

# Prevalence of diabetes in women

## with preeclampsia referred to Imam Hossein and Fatemeh Hospitals in Shahroud

*Prevalencia de diabetes en mujeres con preeclampsia referidas a los hospitales Imam Hossein y Fatemeh en Shahroud*

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### Abstract

**Introduction and objective:** Preeclampsia, characterised by hypertension and proteinuria occurring after 20 gestational weeks, is a leading cause of maternal and foetal morbidity and mortality. The pathophysiology of preeclampsia remains elusive, and the incidence of diabetes during pregnancy in patients with preeclampsia is still a matter of study. Therefore, the objective of this study was to investigate the prevalence of diabetes in women with preeclampsia referred to Imam Hossein and Fatemeh hospitals in Shahroud.

**Methodology:** This descriptive cross-sectional study was conducted on 108 women with preeclampsia (based on clinical symptoms, gynecological tests, and diagnoses) referred to Fatemeh and Imam Hossein hospitals in Shahroud for delivery or termination of pregnancy in 2014. A questionnaire, which included demographic information such as age, number of pregnancies, birth rank, pregnancy conditions, type of delivery, history of hypertension and diabetes in the patient and their first-degree relatives, was used in this study. Data were expressed as percentage, frequency, standard deviation,

mean, and were analyzed by Student's t test and chi-square, using SPSS software. A value of  $p < 0.05$  was considered significant.

**Results:** The incidence of preeclampsia was associated with maternal diabetes ( $p \leq 0.05$ ), maternal age ( $p \leq 0.04$ ), birth rank ( $p \leq 0.04$ ), multiple pregnancies ( $p \leq 0.03$ ), history of maternal diabetes, history of maternal hypertension ( $p \leq 0.03$ ), history of preeclampsia at previous delivery ( $p < 0.02$ ) and age of termination of pregnancy ( $p \leq 0.01$ ). There was no significant difference with regard to other variables.

**Conclusion:** The results revealed that about 25% of preeclampsia patients had gestational diabetes, which increased the risk in pregnant women and neonates. Therefore, by preventing and controlling blood pressure and diabetes, we can reduce the maternal and fetal complications of these disorders, and thus, reduce the rate of mortality.

**Keywords:** Preeclampsia, Gestational Diabetes, Clinical Symptoms, Demographic Variables.

**Introducción y objetivo:** La preeclampsia, caracterizada por hipertensión y proteinuria que ocurren después de las 20 semanas de gestación, es una de las principales causas de morbilidad y mortalidad materna y fetal. La fisiopatología de la preeclampsia sigue siendo difícil de alcanzar y la incidencia de diabetes durante el embarazo en pacientes con preeclampsia sigue siendo un tema de estudio. Por tanto, el objetivo de este estudio fue investigar la prevalencia de diabetes en mujeres con preeclampsia derivadas a los hospitales Imam Hossein y Fatemeh en Shahroud.

**Metodología:** Este estudio descriptivo transversal se realizó en 108 mujeres con preeclampsia (basado en síntomas clínicos, pruebas ginecológicas y diagnósticos) remitidas a los hospitales Fatemeh e Imam Hossein en Shahroud para el parto o la interrupción del embarazo en 2014. En este estudio se utilizó un cuestionario que incluía datos demográficos como edad, número de embarazos, rango de nacimiento, condiciones del embarazo, tipo de parto, antecedentes de hipertensión y diabetes en la paciente y sus familiares de primer grado. Los datos se expresaron como porcentaje, frecuencia, desviación estándar, media, y se analizaron mediante la prueba t de Student y chi-cuadrado, usando el software SPSS. Un valor de  $p < 0,05$  se consideró significativo.

**Resultados:** La incidencia de preeclampsia se asoció con diabetes materna ( $p \leq 0,05$ ), edad materna ( $p \leq 0,04$ ), rango de nacimiento ( $p \leq 0,04$ ), embarazo múltiple ( $p \leq 0,03$ ), antecedentes de diabetes materna, antecedentes de hipertensión materna ( $p \leq 0,03$ ), antecedentes de preeclampsia en el parto anterior ( $p < 0,02$ ) y edad de interrupción del embarazo ( $p \leq 0,01$ ). No se encontró diferencia significativa con respecto a otras variables.

**Conclusión:** Los resultados revelaron que alrededor del 25% de las pacientes con preeclampsia tenían diabetes gestacional, lo que aumentó el riesgo en mujeres embarazadas y recién nacidos. Por lo tanto, al prevenir y controlar la presión arterial y la diabetes, podemos reducir las complicaciones maternas y fetales de estos trastornos y, por lo tanto, reducir la tasa de mortalidad.

**Palabras clave:** Preeclampsia, diabetes gestacional, síntomas clínicos, variables demográficas.

## Introduction

Pregnancy is a natural and vital phenomenon<sup>1</sup>. The pregnancy phenomenon is associated with many physiological changes for each woman. In some cases, it might be associated with serious risks and might threaten the health of the mother and the fetus, indicating the importance of prenatal care<sup>2</sup>. In this regard, preeclampsia and gestational diabetes are one of the major health-threatening problems due to their relatively high prevalence and adverse effects<sup>3,4</sup>. Based on World Health Organization studies, preeclampsia and gestational diabetes are involved in 40% of maternal deaths in the third

world<sup>5</sup>. The prevalence of preeclampsia is around 10% in developing countries and 5% in developed countries<sup>6</sup>. Gestational hypertension often affects primiparous women, and the incidence of preeclampsia in women aged over 35 years is 2-3 times higher, probably due to undiagnosed chronic hypertension in these people<sup>7</sup>. The disorder usually begins after the 37th week of pregnancy<sup>8</sup>.

Annually, about 50000 women around the world die due to gestational hypertension disorders and the almost same number of women die due to preeclampsia complications such as brain hemorrhage and kidney failure<sup>9-12</sup>. The evidence indicates that preeclampsia doubled the risk of developing type 2 diabetes in less than one year after delivery to ten years after the baby's birth. Meta-analysis of Pensee Wu et al., that adjusted for potential confounders demonstrated that pre-eclampsia was independently associated with an increased risk of future diabetes<sup>13</sup>. Gestational diabetes is another important and relatively common problem during pregnancy, which affects a great number of pregnant women. This disorder, like gestational hypertension, can cause serious complications for the fetus and the mother<sup>14-16</sup>. Studies have shown that the risk of diabetes mellitus and polycystic ovary syndrome is increased in the presence of preeclampsia due to insulin resistance. Indeed, Inghand et al., found that pregnant mothers with preeclampsia and gestational diabetes were more prone to preterm labor and type 2 diabetes. Glucose intolerance that starts or is diagnosed during pregnancy for the first time is called gestational diabetes. Gestational diabetes mellitus (GDM) is defined as hyperglycemia that is first diagnosed during pregnancy. The American Diabetes Association (ADA) recommends using either the traditional two-step approach or a newer one step approach to screen for GDM at 24-28 weeks gestation. For the two-step approach, women who fail a 50-g glucose challenge test complete a second diagnostic 75-g oral glucose tolerance test to confirm the diagnosis. The newer one-step approach is based on a single 75-g oral glucose tolerance test and was developed by the International Association of Diabetes and Pregnancy Study Groups (IADPSG), which includes the ADA. GDM is diagnosed if fasting ( $\geq 92$  mg/dl), one hour ( $\geq 180$  mg/dl) or two hour ( $\geq 153$  mg/dl) glucose values exceed established cut points. This definition applies regardless of the need or lack of need of insulin<sup>17</sup>. Gestational diabetes mellitus (GDM) is defined as hyperglycemia that is first diagnosed during pregnancy. The American Diabetes Association (ADA) recommends using either the traditional two-step approach or a newer one step approach to screen for GDM at 24-28 weeks gestation. For the two-step approach, women who fail a 50-g glucose challenge test complete a second diagnostic 75-g oral glucose tolerance test to confirm the diagnosis<sup>18</sup>. The newer one-step approach is based on a single 75-g oral glucose tolerance test and was developed by the International Association of Diabetes and Pregnancy Study Groups (IADPSG), which includes the ADA. GDM is diagnosed if fasting ( $\geq 92$  mg/dl), one hour ( $\geq 180$  mg/dl) or two hour ( $\geq 153$  mg/dl) glucose values exceed established cut points. Gestational diabetes is one of the most common metabolic diseases during pregnancy that can cause serious complications for both mother and fetus

if they are not diagnosed on time. About 7% of pregnancies are associated with gestational diabetes and it affects about 200000 people annually. Its prevalence has been reported to be 1 to 12%, depending on the studied population and utilized diagnostic tests. Some degrees of glucose intolerance disorder is observed almost in most women due to hormonal changes that occur during pregnancy. Their blood glucose levels rise during this period, but it does not increase enough to be considered diabetes. During the third trimester of pregnancy, these hormonal changes put the pregnant woman at risk for gestational diabetes. During pregnancy, an increase, which hormones secreted from the placenta, contributes to the transfer of nutrients from the mother to the fetus, and thus, contributes to the growth of fetus<sup>18</sup>. Another group of , which hormones, produced in the placenta, prevents a drop in blood glucose of the mother, and these hormones work by disrupting insulin function. Thus, during pregnancy, these hormones cause glucose intolerance disorder (increased blood glucose levels)<sup>19</sup>. In such a situation, to prevent high blood glucose, the person's body will need to secrete more insulin to transport glucose into the cells to provide energy for them. Cells in the mothers' pancreas often have the ability to produce more insulin (about 2 times the normal level) to overcome the effects of pregnancy hormones on blood glucose. If the pancreas fails to secrete enough insulin (to overcome the effects of hormones that cause increased blood glucose), blood glucose levels increase, resulting in gestational diabetes<sup>20,21</sup>. Gestational diabetes can affect the growth and development of the fetus during pregnancy. Maternal diabetes can lead to congenital defects and an increased risk of miscarriage in the early days of pregnancy. Many congenital defects have adverse effects on organs such as the brain and heart<sup>22</sup>. During the second and third trimesters of pregnancy, maternal diabetes can lead to over-nutrition and over-growth of the neonate. Neonatal overweight increases the risk of difficult and painful deliveries<sup>23</sup>. Gestational diabetes leads to an increased risk of complications such as preeclampsia, polyhydramnios, fetal macrosomia, difficult labor, neonatal metabolic complications (hypoglycemia, hyperbilirubinemia, and hypocalcemia). GDM and preeclampsia share many risk factors, including advanced maternal age, nulliparity, multifetal pregnancies, non-white race/ethnicity and pre-pregnancy obesity. GDM is often listed as a risk factor for the development of preeclampsia; however, previous research on the co-occurrence of the two conditions has often been underpowered and/or failed to account for shared risk factors such as obesity. Due to the high prevalence of preeclampsia in Iranian pregnant women and the incidence of gestational diabetes among these pregnant women, this study was conducted to investigate the prevalence of gestational diabetes in women with preeclampsia referred to Imam Hossein and Fatemeh hospitals. Hence, the question of the present study is whether diabetes is high in women with preeclampsia and can it be considered as a risk factor for preeclampsia.

## Materials and Methods

This descriptive cross-sectional study was conducted on 108 women with preeclampsia (based on clinical symptoms and gynecologist's diagnosis and examinations) referred to Fate-mieh and Imam Hossein hospitals for the delivery or termination of pregnancy in 2014. In this study, all of the pregnant women were assessed in terms of presence or absence of diabetes (common or previous diabetes or gestational diabetes). After interviewing them, their clinical documents were examined to complete the self-regulatory questionnaire. It included demographic information such as age, number of pregnancies, birth rank, and questions on pregnancy conditions, type of delivery, history of blood pressure, and diabetes in the patient and first-degree relatives. The general screening method for the diagnosis of diabetes was used at the diagnosis of pregnancy while the women were fasting. According to its value and national guidelines for the diagnosis of diabetes, a two-hour oral glucose tolerance test (OGTT) with 75 g glucose for gestational age of 24 to 28 weeks was performed<sup>24</sup>. If the initial fasting blood glucose normal was less than or equal to 92 mg / dL, it would be considered normal, if it was between 93 and 125 mg / dL, the person would be considered pre-diabetic, and if it was 126 mg / dL, the second test would be recommended, and if the second test was 126 mg / dL or more, the person would be considered diabetic. Two-hour oral glucose tolerance test (OGTT) was performed on all non-diabetic pregnant women (normal and pre-diabetic), using 75 g of oral glucose to screen for gestational diabetes at a gestational age of 24 to 28 weeks and it was interpreted as follows: If the fasting blood glucose was greater than or equal to 92 mg/dL, it would be considered abnormal, if blood glucose was greater than or equal to 180 mg / dL one hour after glucose intake, it would be considered abnormal, if blood glucose was greater than or equal to 153 mg / dL, it would be considered abnormal, and if at least one of the cases was abnormal, gestational diabetes would be diagnosed for pregnant women. All women with preeclampsia were screened according to this method and their pregnancy medical records. Data were expressed as percentage, frequency, standard deviation, mean, and were analyzed by Student's t test and chi-square, using SPSS software. A value of  $p < 0.05$  was considered significant.

## Results

In the present study, 108 pregnant women referred to Fate-mieh and Imam Hossein Shahroud hospitals (with the hospitals' permission) in 2014 were studied. The mean age of women was  $27.3 \pm 17.5$  years (at a range of 16-51 years) and the most common age group was 20-30 years old women (49.1%). Also, 91 (84.3%) deliveries were performed by cesarean section, and the rest of them were performed by normal vaginal delivery and 63 (58.3%) of the deliveries were related to first birth and 97 (89.8%) cases were related to a single pregnancy. Also, 27 (25%) of women had diabetes in their current pregnancy, while 19 (17.6%) of women had a previous history of diabetes. Also, 16 (14.8%) of women re-

ported a history of hypertension. In 34 cases (31.5%), severe preeclampsia was reported. The most common gestational age at the termination of pregnancy was 35-39 weeks with 63 cases (58.3%).

#### Inferential results

##### Age group and delivery

According to (Table 1), the majority of women in the present study were between 20 and 30 years old.

Delivery age group	N	%	P-value
Less than 20 years	8	7.6	04.0 p $\leq$
20-30 years	53	49	
31-40 years	35	32	
41-50 years	11	10.1	
Over 50 years	1	0.9	
total	108	100	

##### Diabetes in the current pregnancy

Based on (Table 2), 25% of women had diabetes in the present study.

Delivery	N	%	P-value
Diabetes in the current pregnancy			05.0 p $\leq$
Positive	27	25	
Negative	81	75	
Total	108	100	

##### History of maternal diabetes

According to (Table 3), 82.4% of women had no history of diabetes.

Delivery	N	%	P-value
History of diabetes			03.0 p $\leq$
Positive	19	17.59	
Negative	89	82.40	
Total	108	100	

##### History of diabetes in the first-degree relatives of mothers

According to (Table 4), first-degree relatives of 78.7% of pregnant women did not have a history of diabetes in the present study.

Table 4. Frequency distribution of diabetes based on the history of diabetes in their first degree relatives

Delivery	N	%	P-value
History of diabetes in relatives			NS
Positive	23	21.3	
Negative	85	78.7	
Total	108	100	

##### History of hypertension in pregnant women

According to (Table 5), 14.8% of women had a history of hypertension.

Table 5. Frequency distribution of delivery based on the history of Hypertension

Delivery	N	%	P-value
History of hypertension			03.0 p $\leq$
Positive	16	14.8	
Negative	92	85.2	
Total	108	100	

##### History of hypertension in first-degree relatives of mothers

According to (Table 6), first-degree relatives of 36.1% of women had a history of hypertension

Table 6. Frequency distribution of patients based on a history of hypertension in their first-degree relatives

History of hypertension in relatives	N	%	P-value
Positive	29	36.1	NS
Negative	69	63.9	
Total	108	100	

##### A history of preeclampsia in the previous delivery

According to (Table 7), 6.5% of women had a history of preeclampsia in their previous delivery.

Table 7. Frequency distribution of patients with preeclampsia in the previous delivery

Delivery	N	%	P-value
history of preeclampsia			02.0 p $\leq$
Positive	7	6.5	
Negative	101	93.5	
Total	108	100	

##### The severity of preeclampsia in the current pregnancy

According to (Table 8), 33.5% of women had mild preeclampsia

Table 8. Frequency distribution of patients based on the severity of preeclampsia

Delivery	N	%	P-value
Severity of preeclampsia			04.0 p $\leq$
Mild	74	5.68	
Severe	34	5.31	
Total	108	100	

## Delivery interventions

According to (Table 9), 84.3% of women had cesarean section delivery without any interventions.

**Table 9. Frequency distribution of patients based on the type of delivery intervention**

Delivery	N	%	P-value
Delivery interventions			
Cesarean section delivery without intervention	91	3.84	NS
Normal vaginal delivery without intervention	4	.73	
Normal vaginal delivery and episiotomy	6	5.6	
Normal vaginal delivery and delivery induction	5	4.6	
Normal vaginal delivery with an instrument	2	1.9	
Total	108	100	

## Effect of different factors on diabetes incidence

Table 10 illustrates the effect of different factors on the incidence of diabetes in preeclamptic pregnant women. The incidence of preeclampsia was associated with maternal diabetes ( $p \leq 0.05$ ), maternal age ( $p \leq 0.04$ ), birth rank ( $p \leq 0.04$ ), multiple pregnancies ( $p \leq 0.03$ ), history of maternal diabetes, history of maternal hypertension ( $p \leq 0.03$ ), history of preeclampsia at previous delivery ( $p < 0.02$ ), and age of termination of pregnancy ( $p \leq 0.01$ ). Significant differences were not found with regard to other variables.

**Table 10. The effect of different factors on the incidence of diabetes based on logistic regression analysis in pregnant women with preeclampsia**

Factor	Estimate	Standard error	Odd ratio	p-value	
Maternal age (year)	Over 40	97.2	07.1	38.23	05.0
	30-40	07.2	21.0	12.11	04.0
	20-30	58.1	05.1	25.9	05.0
	Less than 20				
Time of termination of pregnancy (week)	24	03.2	34.0	58.7	03.0
	28-34	79.0	26.0	20.2	03.0
	34-39	33.0	23.0	40.1	01.0
	Over 39				
Type of delivery	Cesarean section Normal vaginal	35.0	51.0	42.1	03.0
The severity of preeclampsia	Severe	62.3	05.1	30.37	231.0
	Mild No	99.0	40.1	69.2	478.0
Previous history of diabetes	Yes No	05.0	18.0	05.1	27.0
Previous history of hypertension	yes No	29.0	18.0	34.1	035.0
Birth rank	More than three	54.0	78.0	14.9	045.0
	Third	23.1	01.1	25.7	034.0
	Second	05.0	95.0	13.17	045.0
	First				
Multiple-pregnancy	More than 3	54.0	78.0	14.9	045.0
	Triplet	23.1	01.1	25.7	025.0
	Twin	05.0	95.0	13.17	038.0
	Singleton				

## Discussion

In the present study, 27 (25%) out of 108 patients with preeclampsia had diabetes. In a study conducted by Qiu et al. (2003), the prevalence of gestational diabetes was reported at 8% in the case group and 2% in the control group<sup>25</sup>. In the present study, gestational diabetes was associated with increased odds of developing hypertension during pregnancy. It increased the odds of developing eclampsia, severe preeclampsia, and mild preeclampsia by 2.7, 1.5, and 1.5 times, respectively. In a study conducted by Berison et al. (2003), 3.9% in the eclampsia group, 4.5 in the severe preeclampsia group, 4.4% in the mild preeclampsia group, and 4.4% in the preeclampsia plus gestational hypertension group had gestational diabetes<sup>26</sup>. The inconsistency of the results of the studies concerning the prevalence of diabetes may be related to the selection of the type of diabetes, since the above-mentioned study, only gestational diabetes was evaluated, but in the present study, type II and other type of gestational diabetes were included.

In the present study, there was a significant relationship between the history of hypertension in the first-degree relatives of patients and preeclampsia. Qiu et al. found that mothers with a history of hypertension in their parents reported a significant increased risk of preeclampsia. In the present study, placenta and cord problems were 17.6%. Safari (2001) investigated the prevalence of preeclampsia and its maternal and fetal complications in 1000 pregnant women referred to the hospital and showed that premature detachment of the placenta was 14.8% in preeclamptic patients<sup>27</sup>, which was consistent with the result of the present study. We also found that the most common age group with preeclampsia was the 20-30-year-old group. This was consistent with the results of the study conducted by Brison et al. In the present study, 14.8% of patients had a previous history of hypertension, similarly as reported by Vigil and Gracia (2013) who indicated that 17% of pregnant women had a history of chronic hypertension. In addition, we report that out of 108 patients with preeclampsia, 34 (31.5%) had severe preeclampsia. Chahan (2012) stated that 49.8% of patients with gestational hypertension had severe preeclampsia, 42.3% had mild preeclampsia, and 7.9% had eclampsia. The rate of preeclampsia in the present study was reported at a lower level compared to other studies, which might be due to more use of care policies in recent years, resulting in earlier diagnosis and treatment of the patients.

Furthermore, in 63 (58.3%) of mothers with preeclampsia experienced their first delivery, which in accordance with Qiu et al. who report that out of 190 patients with preeclampsia, 84 (44.2%) had their first delivery. In the present study, the number of parities did not have an effect on increasing or reducing the incidence of diabetes in pregnant women with preeclampsia, which was consistent with the results of the study conducted by Bryson (2003)<sup>28</sup>. In the present study and the study conducted by Zhung et al (2013)<sup>29</sup>, a significant relationship was found between preeclampsia and variables such as maternal age, number of previous pregnancies, and history of previous preeclampsia<sup>30</sup>. With regard to the type of

delivery in studied women, the majority of the women had cesarean section delivery (84.3%) and only 15.7% of them had a normal vaginal delivery. It was probably due to high rates of pregnancy complications, including severe preeclampsia and the need for immediate termination of pregnancy in these patients. Concerning predisposing complications of the disease, the history of preeclampsia in a previous pregnancy was reported in 6.5% of the women, maternal hypertension was reported in 14.8% of the women, and twin cases were reported in 10.2% of the women. Several studies have reported that maternal age and underlying diseases such as polycythemia, polyhydramnios, and nulliparity are the risk factors for preeclampsia<sup>31</sup>.

## Conclusion

The results of this study showed that age factors and underlying diseases especially the history of diabetes and previous hypertension, multiple pregnancies, and severity of preeclampsia during pregnancy were involved in a large number of diabetes and hypertension cases. It is essential to provide appropriate planning and adequate information for pregnant women, especially those who have a history of diabetes or gestational hypertension so that they can receive the necessary care and consultations during pregnancy.

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