

## Original Article

## Prevalence of Gestational Diabetes Mellitus and Associated Risk Factors during Pregnancy in Turkey

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### Abstract

**Objective:** This study was conducted to assess the prevalence of gestational diabetes mellitus (GDM) and the associated risk factors during pregnancy in Turkey.

**Methods:** The sample of this descriptive and comparative study consisted of 458 pregnant women who referred to the Gynecology Clinic of a university hospital and were administered Oral Glucose Tolerance Test (OGTT) between November 29, 2017 and June 29, 2018. The data were collected by the information form for pregnant women and the risk assessment form. Percentage, mean, student t test and chi-square test were used for statistical evaluation.

**Results:** 17.5% of pregnant women were diagnosed with GDM by the physician. The prevalence of GDM was high in pregnant women who were primary school graduates, who did not work, who were obese, who had four or more pregnancies, who had family history of diabetes and who had high fasting blood glucose level ( $p < 0.05$ ). In addition, prevalence of GDM was found significantly high in pregnant women who had history of stillbirth or neonatal death and had a birth defect in previous births ( $p < 0.05$ ).

**Conclusion:** Almost one fifth of the sample population was having GDM and the major risk factors associated with GDM were educational level, working status, body mass index, number of pregnancies, family history of diabetes, fasting blood glucose values, history of stillbirth or neonatal death and birth defects in previous births.

**Keywords:** Pregnancy, gestational diabetes, prevalence, risk factors.

### Introduction

Pregnancy is a diabetogenic condition and gestational diabetes mellitus develops in 3-25% of all pregnancies (Moore et al., 2014). Gestational diabetes mellitus (GDM) was first detected in pregnant women whose pregnancies were associated with temporary pregnancy-related insulin resistance (American Diabetes Association, 2018). Risk factors for gestational diabetes include advanced age pregnancies (Inan

et al., 2014), BMI > 30 kg/m<sup>2</sup>, family history of diabetes, history of macrosomic birth (4500 g and above), gestational diabetes history in previous pregnancy, and ethnicity (South Asia and Middle East) (Duman, 2015). It is important to detect gestational diabetes in the early period of pregnancy. Because GDM has maternal (risk of spontaneous abortion, preeclampsia-eclampsia, polyhydramnios, etc.), fetal (congenital malformation, macrosomia or retardation, etc.)

and neonatal complications (hypoglycemia, hyperbilirubinemia, etc.) (Canbaz & Dincçag, 2010; Kalyani et al., 2014; Erem et al., 2015). Gestational diabetes research is done with Oral Glucose Tolerance Test (OGTT) in all pregnant women in 24-28 week of pregnancy (Olgun et al., 2011; Cakir, 2014). The anatomical, physiological and biochemical normality of pregnancy is important in terms of perinatal and maternal mortality and morbidity. In this context, the study was conducted to assess the prevalence of gestational diabetes mellitus and the associated risk factors during pregnancy in Turkey.

## Methods

**Type of the research:** The research was descriptive and comparative.

**Population and sample of the research:** The population of this study consisted of pregnant women who referred to the Gynecology Clinic of a university hospital in Turkey and were administered OGTT between November 29, 2017 and June 29, 2018. It was aimed to reach the whole population at the determined time without choosing the sample. In this context, 458 pregnant women who were between 24 and 28 weeks of pregnancy, who did not have multiple pregnancies, who had no Type I or Type II diabetes, liver, kidney and endocrinopathic disease, who had no verbal communication disability and who accepted to participate in the study were included.

**Data collection tools:** Data were collected by “Information Form For Pregnant Women” and “Risk Assessment Form”.

**Information Form For Pregnant Women:** The form included a total of 20 items that address certain personal characteristics (age, educational status, profession, height, weight), obstetric characteristics (gestational week, number of pregnancies, abortion in previous pregnancies), pregnancy-related risk factors (chronic disease, family history of diabetes, having an illness in previous pregnancies, frequency of going to check-ups) and OGTT results (Kalyani et al., 2014; Duman, 2015; Erem et al., 2015). The height and weight of the pregnant women were measured by the researchers. Weighing scale and non-stretching tape were used for height and weight measurements. The height of the pregnant women was recorded as cm and their weight was recorded as kilogram (kg). Body mass index (BMI) was calculated with kg/m<sup>2</sup> formula. In

addition, one-step OGTT was performed for GDM screening in the research institution. In this institution, OGTT was performed to women who were between 24 and 28 weeks of pregnancy by drinking 75 g of oral glucose solution after the measurement of fasting plasma glucose level and then plasma glucose measurement was done in the first and second hours. For OGTT, fasting  $\geq 92$  mg/dl, 1st hour:  $\geq 180$  mg/dl, and 2nd hour:  $\geq 153$  mg/dl were considered diagnostic for gestational diabetes (the International Association of the Diabetes and Pregnancy Study Groups-IADPSG). According to the results of OGTT, the presence or absence of gestational diabetes was expressed by the physician. Fasting blood glucose values of pregnant women were obtained after obtaining verbal consent from laboratory results document.

**Risk Assessment Form:** This form is used by Ministry of Health in Turkey to identify high-risk pregnant women in primary health care. There are 20 items in the form including obstetric history, current pregnancy and general medical history sub-dimensions. Each criterion is answered as “yes” and “no”. Even one answer of “yes” indicates that it is risky for health.

**Application:** The data were collected by researchers with face-to-face interview method in a comfortable room. It took approximately 20-25 minutes to complete the data forms and to measure the height and weight of the pregnant women.

**Ethical considerations:** Written consent was obtained from the ethics committee of a university (Decision no: 2017-11/32) and the institution where the research was conducted before collecting the data. In addition, all pregnant women included in the study were informed about the content of the study and the voluntary participation of the participants, and their verbal consents were taken. The study was conducted in accordance with the ethical standards of the Helsinki declaration.

**Evaluation of the data:** The data were analyzed with SPSS 22.0 package program. Mean, standard deviation and percentage distribution were used in the gestational diabetes related risk assessment and personal and pregnancy related characteristics of pregnant women. Student t-test, chi-square test and Fisher’s Exact test were used for the comparison of personal and pregnancy-related characteristics of pregnant women with and without gestational diabetes. The statistical significance was evaluated as  $p < 0.05$ .

## Results

The mean age of the pregnant women was  $29.25 \pm 5.64$  (min: 18, max: 43), 48% of them were secondary school graduates and 21.4% of them had a job. More than half of pregnant women were overweight and 27.5% were obese. Of 45.4% pregnant women who were in 28 weeks of pregnancy, 39.7% of them had second pregnancy. 5.9% of pregnant women had chronic diseases, 43.2% had family history of diabetes (in mother, father, sister, aunt, uncle). The mean fasting blood glucose value of the pregnant women was  $103.96 \pm 32.63$  mg/dl. 17.5% of pregnant women were diagnosed with GDM by physician according to OGTT results ( $n=80$ ). The prevalence of GDM was higher in women who

were primary school graduates, who did not work, who were obese, who had four or more pregnancies, who had family history of diabetes and who had high fasting blood glucose level ( $p < 0.05$ ) (Table 1). Pregnant women were carrying high risk in criteria such as having surgery before (myomectomy, septum surgery, etc.) (16.8%), being older than 35 years (15.1%), having a preterm birth history (between 22-37 weeks) and using cigarette, alcohol and other substances (5%). The prevalence of GDM was found significantly high in pregnant women who had history of stillbirth or neonatal death and had a birth defect in previous births ( $p < 0.05$ ) (Table 2).

**Table 1. Distribution of GDM Prevalence by Demographic and Clinical Characteristics (N=458)**

Characteristics	General n(%)	GDM			X <sup>2</sup> /p
		Yes n(80)%	No n(378)%		
Age (years) (Mean±SD)	$29.25 \pm 5.64$ (min:18,max:43)	$29.31 \pm 7.05$	$29.17 \pm 5.50$	$t=0.186/$ $0.853$	
Fasting glucose level (mg/dl)	$103.96 \pm 32.63$ (min:64,max:189)	$162.55 \pm 18.98$	$91.55 \pm 18.23$	$t=31.407/$ $0.000^{**}$	(Mean±SD)
Educational status					
Primary school	140(30.6)	40(28.6)	100(71.4)	17.800/	
Secondary school	220(48.0)	30(13.6)	190(86.4)	0.000**	
Higher education	98(21.4)	10(10.2)	88(89.8)		
Occupation					
Yes	98(21.4)	4(4.1)	94(95.9)	15.864/	
No	360(78.6)	76(21.1)	284(78.6)	0.000**	
Body Mass Index (kg/m <sup>2</sup> )					
Normal (18.5-24.9)	103(22.5)	16(15.5)	87(84.5)	20.282/	
Overweight (25-29.9)	229(50.0)	26(11.4)	203(88.6)	0.000**	
Obese (>30)	126(27.5)	38(30.2)	88(69.8)		
Number of pregnancies					
1	109(23.8)	4(3.7)	105(96.3)	42.241/	
2	182(39.7)	37(20.3)	145(79.7)	0.000**	
3	137(29.9)	23(16.8)	114(83.2)		
4 and more	30(6.6)	16(53.3)	14(46.7)		
Cronic disease					
Yes	27(5.9)	4(14.8)	23(85.2)	0.140/	

No	431(94.1)	76(17.6)	355(82.4)	0.476
Family history of diabetes				
Yes	198(43.2)	56(28.3)	142(71.7)	28.301/
No	260(56.8)	24(9.2)	236(90.8)	0.000**

\*p<0.05, \*\*p<0.01

**Table 2. Prevalence of GDM According to Obstetric, Current Pregnancy and General Medical History (N=458)**

	Presence of Risk n(%)				Presence of No Risk n(%)			X <sup>2</sup> / p
	General	GDM		General	GDM			
		Yes n(80)%	No n(378)%		Yes n(80)%	No n(378)%		
<b>Obstetric history</b>								
Stillbirth or newborn loss in previous pregnancies	6(1.3)	5(83.3)	1(16.7)	452(98.7)	75(16.6)	377(83.4)	18.296/ 0.001*	
Preterm birth history (between 22 and 37 wk)	39(8.5)	4(10.3)	35(89.7)	419(91.5)	76(18.1)	343(81.9)	1.538/ 0.153	
History of a baby with anomaly	5(1.1)	5(100.0)	0(0.0)	453(98.9)	75(16.6)	378(83.4)	23.886/ 0.000*	
Hospitalization due to pre-eclampsia/ eclampsia	18(3.9)	4(22.2)	14(77.8)	440(96.1)	76(17.3)	364(82.7)	0.294/ 0.387	
Having surgery in genitals (myomectomy, etc.)	77(16.8)	13(16.9)	64(83.1)	381(83.2)	67(17.6)	314(82.4)	0.022/ 0.516	
<b>Current pregnancy</b>								
Being over 35 years old	69(15.1)	15(21.7)	54(78.3)	389(84.9)	65(16.7)	324(83.3)	1.028/ 0.198	
Rh incompatibility in pregnancies	15(3.3)	0(0.0)	15(100)	443(96.7)	80(18.1)	363(81.9)	3.282/ 0.053	
Diastolic blood pressure above 90 mmHg	13(2.8)	4(30.8)	9(69.2)	445(97.2)	76(17.1)	369(82.9)	1.642/ 0.176	
History of anemia	16(3.5)	2(12.5)	14(87.5)	442(96.5)	80(18.1)	362(81.9)	1.051/ 0.187	
<b>General medical history</b>								
Kidney disease	6(1.3)	0(0.0)	6(100.0)	452(98.7)	80(17.7)	372(82.3)	1.287/ 0.314	
Use of cigarettes, alcohol and other substances	23(5.0)	1(4.3)	22(95.7)	435(95.0)	79(18.2)	356(81.8)	2.891/ 0.066	

\*p<0.01

## Discussion

Gestational diabetes mellitus, the most common medical complication of pregnancy, poses a risk of developing type 2 diabetes in the next decade with an estimated 50% probability (Mihmanli & Mihmanli, 2015). Therefore, it is recommended that gestational diabetes research should be performed with OGTT whether there is a risk or not (Olgun et al., 2011). In the study, 17.5% of pregnant women were diagnosed with GDM by physician according to OGTT results. In other studies, it was found that GDM prevalence varied between 8.4-17.8% in pregnant women (Baci et al., 2013; Ozyurt et al., 2013; Ozdemir et al., 2014). The findings of the study are important to reduce the risks associated with GDM, to protect the health of pregnant women and to monitor the risky individuals in terms of type 2 diabetes. It is known that overweight and obese women during pregnancy have high risk for maternal and perinatal mortality (Athukorala et al., 2010; Yanikkerem & Mutlu, 2012). It is reported in the literature that obesity is also a risk factor for GDM and GDM is one of the independent risk factors for the development of diabetes in the following years (Athukorala et al., 2010; Baci et al., 2013). In the study, it was determined that approximately one third of pregnant women were obese and GDM prevalence was higher in pregnant women who were obese. In other studies, it was found that obese between 15%-23% in pregnant women (Madan et al., 2009; Athukorala et al., 2010; Ozdemir et al., 2014). Baci et al. (2013) found that prevalence of GDM was 1.31%, 3.28% and 9.52% in women with normal weight, overweight and obese, respectively. In similar studies, it was concluded that excessive weight gain especially in the first trimester posed a risk for GDM (Gibson et al., 2012; MacDonald et al., 2017).

On the other hand, in the literature, it is supported that children of women who are obese during pregnancy will develop obesity in the postnatal period with the development of insulin resistance (Sener et al., 2011). Given the clear relationship between obesity and GDM, it is of utmost importance for women to maintain weight control who are planning pregnancy.

Factors such as hypertension, family history of diabetes etc. are important risks for the development of diabetes (Olgun et al., 2011). In the study, the prevalence of GDM was found to

be high in pregnant women who were primary school graduates, who did not work, who were obese, who had four or more pregnancies, who had family history of diabetes and who had high fasting blood glucose level. Similarly, in the study of Ozdemir et al. (2014) and Ozyurt et al. (2013), it was determined that the family history of diabetes and age increased the risk of GDM. Determination and control of risk factors for GDM are important for mother and infant health (Kalyani et al., 2014; Erem et al., 2015).

## Conclusion

Prevalence of GDM, which is one of the most important health problems frequently encountered during pregnancy in pregnant women, was found to be high in this study. Educational status, occupation, body mass index, number of pregnancies, family history of diabetes, fasting blood glucose values, history of stillbirth or neonatal death and birth defects in previous births were found to affect the prevalence of GDM.

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