https://doi.org/10.15218/zjms.2022.021

Gestational diabetes and its correlation with maternal socio-demographic characteristics

Received: 15/06/2021 Accepted: 22/09/2021

Nask Jalal Jubrael[1] Shahla K. Alalaf[2] Nazar Pauls Shabila[3]* Salah Abubaker Ali[4]

Abstract

Background and objective: Gestational diabetes mellitus is the most common metabolic disorder of pregnancy with increasing prevalence at epidemic rates. This study aimed to determine the prevalence of gestational diabetes mellitus and related risk factors in a sample of pregnant women in Erbil city.

Methods: A cross-sectional study was conducted on a convenience sample of 216 pregnant women at primary health care centers in Erbil city, Kurdistan Region, Iraq, from April 2019 to January 2021. The pregnant women were selected independent of having or not having risk factors. Pregnant women were screened for diabetes mellitus using 50 gm glucose challenge test in 24–28th weeks of gestational age. Women with positive glucose challenge test underwent 100 g glucose tolerance test.

Results: The 50g glucose challenge test revealed that 54 women (25.0%) were positive for gestational diabetes mellitus. Glucose tolerance test (100 gm) revealed that the prevalence of diabetes among the sample was 11.9%. The association between the different characteristics and risk factors with the diagnosed diabetic status of the study participants showed that there was a significant association with the older age, obesity, higher parity, and history of recurrent miscarriage.

Conclusion: Pregnancy is associated with a high prevalence of gestational diabetes mellitus in the current research. Pregnant women, particularly those in advanced maternal age, with pre-pregnancy high body mass index and having a history of recurrent miscarriages, should be investigated for the possibility of the presence of gestational diabetes mellitus.

Keywords: Gestational diabetes mellitus; Demographic character; Glucose tolerance test; Prevalence rate.

Introduction

Gestational diabetes mellitus is defined as carbohydrate intolerance resulting in hyperglycemia of variable severity with onset or first recognition during pregnancy, excluding those with diabetes in pregnancy likely to represent overt diabetes mellitus.[1] The worldwide rate of gestational diabetes mellitus varies from 1% to 28%, depending on population characteristics like maternal age, socioeconomic status, race, ethnicity, screening methods, and diagnostic criteria.[2] Globally, gestational diabetes mellitus is rising; furthermore, It is the most global health threat to mothers and newborns babies, especially in low resource countries.[3] It is important to identify a pregnant woman with gestational diabetes mellitus because gestational diabetes mellitus is associated with significant metabolic alterations, maternal morbidity, increased perinatal morbidity and mortality, and long term morbidity among the women and their babies.[4,5]

[1] Directorate of Health, Erbil, Iraq.
[2] Department of Gynecology and Obstetrics, College of Medicine, Hawler Medical University, Erbil, Iraq.
[3] College of Health Sciences, Catholic University in Erbil, Erbil, Iraq.
[4] Department of Basic Sciences, College of Medicine, Hawler Medical University, Erbil, Iraq.
Correspondence: nazar.shabila@cue.edu.krd

https://doi.org/10.15218/zjms.2022.021

There is much controversy about the optimal gestational diabetes mellitus screening strategies, having universal versus selective screening and the best time for screening.[6,7] Most societies now recommend universal gestational diabetes mellitus screening. There is increased debate about the best screening strategies for gestational diabetes mellitus, such as universal versus selective screening and the optimal timing for screening.[8] However, it depends on the financial situation of health authorities and how much they want to spend on universal screening. Moreover, universal screening does not seem to be convincingly cost-effective.[9] Several professional societies currently recommend the universal gestational diabetes mellitus screening at 24–28 weeks of gestation for pregnant women.[10-12]

Gestational diabetes mellitus is of public health concern, and we have to have an overview of this condition in Eastern and Southeastern Asia. However, accessible and systematically organized estimations of the gestational diabetes mellitus prevalence rate in this area are lacking. Furthermore, the lack of uniformity in screening methods all over the world, the definition of gestational diabetes mellitus, and the diagnostic method for gestational diabetes mellitus make it difficult to compare the prevalence of gestational diabetes mellitus between and within countries.[13] This study aimed to determine the prevalence rate of gestational diabetes mellitus and assess the risk factors associated with gestational diabetes in a sample of Kurdish pregnant women.

Methods

Design and setting

This cross-sectional study was conducted on a sample of pregnant women conveniently selected from nine primary health centers in Erbil city, Kurdistan Region, Iraq, from April 2019 to January 2021.

Sample size estimation

Using the Epi-info, the sample size was calculated assuming that the prevalence of gestational diabetes among pregnant women is 16.7%, according to a pilot study on 20 pregnant women. We found that a sample size of 216 pregnant women was sufficient to achieve a 95% confidence interval for the prevalence with ±5% precision.

Inclusion and exclusion criteria

Pregnant women at 24-28 weeks gestation attending antenatal care units, of any parity and age groups, accept to participate in the study were included in the study.

The exclusion criteria included known cases of diabetes mellitus or gestational diabetes, abnormal gestational (>135 mg/ dl) test before 24 weeks of gestation, gestational diabetes in previous pregnancies, pregnancy with more than one fetus and taking medications such as steroids.

Data collection

A convenience sample of pregnant women was selected. The women were selected without known the status of presence of any risk factors. A specially designed questionnaire was used to collect data from the participants. Data were collected about the sociodemographic profile, obstetric history, education level, occupation, height and weight, smoking history, parity, and the presence of any risk factors such as history of diabetes mellitus in first degree relatives, previous fetal weight of 4500 gm or more, previous unexplained fetal loss, and history of recurrent miscarriage.

Screening test of glucose

Glucose challenge test (GCT) was conducted for the entire participants. Those with positive GCT were subjected to the oral glucose tolerance test (OGTT) to confirm the diagnosis of gestational diabetes mellitus.

Method of performing GCT

50 gms of glucose were dissolved in 200 ml of water, and the patient was asked to drink it over five minutes, regardless of the time of the day or the time of the last meal. After one hour of ingestion, a venous blood

https://doi.org/10.15218/zjms.2022.021

sample was drawn. If the blood glucose value was ≥140 mg/dl, the screening test was considered to be positive.[14] The woman was a candidate for the OGTT.

Method of performing OGTT

The woman should have been fasting for 10-12 hours. A fasting blood sample was drawn, after which the woman was asked to drink 100g of glucose dissolved in 200-400 ml of water. Subsequent blood samples were drawn at 1, 2, and 3 hours after glucose water ingestion.

According to the national diabetes data group, the diagnosis of gestational diabetes was made when two or more values mentioned below are met or exceeded.[15]

Fasting: 105 mg/dl
1 hour: 190 mg/dl
2 hours: 165 mg/dl
3 hours: 145 mg/dl

Ethical aspects

The study was approved by the Research Ethics Committee of the College of Medicine, Hawler Medical University (Code No.3/9 on 23rd December, 2019). Informed written consent was obtained from each participant before involving them in the study. The aim and details of the study and the procedures were explained to the participants, and they were allowed to withdraw from the study at any stage.

Statistical analysis

The IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp. was used for data management and analysis. Data were presented as numbers and frequencies. The Chi-square test was used to compare proportions and to assess the association of diabetes with different socio demographic and obstetrics characteristics of the participants and risk factors. When the expected count of more than 20% of the cells of the tables was less than 5, Fisher's exact test was used. The level of statistical significance was set at *P* value ≤0.05. Baseline variables were considered for inclusion in the multivariate models based on a significant univariate test based on the Wald test from the logistic regression with a *P* value cut-off point of 0.25. Odds ratios (ORs) with their 95% confidence intervals (CI) were calculated.

Results

A total of 249 women were interviewed for eligibility, of which 28 did not meet the inclusion criteria and 5 refused to participate. Therefore, 216 pregnant women were recruited in the study.

The mean age of the study participants was 28.8±6.1 years (range 16-45 years). The highest proportion of the participating women were aged 26-35 year (51.4%), had intermediate/secondary school education (37.9%), and were housewives (88.0%) (Table 1)

Table 1 Sociodemographic characteristics of the study participants

Characteristic	No.	(%)
Age group		
≤25	71	(32.9)
26-35	111	(51.4)
36-45	34	(15.7)
Education level of the woman		
Illiterate/primary school	60	(27.7)
Intermediate/secondary school	82	(37.9)
Post-secondary education	74	(34.3)
Occupation of the women		
Housewife	190	(88.0)
Work	26	(12.0)
Total	216	(100.0)

https://doi.org/10.15218/zjms.2022.021

The highest proportion of the study participants were overweight (44.4%), multipara (54.2%), and at 27-28 gestational age (39.8%). Only 1.9% of the women were smokers, while 41.2% had first degree relatives with diabetes mellitus, 11.1% had history of macrosomia, 12.0% had history of recurrent miscarriage, and 2.8% had history of previous stillbirth (Table 2)

Table 2 Clinical and risk factors characteristics of the study participants

Characteristic/risk factor	No.	(%)
BMI		
Normal	50	(23.1)
Overweight	96	(44.4)
Obese	70	(32.4)
Smoking		
Yes	4	(1.9)
No	212	(98.1)
Parity		
Primigravid	68	(31.5)
Multiparous (1-4)	117	(54.2)
Grand multiparous (5+)	31	(14.4)
Gestational age (weeks)		
23-24	53	(24.5)
25-26	77	(35.6)
27-28	86	(39.8)
First degree relative with diabetes mellitus		
Yes	89	(41.2)
No	127	(58.8)
History of macrosomia (large fetus with birth weight 4-4.5 kg)		
Yes	24	(11.1)
No	192	(88.9)
History of recurrent miscarriage		
Yes	26	(12.0)
No	190	(88.0)
History of previous stillbirth		
Yes	6	(2.8)
No	210	(97.2)
Total	216	(100.0)

https://doi.org/10.15218/zjms.2022.021

The 50g GCT test revealed that 54 women (25.0%) had a blood sugar level of more than 140 mg/dl. Of these 54 women, 39 had 100gm GTT and 15 refused to have the test. Of the 39 women who had GTT, 24 (61.5%) had abnormal blood sugar and 15 (38.5%) had normal blood sugar.

After subtracting the 15 women who refused to have 100 gm GTT from the total sample, the prevalence of diabetes among the study sample was 11.9% (24/201). Details are shown in Table 3.

Table 4 shows the association between the different characteristics and risk factors with the diagnosed diabetic status of the study participants. Diabetes was significantly associated with older age, obesity, higher parity, and history of recurrent miscarriage.

Table 3 Results of investigations to diagnose diabetes

	No.	**(%)**
50g GCT		
Less 140	162	(75.0)
140-199	51	(23.6)
200 and more	3	(1.4)
100gm GTT (n=39)		
Normal	15	(38.5)
Abnormal	24	(61.5)
Diabetic status		
Diabetic	24	(11.9)
Not Diabetic	177	(88.1)

https://doi.org/10.15218/zjms.2022.021

Table 4 Association between the different characteristics and risk factors with the diagnosed diabetic status of the study participants

Variable	Diabetic status				*P* value
	Not diabetic		Diabetic		
	No.	(%)	No.	(%)	
Age group					
≤25	65	(92.9)	5	(7.1)	
26-35	91	(89.2)	11	(10.8)	0.015
36-45	21	(72.4)	8	(27.6)	
Education level of the woman					
Illiterate/primary school	47	(85.5)	8	(14.5)	
Intermediate/secondary school	67	(87.0)	10	(13.0)	0.569
Post-secondary education	63	(91.3)	6	(8.7)	
Occupation of the women					
Housewife	157	(88.7)	20	(11.3)	0.499*
Work	20	(83.3)	4	(16.7)	
BMI					
Normal	43	(91.5)	4	(8.5)	
Overweight	87	(93.5)	6	(6.5)	0.006
Obese	47	(77.0)	14	(23.0)	
Smoking					
Yes	3	(75.0)	1	(25.0)	0.401*
No	174	(88.3)	23	(11.7)	
Para					
Primigravid	62	(93.9)	4	(6.1)	
Multiparous (1-4)	95	(89.6)	11	(10.4)	0.002
Grand multiparous (Para ≥ 5)	20	(69.0)	9	(31.0)	
Gestational age (weeks)					
23-24	46	(92.0)	4	(8.0)	
25-26	65	(91.5)	6	(8.5)	0.141
27-28	66	(82.5)	14	(17.5)	
1st degree relative with diabetes mellitus					
Yes	68	(86.1)	11	(13.9)	0.485
No	109	(89.3)	13	(10.7)	
History of macrosomia					
Yes	16	(76.2)	5	(23.8)	0.145*
No	161	(89.4)	19	(10.6)	
History of recurrent miscarriage					
Yes	16	(69.6)	7	(30.4)	0.010*
No	161	(90.4)	17	(9.6)	
History of previous stillbirth					
Yes	2	(100.0)	0	(0.0)	1.000*
No	175	(87.9)	24	(12.1)	

* Fisher's Exact Test

https://doi.org/10.15218/zjms.2022.021

Multivariate logistic regression showed that none of the risk factors independently associated with gestational diabetes (Table 5).

Discussion

The current study revealed that the use of 100gm GTT in the sample size confirmed gestational diabetes mellitus in 11.9% of pregnant women.

Around one in 10 pregnant women in Eastern and Southeastern Asia had gestational diabetes mellitus, and this is approaching our finding. However, our finding is higher than African countries, where the average prevalence of gestational diabetes mellitus is about 6.0%.[16] Similarly, our rate is higher than results from the western countries, such as Europe, the United States, and Australia (5.4%, 9.2%, and 5.7%, respectively).[17,18] This discrepancy could be speculating due to the socioeconomic, racial/ethnic, or lifestyle disparities between different cultural groups.

The higher prevalence in our study might also reflect selecting a convenience sample rather than a random sample and the possibility of having a higher risk group in the selected sample.

The high prevalence of gestational diabetes mellitus in less wealthy countries reviewed here is consistent with studies from other parts of Asia and Africa.[16] Similarly, around 90% hyperglycemic cases during pregnancy occur in low and middle income countries, according to the International Diabetes Federation in 2015.[19]

It is worth to mention that gestational diabetes mellitus prevalence differs largely from 0.6% to 3.6% in North Europe to 6.3% in Italy, which may also be explained by the various diagnostic criteria in different countries and societies.[20] There is also an increase in the prevalence of risk factors for diabetes, like high maternal age, obesity, and family history of diabetes mellitus.[2,21] A systematic review revealed that the overall prevalence of gestational diabetes mellitus, according to the International Association of Diabetes in Pregnancy Study Group (IADPSG) diagnostic criteria, is 10.6% versus a pooled overall prevalence of 4.4%, regardless of the type of screening thresholds.[22]

In our study, gestational diabetes was significantly associated with older age, obesity, higher parity, and history of recurrent miscarriage. Similarly, other studies have shown that advanced maternal age, higher parities, and history of recurrent miscarriages are risk factors for diabetes in pregnancy.[23,24]

In our study, the effect of the risk factors was a combined effect on gestational diabetes as none of the risk factors independently associated with gestational

Table 5 Multiple logistic regression of the association of risk factors with gestational diabetes

Variable	B	Sig.	OR	95% CI for OR	
				Lower	Upper
Age	0.060	0.275	1.062	0.954	1.182
BMI	0.066	0.163	1.069	0.974	1.173
Gestational age	0.266	0.106	1.304	0.945	1.799
Primi para			1		
Mutli para	-0.104	0.888	0.901	0.211	3.845
Grand multi Para	0.479	0.644	1.614	0.213	12.246
History of macrosomia	0.231	0.734	1.260	0.333	4.772
History of recurrent miscarriage	0.901	0.145	2.462	0.733	8.275

https://doi.org/10.15218/zjms.2022.021

diabetes. However, other studies have shown that obesity and maternal age are the two most important factors independently affecting the risk of gestational diabetes.[25]

This study has a number of limitations. A convenience sample from primary health care center was selected rather than a random sample. This might have increased the proportion of those with risk factors in the sample. It is better to include a random sample or women with not known risk factors of gestational diabetes in such studies. While a number of variables were included and tested in this study, there might be other important variables that should be studies as determinants of gestational diabetes.

Conclusion

Pregnancy is associated with a high prevalence rate of gestational diabetes mellitus in the current research. Advanced maternal age, pre-pregnancy high BMI and history of recurrent miscarriages have profound effects on the incidences of a positive OGCT and gestational diabetes mellitus. Gestational diabetes mellitus need to be excluded in pregnant women, particularly those with the above risk factors.

Funding

Not applicable.

Competing interests

The authors declare that they have no competing interests.

References

1. World Health Organization. Diagnostic criteria and classification of hyperglycaemia first detected in pregnancy: a World Health Organization guideline. 2013. (Accessed June 9, 2017, at http://apps.who.int/iris/bitstream/10665/85975/1/WHO_NMH_MND_13.2_eng.pdf).
2. Jiwani A, Marseille E, Lohse N, Damm P, Hod M, Kahn JG. Gestational diabetes mellitus: results from a survey of country prevalence and practices. J Matern Fetal Neonatal Med. 2012; 25(6):600–10.
3. 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 Childbirth. 2019; 19:334.
4. Ogurtsova K, da Rocha Fernandes J, Huang Y, Linnenkamp U, Guariguata L, Cho N, et al. IDF diabetes atlas: global estimates for the prevalence of diabetes for 2015 and 2040. Diabetes Res Clin Pract. 2017; 128:40–50.
5. Shou C, Wei YM, Wang C, Yang HX. Updates in Long-term Maternal and Fetal Adverse Effects of Gestational Diabetes Mellitus. Maternal-Fetal Medicine. 2019; 1(2):91–4. https://doi.org/10.1097/FM9.0000000000000019s
6. Saccone G, Caissutti C, Khalifeh A, Meltzer S, Scifres C, Simhan HN, et al. One step versus two step approach for gestational diabetes screening: systematic review and meta-analysis of the randomized trials. J Matern Fetal Neonatal Med. 2019; 32:1547–55. https://doi.org/10.1080/14767058.2017.1408068
7. Kayal A, Mohan V, Malanda B, Anjana RM, Bhavadharini B, Mahalakshmi MM, et al. Women in India with GDM Strategy (WINGS) – Methodology and development of Model of Care for GDM (WINGS 4). Indian J Endocrinol Metab. 2016; 20(5):707–15. https://doi.org/10.4103/2230-8210.189230
8. Minschart C, Beunen K, Benhalima K. An Update on Screening Strategies for Gestational Diabetes Mellitus: A Narrative Review. Diabetes Metab Syndr Obes. 2021; 14:3047–76.
9. Fitria N, van Asselt AD, Postma MJ. Cost-effectiveness of controlling gestational diabetes mellitus: a systematic review. The Eur J Health Econ. 2019; 20(3):407–17. https://doi.org/10.1007/s10198-018-1006-y
10. American Diabetes A. 2. Classification and Diagnosis of Diabetes: Standards of Medical Care in Diabetes-2019. Diabetes Care. 2019; 42:S13–28.
11. Committee on Practice B-O. ACOG Practice Bulletin No. 190: Gestational Diabetes Mellitus. Obstet Gynecol. 2018; 131:e49–64.
12. Moyer VA. Screening for gestational diabetes mellitus: U.S. Preventive Services Task Force recommendation statement. Ann Intern Med. 2014; 160:414–20.
13. 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; 2018:6536974. https://doi.org/10.1155/2018/6536974
14. Abu-Heija A, Al-Bash M, Ishrat N, Al-Kharausi L. 50 Grams Oral Glucose Challenge Test: Is It an Effective Screening Test for Gestational Diabetes Mellitus? J Obstet Gynaecol India. 2016; 66(Suppl 1):7–11.
15. Carreiro MP, Nogueira AI, Ribeiro-Oliveira A. Controversies and Advances in Gestational

Diabetes-An Update in the Era of Continuous Glucose Monitoring. J Clin Med. 2018;7:2. https://doi.org/10.3390/jcm7020011
16. Macaulay S, Dunger DB, Norris SA. Gestational diabetes mellitus in Africa: a systematic review. PLoS One. 2014; 9(6):e97871.
17. Desisto CL, Kim SY, Sharma AJ. Prevalence estimates of gestational diabetes mellitus in the United States, pregnancy risk assessment monitoring system (PRAMS), 2007–2010. Prev Chronic Dis. 2014; 11:E104. https://doi.org/10.5888/pcd11.130415
18. Eades CE, Cameron DM, Evans JM. Prevalence of gestational diabetes mellitus in Europe: a meta -analysis. Diabetes Res Clin Pract. 2017; 129:173–81. https://doi.org/10.1016/j.diabres.2017.03.030
19. International Diabetes Federation, IDF Diabetes Atlas, 2015. (Accessed July 6, 2021, at https://www.diabetesatlas.org/upload/resources/previous/files/7/IDF%20Diabetes%20Atlas%207th.pdf).
20. Baz B, Riveline JP, Gautier JF. Endocrinology of pregnancy: Gestational diabetes mellitus: Definition, aetiological and clinical aspects. Eur J Endocrinol. 2016; 174(2):R43–51. https://doi.org/10.1530/EJE-15-0378
21. Rajput R, Yadav Y, Nanda S, Rajput M. Prevalence of gestational diabetes mellitus & associated risk factors at a tertiary care hospital in Haryana. Indian J Med Res. 2013; 137(4):728–33.
22. Behboudi-Gandevani S, Amiri M, Bidhendi-Yarandi R, Ramezani Tehrani F. The impact of diagnostic criteria for gestational diabetes on its prevalence: a systematic review and meta-analysis. Diabetol Metab Syndr. 2019; 11:11. https://doi.org/10.1186/s13098-019-0406-1
23. Logakodie S, Azahadi O, Fuziah P, Norizzati B, Tan SF, Zienna Z, 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.
24. Abu-Heija AT, Al-Bash MR, Al-Kalbani MA. Effects of maternal age, parity and pre-pregnancy body mass index on the glucose challenge test and gestational diabetes mellitus. J Taibah Univ Medical Sci. 2017; 12(4):338–42. https://doi.org/10.1016/j.jtumed.2017.01.005
25. 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. Front Endocrinol (Lausanne). 2020; 11:636. https://doi.org/10.3389/fendo.2020.00636