







***Prevalence of Gestational Diabetes and Its Associated Maternal and Neonatal Outcomes
in Women Referred to Ayatollah Mousavi Hospital in Zanjan***

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Abstract

Background: Gestational diabetes is one of the most common complications of pregnancy that has several effects on mother and baby.

Objectives: The aim of this study was to examine the prevalence as well as maternal and neonatal outcomes in women with gestational diabetes.

Methods: This descriptive comparative study was carried out on all pregnant women who underwent 75 g glucose test and referred to Ayatollah Mousavi Hospital in Zanjan for delivery from September to March 2018. Data was collected according to the client's biography obtained by the gynecologist and also the available evidence of gestational diabetes. Data was analyzed by SPSS 25 software.

Results: The prevalence of gestational diabetes in the present study was 4.7%. The mean age in the group with gestational diabetes was 30.65 ± 6.9 years, which was statistically significant compared to the mean age of healthy mothers (27.93 ± 6.4) ($P = 0.01$). There was a statistically significant difference in the type of delivery between the two groups ($P < 0.001$) as the delivery method was cesarean section in 70.6% of patients with gestational diabetes. Evaluation of pregnancy and neonatal outcomes between the two groups in terms of the need for induction (15.8% vs. 47.4%), cases of episiotomy (22.8% vs. 43.9%), cesarean delivery (63.2% vs. 26.3%) and the need for hospitalization of the infant in NICU (26.3% vs. 7%) indicated a statistically significant difference ($P = 0.01$).

Conclusion: This study did not result in a significant difference in maternal and neonatal complications, except for the need for NICU hospitalization and delivery.

Keywords: prevalence, gestational diabetes, pregnancy complications, pregnancy outcomes

Introduction

According to the World Health Organization, gestational diabetes mellitus (GDM) is glucose intolerance that first initiates or is detected during pregnancy [1]. Insulin resistance and compensatory hyperinsulinemia occur in normal pregnancy for metabolic adaptation; they are metabolic changes providing the basic energy and nutrients for the mother and fetus. Glucose intolerance and gestational diabetes occur when

the pancreas is not competent enough to overcome gestational insulin resistance, so it may develop in people prone to diabetes [2].

The number of diabetics worldwide is increasing rapidly, and obvious value of early prevention of the disease requires a global responsiveness to launch a campaign against this widespread outbreak [3].

The number of patients with diabetes is expected to increase doubly by 2030 and this diabetic

epidemic also affects pregnant women [4]. Global prevalence of gestational diabetes depending on demographic characteristics such as maternal age, socioeconomic status, race, ethnicity, body composition as well as screening methods and diagnostic criteria vary from 1 to 28%. In addition, like type 2 diabetes, gestational diabetes can be influenced by genetic factors that can affect the prevalence of this disease in different communities [5].

Gestational diabetes has become a global public health problem [6] and pregnant women are at risk for complications such as gestational hypertension, polyhydramnios, premature rupture of membranes, infection, and preterm labor [7-9]. In severe cases, ketoacidosis may occur and result in long diabetes after delivery [8]. In addition, the fetus is at risk for miscarriage, fetus malformation, and hypoxia, and in severe cases, there is a risk of intrauterine fetal demise. Excess blood sugar can also cause macrosomia in the fetus [8]; infants born to mothers with glucose intolerance had 20% more body fat [10], resulting in an increased risk of shoulder dystocia during childbirth. These infants are also prone to respiratory distress syndrome, hypoglycemia, and other postpartum complications, including death in severe cases [8].

Therefore, considering the importance of gestational diabetes and its maternal and neonatal complications, as well as differences in the results of studies on prevalence and risk factors, along with the impact of racial, ethnic and geographical issues, it is required to analyze the prevalence of gestational diabetes in different parts of the country. As no study has been conducted in this regard in Zanjan, the present study was carried out to determine the prevalence of gestational diabetes and maternal and neonatal outcomes in Zanjan. By conducting this study in Zanjan and comparing its results with other parts of the country and even other countries, it is possible to be effective in providing appropriate planning in the country as this issue is one of the main concerns of health policy makers

Methods

This descriptive comparative study was carried out by available sampling in all pregnant women referring to Ayatollah Mousavi Hospital in Zanjan for delivery from September to March 2018. This

plan has been approved by the ethics committee of Zanjan University of Medical Sciences with the ethical code (IR.ZUMS.REC.1397.166). Gestational diabetes was diagnosed based on the client's history obtained by the gynecologist; and the available evidence of gestational diabetes was approved according to the instructions of the Ministry of Health (75 mg impaired glucose test at 24 to 30 weeks of gestation). Screening test with 75 g of glucose and measuring fasting blood sugar is 1 and 2 hours later. According to the criteria of the American Diabetes Association, the following values were included: fasting blood sugar greater than or equal to 92 mg / dl; blood sugar one hour later greater than or equal to 180 Mg / dl, and blood glucose two hours later greater than or equal to 153 mg/ dl. Individuals having above checklist were considered positive in this screening program [11]. Other data were collected according to the researcher's checklist.

Inclusion criteria were all women having delivery between September and March 2018 in Ayatollah Mousavi Hospital in Zanjan, having single pregnancy and gestational age over 20 weeks, as well as being Iranian and resident in cities and villages of Zanjan. On the other hand, exclusion criteria were the underlying disease in the mother, the presence of preeclampsia, smoking and drug use, and pregnancy using assisted reproductive techniques. According to study by Ekhbari et al, the prevalence of gestational diabetes was estimated at 24% [2]. Three hundred sixty eight people were needed in the following formula to evaluate the prevalence of gestational diabetes. In this study, 1340 people were studied:

$$N = \frac{z_{1-\alpha/2}^2}{d^2}$$

$$r = 0.24 \text{ prevalence}$$

$$z_{1-\alpha/2}^2 = 3.84$$

$$d = 0.05$$

$$N = 3.84 \times 0.24 / 0.0025 = 368$$

Out of 1340 pregnant women who were admitted to Ayatollah Mousavi Hospital in Zanjan for termination of pregnancy and delivery (20 weeks and longer) during this period, a total of 63 patients had gestational diabetes. Individuals having other types of diseases were excluded from the study (n= 57) in order to concentrate on maternal and neonatal outcomes according to

inclusion criteria. The comparison group consisted of 57 healthy pregnant women who were selected by simple random sampling from non-patients. Maternal and neonatal outcomes in the present study included bladder rupture, fetal heart rate failure, meconium, need for induction and episiotomy, first and fifth minute Apgar scores below 7, need for resuscitation in infants, congenital anomalies, need for NICU, type of delivery, and neonatal biometric indices. Data were analyzed by SPSS software version 25. The test (K-R) was applied to monitor the normality of the data. Due to the normality of quantitative data ($p > 0.05$), the two-way t-test was applied. Chi-square test and Fisher's exact test were used for nominal data and ranking. Significance level was considered less than 0.05.

Results

During a seven-month study, 63 patients with gestational diabetes were identified out of 1340 pregnant women referred to Ayatollah Mousavi

Hospital in Zanjan. The prevalence of this disease in our study was estimated to be 4.47%. In this study, six individuals had both gestational diabetes and preeclampsia.

These individuals were excluded from the study in order to analyze maternal and neonatal outcomes based on exclusion criteria. The mean age in the group with gestational diabetes was 30.65 ± 6.9 years, which was statistically significant compared to the mean age of healthy mothers (27.93 ± 6.4) ($p = 0.03$). According to the results of the study, the factors of education level, place of residence, maternal parity, and history of abortion in mothers who had gestational diabetes during pregnancy were not statistically significant with the healthy group, yet the type of delivery was significantly different in both groups ($p < 0.001$) as the method of delivery was cesarean section in 70.6% of individuals with gestational diabetes (Table 1).

Table 1: Demographic and midwifery information

		Diabetic group (percentage) the mean number \pm standard deviation	Comparison group (percentage) the mean number \pm standard deviation	Significance level
Education Level	Illiterate	2(3/5)	3(5/3)	0/9 ^b
	High school	48 (84/2)	47(82/5)	
	University	7(12/3)	7(12/3)	
place of residence	City	29(50/9)	27(47/4)	0/7 ^b
	Village	28(49/1)	30(52/6)	
Parity	Nolipar	16(28/1)	22(38/6)	0/2 ^b
	Primipar	26(45/6)	17(29/8)	
	Multipar	15(26/3)	18(31/6)	
Delivery Type	Vaginal	21(33/3)	42(66/7)	*0/001 ^{>b}
	Cesarean section	36(70/6)	15(29/4)	
History of abortion		13(22/8)	10(17/5)	0/4 ^b
Mother's age		30/65 \pm 6/9	27/93 \pm 6/4	0/03 ^{a*}

a: T-test

b: Chi-square test

*: It is significant

There was a statistically significant difference between the two groups in terms of the need for induction (15.8% vs. 47.4%) ($P < 0.001$) and cases of episiotomy (22.8% vs. 43.9%) ($p < 0.02$) as the need for induction and episiotomy in the healthy group was higher (Table 2). No dystocia was observed in any of the groups; only one case of placental abruption and one intrauterine fetal demise of 29 weeks were observed in the healthy group. There was no significant difference in neonatal outcomes in terms of fluid meconium

impregnation, heart failure, first and fifth minute Apgar scores below 7, and the need for resuscitation. Two cases of fetal abnormalities (clubfoot) were observed in the group of diabetics that were not significantly different from the comparison group ($p < 0.05$). The only significant difference was related to the infants of diabetic mothers who were significantly ($p = 0.01$) admitted more to the NICU than the comparison group (26.3% vs. 7%) ($p = 0.02$) (Table 2)

Table 2: Neonatal and pregnancy outcomes

	Diabetic (percentage) number	Healthy individuals (percentage) number	Significance level
Rupture of membrane	2(3/5)	3(5/3)	0/5 ^b
Fetal heart failure	3(5/3)	4(7)	0/5 ^b
Meconium	0	5(8/8)	0/057 ^b
Induction	9(15/8)	27(47/4)	*0/001 ^{>a}
Episiotomy	13(22/8)	25(43/9)	*0/02 ^a
Apgar first minute below 7	2(3/5)	3(5/2)	0/6 ^b
Apgar fifth minute below 7	0	2(3/5)	0/1 ^b
Need for resuscitation	6(10/5)	3(5/4)	0/49 ^b
Congenital anomalies	2(3/5)	0	0/24 ^b
NICU Hospitalization	15(26/3)	4(7)	*0/01 ^b

A: Chi-square test

B: Fisher's exact test

*: It is significant

T-test was applied to evaluate the biometric indices of the baby and gestational age in the two groups. The test results did not show a statistically

significant difference between the two groups in terms of birth weight, baby height, baby head circumference, and gestational age (Table 3).

Table 3: Comparison of biometric indices of baby and the age of pregnancy in two groups

	Diabetic group (percentage) the mean number \pm standard deviation	Comparison group (percentage) the mean number \pm standard deviation	Significance level*
Birth weight	3165/4 \pm 607/7	3051/32 \pm 671/2	0/34
Height	50/3 \pm 3/4	50/03 \pm 4	0/68
Head circumference	34/3 \pm 2/01	34/5 \pm 2/3	0/5
Age of pregnancy	37/9 \pm 5/2	37/1 \pm 2/02	0/16

T-Test*

Discussion

In the present study, the prevalence of gestational diabetes in pregnant women referred to Ayatollah Mousavi Hospital in Zanjan with 75 g glucose test in 24-30 weeks of pregnancy was 4.7%.

Gestational diabetes has a different prevalence in different parts of the world, which indicates the difference in prevalence between racial and ethnic groups, as the prevalence is higher among blacks, Latins, Native Americans and Asian women [12]. The prevalence of gestational diabetes in the study of Rahimi et al. in Kermanshah was 8.81% [13]. In the study of Borzoi et al. in Hamadan, the prevalence of gestational diabetes in pregnant mothers who underwent 75 g of glucose test in 24 to 28 weeks of pregnancy was reported to be 39.5% [4]. The prevalence of gestational diabetes in a study by Muche et al. in Ethiopia was reported to be 12.8% [14]. Meharry et al. reported a prevalence of gestational diabetes at 3.2% in women referred to health centers in Rwanda [15]. In a study in China in 2017, the estimated prevalence of gestational diabetes in all participants, women in the first pregnancy, and women in the second pregnancy, was 3.7%, 3.4% and 6.6%, respectively [16]. In another study

conducted in Kuwait in 2019, the prevalence of gestational diabetes was reported to be 12.6% [17]. And its prevalence in a study in Selangor of Malaysia was 27.9% [18]. Causes of differences between the results of various studies are due to differences in sample size, non-uniformity of methods (one-stage and two-stage), diagnostic criteria, diversity of races and ethnicities, lifestyle and nutrition, variables such as social status, and the year of the study indicating the increase in the prevalence of gestational diabetes in recent years.

Regarding the demographic characteristics in the present study, the results indicated a statistically significant relationship between the type of delivery in the two groups of mothers. The delivery method was cesarean section in 70.6% of people with gestational diabetes. In a 2017 study by Logakodie et al, which examined the prevalence and maternal and neonatal outcomes of women with gestational diabetes, there was a significant difference ($p = 0.007$) in the delivery of GDM women compared to non-GDM women. Women with GDM had a higher risk of having spontaneous vaginal delivery such as cesarean section than non-GDM women [18]. In the study

of Groof et al, 32.9% of cesarean deliveries in non-diabetic women versus 48.1% in women with gestational diabetes showed an increase in the rate of cesarean section in women with gestational diabetes and this difference was statistically significant [17]. In the study of Bashir et al, delivery method was cesarean section in 52.4% of people with gestational diabetes [19]. In the study of Kumari et al. in Delhi, there was no significant difference in the method of delivery (cesarean section and vaginal delivery) in the GDM group compared to the control group, which the researchers attributed it to adequate control of blood sugar by controlling diet, insulin and oral hypoglycemia. [20].

In the present study, there was a statistically significant difference between the two groups in terms of the need for induction (15.8% vs. 47.4%) and episiotomy (22.8% vs. 43.9%). The reason is that diabetics are more likely to have a cesarean section, and in the present study it has been pointed out that this has resulted in a lower need for induction and episiotomy in diabetic mothers than in healthy mothers as the rate of vaginal delivery in this group was less than the group of healthy mothers. In Jassem's study, which examined the outcomes of pregnancy in 220 Saudi women with gestational diabetes, the results showed that 31.8% of mothers with gestational diabetes needed induction in the labor process, which is 12.3% in healthy women. This result was inconsistent with our study. The reason was probably due to the difference in the rate of cesarean section in this study with the present study, as in Jassem's study, the rate of cesarean section in the gestational diabetes group was 24.1% [21].

Complications of gestational diabetes include increased dystocia, yet no case of shoulder dystocia was observed during delivery, which is due to the high rate of cesarean section in this study. There was a statistically significant difference between the two groups in terms of neonatal outcomes in terms of neonatal hospitalization in NICU (26.3% vs. 7%). Twenty-six infants (20%) needed to be admitted to the neonatal intensive care unit [7]. In another study conducted in Qatar, the need for hospitalization in the NICU for infants of mothers with early diagnosis of gestational diabetes was 17.6% [19].

Conclusion

Due to increase in inactivity, obesity, and the age of marriage, the prevalence of gestational diabetes is considered a growing problem in midwifery. Accordingly, maternal and neonatal outcomes will increase, so it is required to examine the prevalence of diabetes in all provinces in the country considering risk factors and different ethnicities. And also it is important to study prospectively associated factors with diabetes in large samples in different parts of the country. This study is cross-sectional and it is the study's limit. Thus, further studies among pregnant women referring to health centers are suggested in order to extend results of the present study.

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Conflict of interest

This study did not have any conflict of interest for the authors.

References

1. Pouliot A, Elmahboubi R, Adam C. Incidence and Outcomes of Gestational Diabetes Mellitus Using the New International Association of Diabetes in Pregnancy Study Group Criteria in Hôpital Maisonneuve-Rosemon. *Can J Diabetes*. 2019; 43(8): 594- 99.
2. Ekhtiari A, Langari H, Yarjanli M. Prevalence of Gestational Diabetes Mellitus and Fetomaternal Outcomes Using One Step Screening Method. *J Mazandaran Univ Med Sci*. 2016; 26(142): 167-74. [In Persian]
3. Miyakoshi T, Oka R, Nakasone Y, et al. Development of new diabetes risk scores on the basis of the current definition of diabetes in Japanese subjects [Rapid Communication]. *Endocrine J*. 2016; 63(9): 857-65.
4. Borzouei S, Rabiei S, Esna Ashari F, Zareeighane Z, Biglari M. The Relationship between Gestational Diabetes and Risk Factors in Pregnant Women in Hamadan. *Pajouhan Sci J*. 2018; 17(1): 30- 6. [In Persian]

5. Nguyen CL, Pham NM, Binns CW, Duong DV, Lee AH. Prevalence of Gestational Diabetes Mellitus in Eastern and Southeastern Asia: A Systematic Review and Meta-Analysis. *J Diabetes Res.* 2018; 1- 10.
6. Lee KW, Ching SM, Ramachandran V, et al. Prevalence and risk factors of gestational diabetes mellitus in Asia: a systematic review and meta-analysis. *BMC Pregnancy Child.* 2018; 18(1): 494.
7. Prakash GT, KumarDas A, Habeebullah S, Bhat V, Shamanna SB. Maternal and Neonatal Outcome in Mothers with Gestational Diabetes Mellitus. *Indian J Endocrinol Metab.* 2017; 21(6): 854-58.
8. Gao C, Sun X, Lu L, Liu F, Yuan J. Prevalence of gestational diabetes mellitus in mainland China: A systematic review and meta-analysis. *J Diabetes Investig.* 2019; 10(1): 154- 62.
9. Xie GH, Zheng Z, Liu TC, et al. Health care and risk of adverse pregnancy outcomes among diabetic women: an updated meta-analysis. *Arch Gynecol Obstet.* 2019; 299(3): 891- 99.
10. Collier A, Abraham EC, Armstrong J, Godwin J, Monteath K, Lindsay R. Reported prevalence of gestational diabetes in Scotland: The relationship with obesity, age, socioeconomic status, smoking and macrosomia, and how many are we missing? *J Diabetes Investig.* 2017; 8(2): 161- 67.
11. American Diabetes Association. Classification and diagnosis of diabetes. Sec.2. In *Standards of Medical Care in Diabetes- 2016.* Diabetes Care; 39(Suppl.1): S13-S22.
12. Egbe TO, Tsaku ES, Tchounzou R, Ngowe MN. Prevalence and risk factors of gestational diabetes mellitus in a population of pregnant women attending three health facilities in Limbe, Cameroon: a cross-sectional study. *Pan Afr Med J.* 2018; 31: 195.
13. Rahimi M, Karami Moghadam F. The prevalence of gestational diabetes mellitus and its related risk factors using one-step method in Kermanshah 2016, *Iran J Obstet Gynecol Infert.* 2017; 20(4): 1-8 . [In Persian]
14. Muche AA, Olayemi OO, Gete YK. Prevalence of gestational diabetes mellitus and associated factors among women attending antenatal care at Gondar town public health facilities, Northwest Ethiopia. *BMC Pregnancy Child.* 2019; 19(1): 334.
15. Meharry PM, Tenger O, Rulisa S, et al. Prevalence of gestational diabetes mellitus among women attending antenatal care at public health centers in Rwanda *Diabetes Res Clin Pract.* 2019; 151: 252-59.
16. Xianglong Xu, Ying Liu, Dengyuan Liu, et al. Prevalence and Determinants of Gestational Diabetes Mellitus: A Cross-Sectional Study in China. *Int J Environ Res Public Health.* 2017; 14(12): 1532.
17. Groof Z, Garashi Gh, Husain H, et al. Prevalence, Risk Factors, and Feto-maternal Outcomes of Gestational Diabetes Mellitus in Kuwait: A Cross-Sectional Study. *J Diabetes Res.* 2019; 9136250.
18. logakodie s, Azahadi o, Fuziah P, et al. Gestational diabetes mellitus: The prevalence, associated factors and foeto-maternal outcome of women attending antenatal care. *Malays Fam Physician.* 2017; 12(2): 9-17.
19. Bashir M, Baagar Kh, Naem E, et al. Pregnancy outcomes of early detected gestational diabetes: a retrospective comparison cohort study, Qatar. *BMJ Open.* 2019; 9(2): e023612.
20. Kumari R, Dalal V, Kachhawa G, et al. Maternal and Perinatal Outcome in Gestational Diabetes Mellitus in a Tertiary Care Hospital in Delhi. *Indian J Endocrinol Metab.* 2018; 22(1): 116- 20.
21. Gasim T. Gestational Diabetes Mellitus: Maternal and Perinatal Outcomes in 220 Saudi Women. *Oman Med J.* 2012; 27(2): 140- 44.