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Original Research

Prevalence and associated risk factors of gestational diabetes mellitus among pregnant women in south Punjab, Pakistan

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Abstract

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Keywords: Prevalence, Risk factors, Gestational diabetes mellitus, Obstetric risk factors, Pregnant women

To find the Prevalence and risk factors for gestational diabetes among females in district Multan. Pregnant females were the subjects of this analytical cross-sectional study admitted for delivery in gynecology in-patient department of DHQ Hospital Multan and Nishtar hospital, Multan. Using the non-probability purposive sampling method, a sample of 215 participants was taken. Data was collected through a structured questionnaire. 28.17 ± 5.49 was the mean age ± SD (in years). It was discovered that 9.8% of people have GDM. A significant association of residence, education status of women, history of preeclampsia, history of macrosomic baby, history of GDM in females and acquiring extra weight in the period of current gestation was found with gestational diabetes mellitus ($p<0.05$). Gestational diabetes mellitus (GDM) is significantly linked with many demographic, obstetric and gynecological risk factors.

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Introduction: Gestational diabetes mellitus (GDM) is one of the biggest pregnancy-related public health issues, particularly in low- and middle-income countries (LMICs). It is defined as glucose intolerance that is first detected in the second or third trimester of pregnancy [1]. Due to its negative effects on mothers' and fetuses' immediate and long-term health, GDM is becoming more and more of a worry. Macrosomia, delivery trauma, and neonatal hypoglycemia are more common in babies born to moms with GDM. Additionally, women with a history of GDM are more likely to develop type 2 diabetes mellitus, experience pregnancy-related hypertension problems, and require cesarean birth [2]. Globally, GDM affects an estimated 14% of pregnancies, and this rate is rising [3]. Uncontrolled hyperglycemia during pregnancy can lead to miscarriage, pregnancy-induced hypertension, cesarean section, neonatal hypoglycemia, and, in severe cases, respiratory distress in the newborn. A history of GDM raises the long-term risk of diabetes, CVDs, and altered glucose metabolism for both mother and child. In addition to well-known risk factors such advanced maternal age, a family history of diabetes, prior GDM, obesity, and hypertension, race and ethnicity also have an impact on the risk of GDM [4].

Developed countries generally have more established screening and management practices for GDM, whereas LMICs often face challenges such as decreased facilities of diabetes screening, improper health wellbeing infrastructure, and low awareness among women of reproductive age. South Asia has emerged as a hotspot for GDM prevalence, driven by genetic susceptibility, sedentary lifestyles, and unhealthy dietary patterns [3]. In Pakistan, available data suggest a substantial burden of GDM, but most studies have been conducted in major urban centers and tertiary care hospitals, with limited representation of mixed urban–rural populations [7]. Despite the rising prevalence of GDM in Pakistan, there is a paucity of district-level data from South Punjab, particularly from Multan, which has a heterogeneous population with diverse socioeconomic and lifestyle characteristics. Existing studies have not adequately explored the combined influence of sociodemographic, obstetric, and medical risk factors using standardized diagnostic criteria in this region [5, 7]. This gap in localized evidence hinders the generation of specific screening plans and context-specific interventions. Thus, among pregnant females admitted for delivery in District Multan, Pakistan, this study sought to determine the prevalence of GDM and identify related demographic, obstetric, and medical risk factors. By providing district-level data using standardized diagnostic criteria, this study seeks to inform clinical practice and contribute to the evidence base for regional GDM screening and prevention policies.

Materials and Methods:

Study design and Place of study: Pregnant women admitted for delivery taken part in this analytical cross-sectional study in the gynecology in-patient departments of District Headquarters (DHQ) Hospital Multan and Nishtar Hospital, Multan, Pakistan.

Sample size calculation: Based on a previous meta-analysis from Pakistan reporting a GDM prevalence of 16.7% ($p = 0.167$) [7], and a margin of error of 5% ($d = 0.05$), the sample size was calculated as:

n=(1.96)2×0.167×(1−0.167)(0.05)2≈214n=\frac{(1.96)^2\times0.167\times(10.167)}{(0.05)^2}\approx214n=(0.05)2(1.96)2×0.167×(1−0.167)≈214

The minimum required sample size was therefore 214. To account for potential incomplete data and to increase study power, the final sample size was rounded up to 215 pregnant women.

Sampling technique: Participants were recruited using a non-probability purposive selection technique. Pregnant mothers who matched the eligibility requirements and were admitted for delivery during the data collection period were contacted. Purposive sampling was chosen because the study specifically targeted women in late pregnancy who had completed routine antenatal investigations and had their GDM status documented at the time of admission.

Study population and eligibility criteria

Inclusion criteria: Pregnant women were eligible for inclusion if they:

- Were admitted for delivery to the gynecology in-patient departments of DHQ Hospital Multan or Nishtar Hospital, Multan;
- Were aged 18–45 years;
- Had undergone screening for GDM during the current pregnancy based on institutional protocols;
- Were able to provide informed written consent after explanation of the study objectives, risks, and benefits; and
- Agreed to participate voluntarily.

Exclusion criteria: Women with the following conditions were excluded:

- Chronic renal illness or other serious chronic organ malfunction;
- Pre-existing chronic hypertension;
- Type 1 or type 2 diabetes before becoming pregnant
- Major autoimmune diseases;
- Incomplete medical records regarding GDM diagnosis.

Data collection: To ensure content validity, panels of relevant professionals evaluated the questionnaire, including two obstetricians, one endocrinologist, and one epidemiologist.

Diagnostic criteria: A 75-g oral glucose tolerance test (OGTT) was used to diagnose GDM in accordance with IADPSG 2010 and FIGO 2020 criteria. Venous plasma glucose levels were assessed while fasting as well as one and two hours following the oral glucose load. If any one of the following criteria was satisfied, GDM was diagnosed.:

Fasting plasma glucose ≥ 92 mg/dL (5.1 mmol/L)

1-hour plasma glucose ≥ 180 mg/dL (10.0 mmol/L)

2-hour plasma glucose ≥ 153 mg/dL (8.5 mmol/L)

Women who had diabetes before becoming pregnant were not allowed to participate in the study.

Data collection procedure: Trained research assistants used the pre-made, structured questionnaire to gather data through in-person interviews and medical record reviews. Each participant provided written informed consent prior to data collection on a specially designed form that clearly described the study objectives, procedures, potential risks, and benefits. Collected data included sociodemographic information, obstetric and gynecological history, medical and family history, anthropometric measurements (height, weight, and BMI), lifestyle factors, and laboratory results related to GDM diagnosis.

Ethical and legal considerations: The study adhered to ethical and legal principles for research involving human participants, including respect for autonomy, confidentiality, and data protection in line with Institutional Review Board/Ethics Committee, Times Institute, Multan, provided prior ethical clearance. An informed consent form outlining the study's goals, methods, and the freedom to discontinue involvement at any time during the study period was signed by each participant

Statistical analysis: IBM SPSS Statistics, version 25.0 (IBM) was used to enter and analyze the data. Place of residence, educational status, history of preeclampsia, history of macrosomic infant, history of GDM, and excess gestational weight gain were all significantly correlated with GDM, according to the chi-square test of independence ($p < 0.05$). Neonatal mortality history, thyroid dysfunction, hypertension, and infertility treatment did not show any statistically significant correlations.

Results:

Sociodemographic characteristics: The study included 215 pregnant women in total. The average age was 28.17 ± 5.49 years. (age range: 17–41 years). The majority of women (n = 117; 54.4%) lived in cities, with 73 25 (11.6%) came from peri-urban areas and 34.0% from rural ones.

Regarding educational status: 84 (39.1%) women had no formal education, 33 (15.3%) had primary education, 63 (29.3%) had secondary education, 21 (9.8%) had higher secondary education, and 14 (6.5%) had a university degree. Nearly all women (n = 210; 97.7%) were housewives, while only 5 (2.3%) were employed (healthcare workers or laborers). A majority (n = 190; 88.4%) belonged to joint families, whereas 25 (11.6%) lived in nuclear family systems.

Obstetric and medical history: Figure 1 shows the distribution of key obstetric and gynecological characteristics of the participants. The prevalence of GDM in the study sample was 9.8% (n = 21), while 194 (90.2%) women had normal plasma glucose levels. A previous history of GDM in prior pregnancies was reported by 15 (7.0%) women. A history of delivering a macrosomic baby was noted in 4 (1.9%) women, and 38 (17.7%) had a history of preeclampsia. Thyroid dysfunction was reported by 4 (1.9%) women, and 8 (3.7%) had a history of chronic hypertension.

Regarding family history: only 70 (32.6%) women had no family history of major chronic conditions, whereas 145 (67.4%) reported a positive family history of at least one of the following: diabetes, hypertension, obesity, or cardiovascular disease.

Association of risk factors with gestational diabetes mellitus. The association between selected demographic, obstetric, and gynecological risk factors and GDM is presented in Table 1.

The chi-square test of independence displayed clear relation between GDM and place of residence, educational status, history of preeclampsia, history of macrosomic baby, history of GDM, and increased weight gain in pregnancy ($p < 0.05$). No prominant associations were observed for history of neonatal death, thyroid dysfunction, hypertension, or infertility treatment.

Discussion: This study found a GDM prevalence of 9.8% among pregnant women admitted for delivery in two major public sector hospitals in Multan. This prevalence is comparable to some regional estimates from Pakistan but lower than others, highlighting the heterogeneity of GDM burden across the country. For instance, Faisal et al. reported a 13.9% prevalence among urban pregnant women in Rahim Yar Khan [6] while a large meta-analysis by Adnan and Aasim estimated an overall GDM prevalence of 16.7% in Pakistan, with provincial variations ranging from 11.4% in Punjab to 35.8% in Balochistan [7]. A study from Lahore reported a prevalence of 9.7%, which is very similar to the present findings [7], whereas a study from Karachi showed a prevalence of 13.1% [11]. Another cross-sectional study from Mardan reported an even higher prevalence of 24%, indicating that GDM is a considerable and variable public health problem across Pakistan [12].

At the regional level, South Asian and Southeast Asian countries have also reported rising GDM prevalence [3,10]. In Malaysia, GDM prevalence nearly doubled from 12.5% in 2016 to 27.1% in 2022, largely driven by increased maternal age, obesity, and hypertension [13]. In Australia, a population-based study from New South Wales reported a 70% rise in GDM cases over six years, partly attributable to updated diagnostic criteria and lifestyle changes [14]. These trends underscore the global nature of the problem and the importance of standardized diagnostic criteria such as those of the IADPSG and FIGO.

The current study found a strong correlation between GDM and residence, educational status, prior history of GDM, history of macrosomic babies, history of preeclampsia, and excess prenatal weight gain. Women from urban areas had higher GDM prevalence than those from rural/peri-urban settings, possibly reflecting urban lifestyles characterized by reduced physical activity, increased consumption of energy-dense diets, and higher rates of overweight and obesity. Similar urban–rural disparities have been reported in other South Asian settings [3,10].

Educational status also showed a significant association with GDM, with higher prevalence among women with secondary or higher education and especially among those with university degrees. Although higher education is generally associated with better health awareness, it may also be linked with sedentary occupations and lifestyle patterns that favor weight gain. These nuanced relationships between socioeconomic status and GDM risk warrant further exploration.

There was a prominent association seen between past GDM history and present GDM, which is in line with data showing that women who had GDM during prior pregnancies are significantly more likely to experience a recurrence [2,5]. Similarly, a history of giving birth to a macrosomic child was strongly linked to GDM, indicating the connection between fetal overgrowth, maternal hyperglycemia, and subsequent metabolic risk. Preeclampsia was also linked to GDM, which is in line with research showing that endothelial dysfunction, resistance to insulin functioning, and chronic inflammation are common pathophysiological processes [9].

Excess gestational weight gain (≥8 kg) emerged as another significant risk factor for GDM in this research. This result is in line with studies from around the world that links maternal obesity and increased weight during pregnancy to higher risks of GDM, hypertensive diseases, and adverse perinatal outcomes [2,3,13]. In Pakistan, socio-cultural dietary patterns, limited opportunities for physical activity, and inadequate counseling during antenatal care may contribute to unhealthy weight gain during pregnancy [8].

Our findings reinforce the need for context-specific, targeted strategies in Pakistan, including early identification of high-risk women based on age, BMI, obstetric history, and family history of metabolic disease; implementation of standardized screening protocols using validated diagnostic criteria; and integration of lifestyle counseling into routine antenatal care. Tailored interventions in districts like Multan, which have mixed urban–rural populations and socio-economic diversity, can assist in decreasing the high number of GDM-related maternal and neonatal adverse effects. By focusing specifically on pregnant women in District Multan, this study addresses a local knowledge gap and provides baseline data that can inform district-level planning, resource allocation, and guideline implementation for GDM screening and management.

Limitations:

1. The cross-sectional study design decreases the ability to evaluate the temporal correlations between risk factors and GDM and prevents causal inference.
2. Sampling strategy: Non-probability purposive sampling may have added selection bias and restricted the findings' applicability to all pregnant women in Multan, especially those giving birth at home or in private facilities.

Despite these limitations, the study provides valuable district-level evidence on the GDM prevalence and risk factors in Multan and can serve as a basis for future longitudinal and interventional research.

Conclusion:

A significant association of residence, education status of women, history of preeclampsia, history of macrosomic baby, history of GDM in females and acquiring extra weight in the period of current gestation was found with gestational diabetes mellitus (GDM).

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Fig 1. Frequency distribution of obstetric and gynecological history of women (n = 215)

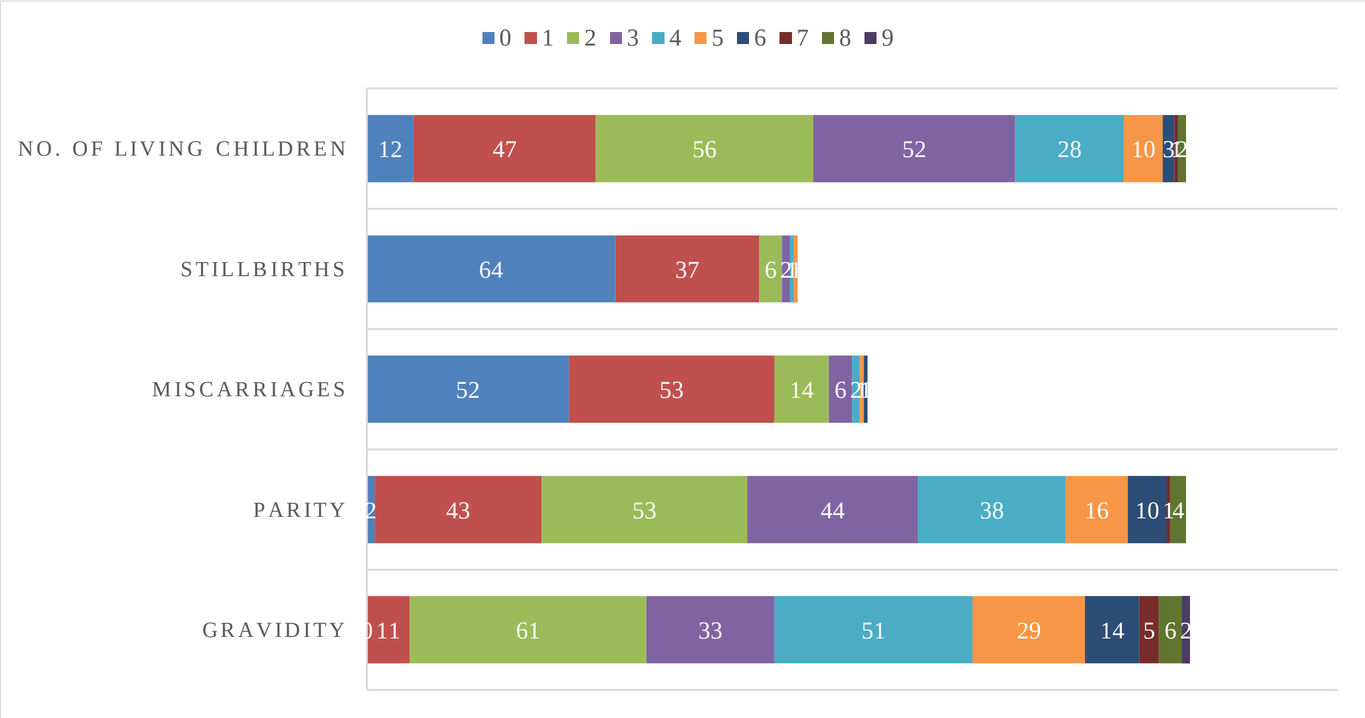

Table 1. Association of demographic, obstetric, and gynecological risk factors with gestational diabetes mellitus (GDM) among pregnant women in District Multan (n = 215)

Variable	Category	Normal n (%)	GDM n (%)	χ² (df)	*p*-value
Residence	Urban	124 (87.3)	18 (12.7)	4.01 (1)	0.04
	Rural/peri-urban	70 (95.9)	3 (4.1)		
Educational status	No formal education	80 (95.2)	4 (4.8)	9.98 (4)	0.04
	Primary	31 (93.9)	2 (6.1)		
	Secondary	54 (85.7)	9 (14.3)		
	Higher secondary	19 (90.5)	2 (9.5)		
	University degree	10 (71.4)	4 (28.6)		
History of preeclampsia	No	161 (92.5)	13 (7.5)	4.37 (1)	0.03
	Yes	31 (81.6)	7 (18.4)		
History of neonatal death	No	175 (91.1)	17 (8.9)	0.80 (1)	0.41
	Yes	17 (85.0)	3 (15.0)		
History of macrosomic baby	No	190 (91.3)	18 (8.7)	7.85 (1)	0.04
	Yes	2 (50.0)	2 (50.0)		
History of GDM	No	186 (93.9)	12 (6.1)	36.62 (1)	0.001
	Yes	7 (46.7)	8 (53.3)		
Thyroid dysfunction	No	191 (90.5)	20 (9.5)	1.07 (1)	0.33

Variable	Category	Normal n (%)	GDM n (%)	χ² (df)	*p*-value
	Yes	3 (75.0)	1 (25.0)		
Hypertension	No	188 (90.8)	19 (9.2)	2.18 (1)	0.14
	Yes	6 (75.0)	2 (25.0)		
Infertility treatment	No	170 (90.9)	17 (9.1)	0.37 (1)	0.54
	Yes	20 (87.0)	3 (13.0)		
Weight gain in current pregnancy (kg)	0–7	118 (93.7)	8 (6.3)	14.57 (1)	0.001
	≥8	34 (72.3)	13 (27.7)		