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Original Research Article

Prevalence and predictors of prenatal maternal stress in a south Indian cohort: A cross-sectional study

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Abstract

Background: Prenatal maternal stress, defined as stress experienced during pregnancy, is associated with adverse pregnancy outcomes and child developmental issues. This study aimed to assess the prevalence of prenatal stress and identify associated factors among pregnant women in and around Coimbatore, Tamil Nadu, India.

Materials and Methods: Conducted this longitudinal study comprising of 301 pregnant women recruited from the antenatal clinic at a tertiary care teaching hospital between May 2023 and April 2024. Universal sampling was employed, whereby all eligible women attending the clinic during the study period were recruited. Data were collected via a semi-structured questionnaire covering socio-demographic and obstetric details. Stress levels were measured using the Cohen's Perceived Stress Scale (PSS-10) and the Perceived Prenatal Maternal Stress Scale (PPNMSS). Statistical analysis was performed using SPSS version 27, with ANOVA used to examine associations.

Results: According to the PSS-10, 55.5% of participants experienced moderate stress, 43.2% low stress, and 1.3% high stress. The PPNMSS revealed 12.9% with high stress, 37.9% moderate stress, and 49.2% low stress. A significant correlation was found between stressful life events and perceived stress levels ($p < 0.05$). No significant association was observed between stress levels and variables such as mean annual income.

Conclusion: A substantial proportion of pregnant women experienced moderate to high stress, primarily influenced by stressful life events. Integrating routine stress screening into antenatal care and offering targeted psychosocial support may enhance maternal well-being and improve pregnancy outcomes.

Keywords: Prenatal maternal stress, Pregnancy, Perceived stress scale, Maternal mental health.

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1. Introduction

Prenatal maternal stress refers to the stress that a mother experiences during pregnancy.[1] Over the past decade, research has increasingly highlighted the significance of the prenatal environment for children's postnatal mental health outcomes.[2] The developmental origins of health and disease framework, supported by empirical data, suggest that maternal stress during pregnancy, alongside nutrition and environmental toxicants, influences the development and mental health of their babies.[3] Prenatal stress has been linked to a range of adverse pregnancy outcomes, including preeclampsia, low birth weight, fetal growth restriction, preterm labor, pregnancy-induced diabetes, asthma, atopic dermatitis, Autism Spectrum Disorders (ASDs), and Attention Deficit Hyperactivity Disorder (ADHD).[4]

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The World Health Organization's Mental Health Action Plan (2013-2030) estimates that the global prevalence of mental health problems is around 10%, with developing countries experiencing a higher prevalence at 15.6%.[5] This prevalence is a cause for concern worldwide. Research on the effects of prenatal stress on child development has seen a significant increase, with 7,087 articles published between 2011 and 2021. The United States leads this research with 2,751 publications (38.82%), followed by Canada with 702 (9.91%) and China with 674 (9.5%).[6]

However, between 1979 and 2023, only 146 publications were found on maternal mental health research in India,[7] indicating a lack of research in developing nations like India. This study aims to determine the prevalence of prenatal maternal stress and identify the associated factors among women residing in and around the Coimbatore region of Tamil Nadu, India.

2. Materials and Methods

2.1. Study design and setting

This research represents the first phase of a longitudinal study focused on prenatal maternal stress and conducted a cross-sectional analysis of 301 pregnant women attending the antenatal clinic at a tertiary care teaching Hospital, Tamil Nadu, South India between May 2023 and April 2024. The study aimed to determine the prevalence of prenatal maternal stress and examine its association with sociodemographic and obstetric factors.

2.2. Study population

Pregnant women were recruited if they met the following inclusion criteria: age between 18-40 years, gestational age of greater than 12 weeks, singleton, who speak the local language Tamil, conceived naturally and planning to deliver at the study hospital. Participants with pregestational thyroid dysfunction, chronic hypertension, or type I/II diabetes mellitus were excluded from the study. The study was approved by the Institutional Ethics Committee (EC/AP/1022/03/2023) and conducted in accordance with the Declaration of Helsinki.

2.3. Sample size determination

The sample size was estimated as 292 considering a prevalence of 15.6% (5) at 95% CI with an absolute precision of 5%.

2.4. Sampling method

We included 301 mothers who fulfilled the criteria through universal sampling method whereby all eligible women fulfilling inclusion and exclusion criteria attending the antenatal clinic during the study period where recruited. A total of 312 women consented to participate. Incomplete responses to the stress assessment (n=11) were treated as missing data and excluded, resulting in a final sample of 301 participants for analysis.

2.5. Data collection

The investigator explained the study's purpose, objectives and methodology and gave the patient participant’s consent sheet, given time to decide and ask their queries regarding the study. All the queries were clarified and once they consented a written inform consent was obtained.

Data collection was carried out using a predesigned semi-structured questionnaire comprising two sections:

2.6. Socio-demographic data

This section collected personal information, such as age, blood group, physical activity, education, occupation, working hours, household size, annual family income, and significant stressful events in the past 6 months (e.g., job loss, death of a family member, serious illness or injury, job transfer, divorce, or separation).

2.7. Obstetric and medical characteristics

This section gathered information on health problems during the current pregnancy, GPAL (Gravida, Para, Abortion, Living children), history of miscarriage, thyroid dysfunction, history of hypertension, and mode of conception.

2.8. Screening for prenatal maternal stress:

The Perceived Stress Scale (PSS-10), a classic stress assessment tool, measures perceived stress with scores ranging from 0 to 40. Scores of 0-13 indicate low stress, 14-26 indicate moderate stress, and 27-40 indicate high stress[8].

The Perceived Prenatal Maternal Stress Scale (PPNMSS) assesses prenatal maternal stress using a four-factor model: perceived social support, pregnancy-specific concerns (both physiological and emotional), intimate partner relations, and financial concerns. This 15-item scale scores stress from 0 to 45, with 0-15 indicating low stress, 16-30 indicating moderate stress, and 31-45 indicating high stress.[9]

Both the stress scales – Cohen’s perceived stress scale (PSS-10) and Perceived Prenatal Maternal stress scale (PPNMSS) – are previously validated instruments widely used in antenatal research. In the present study, they were administered in their original format without any modifications. The semi-structured questionnaire was prepared by adding sociodemographic and obstetric variables to the existing validated questionnaire for data collection. It was reviewed by the PhD guide, Phd co-guide and two clinical experts from obstetrics and gynaecology department to ensure content validity, clarity and relevance.

Data analysis was performed using SPSS version 27, employing descriptive statistics like frequency and percentages. The ANOVA test was used to examine the

association between sociodemographic, obstetric, and medical characteristics and the risk of prenatal maternal stress, with a significance level set at $p < 0.05$.

3. Results

Table 1 provides a descriptive overview of the participants in the study, focusing on both their sociodemographic and obstetric profiles. This helps contextualize the stress findings by showing the background characteristics of the sample.

Table 2 explores how different types of stressful life events are associated with varying levels of prenatal maternal stress. It presents both the distribution of stress levels among participants who experienced these events and the statistical association between the events and stress severity.

The Odds Ratio (OR) was calculated by combining the moderate and high stress categories and comparing them against the low stress category for each scale. Participants who experienced stressful life events showed significantly higher stress levels on both scales. On the Cohen's perceived stress scale (PSS-10), the odds of having moderate-to-high stress were approximately three times higher among those exposed to stressful events compared to those without such events (OR = 3.03; 95% CI 1.59–5.81; p = 0.004). Similarly, on the Perceived Prenatal Maternal Stress Scale (PPNMSS), participants with stressful events had more than twofold higher odds of elevated stress (OR = 2.22; 95% CI 1.19–4.15; p = 0.02). These findings highlight a consistent and statistically significant association between exposure to stressful life events and higher perceived stress levels during the prenatal period.

Table 1: Socio-demographic and obstetric characteristics of participants (N = 301)

Characteristic	Distribution (n, %)
Age	≤20: 27 (9.0%), 21–30: 233 (77.4%), 31–40: 41 (13.6%)
Education	Primary: 1 (0.3%), Secondary: 28 (9.3%), Higher Secondary: 47 (15.6%), Graduation: 153 (50.8%), post-grad: 48 (15.9%), Diploma: 24 (8.0%)
Occupation	Homemaker: 208 (69.1%), Full-time: 80 (26.6%), Part-time: 4 (1.3%), Self-employed: 4 (1.3%), Student: 5 (1.7%)
Working hours	Not applicable: 208 (69.1%), <8 h: 16 (5.3%), 8 h: 45 (15.0%), >8 h: 32 (10.6%)
Physical activity	Active: 126 (41.9%), Sedentary: 175 (58.1%)
Stressful events	None: 239 (79.4%), Death in family: 44 (14.6%), Serious illness/injury: 10 (3.3%), Separation from husband: 6 (2.0%), Job loss: 2 (0.7%)
Family size	2–4: 213 (70.8%), 5–10: 86 (28.6%), >10: 2 (0.7%)
Annual income	Destitute: 30 (10.0%), Aspirer: 199 (66.1%), Middle class: 72 (23.9%), Rich: 0 (0.0%)
Gravida	Primigravida: 184 (61.1%), Multigravida: 117 (38.9%)
Last pregnancy type	LSCS: 71 (60.7%), NVD: 46 (39.3%)
Abortus history	Absent: 247 (82.1%), Present: 54 (17.9%)
COHEN's Stress classification	Mild: 130 (43.2%), Moderate: 167 (55.5%), Severe: 4 (1.3%)
PPNMS Stress classification	Mild: 118 (49.2%), Moderate: 114 (37.9%), Severe: 39 (12.9%)

LSCS = Lower Segment Caesarean Section; NVD = Normal Vaginal Delivery; ₹ = Indian Rupees

Table 2: Distribution and association of stress levels with stressful events

Stress Scale	Stress Level	No Stressful Events (n=232)	With Stressful Events (n=60)	p-value
PSS-10	Low	114 (47.7%)	16 (23.8%)	0.004
	Moderate	123 (51.46%)	44 (70.97%)	
	High	2 (0.84%)	2 (3.22%)	
PPNMSS	Low	127 (53.14%)	21 (33.87%)	0.02
	Moderate	85 (35.56%)	29 (46.77%)	
	High	27 (11.3%)	12 (19.36%)	

PSS-10 = Cohen's Perceived Stress Scale; PPNMSS = Perceived Prenatal Maternal Stress Scale.

Significant associations observed.

Table 3: Association between income category and stress levels

Stress Scale	Stress Level	Dominant Income Category	Trend	p-value
PSS-10	Low	Middle Class / Aspirer	↓ Stress	0.417
	Moderate	Aspirer	—	
	High	Destitute	↑ Stress	
PPNMSS	Low	Aspirer / Middle Class	↓ Stress	0.065
	Moderate	Aspirer	—	
	High	Mixed (including Middle Class)	—	

Table 3 shows the *Income categories* based on Indian socioeconomic classifications: *Destitute:* Severely financially constrained; *Aspirer:* Lower-middle income striving for upward mobility; *Middle Class*: Stable income with moderate financial security; *Rich:* High income and financial affluence (not represented in sample). No statistically significant association was found between income category and stress levels.

The assessment of perceived prenatal maternal stress was conducted using two validated instruments: Cohen's Perceived Stress Scale (PSS) and the Perceived Prenatal Maternal Stress Scale (PPMSS). The results revealed notable differences in stress categorization between the two scales (**Figure 1**).

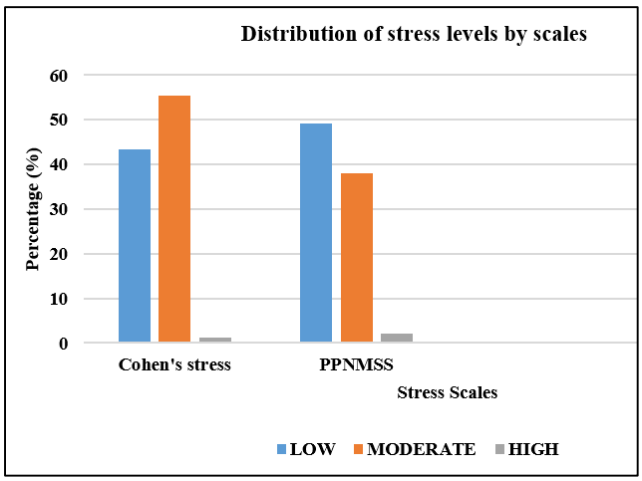

Figure 1: Distribution of stress levels among pregnant women by assessment scale

The bar chart compares stress levels as measured by Cohen's Perceived Stress Scale (PSS-10) and the Perceived Prenatal Maternal Stress Scale (PPNMSS). Stress levels were categorized as mild, moderate, or severe. According to Cohen's scale, 55.5% of participants reported moderate stress, 43.2% mild stress, and 1.3% severe stress. In contrast, the PPNMSS classified 49.2% as mild, 37.9% as moderate, and 12.9% as severe. These findings suggest that the PPNMSS may be more sensitive in detecting prenatal-specific stress compared to the more generalized PSS.

The association between stress levels and other parameters was also measured, revealing no significant association between any of the parameters assessed.

4. Discussion

In the realm of maternal and child health, prenatal maternal stress is a significant area of study and concern. The consequences of psychological and physiological stress on a pregnant mother have garnered increased attention due to their potential impacts on both fetal development and maternal health. The complexity of prenatal maternal stress underscores the critical need for awareness and support, as it can affect the unborn child's lifelong health outcomes, alter hormone levels, and even influence placental function.

This study aimed to investigate the prevalence of stress among pregnant women and identify associated sociodemographic and obstetric factors. Our findings indicate a significant prevalence of moderate stress, and notably, the only factor significantly associated with stress levels was the occurrence of stressful life events in the past six months. This aligns with a growing body of evidence emphasizing the profound impact of psychosocial factors and life events on maternal mental health during pregnancy.[10-14]

Previous research on prenatal stress has examined a wide spectrum of stressors across multiple domains. Many studies have focussed on life events and work-related stress, typically qualifying the total number of stressful experiences over the past year, including events such as bereavement, accidents, and financial hardship, and in some cases extending to extreme exposures like natural disasters. Social determinants of health have also been extensively explored with more than 25 indicators reported in the literature, such as housing instability, food insecurity, financial strain, caregiver burden, discrimination, and adverse neighbourhood conditions. Acculturative stress, particularly among immigrant populations, is frequently highlighted as a significant contributor to prenatal stress. In addition, unplanned pregnancy is commonly assessed a psychosocial stressor, while chronic and cumulative stress – especially among socioeconomically disadvantaged or migrant groups – remains a major area of focus.[15,16]

4.1. Prevalence of antenatal stress

When combining high and moderate stress levels, 56.8% of pregnant women were classified as stressed using Cohen's Perceived Stress Scale, while the Perceived Prenatal Maternal Stress Scale showed a prevalence of 50.8%. These rates are lower than those reported in Ireland (75.6%),[17]

Germany (95%),[18] and China (91.86%),[19] but higher than findings from the USA (6%),[20] Saudi Arabia (33.4%),[21] India (33.3%),[22] Nepal (34.2%),[23] Ghana (28.6%),[24] and Iran (5.5%).[25] In Afghanistan, 51.8% of pregnant women experienced moderate to extremely severe stress.[26] The prevalence rates are often higher in developing countries compared to developed ones.[27] For instance, one study in South India found that 65.4% of pregnant women scored above the mean on the Perceived Stress Scale (PSS), indicating high levels of perceived stress, which is comparable to our findings of a majority experiencing moderate stress.[28] The wide range of prevalence figures observed in the literature likely reflects differences in the stress assessment scales, population settings, and cultural contexts.

The different prevalence rates observed between the Cohen's PSS-10 and PPNMSS scales in our study (1.3% high stress on PSS-10 vs. 12.9% on PPNMSS) highlight the importance of the assessment tool. This discrepancy suggests that the PPNMSS may be more sensitive in identifying high levels of stress in this specific population.

4.2. Association with stressful life events

The primary finding of our study is the strong association between significant stressful life events and higher stress levels, while other sociodemographic and obstetric factors showed no significant association. This result is strongly supported by the literature, which consistently identifies stressful life events as a major contributor to distress in pregnancy.[10-14] Events such as job loss, death of a family member, and marital separation are recognized as significant stressors that can negatively impact a pregnant woman's psychological well-being.[10-14] The concept of "life hassles" and adverse events experienced before or during pregnancy is known to contribute to adverse obstetric outcomes, mediated through psychological, biological, and environmental pathways. This underscores the idea that a woman's perception of stress arises when there is an imbalance between life's demands and her individual adaptive capacity.[26]

There was a significant association between experiencing stressful events and stress levels measured by both scales—Cohen's Stress Scale ($p = 0.000$) and the PPNMS Stress Scale ($p = 0.036$). In contrast, no significant association was observed between mean annual income and stress levels, either on Cohen's Scale ($p = 0.417$) or the PPNMS Scale ($p = 0.065$). These results are consistent with previous research.[29,30,31]

No significant correlation was observed between stress levels and sociodemographic factors such as age, education, occupation, physical activity, family size, or obstetric characteristics in the present study.

Unlike our findings, several studies have linked sociodemographic factors to antenatal stress, anxiety, and depression. A study from Brazil found that prenatal stress was more common among women at the extemes of reproductive age, those without a partner, women with low social support, multiparous mothers.[32] A study from south India found that higher educational levels were associated with lower stress,[26] while another noted that women with less than a grade 11 education were more likely to report high stress levels.[33,34]

4.3. Obstetric factors

Our study found no link between obstetric history (like past miscarriages) and stress levels. For example, one study reported that a history of spontaneous abortion showed a trend towards association with higher stress.[26] Another concluded that women with a past pregnancy loss are at increased risk for postpartum psychiatric disorders.[35-38] It is possible that in our cohort, the immediate impact of recent major life events was a more powerful predictor of current stress than past obstetric events.

4.4. Social and family support

Although we did not measure social support as a separate variable, it is often intertwined with stressful life events like divorce or family death. Factors like spousal alcohol use, marital conflict, physical violence, and pressure to have a male child have also been strongly linked to maternal distress.[26]

5. Limitations

Although the study assessed recent stressful life events such as bereavement, job loss, and marital separation within the preceding six months, the psychosocial stress framework remained relatively narrow compared to the broader domains described in existing prenatal stress research. Important structural and contextual determinants—including food insecurity, housing instability, financial strain, discrimination, caregiver burden, and acculturative stress—were not examined. Additionally, factors like unplanned pregnancy and work-related stress were not assessed. While biomarkers of chronic stress such as hair cortisol were measured in the larger study, these data are not included in the present manuscript. As a result, the current findings are based solely on acute, self-reported stressors and do not capture the cumulative or multidimensional nature of prenatal stress. These limitations should be taken into account when interpreting the results and highlight the need for future work incorporating both biological and psychosocial indicators across multiple stress domains.

Given the unique characteristics of pregnancy and the regional and cultural context in which a woman lives, understanding the factors influencing gestational stress is essential for planning and implementing measures to prevent, identify, monitor, and manage this condition during prenatal care.

6. Conclusion

This study highlights that more than half of the pregnant women assessed experienced moderate to high levels of stress, with prevalence varying depending on the measurement tool used. Stressful life events were significantly associated with elevated stress, underscoring the importance of psychosocial circumstances in shaping maternal well-being, but no significant associations were found between stress and sociodemographic or obstetric characteristics, suggesting that prenatal stress may cut across social and demographic boundaries. However, it is important to note the study's reliance on self-reported data, which may be subject to recall bias.

The findings emphasize the need for routine screening of stress during antenatal visits and for incorporating targeted interventions such as counselling, social support, and stress-management strategies into maternal healthcare. Strengthening awareness and early detection could help mitigate the long-term adverse consequences of prenatal stress on both maternal health and child development. Further research with larger and more diverse populations is warranted to explore additional determinants and to inform region-specific preventive strategies.

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8. Conflicts of Interest

The authors declare no conflicts of interest.

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