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Original Article

Impact of Education Delivered Through Virtual Platforms on the Awareness of Glucose-6-Phosphate Dehydrogenase (G6PD) Deficiency Among Families in Fars Province, Iran

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Abstract

Introduction: Despite the high prevalence of glucose-6-phosphate dehydrogenase (G6PD) deficiency in Iran, public awareness of the disease remains underexplored. This study aimed to evaluate the effect of a virtual educational intervention on parents' awareness of G6PD deficiency in Shiraz, Fars Province.

Methods: This one-group, prospective, quasi-experimental study was conducted on 100 parents of children diagnosed with G6PD deficiency through the neonatal screening program at Shiraz University of Medical Sciences. A researcher-designed checklist was used to assess participants' awareness of G6PD deficiency before and after the educational intervention, delivered via smartphone applications. Statistical analysis was performed to determine the effect of the intervention on participants' knowledge, with results considered significant at $P<0.05$.

Results: Fewer than half of the participants demonstrated sufficient awareness of neonatal G6PD deficiency screening. Before the intervention, participants showed limited awareness of the disease, its manifestations, and foods or drugs to avoid. The educational intervention delivered through virtual platforms significantly improved participants' awareness across all domains ($P<0.001$). The greatest improvements were observed in the domains of general awareness about the disease (mean paired difference = 2.09; SD = 1.33) and disease manifestations (mean paired difference = 2.04; SD = 1.54).

Conclusion: Despite the high prevalence of G6PD deficiency in Iran, public awareness of the condition remains inadequate. Implementing effective educational tools and expanding health education through accessible virtual platforms are essential for increasing awareness and improving disease prevention strategies.

Keywords: Favism, G6PD deficiency, Neonatal screening, Shiraz, Educational intervention

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Introduction

Glucose-6-phosphate dehydrogenase (G6PD) is a key enzyme that protects red blood cells against oxidative damage. G6PD deficiency is an X-linked congenital disorder with diverse clinical manifestations (1). Also known as favism, this condition in newborns increases the risk of hyperbilirubinemia, which can rapidly progress to bilirubin-induced neurologic dysfunction (BIND)(2-4). In addition, several drugs have been linked to acute hemolytic episodes in individuals with G6PD deficiency.

G6PD deficiency is highly prevalent in Africa, Asia, the Mediterranean region, and the Middle East (4). Favism is most commonly associated with the Mediterranean variant of G6PD deficiency (4). According to the World Health Organization (WHO), approximately 7.5% of the global population is carriers of G6PD deficiency, and 2.9% are clinically affected (5). In Iran, the prevalence of G6PD enzyme deficiency ranges between 10% and 14.9%, with the highest rates reported in the northern and southern provinces (8.6–16.4% in the north, 12% in Shiraz, and 19.3% in the southeast) (6). Several studies have confirmed a high prevalence of the condition in various regions of Iran (3, 7, 8). A recent meta-analysis reported that the pooled prevalence of G6PD deficiency among Iranian neonates with jaundice was 7.0%, with a higher prevalence among males than females (12.1% vs. 3.0%) (9).

G6PD deficiency can be effectively managed by preventing hemolysis through the avoidance of oxidative stressors, such as certain drugs and fava beans. However, this preventive approach requires sufficient patient

awareness, which typically develops either after a hemolytic episode or through early screening programs (4). Despite the high prevalence of this disorder in Iran, public awareness regarding G6PD deficiency and neonatal screening remains underexplored.

In the wake of the COVID-19 pandemic, the use of telemedicine and virtual health education has expanded significantly (10). In light of this development, the present study aimed to evaluate the effect of an educational intervention delivered via virtual platforms on parents' awareness of G6PD deficiency in Shiraz, Fars Province.

Methods

Study Design and Setting

This one-group, prospective, quasi-experimental study was conducted in Shiraz, Fars Province, Iran.

Study Population

The study population consisted of parents of children diagnosed with G6PD deficiency through the neonatal screening program at Shiraz University of Medical Sciences from April to May 2025.

Inclusion Criteria

Parents of children diagnosed with G6PD deficiency who owned a smartphone were eligible for inclusion.

Sampling Method

Participants were recruited using a convenience sampling method among parents who visited G6PD screening referral centers in Shiraz between April and May 2025.

Sample Size

The estimated sample size using the formula $n=\frac{\bar{P}(1-\bar{P})(z_{1-\alpha/2}+z_{1-\beta})^2}{(\partial)^2}$ was 37 individuals considering type 1 error = 5%, power of the study = 80%, primary proportion 27% and achieving 50% awareness. However, we recruited 100 individuals.

Data Collection Tool

A researcher-designed checklist was developed to assess participants' awareness about G6PD deficiency and favism before and after the educational intervention. The checklist consisted of two sections: demographic information and awareness domains, including:

- General information about the disease
- Importance of the disease (5 items)
- Risk factors related to disease manifestation (6 items)
- Clinical manifestations of the disease (6 items)
- Prohibited drugs (4 items)
- Prohibited foods (4 items)

Each correct answer received a score of 1, while incorrect answers received a score of 0. The total score for each domain was calculated accordingly. Face and content validity were reviewed and confirmed by a panel of experts. Internal consistency reliability was assessed using Cronbach's alpha, which exceeded 0.60 across all domains.

Educational Intervention

The educational intervention was implemented through multimedia educational packages distributed via commonly used smartphone applications, including WhatsApp and Iranian platforms such as Eitta and Baleh. The educational materials comprised video clips, texts, and images that provided information on G6PD deficiency, disease manifestations, prohibited foods and drugs, and management strategies.

Healthcare providers at G6PD screening facilities informed parents about the availability of these educational materials and assisted interested participants in accessing and using them on their smartphones.

Ethical Considerations

Ethical approval for this study was obtained from the Research Ethics Committee of Shiraz University of Medical Sciences (IR.SUMS.REC.1404.045).

Statistical Analysis

Descriptive statistics, including means and standard deviations for continuous variables (e.g., age of parents and neonates), and frequencies and percentages for categorical variables (e.g., neonate's sex, parental education, history of favism, awareness of screening programs), were calculated. A paired-samples t-test was used to assess the effect of the educational intervention on parents' awareness of G6PD deficiency. Statistical significance was set at $P < 0.05$.

Results

Tables 1 and 2 summarize the demographic characteristics of the study participants. Among the 100 neonates included in the study, 91 (91%) were male. The mean age at G6PD deficiency screening was 4.55 days. The mean ages of mothers and fathers were 31.66 and 36.62 years, respectively. Twenty-two (22%) parents reported having other children previously diagnosed with G6PD deficiency. Forty-one (41%) parents had received education on the importance of neonatal screening, and 47 (47%) were aware of the need to repeat neonatal G6PD screening 120 days after birth.

Figure 1 illustrates the mean (95% CI) parental awareness levels across five domains of G6PD deficiency before and after the educational intervention.

As shown in Table 3, participants' awareness significantly improved in all five domains following the intervention ($P < 0.001$). Before the intervention, the lowest levels of awareness were observed in the domains related to the importance of G6PD deficiency (Mean = 2.81, SD = 1.33)

Table 1. Demographic characteristics of participants (continuous variables)

Characteristics	N	Mean (SD)
Age		
Mother (year)	100	31.66 (6.03)
Father (year)	100	36.62 (5.53)
Neonate (day)	100	27.06 (10.85)
Age at screening (day)	100	4.55 (1.62)

and prohibited drugs (Mean = 2.76, SD = 0.98). Post-intervention analysis indicated a statistically significant increase in awareness across all domains. The greatest improvements were observed in the domains of general awareness about the disease (mean paired difference = 2.09, SD = 1.33) and manifestations of the disease (mean paired difference = 2.04, SD = 1.54), both with $P < 0.001$.

Discussion

This study assessed parental awareness regarding G6PD deficiency and the impact of a virtual educational intervention on improving their understanding of the disease. The findings demonstrated that health education delivered via virtual platforms significantly enhanced parental awareness across all domains, confirming the effectiveness of digital education tools in improving health literacy.

Neonatal screening for G6PD deficiency has been implemented in many countries with a high prevalence of the disorder. The World Health Organization recommends screening all newborns in populations where the prevalence in males is 3–5% or higher (11). Accordingly, neonatal screening programs have been established in non-Western countries such as Central Asia, Eastern Europe, and South Asia (12). In Iran, the national neonatal screening program was piloted in Tehran, Mazandaran, and Fars provinces in 2007, and fully implemented nationwide in 2012 (13). However, a study in Chaharmahal and Bakhtiari Province reported that healthcare providers had only moderate awareness about neonatal screening, which did not effectively improve parents' awareness of the disease or its management (14).

Several studies from different regions of Iran have highlighted the high prevalence of G6PD deficiency and favism. A meta-analysis reported that 6.3% of neonatal jaundice cases in Iran are attributed to G6PD deficiency (15), and another found a pooled prevalence of 7.0% among neonates with jaundice (9). A study in Yazd Province revealed that 35% of neonatal exchange transfusions were due to G6PD deficiency (16). Similarly, studies conducted in Yazd and Qaleh Ganj (central and southern Iran, respectively) confirmed a high prevalence of favism, with a predominance among males (17, 18).

Although the high prevalence of G6PD deficiency poses a significant public health concern, cost-effectiveness studies have shown favorable outcomes for neonatal screening programs. Hatam et al. demonstrated that neonatal screening for favism in Shiraz resulted in an estimated saving of USD 1,088 per patient (19). Likewise, Darbandi et al. found that the cost of screening in Rasht, Gilan Province, was substantially lower than the expenses associated with hospitalization for favism-related complications (12).

Various educational interventions, including face-to-face sessions (20), telehealth education intervention (21),

Table 2. Demographic characteristics of participants (categorical variables)

Characteristics		N (%)
Neonate's gender	Male	91 (91)
	Female	9 (9)
level of education		
Mother	Guidance	9 (9)
	Diploma	31 (31)
	Postgraduate Diploma and Bachelor's Degree	49 (49)
	Master's Degree and Above	11 (11)
Father	Guidance	9 (9)
	Diploma	38 (38)
	Postgraduate Diploma and Bachelor's Degree	38 (38)
	Master's Degree and Above	15 (15)
Favism-related inpatient	Yes	1(1)
	No	99 (99)
Having other children with Favism	Yes	22 (22)
	No	78 (78)
Awareness about the repeating test at the age of 120 days	Yes	47 (47)
	No	53 (53)
Awareness about availability of neonatal screening at the time of pregnancy	Yes	41 (41)
	No	59 (59)

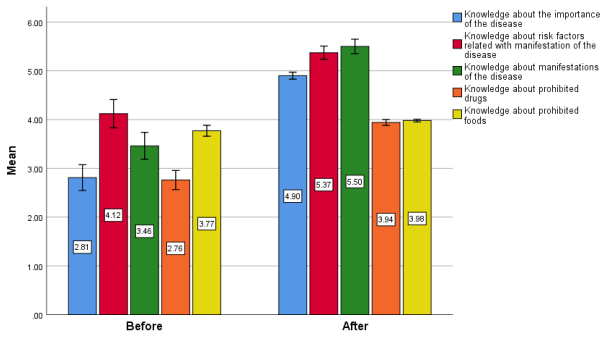

Figure 1. Mean (95% CI) of awareness about 5 aspects of G6PD disease, before and after intervention

Table 3. Effect of educational intervention on parents' awareness about G6PD deficiency

Dimension	Before	After	Paired difference	*P* value
	Mean (SD)	Mean (SD)	Mean (SD)	
Awareness about importance of the disease	2.81 (1.33)	4.90 (0.36)	2.09 (1.33)	<0.001
Awareness about risk factors related to manifestation of the disease	4.12 (1.45)	5.37 (0.69)	1.25 (1.35)	<0.001
Awareness about manifestations of the disease	3.46 (1.39)	5.50 (0.74)	2.04 (1.54)	<0.001
Awareness about prohibited drugs	2.76 (0.98)	3.94 (0.31)	1.18 (0.98)	<0.001
Awareness about prohibited foods	3.77 (0.56)	3.98 (0.14)	0.21 (0.57)	<0.001

video-assisted education (22), have proven effective in enhancing health literacy and promoting screening uptake for various health conditions (23-25). Studies conducted in Egypt also reported low public awareness about G6PD deficiency and favism, emphasizing the positive impact of educational interventions on improving awareness levels (26-28). Similarly, Meloni et al. in Sardinia, Italy, reported that neonatal screening combined with public health education significantly reduced the incidence of favism.(29).

Collectively, these findings highlight the essential role of education in improving awareness and disease management. Nevertheless, evidence on the effectiveness of educational interventions related to G6PD deficiency in Iran remains limited. To the best of our knowledge, the present study is the first comprehensive investigation to assess parental awareness of G6PD deficiency and evaluate the impact of a virtual educational intervention in Iran.

The study's strengths include an adequate sample size, a standardized intervention protocol, and measurement of awareness across domains. However, some limitations should be considered. The study assessed only awareness outcomes and did not evaluate attitudes or practices related to disease management. Additionally, because the intervention relied on smartphone-based delivery, the findings may not be generalizable to populations with limited access to digital technologies. Future studies should explore knowledge, attitudes, and practices comprehensively and compare the effectiveness of various educational modalities to identify the most effective strategy for enhancing public awareness of G6PD deficiency.

Conclusion

Despite the high prevalence of G6PD deficiency in Iran, public awareness about the disease remains inadequate. Expanding health education initiatives through effective tools—whether face-to-face or digital—is essential for improving awareness and reducing disease burden. Virtual education platforms, in particular, offer a cost-effective and scalable approach for promoting health literacy and facilitating early detection and prevention of complications related to G6PD deficiency.

Authors' Contribution

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Availability of Data and Material

The analyzed data during the current study is available from the corresponding author upon reasonable request.

Competing Interests

All authors declare that they have no conflict of interest.

Consent for Publication

Verbal consent for publication was obtained.

Ethical Approval

The study was approved by the Local Ethics Committee of Shiraz University of Medical Sciences (code: IR.SUMS.REC.1404.045). Verbal consent was obtained from participants prior to the initiation of the study.

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