical gaps in disease inheritance,	344
286	sociodemographic characteristics such as nationality,	triggers, and preventive measures. Multivariable analysis	345
287	education level, marital status, and income did not	identified several factors associated with better knowledge,	346
288	significantly influence knowledge levels.	particularly among younger adults, female sex, medical	347
289	Discussion	practitioners, and those previously exposed to genetic	348
290	This study identified substantial gaps in community	health information. Collectively, these results highlight	349
291	knowledge of G6PD deficiency in Madinah Munawwarah.	important public health knowledge gaps and underscore	350
292	The sample size ($n=436$) exceeded the minimum required,	the need for targeted, evidence-based educational	351
293	and a standardized 24-item questionnaire, multivariate	interventions to improve public understanding of G6PD	352
294	logistic regression, and stepwise regression were used to	deficiency and promote appropriate preventive practices.	353
295	assess knowledge and independent predictors. However,	Future studies should explore the underlying reasons	354
296	the cross-sectional design precludes causal inference,	for the low overall awareness, particularly among non-	355
297	while online data collection may have introduced	medical and older populations. Qualitative research	356
298	selection bias and overrepresented younger, female, and	could help identify barriers to knowledge dissemination	357
299	more educated participants. Self-reported responses may	and effective communication strategies. Longitudinal	358
300	also be subject to recall or social desirability bias.	or interventional studies are recommended to assess	359
301	Only 21.6% of participants demonstrated good/fair	the impact of targeted educational programs, especially	360
302	knowledge, indicating insufficient community awareness.	in schools, universities, and community health settings,	361
303	Key misconceptions included hemolysis triggers such as	on improving public understanding of G6PD deficiency.	362
304	henna, infections, and certain medications [9,16]. Such	Additionally, future research may benefit from including	363
305	knowledge gaps are clinically relevant because failure	diverse population groups across regions to examine	364
306	to recognize common triggers may increase the risk of	cultural and contextual factors that influence genetic	365
307	hemolytic crises [6,8]. Younger participants, females,	health literacy.	366
308	medical practitioners, and those previously exposed	Acknowledgment	367
309	to information demonstrated higher knowledge levels,	For taking the time to complete the study questionnaire,	368
310	suggesting potential groups and factors to consider when	the authors would like to sincerely thank each participant.	369
311	designing educational interventions. These findings are	Additionally, the authors acknowledge all individuals	370
312	consistent with previous Saudi studies reporting persistent	who assisted in conduction of the study.	371
313	misconceptions and gaps in knowledge of inheritance,	Conflict of interests	372
314	triggers, and complications of G6PD deficiency [17,18].	Regarding the publishing of this work, the authors confirm	373
315	This study contributes community-level data from	that they have no conflicts of interest.	374
316	Madinah Munawwarah, where evidence remains limited.	Funding	375
317	Higher knowledge among medical practitioners and	There was no specific grant or financial assistance for this	376
318	individuals previously exposed to health information	study from any governmental or private funding organization.	377
319	further supports the potential value of targeted health	Ethical Approval	378
320	education. The findings have direct clinical and public	Ethical approval was granted by the Taibah University	379
321	health implications. Inadequate awareness may contribute	College of Medicine Scientific Research Ethics Committee via	380
322	to unsafe medication use, delayed presentation during	ORG0008716 - IRB00010413. Date of Decision: 15/02/2025;	381
323	hemolytic episodes, and preventable complications.	Expiration date: 2/8/2025	382
324	Education following newborn screening should therefore	Consent to participate	383
325	emphasize trigger avoidance, safe medications, dietary	Before completing the questionnaire, each	384
326	precautions, and recognition of warning symptoms.	participant provided informed consent electronically.	385
327	Physicians, pharmacists, and primary care providers	The aim of the study was explained to participants prior to	386
328	can reinforce this information during routine care and	their permission, and participation was entirely voluntary.	387
329	counseling [19].	Data Availability	388
330	Further research should investigate barriers to G6PD-	The findings of this study are presented in the article; further	389
331	related health literacy, particularly among older and	data can be requested directly from the corresponding	390
332	non-medical populations. Qualitative and interventional	author.	391
333	studies could identify barriers to effective knowledge	Author details	392
334	dissemination and evaluate whether targeted education	Mohammed A. Zolaly ¹ , Nouf A. Alharbi ² , Dina F. Alnakhli ² ,	393
335	through healthcare facilities, schools, universities, or	Eithar K. Alamri ² , Farah M. Albalawi ² , Ghaday A. Alraddadi ² ,	394
336	newborn screening programs improves knowledge,	Layan J. Alsaqqa ² , Razan M. Albalawi ² , Roaa M. Alraddadi ² ,	395
337	preventive behaviors, and clinical outcomes.	Yusra H. AlAbbasi ²	396
338	Conclusion	1. Professor and Consultant of Paediatrics and Paediatric	397
339	This study provides region-specific findings on	Hematology Oncology, College of Medicine, Taibah	398
340	community knowledge of G6PD deficiency in Madinah	University, Madinah, Saudi Arabia	399
341	Munawwarah based on an online convenience sample.		
342	Despite G6PD deficiency's inclusion in the national		
343	newborn screening program, the findings show overall		

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- Supplementary content (if any) is available online.*
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