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Investigating the Prevalence of Gestational Diabetes Mellitus and Its Related Factors in Women Referred To Shahroud Medical-Research Centers

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Abstract--- *Objective: Considering the importance of gestational diabetes mellitus and different reports on the prevalence and risk factors of this disease, this research was conducted among pregnant mothers referred to Shahrood health centers in 2013 to determine the prevalence and risk factors of gestational diabetes mellitus and glucose tolerance disorder.*

Method: *This is a cross-sectional descriptive-analytical study. The study population was pregnant women who referred to clinics (health centers) in Shahroud for controlling pregnancy. The sample size was estimated at 1000 people. In order to screen for gestational diabetes at 24-28 weeks, all 1000 samples with normal blood glucose at first visit were asked a two-hour oral glucose tolerance test with consuming 75 g glucose (OGTT). Descriptive statistics (frequency, percentage and mean) and inferential statistics (t-test) were used for data analysis by SPSS software.*

Results: *The prevalence of gestational diabetes was 3.8%. Another result was that increasing age increased the risk of gestational diabetes and its subsequent complications. Another point is the relationship between the history of gestational diabetes and type 2 diabetes in relatives and the incidence of gestational diabetes.*

Conclusion: *The results of this study can be considered as an alarm signal for increasing the age of the pregnancy. A pregnant woman with a history of gestational diabetes or type 2 diabetes in her first-degree relatives should know that she has a higher risk of developing gestational diabetes. These can be adjusted by appropriate diet and exercise that can reduce the risk of diabetes during pregnancy and protect the mother and fetus from complications of gestational diabetes.*

Keywords: *Gestational diabetes mellitus, type 2 diabetes, gestational age, first-degree relatives, Shahroud.*

I. INTRODUCTION

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The World Health Organization (WHO) has cited diabetes as a latent epidemic and since 2013 has called on all countries around the world to respond to the epidemic. It estimates that the number of people with diabetes will increase from 135 million in 1995 to 300 million in 2025. This increase will be equal to the percentage in developing countries and 42% in developed countries (1). Thus, although diabetes is now considered a problem in developed countries, its impact on developing life expectancy in developing countries is greater (2). Gestational diabetes is the most common metabolic complication of pregnancy and accounts for approximately 4% of all pregnancies in the United States (3). Pregnancy can affect the process of normal endocrine activity to varying degrees, and it requires metabolic and hormonal adaptation (4).

Variable-intensity glucose intolerance that is first started or diagnosed during pregnancy is called gestational diabetes (5) or gestational diabetes refers to conditions in which blood glucose levels rise during pregnancy and symptoms of diabetes mellitus are seen for a pregnant woman who has not previously been diagnosed with diabetes (6). This definition applies whether or not insulin is needed. Certainly, some women with gestational diabetes have not previously been diagnosed with diabetes (6). Approximately 7% of pregnancies are complicated by gestational diabetes and it involves more than 200,000 people a year. Its prevalence has been reported to range from 1% to 14% depending on the study population and diagnostic tests (7).

Gestational diabetes is the most common metabolic disorder during pregnancy (8). Epidemiologically, gestational diabetes is more commonly associated with type 2 diabetes; like type 2 diabetes, increasing age and body mass index (BMI) have been implicated in the development of gestational diabetes and it is more commonly seen in the non-white population. In various studies, the relative risk in African-Americans increased by 1.6-3.5%, in Spain 1.8%, 8.5% in Southeast Asia, 10.9% in East India, and 15% among Native Americans (9-10).

Diagnosis of gestational diabetes in women with moderate or high risk should be done by the method of OGTT (oral glucose tolerance test) as the first method. The formation of an oral glucose tolerance test without previous measurement of plasma glucose or serum is very valuable in high-risk women (10). GCT (Glucose Challenge Test) is the second method; in the 2-step method, plasma glucose is measured one hour after 50 g of glucose (GCT) regardless of the hour of the day or the last meal. If the blood sugar rises more than 140 mg/dl one hour after 50g of glucose, the test will yield 100 grams of oral glucose (GTT) tolerance.

Despite improvements in recent years, women with gestational diabetes are at higher risk of developing pregnancy complications. These effects can occur for both mother and baby. The most important maternal complications of gestational diabetes are the higher risk of preeclampsia and eclampsia. Maternal duct injuries are due to macrosomia, polyhydramnios, and higher prevalence of infections during pregnancy. Its perinatal complications are macrosomia followed by birth injuries and shoulder detachment, neonatal hypoglycemia, Hyperbilirubinemia, and respiratory distress syndrome (11). Gestational diabetes also has long-term side effects; more than half of women afflicted will eventually develop diabetes within the next 20 years. There is increasing evidence that the children of these women have long-term complications, including obesity and diabetes (12). Diagnosis of gestational diabetes is not only important in the prevention of perinatal diseases and disorders but also has long-term consequences on the health of the mother and the baby (13).

The disease is asymptomatic and at the same time complicated because the patient is due to being asymptomatic will not complain not refer to be diagnosed and treated, so screening and diagnosis should be performed as soon as possible (11). The issue of screening is a controversial issue. Some believe that screening is risky, and some recommend screening in general (14).

The US Diabetes Association and the World Conference on Gestational Diabetes have emphasized universal screening until 1997, but more recommendations have been made for selective screening after this year (15).

Given the importance of gestational diabetes and different reports on the prevalence and risk factors of this disease, this research was conducted among pregnant women referred to health centers in Shahrood in 2013 with the aim of determining the prevalence and risk factors of gestational diabetes and Glucose tolerance disorder.

Method

This cross-sectional study is descriptive-analytic. The study population was pregnant women who referred to clinics (health centers) in Shahroud for controlling pregnancy. Samples were selected from pregnant mothers who referred to these centers from April 2012 to March 2013 who were satisfied with the project. Exclusion criteria: People with a history of pre-gestational diabetes mellitus, those whose pregnancy resulted in abortion or termination of pregnancy before 24 weeks, history of pre-pregnancy diabetes mellitus, history of any particular drug use, history of pancreatic disease, Cushing's pre-hormonal syndromes, acromegaly, phenochromosinoma, primary aldosteronism, Glucagonoma, etc.

The sample size was estimated by considering the test power of 80%, 95% confidence level and 20% of loss, and the results of previous studies with 1000 people. Therefore, 1000 individuals whose blood was normal at their first pregnancy visit were selected by convenience sampling method. It is noteworthy that 48 samples were withdrawn from the study over a two-year period due to various factors that were quickly replaced with other samples. All the pregnant women covered by the clinics performed gratuitously routine tests at the center Azima. The kit for blood glucose test was from Pars Test Company and was identical for all samples. We used a researcher-construed questionnaire for data collection. It included the following variables: age, body mass index (weight divided by height square), number of pregnancies (number of pregnancies regardless of outcome), number of births (number of pregnancies that resulted in Birth of newborn), number of miscarriages (repelling of pregnancy products before week 20), history of stillbirth (in the form of two options Yes or No) and macrosomia (in the form of two options Yes or No; if the baby weighs more than 4500, they should choose the option Yes, otherwise No), Family history of diabetes (in the form of two options Yes or No), History of gestational diabetes in Family (in the form of two options Yes or No) and history of gestational diabetes in previous pregnancy (in the form of two options Yes or No). The reliability of the questionnaire was confirmed by the retest method; it was validated by experts and completed by the referrals of pregnant women at the health center during different interviews and assessments. The project process was as follows: On the first visit, the FBS midwife requested routine pregnancy tests. If the fasting blood glucose was less than or equal to 92 mg / dL on the first visit, the individual would be classified as normal and would be eligible for the test. All 1000 samples with normal blood glucose at first visit were asked to screen for gestational diabetes at 24-28 weeks with a two-hour oral glucose tolerance test of 75 g glucose (OGTT). As the result of the test, the following were considered abnormal: fasting blood glucose greater than or equal to 92 mg/dl, one-hour blood glucose greater than or equal to 180 mg/dl, and two-hour blood glucose greater than or equal to 153 mg/dl. If one of the above tests was abnormal, the person would definitely be classified as gestational diabetes. The above methods for interpreting FBS (in first referral) as well as how to diagnose gestational diabetes with a 75-gram OGTT test in 2013 were approved by the International Health Organization and Working Group for Diabetes on Pregnancy Studies and the Ministry of Health and Medical Education notified it in 2013 for the medical universities of the country. Descriptive statistics (frequency, percentage and mean) and inferential statistics (t-test) were used for data analysis by SPSS software.

Results

Table 1. Investigation of the age of subjects

Row	Mean	Standard deviation	Minimum	Maximum

Age (by year)	23.45	5.23	16	43

According to (Table 1) the mean age of subjects was 23.45 years with a standard deviation of 5.23 years.

Table 2. Examination of body mass index of subjects

Row	Mean	Standard deviation	Minimum	Maximum
Body Mass Index (kg / cm2)	28.2	3.66	19	33

According to (Table 2) BMI was calculated based on weight and height of samples (at first visit).

Table 3. Examination of the number of pregnancies

Row	Mean	Standard deviation	Minimum	Maximum
Number of pregnancies	3.32	1.34	0	8

According to (Table 3), the number of pregnancies was assessed.

Table 4. Examination of the number of deliveries

Row	Mean	Standard deviation	Minimum	Maximum
number of deliveries	1.57	0.76	0	7

According to (Table 4), the status of the number of deliveries was assessed.

Table 5. Examination of abortion status of subjects

Row	Mean	Standard deviation	Minimum	Maximum
Number of abortion	0.45	0.11	0	4

According to (Table 5), the abortion status of the subjects was assessed.

Table 6. Examination of stillbirths among the samples understudy

Row	Frequency	Percentage of frequency
history of positive stillbirth	28	5.26
history of Negative stillbirth	684	92.74

Given that 278 samples were their first pregnancy, the results of this parameter were evaluated among 722 samples that were not their first pregnancy. According to (Table 6), out of 722 samples, the history of stillbirth was mentioned. In fact, 5.26% of those who had a previous pregnancy reported stillbirth.

Table 7. Macrosomia survey among the samples understudy

Row	Frequency	Percentage of frequency
history of positive macrosomia	127	12.88
history of negative macrosomia	859	87.12

According to (Table 7), of the 1000 samples under study, 689 births were successful, taking into account all newborns of which 986 were born of these 689 mothers, 127 of whom were macrosomic at birth.
Other findings of the research were that of the 1,000 participants in the study, 289 had type 2 diabetes in their first-degree relatives and 41 had gestational diabetes in their first-degree relatives. In fact, the prevalence of type 2 diabetes among the first-degree relatives was 28.9% and the prevalence of gestational diabetes among the first-degree relatives was 4.1%. Of the 722 non-first pregnancies, 23 reported gestational diabetes in their previous pregnancies. Thus, the prevalence of gestational diabetes in the previous pregnancy was 3.18%.
Subjects who had normal blood glucose at the first visit were followed up. They referred for gestational diabetes screening in the 24-28 weeks of gestation. The result of the national protocol screening was as follows: from among 100 participants, thirty-eight samples (3.8%) had gestational diabetes during screening and abnormal results in favor of gestational diabetes during the 75-g glucose test (OGTT).

Table 8. Test of normality of data distribution

Row		**Age**	**Number of miscarriages**	**Number of pregnancies**	**Number of deliveries**
Healthy mothers	Z Kolmogorov-Smirnov	0.98	8.05	4.49	3.68
	Significance level	0.28	0.01	0.01	0.01
Pre-diabetic	Z Kolmogorov-Smirnov	0.66	3.20	2.01	1.87
	Significance level	0.76	0.01	0.01	0.01
Pregnancy Diet	Z Kolmogorov-Smirnov	0.43	2.18	1.18	1.37
	Significance level	0.99	0.01	0.11	0.045

According to (Table 8), given the significance level obtained, some measurements rejected the assumption of the anomalous distribution of data and confirmed some. In cases where data distribution was abnormal, nonparametric tests (subjects' age) were used and in cases where data distribution was normal, parametric statistical tests were used.
Test of Hypothesis 1: The risk of gestational diabetes is higher in older women.

Table 9. Relationship between age of total samples and samples of gestational diabetes

Group	**Mean age**	**T**	**Freedom of degree**	**Significance level**
Total samples	23.45	1.23	2	0.034
Samples with gestational diabetes	28.66			

The mean age of the subjects was 23.45 years, while the mean age of 38 samples with gestational diabetes was 28.66 years. According to (Table 9), based on the t-test and considering

significance level less than 0.05, we see that the age of people with gestational diabetes was significantly older than the age of the total subjects under study. As a result, we can conclude that as age increases, the risk of gestational diabetes increases.
Test of Hypothesis 2: The incidence of gestational diabetes is significantly higher in women who have gestational diabetes in their first-degree relatives.

Table 10. Relationship between gestational diabetes history in relatives and incidence of gestational diabetes

Group	Prevalence of gestational diabetes	T	Freedom of degree	Significance level
Total samples	4.1	2.34	2	0.014
Samples with gestational diabetes	71.05			

The incidence of gestational diabetes is significantly higher in women who have gestational diabetes in their first-degree relatives. Of the 38 samples with gestational diabetes, 24 had gestational diabetes in their first-degree relatives. According to (Table 10), the prevalence of gestational diabetes in first-degree relatives of samples with gestational diabetes is 71.05%. The prevalence of gestational diabetes was 3.18% among all samples. (This, of course, needs further investigation, as there is no evidence of gestational diabetes in first-degree relatives for the researcher.) The results of the test showed that the prevalence of gestational diabetes was significantly higher in the relatives of gestational diabetes patients than in the whole population. We can conclude that the history of gestational diabetes in first-degree relatives increases the risk of pregnancy.

Table 11. Relationship between gestational diabetes history in relatives and incidence of gestational diabetes

Group	Prevalence of gestational diabetes	T	Freedom of degree	Significance level
Total samples	4.1	2.34	2	0.014
Samples with gestational diabetes	71.05			

Test of Hypothesis 3: The incidence of gestational diabetes is significantly higher in women with type 2 diabetes in their first-degree relatives (Table 11).
Table 12. Relationship between type 2 diabetes history in relatives and incidence of gestational diabetes

Group	Prevalence of type 2 diabetes	T	Freedom of degree	Significance level
Total samples	28.9	1.76	2	0.027
Samples with gestational diabetes	84.21			

The incidence of gestational diabetes is significantly higher in women with type 2 diabetes in their first-degree relatives. Of the 38 samples with gestational diabetes, 32 had type 2 diabetes in their first-degree relatives. According to (Table 12), the prevalence of type 2 diabetes in first-degree relatives of samples was 84.21%. However, the prevalence of type II among all samples

was 28.9%. The results of the t-test showed that the prevalence of type 2 diabetes was significantly higher in the relatives of gestational diabetes mellitus. We can conclude that a history of type 2 diabetes in first-degree relatives increases the risk of gestational diabetes.

Discussion

The mean age of participants in this research was 23.45 years. The mean body mass index of the participants was 28.2 kg / m2. The average number of pregnancies of women was 3.32 pregnancies. The average number of childbirths was 1.57. The average number of miscarriages was 0.45. In this study, 5.26% of the samples with a previous pregnancy had a history of stillbirth. Macrosomal history was 12.88% among the samples with previous infants. The prevalence of type 2 diabetes in first-degree relatives was 28.9%. The prevalence of gestational diabetes in first-degree relatives was 4.1%. The prevalence of gestational diabetes was 3.18% in the samples of previous pregnancy. In this study, 3.8% of the samples were diagnosed with gestational diabetes during screening. In this study, there was a significant and direct relationship between the incidence of gestational diabetes and age. There was also a direct and significant relationship between the incidence of gestational diabetes and the history of gestational diabetes in first-degree relatives, which needs further investigation. In this study, there was a direct and significant relationship between the incidence of gestational diabetes and the history of type 2 diabetes in the first-grade relatives (17-20).

In a study conducted by Hossein Nejad at the University of Tehran clinics, the prevalence of gestational diabetes was 4.7% and 3.8% in the current one. The prevalence of gestational diabetes mellitus and glucose tolerance disorder was 22.2% and, in the present study, the prevalence of gestational diabetes mellitus and pre-diabetic disorder was 23.6%.

In a review done in Iran (21-24), the prevalence of diabetes in 11 provinces was from 1.3 to 8.9% and in the present study, the total prevalence of gestational diabetes in Shahrood was 3.8%. The present study will be a review. In a study conducted by Babaei and Keshavarz (25, 26) in Shahroud, there was a significant relationship between macrosomia history and gestational diabetes mellitus.

Conclusion

In another study conducted by Babaei and Keshavarz in Shahroud, the prevalence of gestational diabetes in Shahroud was 4.8% and in the present study 3.8%. The difference in the prevalence of gestational diabetes in Shahroud can be attributed to two factors. The study of Babaei and Keshavarz in Shahroud dates back about 10 years and we can expect to increase over time as the prevalence of gestational diabetes increases. Criteria for determining pregnancy differed between the two studies so that in the present study the diagnosis of gestational diabetes was based on the 75g OGTT test and in the study of Babaei 50g GCT and then 100g OGTT. In the study of Tabatabai et al. in Isfahan, there was a significant relationship between the number of previous pregnancies and maternal age with gestational diabetes, but there is currently no relationship between the number of previous pregnancies and maternal age with gestational diabetes. There was a significant relationship between maternal age and family history of diabetes in a study conducted by Atashzadeh in Tehran. There is also a significant relationship between the mean age of mothers and family history of diabetes in the present study. There was a significant relationship between age and family history of diabetes in the study of Ishraqian et al. as well as Karami et al. in Tehran. There was a significant relationship between age and family history of diabetes in a study done by Mirfeyzi et al. as in our study, but there was a significant relationship between macrosomia and gestational diabetes in the study of Mirfeyzi. In the study of Hadaeq et al. in Bandar Abbas, there was a significant relationship between macrosomia history and gestational diabetes.

Recommendations

To determine the extent to which the new protocol for the diagnosis of gestational diabetes has been able to contribute to the difference between the results of the present study and previous studies, it is necessary to conduct further studies on gestational diabetes with the new protocol and compare their results with the present research.

We suggest that another study be conducted in Shahroud in a comparative manner between urban and rural statistical population.

Gestational diabetes is a serious general health problem that jeopardizes the health of the mother and fetus and imposes high costs on the health care system.

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