# FREQUENCY AND ASSOCIATION OF RISK FACTORS IN DEVELOPMENT OF GESTATIONAL DIABETES MELLITUS

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## ABSTRACT

**OBJECTIVES:** To determine the frequency of risk factors for gestational diabetes mellitus (GDM) and to analyze the relationship and strength of association among these risk factors in the development of GDM.

**METHODS:** This study was conducted in the Khyber Teaching Hospital, Health Care Center and Kalsoom Maternity Home Peshawar, Pakistan. The targeted population was the registered cases of pregnant women with GDM. Data was collected through properly designed questionnaire and antenatal cards of the GDM patients.

**RESULTS:** Out of 100 patients with GDM 64% patients had age≥30 years and mean age was $31.25 \pm 5.25$ years. BMI≥25 kg/m$^2$ was observed in 64% patients & mean BMI was $25.98 \pm 2.67$ kg/m$^2$. Seventy-three patients were multiparous and grand-multiparous, family history of diabetes mellitus (DM) was present in 71 patients while past history of GDM was present in 66% patients. Positive correlation was observed between advancing maternal age & GDM history ($x^2 = 8.150$, p=<0.05; Phi and Cramer's V test =0.626, p<0.001); advancing maternal age and parity ($x^2 = 39.140$; p= <0.001, Phi and Cramer's V test =0.285, p<0.05) in the development of GDM. Positive correlation was observed between BMI and parity ($x^2 = 14.090$, p=<0.05; Phi and Cramer's V test =0.375, p<0.05) as well as between parity and past GDM ($x^2 = 38.302$, p=<0.001; Phi and Cramer's V test=0.619, p<0.001) in the development of GDM.

**CONCLUSION:** Advanced maternal age (≥30 years), multiparty, BMI≥25 kg/m$^2$, history of GDM in the previous pregnancies and family history of DM were found to be the strong predictors of GDM.

**KEY WORDS:** Gestational Diabetes (MeSH); Advanced Maternal Age (Non-MeSH); Parity (MeSH); Multiparity (Non-MeSH); Grand Multiparity (Non-MeSH); Body Mass Index (BMI) (MeSH).

## INTRODUCTION

The state of high blood glucose level during the second or third trimester of pregnancy due to inability of the pancreas to produce sufficient insulin or inability of the body's cells to properly utilize the insulin is termed as Gestational Diabetes Mellitus (GDM).[1] GDM prevails in almost every country around the world. According to survey conducted in 173 countries found that the incidence of GDM ranged from 1%-28%.[2]

Numerous risk factors for development of GDM have been reported. Advancing maternal age (≥30 years of age) has been described among women developing GDM.[3,4] Body Mass Indexes (BMI) of the women have also been described as a risk factor of developing GDM. Overweight and obesity are strong predictors for development of GDM. The risk of development of GDM is doubled for overweight mothers at body mass index (BMI) 25.0-29.9 kg/m$^2$ and at least 6-fold for obese mothers at BMI ≥30 kg/m$^2$ compared to women

with normal BMI.[5] Family history of Diabetes Mellitus (DM) has also been described as a strong risk factor for development of GDM.[3,6] Especially, family history of maternal DM2 is significantly more common among women with GDM than a paternal family history of DM1.[7] Higher parity has also been revealed as maternal risk factors for GDM. Grand multiparous (i.e. women with ≥5 deliveries) had more often an insulin dependent GDM than multiparous with 2-4 deliveries[8] and the risk of developing GDM was 2-fold compared to women with 2-3 deliveries.[9] Previous specific obstetric outcomes such as giving birth to a macrosomic child and previous GDM are considered as risk factors for GDM in the consecutive pregnancies.[3]

Generally, GDM is associated with obstetric and neonatal complications, morbidity and mortality. The most common fetal complications are fetal and neonatal (0-28 days after birth) loss, macrosomia (which can cause hypertrophic cardiomyopathy, stillbirth, neonatal hypoglycemia, elevated levels of calcium and bilirubin in the blood, polycythemia), birth injury due to shoulder dystocia, respiratory distress syndrome, hyperglycemia are more common and premature delivery is more prevalent in cases of GDM.[10,11]

Maternal complications are pregnancy induced hypertension, pre-eclampsia, caesarean-section deliveries, macrosomia, antepartum hemorrhage, premature rupture of membrane, preterm labor, assisting deliveries.[12] Other complications are hypoglycemia, miscarriages, diabetic ketoacidosis, deterioration of diabetic retinopathy, deterioration of diabetic nephropathy,

polyhydraminos.[13] Early diagnosis of GDM is very essential to prevent maternal, fetal and neonatal morbidity and mortality. GDM may complicate during the pregnancy, intrapartum or postpartum.

Present research was planned in order to identify the strong predictors associated with gestational diabetes mellitus by collecting data through a questionnaire and antenatal cards from gestational diabetic patients visiting the Gynecology departments of various hospitals.

## METHODS

This study was carried out in the Gynae Departments of Khyber Teaching Hospital, Health Care Centre and Kalsoom Maternity Home of Peshawar, Pakistan. Data was collected from hundred pregnant patients suffering from GDM. Non-GDM pregnant mothers were excluded from our study. Properly designed questionnaires were used to collect data from the registered gestational diabetic mothers. Questionnaires include demographic data, diabetes history, anthropometrics, pregnancy history, maternal complications, type of therapy, pregnancy outcome and newborn status.

Information about age, family history of diabetes, previous history of gestational diabetes and parity of the pregnant women were obtained during the face to face interview in the local language. A weight, height, fasting blood glucose and random blood glucose values were taken from the antenatal cards of gestational diabetic patients. Informed consent was obtained from each patient and a questionnaire was administered by researcher herself.

SPSS version 17.0 was applied to statistically analyze the collected data. Descriptive analysis, Pearson's Chi square correlation and Phi and Cramer's V tests were used to statistically analyze the data.

## RESULTS

This study included 100 patients with GDM, ranging in age from 18-42 years with mean age of $31.25 \pm 5.25$ years.

Sixty-four percent patients had age more than 30 years (Table 1). BMI ranged from 18.7 to 31.7 and mean BMI was $25.98 \pm 2.67$ kg/m$^2$. Only 36% patients had normal BMI. Seventy-three patients were multiparous and grand-multiparous. Past history of GDM was present in 66% patients.

Table II shows the correlation and strength of association between the predictors of GDM in the studied population. Pearson chi square correlation values show the relationship and Phi and Cramer's V values shows the strength of association between the predictors. Positive correlation was observed between advancing maternal age & GDM history in the development of GDM ($x^2 = 8.150$, p = <0.05; Phi and Cramer's V test = 0.626, p<0.00). Positive correlation was observed between advancing maternal age and parity in the development of GDM ($x^2 = 39.140$, p = <0.001; Phi and Cramer's V test = 0.285, p<0.05). Positive correlation was observed between BMI and parity in the development of GDM ($x^2 = 14.090$, p = <0.05; Phi and Cramer's V test = 0.375, p<0.05). Significant association was found between parity and past GDM in the development of GDM ($x^2 = 38.302$, p = <0.001; Phi and Cramer's V test = 0.619, p<0.01).

## DISCUSSION

This study was conducted to observe the strong risk factors associated with GDM. According to analysis, advance maternal age, higher BMI, strong family history of diabetes, previous history of gestational diabetes mellitus and higher parity are the strong risk factors.

In this study, we observed that advancing maternal age was significant as 64% GDM patients were above 30 years of age. This shows that carbohydrate intolerance increases with age especially in females. This finding of carbohydrate intolerance with advancing age in females coincides with the results of Khan A and Jaffarey SN and Randhawa MS et al.[4,14]

In this observation, 56 patients were found overweight and 8 were obese which shows that higher BMI during pregnancy can be an alarming sign of GDM. Overweight and obesity are well-known risk factors for development of GDM. Our result correlates well with the observation of Seshiah, et al, 2008[15]

### TABLE I: DESCRIPTIVE ANALYSIS OF MATERNAL AGE AND BODY MASS INDEX AND PARITY

| Variables | | No. of patients (n=100) |
|---|---|---|
| Age (years) | <20 | 3 |
| | 20-29 | 33 |
| | 30-39 | 61 |
| | ≥40 | 3 |
| BMI (kg/m$^2$) | Normal (18.0 – 24.9) | 36 |
| | Overweight (25.0 – 29.9) | 56 |
| | Obese (≥30) | 8 |
| Parity | Nullipara | 27 |
| | Primipara | 7 |
| | Multipara (2-5 children) | 58 |
| | Grand multipara (>5 children) | 8 |
| Family History of Diabetes Mellitus | Yes | 71 |
| | No | 29 |
| Previous History of Gestational Diabetes Mellitus | Yes | 66 |
| | No | 34 |

**TABLE II: ANALYSIS OF CORRELATION AND STRENGTH OF ASSOCIATION BETWEEN THE PREDICTORS OF 100 GESTATIONAL DIABETES MELLITUS PATIENTS**

| VARIABLES | Pearson chi square | | | Phi and Cramer's V | |
|---|---|---|---|---|---|
| | Value | df | p value | Value | p value |
| Age / Family History of DM[#] | 6.866[a] | 3 | 0.076 | 0.262 | 0.076 |
| Age / History of GDM[##] | 8.150[a] | 3 | 0.043* | 0.285 | 0.043* |
| Age / Parity | 39.140[a] | 9 | 0.000* | 0.626 | 0.000* |
| Age / BMI | 7.002[a] | 6 | 0.321 | 0.265 | 0.321 |
| BMI / Family History of DM | 1.381[a] | 2 | 0.501 | 0.118 | 0.501 |
| BMI / History of GDM | 4.392[a] | 2 | 0.111 | 0.210 | 0.111 |
| BMI / Parity | 14.090[a] | 6 | 0.029* | 0.375 | 0.029* |
| Family History of DM / History of GDM | 0.289[a] | 1 | 0.596 | 0.053 | 0.596 |
| Family History of DM / Parity | 0.365[a] | 3 | 0.947 | 0.060 | 0.947 |
| Parity / History of GDM | 38.30[a] | 3 | 0.000* | 0.619 | 0.000* |

p= <.05*, [#]Diabetes Mellitus, [##]Gestational Diabetes Mellitus

and Toloroni, et al, 2009[16] that BMI greater than 25.0 kg/m$^2$ is positively associated with the development of GDM.

Multiparity and grand multiparity was found in 58 and 8 patients, respectively who correlate well with the observation of Randhawa MS et al, Roman H et al, and Nassar AH et al.[4,8,9] respectively that increasing parity is strongly associated with GDM. Grand multiparous (i.e. women with ≥5 deliveries) had more often an insulin dependent GDM than multiparous with 2-4 deliveries and the risk of developing GDM was 2-fold compared to women with 2-3 deliveries Whereas 7% patients were primiparous who gave birth to one child and they were suffered from GDM in their previous pregnancies.

GDM has revealed to follow a strong heritability. Majority of gestational diabetic women showed a positive history of diabetes mellitus in their families. This result is in accordance with the findings of Galtier[17] that GDM is strongly correlated with the positive family history of diabetes mellitus.

Furthermore, more than half of the patients had gestational diabetes history in their past pregnancies which correlates well with the findings of Nohira T et al and Khan R et al[18,19] that women with a previous history of gestational diabetes mellitus are at higher risk of developing GDM in their subsequent pregnancies.

The findings of the present research were in accordance with the results of research done by Khan R and her colleagues on "Socio-demographic Risk Factors of Gestational Diabetes Mellitus"[20] but they made comparison between healthy pregnant women and gestational diabetic patients whereas we observed the most prevailing risk factors for GDM. So according to current research, advancing maternal age, multiparity, family history of diabetes mellitus, BMI ≥25 and previous GDM history were found to be the strong predictors of GDM.

## CONCLUSION

This study revealed that the strong predictors for the development of gestational diabetes mellitus include; maternal age ≥30 years, higher parity, and family history of diabetes mellitus especially among parents. BMI ≥25 kg/m$^2$ and past history of GDM along with the strong predictors of GDM can worsen the situation. Based on this research, we concluded that with advanced maternal age, strong family history of diabetes and multiparity, only BMI is the factor that can be controlled by appropriate diet, physical activity and weight management prior to pregnancy in order to minimize the chances of developing diabetes mellitus in pregnancy.

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