

Original Research Article

Prospective of study of gestational diabetes mellitus risk in relation to maternal recreation physical activity before and after pregnancy

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ABSTRACT

Background: Gestational diabetes mellitus is common complications of pregnancy. Physical activity is associated with a lower risk of type 2 diabetes mellitus. The present study aimed to know association between physical activity and gestational diabetes mellitus in the first 20 weeks of their pregnancy.

Methods: In the current case-control study, 50 pregnant females with gestational diabetes mellitus as the case group and 50 pregnant females as control group were selected. To diagnose gestational diabetes mellitus using diagnostic criteria. Females with abnormal oral glucose challenge test (>140mg/dL) were asked to perform the three-hour 100 g oral glucose tolerance test. The details of physical activity were collected by pregnancy physical activity questionnaire. Anthropometric and other data were recorded for all of the participants.

Results: Females with low total physical activity at early pregnancy were at a significantly higher risk of developing gestational diabetes mellitus compared to the ones with higher levels of physical activity. After adjusting for age, body mass index (BMI), gravidity and a family history of diabetes, females with low physical activity during 20 weeks of pregnancy were at a significantly higher risk of developing gestational diabetes mellitus. Females with the low intensity of sedentary, light and moderate physical activity are at a higher risk of developing gestational diabetes mellitus compared to females with a higher intensity of sedentary, light and moderate physical activity.

Conclusions: Females should be encouraged to do regular daily physical activity during pregnancy, if there is no specific contraindication to it.

Keywords: Gestational diabetes mellitus, Metabolic equivalent test, Physical activity

INTRODUCTION

Gestational diabetes mellitus (GDM) is one of the most common complications of pregnancy and its prevalence widely varies worldwide. According to the study population and the diagnostic test used, the prevalence may range from 2.4% to 21% of all pregnancies. The prevalence of GDM is about 14% in the United States. The prevalence of high blood glucose in pregnancy increases rapidly with age and is highest in women over the age of 45. In 2017 an estimated 204 million women

(20-79 years) living with diabetes.¹ 21.3 million or 16.2% of live births had some form of hyperglycaemia in pregnancy. An estimated 85.1% were due to gestational diabetes.¹ The majority of cases of hyperglycaemia in pregnancy were in low- and middle-income class, where maternal care is accessed is limited. It is important for women with diabetes in pregnancy or GDM to carefully control and monitor their blood glucose levels to reduce the risk of adverse pregnancy outcomes with the support of their healthcare provider.

GDM is related to short and long-term morbidity of both mother and child. They are adverse infant outcomes like macrosomia, hypoglycaemia, erythema, hypocalcaemia, jaundice and birth trauma. Also infants are more likely to become obese, have impaired glucose tolerance or develop diabetes in adolescence or early adulthood, compared to offspring of normoglycaemic females. There is a high risk of future diabetes mellitus among females diagnosed with GDM. More than 50% of such females will have type II diabetes within the next 20 years of their lives.

Physical activity has been proved to reduced risk of type 2 diabetes mellitus.² Studies reported that regular and even infrequent exercise can avoid metabolic anomalies associated with insulin resistance, oxidative stress, increased body fat, dyslipidemia, and elevated blood pressure. Recently, attention has been given to the relation between physical activity and gestational diabetes mellitus.³

As in type 2 diabetes, peripheral insulin resistance contributes to the hyperglycemia of gestational diabetes mellitus. Therefore, physical activity may have the potential for preventing GDM and related adverse health outcomes. current Our study aimed to determine and compare the type and intensity of PA performed by pregnant females with gestational diabetes and healthy pregnant females in the first 20 weeks of pregnancy.

METHODS

It is a case-control study conducted on 50 pregnant females with GDM diagnosed by impaired oral glucose tolerance test (OGTT) based on ADA criteria after 20 weeks of pregnancy admitted to inpatient department as high-risk pregnancy.⁴

The control group including 50 healthy pregnant females who had no GDM were randomly selected in prenatal clinics of the same center, matched to cases on gestational age. The study was approved by the ethical committee and Informed written consent was obtained from all eligible females.

Inclusion criteria

Age 18 - 40 years old, pregnancy at the gestation of 20 to 28 weeks.

Exclusion criteria

History of gestational diabetes, pre-existing diabetes, recurrent miscarriages (three consecutive abortions), having child with congenital abnormalities or neonatal mortality in previous pregnancies, smoking before and during pregnancy, multiple gestation and known chronic disorders like anemia, renal diseases, cardiovascular diseases, hypertension, thyroid and autoimmune diseases.

Anthropometric characteristics including height, weight was measured and BMI was calculated for all the cases. Gestational age was calculated according to their last menstrual cycle (LMP). Every female attending the antenatal clinic was screened for 20th to 28th weeks of pregnancy. As part of a diabetes screening program, the participants took a 1-hour, 50g oral glucose challenge test (OGCT). Females with abnormal plasma glucose concentrations on the OGCT (higher than 140mg/dL) received the 3-hour 100g oral glucose tolerance test (OGTT) to diagnose if they were with GDM using criteria ADA criteria: fasting ≥ 95 mg/dL; 1-hour ≥ 180 mg/dL; 2-hour ≥ 155 mg/dL; 3-hour ≥ 140 mg/dL. Based on the results of a two-step screening approach, females with a positive GCT test and two or more abnormal OGTT readings were diagnosed with GDM. Blood glucose estimated by glucose oxidase method, using s autoanalyzer.

The instruments were used for data collection in the study

Form 1 for entry criteria and plasma glucose check-list, form 2 containing demographic, medical and reproductive details, and form 3 containing physical activity details drafted using a modified version of the pregnancy physical activity questionnaire (PPAQ), which is a semi quantitative questionnaire validated to be used during pregnancy. The physical activity performed by the participants during their first 20 weeks of pregnancy was assessed at the time of enrollment, from 20th to 28th weeks of gestation. The PPAQ evaluates participation in four domains of activities: household/caregiving, occupational, sports/ exercise and transportation. The duration of each activity was summed and multiplied by its intensity as defined by the compendium of physical activities.⁵

The intensity of physical activity is measured in metabolic equivalent test (MET). To calculate the intensity of activity, value of MET is multiplied by duration of activity in every day of the weeks. The activity rate, based on the type of activity, is the sum of intensity per day or per week. In the present study, four categories are constructed for maximal intensity: Activity with MET value ≤ 1.5 is considered as sedentary, from 1.5 to ≤ 3 as light, from three to six as moderate and MET scores ≥ 6 as vigorous intensity. Total physical activity (total MET hours/day) across all activity domains was also calculated. To estimate hours per week of sedentary behavior, participants were asked to report the amount of time they spent watching TV or videos or sitting or standing at home, at work or during transportation. Each physical activity variable was then divided into two with the median (low and high). Cronbach's alpha assessed the reliability of the total scale as 0.78 and ranging from 0.78 to 0.93 for each subscale.⁶ The data were coded and analyzed using the statistical SPSS version 18, and descriptive analysis was performed using standard statistical methods.

RESULT**Table 1: Demographic and reproductive characteristic.**

Variables	GDM		Control cases		P-value
Age group (year)	N=50	Percentage	N=50	Percentage	0.001
<25	10	20	25	50	
25-34	26	52	23	46	
>35	15	30	2	4	
Pre-pregnancy bmi (kg/m ²)					0.001
<25	11	22	26	52	
25-29.9	23	46	15	30	
≥30	16	32	9	18	
Family history of diabetes					0.001
Yes	29	58	8	16	
No	21	42	42	84	
Gravidity					0.002
G1	18	36	29	58	
≥g2	32	64	21	42	
Education					0.8
Less than high school	25	50	24	48	
High school or more	25	50	26	52	
Occupation					0.1
Jobles	42	84	45	90	
In-paid job	3	6	5	10	
Permanent residences					0.32
Urban	22	44	23	46	

Table 2: Association of physical activity in first 20 weeks of pregnancy and GDM with the variables.

Variables	Unadjusted OR (95% CI)	P-Value	Adjusted OR (95% CI)	P-Value
Age Group				
< 25	0.06 (0.02 - 0.17)	0.001	0.06 (0.01 - 0.26)	0.001
25 – 34	0.27 (0.10 - 0.71)	0.011	0.27 (0.07 - 0.99)	0.04
≥ 35	Reference 1.00			
Pre-Pregnancy BMI				
< 25	0.17 (0.08 - 0.37)	0.001	0.26 (0.08 - 0.66)	0.005
25 - 29.9	0.68 (0.32 - 1.45)	0.323	0.88 (0.32 - 2.38)	0.78
≥ 30	Reference 1.00			
Family history of diabetes				0.001
Yes	7.55 (3.87 - 14.77)	0.001	6.32 (2.68 - 15.42)	
No	Reference 1.00			
Gravidity				0.79
G1	0.46 (0.25 - 0.73)	0.002	1.15 (0.45 - 3.00)	
≥ G2	Reference 1.00			
Total Physical Activity				0.89
Low	4.13 (2.29 - 7.45)	0.001	1.09 (0.31 - 3.99)	
High	Reference 1.00			
Physical activity at home				0.23
Low	3.93 (2.14 - 7.22)	0.001	2.18 (0.61 - 7.61)	
High	Reference 1.00			
Transportation physical activity				0.008
Low	6.82 (3.67- 12.72)	0.001	3.89 (1.44 - 10.52)	
High	Reference 1.00			
Occupational physical activity				0.504
Low	2.07 (0.99 - 4.47)	0.063	1.48 (0.43 - 4.44)	
High	Reference 1.00			

The mean age of the participants was 27.7±6.4 years. Almost more than half of the participants were overweight or obese prior to pregnancy (46 % overweight and 22% obese). The age, pre-pregnancy BMI, gravidity and a family history of diabetes were all significantly higher in females with GDM compared to healthy pregnant females. Females with GDM had significantly multi gravidity and were older and heavier than the subjects in the control cases (P <0.001).

The mean age of the females with GDM and the healthy pregnant ones were 30.61±6.1 and 24.71±6.2 respectively (P <0.001).

Moreover, the mean pre-pregnancy BMI was 29.01±5.10 for pregnant females with GDM and 25.22±4.69 for healthy ones (P <0.001).

There was no association between GDM and educational level, occupation and permanent residences.

Females had a low total physical activity during their first 20 weeks of pregnancy based on the PPAQ, had a higher odd ratio to develop GDM (OR = 4.13, 95% CI (2.29 - 7.45), P = 0.001) compared to those with a high total physical activity.

Table 3: Association intensity of physical activity during the first 20 weeks of pregnancy and GDM and the variables in study.

Physical activity by intensity	B (SE)	OR (95% CI)	P-value
Sedentary			
Low	0.87 (0.31)	2.37 (1.23-4.47)	0.01
Moderate	0.55 (0.39)	1.76 (0.88-3.59)	0.15
High	Reference 1.00		
Light			
Low	1.87 (0.33)	6.27 (2.99-13.4)	0.001
Moderate	1.08 (0.38)	2.99 (1.44-6.06)	0.004
High	Reference 1.00		
Moderate			
Low	1.91 (0.35)	6.7 (3.18-14.36)	0.001
Moderate	0.91 (0.39)	2.25 (1.14-4.66)	0.026
High			

The present findings showed the association between the type of physical activity and the risk of GDM. There were statistically significant findings for reduced risk of

GDM in all types of physical activities except the occupational.

The present study findings showed that the association between the intensity of each activity (i.e., sedentary, light, moderate, and vigorous) and the risk of GDM were evaluated in the study. The low intensity of sedentary, light and moderate physical activity had a statistically significant relationship with increased risk of developing GDM (OR 2.37 (1.23 - 4.47) P = 0.010, OR 66.7 (3.18 - 14.36) respectively, P = 0.001) compared to females with a high intensity of sedentary, light and moderate physical activity.

DISCUSSION

In present study it was found that females with low total physical activity during early pregnancy, according to PPAQ, were at a four times higher risk of developing GDM compared to those who reported increased level of physical activity. After adjusting for age, BMI, gravidity and a family history of diabetes, females with lower physical activity (PPAQ) during the first 20 weeks of pregnancy were at a significantly higher risk of developing GDM (Table 1).

The findings of the present study showed significant relationship between the intensity of sedentary, light, and moderate physical activity and a lower risk of developing GDM. Literature show that light to moderate intensity of PA in early gestation is associated with a lower risk of developing GDM (Table 2). Oken et al, reported that light to moderate activity during pregnancy may reduce the risk of abnormal glucose tolerance and GDM.⁷ Furthermore, Harizopoulou et al, found that females who were inactive during early pregnancy had an OR 1.3 (95% CI 1.2-1.4) of developing GDM, compared to minimally active or active females.⁸ The findings of the present study were consistent with the results of these studies.

Yang et al, concluded that there is a relationship between physical activity (PA) and reduced risk of type 2 diabetes mellitus.⁹ Therefore, inactivity, especially watching television for long durations, increases the risk of diabetes. Recently, an attention is drawn to the relationship between PA and gestational diabetes mellitus. In type 2 diabetes is with peripheral insulin resistance contribute to hyperglycemia in gestational diabetes mellitus.

Holloszy stated that: regular physical activity is known to improve peripheral insulin sensitivity.¹⁰ Beneficial effect of physical activity on glucose metabolism and insulin sensitivity are well documented in non-pregnant populations. Participation in physical activity decreases blood glucose concentration, increases insulin sensitivity, improves cardiovascular fitness and leads to a lower body fat. Evidence indicates the existence of these beneficial

effects during pregnancy, with respect to insulin sensitivity and B cell response.¹¹

The association between the levels of physical activity during pregnancy and risk of GDM in the present study was consistent with the previous literature. In different from current study results, both Dempsey et al, and Oken et al, found that physical activities during pregnancy were associated with reduction in risks of GDM ranging from approximately 10%-40%; however, none of the estimations reached statistical significance in the adjusted models.^{7,12} However, the present study demonstrated that after adjusting for age, BMI, gravidity and a family history of diabetes, females with low PA in the domain of transportation activity during the first 20 weeks of pregnancy were at a significantly higher risk of developing GDM (Table 3). In addition, Chasen-Taber et al, reported an 80% - 90% lower risk of GDM for females with the highest quartiles of household/caregiving and sports or exercises at the 28th week of gestation compared to those with the lowest quartile.¹³

CONCLUSION

Finally, the clinical interpretation of the present study was that pregnant females should be encouraged to have regular daily physical activity during pregnancy, if there is no specific contraindication to do it. These findings send message to pregnant females that promoting an active lifestyle may lower the risk of GDM.

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