

## Prevalence and Risk Factors of Gestational Diabetes Mellitus in Yazd Province, Iran

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ARTICLE INFO	ABSTRACT
<p><i>Article type:</i> Original article</p>	<p><b>Background &amp; aim:</b> The global prevalence of Gestational Diabetes Mellitus (GDM) is increasing with an alarming rate. It commonly manifests during the third trimester of pregnancy and may lead to multiple maternal complications. Neonates of women with GDM are more likely to suffer from metabolic problems later. Considering the importance of GDM, this study was performed with aim to determine the prevalence and risk factors of GDM in Yazd province.</p> <p><b>Methods:</b> This cross-sectional study was carried out on 3202 pregnant women in Yazd province from March 2008 to March 2011. The Glucose Challenge Test and Oral Glucose Tolerance Test were used to diagnose GDM. The interpretation was based on Coustan-Carpenter criteria. Sampling was done in a full-census manner. Statistical analysis was performed using SPSS software (version 19). Logistic Regression was used to calculate the Odds Ratio at 95% Confidence Interval to estimate the independent association of different risk factors with GDM.</p> <p><b>Results:</b> The overall prevalence of GDM in this study was 3.3%. The mean age of participants was 27.7±5.7 years. Identified risk factors were age (OR: 1.1, P&lt;0.001), BMI (OR: 1.1, P&lt;0.001), history of abnormality in neonates (OR: 2.84, P=0.036), macrosomia (OR: 3.19, P=0.004), and diabetes in the family (OR: 2.9, P&lt;0.001).</p> <p><b>Conclusion:</b> Among the risk factors identified for GDM, BMI is the only modifiable factor, which can implicate the development of gestational diabetes mellitus. Public management of weight, and avoiding a sedentary lifestyle can reduce the risk of GDM. It is also suggested that it is better to plan for pregnancy at younger ages.</p>
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### Introduction

There is an alarming increase in prevalence of gestational diabetes mellitus (GDM) globally (1). Based on the different study setting and diagnostic criteria, the prevalence of GDM differs in various parts of the world. Other factors which can influence the prevalence are age, obesity and health care use. For instance, the prevalence of GDM based on International Classification of Disease (ICD) criteria in the USA (2) and Korea (3) was reported 6% and 10%, respectively. A meta-analysis of various studies conducted in sub-Saharan Africa with different diagnostic criteria and setting of studies

reported a prevalence of 2–6% for GDM (4). In Iran, the result of a meta-analysis showed that the prevalence of GDM is 3.4% (the highest and lowest incidence rate were 18.6% and 1.3%, respectively) (5). According to the recent update by the International Diabetes Federation (IDF), hyperglycemia during pregnancy were affected 21.3 million or 16.2% of live births, and 75–90% of these pregnancies were GDM (1). World Health Organization (WHO) defined the diagnostic criteria of gestational diabetes mellitus as “any degree of glucose intolerance leading to hyperglycemia of different grades with onset or

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first recognition during pregnancy" (6). GDM more commonly manifests during the third trimester of pregnancy, although its symptoms may start as early as the end of the second trimester (7, 8) and it is a high associated risk factor for prenatal mortality and morbidity (9). Gestational diabetes mellitus may lead to multiple maternal complications including antepartum hemorrhage, hypertensive disorders during pregnancy and risk of future diabetes mellitus; and fetal and neonatal complications such as stillbirth, dystocia, spontaneous abortion, macrosomia, prematurity, respiratory distress syndrome and the risk of developing neonatal diabetes (10, 11). The children born to GDM mothers are at higher risk of cardiovascular disease and metabolic disorders in later life (12). GDM plays a key role in diabetes pathogenesis, about 50% of mother with GDM will have the chance of developing diabetes in 10 years, indicates GDM as an important predictor of diabetes (13). Therefore, knowledge about GDM in various parts of the world can help with health policies and planning (14).

Considering the growing prevalence of GDM in all developed and developing countries (15) and estimation of increasing in upcoming years due to increased mean age of the population, urban sedentary lifestyle and increasing the number of obese women (16), And association of negative health outcome over the short-term and long-term on both mothers and their babies (17), this study aimed to determine the prevalence of GDM and provide an update on the assessment of different risk factors on GDM.

## Materials and Methods

This was cross-sectional study conducted on all pregnant women who were screened for gestational diabetes mellitus in Yazd province from March 2008 to March 2011. The ethical code of the present study was obtained from the Shiraz University of Medical Sciences Ethics Committee (IR.SUMS.REC.1393.S7390). Women with Diabetes Mellitus, chronic liver disorder, glandular disorders, and those using the medications affecting glucose metabolism were excluded from the study.

After providing written informed consent from the eligible pregnant women, data were collected by using a structured questionnaire which included socio-demographic information,

and medical and obstetrics history. The information included mother's age, parity, history of diabetes in the family, hypertension, GDM, and miscarriage, stillbirth, macrosomia, abnormality in the previous pregnancies.

If the first visit was before 24-28 weeks, and the pregnant women did not have any risk factors of gestational diabetes (including: age  $\geq$  30 years, history of gestational diabetes, history of diabetes in first-degree relatives, history of hypertension, history of macrosomia, BMI  $>$  30, history of miscarriage more than 2 times, history of stillbirth, and history of fetal abnormalities in previous pregnancies), Glucose Challenge Test (GCT) was postponed to 24-28 weeks of gestation. But if the mother had at least one risk factor of gestational diabetes, she was considered as high risk, and non-fasting GCT was done using 50 g oral glucose. One hour after consuming glucose, if the glucose level was  $<$  130 mg/dl, the risk of GDM was temporarily ruled out and the test was repeated during 24-28 weeks of gestation. If blood glucose level was  $>$  130 mg/dl, a standard 4 split Oral Glucose Tolerance Test (OGTT) with 100 g oral If blood glucose was impaired only in one of the OGTT tests, the test was repeated one month later and the decision was made based on the test results.

After finishing screening tests, 1601 women were diagnosed with GDM. Sampling was done in a full-census manner and all 1601 entered to the study. To be able to, we selected the same number of women who were not diagnosed with GDM were selected by using simple random sampling in order to make a comparison. Data were analyzed by SPSS software (version 19). After checking the normality of continuous variables, Chi-Square test was used for categorical and Student T-Test (Man-Whitney for non-parametric) for continuous to estimate the association between the variables and GDM. Logistic Regression (Wald) was used to calculate the Odds Ratio (OR) and 95% Confidence Interval (95% CI) to estimate the independent association of different risk factors with GDM. All variables with a P-value of  $\leq 0.2$  were candidate to enter the logistic regression model.

## Results

A total of 3202 women entered into the study (1601 GDM women and 1601 non-GDM). The youngest mother was 15 years old and the

oldest was 47 years old. The mean age of participants was 27.7±5.7 years. The overall

prevalence of GDM in the study's population was 3.3%.

**Table1.** Results of bivariate analysis of risk factors associated with Gestational Diabetes Mellitus

Variable	Mean ± SD	P-Value	
<b>Age</b>			
GDM	29.46±5.74	<0.001	
Non-GDM	25.99±5.25		
<b>Parity</b>			
GDM	2.44±1.34	<0.001	
Non-GDM	1.89±1.10		
<b>Body Mass Index</b>			
GDM	27.82±4.65	<0.001	
Non-GDM	25.04±4.64		
Variable	GDM N (%)	Non-GDM N (%)	P-Value
<b>Diabetes in family</b>	694(43.3%)	303(19.92%)	<0.001
<b>GDM history</b>	44(2.7%)	4(0.2%)	<0.001
<b>Hypertension history</b>	46(2.8%)	14(0.8%)	<0.001
<b>Abortion history</b>	74(4.6%)	40(2.4%)	0.001
<b>Abnormality history</b>	22(1.3%)	6(0.3%)	0.004
<b>Macrosomia history</b>	37(2.3%)	6(0.3%)	<0.001
<b>Stillbirth history</b>	32(1.9%)	11(0.6%)	0.002

The results of the bivariate analysis showed that women with GDM were significantly older compared to the women without GDM

( $P < 0.001$ ) and more likely to report a history of diabetes in the family ( $P < 0.001$ ). The results are shown in Table 1.

**Table2.** The results of logistic regression analysis of the risk factors of Gestational Diabetes Mellitus

Variables	OR	CI (95%)	P-value
<b>Age</b>	1.1	1.08 - 1.12	<0.001
<b>BMI</b>	1.1	1.07 - 1.11	<0.001
<b>Abnormality</b>	2.84	1.04 - 7.74	0.036
<b>Macrosomia</b>	3.19	1.28 - 7.92	0.004
<b>Diabetes in family</b>	2.9	2.50 - 3.52	<0.001

In bivariate analysis, the variables with a P-value of  $\leq 0.2$  were entered into the logistic regression model (P-value of all variables was  $\leq 0.2$ ); the results of the analysis showed that five factors were associated with GDM. The history of macrosomia was the most important factor (OR: 3.19, 95% CI: 1.28-7.92.  $P=0.004$ ) and women with GDM history were 3 times at higher risk of Gestational Diabetes Mellitus. The results were also shown in Table 2.

## Discussion

This was cross-sectional study conducted in Yazd province from March 2008 until March 2011. We aimed to estimate the prevalence of GDM, determining the association of some socio-demographic risk factors with GDM, and

comparison of those variables among women with and without GDM. In this study, the prevalence of GDM was 3.3 %, but it varies in different places of the world from 1.4 to 14% (18). A meta-analysis in Turkey, reported the prevalence of 7.7% for GDM (19), and a reported prevalence of GDM in the USA (2) and Korea (3) were 6% and 10%, respectively. Differences in the prevalence of GDM can be ascribed to the study's settings and diagnostic criteria. The finding of this study was relatively consistent with the result of the study of Jafari-Shobeiri and et al. that reported the prevalence of 3.4% in Iran (5). Identified risk factors for the present study were "age", "BMI", "abnormality", "macrosomia", and "diabetes in the family".

According to the analysis, there was a statistically significant association between BMI with GDM. The mean BMI for women with GDM in the present study was 27.82 and for non GDM was 25.04. For every unit increase in BMI, the risk of GDM increased by 10 %. Several studies confirmed this association (20-22). A study conducted in Peru reported BMI>25 as a risk factor for GDM (23). Maternal age was another identified risk factor in this study. The result was consistent with the findings of other studies (24-26); these studies reported that women with GDM had older maternal age. Larrabure-Torrealva also reported that the prevalence of GDM is associated with older maternal age (23). In this study, there was a significant association between the history of diabetes in the family and GDM. Some previous studies are in general agreement with this finding. For instance, the study conducted among rural and urban Tanzania reported that the family history of diabetes 2 increases the risk of GDM as 2.1 times (4). There are several studies from different parts of Iran that supported this result; the study carried out in Shoushtar reported a seven-fold risk of GDM in women with the history of diabetes2 in the family (27). Other studies conducted in Shiraz (28) and Kermanshah (29) also confirmed this association. However, the study in Cameroon (24) reported that despite an association between GDM and history of diabetes2 in the family in Univariate analysis, it didn't show a significant association in multivariate analysis. Concerning the role of genetic and environment and their interaction in diseases, it seems that a significant association is logical, and the reason for this contrary may be attributed to the small sample size of the study and ethnicity. According to the findings of this study, women with macrosomia had 3.75 times risk of GDM. A cross-sectional study in Cameroon reported that women with a history of macrosomia are at risk of gestational diabetes mellitus (24). Another study in southern Tanzania reported a significant association between macrosomia and GDM (30). In Iran, Bouzari reported macrosomia as a risk factor for gestational diabetes mellitus (31). In this study, the presence of abnormality in previous pregnancies increased the risk of GDM by almost three times, but this finding is

contrary to other studies conducted in different parts of Iran (29, 30, and 32). This inconsistency may be attributed to the different sample size in these studies. The history of stillbirth, hypertension, and parity are the factors which showed significant association in Univariate analysis, but the association was not significant in multiple logistic regression. There are contradictory reports about the association of these factors with gestational diabetes mellitus (24, 30, and 33). The major strength of the present study was the large sample size leading to the statistical power to evaluate the mentioned associations. However, there were some limitations: the numbers of the studied variables were limited, assessment of the history of diabetes in the family was based on self-report, therefore there was the possibility of recall bias.

## Conclusion

Among the risk factors identified for GDM, BMI was the only modifiable factor, which can implicate the development of gestational diabetes mellitus, public management of weight, and avoiding a sedentary lifestyle can reduce the risk of GDM. We also suggest that it is better to plan for pregnancy at younger age

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## Conflicts of interest

Authors declared no conflicts of interest.

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