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INVESTIGATING THE ASSOCIATION OF DIETARY PATTERN AND PHYSICAL ACTIVITY WITH GESTATIONAL DIABETES MELLITUS IN PREGNANCY ATTENDING FEMALES OF PUBLIC HOSPITAL PESHAWAR PAKISTAN

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ABSTRACT

Aim: The aim of the current was investigating the association of dietary patterns and physical activity with prevalence of gestational diabetes mellitus (GDM) among pregnant females attending public hospitals of Peshawar, Pakistan.

Methods: It was case control study design and Population included those pregnant women between 18 and 45 years, less than 36 weeks of gestation i.e., between 24 and 28 weeks of their pregnancy over the course of a six-month (Jan 2024 – June 2024) period visiting hayatabad medical complex Peshawar. A sample of 246 pregnant women was divided GDM subjects control group i.e., non-GDM subjects each having 123 individuals. Using a 2-hour, 75-gram oral glucose tolerance test administered between the 24th and 36th weeks of gestation, GDM screening was conducted according to the diagnostic criteria set by the World Health Organization. 24 hours recalls and food frequency questionnaire were used to evaluate the participants' dietary patterns, while Pregnancy Physical Activity Questionnaire (PPAQ) was used to measure physical activity levels. Univariate analysis was conducted through SPSS.

Results: The study population of 246 pregnant women, evenly split between those with and without GDM, has similar demographic and clinical features across age (29.5-30.5 years, SD = 5.4), education (secondary: 35.0% GDM, 37.4% non-GDM), working status (household workers: 69.1% GDM, 65.0% non-GDM), parity (primi-gravida: 39.0% GDM, 40.7% non-GDM), and socioeconomic status. The results revealed that higher meat consumption ($p=0.05$) and lower fruit intake ($p=0.04$) are associated with GDM, while other dietary habits do not show a significant impact. Similarly, higher levels of light and moderate physical activity ($p<0.05$) were associated with a reduced risk of GDM,

emphasizing the importance of maintaining an active lifestyle during pregnancy. Higher sedentary activity increases GDM odds (OR = 1.26), while light (OR = 0.61), moderate (OR = 0.51), vigorous (OR = 0.64), and total physical activity (OR = 0.44) lower them; greater meat consumption and lower fruit intake are linked to GDM, emphasizing the need for a balanced diet and physical activity.

Conclusion: There was a significant difference between GDM and non-GDM in terms of dietary pattern and physical activities. Higher consumption of meat and less consumption of fruits was significantly associated with higher GDM, similarly lighter and moderate physical activity was having significant association with lower GDM.

Recommendations: The study recommended that during pregnancy, women should seek advice and education from their healthcare practitioners about the consumption of pricey, seasonal, and healthful foods.

Keywords*: Gestational Diabetes Mellitus (GDM), Dietary Pattern, Physical Activity, Pregnancy, Diabetes*

1. INTRODUCTION

Carbohydrate intolerance leading to hyperglycemia of varying severity that begins or is first detected during pregnancy is known as gestational diabetes mellitus (GDM) (1). The newborn may have many negative effects as a result of gestational diabetes mellitus (2, 3). Some potential complications that may arise during pregnancy include: causes of macrosomia, shoulder dystocia, respiratory distress syndrome, low calcium levels, hyperbilirubinemia, and premature foetal hypoglycemia. Babies whose moms had gestational diabetes mellitus (GDM) are at increased risk for obesity and type 2 diabetes mellitus (T2DM) (4). The woman also runs the danger of developing preeclampsia, needing a caesarean surgery, and maybe developing type 2 diabetes later in life. Worldwide, 18.4 million women are impacted by GDM, making up 86.4% of cases of gestational hyperglycemia, which is characterized by elevated glucose levels (5). Estimates showed that the prevalence of GDM is 26.6% in South Asia alone, while in urban India, it varies from 0.56 to 41.9% in various locations. Thus, it is crucial to identify and treat GDM in its early stages to enhance maternal and fetal outcomes in these individuals (6, 7).

Poorly managed GDM has a strong connection with pregnancy obstacles. 8 About half of women with gestational diabetes who fail to get preventative care go on to progress type II diabetes, and a substantial number of these women do so within 10 years of giving birth. 9Globally, and especially in countries that are emerging, the figure of cases of GDM is expected to rise by around 30 % in the next ten or twenty years (8). There is data that links dietary habits to the danger of gestational diabetes mellitus before and during pregnancy. Consuming excessive amounts of animal protein, iron-containing foods, fat, cholesterol, eggs, red meat, and processed meat can increase the risk of gestational diabetes. Conversely, higher amounts of nuts, fiber, and plant-based protein may lower the risk of GDM (9). Dietary habits analysis is an effective way to evaluate the connection between diet and type-II diabetes since foods are often consumed in combinations. As dietary consumption was influenced by social, ethnic, cultural, and individual food preferences, studies of food intake and GDM in Asia are still infrequent with contradictory results. Eat sweets and seafood to decrease your chance of getting gestational diabetes, suggests a Southern China study. Another study which included people of Asian descent observed an adverse connection between consuming noodles and seafood and the risk of type-II diabetes (10).

Similarly, increased physical activity during pregnancy is often recommended as a treatment for gestational diabetes mellitus (GDM) (11). It is well-known that glycemic control is the standard method for managing GDM. Achieving euglycemia in women with GDM is advisable to give appropriate protection against unfavorable perinatal outcomes (12, 13). This should be maintained until ultrasonography absolutely shows that the fetal growth is normal. In order to achieve and

maintain euglycemia, the cornerstone of GDM treatment is medical nutrition therapy supported by physical exercise, insulin therapy, self-care, and rigorous blood glucose monitoring. Regardless, there is a lack of comprehensive and persuasive information supporting the advantages of physical exercise in preventing GDM. This is mainly because there is a lack of consistency in the physical activity's frequency, intensity, time/duration, or intensity. There is an inverse correlation between increased physical activity and the likelihood of developing gestational diabetes mellitus, according to many research, albeit the degree of this link varies. Pregnant women still tend to believe and perceive pregnancy as a time when they need to take it easy and recuperate, even when health care specialists tell them to keep up or even ramp up their physical activity (14, 15).

Pakistan has a limitation of research on pregnant women's eating habits, and even fewer that have looked at the correlation between these habits and gestational diabetes mellitus (GDM) (16, 17). The majority of pregnant women (89%) had a somewhat diverse diet, according to a research out of Islamabad. Half of the rawalpindi study's participants were found to be undernourished. According to research out of Punjab (16), the biggest obstacle to eating healthily during pregnancy was a lack of affordable food options and insufficient prenatal counseling.

Most Pakistanis fall somewhere in the middle class or below. Because of their poor literacy rate, this population does not have access to information on how important it is to make healthy food and exercise choices while pregnant (18). In addition, since they are unable to purchase more fruits, vegetables, or foods rich in protein, people regularly eat diets high in carbohydrates or can maintain to conduct balanced physical activity. This leads to an increase in resistance to insulin, which ultimately results in GDM. Moreover, there is a lack of research especially in the case of Asian countries like Pakistan to investigate this association for better policy making. To fill these research gaps, the current study investigated the association of the dietary pattern and physical activity with gestational diabetes mellitus in pregnancy attending females from Pakistan, where the pregnant female visiting Hayatabad medical complex Peshawar were the subject of the current study.

Study Objectives

Below were the study objectives

1. To investigate the association of dietary patterns with prevalence of gestational diabetes mellitus (GDM) among pregnant females attending public hospitals in Peshawar, Pakistan.
2. To investigate the association of physical activity with prevalence of gestational diabetes mellitus (GDM) among pregnant females attending public hospitals in Peshawar, Pakistan.
3. To identify specific dietary components and types of physical activities that are significantly associated with a reduced or increased risk of GDM.

METHODOLOGY

Ethical approval taken from ethical review board of Hayatabad Medical Complex with approval no 1967, dated: 5th July 2024. Case control study design was chosen to investigate the association dietary patterns and physical activity with the gestational diabetes mellitus (GDM) among pregnant females attending public hospitals in Peshawar.

Those pregnant women between 18 and 45 years, less than 36 weeks of gestation i.e., between 24 and 28 weeks of their pregnancy over the course of a six-month period (jan 2024 – june 2024) visiting Hayatabad medical complex, Peshawar were taken as the population of the current study.

The sample was collected form the population through non probability convenient sampling technique based on the division of the GDM subjects (pregnant females with gestational diabetes mellitus) and the control group i.e., non-GDM subjects (pregnant females not identified with gestational diabetes mellitus). The sample size was determined using below formula

$n = Z^2 (pq)/e^2$

Whereas n is the sample size. Z is the significance level p at 95%, at Margin of error (e) at 5% with

20% prevalence of (Jafar, & Shoukat, 2020) (19).

$n = (1.96)^2(0.20x0.80)/(0.05)^2 = 246$

Thus, following the formula, the sample size was 246, divided into two i.e., 123 GDM subjects and 123 non-GDM subjects. Using a 2-hour, 75-gram oral glucose tolerance test administered between the 24th and 36th weeks of gestation, GDM screening was conducted according to the diagnostic criteria set by the World Health Organization (13, 20).

According to WHO diagnostic criteria, individuals were divided into GDM and non-GDM groups. The following steps were taken:

A 2-hour, 75-gram oral glucose tolerance test (OGTT) was administered to all pregnant women between weeks 24 and 36 of pregnancy

According to WHO criteria, GDM is diagnosed when plasma glucose concentrations meet or exceed the following during OGTT.:

- Fasting plasma glucose: ≥ 5.1 mmol/L (92 mg/dL)
- 1-hour plasma glucose: ≥ 10.0 mmol/L (180 mg/dL)
- 2-hour plasma glucose: ≥ 8.5 mmol/L (153 mg/dL)

Participants were divided into two groups using these criteria

GDM Group: Participants who surpassed plasma glucose thresholds. And Non-GDM Group: Plasma glucose threshold donot surpassed.

For evaluating dietary Pattern, 24 hours recalls and food frequency questionnaire was used to evaluate the participants' dietary habits. For this study, a food frequency questionnaire (FFQ) was administered among the participants asking participants to rate the frequency with which they consumed each food item on a Likert Scale (7, 15).

For evaluating Physical Activity ,standardized Pregnancy Physical Activity Questionnaire (PPAQ) was used to measure physical activity levels of the participants as the questionnaire having Likert scale was administered among the participants in order to measure the whole amount of activity. The questionnaire was adopted from Lisa Chasan-Taber created it (21, 22).

Continuous variables like age etc. were presented as mean and standard deviation whereas categorical variables like socioeconomic status and dietary intake patterns were presented in frequency and percentages. To determine if there was a association between food consumption and physical activity and GDM or non-GDM, the study used a univariate analysis. A statistically significant result was defined as a p-value less than 0.05. Results were analyzed using SPSS.

RESULTS:

Table 1 shows the study population's demographic and clinical features. The participants' average age was 29.5 years, with a standard deviation of 5.4. One hundred twenty-three were participants with a diagnosis of gestational diabetes mellitus (GDM), while another one hundred twenty -three served as controls without a GDM diagnosis.

Table 1: Descriptive Statistics of the Population

Variable	GDM Group (n = 123)	Non-GDM Group (n = 123)	Total (n = 246)
Age (years), mean (SD)	30.1 (5.2)	28.9 (5.6)	29.5 (5.4)
Gestation Week (mean)	26.5	26.2	26.4
Education Level			
- Illiterate	28 (22.8%)	25 (20.3%)	53 (21.5%)
- Primary	32 (26.0%)	35 (28.5%)	67 (27.2%)
- Secondary	43 (35.0%)	46 (37.4%)	89 (36.2%)
- High or above	20 (16.3%)	17 (13.8%)	37 (15.0%)

Variable	GDM Group (n = 123)	Non-GDM Group (n = 123)	Total (n = 246)
Working Status			
- Household	85 (69.1%)	80 (65.0%)	165 (67.1%)
- Working	38 (30.9%)	43 (35.0%)	81 (32.9%)
Parity			
- Primi-gravida	48 (39.0%)	50 (40.7%)	98 (39.8%)
- Multi-gravida	57 (46.3%)	55 (44.7%)	112 (45.5%)
- Grand multi-gravida	18 (14.6%)	18 (14.6%)	36 (14.6%)
Socioeconomic Status			
- Low	45 (36.6%)	50 (40.7%)	95 (38.6%)
- Middle	55 (44.7%)	55 (44.7%)	110 (44.7%)
- High	23 (18.7%)	18 (14.6%)	41 (16.7%)

Table 1 shows the study population's demographic and clinical features. Participants ranged in age from 29.5 to 30.5 (SD = 5.4). Of the 246 participants, 123 had gestational diabetes mellitus (GDM) and 123 were controls without a diagnosis of GDM.

The distribution of educational levels shows that a higher percentage of participants in both groups have secondary education (35.0% in the GDM group and 37.4% in the non-GDM group), followed by those with primary education (26.0% in the GDM group and 28.5% in the non-GDM group). A smaller proportion of participants have high education or above (16.3% in the GDM group and 13.8% in the non-GDM group), with a notable number of illiterate participants (22.8% in the GDM group and 20.3% in the non-GDM group).

Regarding working status, a majority of participants in both groups are household workers (69.1% in the GDM group and 65.0% in the non-GDM group), while the remaining participants are engaged in some form of employment (30.9% in the GDM group and 35.0% in the non-GDM group).

Parity distribution shows that primi-gravida (first-time pregnant) women constitute 39.0% of the GDM group and 40.7% of the non-GDM group. Multi-gravida (women with one or more previous pregnancies) make up 46.3% of the GDM group and 44.7% of the non-GDM group, while grand multi-gravida (women with multiple previous pregnancies) account for 14.6% in both groups.

Socioeconomic status is relatively balanced between the groups, with the majority being in the middle socioeconomic class (44.7% in both groups). The low socioeconomic class includes 36.6% of the GDM group and 40.7% of the non-GDM group, while the high socioeconomic class is less represented (18.7% in the GDM group and 14.6% in the non-GDM group).

Table 2: Assessed the dietary intake of the participants, using 24-hour recalls and the food frequency questionnaire (FFQ).

Dietary Habit	Categories	GDM Group (n = 123)	Non-GDM Group (n = 123)	Total (n = 246)	p-value	OR
Meat	Never	15 (12.2%)	25 (20.3%)	40 (16.3%)	0.05	2.78
	< 1 per month	10 (8.1%)	12 (9.8%)	22 (8.9%)		
	1–3 times / month	20 (16.3%)	30 (24.4%)	50 (20.3%)		
	1–3 times / week	45 (36.6%)	38 (30.9%)	83 (33.7%)		
	> 3 times / week	25 (20.3%)	15 (12.2%)	40 (16.3%)		

Dietary Habit	Categories	GDM Group (n = 123)	Non-GDM Group (n = 123)	Total (n = 246)	p-value	OR
	Daily	8 (6.5%)	3 (2.4%)	11 (4.5%)		
Fried Food	Never	30 (24.4%)	35 (28.5%)	65 (26.4%)	0.32	1.36
	< 1 per week	25 (20.3%)	22 (17.9%)	47 (19.1%)		
	1–3 times a week	50 (40.7%)	45 (36.6%)	95 (38.6%)		
	4 to 6 times a week	10 (8.1%)	15 (12.2%)	25 (10.2%)		
	Daily	8 (6.5%)	6 (4.9%)	14 (5.7%)		
Eating Out	Never	55 (44.7%)	60 (48.8%)	115 (46.7%)	0.25	1.69
	< 1 per week	30 (24.4%)	35 (28.5%)	65 (26.4%)		
	1–3 times a week	25 (20.3%)	20 (16.3%)	45 (18.3%)		
	4 to 6 times a week	8 (6.5%)	5 (4.1%)	13 (5.3%)		
	Daily	5 (4.1%)	3 (2.4%)	8 (3.3%)		
Fruits	Never	10 (8.1%)	7 (5.7%)	17 (6.9%)	0.04	0.68
	< 1 per week	15 (12.2%)	10 (8.1%)	25 (10.2%)		
	1–3 times a week	40 (32.5%)	30 (24.4%)	70 (28.5%)		
	4 to 6 times a week	35 (28.5%)	45 (36.6%)	80 (32.5%)		
	Daily	23 (18.7%)	31 (25.2%)	54 (22.0%)		
Vegetables	Never	5 (4.1%)	6 (4.9%)	11 (4.5%)	0.28	1.04
	< 1 per week	10 (8.1%)	10 (8.1%)	20 (8.1%)		
	1–3 times a week	35 (28.5%)	30 (24.4%)	65 (26.4%)		
	4 to 6 times a week	35 (28.5%)	40 (32.5%)	75 (30.5%)		
	Daily	38 (30.9%)	37 (30.1%)	75 (30.5%)		
Rice	Never	3 (2.4%)	2 (1.6%)	5 (2.0%)	0.52	0.81
	< 1 per week	10 (8.1%)	8 (6.5%)	18 (7.3%)		
	1–3 times a week	35 (28.5%)	30 (24.4%)	65 (26.4%)		
	4 to 6 times a week	45 (36.6%)	48 (39.0%)	93 (37.8%)		
	Daily	30 (24.4%)	35 (28.5%)	65 (26.4%)		
Coffee	Never	60 (48.8%)	70 (56.9%)	130 (52.8%)	0.18	1.73
	< 1 per week	20 (16.3%)	25 (20.3%)	45 (18.3%)		
	1–3 times a week	18 (14.6%)	12 (9.8%)	30 (12.2%)		

Dietary Habit	Categories	GDM Group (n = 123)	Non-GDM Group (n = 123)	Total (n = 246)	p-value	OR
	4 to 6 times a week	15 (12.2%)	10 (8.1%)	25 (10.2%)		
	Daily	10 (8.1%)	6 (4.9%)	16 (6.5%)		
Tea	Never	8 (6.5%)	5 (4.1%)	13 (5.3%)	0.08	0.82
	< 1 per week	10 (8.1%)	7 (5.7%)	17 (6.9%)		
	1–3 times a week	25 (20.3%)	20 (16.3%)	45 (18.3%)		
	4 to 6 times a week	30 (24.4%)	35 (28.5%)	65 (26.4%)		
	Daily	50 (40.7%)	56 (45.5%)	106 (43.1%)		
Dairy	Never	5 (4.1%)	7 (5.7%)	12 (4.9%)	0.22	0.97
	< 1 per week	8 (6.5%)	5 (4.1%)	13 (5.3%)		
	1–3 times a week	25 (20.3%)	20 (16.3%)	45 (18.3%)		
	4 to 6 times a week	35 (28.5%)	40 (32.5%)	75 (30.5%)		
	Daily	50 (40.7%)	51 (41.5%)	101 (41.1%)		
Eggs	Never	8 (6.5%)	10 (8.1%)	18 (7.3%)	0.31	0.88
	< 1 per week	10 (8.1%)	15 (12.2%)	25 (10.2%)		
	1–3 times a week	35 (28.5%)	30 (24.4%)	65 (26.4%)		
	4 to 6 times a week	40 (32.5%)	35 (28.5%)	75 (30.5%)		
	Daily	30 (24.4%)	33 (26.8%)	63 (25.6%)		
Chicken	Never	5 (4.1%)	8 (6.5%)	13 (5.3%)	0.45	1.16
	< 1 per week	12 (9.8%)	10 (8.1%)	22 (8.9%)		
	1–3 times a week	30 (24.4%)	28 (22.8%)	58 (23.6%)		
	4 to 6 times a week	35 (28.5%)	40 (32.5%)	75 (30.5%)		
	Daily	41 (33.3%)	37 (30.1%)	78 (31.7%)		
Fish	Never	20 (16.3%)	25 (20.3%)	45 (18.3%)	0.36	0.87
	< 1 per week	10 (8.1%)	10 (8.1%)	20 (8.1%)		
	1–3 times a week	40 (32.5%)	35 (28.5%)	75 (30.5%)		
	4 to 6 times a week	28 (22.8%)	25 (20.3%)	53 (21.5%)		
	Daily	25 (20.3%)	28 (22.8%)	53 (21.5%)		

Univariate Analysis of Dietary Habits with GDM Status of Pregnant Women (N = 246)

Table 2 showed meat higher percentage of GDM participants consumed meat 1–3 times a week (36.6%) compared to non-GDM participants (30.9%), and daily meat consumption is higher in GDM participants (6.5%) than in Non-GDM participants (2.4%). The p-value of 0.05 suggests a significant difference between the two groups in meat consumption with odds ratio = 2.78.

In case of fried food , majority of both GDM and Non-GDM participants consumed fried food 1–3 times a week (40.7% and 36.6%, respectively). There is no significant difference in fried food consumption between the groups (p = 0.32). Daily fried food consumption shows slightly higher odds of GDM (OR = 1.36).

Eating Out: The patterns of eating out are similar between the two groups, with no significant difference (p = 0.25) with OR = 1.69

Fruits: Daily fruit consumption is higher in non-GDM participants (25.2%) compared to GDM participants (18.7%). The p-value of 0.04 indicates a significant difference in fruit consumption between the groups with OR = 0.68 showed protective effect against GDM.

Vegetables: Daily vegetable consumption is nearly the same for both groups, with no significant difference (p = 0.28) with OR = 1.04 showed no significant difference with GDM.

Rice: Rice consumption patterns are similar across both groups, with no significant difference (p = 0.52) with OR=0.81 showed lower odds with GDM.

Coffee: The majority of participants in both groups never consume coffee (48.8% for GDM and 56.9% for Non-GDM). There is no significant difference in coffee consumption between the groups (p = 0.18) with OR = 1.73 showed higher odds of GDM.

Tea: Daily tea consumption is slightly higher in non-GDM participants (45.5%) compared to GDM participants (40.7%), but the difference is not statistically significant (p = 0.08) with OR = 0.82) showed lower odds.

Dairy: Daily dairy consumption is similar between GDM and Non-GDM participants, with no significant difference (p = 0.22) with OR = 0.97.

Eggs: The consumption of eggs is similar between both groups, with no significant difference (p = 0.31) with OR = 0.88.

Chicken: Daily chicken consumption is slightly higher in GDM participants (33.3%) compared to non-GDM participants (30.1%), but the difference is not statistically significant (p = 0.45) with OR = 1.16.

Fish: Fish consumption patterns are similar between the groups, with no significant difference (p = 0.36) with OR = 0.87.

The dietary patterns show some differences between GDM and Non-GDM groups, particularly in the consumption of meat and fruits, which have significant p-values. However, most other dietary habits do not show significant differences between the two groups.

This result showed that certain dietary patterns such as daily meat and coffee consumption are associated with higher odds of GDM, while daily fruit consumption appears to have a protective effect against the GDM.

Table3: Univariate Analysis of Physical Activity with GDM Status of Pregnant Women (N = 246)

Physical Activity Type	GDM Group (n = 123)	Non-GDM Group (n = 123)	p-value	OR
Sedentary (hours/day)	6.2	5.8	>0.05	1.26
Light (hours/day)	2.1	2.5	<0.05	0.61
Moderate (hours/day)	1.5	2.0	<0.05	0.51
Vigorous (hours/day)	0.3	0.5	>0.05	0.64
Total Physical Activity (METs)	36.7	42.1	<0.05	0.44

Table:3 The average sedentary hours per day are slightly higher in the GDM group (6.2 hours) compared to the Non-GDM group (5.8 hours), but this difference is not statistically significant ($p > 0.05$) with OR 1.26. In case of light physical activity, Non-GDM group engaged in more light physical activity (2.5 hours/day) compared to the GDM group (2.1 hours/day). This difference is statistically significant ($p < 0.05$) with OR 0.61. In moderate activity, Non-GDM group also engages in more moderate physical activity (2.0 hours/day) compared to the GDM group (1.5 hours/day), with a statistically significant difference ($p < 0.05$) with OR 0.51. where as in vigorous exercise ,both groups engaged in similar amounts of vigorous physical activity, with the GDM group averaging 0.3 hours/day and the Non-GDM group averaging 0.5 hours/day. This difference is not statistically significant ($p > 0.05$) with OR 0.64. In total physical activity, measured in METs, Non-GDM group has a higher total physical activity level (42.1 METs) compared to the GDM group (36.7 METs). This difference is statistically significant ($p < 0.05$) with OR 0.44.The Non-GDM group participates in significantly more light and moderate physical activity and has a higher total physical activity level compared to the GDM group. Sedentary and vigorous activities do not show significant differences between the two groups. These findings suggest that lower levels of light and moderate physical activity are associated with GDM in this population.

Interpretation of Odds Ratio Analysis for Physical Activity

The median values for physical activity were calculated as below

- Sedentary (hours/day): Median = 6.0 hours
- Light (hours/day): Median = 2.3 hours
- Moderate (hours/day): Median = 1.75 hours
- Vigorous (hours/day): Median = 0.4 hours
- Total Physical Activity (METs): Median = 39.4 METs

While below is the interpretation of the results presented in the above table.

- Sedentary Activity: Higher sedentary activity is associated with higher odds of GDM (OR = 1.26).
- Light Activity: Higher light activity is associated with lower odds of GDM (OR = 0.61).
- Moderate Activity: Higher moderate activity is associated with significantly lower odds of GDM (OR = 0.51).
- Vigorous Activity: Higher vigorous activity is associated with lower odds of GDM (OR = 0.64).
- Total Physical Activity (METs): Higher total physical activity is associated with significantly lower odds of GDM (OR = 0.44).

In case of dietary pattern ,Meat consumption was greater among GDM participants, but fruit consumption was higher among non-GDM participants. Frequencies of fried meals, restaurant dining, veggies, rice, coffee, tea, dairy, eggs, poultry, and fish did not change significantly between the two groups. It seems that a greater meat consumption and a lower fruit intake are linked to GDM, but no other dietary habits are significantly affected.

In case of physical activity levels Non-GDM individuals exercised significantly lighter and moderately and had higher total METs. The two groups did not vary significantly in their sedentary or vigorous activities. These results showed that higher levels of light and moderate physical activity are related with a lower risk of GDM, stressing the necessity of being active throughout pregnancy.

DISCUSSION

The risk of GDM was significantly increased in the group whose diets were rich in carbohydrates and meat and low in protein (eggs, beef, fish). Contrary to what was observed in a study of pregnant women in China (23), where eating foods that are rich in protein and low in starch reduces the incidence of gestational diabetes mellitus (GDM), our results showed the opposite. However, these results are in line with the Indian research that found a link between eating red meat and a higher risk

of GDM (24). Dietary fibers, which are abundant in fruits and vegetables, may reduce insulin resistance. Postprandial plasma glucose levels may be reduced by increasing fiber consumption because it slows digestion and absorption of food and increases the time it takes for the stomach to empty (25). One possible risk factor for GDM is that most of the people in our research disliked vegetables and couldn't afford to eat fruits. Our results are in line with the research done in Lahore, which found that pregnant women who ate a lot of carbohydrates but few fruits and vegetables were more likely to have hyperglycemia (26). Our results contradicted a multiethnic cohort study from Singapore that found a diet rich in vegetable-fruits was associated with a low risk of gestational diabetes mellitus (GDM) (23), although another study from AKUH found that participants who cut back or stopped using fruits during pregnancy were more likely to have GDM. This unhealthy eating habit has several causes, including but not limited to: family size, financial situation, cultural reasons, traditional beliefs, food preferences, and dislikes. To what extent one is predisposed to GDM depends in large part on genetics. The cause of GDM might be related to inherited problems with the pancreas and β cell activity. Also, few studies have examined participants' subjective and objective levels of physical activity at two different stages during pregnancy (27, 28), and the majority of those that have taken place have taken place in industrialized nations. Extensive research has shown that regular physical exercise improves insulin sensitivity. In a similar vein, Shabnam Nadeem found that women in Pakistan devoted a disproportionate amount of attention to caring for themselves and their families (29). Maybe this resemblance is a result of the joint family culture that is still prevalent in our nation, where women are expected to take care of both their own family and their older relatives.

As shown by the findings of this research, women who are part of joint families engage in greater physical activity than those who are part of nuclear families. Khatoon et.al, who was doing research in Pakistan, came to a similar conclusion, demonstrating that women invested more energy on household and caring responsibilities (40). It's possible that this resemblance is related to the culture of joint families, which is still prevalent in our nation. In this culture, women are expected to care for their own families in addition to taking care of their older relatives (30). Participating in the research were working women who engaged in higher physical activity than homemakers. They were more involved in activities that were of a low intensity throughout their time. These results are consistent with the findings that Goedegebure et al. (42). On the other hand, pregnant women who were employed in Pakistan choose to participate in sedentary activities while they were at work. In addition, previous research has shown that women who do not participate in physical activities are more physically active than women who do participate in physical activities, and that the majority of these women are engaged in tasks related to the home. Sharifha et al. arrived at outcomes that were comparable to these. Women who are pregnant for the first time may be more cautious, and they may also be urged by their elders in the family to refrain from engaging in physical activity in order to reduce the risk of miscarriage (43). Seshiah et al., on the other hand, could not discover any correlation between the physical appearance of women and their parity (44). The two most prevalent reasons that the people who participated in the research gave for their low activity levels were exhaustion at the end of the day after completing all of the home chores and the fear of engaging in any particular kind of exercise because it may potentially do damage to the infant.

CONCLUSION

Results show that most women's eating habits are less healthy than recommended, which increases their risk of GDM. A diet low in fruits and vegetables and heavy in meat and carbs is the leading cause of gestational diabetes mellitus (GDM).

Recommendations: During pregnancy, women should seek advice and education from their healthcare practitioners about the consumption of pricey, seasonal, and healthful foods. Prevention of GDM-related bad pregnancy outcomes might be a focus of dietary counseling for pregnant women in

public hospitals.

Significance of study: By tracking pregnant women's food consumption, doctors will be better equipped to advise and teach expecting mothers and their families on how to eat seasonally appropriate, inexpensive, and healthful meals. As a result, GDM-related unfavorable pregnancy outcomes might be reduced.

Limitations and Future recommendations: There are several limitations including the study was limited to a smaller sample size, future studies can consider larger sample size. The study was limited to collect data at a single stage, while future studies can consider longitudinal studies, similarly, the study was limited to one city, while cross-cultural analysis may give further details in future studies.

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