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## ORIGINAL ARTICLE

### Factors affecting the depression and impact of depression on maternal outcomes: A prospective observational study from a rural tertiary care South Indian hospital

**Short title:** Factors affecting depression and its impact on maternal outcome

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## ABSTRACT

**Objective.** There is a dearth of evidence from lower income countries on impact of depression and mental health issues on pregnancy outcomes. This study aimed to examine the factors affecting the depression and its effect on maternal outcomes in a rural South Indian tertiary care hospital.

**Materials and Methods.** A 9-month prospective observational study was carried out among the pregnant women in a tertiary care facility in south India. The pregnant woman aged 18 years or above were included in the study. The participants with a history of depressive symptoms and not willing to provide the informed consent were excluded from the study. The depression was measured using The Edinburgh Postnatal Depression Scale and a score of  $\leq 13$  and  $> 13$  were considered to be no abnormality and possible depression. The effect of various demographics on depression and effect of depression on maternal outcomes is assessed using the chi-square and regression analysis, respectively. A p-value  $< 0.05$  considered to be significant.

**Results.** A total of 150 patients were included in the study and 48% (n=72) had the possible depression. The factors such as being obese (p=0.020), and being a housewife (p=0.000) were significantly associated with depression. Depression was significantly associated with the gestational diabetes (p=0.036), but not with gestational hypertension and pre-eclampsia.

**Conclusions.** Among pregnant women, being obese, and housewife was significantly associated with depression. The depression was significantly associated with gestational diabetes.

**Keywords:** Pregnancy; Obstetrics; Pre-natal; Depression; Gestation; Mental health

## **INTRODUCTION**

The depression can exist in an undetected state before becoming pregnant and can aggravate during pregnancy due to many issues. Pregnancy-related effects of depression cause higher hazards to the developing baby and a heavy burden on obstetric care providers [1]. Depression has been associated with various maternal outcomes such as heavy, larger, thicker, and less effective placentas and poor pregnancy consequences [2,3]. It also causes post-natal abnormalities and other long-term consequences to the mother as well as the newborn [4]. Many abnormal physiological issues like decreased esophageal sphincter tone, hormonal changes (human chorionic gonadotropin hormone), increased uterine size, and increased micturition can occur due to the emotional disturbance in pregnant woman [5].

The occurrence of noxious events such as miscarriage, complicated delivery, postpartum morbidity, and adverse health impacts on the offspring's short- and long-term development seem to be more common in women with clinical depression than the healthy woman [6, 7]. Appropriate medical care and diligent monitoring is crucial to avoid the depression related natal adverse events and depression is a known component that grows with gestational age [8-11].

This may start during pregnancy and continue after delivery, affecting the mother and the unborn child is very rare [12, 13]. There are few Indian studies [14, 15] that evaluated the complications of pregnancy and motherhood linked to psychiatric disorders like depression. However, these studies have limited sample size and did not address these issues in the rural community. The studies need to be conducted among the group of people who are on insufficient surveillance among the rural population. Hence, this study aimed to address the maternal outcomes among the pregnant woman with depression and also to explore the factors affecting the depression among them.

## **MATERIALS AND METHODS:**

### **Ethical Approval and consent:**

The study was commenced after procuring an ethics approval from the institution's ethics committee (IEC/029/2021), and all study procedures were carried out in accordance with the Declaration of Helsinki. Prior to their participation in the study, each subject was asked to provide a signed informed consent. A written informed consent was obtained from all the participants before enrolling to the study.

### **Sampling technique and sample size calculation**

A prospective random sampling technique was adapted in this study. We estimated a minimum sample size of 148 participants with a margin of error of 5%, power of 80%, precision of 0.05, at confidence interval of 95% and a prevalence of 24% by considering the prevalence in Indian studies to be in this range [15].

### **Study design and study setting:**

This was a prospective observational research study in a rural tertiary care hospital for a period of nine months (October 2021 to June 2022). The hospital setting is a 1300 bedded hospital with all the facilities for the medical and maternal care with an advanced woman and child block. The hospital is accessible to more than three districts.

### **Participants inclusion and exclusion criteria**

The pregnant women aged 18 or above and who are on their first and second trimester from a south Indian tertiary care teaching hospital were considered for this study. After obtaining an explanation of all the specific study methods, those who were accepted and willing to give written informed consent were included for this study. Participants who had a history of any psychological problem were not allowed to participate. The patients had a right to withdraw from the study at any point of time without even giving any justification.

### **Data collection and instruments**

A detailed data collection form which included the patients' demographics, diagnosis, pregnancy details, stage of pregnancy, comorbidities, drugs used, clinical outcome, were designed to collect the data from patients. The enrolled patient was followed up to the third trimester and the depression were calculated using The Edinburgh Postnatal Depression Scale [16] Questionnaire as per the data from the patient record during third trimester. A score of 13 or lesser considered to be no abnormality and a score of above 13 considered to be possible depression [16]. The maternal outcomes such as gestational hypertension (GHT), gestational diabetes (GDM) and pre-eclampsia was also measured at the last stage or third trimester of pregnancy.

### **Statistical analysis:**

All collected data were entered into Microsoft Excel, and statistical analysis was done with the help of a computer with Statistical Package for the Social Sciences version 16.0 developed by IBM [17]. The descriptive statistics were computed; the categorical and continuous data were presented as frequencies with percentage and mean with standard deviation, respectively. The demographic factors (age, BMI, education, diet, hemoglobin abnormality, occupation, annual income, BP in 3 months and BP in 6 months) and the depression were considered to be the independent and dependent factors, respectively while analyzing the factors affecting the depression. Whereas, depression and maternal outcomes (GDM, GHTN and pre-eclampsia) were considered to be the independent and dependent factors, respectively in case of analyzing the effect of depression on maternal outcomes. A chi-square test and regression analysis was used to assess the effect of demographic factors on depression and effect of depression on maternal outcomes, respectively. The outcomes were expressed in odds ratios along with its 95% confidence interval. A probability value of less than 0.05 is considered to be statistically significant.

## **RESULTS:**

### **Demographic characteristics of the patients**

As per the aforementioned criteria, 150 individuals in total with an average age of  $25.05 \pm 5.5$  years were included in this study. 96.7 percent ( $n=145$ ) of the participants were aged 18 to 35, and the 3.3 percent ( $n=145$ ) were aged 36 to 60. Majority (65.3%) had a normal BMI, whereas 32% were obese. Among the participants, 52% had a higher secondary education and 71.3% were following the mixed diet. A major population (69.3%) were house wives. Among the included participants, 21 (14%), and 10 (6.7%) had a high BP at 3 months and 6 months, respectively.

Among the included participants, 48% (n=72), 39.3 (n=59), 8.7 (13%), and 5.3 (n=8) of the participants observed to have a possible depression, GDM, GHT, and pre-eclampsia, respectively. The demographics and outcomes are presented in Table 1.

*Table 1: Demographic details and pregnancy outcomes in the included participants*

### **Factors affecting the depression:**

Various demographics factors were correlated with the depression and the factors such as being obese (p=0.020; OR: 2.356; 95%CI: 1.147-4.838), and being a housewife (p=0.000; OR: 14.300; 95%CI: 3.217-63.568) were significantly associated with a higher risk of depression. No other factors were correlated with depression among the pregnant woman. The detailed analysis on factors affecting depression is provided in Table 2.

*Table 2: Factors affecting the depression among the pregnant woman*

### **Effect of depression on maternal outcomes:**

The depression was significantly associated with the higher risk of gestational diabetes (p=0.036; OR: 2.051; 95%CI: 1.049-4.008), but not with gestational hypertension (p=0.073; OR: 3.382; 95%CI: 0.892-12.827) and pre- eclampsia (p= 0.137; OR: 0.289; 95%CI: 0.056-1.483) [Table 3]. The overall findings of the study are provided in Table 4.

*Table 3: Effect of depression on maternal outcomes*

Table 4: The overall findings of the study

## **DISCUSSION:**

Depression is a major threat and identified as a global health hazard among the pregnant woman which is associated with negative impact on delivery and child health, hence this condition should be taken care very effectively to have a better maternal outcomes [16]. This study, analyzed the factors contributing the depression among pregnant woman and how the depression affects the maternal outcomes.

It is observed that, a major proportion (96.7%) of the included participants were aged between 18 and 35. A Bangalore based study by Sheeba et al., recorded similar findings wherein 72.9% of their population were aged above 20. However, remaining 27.1% were  $\leq 20$  years of age [15]. This might be the result of Indian culture, where the girls will get married and becoming pregnant at their early stages of life [5,17]. An earlier cross sectional study by Raj A et al., among Indian woman 20-24 years indicated that, 44.5% reporting the child marriage; 22.6% reporting marriage before 16 years and 2.6% reporting marriage prior 13 years of age [17]. Another Ethiopian study recorded that, 53.9%, 34.1% and 12.0% were aged between 20-30, 15-19 and  $> 30$ , respectively [16]. The woman carrying the baby during their early age should be provided with utmost care for a better maternal outcome.

Majority (65.3%) had a normal BMI, whereas 32% were obese. The cross sectional study by Cochrane L et al., recorded that, more than 50% of their included participants were overweight or obese during the start of pregnancy, out of which 5.2% of mothers were morbidly obese. They also noted that, the birth weight of mothers during delivery was further increased with a BMI of  $>25$  [18]. Among the participants, 52% had a higher secondary education and 71.3% were following the

mixed diet. A study by Duko et al., recorded that, 54% of their population had a higher secondary education [16].

A major population (69.3%) were house wives. A similar observation was reported by Duko B et al., where 63.7% of their participants were housewives [16]. In India, major proportion of the woman engaged with household works and housewives. Though they are happy for being a housewife and taking care of family, proper support should be provided by the husband and in-laws. A qualitative research by Naz S et al., observed a reduced support from the husbands and in-laws in terms of emotional, physical, psychological, housekeeping, and financial aspects during pregnancy [19]. This might further contribute to the anxiety and depression among the woman and affect their maternal health.

This study indicates that, being obese (OR: 2.35;  $p=0.020$ ) was significantly associated with a higher risk of depression. Many studies reported the similar findings. The study by Jani et al., among the 16,528 participants recorded that, the obesity at early pregnancy stage was significantly associated with perinatal depression (OR: 1.421;  $P<0.001$ ), although this risk was mediated by vitamin D levels [20]. Another study Kumpulainen et al., among 3,234 pregnant woman observed that, maternal obesity was correlated with depressive symptoms during pregnancy (OR: 1.43;  $p<0.001$ ) and after pregnancy (OR: 1.36;  $p=0.01$ ) [21]. The other determinants of obesity such as gestational weight gain, pre-pregnancy obesity, higher BMI, and severe pre-pregnancy maternal obesity, were significantly associated with pre-natal depression and depressive symptoms [22-26].

The study by Cochrane L et al., indicated that increased BMI was associated with a higher risk of transfer, GDM, and elective Caesareans [18].

This study observed that, being a housewife ( $p=0.000$ ) were significantly associated with a higher risk of depression. The study conducted by Fall A et al., indicated that, women's employment status were significantly affecting the pre-natal depression. The status such as women who had stopped working (OR: 1.61) and housewives (OR: 1.46; 95% CI 1.10 to 1.94) were a significant predictors depression [27]. Marital adjustment is very important and findings indicate that, a 52% reduction in depression after childbirth observed after explaining marital adjustment and social support [28]. Many other factors were found to be associated with the depression which include age, education, abortion status, loss of new born child, history and current pregnancy, partner support, family feeling, poor social support and planned pregnancy were significantly associated with depression [16].

The findings from this study indicated a significant association between depression and gestational diabetes ( $p=0.036$ ; OR: 2.051). A systematic review and meta-analysis by Delanerolle G et al., observed a significant risk of GDM (OR: 1.30;  $p=0.01$ ) among the women with history of depression [29]. A study by Mahale et al., among 600 post natal woman recorded a 7.7% of the pregnant woman had a postpartum depression and 135 of them had a score of  $> 13$  on the EPDS on the 3rd postpartum day [30]. Another systematic review by OuYang H et al., also indicated a significant association between the depression and GDM among pregnant woman [31]. Antenatal and perinatal care is very important and the studies are evident for a better neonatal and maternal outcomes among those who are adhering to the antenatal care interventions [32]. Successful interventions should be planned to control the depression among the pregnant woman.

Sub-threshold psychiatric symptoms is a major important factor in predicting postpartum depression. Anger and its expression can be considered as significant factors for postpartum mood disorders onset. Early identification of these symptoms which potentiate the development of depression in the pregnant woman is very important for a better mental health and prevention of mental problems. [33-35]. Evidences also indicates that, rapid metabolic, hormonal, physiologic, and developmental

changes especially in adolescent pregnant woman can lead to depression, though it is a complex process of change in physiology [36,37].

The public and healthcare sector policy makers should make the relevant guidelines and should implement the interventional programs such as awareness campaigns and individualized counselling centers to tackle the depression and other mental health issues in the pregnant woman especially in rural areas for a better maternal outcomes and an excellent future generation. The study conducted by Quaresima et al., indicated that, the post-diagnosis counselling plays an important role in improving women awareness about GDM, depression and foetal-maternal related risks [38]. A structured counselling should be planned with respect to the incidence, pathophysiology, risk factors, foetal-maternal risks, glucose monitoring, and pregnancy management among the pregnant woman which in turn helps to reduce the occurrence of maternal complications. A good trained team consist of a diabetologist and an obstetrician can perform the counselling for approximately 20-25 min to each woman and later they can be given a chance to ask their queries and share their feelings [38]. Moreover, these patients should be a followed up to check whether they are adherent to the recommendations or not.

The smaller population was a limitation of study, and further studies with a larger population shall be planned to strengthen our findings. This study was conducted among the rural population and hence future comparative studies are needed to understand the effect of living status, economic status and employability status in pre-natal outcomes.

## **CONCLUSION:**

The current evidence implies that, being obese and housewife was significantly associated with the depression and depression was significantly associated with the gestational diabetes. Further adequately powered prospective studies are needed to strengthen this findings.

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## **COMPLIANCE WITH ETHICAL STANDARDS**

### ***Authors contribution:***

RSV., R.V.: Conceptualized the study. RSV., R.V.:Checked and corrected the data of the CedAP informative flow. S.KY.:analysed the data. S.KY.,R.V.:Drafted the initial manuscript. S.KY., R.V., R.S.V., Interpreted the results and reviewed the manuscript. All authors approved the final manuscript as submitted and agreed to be accountable for all aspects of the work.

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### ***Study registration***

N/A.

### ***Disclosure of interests***

All authors declare they have no conflicts of interest and they have no financial or personal relationships with other people or organizations that could inappropriately influence (bias) their work.

### **Ethical approval**

All study procedures were carried out according to the Declaration of Helsinki, and the study was approved by the institutional ethical committee (IEC/029/2021).

### **Informed consent**

A written informed consent were obtained from all the participants before enrolling to the study.

### **Data sharing**

Data are available under reasonable request to the corresponding author.

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**Table 1: Demographic details and pregnancy outcomes in the included participants**

<b>Demographic character</b>	<b>Frequency (%)</b>
<b>Age</b>	
Mean age	25.05±5.5 years
18-35	145 (96.7)
36-60	5 (3.3)
<b>BMI</b>	
Underweight	4 (2.7)
Normal	98 (65.3)
Overweight	48 (32)
<b>Education</b>	
Illiterate	7 (4.7)
High school	65 (43.3)
Higher secondary and Above	78 (52)
<b>Diet</b>	
Mixed	107 (71.3)
Vegetarian	43 (28.7)
<b>Occupation</b>	
Private	30 (20)
Housewife	104 (69.3)
Government	16 (10.7)
<b>Hemoglobin abnormality</b>	
No	64 (42.7)
Yes	86 (57.3)
<b>Family members</b>	
Below 4	2 (1.3)
4-10	143 (95.3)
Above10	5 (3.3)
<b>Annual Income (INR)</b>	
Below 1 Lakh	99 (66)
Above 1 Lakh	51 (34)
<b>BP at 3 months</b>	
Normal	129 (86)
High	21 (14)
<b>BP at 6 months</b>	
Normal	140 (93.3)
High	10 (6.7)
<b>Depression as per EPDS scale</b>	
No abnormality	78 (52)
Possible depression	72 (48)
<b>GDM</b>	
No	91 (60.7)
Yes	59 (39.3)
<b>GHT</b>	
No	137 (91.3)
Yes	13 (8.7)

Pre-eclampsia	
No	142 (94.7)
Yes	8 (5.3)

**Table 2: Factors affecting the depression among the pregnant woman**

Demographic	Variable	p-value	Odds ratio (95%CI)
<b>Age</b>	18-35	NA	1
	36-60	0.369	0.261 (0.028-2.388)
<b>BMI</b>	Underweight	NA	1
	Normal	0.134	6.000 (0.577-62.374)
	Overweight	<b>0.020*</b>	<b>2.356 (1.147-4.838)*</b>
<b>Education</b>	Illiterate	NA	1
	High school	0.126	5.415 (0.622-47.099)
	Higher secondary and Above	0.093	0.564 (0.289-1.101)
<b>Diet</b>	Mixed	NA	1
	Vegetarian	0.896	0.954 (0.470-1.937)
<b>Haemoglobin abnormality</b>	No	NA	1
	Yes	0.220	0.665 (0.346-1.276)
<b>Occupation</b>	Private	NA	1
	Housewife	<b>0.000*</b>	<b>14.300 (3.217- 63.568)*</b>
	Government	0.533	1.432 (0.463-4.423)
<b>Annual income</b>	Below 1 Lakh	NA	1
	Above 1 Lakh	0.868	1.059 (0.538-2.083)
<b>BP at 3 months</b>	Normal	NA	1
	High	0.061	2.619 (0.956-7.175)
<b>BP at 6 months</b>	Normal	NA	1
	High	0.371	1.917 (0.461-7.967)

\*indicate the significant effect

**Table 3: Effect of depression on maternal outcomes**

Variable	Maternal outcome	p-value	Odds ratio (95%CI)
<b>Depression</b>	Gestational diabetes	<b>0.036*</b>	<b>2.051 (1.049-4.008)*</b>
	Gestational hypertension	0.073	3.382 (0.892-12.827)
	Pre-eclampsia	0.137	0.289 (0.056-1.483)

\*indicates the significant effect

**Table 4: Overall Interpretation of the findings**

Significant factors affecting the depression	Significant effect of depression on maternal outcomes
<ul style="list-style-type: none"> <li>Overweight (p=0.020)</li> <li>Being housewife (p=0.000)</li> </ul>	<ul style="list-style-type: none"> <li>Gestational diabetes (p=0.036)</li> </ul>