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Original Research

Prevalence and associated risk factors of gestational diabetes mellitus in a tertiary hospital in Iran

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Summary

Purpose of investigation: To evaluate the risk factors of gestational diabetes mellitus (GDM) to decrease maternal and neonatal complications. *Materials and Methods:* This cross- sectional study was performed on parturients in the single-maternity hospital of Sabzevar, Iran. All of them had been screened for GDM in the first trimester and 24-28 weeks of gestational age. The prevalence and risk factors of GDM were assessed by STATA. *Results:* From 609 women, GDM was found in 28 persons (4.6%). Maternal age and body mass index (BMI), multiparity, family history of diabetes, prior GDM, hirsutism, hypertension, and hypothyroidism had significant association with GDM. Opiate addiction did not show any relation. Previous birth of preterm or handicapped baby was significantly higher in GDM group; however previous abortion, stillbirth, and birth of large baby showed no significant relation with GDM. *Conclusions:* Providing a risk assessment checklist is very helpful for prevention and early detection of GDM.

Key word: Gestational diabetes mellitus; Prevalence; Risk factor.

Introduction

Gestational diabetes mellitus (GDM) is defined as glucose intolerance with first onset or first recognition during pregnancy. It is accepted that increasing estrogen and human placental lactogen during pregnancy are responsible for this phenomenon [1]. The prevalence of GDM has been reported in about 7% of all pregnancies in North America, 1-6% in Europe, and 1.3% to 18.6% in Iran [1-3]. Several methods have been applied for the screening of GDM like taking 75 or 100 grams of glucose which have certainly influenced on different incidence rates reported worldwide until 2013 when World Health Organization (WHO) accepted the method of International Association of Diabetes and Pregnancy Study Groups (IADPSG) and the applied tests became to some extent unified. Based on it, fasting blood sugar (FBS) > 93 mg/d or one hour glucose (GL) >180 mg/d or two hours GL > 153 mg/d after taking 75 grams GL indicates the diagnosis of GDM [4].

Detection of GDM is very important because it can induce maternal adverse effects like polyhydramnios, preeclampsia, increased caesarean section, infection, and other postpartum complications in current pregnancy; moreover, it can be a main risk factor for future obesity, type 2 diabetes, and hypertension in mothers [5-7]. Also their offspring are at risk of macrosomia, prolonged labor, shoulder dystocia, bone fracture, erb pulsy, hypoglycemia, hypocalcemia, hypomagnesemia, hyperbilirubinemia, respiratory distress syndrome, polycythemia, perinatal mortality, and also obesity and type 2 diabetes in adulthood [6, 8-10]. Some contributor factors have been discussed for GDM including maternal old age, obesity, prior GDM, family history of diabetes, high parity, and also past history of cesarean section, abortion, stillbirth, and childbirth with macrosomia or malformation [3, 6, 11, 12].

GDM prevalence is increasing in many populations worldwide [13] and it is said that Asians have a much higher risk, even at a very low BMI [14]. Its different distributions can be due to racial and geographical differences, dietary habits, and socio-economic status [15]. Regarding the population-based differences observed in literature, the present authors aimed to evaluate the prevalence and risk factors of gestational diabetes in this region to prevent related obstetric complications.

Materials and Methods

This cross-sectional study was performed in Mobini Hospital which is the only referral maternity center in Sabzevar, Iran. After approval from ethics committee and consent forms, all the women admitted to Mobini Hospital for delivery in any stage of gestational age, from September to December 2014 participated in the study. Their demographic data, past medical, obstetrical and family history included: age, BMI, parity, history of GDM, familial di-

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abetes mellitus, History of still birth, history of abortion, opiate addiction, location, history of thyroid disorders, irregular menstruation, hirsutism, hypertension, preterm, abnormality, macrosomia, cardiac disorder, and results of blood glucose tests during pregnancy were registered. The mothers with pre-pregnancy diabetes were excluded from study. The diagnosis of GDM was made by the screening test of IADPSG (75 grams) which was performed twice during pregnancy; the first trimester and 24-28 weeks of gestational age.

The collected data was analyzed by STATA [12] while $p < 0.05$ was considered significant. In the analysis besides calculating GDM incidence, the related risk factors were assessed by comparing the parturients managed as diagnosis of GDM with the healthy population through Chi-square test (χ^2) and independence of the two groups (independent *t*-test). Odds ratio (OR) (95%CI) in logistic regression analysis was used.

Results

In 609 women who participated in study, 28 (4.6%) had GDM. The mean age of them was 27.60 ± 5.93 years. Demographic features and relevant obstetric history for the normal and GDM groups are given in Table 1. The results showed that the mothers with GDM were significantly older than the others (6.38 ± 31.75 *vs*. 5.84 ± 27.4), ($p < 0.001$). Also, the mean of BMI in mothers with GDM was higher than the others significantly (26.15 ± 3.09 *vs*. 24.72 ± 5.22) ($p = 0.02$). GDM incidence was higher in age > 35, BMI > 25, and significantly in multiparity ($p < 0.0001$, $p = 0.03$, and $p = 0.04$, respectively). GDM in previous pregnancy and family history of diabetes showed a strong relation with new cases of GDM ($p < 0.0001$). Although GDM affliction in rural women was greater than in urban women, they did not have significant difference ($p = 0.282$). Thyroid diseases, hypertension or hirsutism were significantly associated with appearance of GDM ($p = 0.02$, $p = 0.03$, and $p = 0.002$, respectively). However history of menstrual irregularity independent of hirsutism had no meaningful relation with GDM ($p = 0.36$). There was no meaningful relation between opiate addiction and GDM ($p = 0.790$). Previous birth of preterm or handicapped baby was significantly higher in GDM group ($p = 0.039$ and $p = 0.006$); however previous abortion, stillbirth and birth of large baby showed no significant relation with GDM ($p = 0.87$, $p = 0.487$, $p = 0.234$, respectively). The results of logistic regression analysis showed that GDM was associated independently with history of GDM and family history of diabetes (Table 2). The comparison of related risk factors in GDM and healthy population is demonstrated in Figure 1.

Discussion

GDM is an important complication of pregnancy and about 40% of the affected persons will be afflicted with overt diabetes in the future [16]. The GDM prevalence obtained in the present study was 4.6%, which is consistent with that of Tehran (4.7%), Turkey (4.8%), and Yemen (5.15%) [6, 17, 18]. However in America (8.5%) and India (7.1%), Tanzania (0%), Nigeria (13.9%) and Korea (7.5%) have been reported differently [15, 19-21].

A meta-analysis from Iran in 2015 showed it on the average of 3.41%, with the maximum in Karaj (18.6%) and the minimum in Ardabil (1.3%) [3]. Certainly, although demographic characteristics effect these differences, and the type of the screening tests applied in the investigations have also been very effective, they usually did not have similarity in their methods [4]. It should be mentioned that the majority of the prenatal care centers perform screening according to WHO and IADPSG recommendations [16, 18]; the present authors used 75 grams of glucose as well.

The present findings showed that GDM had a meaningful association with maternal age and BMI which is in agreement with reports from other regions of Iran, India, and Turkey [6, 15, 16, 22]. Maternal obesity besides increasing the GDM prevalence, aggravates obstetric complications by a synergistic effect with GDM [23]. Other researchers have declared that less weight gain in pregnancy can predict GDM in late pregnancy [24], in contrast to others who explain that the risk of GDM increases with increasing gestational weight gain [25]. The present study did not show any association between pre-pregnancy cigarette smoking or opiate addiction with GDM which confirms other reports [26]. Based on the present findings, the women who live in rural regions are more susceptible to gestational diabetes compared to urban women, although the difference was not significant statistically. It may be due to more knowledge about diabetes and also different life style in urban areas.

The present authors found that family history of diabetes and GDM in previous pregnancy have a strong association with affection of GDM which supports the reports from other regions of Iran, India, and Turkey [6, 15, 16, 22]. This fact must be emphasized in educating healthcare providers to obtain exact personal or family history from their recipients to identify high risk mothers.

Similar to other studies the present authors found multiparity as a significant risk factor for GDM [3, 12, 18]. There was significant relation between past history of hypertension and GDM in this study, which confirmed the results of other studies [15, 22]. On the contrary, the women with GDM may be at increased risk for pregnancy-induced hypertension [5].

The present results showed a meaningful association between thyroid diseases and GDM, particularly hypothyroid status. Whether autoimmune factors induce multi-endocrine disorders in pregnancy or not remain a challenge that require more investigations. Hyperandrogenism and hirsutism whose association with GDM have been declared in prior investigations, showed a meaningful correlation in the present study as well [27]. An interesting finding was the subject that menstrual irregularity exclusively did not

Table 1. — *Demographic and historical characteristics of participants.*

Characteristic	Subjects n=609	GDM N n=28 (%)	No GDM n=581 (%)	*p* value*
Age (years)				
> 35	65	10 (15.3)	55 (84.6)	< 0.0001
< 35	544	18 (3.3)	526 (96.6)	
BMI (kg/m^2)				
> 25	216	15 (6.9)	201 (97.1)	0.038
< 25	393	13 (3.0)	380(97)	
Parity (n)				
Multiparous	321	19 (5.9)	302 (94.0)	0.04
Nulliparous	288	9 (3.1)	279 (96.8)	
History of GDM				
Yes	17	14 (82.3)	3 (17.6)	< 0.0001
No	592	14 (2.3)	578 (97.6)	
Familial DM				
Yes	123	13 (10.5)	110 (89.4)	< 0.0001
No	486	15 (3.0)	471 (96.9)	
History of still birth				
Yes	14	1 (7.1)	13 (92.8)	0.487
No	595	27 (4.5)	568 (95.4)	
History of abortion				
Yes	141	10 (7.0)	131 (92.9)	0.087
No	468	18 (3.8)	450 (96.1)	
Addict				
Yes	5	0	5 (100)	0.790
No	604	28 (4.6)	576 (95.3)	
Location				
urban	178	18 (4.1)	413 (95.8)	0.282
rural	431	10 (5.6)	168 (94.3)	
History of thyroid disorders				
Yes	20	3 (15)	17 (85)	0.022
No	589	25 (4.2)	564 (95.7)	
Irregular menstruation				
Yes	66	4 (6.0)	62 (93.9)	0.360
No	543	24 (4.4)	519 (95.5)	0.531
Hirsutism				
Yes	17	14 (82.3)	3 (17.6)	0.002
No	592	14 (2.3)	578 (97.6)	
History of HTN				
Yes	41	5 (12.1)	36 (87.8)	0.034
No	568	23 (4.0)	545 (95.9)	
History of preterm labor				
Yes	29	4 (13.7)	25 (86.2)	0.039
No	580	24 (4.1)	556 (95.8)	
History of abnormality				
Yes	3	2 (66.6)	1 (33.3)	0.006
No	606	26 (4.2)	580 (95.7)	
History of macrosomia				
Yes	20	2 (10)	18 (90)	0.234
No	589	26 (4.4)	563 (95.5)	
History of cardiac disorders				
Yes	8	0	8 (100)	0.684
No	601	28 (4.6)	573 (95.3)	

*DM: diabetes dellitus, HTN: hypertension * $p < 0.05$ considered significant.*

have any association with GDM which confirms that only in the case of hyperandrogenism, glucose intolerance disorders occurs but not with menstrual irregularity independently. Based on the present research, past history of delivering a baby with congenital anomaly could be a risk factor of GDM, which was similar to the results of Isfahan and unlike the ones of Ahvaz in Iran [12, 28]. Some investigations have demonstrated previous birth of large-for-

Table 2. — *Results of regression analysis for the risk factors of GDM.*

Characteristic	Adjusted odd ratio (95%CI)	*p* value*
Age (years)	.965	0.426
BMI (kg/m^2)	.994	0.895
History of GDM <0.0001	9.440	
Familial DM	3.012	0.031
Hirsutism	2.430	0.114
History of abnormality	2.699	0.656

*CI: confidence Interval *p<0.05 considered significant*

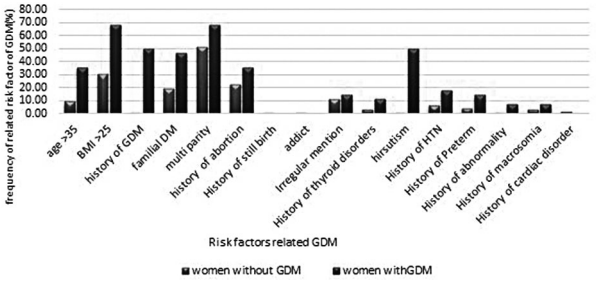

Figure 1. — Comparison of related risk factors in women with and without GDM.

gestational age as the risk factor of GDM, but the present authors did not find such a result [3, 12, 17, 22].

This study showed no meaningful association between GDM and previous abortion or stillbirth, but a significant relationship with preterm labor while some other studies showed similar or contradictory results [12, 16, 28].

Although it should be remembered that numerous factors can impact on fetal outcome like maternal age, BMI, nutrition, socioeconomic status, preconceptional and prenatal care, and also population-based differences like race/ethnicity, which in turn effect on different results reporting in the studies [15, 29].

Ultimately the present study faced some limitations. Although women come to Mobini Hospital whenever they are in pregnancy-termination, it is possible that rare cases of GDM who were involved in spontaneous abortion in initial phases of pregnancy without hospital referral, have been missed in the present assessment.

In short, the prevalence of GDM in Sabzevar demonstrates a moderate level compared with other regions of Iran and also in the world. Some characteristics such as maternal age and BMI, multiparity, diabetes in family relatives, prior GDM, hirsutism, hypertension, hypothyroidism, previous preterm labor, and handicapped baby can be considered as predictor variables for GDM. The present authors support the idea that using a checklist of risk factors help to identify the women at risk of GDM with accuracy of approximately three to four times higher than current maternal care [30].

Conclusion

Knowledge of the risk factors of GDM conducts the health providers to perform a risk-assessment before and during pregnancy. Preconception consultation for prevention of GDM should be considered in order to improve changeable risk factors like maternal BMI and also to guide the women whether it is safe to become pregnant or not. Subsequently, identification of the high risk mothers associated with special attention in prenatal period can be very beneficial for prevention of probable maternal and neonatal complications resulting from GDM.

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