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Prevalence and Risk Factors of Gestational Diabetes Mellitus in Yazd Province, Iran

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ABSTRACT

Background & aim: The global prevalence of Gestational Diabetes Mellitus (GDM) is increasing with an alarming rate. It commonly manifests during the third trimester of pregnancy and may lead to multiple maternal complications. Neonates of women with GDM are more likely to suffer from metabolic problems later. Considering the importance of GDM, this study was performed with aim to determine the prevalence and risk factors of GDM in Yazd province.

Methods: This cross-sectional study was carried out on 3202 pregnant women in Yazd province from March 2008 to March 2011. The Glucose Challenge Test and Oral Glucose Tolerance Test were used to diagnose GDM. The interpretation was based on Coustan-Carpenter criteria. Sampling was done in a full-census manner. Statistical analysis was performed using SPSS software (version 19). Logistic Regression was used to calculate the Odds Ratio at 95% Confidence Interval to estimate the independent association of different risk factors with GDM.

Results: The overall prevalence of GDM in this study was 3.3%. The mean age of participants was 27.7±5.7 years. Identified risk factors were age (OR: 1.1, P<0·001), BMI (OR: 1.1, P<0·001), history of abnormality in neonates (OR: 2.84, P=0·036), macrosomia (OR: 3.19, P=0·004), and diabetes in the family (OR: 2.9, P<0·001).

Conclusion: Among the risk factors identified for GDM, BMI is the only modifiable factor, which can implicate the development of gestational diabetes mellitus. Public management of weight, and avoiding a sedentary lifestyle can reduce the risk of GDM. It is also suggested that it is better to plan for pregnancy at younger ages.

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Introduction

There is an alarming increase in prevalence of gestational diabetes mellitus (GDM) globally (1). Based on the different study setting and diagnostic criteria, the prevalence of GDM differs in various parts of the world. Other factors which can influence the prevalence are age, obesity and health care use. For instance, the prevalence of GDM based on International Classification of Disease (ICD) criteria in the USA (2) and Korea (3) was reported 6% and 10%, respectively. A meta-analysis of various studies conducted in sub-Saharan Africa with different diagnostic criteria and setting of studies reported a prevalence of 2–6% for GDM (4). In Iran, the result of a meta-analysis showed that the prevalence of GDM is 3.4% (the highest and lowest incidence rate were 18.6% and 1.3%, respectively) (5). According to the recent update by the International Diabetes Federation (IDF), hyperglycemia during pregnancy were affected 21.3 million or 16.2% of live births, and 75–90% of these pregnancies were GDM (1). World Health Organization (WHO) defined the diagnostic criteria of gestational diabetes mellitus as “any degree of glucose intolerance leading to hyperglycemia of different grades with onset or

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first recognition during pregnancy" (6). GDM more commonly manifests during the third trimester of pregnancy, although its symptoms may start as early as the end of the second trimester (7, 8) and it is a high associated risk factor for prenatal mortality and morbidity (9). Gestational diabetes mellitus may lead to multiple maternal complications including antepartum hemorrhage, hypertensive disorders during pregnancy and risk of future diabetes mellitus; and fetal and neonatal complications such as stillbirth, dystocia, spontaneous abortion, macrosomia, prematurity, respiratory distress syndrome and the risk of developing neonatal diabetes (10, 11). The children born to GDM mothers are at higher risk of cardiovascular disease and metabolic disorders in later life (12). GDM plays a key role in diabetes pathogenesis, about 50% of mother with GDM will have the chance of developing diabetes in 10 years, indicates GDM as an important predictor of diabetes (13). Therefore, knowledge about GDM in various parts of the world can help with health policies and planning (14).

Considering the growing prevalence of GDM in all developed and developing countries (15) and estimation of increasing in upcoming years due to increased mean age of the population, urban sedentary lifestyle and increasing the number of obese women (16), And association of negative health outcome over the short-term and long-term on both mothers and their babies (17), this study aimed to determine the prevalence of GDM and provide an update on the assessment of different risk factors on GDM.

Materials and Methods

This was cross-sectional study conducted on all pregnant women who were screened for gestational diabetes mellitus in Yazd province from March 2008 to March 2011. The ethical code of the present study was obtained from the Shiraz University of Medical Sciences Ethics Committee (IR.SUMS.REC.1393.S7390). Women with Diabetes Mellitus, chronic liver disorder, glandular disorders, and those using the medications affecting glucose metabolism were excluded from the study.

After providing written informed consent from the eligible pregnant women, data were collected by using a structured questionnaire which included socio-demographic information, and medical and obstetrics history. The information included mother's age, parity, history of diabetes in the family, hypertension, GDM, and miscarriage, stillbirth, macrosomia, abnormality in the previous pregnancies.

If the first visit was before 24-28 weeks, and the pregnant women did not have any risk factors of gestational diabetes (including: age ≥ 30 years, history of gestational diabetes, history of diabetes in first-degree relatives, history of hypertension, history of macrosomia, BMI > 30, history of miscarriage more than 2 times, history of stillbirth, and history of fetal abnormalities in previous pregnancies), Glucose Challenge Test (GCT) was postponed to 24-28 weeks of gestation. But if the mother had at least one risk factor of gestational diabetes, she was considered as high risk, and non-fasting GCT was done using 50 g oral glucose. One hour after consuming glucose, if the glucose level was < 130 mg/dl, the risk of GDM was temporarily ruled out and the test was repeated during 24-28 weeks of gestation. If blood glucose level was > 130 mg/dl, a standard 4 split Oral Glucose Tolerance Test (OGTT) with 100 g oral If blood glucose was impaired only in one of the OGTT tests, the test was repeated one month later and the decision was made based on the test results.

After finishing screening tests, 1601 women were diagnosed with GDM. Sampling was done in a full-census manner and all 1601 entered to the study. To be able to, we selected the same number of women who were not diagnosed with GDM were selected by using simple random sampling in order to make a comparison. Data were analyzed by SPSS software (version 19). After checking the normality of continuous variables, Chi-Square test was used for categorical and Student T-Test (Man-Whitney for non-parametric) for continuous to estimate the association between the variables and GDM. Logistic Regression (Wald) was used to calculate the Odds Ratio (OR) and 95% Confidence Interval (95% CI) to estimate the independent association of different risk factors with GDM. All variables with a P-value of ≤0.2 were candidate to enter the logistic regression model.

Results

A total of 3202 women entered into the study (1601 GDM women and 1601 non-GDM). The youngest mother was 15 years old and the

oldest was 47 years old. The mean age of participants was 27.7±5.7 years. The overall prevalence of GDM in the study's population was 3.3%.

Table1. Results of bivariate analysis of risk factors associated with Gestational Diabetes Mellitus

Variable	Mean ± SD		P-Value
Age			
GDM	29.46±5.74		<0·001
Non-GDM	25.99±5.25		
Parity			
GDM	2.44±1.34		<0·001
Non-GDM	1.89±1.10		
Body Mass Index			
GDM	27.82±4.65		<0·001
Non-GDM	25.04±4.64		
Variable	**GDM N (%)**	**Non-GDM N (%)**	**P-Value**
Diabetes in family	694(43.3%)	303(19.92%)	<0·001
GDM history	44(2.7%)	4(0.2%)	<0·001
Hypertension history	46(2.8%)	14(0.8%)	<0·001
Abortion history	74(4.6%)	40(2.4%)	0·001
Abnormality history	22(1.3%)	6(0.3%)	0·004
Macrosomia history	37(2.3%)	6(0.3%)	<0·001
Stillbirth history	32(1.9%)	11(0.6%)	0·002

The results of the bivariate analysis showed that women with GDM were significantly older compared to the women without GDM (P<0·001) and more likely to report a history of diabetes in the family (P<0·001). The results are shown in Table 1.

Table2. The results of logistic regression analysis of the risk factors of Gestational Diabetes Mellitus

Variables	OR	CI (95%)	P-value
Age	1.1	1.08 - 1.12	<0.001
BMI	1.1	1.07 - 1.11	<0.001
Abnormality	2.84	1.04 - 7.74	0.036
Macrosomia	3.19	1.28 - 7.92	0.004
Diabetes in family	2.9	2.50 - 3.52	<0.001

In bivariate analysis, the variables with a P-value of ≤0.2 were entered into the logistic regression model (P-value of all variables was ≤0.2); the results of the analysis showed that five factors were associated with GDM. The history of macrosomia was the most important factor (OR: 3.19, 95% CI: 1.28-7.92. P=0·004) and women with GDM history were 3 times at higher risk of Gestational Diabetes Mellitus. The results were also shown in Table 2.

Discussion

This was cross-sectional study conducted in Yazd province from March 2008 until March 2011. We aimed to estimate the prevalence of GDM, determining the association of some socio-demographic risk factors with GDM, and comparison of those variables among women with and without GDM. In this study, the prevalence of GDM was 3.3 %, but it varies in different places of the world from 1.4 to 14% (18). A meta-analysis in Turkey, reported the prevalence of 7.7% for GDM (19), and a reported prevalence of GDM in the USA (2) and Korea (3) were 6% and 10%, respectively. Differences in the prevalence of GDM can be ascribed to the study's settings and diagnostic criteria. The finding of this study was relatively consistent with the result of the study of Jafari-Shobeiri and et al. that reported the prevalence of 3.4% in Iran (5). Identified risk factors for the present study were “age”, “BMI”, “abnormality”, “macrosomia”, and “diabetes in the family”.

According to the analysis, there was a statistically significant association between BMI with GDM. The mean BMI for women with GDM in the present study was 27.82 and for non GDM was 25.04. For every unit increase in BMI, the risk of GDM increased by 10 %. Several studies confirmed this association (20-22). A study conducted in Peru reported BMI>25 as a risk factor for GDM (23). Maternal age was another identified risk factor in this study. The result was consistent with the findings of other studies (24-26); these studies reported that women with GDM had older maternal age. Larrabure-Torrealva also reported that the prevalence of GDM is associated with older maternal age (23). In this study, there was a significant association between the history of diabetes in the family and GDM. Some previous studies are in general agreement with this finding. For instance, the study conducted among rural and urban Tanzania reported that the family history of diabetes 2 increases the risk of GDM as 2.1 times (4). There are several studies from different parts of Iran that supported this result; the study carried out in Shoushtar reported a seven-fold risk of GDM in women with the history of diabetes2 in the family (27). Other studies conducted in Shiraz (28) and Kermanshah (29) also confirmed this association. However, the study in Cameroon (24) reported that despite an association between GDM and history of diabetes2 in the family in Univariate analysis, it didn't show a significant association in multivariate analysis. Concerning the role of genetic and environment and their interaction in diseases, it seems that a significant association is logical, and the reason for this contrary may be attributed to the small sample size of the study and ethnicity. According to the findings of this study, women with macrosomia had 3.75 times risk of GDM. A cross-sectional study in Cameroon reported that women with a history of macrosomia are at risk of gestational diabetes mellitus (24). Another study in southern Tanzania reported a significant association between macrosomia and GDM (30). In Iran, Bouzari reported macrosomia as a risk factor for gestational diabetes mellitus (31). In this study, the presence of abnormality in previous pregnancies increased the risk of GDM by almost three times, but this finding is contrary to other studies conducted in different parts of Iran (29, 30, and 32). This inconsistency may be attributed to the different sample size in these studies. The history of stillbirth, hypertension, and parity are the factors which showed significant association in Univariate analysis, but the association was not significant in multiple logistic regression. There are contradictory reports about the association of these factors with gestational diabetes mellitus (24, 30, and 33). The major strength of the present study was the large sample size leading to the statistical power to evaluate the mentioned associations. However, there were some limitations: the numbers of the studied variables were limited, assessment of the history of diabetes in the family was based on self-report, therefore there was the possibility of recall bias.

Conclusion

Among the risk factors identified for GDM, BMI was the only modifiable factor, which can implicate the development of gestational diabetes mellitus, public management of weight, and avoiding a sedentary lifestyle can reduce the risk of GDM. We also suggest that it is better to plan for pregnancy at younger age

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Conflicts of interest

Authors declared no conflicts of interest.

References

1. International Diabetes Federation. *IDF Diabetes Atlas, 9th edn.* Brussels, Belgium: International Diabetes Federation, 2019.
2. Lavery JA, Friedman AM, Keyes KM, Wright JD, Ananth CV. Gestational diabetes in the United States: temporal changes in prevalence rates between 1979 and 2010. British Journal of Obstetrics and Gynaecology. 2017; 24(5): 804-813.
3. Koo BK, Lee JH, Kim J, Jang EJ, Lee CH. Prevalence of gestational diabetes mellitus in Korea: a National Health Insurance Database Study. PLoS One. 2016; 11(4): e0153107.
4. Mwanri AW, Kinabo J, Ramaiya K, Feskens EJ. Prevalence of gestational diabetes mellitus in urban and rural Tanzania. Diabetes Res Clin Pract.

2014; 103(1): 71-78.
5. Jafari-Shobeiri M, Ghojazadeh M, Azami-Aghdash S, Naghavi-Behzad M, Piri R, et al. Prevalence and Risk Factors of Gestational Diabetes in Iran: A Systematic Review and Meta-Analysis. Iranian Journal of Public Health. 2015; 44(8): 1036-1044.
6. Diagnostic World Health organization. Diagnostic criteria and classification of hyperglycemia first detected in pregnancy. Geneva : World Health Organization. 2013. Available from: http://www.who.int/diabetes/publications/Hyperglycamia In_ Pregnancy/en/. page
7. Dabelea D, Snell-Bergeon JK, Hartsfield CL, Bischoff KJ, Hamman RF, McDuffie RS. Increasing prevalence of gestational diabetes mellitus (GDM) over time and by birth cohort – Kaiser permanente of Colorado GDM screening program. Diabetes Care. 2005; 28(3): 579–584.
8. Deierlein AL, Siega-Riz AM, Chantala K, Herring AH. The association between maternal glucose concentration and child BMI at age 3 years. Diabetes Care. 2011; 34(2): 480–484.
9. Jovanovic L, Pettitt DJ. Gestational diabetes mellitus. Journal of American Medical Association. 2001; 286: 2516–2518. doi: 10.1001/ jama. 286.20.2516
10. Njete HI, John B, Mlay P, Mahande MJ, Msuya SE. Prevalence, predictors and challenges of gestational diabetes mellitus screening among pregnant women in northern Tanzania. Tropical Medicine & International Health. 2018; 23(2): 236-242.
11. Gabbe SG, Mestman JH, Freeman RK, Anderson GV, Lowensohn RI. Management and outcome of class A diabetes mellitus. American Journal of Obstetrics and Gynecology. 1977; 127(??0: 465–469.
12. Damm P, Houshmand-Oeregaard A, Kelstrup L, Lauenborg J, Mathiesen ER, Clausen TD. Gestational diabetes mellitus and long-term consequences for mother and offspring: a view from Denmark. Diabetologia. 2016; 59(7):1396-1399. doi: 10.1007/s00125-016-3985-5
13. Leybovitz-Haleluya N, Wainstock T, Landau D, Sheiner E. Maternal gestational diabetes mellitus and the risk of subsequent pediatric cardiovascular diseases of the offspring: a population-based cohort study with up to 18 years of follow up. Acta Diabetologica. 2018; 55(10): 1037–1042. doi: 10.1007/s00592-018-1176-1
14. Nguyen C L, Pham N M, Binns C W, Van Duong D, H. Lee A. Prevalence of Gestational Diabetes Mellitus in Eastern and Southeastern Asia: A Systematic Review and Meta-Analysis. Journal of Diabetes Research. 2018. 20;2018:6536974. doi: 10.1155/2018/6536974. PMID: 29675432; PMCID: PMC5838488.
15. Nezami N, Safa J, Eftekhar-Sadat AT, Salari B, Ghorashi S, Sakhaee K, et al. Lovastatin raises serum osteoprotegerin level in people with type 2 diabetic nephropathy. ClinBiochem. 2010; 43(16): 1294-1299.
16. Seshiah V, Das AK, Balaji V, Joshi SR, Parikh MN, Gupta S. Screening for gestational diabetes: a summary of the evidence for the U.S. Preventive Services Task Force. Journal of the Association of Physicians of India. 2006; 54: 622-628.
17. Farrar D, Simmonds M, Bryant M, Sheldon TA, Tuffnell D, Golder S, et al. Hyperglycaemia and risk of adverse perinatal outcomes: systematic review and meta-analysis. British Medical Journal. 2016; 13: 354:i4694. doi: 10.1136/bmj.i4694. PMID: 27624087; PMCID: PMC5021824.
18. DeSisto CL, Kim SY, Sharma AJ. Prevalence estimates of gestational diabetes mellitus in the United States, pregnancy risk assessment monitoring system (PRAMS), 2007-2010. Preventing Chronic Disease. 2014; 11(5): E104. PubMed.
19. Zekiye Karaçam & Demet Çelİk. The prevalence and risk factors of gestational diabetes mellitus in Turkey: a systematic review and meta-analysis. The Journal of Maternal-Fetal & Neonatal Medicine. 2021; 34(8): 1331-1341. DOI: 10.1080 /14767058.2019.1635109
20. Janevic T, Zeitlin J, Egorova N, Balbierz A, Howell EA. The role of obesity in the risk of gestational diabetes among immigrant and U.S- born women in New York City. Ann Epidemiol. 2018; 28(4) :242–248. doi: 10.1016/j.annepidem.2018.02.006
21. Groof Z, Garashi G, Husain H, Owayed S, AlBader S, Mouhsen H, et al. Prevalence, risk factors, and fetomaternal outcomes of estational diabetes mellitus in kuwait: a cross-sectional study. Journal of Diabetes Research. 2019: 9136250. doi: 10.1155/2019/9136250
22. Li G, Wei T, Ni W, Zhang A, Zhang J, Xing Y, et al. Incidence and Risk Factors of Gestational Diabetes Mellitus: A Prospective Cohort Study in Qingdao, China. Frontiers in Endocrinology. 2020; 11(11): 636. doi: 10.3389/fendo.2020.00636
23. Larrabure-Torrealva GT, Martinez S, Luque-Fernandez MA, Sanchez SE, Mascaro PA, Ingar H, et al. Prevalence and risk factors of gestational diabetes mellitus: findings from a universal screening feasibility program in Lima, Peru. BMC Pregnancy Childbirth. 2018; 18(1): 303. doi: 10.1186/s12884-018-1904-0. PMID: 30021539; PMCID: PMC6052534.
24. Egbe T. O, Tsaku E.S, Tchounzou R, Ngowe M.N. 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. The Pan African medical journal. 2018; 31: 195. https://doi.org/10.11604/pamj.2018.31.195.17177.
25. Erem C, Kuzu UB, Deger O, Can G. Prevalence of gestational diabetes mellitus and associated factors in Turkish women: the Tabzon GDM study. Archices of Medical Science Journal. 2015; 11(4): 724-735.
26. Rajput R, Yadav Y, Nanda S, Rajput M. Prevalence of gestational diabetes mellitus & associated risk factors at a tertiary care hospital in Haryana. Indian Journal of Medical Research. 2013; 137(4): 728-733.
27. Doostifar K, Parsanahad M, Baharzadeh K, Khadem F, Ahmadi Angali K, et al. Risk Factors for Gestational Diabetes in Pregnant Women: A case-control study. Payesh. 2019; 18(6): 559- 567. [In Persian]
28. MohammadBeigi A, HamidReza T, MohammadSalehi N. Modeling the determinants of diabetes in pregnancy in Shiraz. Feyz Journal of Kashan University of Medical Science. 2009; 13(1): 37-42. [In Persian]
29. Rahimi M, Dinari Zh, Najafi F. Prevalence of gestational diabetes and its risk factor in Kermanshah 2009. Behbood Journal. 2010; 14(3): 244-250.
30. Mghanga F.P, Maduhu E.A, Nyawale H.A. Prevalence and associated factors of gestational diabetes mellitus among rural pregnant women in southern Tanzania. Ghana Medical Journal. 2020; 54(2): 82-87. DOI: http://dx.doi.org/10.4314/gmj.v54i2.5
31. Bouzari Z, Yazdani S, Abedi Samakosh M, Mohammadnetaj M, Emamimeybodi S. Prevalence of gestational diabetes and its risk factors in pregnant women referred to health centers of Babol, Iran, from september 2010 to march 2012. The Iranian Journal of Obstetrics, Gynecology and Infertility. 2013;16(43): 6-13.
32. Goli M, Hemmat A.H, Foroughi pour A. Risk factors of gestational diabetes mellitus in Iranian pregnant women. Health System Research Journal. 2012, 8(2): 282-289.
33. Goli M, Firouzeh F. Prevalence of gestational diabetes and efficacy of risk factors in screening of referrals to health centers. Journal of Holistic Nursery and Midwifery. 2014; 24(3): 56-63.