

## Original Article

**The Relationship Between Some Risk Factors and Gestational Diabetes Mellitus In Pregnant Women Referred to Health and Treatment Centers in Zahedan, Iran, in 2012**Mansour Karajibani<sup>1</sup> \*Farzaneh Montazerifar<sup>2</sup> Sara Abdolahi<sup>3</sup>

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**Abstract**

**Background and purpose:** Gestational diabetes mellitus (GDM) is the most common metabolic disorder in pregnancy. It was known one of the complications of this period. The aim of this study was to investigate the relationship between some risk factors with GDM in pregnant women in Zahedan, Iran.

**Materials and Methods:** In a descriptive-analytical study, 70 pregnant women with GDM and 140 healthy pregnant women were selected referring to health and treatment centers in Zahedan by multistage sampling method. Weight and height were measured, and body mass index (BMI) was calculated using standard method. Other data were recorded by clinical examination, health record of anybody and interview in health centers. SPSS for Windows was used for statistical analysis. t-test and Chi-square test were used for comparison of two groups.  $P < 0.0500$  was considered as a significant difference between groups.

**Results:** As compared to controls the prevalence of GDM was more common in pregnant women who were older ( $P = 0.0001$ ), high BMI ( $P = 0.0020$ ), and more parity ( $P = 0.0200$ ), family history of diabetes ( $P = 0.0001$ ) and macrosomia ( $P = 0.0100$ ). There was significant difference between GDM with age ( $P = 0.0080$ ), BMI ( $P = 0.0020$ ), family history of diabetes ( $P = 0.0001$ ), history of macrosomic infant's birth ( $P = 0.0300$ ). But it was not observed significant differences between GDM with smoking, history of hypertension, abortions, stillbirth, and preeclampsia.

**Conclusion:** This study emphasizes to do GDM screening in the population of this area. It can be determined risk factors of GDM as moderate and severe status. Because; GDM during pregnancy is associated with adverse outcomes.

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**Key words:** Risk Factors, Gestational diabetes mellitus, Screening, Iran

## 1. Introduction

GDM is one of the most common medical problems found in pregnancy (1). Gestational Diabetes Mellitus (GDM) occurred in 3-10 pregnancies. These differences may be related to characteristics of demographic, geography, race, and or screening methods of population study (2-4). GDM is defined as glucose intolerance of different degree with beginning or first recognition during pregnancy (5). GDM depends on the population studied and the diagnostic test employed, prevalence may range from 2.4% to 21% of all pregnancies (6,7). Women with GDM are likely to develop type 2 diabetes. Besides, the offspring of women with GDM have a greater risk of childhood obesity, glucose intolerance, and diabetes in early adulthood (1). The factors that contribute to higher insulin resistance or impaired insulin secretion before pregnancy can be expected to have an inheritance during pregnancy (8). Risk assessment for GDM should be undertaken at the prenatal visit. Women with clinical characteristics of GDM should undergo glucose testing as soon as possible.

According to complications of GDM, the risk of adverse maternal, fetal, and neonatal outcomes gradually increases as a function of maternal glycemia at 24-28 weeks of gestation. There was no beginning for most of these complications, but preventing and early identifying GDM is a growing health concern (9). GDM is increasing in parallel to progress epidemic of obesity and type 2 diabetes in women of child-bearing age. Nonmodifiable risk factors such as history of GDM and increasing maternal age have been known. Nevertheless, the effect of diet and lifestyle modifiable risk factors have not yet been logically synthesized (10). It has been reported, factors such as physical activity and weight loss, improve insulin sensitivity and insulin secretory function so reduce the risk of type 2 diabetes (5,8). Factors that increase the risk of GDM were age, body mass index (BMI), and number of pregnancies diabetes

(11). It seems in young and middle-aged women, a dietary high fiber has an inverse association with the development of type 2 diabetes (12). Other neonatal morbidities that occur often in infants of women with GDM include hypoglycemia, hyperbilirubinemia, hypocalcemia, erythremia, and poor feeding. Prevalence and severity of morbidities depend on gestational age at delivery as well as on metabolic factors (13).

Birth weight history, maternal age, and ethnicity can be caused variation in the prevalence of GDM. Other factors include obesity particularly in youth and improved survival of female infants whose birth weights were at the excessive of the normal range. In adults, the last individuals have altered insulin action and/or insulin secretory capacity that may predispose them to the development of GDM (13). It was found that differences in screening programs and diagnostic criteria or various ethnic groups make it difficult to compare frequencies of GDM among various population (11).

There are limited studies relating to the risk factors of GDM in the Zahedan, Iran. Besides, identification of risk factors in GDM as a disorder could be useful in interventional program, at the time of screening for GDM, with the potential of preventing the development of or ameliorating GDM. On the other hand, variation in the prevalence of GDM as well as no available information in Zahedan encouraged us to design this study aimed to investigate the relationship between some risk factors with GDM in pregnant women with this condition in this area.

## 2. Materials and Methods

This study was a descriptive – analytical one in which pregnant women with GD in Zahedan, southeast of Iran. 70 pregnant women were selected according to Constant and Carpenter criteria (14) and following formula:

$$N = \frac{(Z_{1-\alpha/2} + Z_{1-\beta})^2 [P_1(1-P_1) + P_2(1-P_2)]}{(P_1 - P_2)^2}$$

It is estimated the prevalence of GDM in case group  $P_1 = 0.25$  and healthy subjects group  $P_2 = 0.02$  based on similar study in Iran (15), and,  $Z_{1-\alpha/2} = 1.96$ ,  $Z_{1-\beta} = 1.64$ ,  $\alpha = 0.05$ . Therefore, 70 GD pregnant women in case and 140 healthy pregnant women in control groups were selected respectively.

Diagnosis of the subjects based on the clinical examination carried out by the laboratory test.

All the individuals were selected from five regions which covered by healthy and treatment centers of Zahedan University Medical Sciences and Health services, Iran. According to the proportion and pregnant women population of every healthy and treatment center samples were selected random sampling. For every one GD pregnant of the case group, two healthy subjects were selected. Totally, all cases in GD and healthy subjects were selected including 19 women with GD and 38 healthy subjects from Sajad Health Center (1), 20 women with GD and 40 healthy subjects from Hazrat Seyed ilshohada Health Center (2), 14 women with GD and 28 healthy subjects from Kosar Health Center (3), 5 women with GD and 10 healthy subjects from Hazrat Fatemea Health Center (4), and 12 women with GD and 24 healthy subjects from Hazrat Masomea Health Center (5), respectively.

Individuals were selected using multistage stratified random sampling. All the subjects in two groups were selected between October 1, and December 30, 2012 from all pregnant women covered by healthy and treatment centers in Zahedan.

Data were collected through interview and information of health record of anybody in every health center. Age, body weight, and barefoot height were measured using digital scales (Seca, Germany) with precision rate of 0.2 kg and a non-stretch tape fixed to a flat vertical wall with

precision rate of 0.5 cm. BMI was calculated by dividing body weight (kg) by the square of the height ( $m^2$ ), and its position in the BMI indicator was determined (16).

All the participants (both groups) had given informed consent, and the study protocol was approved by Medical Ethics Committee of the Zahedan University of Medical Sciences (2012, June 13).

Data are expressed as mean  $\pm$  standard deviation. Statistical analysis was performed using SPSS for Windows (version 11.5, SPSS Inc., Chicago, IL, USA). For comparison of the quantitative data t-test and for comparison qualitative data Chi-square test was used. The difference was considered significant at  $P < 0.0500$  levels

### 3. Results

The mean age of pregnant women with GD and healthy subjects were  $31.0 \pm 6.4$  (17-48),  $26.9 \pm 5.7$  (15-47) years, respectively ( $P < 0.0001$ ).

There was no significant difference between Sistan, Baluchistan, Iran and others ethnicity based on GDM in two groups.

BMI of GD patients and healthy subjects were  $27.0 \pm 5.5$  (15.6-39.5) and  $24.2 \pm 4.5$  (16.4-37.1)  $kg/m^2$ , respectively, ( $t = -3.14$ ;  $P < 0.0020$ ). It shows there was a significant difference between the two groups ( $P < 0.0020$ ).

There was a significant difference according family history of diabetes between case and controls groups ( $\chi^2 = 16.6$ ,  $P = 0.0001$ ) (Table 1).

Of all, 37.1% and 12.9% of case and control groups were family history of diabetes and also 62.9% and 87.1% of following groups were without family history of diabetes. There was no significant difference based on history of blood pressure and smoking in two groups ( $\chi^2 = 2$ ,  $P = 0.1000$ ). It has not been shown.

As shown in table 2, there was a significant difference between two groups based on parity.

The result showed based on birth of macrosome newborn, there is a significant difference between case and controls (4.3% vs. 0%) ( $P = 0.0100$ ), But, there was no significant difference according to birth of premature newborn, stillbirth history, and preeclampsia between two groups ( $P > 0.0500$ ).

Although the percentage of abortions in Pregnant women with GD was more than controls, but this difference was not significant statistically (25.7% vs. 15.7%) (Table 3).

#### 4. Discussion

The results of the present study showed some risk factors are significantly associated with GDM. According to ethnicity, more people in Zahedan are Baloch and Sistani and the rest make up other ethnic groups population. In this study, no significant relationship was found between ethnicity and incidence of GDM. In contrast to the results of the study in New York showed there was significantly GD between different races, especially South Asia, central Asia. Risk of GD appears to vary markedly

among ethnic groups, Genetic, differences in geographical conditions, lifestyle, culture, and religious factors have an important role in causing these differences (17).

Ethnicity has been proven to be an independent risk factor for GDM, which varies in prevalence in direct proportion to the prevalence of type 2 diabetes in a given population or ethnic group. There are several identifiable predisposing factors for GDM, and in the absence of risk factors, the incidence of GDM is low (18). In the present study, the mean age of pregnant women with GD was more than healthy subjects significantly. Danilenko-Dixon et al. were reported the risk of GDM becomes significantly increased from 25 years further. This supports the American Diabetes Association recommendation on the use of age  $\geq 25$  years as the cutoff for screening and the observation that maternal age  $\geq 25$  years is the factor most predictive of GDM. In clinical practice, maternal age of  $\geq 25$  years should be adopted instead of  $\geq 35$  years or 40 years as a risk factor for the development of GDM (19).

**Table 1.** Distribution of frequency of family history of diabetes in the two groups

Groups	Family history of diabetes		
	Yes (%)	No (%)	Total (%)
Pregnant women with GD (n, %)	26 (37.1)	44 (62.9)	70 (100)
Control (n, %)	18 (12.9)	122 (87.1)	140 (100)
Total (n, %)	44 (21.0)	166 (79.0)	210 (100)

$\chi^2 = 16.6$ ;  $P = 0.0001$ ; GD: Gestational diabetes

**Table 2.** Distribution of frequency of parity in the two groups

Groups	Parity		
	1-2 (%)	3-4 (%)	Total (%)
Pregnant women with GD (n, %)	91 (65.0)	49 (35.0)	140 (100)
Control (n, %)	34 (48.6)	36 (51.4)	70 (100)
Total (n, %)	125 (59.5)	85 (40.5)	210 (100)

$\chi^2 = 5.2$ ;  $P = 0.0200$ ; GD: Gestational diabetes

**Table 3.** Distribution frequency of abortion in the two groups

Groups	Abortion		
	Yes (%)	No (%)	Total (%)
Pregnant women with GD (n, %)	18 (25.7)	52 (74.3)	70 (100)
Control (n, %)	22 (15.7)	118 (84.3)	140 (100)
Total (n, %)	40 (19.0)	170 (81.0)	210 (100)

$\chi^2 = 3$ ;  $P = 0.0800$ ; GD: Gestational diabetes



Future studies are needed to compare the incidence of GDM-related maternal and fetal morbidity such as pre-eclampsia, premature rupture of membranes, cesarean section, preterm delivery, macrosomia for GDM and to examine whether there is a trend in decreasing GDM related maternal and fetal morbidity after universal screening of GDM (20). There are also great geographic and ethnic variations in the prevalence of GDM (21). Maternal age is a well-known risk factor for GDM, but there is no agreement on the age above which there is considerably increased risk of GDM (22). An age > 25 years increased the risk of GDM almost twofold and BMI >25 kg/m over fivefold (23).

According to BMI, there was significantly different between pregnant women with GD and healthy subjects. It seems the risk of GDM increased with increasing BMI. It was reported, the GDM patients were significantly older than the pregnant women with normal glucose tolerance (NGT) and had a greater tendency toward obesity before pregnancy, more often had relatives with diabetes, (third or subsequent pregnancy) and more often experienced adverse perinatal outcomes. Age, overweight and obesity, diabetes in the family, parity, macrosomia, and a history of perinatal complications were determined as risk factors for GDM. Nevertheless, there is no reliable method of identifying subjects at increased GDM risk is found (23). Although macrosomia can be influenced by both genetic and environmental factors, the increase in prevalence is principally attributable to environmental reasons (24). Pre-gestational BMI is a generally known factor affecting fetal growth (25). It is stressed, obesity, excessive gestational weight gain, and diabetes should be considered independent risk factors for newborn macrosomia. Therefore, evaluate the clinical evolution of pregnancy, all three variables need to be carefully assessed and monitored. It is also suggested that maternal obesity, excessive

gestational weight gain, and diabetes are independent valuable predictors of macrosomia, when adjusted for other recognized risk factors (parity, mother's height, gestational age at birth, neonate sex) (26).

On family history of diabetes, there are significant differences between pregnant women with GD and healthy subjects. In the present study, the family history of diabetes in cases and controls were 37.1% and 12.9%, respectively. In another study, it was observed significant difference based on relatives' diabetes between GD patients and the normal glucose tolerance subjects (40.0 vs. 25.7%;  $P < 0.0100$ ) (23). In a similar study in Kermanshah (North – west of Iran) has been reported 37.3% and 6.7% of pregnant women with GD and without GD were family history of diabetes, respectively (15). GDM showed an association with increasing age, higher parity, higher pre-pregnancy weight and BMI, history of diabetes in the first degree relatives, past history of GD in various studies (13,27). It was found a significantly higher percent of women with GDM had positive family history of diabetes mellitus (28).

In the present study, it was observed significantly associated between the history of newborn macrosomia and GD. Neonatal body weight has correlation with maternal gestational weight gain, placenta weight. According to pathogenesis of fetal macrosomia, it seems to consider all aspects of maternal fuel metabolism (insulin secretion, insulin sensitivity and also carbohydrate, fat, and amino acid metabolism) instead of focusing of blood glucose level (29,30). However, other studies have been shown, there was not significant correlation between history of blood pressure, pre-eclampsia with GDM (31,32). Although, it was observed blood pressure in GDM. Blood pressure and pre- eclampsia are considered as a risk factor of pregnancy. It was reported, pregnant women with GD to have increased the risk of pregnancy-associated hypertension

compared with nondiabetic women. On the other hand, pregnant women with hypertension are at increased risk for GDM. It is supposed to that this association could be due to insulin resistance. In predisposed individuals, insulin resistance lead to hyperinsulinemia and increasing of hypertension and GDM (33).

In the present study, it seems no association between hypertension and preeclampsia individuals with GDM was due to small sample size of patients with hypertension and preeclampsia which require more studies with larger sample size. However, the risk of hypertensive disorders is increased in women with GDM (13). The present study showed that there was significant difference between women with GD and healthy subjects based on parity ( $P < 0.0200$ ), which is consistent with the results of a study Tabatabaei et al. (34).

It is likely to increase, along with other risk factors such as age, body weight, BMI, and fat storage prevalence of diabetes more development in the pregnant women who are prone to GD (35).

The results showed according to other risk factors such as the history of stillbirths and abortion, premature birth, and cigarette smoking, there was no significant difference between two groups which is similar to other studies (13,20). It is reported the frequency of spontaneous preterm birth may be increased in women with untreated GDM (11). Cigarette smoking during pregnancy may increase the risk of GDM or pregestational diabetes mellitus. Smoking has been associated with hyperinsulinemia and insulin resistance in experimental studies, although the association with diabetes remains unclear (36). In the present study, the lack of significant differences in some risk factors of GDM may be due to time restriction, Small sample size, and sampling method in the study population of all high risk factors, previous history of congenital anomaly, recurrent abortions and

previous stillbirth, maternal age, and family history of diabetes were only statistically significant for GD (37).

There was a limitation in our study. For example, the sample size of population study was low. It is recommended that the study be conducted with a larger sample size. The results indicated that GD is common among pregnant of this area. It significantly associated with age, BMI, family history of diabetes, parity, history of macrosomic infant's birth. However, no significant association was observed between GDM with cigarette smoking, history of hypertension and preeclampsia, abortion, stillbirth. This study emphasized on laboratory screening for GDM in the subjects from moderate to severe status of GD. Because of, there was no threshold for most of the complications of GD but preventing and early identifying GDM is a growing health concern. It is recommended to design extensive studies with more subjects for identify risk factors of GD in the population.

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