



What is Gestational Diabetes Mellitus Awareness in Pregnant Women: A Survey Study

Gebelerde Gestasyonel Diyabet Farkındalığının Araştırılması: Anket Çalışması

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ABSTRACT

Objective: Gestational diabetes mellitus (GDM) is an increasing problem in our present day. It is important to increase the awareness of pregnant women regarding this issue for compliance in diagnosis, follow-up, and treatment processes. The purpose of the present study was to evaluate the awareness of GDM and its complications and the approach to the oral glucose tolerance test (OGTT) in pregnant women.

Methods: Fifty patients with GDM or pre-gestational diabetes mellitus (PGDM) after 24 weeks of gestation and 250 patients without GDM and PGDM history were evaluated. A questionnaire on GDM and its complications, consisting of 18 questions, was administered to the groups.

Results: The mean obesity rate was higher ($p=0.0001$), body mass index was higher ($p=0.0001$), and a family history of diabetes was found to be more common ($p=0.0001$) in the group of pregnant women with GDM and PGDM. The rate of correct answers to the questions was 65% in all patients. The awareness level was found to be higher in those who had higher educational status ($p=0.0001$), those with higher income levels ($p=0.0001$), and smokers ($p=0.03$). OGTT rejection was found with a higher rate among those who thought that OGTT would harm the pregnancy and fetus among the pregnant women who did not have diabetes before the 24th gestational week ($p=0.006$).

Conclusion: Although the awareness of pregnant women regarding GDM was not at an insufficient level, there was a lack of knowledge regarding some issues.

Keywords: Gestational diabetes, diabetes complications, pregnancy complications

ÖZ

Amaç: Gestasyonel diabetes mellitus (GDM) günümüzde giderek artan bir sorundur. Gebelerin bu konudaki farkındalıklarının artırılması tanı, takip ve tedavi süreçlerine uyum açısından önemlidir. Bu çalışmanın amacı gebelerde GDM ve komplikasyonlarının farkındalığını ve oral glukoz tolerans testine (OGTT) yaklaşımı değerlendirmektir.

Gereç ve Yöntem: 24. gebelik haftasından sonra GDM veya pre-gestasyonel diabetes mellitus (PGDM) tanısı alan 50 hasta ile GDM ve PGDM öyküsü olmayan 250 hasta değerlendirildi. Gruplara GDM ve komplikasyonları hakkında 18 sorudan oluşan bir anket uygulandı.

Bulgular: GDM ve PGDM öyküsü olan gebelerde ortalama obezite oranı daha yüksek ($p=0,0001$), vücut kitle indeksi daha yüksek ($p=0,0001$) ve ailede diyabet öyküsü daha yaygın ($p=0,0001$) bulundu. Tüm hastalarda sorulara doğru yanıt verme oranı %65'tir. Eğitim düzeyi yüksek olanlarda ($p=0,0001$), gelir düzeyi yüksek olanlarda ($p=0,0001$) ve sigara içenlerde ($p=0,03$) farkındalık düzeyi daha yüksek bulunmuştur. Diyabeti olmayan gebeler arasında 24. gebelik haftasından önce OGTT'nin gebeliğe ve fetüse zarar vereceğini düşünenler arasında OGTT reddi daha yüksek oranda bulunmuştur ($p=0,006$).

Sonuç: Gebelerin GDM ile ilgili farkındalıkları yetersiz düzeyde olmamakla birlikte bazı konularda bilgi eksikliği olduğu saptanmıştır.

Anahtar Kelimeler: Gestasyonel diyabet, diyabet komplikasyonları, gebelik komplikasyonları

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INTRODUCTION

Insulin resistance and pancreatic beta cell dysfunction during pregnancy negatively affect maternal and fetal health. A total of 9-25% of pregnancies worldwide are affected by acute or long-term complications (1).

According to the data in the Diabetes Atlas published by the International Diabetes Federation in 2021, 16.7% of 126.4 million women who were aged 20-49 who gave birth had diabetes. Among these, 80.3% had gestational diabetes mellitus (GDM), 9.1% had other types of diabetes and were diagnosed first during pregnancy, and the remaining 10.6% had pre-gestational diabetes mellitus (PGDM) (2).

During pregnancy, behaviors such as adopting healthy lifestyle behaviors, nutrition, diet, exercise, coping with stress, and taking health responsibility by self-monitoring blood glucose are effective in preventing GDM complications. Awareness among women about GDM and its risks to the fetus has effects on compliance with recommendations (3).

METHODS

Conducting the Study

This study was planned with a prospective survey design. The study was initiated with the approval of the University of Health Sciences Türkiye, İstanbul Prof. Dr. Cemil Taşcıoğlu City Hospital Clinical Research Ethics Committee dated 08.08.2022 and decision numbered 236.

The patients who applied to the Internal Diseases and Gynecology and Obstetrics Outpatient Clinics of University of Health Sciences Türkiye, Prof. Dr. Cemil Taşcıoğlu City Hospital, were older than 18 years of age, passed the 24th gestational week, were diagnosed with GDM by applying a single or two-stage oral glucose tolerance test (OGTT), or had PGDM, and after the 24th gestational week, with known GDM and Pregestational DM between August 5, 2022 and September 15, 2022 were evaluated prospectively by obtaining the consent of the patients. A questionnaire was administered to the patients during their application for outpatient follow-ups. Informed consent was obtained by giving information beforehand, and education level, demographic characteristics, and knowledge level were investigated. The study had a cohort design with 300 patients, 250 of whom had no history of GDM and PGDM before 24 weeks of gestation, and 50 pregnant patients who had GDM and PGDM after 24 weeks of gestation. The sociodemographic characteristics of the patients were questioned, and a 20-item questionnaire was used to assess their awareness of GDM symptoms, general information about follow-up treatment, approach to OGTT, and fetal-maternal risks.

Data Collection Tool

A questionnaire was used as the data collection tool, the first part of which included sociodemographic characteristics such as age, height, body mass index (BMI), smoking, income level, and educational status, and the second part consisted of 20 items in total. One question included the approach to OGTT, two questions about GDM symptoms, two questions about blood glucose targets, three questions approach to treatments, eight questions about GDM complications, and one question about GDM information resources. The answers to questions 1 to 18 consisted of two options: "True" and "False". Item 19 consisted of seven options questioning the sources of information about GDM. In item 20, it was questioned whether pregnant women without pregestational DM, who were not diagnosed with GDM, and who were before the 24th gestational week were considering OGTT. The group with known pregestational DM and GDM was not asked this question. The questionnaire was adapted from similar studies (4-6).

The correct answers to questions 2, 4, 5, 6, 7, 11, 12, 15, and 17 were "True", and the correct answers to questions 1, 3, 8, 9, 10, 13, 14, 16, and 18 were "False". Awareness levels were determined by dividing the number of correctly answered questions by the number of answers.

When the tables were created, pregnant women with GDM and PGDM after 24 weeks of gestation were considered to have GDM (+), and pregnant women without known GDM before 24 weeks of gestation were considered as GDM (-).

Implementation and Evaluation of the Survey

The patients who met the inclusion criteria to participate in the survey were informed about the study, and the volunteers filled out the questionnaires through face-to-face interviews.

Statistical Analysis

Statistical analyses were performed using the NCSS (Number Cruncher Statistical System) 2007 Statistical Software (Utah, USA) package program. In the evaluation of the data, as well as the descriptive statistical methods (mean, standard deviation, median, minimum, maximum), the distribution of the variables was examined with the Shapiro-Wilk normality test, the One-Way Analysis of Variance was used in the comparison of the normally distributed variables, the Tukey multiple comparison test was used in the subgroup comparisons, the independent t-test was used for the pairwise comparisons, and the chi-square test was used in the comparison of qualitative data. The results were evaluated at a significance level of $p < 0.05$.

RESULTS

A total of 300 patients aged between 18 and 47 years with a mean age of 30.19 ± 5.71 years participated in the study. The sociodemographic characteristics of the patients are listed in Table 1. The education level distributions were as follows; those who were literate were 35 participants (11.67%), 98 (32.67%) participants were primary school graduates, 90 (30%) were high school graduates, and 77 (25.67%) were university graduates. Regarding the distribution of income levels, the group earning less than 4253 Turkish Liras (TL) (the minimum wage at the time of study) constituted the majority (34%). Also, the group earning between 4254 and 5000 TL was 19%, and the group earning >7000 TL was 15%.

The detailed results of the GDM and its complication awareness questionnaire are given in Table 2.

Although the level of awareness was found to be higher in the groups with higher education and income status (Tables 3, 4), no significant differences were detected between the knowledge levels in the GDM (+) group and the GDM (-) group.

DISCUSSION

Although there is a good level of awareness regarding GDM and its complications in pregnant women, whether or not they have GDM, there is a lack of knowledge on some issues. The present study is among the first in our country to raise awareness of GDM and its complications, which are common in our country and are increasing in parallel with the obesity epidemic all over the world. The number of studies conducted on this subject is limited worldwide.

Table 1. Sociodemographic characteristics of the patients

		Entire patient group		GDM (-)		GDM (+)		p-value
Age (years)		30.19±5.71		29.87±5.78		31.08±5.11		0.169*
Age (years)	<35 Years	223	74.33%	189	75.60%	34	68.00%	0.261+
	≥35 Years	77	25.67%	61	24.40%	16	32.00%	
BMI (kg/m ²)		27.45±5.04		26.54±4.46		31.99±5.37		0.0001*
BMI (kg/m²)	<30 BMI	214	71.33%	194	77.60%	20	40.00%	0.0001+
	≥30 BMI	86	28.67%	56	22.40%	30	60.00%	
Number of pregnancies		2.51±1.54		2.35±1.44		3.28±1.79		0.0001*
Number of children		1.27±1.2		1.2±1.14		1.64±1.38		0.017*
Family history of DM		114	38.00%	85	34.00%	29	58.00%	0.001+
Education level	Literate	35	11.67%	26	10.40%	9	18.00%	0.337+
	Primary school	98	32.67%	81	32.40%	17	34.00%	
	High school	90	30.00%	79	31.60%	11	22.00%	
	University	77	25.67%	64	25.60%	13	26.00%	
Smoking		36	12.00%	33	13.20%	3	6.00%	0.153+
Income level	<4253 TL	102	34.00%	80	32.00%	22	44.00%	0.281+
	4254-5000 TL	57	19.00%	48	19.20%	9	18.00%	
	5001-7000 TL	96	32.00%	81	32.40%	15	30.00%	
	>7000 TL	45	15.00%	41	16.40%	4	8.00%	
Information sources	Internal medicine specialist	114	38.00%	69	27.60%	45	90.00%	0.0001+
	Family doctor	67	22.33%	61	24.40%	6	12.00%	0.055+
	Family and friends	24	8.00%	23	9.20%	1	2.00%	0.087+
	TV, newspapers	14	4.67%	12	4.80%	2	4.00%	0.807+
	Social media and the internet	56	18.67%	48	19.20%	8	16.00%	0.596+
	Pregnancy training school	11	3.67%	9	3.60%	2	4.00%	0.891+
	Other	38	12.67%	33	13.20%	5	10.00%	0.535+

*Independent t-test, +chi-square test, GDM (+): Pregnant women over 24 weeks of gestation with GDM and PGDM, GDM (-): Pregnant women without known diabetes before the 24th gestational week

GDM: Gestational diabetes mellitus, PGDM: Pre-gestational diabetes mellitus, BMI: Body mass index, TL: Turkish liras

Diabetes is a risk factor for the mother and fetus because of the degree of hyperglycemia and its chronic complications and related comorbidities (3,7). OGTT is recommended for pregnant women who have not been diagnosed with diabetes in the previous stages of pregnancy between weeks 24 and 28. Misconceptions and prejudices about OGTT reduce the participation of pregnant women in these tests that are used for diagnosis, and in case of missed diagnoses, both maternal and fetal risks increase and cause

problems for generations that may result in the future development of type 2 DM, hypertension, and obesity in the child to be born. Although GDM is followed with a dynamic and variable treatment protocol, optimal follow-up can be achieved with the cooperation of the patient and clinician because it requires high patient compliance, adherence to diet, exercise, and self-monitoring of glucose at home, in addition to pharmacological treatment. The consciousness of patients is a factor that increases their adaptation (8).

Table 2. Detailed results of the GDM and complication awareness questionnaire

Number of correct answers and rates	Entire patient group		GDM (-)		GDM (+)		p-value ⁺
	n	%	n	%	n	%	
GDM does not cause the baby to have an excessive birth weight.	179	65.57%	147	65.63%	32	65.31%	0.966
GDM increases the risk of shoulder dystocia.	145	57.77%	117	57.35%	28	59.57%	0.781
GDM does not increase the risk of neonatal jaundice.	166	64.59%	136	64.15%	30	66.67%	0.749
GDM increases the risk of stillbirth.	209	79.47%	169	78.60%	40	83.33%	0.463
GDM increases the risk of preterm birth.	232	87.88%	191	87.21%	41	91.11%	0.466
GDM increases the fluid that the baby is in the womb.	168	67.47%	141	68.78%	27	61.36%	0.341
GDM increases the risk of preeclampsia.	195	78.00%	168	81.16%	27	62.79%	0.008
Patients with GDM do not have an increased risk of developing DM after delivery.	152	59.61%	123	58.85%	29	63.04%	0.600
The oral glucose tolerance test can have negative consequences for pregnancy and the baby.	139	53.26%	113	52.56%	26	56.52%	0.625
Consuming too much sugar is a cause of diabetes.	54	20.45%	44	20.28%	10	21.28%	0.878
One hundred and fifty is a high value for fasting glucose during pregnancy.	205	80.71%	163	77.99%	42	93.33%	0.018
Two hundred is a high value for postprandial glucose in pregnancy.	191	79.25%	150	76.53%	41	91.11%	0.300
Medication is more important than diet for the control of diabetes during pregnancy.	157	63.56%	124	61.39%	33	73.33%	0.132
Shivering and sweating are signs of high blood glucose levels.	72	28.13%	49	23.22%	23	51.11%	0.0001
Excessive thirst and urination are signs of high blood glucose.	209	83.60%	168	82.35%	41	89.13%	0.262
The use of insulin leads to addiction.	138	56.56%	114	57.00%	24	54.55%	0.766
Postprandial blood glucose is measured 1 h after a meal in pregnant women.	212	87.60%	166	85.13%	46	97.87%	0.017
Walking and exercise have no effect on blood sugar regulation.	197	78.49%	166	80.98%	31	67.39%	0.043

⁺Chi-square test GDM (+): Pregnant women with GDM and PGDM past the 24th gestational week, GDM (-): Pregnant women without known diabetes before the 24th gestational week
GDM: Gestational diabetes mellitus PGDM: Pre-gestational diabetes mellitus

Table 3. Awareness comparison between the education level groups in the non-diabetic patient group

Tukey's multiple comparison test	Awareness level [†]
Literate/primary education	0.999
Literate/high school	0.510
Literate/university	0.041
Elementary/high school	0.100
Elementary/university	0.001
High school/university	0.386

[†]P-value

Table 4. Comparison of income distribution and awareness level of the non-diabetic patient group

Tukey's multiple comparison test	Awareness level [†]
<4253 TL/4254-5000 TL	0.951
<4253 TL/5001-7000 TL	0.027
<4253 TL/>7000 TL	0.0001
4254-5000 TL/5001-7000 TL	0.237
4254-5000 TL/>7000 TL	0.007
5001-7000 TL/>7000 TL	0.282

[†]P-value, TL: Turkish Liras

The prevalence of obesity in Türkiye was found to be 32% in TURDEP II (Turkish Diabetes Epidemiology Study), which is one of the most comprehensive studies conducted in Türkiye in which diabetes was evaluated epidemiologically, and it was found to be 28.6% in those who participated in this study.

Unlike the literature data, no age difference was detected between the group with GDM and PGDM and the group without diabetes; however, the mean age was found to be higher in the group with GDM and PGDM, and the rate of pregnant women aged 35 and over was higher in accordance with the literature data (9). The reason for the lack of difference might be that the non-diabetic group was born before the 24th gestational week and OGTT had not been performed. It is possible that some women were diagnosed with GDM in the following weeks of pregnancy.

Consistent with the literature data, the BMI values of the pregnant women who had GDM and PGDM were found to be significantly higher than those of pregnant women without diabetes, and the number of obese patients (BMI >30) in this group was significantly higher than that in the group without diabetes ($p=0.0001$) (10). Also, in accordance with the literature data, the incidence of DM in the family was significantly higher in the group with GDM and PGDM ($p=0.001$). The data of the TURGEP Study, which evaluated the prevalence and predictive factors of national GDM as one of the largest studies conducted in our country in 2019, were similar (9).

Gravida and parity ratios were high in the GDM and PGDM ($p<0.05$). In the study conducted by Gürkan et al. (11), an increased risk of GDM was found in the group with multiparity, especially in the group with four or more pregnancies.

The low rate of pregnant smokers (12%) can be interpreted as the risks of smoking during pregnancy were widely known with the policies implemented by the Ministry of Health.

Among all participants, the rate of patients who thought that insulin could be addictive was 43%, and 45.5% in the group with gestational diabetes and pregestational diabetes, who may need insulin during their follow-up. This was an important finding because it shows that a significant

number of patients were biased toward insulin use and might resist initiating insulin, which is a reliable treatment option that has been used in pregnancy for many years in the face of necessary indications.

The fact that approximately one-third of the pregnant women who have GDM do not know that they have an increased risk of diabetes in later life, with their prevalence of type 2 DM being 38% in the first year and 60% in the next 16 years, will cause them to skip their follow-ups in this regard after delivery, they might have delayed diagnoses, and there will be an increase in the risk of complications (12,13).

Hypoglycemia, which can be life-threatening and cause serious complications if it persists for a long time, is important during pregnancy. It was noteworthy that only 20.45% of the participants knew that sweating and shivering were symptoms of hypoglycemia. Although this question had a higher rate of correct answers among diabetic pregnancies, it is serious that approximately half of them did not know the answer. Self-monitoring of blood glucose at home has great importance for patients with GDM. The fact that they do not know that sweating and shivering will be because of hypoglycemia will complicate the situations in which they can intervene on their own at home, and this will cause the patients who use insulin to lose their compliance with the treatment and even to stop their treatment.

GDM and PGDM pregnant women gave correct answers at an average rate of 66.2% to the questions in the survey of Quaresima et al. (14) on macrosomia, polyhydramnios, shoulder dystocia, preeclampsia, and fetal death risk associated with GDM complications. The correct answer rate was 51.8% in the GDM group in the study conducted by Quaresima et al. (14). This showed that the level of knowledge was higher in patients followed up in our center. More correct answers were given to the questions including information about fasting glucose value, blood glucose monitoring, and hypoglycemia symptoms in the group with GDM and PGDM compared with the non-diabetic group by over 90% of pregnant women. This result can be considered the success of the GDM outpatient clinics in our hospital. In a study by Hassan et al. (15) with 482 pregnant women, 65.6% answered the questions correctly, which is consistent

Table 5. Comparison of the tendency to have OGTT and the rate of correct answers to question 9

	Do you have the intent to have an OGTT?				p-value
	No		Yes		
The oral glucose tolerance test can have negative outcomes for pregnancy and the baby.	Wrong answers	59	58.42%	40	0.006
	Correct answers	42	41.58%	62	

OGTT: Oral glucose tolerance test

with our findings. Similar results were obtained in a study by Ludowici (4) with 202 women aged 12-51 years.

It was found that a significant proportion of pregnant women considered that OGTT could be harmful to pregnancy and the fetus (46.7%). In the question on the pregnancy process and whether OGTT would harm the fetus, which was asked to pregnant women before the 24th gestational week who were not diagnosed with diabetes, pregnant women who considered it harmful remained significantly abstained from having OGTT ($p=0.006$) (Table 5). Similarly, in the study conducted by Dalgıç et al. (16), it was shown that 53% of pregnant women did not have OGTT because they considered it harmful and received information from the media that it was harmful. This shows that misinformation and prejudices are high because of information pollution and that more information should be given on this issue.

The information sources for GDM were mostly internal medicine specialists (38%), family physicians (22%), and social media and the internet. Similarly, the most common source of information about GDM was answered by doctors in the study by Price et al. (5) (30%). The fact that patients with GDM and PGDM were followed up in the internal diseases outpatient clinic was effective in increasing the rate of this response.

The general awareness level was found to be 65% in this study. The awareness level was found to be as high as 73% in the GDM awareness study conducted by Amr et al. (6) on women of reproductive age in the Sharjah region.

Although the level of awareness increased with increased education and income levels among pregnant women without diabetes, this difference between pregnant women with GDM and PGDM was closed with the knowledge of the subject after the diagnosis of pregnant women with low education and income levels, and no significant differences were detected according to income and education levels, and it was higher in pregnant women with obesity in this group.

When the factors that affected the awareness levels of the patients were evaluated, factors such as high education levels, high income levels, and smoking levels increased the awareness of GDM among the participants.

The fact that the awareness levels of smokers were high might be associated with the higher income levels and educational status of these people and the concern that smoking will harm the fetus with a greater risk. In the study conducted by Quaresima et al. (14), it was reported that the level of knowledge increased with the increased education levels. Although awareness was found to be higher in

pregnant women with GDM and PGDM in the study, no difference was detected in terms of knowledge levels in pregnant women without diabetes. This result can be explained by the fact that the percentage of patients who had primary education and below level was 43% in the non-diabetic group and 52% in the group with GDM and PGDM, and education and awareness did not increase sufficiently in the diagnosed patients.

The fact that the present study was conducted in a single center may not reflect the same result as the entire society because it may have been conducted on similar groups in terms of sociodemographic, cultural, and educational levels. Conducting the study with larger patient groups might provide more statistically significant results.

CONCLUSION

GDM, which is predicted to be an important public healthcare concern in the coming years, can be controlled to a large extent by raising the awareness of pregnant women. This study demonstrated the need for more information and training. It is necessary to raise awareness of GDM and its complications and to raise the awareness of pregnant women about OGTT.

ETHICS

Ethics Committee Approval: The study was initiated with the approval of the University of Health Sciences Türkiye, İstanbul Prof. Dr. Cemil Taşcıoğlu City Hospital Clinical Research Ethics Committee dated 08.08.2022 and decision numbered 236.

Informed Consent: Informed consent was obtained from all individual participants included in the study.

Authorship Contributions

Concept: A.B., Design: A.B., Data Collection or Processing: S.T., Analysis or Interpretation: S.T., Literature Search: S.T., Writing: S.T., A.B.

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