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# INVESTIGATING THE CORRELATION BETWEEN GESTATIONAL DIABETES MELLITUS AND URIC ACID

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**ABSTRACT**

**Background**: In the second or third trimester of pregnancy, there is an increased chance of developing gestational diabetes mellitus in some pregnant women who had high uric acid levels in the first trimester. There is a dearth of literature to evaluate this relationship among Indian girls.

**Aim**: The purpose of this study was to evaluate the early pregnancy blood uric acid level in order to predict the development of gestational diabetes mellitus.

**Methods**: 168 females who are less than 13 weeks pregnant in the first trimester of their pregnancy are evaluated in this study. The assessment of uric acid was conducted using the calorimetric technique, with a detection limit of 10 mg/dl. The DIPSI-recommended technique was applied during 24-48 gestation weeks in order to evaluate gestational diabetes mellitus. The main finding of the study was the relationship between blood uric acid levels and the development of gestational diabetes mellitus. The secondary finding was the relationship between the development of diabetes mellitus and high-risk variables, age, and body mass index (BMI).

**Results**: 168 pregnant women were evaluated in the research. With 51.19% (n=86) of the patients being female, 85.71% (n=144) having a BMI of less than 25 kg/m2, and 64.88% (n=109) of the subjects being primigravida, the majority of the research participants were between the ages of 21 and 25. Twenty participants, or 11.90%, exhibited high risk factors. In 16.07% of cases (n=27), serum uric acid levels were more than 3.5 mg/dl. Of the 13 study females, 7.73% had gestational diabetes mellitus, and 12 had elevated blood uric acid. With p=0.0003, increased age was the major risk factor for the development of gestational diabetes mellitus.

**Conclusions:** The current study suggests that when blood uric acid levels are greater than 3.5 mg/dl, pregnant women who have known high-risk factors for gestational diabetes mellitus are at risk of acquiring the disease. Additionally, elevated blood uric acid levels in the first trimester of pregnancy can serve as a trustworthy indicator for predicting the onset of gestational diabetes mellitus.

**Keywords:** diabetes mellitus, gestational diabetes mellitus, feto-maternal complications, pregnancy. Serum uric acid

## INTRODUCTION

In certain females, a certain degree of glucose intolerance is evident during or first experienced during pregnancy. This

illness is known as gestational diabetes mellitus. One important and significant pregnancy-related issue that is linked to both foetal and maternal death and morbidity is gestational diabetes mellitus.1

In all pregnant women, the prevalence of gestational diabetes mellitus ranges from 1% to 14%. In the Indian situation, there is a significant difference in the prevalence rates of gestational diabetes mellitus in pregnant women. The significantly varied range observed in Indian girls is about between <4% and 18%. According to national statistics, the overall prevalence of diabetes mellitus among Indians is rising quickly. India has an overall 7% prevalence rate of diabetes mellitus, with greater rates among urban vs rural populations, high rates among subjects with better socioeconomic level, and higher rates among subjects in older age groups.2,3 The prevalence of gestational diabetes mellitus is rising quickly, which can be linked to changes in the demographics of women who are no longer reproductive age as well as rising rates of obesity and advanced maternal age in these women.[4] Pre-gestational diabetes, also known as diabetes before pregnancy, has become more common in recent years, mostly as a result of an increase in the frequency of type 2 diabetes mellitus. According to statistics from the most recent literature, the weighted age-adjusted prevalence from the fourth National Family Health Survey was 1.3%, 2.4% in females over 35, and 1.8% in females with a BMI of at least 27.5 kg/m2.5,6

There is evidence linking a mild sensitivity to carbs or gestational diabetes mellitus to higher incidence of pregnancy complications for both the mother and the foetus. There is strong evidence from earlier research to suggest that uric acid is a significant risk factor for type 2 diabetes mellitus, particularly in females. This literature review is especially important during the first trimester of pregnancy since there is a 25%–35% drop in serum uric acid at this time, which is linked to an increase in GFR (glomerular filtration rate). As a result, a small percentage of pregnant women who have elevated blood uric acid levels in the first trimester run a higher risk of developing gestational diabetes mellitus in the second or third trimester.7,8

In order to prevent harmful effects of disease on both the mother and the foetus, the current study set out to evaluate the relationship between the development of gestational diabetes mellitus and the mother's serum uric acid concentration in the early stages of pregnancy.

**MATERIALS AND METHODS**

The objective of the current prospective observational study was to evaluate the serum uric acid level in the first trimester of pregnancy in order to predict the development of gestational diabetes mellitus. This information can be used to modify early steps for subject diagnosis and management in order to minimise the disease's harmful effects on the foetus and mother. The research participants came from the Institute's Department of General Medicine.

Prior to research participation, informed permission was obtained from all individuals, both verbally and in writing. 175 consenting female participants in the first trimester of pregnancy with a gestational age of less than 13 weeks were included in the research. Participants having a history of alcoholism or smoking, those using medicine that causes hyperuricemia, those with any medical condition, subjects with pre-existing diabetes mellitus, and subjects who did not give consent for study participation.

Following the research patients' final inclusion, a thorough medical history was taken, and the ANC profile evaluated all standard prenatal tests in addition to monitoring blood uric acid levels. The calorimetric test with a detection limit of 10 mg/dl was used to measure the level of uric acid in all research participants who were female. The DIPSI-recommended technique was employed to diagnose gestational diabetes mellitus between weeks 24 and 48 of pregnancy. Regardless of whether the individuals were fasting or not, they received 75 grammes of glucose, and their blood glucose levels were measured after two hours. Serum glucose levels above 1540 mg/dl were indicative of gestational diabetes mellitus in the patients.

Data on medical features, behavioural traits, and maternal sociodemographics were collected from every research participant. Along with these details, data was collected on maternal age, height, weight before to pregnancy, personal history, and family medical history. When measuring height in meters and weight in kilogrammes, maternal adiposity was determined using the BMI in kg/m2. The study's main finding was that there was a relationship between the incidence of prenatal diabetes mellitus and serum uric acid levels. Its secondary finding examined the relationship between high-risk variables, age, and BMI, and the development of gestational diabetes mellitus.

The chi-square test and SPSS software version 21.0 (IBM Corp., Armonk, NY, USA) were used for the statistical analysis of the collected data. The statistics were presented as percentage, frequency, mean, and standard deviation. An acceptable p-value for statistical significance was <0.05.

**RESULTS**

The objective of the current prospective observational study was to evaluate the serum uric acid level in the first trimester of pregnancy in order to predict the development of gestational diabetes mellitus. This information can be used to modify early steps for subject diagnosis and management in order to minimise the disease's harmful effects on the foetus and mother. 168 pregnant ladies were evaluated for the research. According to Table 1, the majority of study participants were between the ages of 21 and 25. Of them, 51.19% (n =86) were female, followed by 20.83% (n =35) who were from the 26 to 30 age range, 18.45% (n =31) who were from the >30 age range, and at least 9.52% (n =16) who were from the <20 age range.

Of the 144 females, 85.71% had a BMI of less than 25 kg/m2 and BMI of 25-29.9 kg/m2 was seen in 11.90% (n=20) females, and a 2.38% of the research individuals (n = 4) had a BMI of ≥30. 16.07% (n=27) of the research participants had serum uric acid levels greater than 3.5 mg/dl, whereas 83.92% (n=141) of the study females had values less than 3.5 mg/dl. In 20 research participants, or 11.90%, high-risk indicators were observed; in 148 study participants, or 88.09%, they were not. 64.88% of the study's 109 female participants were primigravida, while 35.11% of the study's 59 female participants were multigravida (Table 1).

When the demographic information of research participants with and without gestational diabetes mellitus was compared, it was observed that 7.69% (n=1) of those under the age of twenty had the condition, 30.76% (n=4) of those between the ages of twenty and fifty, and 7.69% (n=1) of those between the ages of thirty and sixty had it and 53.84% (n=7) subjects from >30 years of age range respectively. With p=0.0003, the difference was statistically significant. In terms of BMI, gestational diabetes was recorded in 33.33% (n=11) of study participants with a BMI <25 kg/m2, 1.19% (n=2) of subjects with a BMI 25–29.9 kg/m2, and none of the individuals with a BMI ≥30, respectively. Table 2 summarises the statistical non-significantness of the difference, which was p = 0.61.

The study's findings demonstrated that, when comparing the demographic information of research participants with and without gestational diabetes mellitus, 46.15% (n = 6) of primigravida subjects and 61.53% (n = 8) of multigravida subjects had gestational diabetes, a finding that was statistically non-significant (p = 0.48). Gestational diabetes mellitus was seen in 53.84% (n=7) of persons with high-risk factors for the condition and 46.15% (n=6) of those without high-risk factors.

With p<0.0001, the difference was statistically significant. Table 2 shows that gestational diabetes mellitus was seen in 92.30% (n=12) study individuals with serum uric acid levels >3.5 mg/dl and in 0.59% (n=1) patients with serum uric acid levels ≤ 3.5 mg/dl, indicating a statistically significant difference with p<0.0001.

**DISCUSSION**

In this current study, 168 pregnant women were evaluated. The study sample consisted primarily of individuals between the ages of 21 and 25. Specifically, 51.19% of the subjects were female, followed by 20.83% of subjects from 26 to 30 years old, 18.45% of subjects from > 30 years old, and at least 9.52% of subjects from < 20 years old (n = 16). This was comparable to research conducted in 2012 by Carolan M et al. and in 2013 by Qiu L et al where The bulk of the female participants in the current study were evaluated by the authors between the ages of 21 and 25.

85.71% (n=144) of the female research participants had a BMI of less than 25 kg/m2, 11.90% (n=20) had a BMI of 25–29.9 kg/m2, and 2.38% (n=4) had a BMI of 30 or higher. Of the research subjects, 16.07% (n=27) had serum uric acid levels >3.5 mg/dl, whereas 83.92% (n=141) of the study females had values ≤ 3.5 mg/dl. In study participants, high-risk variables were present in 11.90% (n=20) and absent in 88.09% (n=148) of the individuals, respectively. 35.11% (n=59) of the female participants in this study were multigravida, while 64.88% (n=109) of the female participants were primigravida.

These results were similar to those of studies conducted by Stewart FM et al. in 2007 and Khambule L et al. in 2019 that evaluated participants using demographic data similar to those of the current investigation. According to the study's findings, when the demographic information of study participants with and without gestational diabetes mellitus was

compared, it was found that, among those under the age of 20, 7.69% (n=1) had the condition, followed by 30.76% (n=4) in the age range of 21–25, 7.69% (n=1) in the age range of 26–30, and 53.84% (n=7) in the age range of >30.

With p=0.0003, the difference was statistically significant. Of the research patients, 33.33% (n=11) had gestational diabetes while their BMI was less than 25 kg/m2 in 1.19% (n=2) subjects with BMI 25-29.9 kg/m2, and in no subjects with BMI ≥30 respectively. With p=0.61, the difference was statistically not significant. The current study's findings were in line with studies conducted in 2018 by Lee KW et al. and in 2017 by Marchetti D et al. These studies indicated a high incidence of gestational diabetes mellitus in females throughout a wider age range.

When research participants with and without gestational diabetes mellitus were compared demographically, it was found that 46.15% (n=6) of primigravida individuals and 61.53% (n=8) of multigravida patients had gestational diabetes, a finding that was statistically non-significant (p=0.48). Gestational diabetes mellitus was seen in 53.84% (n=7) of persons with high-risk factors for the condition and 46.15% (n=6) of those without high-risk factors.

The difference was statistically highly significant with p<0.0001. In subjects with serum uric acid levels of >3.5 mg/dl, gestational diabetes mellitus was seen in 92.30% (n=12) research **participants**, and in 0.59% (n=1) of them, a statistically significant difference with p<0.0001 was seen in blood uric acid levels of ≤ 3.5 mg/dl. These findings corroborated those of Kanguru L et al. (2015) and Tovar A et al. (2009, 2009), who found that females with high-risk characteristics and blood uric acid levels more than 3.5 mg/dl had a higher prevalence of gestational diabetes mellitus.

## CONCLUSIONS

Taking into account the limitations of the research, it is concluded that prenatal women who have known high-risk factors for gestational diabetes mellitus are at a higher chance of acquiring the condition when their blood uric acid levels are greater than 3.5 mg/dl. Additionally, elevated blood uric acid levels in the first trimester of pregnancy can serve as a trustworthy indicator for predicting the onset of gestational diabetes mellitus. In the future, further longitudinal research is necessary.

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| **Characteristics** | **Number (n=168)** | **Percentage (%)** |
|---|---|---|
| **Age range (years)** | | |
| <20 | 16 | 9.52 |
| 21-25 | 86 | 51.19 |
| 26-30 | 35 | 20.83 |
| >30 | 31 | 18.45 |
| **Serum uric acid levels (mg/dl)** | | |
| >3.5 | 27 | 16.07 |
| ≤ 3.5 | 141 | 83.92 |
| **High-risk factors** | | |
| Present | 20 | 11.90 |
| Absent | 148 | 88.09 |
| **BMI (kg/m2)** | | |
| <25 | 144 | 85.71 |
| 25-29.9 | 20 | 11.90 |
| ≥30 | 4 | 2.38 |
| **Gravida** | | |
| Primigravida | 109 | 64.88 |
| Multigravida | 59 | 35.11 |

**Table 1: Demographic data of study participants**

| **Demographics** | **Gestational diabetes mellitus** | | | | **Total** | | **p-value** |
|---|---|---|---|---|---|---|---|
| | **Absent** | | **Present** | | **n=168** | **%** | |
| | **n=155** | **%** | **n=13** | **%** | | | |
| **Age range (years)** | | | | | | | |
| <20 | 15 | 9.67 | 1 | 7.69 | 16 | 9.52 | **0.0003** |
| 21-25 | 82 | 52.90 | 4 | 30.76 | 86 | 51.19 | |
| 26-30 | 34 | 20.23 | 1 | 7.69 | 35 | 20.83 | |
| >30 | 24 | 14.28 | 7 | 53.84 | 31 | 18.45 | |
| **Serum uric acid levels (mg/dl)** | | | | | | | |
| >3.5 | 15 | 9.67 | 12 | 92.30 | 27 | 16.07 | **<0.0001** |
| ≤ 3.5 | 140 | 83.33 | 1 | 0.59 | 141 | 83.92 | |
| **High-risk factors** | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Present | 13 | 8.38 | 7 | 53.84 | 20 | 11.90 | **<0.0001** |
| Absent | 142 | 91.61 | 6 | 46.15 | 148 | 88.09 | |
| **BMI (kg/m2)** | | | | | | | |
| <25 | 133 | 85.80 | 11 | 33.33 | 144 | 85.71 | 0.61 |
| 25-29.9 | 18 | 10.71 | 2 | 1.19 | 20 | 11.90 | |
| ≥30 | 4 | 2.58 | - | | 4 | 2.38 | |
| **Gravida** | | | | | | | |
| Primigravida | 103 | 66.45 | 6 | 46.15 | 109 | 64.88 | 0.48 |
| Multigravida | 51 | 30.35 | 8 | 61.53 | 59 | 35.11 | |

**Table 2: Comparison of demographic data in study subjects with or without gestational diabetes mellitus**