**Research Article**

# Prevalence of Gestational Diabetes and its Related Risk Factors among Rural Pregnant Women

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## Abstract

**Objectives:** To estimate the prevalence of gestational diabetes among rural pregnant women and to assess the related risk factors among gestational diabetes mothers in rural areas.

**Methods:** A community-based cross-sectional study was conducted among antenatal mothers between 24 to 28 weeks of gestation in rural areas of Kancheepuram district, Tamil Nadu, for a period of one year from January 2017 to December 2017. Data were collected using a semi-structured questionnaire through face-to-face interviews with antenatal mothers regarding their demographic profile, obstetric history, nutrition, and lifestyle. The level of stress was assessed using the Perceived Stress Scale. Oral glucose tolerance tests (OGTT) were performed after an overnight fast of at least 12 hours, with a 75 g glucose load administered, and venous samples were drawn after 2 hours. GDM was diagnosed using specific criteria.

**Results:** Out of 244 antenatal mothers, 36 (14.8%) were found to have gestational diabetes. The majority of gestational diabetes mothers were housewives (p=0.02). In the current study, most of the GDM mothers were from lower-middle-class families (p=0.04). GDM mothers with a family history of chronic diseases like diabetes, hypertension, and heart disease (p=0.009), as well as those with an increased number of pregnancies, had a higher risk of gestational diabetes (47.6%), which was statistically significant (p=0.001). Patients with hypertension and thyroid disorders were also at an increased risk of developing diabetes during pregnancy (p=0.04). Past history of surgery (p=0.03), low calorie intake, and nutritional deficiencies in their diet (p=0.02) were other identified risk factors.

**Conclusion:** This study suggests that the prevalence of gestational diabetes is high among rural antenatal mothers. Therefore, these risk factors should be identified and managed through a risk-based approach to minimize the complications of GDM in both the mother and fetus.

**Keywords:** diabetes, pregnancy, stress.

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## INTRODUCTION

There is a significant burden of non-communicable diseases, particularly diabetes, which needs to be addressed by our public health facilities. Diabetes poses a major public health challenge globally, including in India. The prevalence of diabetes is increasing worldwide, and these figures include women with gestational diabetes mellitus[1].The prevalence of diabetes mellitus (DM) is increasing worldwide and more so in developing countries such as India[2]. Gestational Diabetes Mellitus (GDM) is defined as 'Carbohydrate intolerance with recognition or onset during pregnancy', irrespective of the treatment with diet or insulin[3].

In highly developed countries like the United States, approximately 135,000 cases of GDM are diagnosed annually, representing 3–8% of all pregnancies[4]. "Gestational Diabetes Mellitus (GDM)"has been identified as a potential risk factor for poor health outcomes in pregnant women, contributing to various complications during pregnancy and childbirth, which directly in.

Diabetes complicating pregnancy is associated with adverse maternal and perinatal outcomes, including an increased risk of pre-eclampsia

during the antepartum period, as well as a higher risk of macrosomia, hypoglycemia, jaundice, respiratory distress syndrome, polycythemia, and hypocalcemia in infants,[5,6].

Despite glucose levels returning to normal after delivery, mothers with a history of GDM are at a higher risk of developing type 2 diabetes, while children born to mothers with GDM are at increased risk of developing metabolic syndrome.[7] In India, one of the world's most populous countries, GDM rates are estimated to be between 10-14.3%, significantly higher than in the West. The prevalence of gestational diabetes among rural pregnant women is 9.9%, compared to 16.6% among urban pregnant women. This suggests a significant underdiagnosis of GDM cases, particularly in rural populations. [8,9] This study aims to investigate the prevalence and risk factors of gestational diabetes among rural pregnant women.

## METHODS

A cross-sectional, community-based study was conducted in the rural field practice area of the Rural Health and Training Center, Poonjeri, Chettinad Hospital and Research Institute, over a period of one year from January 2017 to December 2017. All pregnant women with an estimated gestational age between 24th and 28th weeks during the study period were included, while women who were known diabetics, critically ill, or refused to participate were excluded. Based on a prevalence rate of 9.9% from previous studies3 and assuming a 95% confidence level with an allowable error of 5%, the sample size was calculated using the formula N= 4pq/E^2, where p represents prevalence, q is 1-p, and E is the allowable error of P. The sample size was calculated to be 244. Institutional Ethical Committee approval from Chettinad Hospital and Research Institute was obtained prior to commencing the study.

The total population of 12 villages, as recorded in the household family register maintained at RHTC, Poonjeri, was 39,545. Out of these 12 villages, 6 were selected using a simple random sampling method (lottery method). The population of pregnant mothers with a gestational age between 24 to 28 weeks in these 6 villages was 815, as obtained from the respective primary health centers, sub-centers, and ICDS of the villages. A total of 514 pregnant mothers were identified from this population. Systematic random sampling was then employed to select every 2nd antenatal mother until the required sample size of 244 was achieved.

After obtaining consent from the pregnant women, they were interviewed using a semi-structured questionnaire containing demographic profile, obstetric history, nutrition and lifestyle history, and the Perceived Stress Scale. The following day, each mother was given a 75-gram oral glucose load, and at a 2-hour interval, a 2 ml venous blood sample was collected. Plasma glucose was measured using the Glucose Peroxidase method in our institutional laboratory, which is certified by the National Accreditation Board for Laboratories. If the plasma glucose level was ≥140mg/dl, the participant was diagnosed with GDM according to the DIPSI guidelines. The collected data were checked for completeness before being entered into a Microsoft Excel spreadsheet. The entered data were analyzed using the Statistical Package for Social Sciences (SPSS IBM) 21.

## RESULTS

The majority of the participants belonged to the age group of 26-30 years (39.6%), followed by those aged 21-25 years (31.8%). Most of the participants were not employed (56.3%), followed by unskilled (15.9%) and semi-skilled workers (12.2%). In terms of education, 40.4% had completed secondary education, with high school (25.7%) and graduate school (22.4%) being the next most common levels. Regarding socioeconomic status, 48.2% belonged to the lower middle class, 23.3% to the middle class, and 22.9% to the lower class, based on the modified BG Prasad classification 2018.

**Table 1.** Distribution of Antenatal Mothers According to GDM

| GDM | Frequency | % |
|---|---|---|
| Yes | 36 | 14.8 |
| No | 208 | 85.2 |

Frequency Data used for prevalence of Gestational Diabetes.

Table 1 shows prevalence of the Gestational diabetes, among 244 antenatal mothers 36 (14.8%) were diagnoses as GDM.

**Table 2.** Demographic Variable Associated with Gestational Diabetes Mellitus

| Variable | | GDM | | *P-value* |
|---|---|---|---|---|
| Socioeconomic status | | **Yes** | **No** | |
| | Upper | 1 | 1 | 0.045 |
| | Upper middle | 3 | 8 | |
| | Middle | 13 | 44 | |
| | Lower middle | 16 | 102 | |
| | Lower | 3 | 53 | |
| Occupation | Professional | 0 | 4 | 0.029 |
| | Semi professional | 2 | 7 | |
| | Clerk/shop owner/Farmer | 2 | 0 | |
| | Skilled | 5 | 17 | |
| | Semi skilled | 4 | 26 | |
| | Unskilled | 3 | 36 | |
| | Unemployed | 20 | 118 | |
| Education | illiterate | 0 | 0 | 0.436 |
| | Primary | 2 | 6 | |
| | Middle | 2 | 15 | |
| | High | 13 | 50 | |
| | Secondary | 10 | 89 | |
| | Graduate | 9 | 46 | |
| | Post graduate | 0 | 2 | |
| Age | Below 20 | 0 | 8 | 0.002 |
| | 21-25 | 3 | 75 | |
| | 26-30 | 18 | 79 | |
| | 31-35 | 11 | 40 | |
| | Above 35 | 4 | 6 | |

The Frequency data was mentioned. Chi square test was applied for quantitative variables in which p value<0.05 was taken as significant.

Among the antenatal mothers in the study, the majority were primigravida (48.2%), followed by 42% who were gravid with their second child. The highest proportion of participants had no history of abortions (82.4%), while 15.9% had experienced one abortion, and only 1.2% had experienced two abortions. Regarding parity, 43.3% had a parity index of one, and only 0.8% had a parity index of two. Most participants did not have any living children (56.7%), while 42.9% had one living child. The majority of participants had blood pressure below 130/90 mmHg (84.5%), while 15.5% had blood pressure above 140/90 mmHg. In terms of weight, the majority of participants fell within the 51-60 kg range (56.7%), followed by 32.2% in the 41-50 kg range. Regarding BMI, the majority had a normal BMI (57.6%), while 39% were overweight before pregnancy. Family history showed that the majority had a history of diabetes mellitus (41.2%), followed by systemic hypertension (31.4%) (p<0.05). Only 10% had a history of complications in a previous pregnancy.

Majority of the participants had family history of diabetes mellitus (41.2%), followed by systemic hypertension (31.4%).It was seen that majority of the participants with GDM had diabetes. The association between family history and GDM was statistically significant (p=0.009).Majority of the participants that is 57.1% consumed 1800-1999 calories per day, followed by 2000- 2500. Statistically significant association between calories and GDM participants was seen with (p= 0.02). Among the participants 48.2% were primi, 42% were gravid status 2, 8.6% percentage of the mother third time got pregnant and remaining 0.8% participants got $4^{th}$ time got pregnant. Most of the participants with GDM had gravida status of 2. Association between gravida and GDM between participants was found to be statistically significant (p<0.05).Association between past surgery and GDM between participants was found to be statistically significant. (p=0.03)

**Table 3.** Obstetric History Associated with Gestational Diabetes Mellitus

| Variable | | GDM | | *P-value* |
|---|---|---|---|---|
| Gravida | | **Yes** | **No** | |
| | 1 | 9 | 109 | |
| | 2 | 17 | 86 | 0.001 |
| | 3 | 10 | 11 | |
| | 4 | 0 | 2 | |
| Abortions | 0 | 25 | 17 | |
| | 1 | 10 | 29 | 0.087 |
| | 2 | 1 | 2 | |
| Parity | 0 | 11 | 125 | |
| | 1 | 25 | 81 | 0.019 |
| | 2 | 0 | 2 | |

Chi square test was applied for quantitative variables in which p value <0.05 was taken as significant.

Among the pregnant mothers, 10.2% had a history of hypertension, 13.9% had thyroid disorders, and 2.8% had PCOD ($p<0.05$). The majority of participants (96%) did not engage in any form of exercise. Most participants were involved in inactive work for approximately 3 hours every day. Among the study participants, 22% were engaged in inactive work for around 4 hours, while only 14% were inactive for less than 2 hours, such as watching TV, reading newspapers, or simply sitting. Regarding sleep duration, 78% of participants slept for 8-10 hours per day, followed by 17% who slept for 10-12 hours per day. The majority of participants (57%) consumed fewer calories than required for a pregnant mother ($p<0.05$). Upon evaluating stress scores using the PSS stress scale, 50.8% had moderate stress, while 49.2% had low stress.

## DISCUSSION

The majority of the participants belonged to the age group of 26-30 years, followed by those aged 21-25 years, indicating an increased likelihood of gestational diabetes with age. Most participants were not employed (56%), with smaller percentages being unskilled (15.9%) and semi-skilled (12.2%), suggesting lower activity levels. In terms of education, 40% completed secondary education, while 25.7% attended high school and 22.4% graduated. Among the study participants, 48% belonged to the lower middle class, 23% to the middle class, and 22.9% to the lower class.

In our study, the majority of participants were primigravida (48%), followed by 42% gravid with their second child. The highest proportion of participants had no history of abortions (82%), while 15.9% had one abortion in the past, and only 1.2% had two abortions. Among the study participants, 43% had a parity of one, followed by just 0.8% with a parity index of two. The majority of participants did not have any living children (56.7%), while 42.9% had one living child. These findings were somewhat similar to those reported in previous studies.[10]

In this study, the majority of participants had blood pressure below 130/90 mmHg (84%), while 15.5% had blood pressure above 140/90 mmHg. Additionally, the majority had a normal BMI (57.6%), while 39% were overweight. Body mass index (BMI) ≥ 25 was significantly higher in cases than controls (37.9% vs. 14.3%).

Regarding chronic diseases, hypertension was found in 10.2% of participants, followed by 13% with thyroid disease, and approximately 2.5% with PCOD. Only 10% had a history of complications in a previous pregnancy, with the majority experiencing stillbirths (92.3%), followed by large babies (7.7%). In terms of physical activity, 96% of participants did not engage in any form of exercise. Most were involved in inactive work for approximately 3 hours every day, with 22% engaged in inactive work for around 4 hours, and only 14% inactive for less than 2 hours. Regarding sleep duration, 78% slept for 8-10 hours per day, followed by 17% who slept for 10-12 hours per day. In terms of calorie intake, 57% consumed 1800-1999 calories per day, followed by 2000-2500 calories. None of the participants had insomnia, and 98% did not have eating disorders. Among the study participants, 71% had fasting blood sugar levels less than 100mg/dL, while 25% had impaired fasting glucose. On evaluation of postprandial blood sugar levels, 85.2% had levels less than 140 mg/dL.

The mean age of these pregnant women was 23 +/- 4 years. There was a significant increase in the prevalence of GDM in relation to gravidity. Out of the 1251 women who underwent the 50 gm oral glucose challenge test, 670 (53.55%) had one-hour plasma glucose levels greater than or equal to 130 mg/dl. Among the 891 pregnant women who underwent the 75 gm OGTT, 168 (18.9%) were diagnosed with GDM, with both fasting plasma glucose levels greater than or equal to 126 mg/dl and/or 2-hour postprandial glucose levels greater than or equal to 140 mg/dl used as cut-off values. Considering only the 2-hour plasma glucose for analysis, 144 (16.2%) had values greater than or equal to 140 mg/dl.

Stillbirth and the number of premature babies were higher in women with GDM.[11]. Women with GDM had a history of PCOS more frequently than the control group, but regarding body mass index, a history of PCOS did not show a significant relationship with GDM.[12]

In this study, we utilized the Perceived Stress Scale to assess mental stress among pregnant women, particularly those in rural areas. There has been no previous research exploring the relationship between mental stress and gestational diabetes, thus prompting the use of the Perceived Stress Scale in this study. Among the 244 antenatal mothers surveyed, 120 (49.2%) reported low stress levels, while 124 (50.8%) reported moderate stress levels. Interestingly, the study also revealed that 51% of antenatal mothers were unaware of gestational diabetes. This highlights the importance of raising awareness about gestational diabetes among pregnant women.

Previous studies have primarily been conducted in tertiary care centers, which may not accurately reflect the prevalence rate of gestational diabetes. Tertiary care centers often report higher prevalence rates due to referred cases from other healthcare facilities such as subcenters, primary health centers, and secondary care centers. This study, however, was conducted as a community-based study to accurately estimate the prevalence rate of gestational diabetes.

## CONCLUSION

This study reaffirms previous findings of a high prevalence rate of gestational diabetes in rural areas of Tamil Nadu, estimated at 14.8%. The identified risk factors include an increased number of pregnancies, being a skilled worker, belonging to the lower middle class, having a family history of diabetes, and chronic diseases such as hypertension, coronary artery disease, thyroid disorders, and polycystic ovary syndrome. Additionally, a history of previous surgery, both obstetric and non-obstetric, and low-calorie intake were identified as risk factors. To mitigate the risk of gestational diabetes, it is crucial to emphasize the importance of nutritional supplements, healthy food choices, balanced diets, and high protein intake before pregnancy, particularly during the prenatal period.

It is imperative to prioritize raising awareness about gestational diabetes among antenatal mothers, given that many are unaware of the condition. Despite the existence of a well-established healthcare system in rural areas, the nutritional status of pregnant women in these regions remains poor. Consequently, interventions aimed at enhancing nutritional intake and providing supplements through primary health centers (PHCs) and Integrated Child Development Services (ICDS) centers are essential. Additionally, promoting increased physical activity in conjunction with regular antenatal care can assist in regulating blood glucose levels and enhancing overall maternal well-being. These strategies should be given precedence to improve the health outcomes of pregnant women residing in rural areas.

## LIMITATIONS

Certain risk factors, such as familial structure and religious affiliation, were not accounted for in this study. Furthermore, there was a lack of continuous monitoring during both the antenatal and postnatal periods to evaluate potential fetal complications.

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