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Awareness and Knowledge for Risk Factors, Screening, Control of GDM and its Effect among Pregnant Women Visiting Gynae Outpatient Department at Tertiary Care Hospital Bahawalpur

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ABSTRACT

This study explores the disparities observed in knowledge and awareness of Gestational Diabetes Mellitus (GDM) among pregnant women attending a military hospital. **Objective:** To determine the awareness and knowledge on GDM among pregnant mothers during antenatal visit, to identify factors that can influence such knowledge (demographics) population. **Methods:** This cross-sectional study was carried out in the Department of Obstetrics and Gynaecology, Tertiary Care Hospital Bahawalpur during November 24, 2022 till June 23, 2023. The data were collected via face to face interview employing a pretested structured questionnaire and it aimed the risk factors of GDM, history and lifestyle with regard to GDM screening/management.Statistical analysis involved the chi-square tests and ANOVA to investigate associations among demographic variables with knowledge of GDM. **Results:** Total 196 pregnant women were selected.The pre-pregnancy, mean BMI was 25.00 ± 4.384, mean age was 31.42 ± 8.215 years, and the average fasting glucose level was 96.71 mg/dL (SD = 15.588). Significant associations were found between family history and GDM knowledge ($p = 0.004$), as well as previous history of GDM and screening awareness ($p < 0.001$). **Conclusions:** There was a notable gap in GDM knowledge among pregnant females, influenced by demographic factors. Enhanced targeted educational programs are necessary to improve awareness and management of GDM.

INTRODUCTION

Gestational Diabetes Mellitus (GDM) is one of the most common metabolic disorders identified during pregnancy, characterized by glucose intolerance first diagnosed during gestation. Typically, GDM is diagnosed between 24 and 28 weeks of pregnancy due to increased insulin resistance occurring in the second trimester. Its prevalence has significantly increased globally, paralleling the rise in obesity and Type 2 Diabetes Mellitus (T2DM) [1]. GDM has profound implications for maternal and fetal health, significantly increasing risks for adverse outcomes such as hypertensive disorders of pregnancy, preeclampsia, fetal macrosomia, neonatal hypoglycemia, birth trauma, respiratory distress syndrome, and long-term metabolic complications in offspring, including increased risk of obesity and diabetes later in life [2, 3]. Early identification and effective management of GDM are crucial in reducing these adverse outcomes. Current guidelines from the American Diabetes Association recommend universal screening for GDM between 24–28 weeks of gestation; however, earlier screening may be beneficial for high-risk populations, enabling earlier intervention and potentially improved pregnancy outcomes [3, 4]. Nonetheless, there remains debate regarding the optimal timing of screening, as some studies

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suggest limited benefits from early screening compared to the standard mid-pregnancy screening approach [4]. Risk factors strongly associated with the development of GDM include advanced maternal age (≥35 years), elevated pre-pregnancy body mass index (BMI ≥25 kg/m^2), and excessive gestational weight gain. Guidelines from the World Health Organization (WHO) and American College of Obstetricians and Gynecologists (ACOG) support these BMI thresholds, associating higher BMI with increased insulin resistance and consequently higher risk of GDM [4-6]. Maternal hyperglycemia directly affects fetal health through mechanisms such as increased transplacental glucose transfer, leading to fetal hyperinsulinemia and excessive fetal growth (macrosomia). Additionally, maternal hyperglycemia induces placental alterations, such as villous immaturity and increased placental-to-fetal weight ratios, negatively impacting placental function and fetal nutrient and gas exchange, thus exacerbating neonatal risks [7, 8]. Women diagnosed with GDM also face increased postpartum risk of developing T2DM. Research indicates that even mild cases of GDM significantly contribute to the global burden of T2DM, highlighting the importance of postpartum glucose monitoring and targeted interventions aimed at lifestyle modification [9, 10]. Selective screening based on specific risk factors has been proposed as an efficient alternative to universal screening; however, universal screening remains widely recommended to prevent missing at-risk individuals [4]. Recent evidence also suggests potential advantages in utilizing first-trimester HbA1c measurements as an additional screening method, although definitive guidelines for this practice are yet to be standardized [10]. Considering the escalating incidence and significant public health implications of GDM, comprehensive educational programs targeting healthcare providers and pregnant women, alongside evidence-based screening and intervention strategies, are essential.

Effective management through dietary modifications, increased physical activity, and consistent antenatal care is vital in mitigating the short- and long-term impacts of GDM, reinforcing the importance of an integrated approach to managing this growing global health concern.

METHODS

This cross-sectional study was conducted in the Department of Obstetrics and Gynecology, Tertiary Care Hospital Bahawalpur, from November 24, 2022, to June 23, 2023. Pregnant women aged 18 years or older who visited the antenatal clinic and consented to participate were included. Women with pre-existing Type 1 or Type 2 diabetes or those unable to participate due to severe medical illness or language barriers were excluded. A convenience sampling technique was used. Potential participants were identified through hospital visitation logs and approached in the waiting area before their appointments. Informed written consent was obtained from all participants. The sample size was calculated using a reported GDM awareness prevalence of 16.7% among pregnant women in Pakistan, as reported by Adnan and Aasim, (2024) conducted a systematic review and meta-analysis revealing a high and variable prevalence of gestational diabetes mellitus across different regions of Pakistan [11]. Furthermore, a post-hoc power analysis based on one of the key outcome comparisons awareness of GDM screening between women with and without a previous history of GDM (86.5% vs. 51.1%) confirmed that the study had over 95% power to detect statistically significant differences with an alpha level of 0.05. These findings support that the sample size was sufficient not only for prevalence estimation but also for subgroup comparisons, providing robust evidence to address the study objectives. Data were collected through face-to-face interviews conducted by trained healthcare staff in a private clinic setting to ensure confidentiality. A structured questionnaire (available in Urdu and English) was used to evaluate participants' awareness of GDM risk factors, screening, management, and complications. The questionnaire included both open- and closed-ended items. Key variables included maternal age (years), pre-pregnancy BMI (kg/m^2, categorized), family history of diabetes, previous history of GDM, and fasting glucose levels (mg/dL). Knowledge about GDM risk factors was scored and categorized as: Low (0), Moderate (1), High (2) and Very High (3). All data were analyzed using SPSS version 25.0. Descriptive statistics (mean ± standard deviation for continuous variables; frequencies and percentages for categorical variables) were used to summarize demographic and clinical characteristics. Chi-square tests were used to explore associations between categorical variables. Where significant, odds ratios (ORs) with 95% confidence intervals (CIs) were computed to quantify effect sizes. One-way ANOVA was used to assess differences in continuous variables (age and BMI) across GDM knowledge groups, and meta squared (η^2) was calculated to estimate effect sizes. The internal consistency of the knowledge assessment section of the questionnaire was evaluated using Cronbach's alpha, which yielded a value of $\alpha = 0.82$, indicating good reliability. The study was approved by the Ethical Review Committee of Tertiary Care Hospital Bahawalpur (1516/Tig/2022). Ethical guidelines, including voluntary participation, informed consent, and confidentiality of participant data, were strictly followed throughout the study.

RESULTS

A total of 196 pregnant women were enrolled in the study. The average age was 31.42 ± 8.21 years, and the mean pre-pregnancy BMI was 25.00 ± 4.38 kg/m^2. The average fasting blood glucose level was 96.71 ± 15.59 mg/dL. Among

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participants without a family history of diabetes (n = 96), 4 (4.2%) had low, 32 (33.3%) moderate, 42 (43.8%) high, and 18 (18.8%) very high knowledge of GDM risk factors. Among those with a positive family history (n = 100), 10 (10.0%) had low, 30 (30.0%) moderate, 24 (24.0%) high, and 36 (36.0%) very high knowledge. This association was statistically significant ($\chi^2 = 13.469$, $p = 0.004$). Participants with a family history of diabetes were more likely to have very high knowledge (36.0%) compared to those without such history (18.8%), indicating that family exposure may increase GDM awareness (Table 1).

Table 1: Distribution of GDM Risk Factor Knowledge Levels by Family History of Diabetes

Family History	Low	Moderate	High	Very High	Total
No (n = 96)	4 (4.2%)	32 (33.3%)	42 (43.8%)	18 (18.8%)	96 (49.0%)
Yes (n = 100)	10 (10.0%)	30 (30.0%)	24 (24.0%)	36 (36.0%)	100 (51.0%)

Among participants without a previous history of GDM (n = 92), 4 (4.3%) had low, 34 (37.0%) moderate, 38 (41.3%) high, and 16 (17.4%) very high knowledge.In contrast, among those with a previous history of GDM (n = 104), 10 (9.6%) had low, 28 (26.9%) moderate, 28 (26.9%) high, and 38 (36.5%) very high knowledge.This association was statistically significant ($\chi^2 = 12.944$, $p = 0.005$).Women with prior GDM were more than twice as likely to have very high knowledge (36.5%) compared to those without GDM history (17.4%) (Table 2).

Table 2: Distribution of GDM Risk Factor Knowledge Levels by Previous History of GDM

GDM History	Low	Moderate	High	Very High	Total
No (n = 92)	4 (4.3%)	34 (37.0%)	38 (41.3%)	16 (17.4%)	92 (46.9%)
Yes (n = 104)	10 (9.6%)	28 (26.9%)	28 (26.9%)	38 (36.5%)	104 (53.1%)

Among participants without a family history (n = 96), 75 (78.1%) were aware and 21 (21.9%) were not. Among those with a family history (n = 100), 62 (62.0%) were aware and 38 (38.0%) were not. This association was significant ($\chi^2 = 6.053$, $p = 0.014$). The adjusted odds ratio showed that those with a family history of diabetes had 2.19 times higher odds of being unaware (aOR = 2.19, 95% CI: 1.17–4.11, p = 0.037), after controlling for confounders. Despite having a family history, participants were less likely to be aware of screening methods, which may indicate a knowledge gap in early detection protocols (Table 3).

Table 3: Awareness of GDM Screening Methods by Family History of Diabetes with Adjusted Odds Ratios

Family History	Not Aware	Aware	Total	aOR (95% CI)
No (n = 96)	21 (21.9%)	75 (78.1%)	96 (49.0%)	Reference
Yes (n = 100)	38 (38.0%)	62 (62.0%)	100 (51.0%)	2.19 (1.17–4.11)

Among participants without a previous history of GDM (n = 92), 47 (51.1%) were aware and 45 (48.9%) were not. Among those with previous GDM (n = 104), 90 (86.5%) were aware and 14 (13.5%) were not. This difference was statistically significant ($\chi^2 = 29.159$, $p < 0.001$). Multivariate analysis revealed that participants with prior GDM had 84% lower odds of being unaware of screening methods (aOR = 0.16, 95% CI: 0.08–0.33, $p < 0.001$). Previous experience with GDM greatly improved screening awareness, reinforcing the role of patient education during and after diagnosis (Table 4).

Table 4: Awareness of GDM Screening Methods by Previous History of GDM with Adjusted Odds Ratios

GDM History	Not Aware	Aware	Total	aOR (95% CI)
No (n = 96)	45 (48.9%)	47 (51.1%)	92 (46.9%)	Reference
Yes (n = 104)	14 (13.5%)	90 (86.5%)	104 (53.1%)	0.16 (0.08–0.33)

One-way ANOVA showed significant differences in age and BMI across GDM knowledge levels. Women with very high knowledge had the youngest mean age (29.63 ± 6.18 years) and highest BMI (26.89 ± 4.27 kg/m^2). Eta squared (η^2) = 0.096 for both age and BMI, indicating a moderate effect size (9.6% variance explained). Post-hoc comparisons confirmed significant differences between very high knowledge and all other groups ($p < 0.05$).

Table 5: Comparison of Age and Prepregnancy BMI across GDM Risk Factor Knowledge Levels

Knowledge Level	N	Age (Mean ± SD)	BMI (Mean ± SD)
Low	14	34.71 ± 5.93	26.84 ± 4.52
Moderate	62	31.18 ± 4.34	25.80 ± 4.09
High	66	32.32 ± 7.23	25.30 ± 4.50
Very High	54	29.63 ± 6.18	26.89 ± 4.27

Using "Low knowledge" as the reference, we found that, Age remained a significant inverse predictor for both moderate (aOR = 0.80, p = 0.006) and very high knowledge levels (aOR = 0.73, $p < 0.001$). Previous GDM significantly predicted moderate (aOR = 0.12, p = 0.007) and high knowledge (aOR = 0.13, p = 0.011). Family history was inversely related to moderate and high knowledge levels but not to very high knowledge. This adjusted model confirms that age and prior GDM experience are robust predictors of GDM knowledge, even when accounting for other variables (Table 6).

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Table 6: Multinomial Logistic Regression for Predictors of GDM Risk Factor Knowledge (Reference: Low Knowledge)

Predictor	Moderate OR (95% CI)	p	High OR (95% CI)	p	High OR (95% CI)	p
Age	0.80 (0.68–0.94)	0.006	0.89 (0.76–1.05)	0.172	0.73 (0.62–0.86)	<0.001
BMI	0.90 (0.62–1.41)	0.581	0.71 (0.48–1.39)	0.081	1.19 (0.83–1.71)	0.344
Family History	0.17 (0.04–0.78)	0.022	0.08 (0.02–0.36)	0.001	0.68 (0.30–2.07)	0.616
Previous GDM	0.12 (0.03–0.56)	0.007	0.13 (0.03–0.63)	0.011	0.32 (0.07–1.55)	0.158

In addition to overall group differences, a post-hoc analysis using Tukey's HSD test revealed that participants with very high knowledge were significantly younger than those in the low (mean difference = -5.08, p = 0.002), moderate (-1.55, p = 0.045), and high knowledge groups (-2.69, p = 0.001). With respect to BMI, women in the very high knowledge group had significantly higher BMI than those in the moderate (mean difference = -1.09, p = 0.031) and high knowledge groups (-1.59, p = 0.001). These findings suggest that younger and overweight or obese women may receive more targeted antenatal education or may be more proactive in learning about GDM.

Table 7: Tukey's HSD Post-Hoc Comparisons for Age and BMI across GDM Knowledge Levels

Comparison	Age Mean Diff (Years)	Age p-value	Age Interpretation	BMI Mean Diff (kg/m^2)	BMI p-value	BMI Interpretation
Low vs. Very High	-5.08	0.002	Very High group significantly younger	—	—	—
Moderate vs. Very High	-1.55	0.045	Very High group younger	-1.09	0.031	Very High group had higher BMI
High vs. Very High	-2.69	0.001	Very High group younger	-1.59	0.001	Very High group had significantly higher BMI

DISCUSSION

This study conducted at a Tertiary Care Hospital in Bahawalpur highlights considerable variability in the understanding of Gestational Diabetes Mellitus (GDM) among pregnant women, mirroring trends observed globally. A key finding was the significant association between having a family history of diabetes and enhanced awareness of GDM risk factors, suggesting that personal or familial experiences with diabetes may serve as a driver for better understanding and vigilance.These observations align with the results of Adnan and Aasim, who in their systematic review and meta-analysis reported a high and regionally diverse prevalence of GDM across Pakistan, indicating not only clinical but also educational disparities [11].Notably, these findings on the inadequate awareness regarding GDM screening methods resonate with the study conducted by Alharthi *et al.*, who reported a marked deficiency in knowledge of GDM diagnostic practices among Saudi women despite general awareness about the disease itself [12].Thomas *et al.*, further support these findings, noting that demographic factors, particularly maternal age, significantly influence GDM awareness [13]. Younger pregnant women in this study exhibited greater awareness, suggesting targeted educational strategies could effectively address knowledge disparities among older age groups. Wafa *et al.*, have also highlighted that comprehensive educational interventions significantly elevate awareness levels among women in Saudi Arabia [14].Similarly, Bhavadharini *et al.*, emphasize the critical need for culturally tailored public health initiatives to address regional disparities in GDM knowledge across India, suggesting the potential effectiveness of localized educational approaches [15].Kondamuri *et al.*, further advocate for targeted health education campaigns tailored to semi-urban and rural communities, underscoring their necessity in regions with limited healthcare access [16]. Their findings regarding these observations were the urgent requirement for focused interventions aimed at enhancing GDM screening awareness, especially in populations with limited prior exposure or knowledge.The influential role of personal experience with GDM, as noted by Byakwaga *et al.*, highlights how experiential learning substantially enhances women's readiness and awareness regarding GDM management [17].These findings corroborate this perspective, with significantly higher awareness levels among women with previous GDM histories, indicating the value of integrating personal experiences into educational frameworks.Chikeme, and Bada both emphasize the effectiveness of culturally adapted educational interventions tailored specifically to local demographic characteristics [18, 19].They argue that culturally sensitive health education significantly enhances both engagement and understanding, effectively improving outcomes related to GDM screening and management.Recent studies further validate these insights, emphasizing critical gaps in GDM awareness due to persistent misconceptions about screening methods, particularly the Oral Glucose Tolerance Test (OGTT).Tan and Bayyiğit identified prevalent misconceptions among Turkish women regarding OGTT safety, resulting in higher refusal rates and reinforcing the need for focused educational interventions addressing such specific misconceptions [20].Moreover, recent findings highlight significant socioeconomic disparities in GDM knowledge, with rural, less-educated, and lower socioeconomic groups

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exhibiting notably lower awareness [21].This underscores the necessity of educational programs specifically designed to bridge these disparities, ensuring equitable knowledge distribution and improved health outcomes across diverse population segments.Additionally, demographic influences such as maternal age, gestational age, and parity significantly affect GDM awareness, according to recent research by Gari *et al* [22].These demographic factors must be considered in the design and implementation of educational programs, further enhancing their efficacy and relevance.In line with these international observations, studies from Pakistan have reported similarly low levels of GDM awareness among pregnant women.For instance, a cross-sectional study conducted at Niazi Medical and Dental College, Sargodha, involving 150 pregnant women diagnosed with GDM, revealed that 60% lacked knowledge about GDM risk factors and symptoms, and 67.3% had poor knowledge about glucose monitoring [23].Another study conducted at Shifa College of Medicine and Shifa Foundation Community Health Centre, Islamabad, assessed the perception and knowledge of women regarding GDM and identified barriers faced in acquiring healthcare and lifestyle modifications [24].These findings support the results and emphasize the urgent need for targeted awareness programs tailored to local communities to enhance GDM knowledge and screening adherence in Pakistan. While this study provides valuable insights, it is important to acknowledge that the current dataset did not include stratification by socioeconomic status, educational background, or parity factors known to influence health literacy and maternal health outcomes.Future studies should incorporate these variables to explore more nuanced associations and to better guide the design of targeted, demographically sensitive educational interventions. In conclusion, these findings combined with recent literature emphasize the critical need for culturally tailored, targeted educational interventions addressing demographic-specific knowledge gaps and misconceptions surrounding GDM. Such tailored strategies are essential for improving awareness, screening adherence, and overall pregnancy outcomes related to GDM.

CONCLUSIONS

This study identified significant gaps in knowledge and awareness of Gestational Diabetes Mellitus (GDM) among pregnant women attending a military hospital in Bahawalpur. The findings emphasize that demographic factors, particularly a family history of diabetes and previous GDM experience, are strongly associated with increased awareness. Despite these associations, overall understanding of GDM remained limited, underscoring the need for targeted antenatal education programs. Implementing structured counseling and awareness initiatives during routine antenatal visits may play a pivotal role in improving early detection, management, and outcomes related to GDM in similar healthcare settings.

Authors Contribution

Conceptualization: NS
Methodology: NH
Formal analysis: RS
Writing, review and editing: NS, VA, SU, NH

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

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