

GESTATIONAL DIABETES MELLITUS AND PSYCHOLOGICAL STRESS IN BANGLADESHI WOMEN: A CROSS-SECTIONAL COMPARATIVE STUDY

Running title: GDM and Psychological Stress

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ABSTRACT

BACKGROUND: Gestational Diabetes Mellitus (GDM) is a common disorder among pregnant women, increasing their vulnerability to psychological stress compared to non-GDM pregnant women. Motherhood is already a significant life-changing and stressful condition. Developing diabetes during pregnancy elevates women's psychological stress levels, leading to pregnancy-related complications and poor neonatal outcomes. This study aims to explore and compare the psychological stress of GDM in pregnant women with non-GDM women.

METHODS: This cross-sectional comparative study investigated diabetes-related distress using the Depression, Anxiety Stress Scale-21 (DASS-21) and the Problem Areas in Diabetes Scale-5 (PAID-5) in purposively selected 75 pregnant women with GDM and compared them to 75 non-GDM women attending antenatal checkups at BIHS General Hospital, Dhaka.

RESULTS: The average age of the pregnant women was 27.71 ± 5.10 (GDM mean = 29.48 ± 4.57 , non-GDM mean = 25.95 ± 5.02). Pregnant women with GDM had more stress (57.3%), anxiety (46.7%), and depression (61.3%) compared to non-GDM women ($p < .001$). According to DASS-21, among all women with GDM, 25.3% had moderate stress, 22.7% mild depression, and 29.3% extreme-severe anxiety. According to the PAID-5 scale, more than half (63%) of the GDM women had diabetes-related emotional distress.

CONCLUSION: Women with GDM are more likely to have psychological distress compared with non-GDM pregnant women. Interventions are needed to improve access to diabetes and mental health care with appropriate tools, such as digital technology-based health interventions.

KEYWORDS: Pregnant Women, Gestational Diabetes Mellitus, Psychological Stress, DASS scale, PAID-5 scale.

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INTRODUCTION

Gestational diabetes mellitus (GDM) is one of the most common disorders affecting pregnant women worldwide, although its prevalence varies due to different diagnostic criteria.^{1,2} It is defined as “any glucose intolerance with onset or first recognized during pregnancy.”² A recent meta-analysis revealed that, based on the International Association of Diabetes and Pregnancy Study Groups (IADPSG) criteria, the global prevalence of GDM is 14.7%.^{1,3} GDM affects 20.8% of pregnant women in South-East Asia.¹ Demographic Health Survey findings indicate the prevalence of GDM in Bangladesh ranges from 6.8% to 40.3%, and this number is increasing.²

It is estimated that one in ten pregnancies is associated with diabetes, 90% of which are diagnosed as GDM.⁴⁻⁶ Compared to healthy pregnant women, those with GDM are more likely to develop high blood pressure and consequently, preeclampsia or eclampsia during pregnancy. As a result, these women are at risk of developing type 2 diabetes and cardiovascular diseases later in life.^{7,8} Furthermore, the babies of mothers with GDM can develop macrosomia, low blood sugar, breathing problems at birth, and type 2 diabetes later in life.^{9,10}

GDM has also been linked with adverse psychological health consequences. In low- and middle-income countries, women with GDM and antenatal depression have a poor quality of life and are at risk of adverse pregnancy and fetal outcomes.^{11,12} Stress can lead to negative pregnancy outcomes such as preeclampsia, prematurity, and low birth weight.^{13,14} This reactivity to stress, higher during the early part of pregnancy, is attributable to increased serum cortisol levels and can lead to prematurity.¹⁵ Chronically increased cortisol levels can raise blood glucose levels and potentiate insulin resistance, which shares the pathogenesis of GDM.^{16,17} There is conflicting evidence in the literature regarding the relationship between psychological stress, like anxiety and depression,

and GDM. Research suggests that anxiety and stress can play an important role in the development of GDM. Conversely, GDM is considered a risk factor for antepartum and postpartum depression.¹⁸

Like other forms of diabetes mellitus, GDM can affect the psychological well-being of individuals living with this condition.¹⁹ This is especially important during pregnancy, which is a major cause of complications, morbidity, and mortality in a woman’s life. Considering the lower access to healthcare by women in Bangladesh, adhering to GDM treatment can be difficult during pregnancy. Effective management of GDM is crucial to improve pregnancy outcomes in a population where utilization of antenatal care is often suboptimal.²⁰ Therefore, considering the paucity of data on GDM and psychological stress in Bangladesh, this study aims to compare the psychological stress, in the form of anxiety, stress, and depression, in pregnant women living with or without GDM.²¹

METHOD

This is a cross-sectional comparative study on women with GDM (GDM group) and without GDM (non-GDM group). The study was conducted over 3 months (October 2022 to December 2022). Pregnant women seeking antenatal care at the Bangladesh Institute of Health Sciences (BIHS) General Hospital in Dhaka were the study population. This hospital is affiliated with the Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM) and provides a range of general health services. A total of 150 pregnant women, equally divided into two groups—75 with GDM and 75 without GDM—were selected as the sample. Respondents were purposively selected for the study to compare pregnant women with and without the characteristics. Gestational Diabetes Mellitus was diagnosed according to the WHO (2013) OGTT criteria for GDM during antenatal visits.²² Ethical approval was obtained from Bangladesh University of Health Sciences. Verbal and written consent were obtained before administering the interview.

The Depression Anxiety Stress Scale-21 (DASS-21) and the Problem Areas in Diabetes Scale (PAID-5) were used to investigate diabetes-related distress. The DASS is a 21-item self-administered questionnaire designed to measure the magnitude of three negative emotional states: depression, anxiety, and stress.²³ The validated Bangla version of DASS-21 was utilized for this study.²⁴ Each of the three domains of psychological stress (anxiety, stress, and depression) is assessed with the scale. Based on the

score of responses to specific statements, the result is expressed as mild, moderate, severe, and extremely severe. Details of scoring are available elsewhere.²⁵ The PAID-5 is a 5-item self-reported instrument for measuring diabetes-related emotional distress and covers a range of negative emotional problems of patients with diabetes.²⁶ Appropriate descriptive and inferential statistical analyses were performed. Statistical significance was set at $p < .001$.

Results

Table 1: Socio-demographic-anthropometric characteristics of participants

Factors	Group	GDM (N=75) n (%)	Non-GDM (N=75) n (%)	All (N=150) n (%)
Age Group (Years)	18-22	3 (4.0%)	19 (25.3%)	22(14.8%)
	23-32	54 (72.0%)	49 (65.3%)	103(68.6%)
	33-37	15 (20.0%)	5 (6.7%)	20(13.3%)
	>37	3 (4.0%)	2 (2.70%)	5(3.3%)
Age (Years) (Mean ± SD)		29.48±4.57	25.95±5.02	27.71±5.10
Level of Education	Illiterate	2(2.7%)	0(0.0%)	2(1.3%)
	Primary	8(10.7%)	15(20.0%)	23(15.3%)
	Secondary	27(36.0%)	32(42.7%)	59(39.3%)
	Graduate and above	42(56.0%)	30(38.0%)	72(48.0%)
Residence	Urban	66(88.0%)	67(89.3%)	133(88.7%)
	Rural	9(12.0%)	8(10.7%)	17(11.3%)
Occupation	Housewife	55(73.3%)	60(80.0%)	115(76.7%)
	Service Holder	17(22.7%)	4(5.3%)	21(14.0%)
	Business	1(1.3%)	0(0.0%)	1(0.7%)
	Others	2(2.7%)	11(14.7%)	13(8.7%)
Monthly Income	Less than BDT 40000	55(73.3%)	64(85.5%)	119(79.3%)
	BDT 40000-80000	18(24.0%)	9(12.0%)	27(18.0%)
	More than BDT 80000	2(2.7%)	2(2.7%)	4(2.7%)
Family type	Nuclear	48(64.0%)	44(58.7%)	92(61.3%)
	Joint/Extended	27(36.0%)	31(41.3%)	58(38.7%)
BMI (Pre-pregnancy/ 1 st trimester)	<18.5	3(4.0%)	4(5.3%)	7(4.7%)
	18.5 to <25	20(26.7%)	34(45.3%)	54(36.0%)
	25 to <30	39(52.0%)	27(36.0%)	66(44.0%)
	≥30	13(17.3%)	10(13.3%)	23(15.3%)
BMI (Pre-pregnancy/ 1 st trimester) (Mean ± SD)		26.76±3.95	25.32±4.33	26.04±4.19

Table 1 describes the socio-demographic-anthropometric characteristics of the GDM and non-GDM pregnant women. Majority of the GDM affected pregnant women belonged to the age group of 23–32 years (72%) where as 65.3% from non-GDM group. Average age of the pregnant women

was 27.71±5.10. Mean age of pregnant women is higher in GDM group. Nearly all pregnant women were living in urban area. Majority of the pregnant women were housewife. The mean BMI was higher in the GDM group.

Table 2: Distribution of pregnant women according to DASS-21

Criteria	Stress GDM		Depression GDM		Anxiety GDM	
	No	Yes	No	Yes	No	Yes
Scale						
Mild	9 12.0%	16 21.3%	5 6.7%	17 22.7%	0 0.0%	0 0.0%
Moderate	7 9.3%	19 25.3%	10 13.3%	15 20.0%	4 5.3%	7 9.3%
Severe	3 4.0%	7 9.3%	1 1.3%	8 10.7%	5 6.7%	6 8.0%
Extreme-Severe	0 0.0%	1 1.3%	0 0.0%	6 8.0%	4 5.3%	22 29.3%

Table 2 shows that among the GDM group, 25.3% had moderate stress, 22.7% had mild depression, and 29.3% had extreme-severe anxiety (according to DASS-21).

Table 3: DASS-21 score for psychological distress of both groups

Variable	GDM Median (min-max)	Non-GDM Median (min-max)	GDM vs Non-GDM
Depression	10 (0-34)	4 (0-24)	.000* †
Anxiety	8 (0-34)	6 (0-24)	.000* †
Stress	16 (0-38)	8 (0-28)	.000* †

*p<0.001, †= Mann-Whitney U test

Table 3 depicts the mean difference in DASS-21 score regarding depression, anxiety and stress between women with GDM and women without GDM was statistically significant. The median score for all three psychological distress domains were higher in the GDM group.

Table 4: Comparison between GDM and non-GDM pregnant women according to demographics and psychological stress

Variables		Depression GDM n (%)	Anxiety Non-GDM n (%)	Stress GDM n (%)	Non-GDM n (%)	GDM n (%)	Non-GDM n (%)
Age Group (years)	18-22	2 (4.3%)	3 (18.8%)	1 (2.9%)	1 (7.7%)	2 (4.7%)	2 (10.5%)
	23-27	16 (34.8%)	7 (43.8%)	10 (28.6%)	5 (38.5%)	15 (34.9%)	9 (47.4%)
	28-32	16 (34.8%)	5 (31.3%)	14 (40.0%)	5 (38.5%)	15 (34.9%)	5 (26.3%)
	33-37	9 (19.6%)	0 (0.0%)	7 (20.0%)	1 (7.7%)	8 (18.6%)	1 (5.3%)
	More than 37	3 (6.5%)	1 (6.3%)	3 (8.6%)	1 (7.7%)	3 (7.0%)	2 (10.5%)
Residence	Urban	30 (65.2%)	10 (62.5%)	21 (60.0%)	9 (69.2%)	28 (65.1%)	13 (68.4%)
	Peri-Urban	11 (23.9%)	4 (25.0%)	9 (25.7%)	3 (23.1%)	10 (23.3%)	4 (21.1%)
	Rural	5 (10.9%)	2 (12.5%)	5 (14.3%)	1 (7.7%)	5 (11.6%)	2 (10.5%)
Level of education	Illiterate	2 (4.3%)	0 (0.0%)	2 (5.7%)	0 (0.0%)	2 (4.7%)	0 (0.0%)
	Primary	5 (10.9%)	3 (18.8%)	3 (8.6%)	2 (15.4%)	5 (11.6%)	3 (15.8%)
	Secondary	15 (32.66%)	9 (56.3%)	13 (37.1%)	6 (42.2%)	14 (32.6%)	8 (42.1%)
	Graduate and above	20 (43.5%)	3 (18.8%)	15 (42.9%)	4 (30.8%)	18 (41.9%)	5 (26.3%)
	Others	4 (8.7%)	1 (6.3%)	2 (5.7%)	1 (7.7%)	4 (9.3%)	3 (15.8%)
Monthly Income	Less than BDT 26000	9 (19.6%)	6 (37.5%)	8 (22.9%)	3 (23.1%)	9 (20.9%)	7 (36.8%)
	BDT 26000-50000	23 (50.0%)	8 (50.0%)	15 (42.9%)	8 (61.5%)	21 (48.8%)	9 (47.4%)
	BDT 51000-75000	9 (19.6%)	1 (6.3%)	8 (22.9%)	1 (7.7%)	9 (20.9%)	0 (0.0%)
	BDT 76000-100000	3 (6.5%)	0 (0.0%)	2 (5.7%)	0 (0.0%)	3 (7.0%)	1 (5.3%)
	More than BDT 100000	2 (4.3%)	1 (6.3%)	2 (5.7%)	1 (7.7%)	1 (2.3%)	2 (10.5%)
Family type	Nuclear	29 (63.0%)	11 (68.8%)	22 (62.9%)	10 (76.9%)	27 (62.8%)	12 (63.2%)
	Joint	17 (37.0%)	5 (31.3%)	13 (37.1%)	3 (23.1%)	16 (37.2%)	7 (36.8%)

Depression and stress were more common in pregnant women of 23-27 years of age (34.8% and 34.9% respectively) while anxiety in common in the age group of 28-32 (40.0%) (Table 4). Pregnant women living in an urban area had higher proportion of depression, anxiety, and stress (65.2%, 60.0% and 65.1% respectively). The three types of psychological stress were more common in women living in a nuclear family while being pregnant than those living in a joint/extended family.

Observations from using PAID scale demonstrated that the pregnant women in GDM group (63%) scored ≥ 8 indicating the presence of diabetes-related distress, whereas rest of the pregnant women (37%) obtained a score < 8 (Table 5).

Table 5: Distribution of respondents according to PAID-5 score

PAID -5 Score	Frequency (%)
Possible Diabetes Related Emotional Distress (≥ 8)	47 (63%)
No Diabetes Related Emotional Distress (< 8)	28 (37%)
Total	75 (100%)

Pregnant women with GDM experienced more stress (57.3%), more anxiety (46.7%) and more depression (61.3%) compare to non-GDM pregnant women ($p < .001$) (Table 6).

Table 6: Association between GDM and non-GDM pregnant women and psychological stress

	Stress		Significance	Anxiety		Significance	Depression		Significance
	No	Yes		No	Yes		No	Yes	
Non-GDM	56(74.7%)	32(42.7%)	$p = 0.000$	62(82.7%)	40(53.3%)	$p = 0.000$	59(78.7%)	29(38.7%)	$p = 0.000$
GDM	19(25.3%)	43(57.3%)		13(17.3%)	35(46.7%)			16(21.3%)	46(61.3%)

DISCUSSION

The present study compared the psychological distress—such as anxiety, stress, and depression—between pregnant women with GDM and those without GDM. Pregnant women diagnosed with GDM reported higher frequencies of each of these conditions. Utilizing the DASS-21 scoring scale, these women were found to have varying degrees of anxiety, stress, and depression. Emotional distress, detected through the PAID-5 scale, was also more common in this group. The differences between the two groups were statistically significant.

Many women with GDM and psychological stress belonged to a relatively young age group of 23–32 years (72%). Younger women had higher levels of stress, anxiety, and depression. These findings are consistent with similar studies.²⁷⁻³⁰ It can be hypothesized that younger pregnant women are less experienced in coping with the demands of pregnancy and associated lifestyle changes.

Literature indicates that socio-demographic factors are strongly linked with GDM and its psychological effects on women.^{27,28,31,32} In this study, the majority (73.3%) of GDM pregnant mothers belonged to the lower-income group, which increases the risk of adverse pregnancy outcomes. Lack of awareness, low health-seeking behavior, financial constraints, and mental health issues can create vulnerability for pregnancy

and potential delivery complications. This can lead to abortion, preterm delivery, preeclampsia, eclampsia, obstructed labor, and psychological distress.³³ A systematic review demonstrated that women in the low socio-economic group commonly develop psychological distress during gestation.¹⁸

Completing higher education and having a stable career with financial security are considered to lower the risk of mental distress for women.^{29,34} This study observed similar findings. Better mental health is associated with higher educational attainment. A greater number of life choices and more control over different aspects of life, including health, are benefits of education.³⁵

More women in urban areas had one or more psychological distress conditions compared to rural women. This is consistent with findings in a meta-analysis that postulates features of urbanization like higher population density, housing issues, and social isolation as facilitators for any type of psychopathology.³⁶

Six out of ten (64.0%) women in the GDM group lived in nuclear families compared to 58.7% in the non-GDM group. A nuclear family consists of parents and children living in a single household, while a joint family is an extended family where three or more generations live together with a single line of authority.³⁷ Pregnant women with GDM in nuclear families are more likely to experience depression, anxiety, and stress than those in

joint families. Possible reasons include lack of antenatal checkups, continued household chores, and lack of emotional support from family members, which are vital for the health of both the mother and unborn child. Managing GDM can create extra pressure for a woman experiencing additional psychological stress during this period. A study from Turkey revealed that pregnant women living in joint families had more ability to cope with stress.³⁸ Women who receive emotional support develop fewer complications during pregnancy and can give birth to healthier babies.³⁹

A high degree of association was observed between women living with GDM and psychological distress compared to the non-GDM group (DASS-21 scale). Each component of psychological stress was more common in the GDM group. Pregnancy complications such as premature delivery or abortion can increase medical costs, including longer hospital stays, and interfere with the cognitive development of newborns. In Bangladesh, these can strain healthcare resources that are sub-optimal to meet the needs of the population. A recent study revealed that GDM is associated with a high prevalence of depressive symptoms in Bangladesh due to multiple contextual factors.³¹ A systematic review in China demonstrated a strong association between GDM and anxiety in pregnant women.¹⁸ In Bangladesh, physicians are often unable to visit patients for extended periods, address their psychological problems, or offer counseling due to high population density and low healthcare human resources, similar to an example observed in northern Bangladesh.⁴⁰ However, there may be some exceptions in private healthcare settings, though these services are often too expensive for the general population. In these circumstances, digital technology-based education or counseling could be beneficial for addressing psychological distress in pregnant women.

This study explored the emotional distress of pregnant women with GDM. They were apprehensive about living with diabetes, feeling depressed, worrying about the future, and the possibility of serious complications. They felt that diabetes was taking too much mental and

physical energy every day and faced difficulties coping with complications of diabetes.

According to the PAID-5 scale, more than half (63%) of the GDM women in this study had diabetes-related emotional distress. This encompasses anxiety related to pregnancy and unforeseen complications such as difficult labor, economic concerns, and child care expectations, which can ultimately lead to depression exacerbated by the diagnosis of diabetes in pregnancy.⁴¹ This is consistent with a study in Malaysia that found the prevalence of anxiety, stress, and depression symptoms highest among women with GDM.²⁸ Digital technology-based counseling and education could help manage these problems. Readily available technology like smartphones has the potential to transform care for pregnant women living with chronic diseases like diabetes and mental health issues while respecting privacy and providing patient care in a safe environment. App-based mobile phone solutions have advantages, including portability, continual internet connectivity, and ease-of-use, to provide personalized interventions (e.g., reminders, alerts, voice messages, images, graphics) for GDM patients. The expected result includes alleviation of anxiety and stress and improved pregnancy outcomes for women with GDM.

Previously published data are consistent with the current study in that pregnant women with GDM experience higher levels of anxiety and stress than non-pregnant and healthy pregnant women.⁴² Susceptibility to depression or anxiety is increased by the diagnosis of GDM in pregnant women, resulting in a 2-4 times higher likelihood of antenatal or postnatal depression compared to non-GDM women.⁴³⁻⁴⁵ A comparative study revealed pregnant women with diabetes were more prone to and had the highest scores of depression, anxiety, and stress compared with pregnant women without diabetes.⁴⁶ A retrospective cohort study ascertained that pregnant women with GDM were twice as likely to develop prenatal depression as those without GDM.⁴⁷

CONCLUSION

Psychological distress was found to be common in pregnant women with GDM. Any degree of anxiety, stress and depression was determined to be higher in pregnant women with GDM. Therefore, intervention strategies (e.g., in-person and digital technology-based psychological education) tailored to individual pregnant woman need to be implemented to increase access to diabetes and mental health care so that every woman can experience a risk-free and healthy pregnancy outcome.

DECLARATIONS

Limitations of the Study

The limitations of this study include its cross-sectional design, which may hinder the ability to infer causal relationships. The small sample size and inclusion of participants from a single hospital limit generalizability. Inherent disadvantages of the purposive sampling technique include selection bias and lack of generalization from sample to study population. The strength of this study lies in exploring and identifying an important but neglected aspect of an increasingly common condition with potential multiple health effects in Bangladesh. Longitudinal research could help identify risk factors that could be targeted for pragmatic interventions to prevent the deleterious short- and long-term consequences of GDM and psychological stress on both mother and child.

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