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Does health literacy affect the decision to have gestational diabetes screening test?

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ABSTRACT

Objectives: The main objective of this study is to assess the relationship between the level of Health Literacy and the patient's decision to refuse the Gestational diabetes mellitus screening test.

Methods: This cross-sectional study was conducted at a high-volume public hospital from March 2020 to September 2020 with women between 24-28 weeks of gestation. Demographic characteristics and gestational diabetes mellitus screening status were recorded for each woman. The European Health Literacy Survey Questionnaire was used to assess health literacy.

Results: A total of 364 women were included in the study. Two hundred and three (55.7%) women accepted the gestational diabetes mellitus screening test, and 44.2% did not. Health care, disease prevention, health promotion subscales, and the general scale scores were higher in the gestational diabetes mellitus screening group (P=0.001, P=0.024, P=0.01, and P=0.003, respectively). It was determined that a 1-point increase in the health care score decreased the probability of rejecting the gestational diabetes mellitus screening by 1.03 times (P=0.003).

Conclusions: Lower health literacy levels were associated with higher rates of gestational diabetes mellitus screening test rejection.

Keywords: Gestational diabetes, health literacy, surveys and questionnaires

Gestational diabetes mellitus (GDM) has been defined as glucose intolerance with onset or first identified during pregnancy. GDM, the most common medical disease during pregnancy, affects approximately 20 million live births worldwide [1]. The prevalence of GDM is reported as 6% of all pregnancies in the United States [2]. In Turkey, the prevalence of GDM is approximately 7.7%, according to a systematic review [3].

Screening and diagnosis of GDM aim to identify women at risk for an adverse pregnancy outcome. GDM is associated with many fetal and maternal complications: preeclampsia, gestational hypertension, polyhydramnios, macrosomia, increased risk of birth trauma, perinatal mortality, increased frequency of operative birth, fetal cardiomyopathy, and neonatal respiratory and metabolic problems [4]. Women who develop GDM during pregnancy have an increased

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risk of developing type 2 and type 1 diabetes in the long term [5]. Early diagnosis is important, and effective management of GDM has been demonstrated to enhance pregnancy outcomes and reduce the risk of perinatal complications [6].

GDM screening is universally recommended for all pregnant women between 24-28 weeks of pregnancy [7]. GDM screening can be performed in one of two options: the International Association of Diabetes and Pregnancy Working Groups (IADPSG) 1-stage screening approach (currently preferred by the American Diabetes Association) and the 2-stage Carpenter-Coustan screening approach (recommended by the American College of Obstetricians and Gynecologists) [8]. In the one-step approach, the diagnosis of GDM is done with OGTT with 75g of glucose. The two-step approach includes an initial 1-hour non-fasting 50-gram glucose challenge test. If blood glucose higher than the threshold value is detected, a 3-hour fasting diagnostic oral glucose tolerance test is performed [9, 10].

Health literacy (HL) is defined as "the degree to which individuals can obtain, process, and understand basic health information and services needed to make appropriate health decisions" [11].

Patients with low health literacy have difficulty accessing health care and understanding medical advice [12]. Low levels of health literacy are associated with poorer health outcomes, including increased rates of chronic disease. A factor that can contribute to low levels of health literacy is inadequate education, which can lead to a lack of knowledge about health-related issues and difficulty understanding health information [13].

We hypothesized that women with low health literacy are more likely to refuse gestational diabetes screening tests. The present study aimed to evaluate the relationship between the rejection of GDM screening tests and health literacy and GDM screening rejection prevalence.

METHODS

This cross-sectional study was conducted in a high-volume public hospital from March 2020 to September 2020. The study protocol was approved by the Uludag University Faculty of Medicine Clinical Research Ethics Committee at the beginning of the study (approval number: 2020-3/21). This study was performed under all ethical standards described in an appropriate version of the 1975 Declaration of Helsinki, as revised in 2000.

Voluntary patients who visited the obstetrics outpatient clinic for routine pregnancy follow-up were included. A total of 380 eligible patients were invited, and 16 refused to participate in the study. A total of 364 patients were included in the study. The inclusion criteria were to be over the age of 18 and to be able to read and understand Turkish. Exclusion criteria were: having pregestational diabetes and any condition that prevented filling out the questionnaires. Patients at 24-28 weeks of gestation were informed about GDM and adverse pregnancy outcomes, and screening was recommended for all patients. The two-stage screening was applied to the patients included in the study. Whether or not the patients accepted the screening test was recorded.

The socio-demographic information regarding age, body mass index (BMI), smoking status (yes: still smoking, no: quit smoking before pregnancy, quit smoking: quit smoking during pregnancy), education level, reading habits (yes: regularly reading magazines, newspaper, book), employment status, comorbid diseases (hypertension, thyroid diseases, cardiac diseases, Etc.), family structure, income status (low income <2500 Turkish Liras (TL)/month, moderate income: 2500-7500 TL/month, high income >7500 TL/month) and presence and type of health insurance were recorded for each patient.

The Turkish version of the European Health Literacy Survey Questionnaire (HLS-EU-16) was used to assess health literacy. The HLS-EU-16 questionnaire is a validated measurement tool for evaluating HL levels in Turkey [14]. HLS-EU-Q16 comprises 16 items that provide to evaluate difficulties in understanding, evaluating, and implementing issues related to processing related to health care, disease prevention, and health promotion. Each item was rated on four points Likert scale (I do not know: 0, very difficult: 1, difficult: 2; easy: 3, and very easy: 4 points). Survey questions were divided into subgroups and assessed as follows: health care (HC): questions 1-7; disease prevention (DP): questions 8-12; and health promotion (HP): questions 13-16.

Written consent was obtained from each patient before their inclusion in the study.
The HLS-EU-16 questionnaire was applied to the patients with face-to-face interviews between patients and clinicians.

Statistical Analysis

Post-hoc power analysis was performed using the available findings of the study. The mean HC score of the patients who underwent GDM screening was 35.01±10.06, and the mean value of the patients who did not have GDM screening was 31.79±10.15. The power value was determined using the corresponding effect size value. The 85% power value obtained from the study at the α=0.05 level was determined as n = 203 in the GDM screening group and n=161 in the non-GDM screening group.

The compliance of continuous variables to normal distribution was examined using the Shapiro-Wilk test. Age and scores of the general and subscales of the HL-EU-Q16 scale are expressed as mean±standard deviation and median (minimum: maximum) values. Categorical variables are expressed with n (%) Pearson's chi-square. Fisher's exact and Fisher-Freeman-Halton tests were used for intergroup comparisons of categorical variables. The Mann-Whitney U test was used to compare the scores of the general and subscales of the HL-EU-Q16 scale between groups. Internal consistency of the general and subscales of the HL-EU-Q16 scale was examined using the Cronbach alpha reliability coefficient.

Logistic regression analysis was performed to investigate the factors that may cause not having a GDM screening test. SPSS (IBM Corp. Released 2012. IBM SPSS Statistics for Windows. Version 21.0. Armonk. NY: IBM Corp.) program was used for statistical analysis. The type I error level was determined as 5% in statistical analysis.

RESULTS

During the study period, 380 eligible women applied to the outpatient clinic for routine pregnancy follow-up, of which 16 were excluded because they refused to participate. The final analysis was made with the data of a total of 364 patients. Of the 364 patients included in the study, 203 patients (55.76%) accepted to have the GDM screening test, and 161 of them were rejected to have.

The mean age of patients was similar between the two groups (28.18±5.75 years versus 28.12±5.48 years, respectively, P=0.975). BMI and the presence of the chronic disease did not differ between patients who accepted a GDM screening test and those who did not (P=0.07 and P=0.43, respectively).

There was no difference between the groups regarding smoking habits (P=0.850). The education level was observed to vary between patients who had GDM screening and those who did not (P=0.014). The distribution of the patients according to their education level is shown in Table 1. In subgroup analyses according to education level, it was determined that the proportion of participants with a level of education below high school differed between the two groups (P=0.004). There was no difference between patients with high school and post-high school education and those who did not have GDM screening (P=0.172 and P=0.064, respectively). Similarly, there was no difference between both groups according to income status, reading habits, family structure, employment status, and presence of health insurance (P=0.145, P=0.719, P=0.283, P=0.920, and P=0.613, respectively). The socio-demographic characteristics of both groups are shown in Table 1.

Cronbach alpha reliability of the subscale for health care was calculated as 0.76 (Table 2). It was seen that the reliability of the healthcare subscale is at a good level. The reliability of the Cronbach alpha scale for disease prevention and health promotion scale was found to be 0.68 and 0.64, respectively. These reliability values were at an acceptable level. Finally, the Cronbach alpha reliability for the general scale was found to be 0.86. Its reliability for the general scale was at a good level.

A comparison of HLS-EU-Q16 scale scores between GDM screening and refusing groups was presented in Table 3. It was determined that the scale scores of the health care, disease prevention, and health promotion subscales were higher in the group that had GDM screening (P=0.001, P=0.024, and P=0.010, respectively). Again, it was determined that the general scale score was higher in the group that had GDM screening (P=0.003).

Table 1. Socio-demographic characteristics of the participants

	GDM Screening		
	Accepted (n=203)	Refused (n=161)	P value
Age (years)	28.18±5.75 28 (17:44)	28.12±5.48 28 (18:42)	0.975[a]
BMI (kg/m^2)	28.15±4.47 27.54 (13.32-40)	29.01±4.06 28.39 (19.05-42.54)	0.070[a]
Presence of chronic disease	18 (8.90%)	10(6.20%)	0.345[b]
Smoking status			
Yes	13 (6.40%)	10 (6.20%)	0.850[b]
No	150 (73.90%)	120 (74.50%)	
Quit smoking	8 (3.90%)	9 (5.60%)	
Never smoked	32 (15.80%)	22 (13.70%)	
Educational status			
Under high school	74 (36.50%)	83 (51.60%)	**0.014[b]**
High school	73 (36%)	47 (29.20%)	
Above high school	56 (27.60%)	31 (19.30%)	
Employment status			
Working	47 (23.20%)	38 (23.60%)	0.920[b]
Not working	156 (76.80%)	123 (76.40%)	
Income status*			
Low income	2 (1%)	6 (3.70%)	0.144[c]
Moderate income	156 (76.80%)	126 (78.30%)	
High income	45 (22.20%)	29 (18%)	
Reading habits			
Yes	173 (85.20%)	135 (83.90%)	0.719[b]
No	30 (14.80%)	26 (16.10%)	
Family structure			
Nuclear family	187 (92.10%)	143 (88.80%)	0.283[b]
Extended family	16 (7.90%)	18 (11.20%)	
Health insurance			0.631[c]
General health insurance	180 (88.70%)	138 (85.70%)	
Private health insurance	3 (1.50%)	4 (2.50%)	
Green card**	2 (1%)	4 (2.50%)	
None	18 (8.90%)	15 (9.30%)	

Data are expressed as mean±standard deviation or n (%) or median (minimum- maximum), GDM=Gestational Diabetes Mellitus, BMI=Body Mass Index, TL = Turkish Lira

[a]Mann Whitney U test, [b]Pearson Chi-Square test, [c]Fisher-Freeman-Halton Test

*Low income is <2500 TL month, Moderate income: 2500-7500 TL/month and High income >7500 TL/month **Green card is a document that is given to people in Turkey who are in need and do not have health insurance so that they can receive health services free of charge.

Table 2. Distribution of HL-EU-Q16 general and subscales

Health literacy	Insufficient	Problematic	Sufficient	Excellent	Cronbach α
Health care	17.90%	21.40%	36.80%	23.90%	0.76
Disease prevention	26.60%	16.90%	34.60%	25.80%	0.68
Health promotion	11.50%	7.70%	54.40%	26.40%	0.64
Total	19.50%	21.40%	37.90%	21.20%	0.86

Data expressed as n %. HL=Health Literacy

To determine the risk factors thought to be effective in GDM screening, variables were first examined with univariate logistic regression analysis, and variables meeting the P<0.25 criterion after the analysis were included in the multivariate logistic regression model. After the logistic regression analysis of the relevant variables, the variables that meet the P<0.25 criterion were determined as BMI, educational status, income status, family structure, HC, DP, HP, and general health literacy. These variables were included in the multivariate logistic regression model. The analysis result of the last step was presented in Table 4, and the risk factors thought to have an impact on rejecting GDM screening were reported in Table 4. The forward selection approach was used as the variable selection method. The risk factors thought to be effective in rejecting GDM screening were listed in the table. When the analysis results were examined, it was seen that the logistic regression model obtained in the last step was compatible with the data (Hosmer and Lemeshow test P=0.347), and the logistic regression model obtained was also significant (P=0.003). It was determined that a 1-point increase in the HC score decreased the probability of rejecting the GDM screening by 1.03 times.

DISCUSSION

This study aims to determine the relationship between the GDM screening test acceptance rate and HL. In this study, 55.76% of the patients who applied to the outpatient clinic accepted to have a GDM screening test in our hospital. In a recent study by Hocaoğlu *et al*. [15], the reasons why some patients in Turkey rejected the GDM screening test were evaluated. The study was performed on 312 patients of any gestational age 42.5% of patients under 28 weeks and 37.8% of patients over 28 weeks agreed to have the test. Hocaoğlu *et al*. [15], in their study, questioned the

Table 3. Comparison of HLS-EU-Q16 scale scores between GDM screening and refusing groups

	GDM Screening		
	Yes (n=203)	No (n=161)	P value [a]
Health care	35.01±10.06 35.71 (2.38-50)	31.79±10.15 3.33 (4.76-50)	**0.001**
Disease prevention	33.75±11.83 33.33 (3.33-50)	31.20±11.90 33.33 (3.33-50)	**0.024**
Health promotion	37.70±8.66 33.33 (8.33-50)	35.27±9.18 33.33 (12.50-50)	**0.010**
Total	35.29±8.93 34.38 (9.38-50)	32.47±9.14 33.33 (11.46-50)	**0.003**

Data are expressed as mean±standard deviation or n (%) or median (minimum-maximum), GDM=Gestational Diabetes Mellitus

[a]Mann Whitney U test

Table 4. Factors affecting the likelihood of rejection of GDM screening (n= 64)

	Univariate Model				Multivariate Model			
	OR	95% CI		P value	OR	95% CI		P value
Age	1	0.97	1.04	0.929				
BMI	0.96	0.91	1	0.064				
Chronic Disease (Reference Coefficient: Yes)	0.68	0.31	1.52	0.347				
Smoking (Reference Coefficient: Yes)								
No	0.96	0.41	2.27	0.929				
Quit smoking	0.68	0.19	2.41	0.554				
Never smoked	1.12	0.42	3	0.823				
Educational Status (Reference Coefficient: Above High School)								
Under high school	0.50	0.29	0.86	0.012				
High school	0.85	0.49	1.50	0.572				
Employment Status (Reference Coefficient: Working)	0.98	0.60	1.59	0.920				
Income status (Reference Coefficient: High Income)								
Low Income	0.22	0.04	1.14	0.071				
Moderate income	0.80	0.47	1.35	0.397				
Reading Habits (Reference Coefficient: Yes)	0.90	0.51	1.59	0.719				
Family Structure (Reference Coefficient: Nuclear family)	1.47	0.73	2.99	0.285				
Health Insurance (Reference Coefficient: None)								
General health insurance	2.40	0.39	14.97	0.349				
Private health insurance	2.61	0.47	14.45	0.272				
Green card	1.50	0.16	14.42	0.725				
Health care	1.03	1.01	1.05	0.003	1.03	1.01	1.05	**0.003**
Disease Prevention	1.02	1	1.04	0.043				
Health Promotion	1.03	1.01	1.06	0.011				
Health Literacy	1.04	1.01	1.06	0.004				

GDM= Gestational diabetes mellitus, OR= Odds ratio. CI= Confidence interval

χ^2=8.97; P=0.003

reasons for patients' refusal to test and found that the most frequently indicated reason was the belief that GDM screening test is harmful to themselves and the baby.

GDM screening rates in various countries are available in the literature. In our study, screening test rates seem lower than most countries in the literature. For example, the rate in Israel is 89%; in a US study, including women who benefit from health insurance is 68%, which has been reported as 30% in Lombardy / Italy [16-18].

In our study, it was observed that the education level varies between patients who had GDM screening and those who did not. When subgroup analysis was made according to education level, we demonstrated a positive association between the level of education under high school and rejection of the screening test (36.5% versus 51.6%). In a study by van der Heide *et al*., using data from 5136 adults, examined the relationship between education and health literacy and showed a significant relationship between health literacy and education level. They pointed out that those who completed their tertiary education had a higher level of health literacy than those who had completed secondary education [19].

According to a European study of 8000 people by Sørensen *et al*. [20], financial deprivation, low social status, low education status, or old age had been seen in higher proportions of people with limited health literacy [20]. Contrastingly, in our study, there was no difference between the groups regarding employment status, income status, reading habits, family structure, and health insurance. We explained this because the Sørensen *et al*.'s study [20] was multinational and conducted with data from 8000 patients.

The possible reason for the discrepancy in our findings is that our study was conducted in a tertiary hospital in the city center. In our study, there was no significant difference in socio-demographic characteristics of the groups who had and did not have the screening test, except for the level of education; this gave us a significant advantage: we were able to analyze health literacy and subgroup scores without bias due to socio-demographic characteristics.

In a manual about the problem of health literacy, it was reported that patients with low health literacy skills have poorer health status than those with adequate skills, even after controlling for a variety of socio-demographic variables [21]. This supports the findings of our study and highlights the importance of HL.

Stafford *et al*. [22] investigated the associations between health literacy and postpartum outcomes. They found that women in the lowest health literacy group were less likely to plan to breastfeed.

Endres *et al*. [23], in their study investigating the relationship between health literacy and planned pregnancies in women with pregestational diabetes, found that women with low health literacy were significantly more likely to have an unplanned pregnancy. Pirdehyghan *et al*. [24] conducted a study on the relationship between HL and glycemic control in pregnant women with GDM. And they concluded that low HL was associated with insufficient glycemic control. Low health literacy is associated with poorer health status; this is consistent with the results of our study.

As a result of mutually evaluating the groups that accepted and did not accept to have GDM screening, we determined that the scores on health care, disease prevention, and health promotion scales were higher in the group that had the screening test. It was determined that a 1-point increase in the HC score decreased the probability of rejecting the GDM screening by 1.03 times ($p = 0.003$). In addition, the results of the logistic regression model created with the risk factors that are thought to be effective in rejecting the GDM screening can also call for more awareness in the healthcare community about the importance of GDM diagnosis and the need for health education materials that encourage screening. Seeking methods to alleviate the impact of poor health literacy on health results is a crucial measure to be taken.

Limitations

Our study has some strengths and limitations. The prospective design of our study strengthened the power of the results. There were also limitations of the study: we included patients living in the city center so that the results may reflect only some of the population in terms of socio-demographic characteristics.

CONCLUSION

We found the HL score of the patients who accepted the screening test significantly higher than those who did not want to have the test. Among the socio-demo-

graphic characteristics, it was determined that the patients with less than a high school education were significantly higher in the group who did not have the GDM test. Further large, multicenter studies are needed to determine the knowledge and attitudes of the pregnant population on the importance of GDM and GDM screening.

Authors' Contribution

Study Conception: ÖÖU; Study Design: ÖÖU, ZA, SRO, GO; Supervision: ÖÖU; Funding: ÖÖU, ZA, SRO; Materials: ÖÖU, ZA, SRO; Data Collection and/or Processing: ÖÖU, ZA, SRO; Statistical Analysis and/or Data Interpretation: ÖÖU, SRO, HO, GO; Literature Review: ÖÖU, ZA, SRO; Manuscript Preparation: ÖÖU, SRO, HO, GO and Critical Review: ÖÖU, ZA, SRO, HO, GO.

Conflict of interest

The authors disclosed no conflict of interest during the preparation or publication of this manuscript.

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