

## ORIGINAL ARTICLE

# Exercise and Its Effects on Gestational Diabetes Mellitus and Related Parameters

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## ABSTRACT

**Background:** Gestational Diabetes Mellitus (GDM) has now become one of the most common and important complication of pregnancy worldwide. There are conflicting results of various studies regarding the role of exercise in reducing the risk of GDM. Therefore, the aim of this study was to determine the effectiveness of exercise on prevention of gestational diabetes.

**Methods:** It is a randomized controlled study directed in the obstetrics and gynecology outpatient clinic of Pakistan Institute of Medical Sciences (PIMS) hospital Islamabad beginning from 6 June 2016 to 5 December 2016 including 170 pregnant women satisfying the inclusion criteria. Group A received routine antenatal care while Group B included the pregnant women that were advised brisk walk for 30 minutes three days per week. At 24-28 week of pregnancy, 75gm oral glucose tolerance test (OGTT) was performed and International association for Diabetes in Pregnancy Study Group (IADPSG) and Hyperglycemia and adverse pregnancy outcome (HAPO) standards, determined GDM. Chi Square was applied for comparing GDM frequency and  $p$ -value  $\leq 0.05$  was considered as significant.

**Results:** The mean age of the patients was  $28.08 \pm 4.15$  years and mean gestation of pregnancy was  $17.18 \pm 0.78$  weeks. Gestational diabetes was seen in 08 (9.41%) patients of non-exercising group while in exercise group only 01 (1.18%) patient had GDM ( $p$ -value 0.016).

**Conclusion:** Moderate exercise during pregnancy decreases the risk of gestational diabetes mellitus and is safe for the mother and the baby. However, more studies are needed to establish recommendations.

**Keywords:** Gestational Diabetes Mellitus; Exercise; Oral Glucose Tolerance Test.

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## INTRODUCTION

Gestational diabetes mellitus (GDM) has become one of the most common complication of pregnancy and has both short and long-term adverse effects on health of the mother and the baby<sup>1,2</sup>. It is defined as "carbohydrate intolerance of varying degrees of severity with onset or first recognition during pregnancy"<sup>3</sup>. The current prevalence of GDM is 14% which varies with ethnicity<sup>4,5</sup>. The risk factors for GDM include obesity, advanced maternal age, family history of diabetes, previous history of GDM and good size baby<sup>6,7</sup>. It is associated with serious complications such as pre eclampsia, preterm birth, caesarean section, labor induction

and increased perinatal morbidity and mortality (stillbirths and first-week neonatal deaths)<sup>6,8,9</sup>. Patients with GDM are at increased risk of type 2 diabetes later in life with risk becoming nearly 50% in high-risk ethnicity<sup>7,10</sup>. Furthermore the offspring are at increased risk of childhood obesity and Diabetes later on<sup>11</sup>. Early detection and treatment of GDM reduces these risks and improves general health of the patient<sup>12</sup>.

Earlier on physical activity during pregnancy has been discouraged due to concerns regarding adverse fetal and maternal outcomes<sup>13</sup>. However due to its many advantages physical activity in pregnancy is now encouraged to improve mater-

nal and fetal health provided there is no medical or obstetrical contraindication<sup>4,14,15</sup>. It is well known that moderate exercise in pregnancy improves insulin sensitivity and reduces the risk of GDM and provides numerous health benefits<sup>16</sup>.

Physical activity promotes skeletal muscle glucose uptake and mitochondrial expression of glucose transport proteins thus improving insulin sensitivity<sup>17,18</sup>. Hence, moderate intensity physical activity during pregnancy and puerperium prevents GDM, postpartum depression and excessive pregnancy weight gain<sup>19</sup>. However despite this fact majority of the women reduce their physical activity in pregnancy due to misconceptions<sup>20,21</sup>. Regular and moderate physical activity in pregnancy does not cause any risks to mother and fetus<sup>22</sup>. Thus pregnant women are advised to exercise for 30 minutes three days per week<sup>22,23</sup>. So far the effect of exercise on the development of gestational diabetes has been studied little and the study results are conflicting<sup>1,24,25</sup>. In 2012 a Cochrane review did not show any significant role of exercise in GDM prevention<sup>10</sup> hence clinicians are reluctant to recommend physical exercise to pregnant women<sup>10</sup>. Therefore, this study was conducted to determine the role of physical activity in prevention of gestational diabetes.

## METHODS

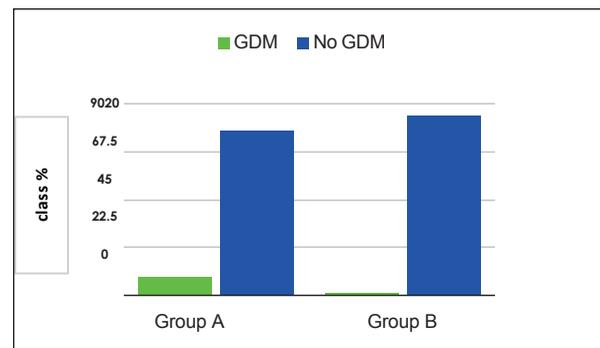
This study was conducted in the maternal and child unit of PIMS hospital from 6 June 2016 to 5 December 2016. One hundred and seventy women at 16-18 weeks of gestation carrying single fetus fulfilling inclusion criteria (age 20-35 years, parity 1-4, previous history of GDM, good size baby or diabetes in first degree relatives) were selected. The study was approved from the ethical review board of PIMS Hospital, Islamabad. Informed written consent and relevant history was taken from all participants. Patients with multiple pregnancies, known diabetics, history of chronic hypertension, pregnancy induced hypertension, cardiac disease, intrauterine growth restriction, preterm labor and any medical condition where exercise is contraindicated were excluded. Allocation to group A or B was done by lottery method. Group A included the gravid women that received routine antenatal care while Group B included those who were advised brisk walk for 30 minutes three days per week. For study purpose gestational diabetes was defined as fasting blood sugar of  $\geq 92$  mg/dl or a 2 hours post meal level of  $\geq 153$  mg/dl and brisk walk was defined as (100 steps/minute) for 30 minutes three days per week.

All the participants were followed up fortnightly for assessment until 28 weeks of gestation. On each visit, patients were checked for the compliance. A specially designed proforma was used to record data. At 24-28 week of gestation 75gm oral glucose tolerance test was performed to confirm GDM

(fasting blood sugar  $\geq 92$  mg/dl or a 2 hour post meal sugar levels of  $\geq 153$  mg/dl). The data was interpreted by using SPSS version 20.0. Age and gestation was calculated as mean and standard deviation (SD) while parity and gestational diabetes was recorded as frequency and percentage. Chi Square was utilized for comparing GDM frequency, p value  $\leq 0.05$  was considered as significant.

## RESULTS

There was a significant difference between the number of cases diagnosed with GDM between the two groups (Control group A 9.41%, n=8 and Intervention group B 1.18 %, n=01) p=0.016 (Graph 1).



**Graph 1: Comparison of GDM between both groups: Group A=Non-exercise group (n=85) Group B= Exercise group (n=85).**

Table 1 shows maternal characteristics for both groups. No significant differences between groups were found.

**Table 1: Descriptive characteristics for intervention and control group.**

Parameters	Group A (n=85)	Group B (n=85)	Total (n=170)
<b>Age (years)</b>			
20-25	23 (27%)	22(25)	45 (26%)
26-30	34 (40%)	37 (43%)	71(41%)
31-35	28 (32.9%)	26 (30%)	54 (31%)
Mean $\pm$ SD	28.24 $\pm$ 4.21	27.99 $\pm$ 4.13	28.08 $\pm$ 4.15
<b>Gestational age (weeks)</b>			
16 weeks	19(22%)	20(23%)	39(22%)
17 weeks	31(36%)	29(34%)	60(35%)
18 weeks	35(41%)	36(42%)	71(41%)
Mean $\pm$ SD	17.19 $\pm$ 0.78	17.19 $\pm$ 0.79	17.18 $\pm$ 0.78
<b>Parity</b>			
Para 1	18(21%)	19(22%)	37(21%)
Para 2	27(31%)	28(32%)	55(32%)
Para 3	23(27%)	20(23%)	43(25%)
Para 4	17(20%)	18(21%)	35(20%)

Significant correlation was found between previous history of good size baby and GDM prevention by exercise ( $p=0.044$ ) whereas no effect was seen in

those with GDM in previous pregnancies and diabetes in family (Table 2).

**Table 2: Stratification of GDM with respect to confounding variables.**

Confounding variables	Group A (n=85)		Group B (n=85)		p-Value
	Presence of GDM n (%)	Absence of GDM n (%)	Presence of GDM n (%)	Absence of GDM n (%)	
Previous history	05(20%)	20(80%)	01(4.16%)	23(95.83%)	0.095
Baby's size	01 (03.33%)	29(96.66%)	00	35(100%)	0.044
Family history	02(06.66%)	28(93.33%)	00	26(100%)	0.391

The risk of gestational diabetes mellitus with respect to gestational age showed that earlier the exercise started in pregnancy lesser would be the chance of developing GDM later on. Significant effect was seen at 16 weeks of gestation ( $p$ -value 0.03) (Table

3). Stratification of gestational diabetes risk with respect to age of patients and parity does not show any significant correlation between both groups. The advanced maternal age and high parity was not a risk factor for GDM ( $p$ -value  $>0.05$ ) (Table 3).

**Table 3: Stratification of GDM with respect to gestational age (GA), patient age and parity.**

Parameters	Group A (n=85)		Group B (n=85)		p-Value
	Presence of GDM n (%)	Absence of GDM n (%)	Presence of GDM n (%)	Absence of GDM n (%)	
<b>Gestational age in weeks</b>					
16	4(21.05%)	15(78.95%)	0(0%)	20(100%)	0.03
17	2(6.45%)	29(93.55%)	0(0%)	29(100%)	0.164
18	2(5.71%)	33(94.29%)	1(2.78%)	35(97.2%)	0.539
<b>Patient age (years)</b>					
20 -25	2(8.7%)	21(91.3%)	0(0%)	22(100%)	0.157
26 -30	3(8.2%)	31(91.18%)	1(3.7%)	36(96.3%)	0.264
31 -35	3(10.7%)	25(89.2%)	0(0%)	26(100%)	0.086
<b>Parity</b>					
Para 1	1(5.56%)	17(94.44%)	0(0%)	19(100%)	0.298
Para 2	3(11.1%)	24(88.89%)	1(3.57%)	27(96.4%)	0.282
Para 3	2(8.7%)	21(91.3%)	0(0%)	20(100%)	0.177
Para 4	2(11.76%)	15(88.24%)	0(0%)	18(100%)	0.134

## DISCUSSION

Current study showed strong association of maternal exercise during pregnancy and reducing the incidence of GDM (p-value of 0.016). Multiple studies have been conducted to see the benefit of exercise in decreasing the risk of GDM. A study in 2012 by Barakat et al. showed the higher incidence of GDM in pregnant women who do not exercise compared to those who underwent moderate exercise i.e. 7.0% vs. 0.0% respectively, which is consistent with our study findings<sup>13</sup>. Similarly Chen Wang et al. revealed that women randomized to exercise group has less risk of GDM (22 vs. 40% p <0.001)<sup>26</sup>. Another study by Jovanovic-Peterson et al. that compared exercise and diet control versus diet alone in controlling GDM found that after 6 weeks fasting plasma glucose was lower in first group compared to the latter<sup>27</sup>. However, there is controversy that physical activity during pregnancy prevents GDM. A Cochrane review in 2012 included three trials to report incidence of GDM and found no significant difference between women who performed exercise and those who did not (RR 1.10, 95% CI 0.66 to 1.84)<sup>10</sup>. Study by Stafne SN et al. showed that the risk of developing GDM is not reduced by physical activity (OR 0.84, 95% CI 0.50 to 1.40)<sup>4</sup>.

In our study, no significant correlation is found between GDM and maternal age. The upper age limit in this study is 35 years. In a study by Colberg et al. age greater than 35 years has had been found as a risk factor for GDM<sup>17</sup>. More over there is no significant correlation of parity with GDM. Our study shows that exercise advised at earlier gestation (16 weeks) has significant association in reducing the risk of GDM (p-value 0.030) as compared to later gestation. Similar findings was seen in SR Colberg et al. that physical activity reduces the risk of GDM by 50% in those performing exercise in first 20 weeks of pregnancy<sup>17</sup>. In women, having previous history of good size baby exercise significantly reduced the risk of GDM (p=0.044) whereas no effect is seen in those with previous history of GDM and history of diabetes in first degree relatives.

At present, the obstetricians are emphasizing on exercise in prevention and management of GDM. A recent meta-analysis showed that high levels of activity pre-conceptionally (OR=0.45, 95 % CI, 0.28–0.75) or in early pregnancy (OR= 0.76, 95 %, CI 0.70–0.83) helped in lowering the risk of GDM<sup>31</sup>. Higher levels of moderate physical activity such as aerobics or weight work reduce the GDM risk and lowers blood sugar levels in those who already develop it<sup>28</sup>. Although exercise is an important lifestyle intervention for protecting against GDM and its role has been<sup>31</sup> demonstrated by various meta-analysis<sup>29,31,32</sup>. However, there are certain medical conditions in which exercise is contraindicated therefore close liaison with medical practitioner and exercise physiologist is very important for appropriate patient selection<sup>33</sup>. Moreover, patient education can further add on in

improving the outcome.

## CONCLUSION

Our study concluded that frequency of gestational diabetes mellitus is less in women who exercise during pregnancy compared to those who do not. Therefore, we recommend public awareness programs on national level to encourage pregnant women regular exercise during pregnancy hence improving maternal and fetal outcome. Our data supports that earlier the physical activity started in pregnancy higher will the reduction in GDM.

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## CONFLICT OF INTEREST

There was no conflict of interest among the authors.

## ETHICS APPROVAL

Ethic review board of Shaheed Zulfiqar Ali Bhutto medical university approved the study for PIMS Islamabad (Reference number: F.1-1/2015/ERB/SZABMU/).

## PATIENTS CONSENT

Verbal and written informed consent was obtained from all patients.

## AUTHORS' CONTRIBUTION

SY was involved in randomization of patients, data collection, literature review, discussion and reference writing and authored the study. MZ helped in discussion writing. BM conceived the idea and reviewed the study. AT reviewed the study. All authors proofread and approved the manuscript.

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