



## UNDERSTANDING THE PREVALENCE OF DEPRESSION IN PREGNANT WOMEN WITH GESTATIONAL DIABETES MELLITUS AND ITS ASSOCIATION WITH METABOLIC PROFILE

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### ABSTRACT

**Introduction-** Previous literature suggest that there exists a bi-directional relationship between diabetes and depression. But the evidence about the prevalence of depression in pregnant women with gestational diabetes mellitus in India and its co-relation with the sugar laboratory profile and anthropometrics is scanty.

**Objectives-** To study the prevalence and association of depression during pregnancy with GDM, and to analyse and associate the metabolic parameters like BMI, Glucose tolerance and BP with depression in GDM patients.

**Methodology-** In this cross-sectional analytical study, done at the obstetrics OPD of a hospital, on 347 antenatal cases (gestational age > 24 weeks), sociodemographic details, BP, BMI, Blood Sugar (OGTT) were measured. For depression status's assessment, CUDOS (Clinically Useful Depression Outcome Scale) Questionnaire used. Data analyzed by SPSS 23.

**Results-** In our study, significant difference was found in prevalence of depression in GDM patients (56.07%) and Non-GDM Sub-group (38.5%). And GDM subgroup had more number of women with mild and moderate depression. Mean Depression Score was 14.7 and 9.5 in GDM and Non-GDM groups, respectively. Also, Depression and GDM were found to be significantly associated. GDM group was found to have more mean age (GDM with depression = 27.5 and Non-GDM without depression = 24.9). Also, GDM aged more than 30 were more prone to develop depression. GDM women with depression had more mean BMI (27.14) vs. GDM without depression (25.03). BMI was significantly associated with the depression in the GDM population. Mean OGTT values were higher among the women who had depression and the difference was significant for the 1hr and 2hr blood glucose sample. We found that there is a significant association between the deranged OGTT values above diagnostic cutoff of GDM and the depression among GDM population. GDM sub-group chiefly consisted of women with middle and high socio-economic group.

**Conclusion-** Early screening for depression in GDM patients must be done, to manage the diabetes well and prevent the development of complications. As this will prove beneficial for the physiological and psychological condition of the patient.

**KEY WORDS :** Gestational Diabetes Mellitus, Metabolic Profile, Pregnant Women, Gdm Patients, Neonatal Hypoglycaemia

### INTRODUCTION -

India is home to an estimated 57 million people (18% of the global estimate) affected by depression<sup>1</sup>. Also, Indian subcontinent is going through rapid changes, which includes urbanization and modernization. Prevalence of depression is therefore likely to increase in the future. Overall, the prevalence of mood disorders is reported more in the diabetic population<sup>2,3,4</sup>. The overall prevalence of diabetes in all 15 states of India is 7.3% (95% CI 7.0–7.5)<sup>3</sup>. According to past studies, diabetes and depression are associated with each other<sup>4,5</sup>. And is reported more among the females. One in five women is affected by depression at least once in her lifetime<sup>6</sup>. Indian women have 11-fold increased risk of developing glucose intolerance in pregnancy compared to Caucasian women<sup>11</sup>. In a recent study, which did meta-analysis of 64 studies from India, the Prevalence of Gestational Diabetes Mellitus (GDM) in pregnant women ranged from 0 to 41.9%<sup>7</sup>.

GDM is also found to be associated with increased risk of miscarriage, stillbirth, pre-eclampsia, neonatal hypoglycemia, neonatal respiratory distress, and obesity and insulin resistance in childhood, and are at risk to develop impaired glucose tolerance and type 2 diabetes later in the life<sup>1</sup>. Several meta-analyses of longitudinal studies suggest that diabetes is a risk factor for the development of depression<sup>1</sup>. Importantly, depression is associated with poor diabetes self-care high expenditure on health-care<sup>2</sup>, which may be more challenging during pregnancy and postpartum when diabetes management and glycemic control are especially complex<sup>21</sup>. Antenatal mental problems might also lead to poor maternal health problems such as poor nutrition and irregular antenatal appointments<sup>23,24</sup> and increase the susceptibility to allergic diseases<sup>24,25</sup>.

Therefore, in this study we planned to estimate the prevalence of depression during pregnancy with or without gestational diabetes mellitus and to find its co-relation with the metabolic and socio-demographic profiles.

### REVIEW OF LITERATURE -

Depression and Diabetes are related at the micro level as well, several research studies have provided various pathophysiological mechanisms that proved the association between depression and diabetes.

The dysregulation of hypothalamic- pituitary axis in diabetes might be involved in decreased level of insulin and impaired sensitivity of glucocorticoid negative feedback that may further increase central drive of the axis<sup>5</sup>.

Steven Roose has also proposed a pathway between depression and diabetes<sup>5,7</sup> where increased blood glucose has been found to inhibit the BDNF output from brain, which is a potential mediator of depression and type 2 diabetes. Kumar et al. did a cross-sectional study by using magnetization transfer imaging studies to examine the protein biophysical structure in white and grey matter in CNS of the patients with type 2 diabetes mellitus and demonstrated that in the diabetes and depression group, magnetization transfer ratios were significantly lower bilaterally in the head of the caudate nucleus<sup>5</sup>. In mothers with pre-existing mood -disorders, having increased OGTT levels may contribute to adverse outcomes like pre-term birth<sup>28</sup>. Depression has been found to be associated with poor glycemic control<sup>27</sup> and increased risk of GDM<sup>9</sup>. Another study analysis suggested that the patients with diabetes are under more

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psychological stress associated with management of diabetes and its complications relative to undiagnosed patients thus leading to elevated depressive symptoms.<sup>10,11</sup>

**AIMS AND OBJECTIVES**

To study the prevalence of depression during pregnancy in patients having gestational diabetes mellitus.

- To find the association of gestational diabetes mellitus and depression.
- To analyze metabolic parameters like BMI, Glucose tolerance and Blood Pressure.
- To associate the results with the socio-demographic variables.

**MATERIALS AND METHODOLOGY**

Type of study :Cross sectional analytical study. Duration of study:Two months

**Study setting :**The study was conducted in the Obstetric OPDof a Tertiary Care Centre.

**Study population:** Antenatal patients with pregnancy over 24th week attending obstetrics OPD

**Inclusion criteria -** Antenatal cases who were booked with the Tertiary Care Centre and had undertaken OGTT

Exclusion criteria- Exclusion Criteria included:

- Women with family history of diabetes mellitus
- Old registered GDM patients
- Women on anti- depressants
- History of any mental disorder and smoking

**Sample size with justification**

Every month around 600 female patients visit obstetrics Care Out-patient Department in Tertiary health care Centre. Approximately 20% of pregnant women (120 in number) attending Ante-natal OPD are diagnosed with gestational diabetes mellitus. Assuming that 13% of the GDM patients will have mild to moderate depressive symptomsand with acceptable margin of error as 5% and a value as 0.05, sample size calculated was 173 GDM cases.Also another 174 antenatal females without GDM were taken as comparison group for the study.

- AssessmentofDepression status - Using Clinically Useful Depression Outcome Scale(CUDOS)<sup>[25]</sup>. The CUDOS contains 18 items assessing all of the DSM-IV inclusion criteria for major depressive disorder as well as psychosocial impairment and quality of life. The respondent is instructed to rate the symptom items on a 5-point Likert scale indicating "how well the item describes you during the past week, including today"
- Data Analysis: The data obtained was tabulated in MS Excel, and analyzed using IBM SPSS 23 software. Some of the continuous variables were categorized according to objectives and using percentages, means and standard deviations performed descriptive analysis. For categorical variables Chi-square test/Fisher's exact test was used. Different groups were compared statistically using the Chi-Square test. Data analysis was done using SPSS software version 23.0.

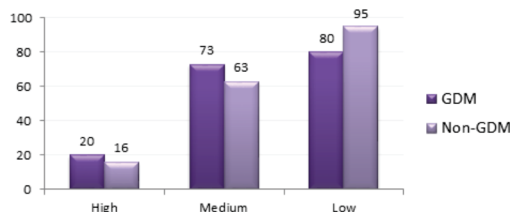
**OBSERVATIONS AND RESULTS**

Socio-demographic details of cases are given in Table 1 and Figure 1-3. All the respondents were married.

**Table 1: Distribution of subjects as per socio-demographic variables**

Variable	With GDM N=173	Without GDM N=174
Socio-economic category		
Upper Class	1	0
Upper Middle Class	19	16
Lower Middle Class	73	63
Upper Lower Class	78	94

Lower Class	2	1
Monthly Family Income (in Rs)		
>63,182	18	9
47,266-63178	56	53
31,591-47262	54	36
18,953-31589	26	52
6327-18949	19	20
≤6323	0	4
Education of the Woman		
Profession or Honors	19	14
Graduate	53	55
Intermediate or Diploma	42	48
High School Certificate	41	26
Middle School Certificate	17	18
Primary School Certificate	3	7
Illiterate	1	3

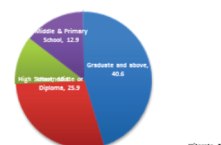


**Figure 1: Distribution of Subjects according to Socio-demographic category**

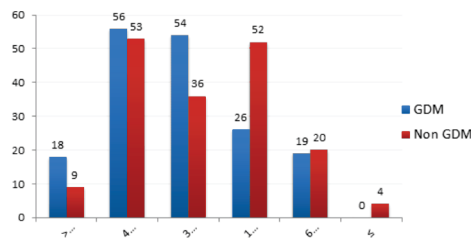
Majority (49.5%) of the population belonged to low socio-economic category, where most of the cases had no GDM. But there was preponderance of GDM cases in both the high and medium socio-economic categories.

**Figure 2: Distribution of Study Population as per Qualification**

Of the total population (n=347), 40.6% were having qualification of graduate and above, 25.9%



had done Intermediate or diploma, 10.1% were high school passed and 12.9% were educated till middle school level and 0.1% were illiterate.



**Figure 3: Distribution of population with respect to average monthly family income.**

More than half of subjects (57.3%) of the population had monthly family income between Rs. 31,591 and Rs. 63,178.

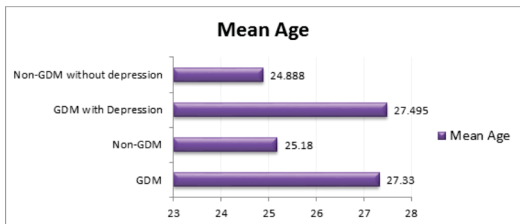
Cases having GDM were greater as compared to those without GDM in the high monthly income category (more than Rs. 31,591/pm). But in the income group, earning less than Rs.31, 591 per month consisted chiefly of women not having GDM.

Mean age of the total population was 26.25±4.36. Mean of other

subgroups is given in table 2

**Table 2: Mean age of population subgroups**

	GDM population	Non- GDM Population	GDM with Depression	Non-GDM without depression
Mean Age	27.33 ± 4.64	25.18 ± 4.36	27.495 ± 5.38	24.888 ± 4.02



**Figure 4: Mean Age of the Population Subgroups.**

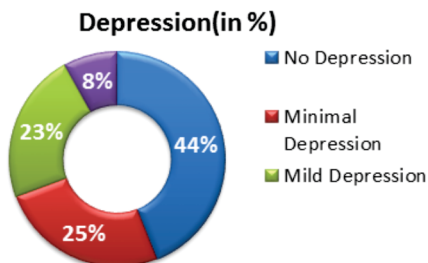
**Table 3: Association between age of GDM patients and presence of depression**

	Age of woman	Depression Status (in GDM)		Total	p-value
		No depression	Depression Present		
	< 30	58	60	118	0.043
	>30	18	37	55	

Table 3 shows women elder women (more than 30) were prone to be depressed as there is a statistically significant association between age of the antenatal woman above 30 and depression (p-value < 0.05).

**Prevalence of Depression**

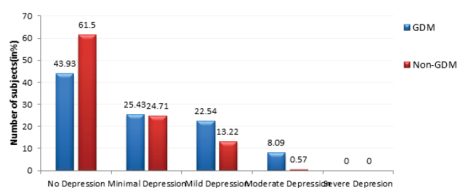
The prevalence of depression among antenatal cases with GDM was **56.07% (97)**. Out of the total depressed GDM patients, 14 were found to be moderately depressed, 39 were mildly and 44 were minimally depressed (Figure 5). The overall prevalence of depression in Non- GDM women was 38.5%.



**Figure 5: Distribution based on severity of depression in GDM cases (n=173)**

**Table 4: Distribution of the subjects according to the depression severity**

Depression Severity	Whole population	With GDM	Without GDM
No depression	183(52.73%)	76(43.93%)	107(61.5%)
Minimal	87(25.07%)	44(25.43%)	43(24.71%)
Mild	62(17.8%)	39(22.54%)	23(13.22%)
Moderate	15(4.32%)	14(8.09%)	01(0.57%)
Severe	00(0%)	00(0%)	00(0%)



**Figure 6: Distribution of the subjects (in%) according to the depression severity**

When distribution of depression was analyzed in the total population, more percentage of the people without GDM had no depression as compared to people with GDM. Lesser percentage of Non-GDM cases was found to have mild depression. Only 0.57% of the Non- GDM cases had moderate depression.

None of the study population had symptoms suggestive of severe depression.

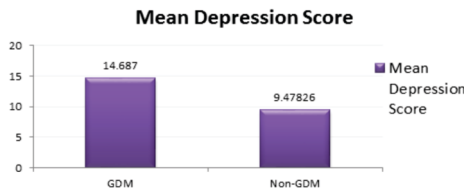
**Table 5: Association between Gestational Diabetes Mellitus and Depression**

	Depression Status (in total population)		Total	p-value
	ABSENT	PRESENT		
GDM	76	97	173	.001
Non- GDM	107	67	174	
Total	183	164	347	

Table 5 shows that there is a statistically significant association between presence of GDM and depression and GDM.

**Table 6: Mean CUDOS Depression Score of antenatal cases with and without GDM**

Characteristics	With GDM N=173	Without GDM N=174	p-value
Mean Depression Score	14.687 ± 10.5318	9.47826 ± 8.0713	< 0.0001



**Figure 7: Comparison of Mean Depression Score in with and without GDM.**

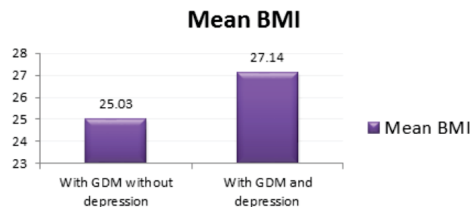
Mean CUDOS Depression Score was significantly higher in GDM cases (Table 6)

Anthropometrical analysis: Mean Body Mass Index among the GDM women was 26.37 ± 4.20.

Table 7: The Mean BMI in the subjects having GDM with and without depression

**Table 7 shows that mean BMI in the GDM cases; those without depression (n=76) had lower mean BMI than the subjects having both GDM and depression (n=97).**

	With GDM without depression (n=76)	With GDM and depression (n=97)
Mean BMI	25.03 ± 3.47	27.14 ± 4.56



**Figure 8: Comparison of BMI in GDM Population with and without depression.**

**Table 8: Association between BMI of GDM subjects with depression severity.**

	Depression Severity				Total	p-value
	No depression	Minimal Depression	Mild Depression	Moderate Depression		

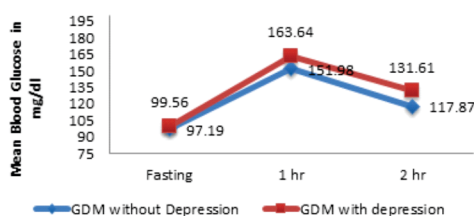
<b>Body Mass Index</b>	>18.5	4	1	2	0	7	0.016
	18.5-22.9	16	7	2	1	26	
	23-24.9	19	7	5	1	32	
	25-29.9	32	21	16	7	76	
	<30	5	8	14	5	32	

**Table 8 shows that there is a significant association between Body Mass Index and Severity of Depression.**

**Analysis of Sugar Profile**

**Table 9: Means of Sugar Profile of GDM cases with and without depression**

Characteristics	With GDM without depression N=76	With GDM and depression N=97	p-value
<b>Fasting</b>	98.72±15.13	95.38±10.76	0.01
<b>Post Prandial</b>	123.91±17.83	124.27±26.10	0.88
<b>OGTT</b>			
<b>Fasting</b>	97.19±10.65	99.56±19.38	0.16
<b>1hr</b>	151.98±29.44	163.64±38.19	0.0016
<b>2hr</b>	117.87±26.67	131.61±37.49	0.0001



**Figure 9: Mean OGTT values in GDM population with and without depression.**

On comparing the results of sugar profile among GDM subjects (Table 9), significant difference was found in the means of Fasting Blood Sugar done at the first Antenatal visit, and was higher in those having depression. Also, significant difference was found in the mean blood sugar level of the samples taken after 1 hour and 2 hours after administering 75gm glucose, done as a part of Oral Glucose Tolerance Test.

**Table 10: Association of OGTT values with Severity of Depression**

Number of OGTT values above cut-off* among the three values	Depression Status				Total	p-value
	Absent	Minimal	Mild	Moderate		
1	67	30	15	8	120	Chi-square statistic is 37.5703
2	7	13	16	3	39	
3	2	1	8	3	14	
<b>Total</b>	76	44	39	14	173	

\*Where the cut-off is 93, for the fasting, 180, for the 1 hr and 153 for the 2hr Blood glucose sample. According to the IADPSG diagnostic protocol for the Gestational Diabetes Mellitus. There is a significant association between derangement of OGTT values and severity of depression in GDM subjects (p<0.0001).

**Blood Pressure**

**Table 11: Means of Blood Pressure of GDM cases with and without depression**

Characteristics	With GDM without depression N=76	With GDM and depression N=97	p-value
<b>Systolic BP</b>	119.92±6.68	121.5±10.89	0.10
<b>Diastolic BP</b>	79.49±9.775	81.29±9.05	0.07

On comparing the means of Systolic and Diastolic Blood pressure in GDM cases, no significant difference was found between those with and without depression.

**DISCUSSION**

In this study, with help of self-rating CUDOS questionnaire, we aimed to identify minimal to severe symptoms of depression among the women with GDM in the antenatal period. And in our study, the prevalence of depression among GDM patients was found to be 56.07%(n=97). But out of the total depressed GDM patients, 45.3%(44 out of 97) had only minimal depression, and none of the subjects was found to be severely depressed. Also, we showed that there was a significant difference between the prevalence of depression in the GDM patients (56.07%) as compared to women without GDM (38.5%). Bisson et al. did a prospective case-control study on women with GDM and showed that they had a greater prevalence of depressive symptoms vs. women without GDM (23% vs0%, P = 0.023)<sup>12</sup>. On comparing the distribution of severity of depression between GDM and Non-GDM group, GDM cases had more percentage of subjects with mild (22.54%) and moderate (8.09%) depression as compared to a Non-GDM group where 13.2% and 0.57% of the subjects had mild and moderate depression respectively.

Our findings confirmed and served as an add-on to previous studies showing that there is an association between depression and GDM<sup>13</sup>. And we found out that depression and GDM are significantly co-related (Table 5). However few studies have reported no significant association between the GDM and depression<sup>14</sup>.

Our study highlights the psychological state of woman in pregnancy, which affects the metabolic state of the woman, thus resulting in the developments of Gestational Diabetes Mellitus. This notion is also supported at the micro-level by the work of Chan et al. where they found that depression activates the Hypothalamic-Pituitary Axis, leading to increasing glucocorticoid and cortisol levels, which acts on the liver and the adipose tissue, thus increasing the blood glucose levels, further leading to insulin resistance and GDM<sup>15</sup>.

Depression has also been associated with hyperglycemia in individuals with diabetes, suggesting that there may be a physiological association between depression and diabetes as well as a psychological association. On analyzing the results of OGTT among the GDM cases, there was a significant difference between the mean OGTT values of 1 hr and 2 hr blood sample among the cases who were found to have depression as compared to those without any depression, this was in addition to higher mean values in cases with depression (Figure 9). In our study, we found that there was a significant association between the number of OGTT values above the diagnostic cut-off for GDM and the depression severity (Table 10).

**CONCLUSION**

Our study establishes that depression is prevalent during pregnancy, and is found to be more in the women having GDM as compared to those without it. Women having GDM with higher BMI and more age are more likely to have depressive symptoms and deranged OGTT values. However, further investigations with large study sample are required to assess the role of socio-economic factors responsible for depression. Since, much of the current studies available focus on the post partum depression. Future research need to be focused on longitudinal, prospective studies to analyze the factors involved with depression in GDM.

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