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PREVALENCE OF GESTATIONAL DIABETES AMONG WOMEN ATTENDING PRIMARY HEALTH CARE CENTERS IN AL-NAJAF CITY, IRAQ: A CROSS -SECTIONAL STUDY

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Abstract
Background:
Gestational diabetes mellitus (GDM) Gestational diabetes is Gestational diabetes mellitus (GDM) is a common pregnancy complication characterized by hyperglycemia with onset or first recognition during pregnancy it can happen at any stage of pregnancy, but is more common in the second or third trimester. It is a serious health issues for both mother and child so health care provider must pay attention to screening and management of pregnant women to provide good outcomes for both mother and child.
Objective: The study aim to identify the prevalence of Gestational diabetes mellitus and associated risk factor in Al Najaf Al Ashraf City.
Methods: This is cross sectional study .history was obtained by personal interviewing, questionnaire and the diagnosis of gestational diabetic made by measuring fasting blood glucose and after one ,two hours of giving the patiant75 g of glucose .and the diagnosis done according to the reading of WHO in diagnosis of gestational diabetes .The study include 215 pregnant women from Al Najaf Al Ashraf City. Data entry and analysis done by statistical package for social sciences (SPSS) ,descriptive statistics done by frequency and percentage while analytic statistics done by chi square test for categorical data and t- test used for numerical data .
P value ≤ 0.05 regarded significant.
Result: The total number of participants were 215, 18% of them were diagnosed as GDM. Five factors were significantly associated with developing GDM ,including family history of diabetic(p value 0.003) ,obesity(p value <0.001) , age of mother(p value 0.008) ,history of GDM(p value <0.001) and macrosomia(p value 0.001) .also the study did not find associated with GDM like occupation ,gestational hypertension ,residence and number of miscarriage
Conclusion: The study identified several risk factors associated with increased prevalence of GDM including family history of diabetes ,advanced maternal age ,history of GDM ,over weight/obesity and macrosomia .It is recommended that antenatal care providers must screen for GDM specially women having risk factors and monitor the weight of the mother also education and counseling on healthy lifestyle
Keywords: Gestational diabetes mellitus, Risk factor, Prevalence, Screening, OGGT, Cross-sectional study

Introduction

Gestational diabetes mellitus (GDM) is a common pregnancy complication characterized by hyperglycemia with onset or first recognition during pregnancy.[1, 2] .

The mother's body goes through a number of physiological changes in a healthy pregnancy to meet the needs of the developing fetus. These consist of modifications to the respiratory, hematologic, renal, cardiovascular, and metabolic systems. An essential metabolic adaptation is the sensitivity to insulin. [3,4]

Then after delivery of the placenta. Return to the normal therefore, GDM usually appear in the late second trimester and disappears post-delivery [3,5,6].

Worldwide, the overall prevalence of GDM is estimated to be (14%) [7, 8,9].

In Iraq the prevalence of GDM is 13.3 % in 2020 [10].

The prevalence increase parallel to the increased in the prevalence of obesity and type 2 diabetes mellitus (T2DM). [11,12,13]

The majority of people with GDM live in the Asia-Pacific area. The Asia-Pacific area has the highest prevalence of GDM because Asian inhabitants are more likely than Western populations to be abdominally obese, have low muscle mass, and have greater insulin resistance [14, 15]. In contrast to the rest of the world (3.6–6.0%), South Asia (Bangladesh, India, and Sri Lanka) has 11.4% of GDM [11].

Women from the Middle East (Iraq, Afghanistan, Iran, Syria, Lebanon, and Lebanon) are the main populations at risk for GDM.[14] A comprehensive review and meta-analysis study conducted in Iran found that the prevalence of GDM is quite high, with possible causes. [16] 6.9% of Tehran's population has gestational diabetes. [16]In Iraq the prevalence of GDM is 13.3 % in 2020 [10]

Hyperglycemia is thought to affect 16.9% of pregnancies and has numerous negative effects on both the mother and the unborn child. Southeast Asia has the highest prevalence, with GDM affecting 1 in 7 infants there [17].

The clinical diagnosis of gestational diabetes mellitus (GDM) is crucial since reducing GDM-associated perinatal morbidity and death frequently involves food therapy and medication therapy, such as insulin and antepartum fetal surveillances. The oral glucose tolerance test is frequently used to confirm hyperglycemia during pregnancy (OGTT). For high-risk pregnant women as well as all pregnant women between weeks 24 and 28, using the OGTT for screening is advised in the early stages of pregnancy [4,7,18].

Subject and Method:

1. Study design, setting and time:

Descriptive cross sectional study was performed on pregnant women attending to primary health care centers in Al Najaf Al Ashraf City, during the period from 1st of February to 1st of December 2023.

2. Sampling design

Five PHCCS were chosen randomly by simple random sampling technique, the pregnant women who attend to the primary health care centers for routine antenatal care were selected by systematic sampling technique ,collection of cases was done in about 4hours of two day time per week of the study period .history was obtained by personal interviewing and records . and the diagnosis of gestational diabetic made by measuring fasting blood glucose after prepare the women (fasting for 8 hours at night) .and if the result of fasting blood glucose is positive according to the criteria of diagnosis GDM then no need to give 75g of glucose powder and not complete the OGGT test, if the result negative then give the pregnant women the glucose powder and complete the test, the diagnosis done according to the one step approach of (IADPSG) in diagnosis of gestational diabetics .

the use of 75 g oral glucose tolerance test (OGTT) between 24 and 28 weeks of pregnancy.[32,33] any of the following values is considered sufficient to label the woman as having GDM;

1) A fasting plasma glucose (FPG) ≥5.1 mmol/L (≥92 mg/dL),

2) A one-hour plasma glucose level ≥10 mmol/L (≥180 mg/dL), or

3) A two-hour plasma glucose ≥8.5 mmol/L (≥ 153 mg/dL).

3 .Sample size: The sample size estimation was done according to the following equation:

Sample size = **N=Z^2(p*q)/d^2**

Z = 1.96 corresponding value for the 95% confidence interval

P= prevalence of gestational diabetic in Iraq

d= degree of precision was at 0.05% at 95% confidence interval

q= 1-P

The prevalence of gestational diabetic in Iraq is 13.3% in 2020 [16].

According to this equation N=Z^2(p*q)/d^2, sample size was 177 participants will be selected using systematic random sampling.

4 .The questionnaire:

A well-constructed questionnaire consist of different points related to sociodemographic, medical history had been used for this study, the questionnaire were presented to experts, and they gave their comments on them.

It is include the age ,parity ,gestational age of pregnancy ,history of abortion number of abortion, history of DM before pregnancy ,history of GDM, family history of DM (father or mother), if have gestational hypertension, ,history of macrosomic baby ,also ask about occupation of women ,residence and education state, also measure BMI.

5 .Inclusion criteria:

All pregnant women in the 2nd and 3rd trimester of pregnancy

6. Exclusion criteria:

1. Pregnant women with diabetic before pregnancy.
2. Pregnant women in the 1st trimester of pregnancy.

7 .Ethical issues:

Verbal consent was taken from all participant, data taken and kept confidentially and securely and officially agreement from Iraqi board of medical specialization.

8 .Statistical analysis:

Data entry and analysis done by statistical package for social sciences (SPSS) version 23 ,descriptive statistics done by frequency percentage while analytic statistics done by chi square test for categorical data and t- test used for numerical data .

P value ≤0.05 regarded significant.

Result:

A total of 215 pregnant women had been included in this study. The prevalence of gestational diabetes was 18.6%.

Table (1) diagnostic criteria for GDM

Readings	GDM N(%)
Fasting	30 (14%)
One hour	8 (3.7%)
Two hour	2 (0.9%)

The total number of pregnant women with positive GDM are 40 patients there is 30 (14%) of theme were diagnosed from fasting reading (the fasting reading positive so not complete the test) ,8 (3.7%)diagnosed after one hour from giving 75g of glucose powder and 2 (0.9%) after two hours reading .

Table (2): Sociodemographic characteristic of participant

Variable	GDM Mean±SD	No GDM Mean±SD	P value
Age(years)	26.4±6.3	23.7±5.4	0.008
Para	1.4±1.6	1.02±1.2	0.052
Abortion	0.4±0.7	0.21±0.51	0.061
Gestational age	26.4±4.9	25.7±5.3	0.418
BMI	30.3±5.6	26.9±4.9	0.000

Table 2 shows significant difference between GDM and no GDM women in Age, BMI In which the age, BMI was higher in GDM patients.

Table (3): Association between sociodemographic characteristic of participant and GDM

		GDM_		Total	P value
		Yes	No		
Family history of DM	YES	24(28.6%)	60(71.4%)	84(100%)	0.003
	NO	16(12.2%)	115(87.8%)	131(100%)	
occupation	employed	1(14.3%)	6(85.7%)	7(100%)	0.765
	Not employed	39 (18.8%)	169 (81.2%)	208 (100%)	
Residence	Rural	4 (28.6%)	10 (71.4%)	14 (100%)	0.322
	Urban	36(17.9%)	165(82.1%)	201(100%)	

Educational level	**Not read not write**	**2(100.0%)**	**0(0%)**	**2(100.0%)**	**0.016**
	Primary	**11(14.9%)**	**63(85.1%)**	**74(100%)**	
	Secondary	**23(20.9%)**	**87(79.1%)**	**110(100%)**	
	Graduated	**4(13.8%)**	**25(86.2%)**	**29(100%)**	
Total		**40 (18.6%)**	**175 (81.4%)**	**215 (100%)**	

In table 3 shows that there is significant association between family history of diabetes mellitus and the occurrence of GDM (p=0.003).
The prevalence of patient who have GDM with positive family history was (28.6%) while the prevalence of patient who have GDM with no family history is (12.2%) .

According to occupation there was no significant association between occupation and GDM (p=0.765) as shown in table 3

There was no significant association between residence and GDM (p value 0.322) as shown in table 3.

There was significant association between educational level and GDM; there is more GDM patients in secondary educational level as shown in table 3.

Table (4) Association between obstetrical history and GDM

		GDM_		Total	P value
		Yes	No		
Gestational Hypertension	**YES**	**6(15%)**	**9(5.1%)**	**15(7%)**	**0.062**
	NO	**34(85%)**	**166(94.9%)**	**200(93%)**	
History of previous Gestational DM	**YES**	**5(12.5%)**	**2(1.1%)**	**7(3.3%)**	**<0.001**
	NO	**35(87.5%)**	**173(98.9%)**	**208 (96.7%)**	
Macrosomia	**YES**	**5(100%)**	**0(0%)**	**5(100%)**	**<0.001**
	NO	**35(16.7%)**	**175(83.3%)**	**210(100%)**	
Total		**40(18.6%)**	**175(81.4%)**	**215(100%)**	

In table 4 there is no significant association between gestational hypertension and GDM , p value (0.062) ,there was significant association between previous GDM and GDM P value (<0.001) (5 0f 40 patients with) GDM have previous history of GDM) and there was significant association between macrosomia and GDM , p value <(0.001

Table (5) association between age and gestational diabetes mellitus

		GDM_		Total	P value
		Yes	No		
Age group	**15-25**	**18(12.9%)**	**121(87.1%)**	**139(100%)**	**0.008**

	26-35	**17(25.8%)**	**49(74.2%)**	**66(100%)**	
	>35	**5(50%)**	**5(50%)**	**10(100%)**	
Total		**40(18.6%)**	**175(81.4%)**	**215(100%)**	

The age was significant risk factor as GDM more in age 35 and above while less GDM in age 25 and below as shown in table(5) age group from (15-25) was 139 ,only 18 women have GDM ,from (26-35) was 66 ,only 17 have GDM ,while age 35 and above was 10 women and half of them have GDM.

Table (6) association between body mass index and gestational diabetes mellitus

					P value
		GDM_		**Total**	**<0.001**
		Yes	**No**		
BMI	**Underweight**	**0(0%)**	**1(0.6%)**	**1(0.5%)**	
	Normal	**8(20%)**	**57(32.6%)**	**65(30.2)**	
	Overweight	**12(30%)**	**74(42.3%)**	**86(40%)**	
	Obesity	**20(50%)**	**43(24.6%)**	**63(29.3%)**	
Total		**40(100%)**	**175(100%)**	**215(10%)**	

The obesity is significant risk factor as shown in table 12 the percentage of GDM is more in obese patient (50%) while in overweight is (30%) and in normal weight (20%).

Discussion:

In our study use of 75g GGT to confirm GDM in a sample taken from five primary health care centers in Al Najaf Al Ashraf city ,the prevalence was 18.6%.The prevalence of GDM in the world was between 1-14%, in Asia Arab countries ,the prevalence of GDM 15.5% done by Alduayji MM et.al,(2021) in Saudia Arabia [7] ,Oman 26.4% done by Chitme HR et.al, (2016) in Oman [19] , Palastien 20.8%(Abu-Rmeileh NM et.al, (2013) in Palastien [20], Jordin 13.5 %(Basha AS et.al, (2019) in Jordin [21] , Iraq 13.3% done by Mohammed MK et.al,(2020)in Iraq [10] , Kuwait 12.6% done by Groof Z et.al,(2019)in Kuwait [22] and yemen done by 3.9% Agarwal MM et.al, (2020)in Yemen [23] . In Africa, Egypt (8-24,2)% (Badakhsh M et.al, (2019)in Egypt [24] , Morocco (8.2-23.7)% done by Agarwal MM et.al,2015 in Morocco [25],Bangladesh 35% done by Mazumder T et.al,(2022)in Bangladesh [26] and Pakistan 21.8% done by Wali AS et.al,(2020) in Pakistan [27] .In North America 7.1 % done by Wang H et. al ,(2022) [28] , USA 17.8% done by Lende L et. al,(2020) [29] In South America 10.3% done by Wang H et. al ,(2022) [28] ,barazil 5.4%done by Santos PA et.al,(2020)in Brazil [30] .In Europe ,France 13.5 % done by Cosson E el.al,(2021)in France [31],Germeny 6.6 % done by Melchior H et.al, (2017)in Germeny [32] and UK was 6.8% done by Plant N et.al,(2020) in UK [33].

Consequently, the prevalence of GDM was higher in Asia and the Arab world than in Europe, North America, and South America, but it was lower in Africa. This could be due to an analysis of the Mediterranean diet's impact on GDM, which revealed a lower prevalence of GDM in the group that followed this diet. Additionally due to the distinct lifestyles of Arab nations and others. This wide range of variation of prevalence of GDM worldwide may be affected by geographical

region. In this study we found higher percentage of GDM (50%) in age more than 35 years, followed by (25.8%) in age group 26-35 and (12.9%) in the age group 15-25 .so the age is significant risk factor of GDM (p = 0.008).While in New-Zealand (Lawrence RL et.al,(2019)in New-Zealand) a retrospective study conducted in 6818 was found 31.1% of pregnant women with GDM were in the age group (30-34)years old [34] .Another study in Saudi Arabia ,in PHCs in Riyadh (Alharbi T et.al,(2021)in Saudi Arabia) a total

384 women participate ,the highest percentage (29.7%) of them were in the age group (26-30)years old[35] .

While a study done by Eltoony LF,et,al.(2021)in Egypt that significant association between age of pregnant women and GDM as the prevalence of patient with GDM who there age less than 25 years old was 15.4% and prevalence of patient with GDM who there age more than 25 was 84.6%.[36] .Another study shows nearly the same result across sectional study of GDM done by (Groof Z et.al(2019)in Kuwait) found that prevalence of GDM increase as maternal age increased reaching 18.2% among mothers aged 35 years and above [37] .

Maternal age is a well-documented risk factor of GDM, so advance maternal age is very important risk factor this may be due to increase in dysfunctional pre adipocytes and fat redistribution with aging which may cause the release of pro inflammatory cytokines and chemokines disrupting insulin pathogenesis .

In this study we found that 50% of the cases are obese, 30 % are overweight and 20% are normal weight.so there was significant association between GDM and obesity (p = 0.001).in a study in Saudi Arabia in PHCs in Riyadh done by Alharbi T et.al,(2021)in Saudi Arabia was found that 35% of the cases were overweight (BMI 25-29.9kg/m), 24% were obese (BMI 30-34.9 kg/m).[35]

In the cross sectional study done by Groof Z et.al,(2019)in Kuwait)were found that prevalence of GDM in normal weight are 7.9% ,15.7% in overweight and 17.0% in obese women .excessive gestational weight gain ,particularly between early and mid-pregnancy was positively associated with GDM risk .[37] these studies nearly the same result with our study .

Also the obesity is a well-documented risk factor of GDM and associated with insulin resistance ,ectopic fat accumulation and chronic inflammation and release of pro inflammatory cytokines and chemokines. also there is study shows that obese women had higher levels of adipokines like chemerin and leptin that cause inflammation and insulin resistance .

In this study the prevalence of patients who have GDM with positive family history is (28.6%) while the prevalence of patients who have GDM without family history is (12.2%) so there was significant association between GDM and family history of DM (p = 0.003) .

In a study done by Eltoony LF et.al,(2021)in Egypt show significant association between GDM and family history of diabetes (p value 0.002) and also significant association between GDM and previous history of GDM (P = 0.004)[36].Also in a study in Saudi Arabia in PHCs in Riyadh done by Alharbi T et.al,(2021)in Saudi Arabia was found that more than half of the participant (57.8%)have family history of DM , while (17.4%) have previous history of GDM [35].

Another study done by Jain U et.al, (2021) in India was found that family history of diabetic is 8.33% of cases of GDM [38].In the cross sectional study in Kuwait (Groof Z et.al, (2019) in Kuwait) were found that women with family history (mother/sister) of GDM were more likely to having GDM than those with no family history of GDM [39].

So family history is significant risk factor for GDM in all these studies.

In this study There is no significant association between gestational hypertension and GDM , (p =0.062) ,while in study done by the Alharbi T et.al, (2021)in Saudia Arabia prevalence of patient with GDM who are hypertensive was 1% [35]. This may be because the different in sample size

In this study, the percentage of patient with GDM who have previous history of GDM is 12.5 %(P <0.001)), while the percentage is 17.4% in a study in Saudi Arabia in PHCs in Riyadh (Alharbi T et.al, (2021) in Saudi Arabia .so nearly the same result and there was significant association [35].
This may be because pregnant women with history of GDM, in the next pregnancy have the same factors that cause hyperglycemia (age, obesity…) and pregnancy itself is in insulin resistance state so may cause GDM in next pregnancy.
In this study There was significant association between macrosomia and GDM , p<(0.001) and the percentage of patient with GDM and have previous history of macrosomia is 100.0% while in a study in india(Jain U et.al, (2021)in India) is 17.85%[38] ,in another study done by Ali AD et.al,(2016)in Yemen the prevalence of patient who have previous macrosomic baby was 12.2% [39] .
While in study done by Eltoony LF et.al,(2021)in Egypt there was no significant association between GDM and previous history of macrosomic baby (p value 0.819) [36] .
Previous history of macrosomic infant is another well-established risk factor for GDM. This could be the result of high blood sugar in mothers who have a history of macrosomic babies, even though their blood sugar levels do not approach GDM (high normal).Since glucose is the primary food for fetal growth; the high blood sugar causes the fetus to grow excessively
In this study There was significant association(p= 0.016) between educational level and GDM because I think this group of patient more interested to do checkup and visit the primary health care center than non-educated group . The prevalence of GDM patient was higher in secondary school (20.9%) while in study done by Alharbi T et.al, (2021)in Saudi Arabia was half of the participant 57.4% have university educational level[35] ,so nearly the same result.

In this study There was no significant association between occupation and GDM (p=0.765) .there were 14.3% of GDM patients were employed and 18.8% not employed. While in study done by Eltoony LF et.al,(2021)in Egypt the prevalence of patient with GDM who are working was 9.1% while prevalence of patient with GDM who are not working was 90.9% [36] .this disagree with our study.Also in study done by Alharbi T et.al, (2021)in Saudi Arabia the prevalence of cases who are employed 17.6% while the prevalence of cases who are not employed 80.3%[35] .In this study There was no significant association between residence and GDM (p = 0.322) .while in study done by Eltoony LF et.al,(2021)in Egypt show pregnant women in rural area were significantly protected against GDM than those from urban as 96.6% of GDM patient were urban and 3.4% were rural [36]. This may be because women from rural area have better life style and diet than urban women, also in our study there was no significant association because we take AL Najaf City center only.

Conclusion

In our study the prevalence of GDM in pregnant women in PHCCs in Al Najaf Al Ashraf City was higher than global figure(18.6%) and significantly associated with several risk factors like age ,obesity, history of macrosomic baby ,family history of DM and previous history of GDM and also not related to women occupation , residence and history of gestational hypertension.

Recommendation

1.We recommended to raise awareness of pregnant women about healthy life styles and training on the complication that be developed during pregnancy due to modifiable factors like obesity and sedentary life style and non-modifiable risk factor like family history of diabetes .

2. We recommended all pregnant women about screening for GDM, providing information, allowing personalized self-management and facilitating support from family.

3. Using educational and informative posters about gestational diabetes and it is complication, how to detect it early and importance of visiting primary health care centers to protect the mother and child.

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