INTRODUCTION

According to American College of Obstetrics and Gynaecology, gestational diabetes mellitus (GDM) is any degree of glucose intolerance that either commences or is first diagnosed in pregnancy. This definition does not exclude the possibility that the diabetes may have existed but been recognized before pregnancy. Conventionally, quoted prevalence figures are around 5–7% and the prevalence of GDM directly reflects that of Type 2 diabetes in a given population and, therefore, can be expected to be rising. With newer thresholds, the prevalence in general obstetric population may be up to 18%. However, the prevalence of GDM in India varied from 3.8% to 21% in different parts of the country depending on geographical locations and diagnostic methods.

ABSTRACT

Background: Gestational diabetes mellitus (GDM) is associated with hypertension, preeclampsia, stillbirth, macrosomia, unexplained intrauterine death, instrumental and traumatic delivery leading to both maternal and foetal injuries, and increased risk of maternal and neonatal infections. The present study was conducted at Rajendra Institute of Medical Sciences, Ranchi to determine the prevalence of Gestational Diabetes Mellitus (GDM) and its associated risk factors in tribal population of Jharkhand. Aims and Objectives: The aim of the study was to determine the prevalence of GDM and to analyze its association with various risk factors. Materials and Methods: Detailed history of all patients was taken with emphasis on genetic and family history and history of the previous pregnancies. All the patients were screened by the single step 75 gm 2 hours oral glucose tolerance test (OGTT) as recommended by the World Health Organization. GDM was diagnosed if 2 hours PG is ≥140 mg/dL. Results: Most patients of GDM were from upper middle class 45.45%, followed by lower middle class (27.27%) and upper lower class (18.18%). For the non-GDM patients, most patients were from upper lower class (55.055%), followed by upper middle (24.71%). The prevalence of GDM was 12.12 % in the tribal population as compared to non-tribal population (10.44 %). In present study, in majority (89.00 %) of study subjects, result of 75 gm OGTT was negative. Result of 75 gm OGTT was positive in only 11 out of 100 study subjects (11.00 %). Conclusion: Tribal population in Jharkhand has very poor access to health-care services of the state. This study is first of its kind in our state which will set as an eye opener to further deliver better health-care facilities at grassroot level in Jharkhand.

Keywords: Tribal; Pregnant; Gestational diabetes mellitus; Glucose tolerance test; Risk factors.

BACKGROUND

Gestational diabetes mellitus (GDM) is associated with hypertension, preeclampsia, stillbirth, macrosomia, unexplained intrauterine death, instrumental and traumatic delivery leading to both maternal and foetal injuries, and increased risk of maternal and neonatal infections. The present study was conducted at Rajendra Institute of Medical Sciences, Ranchi to determine the prevalence of Gestational Diabetes Mellitus (GDM) and its associated risk factors in tribal population of Jharkhand.
GDM is associated with hypertension, preeclampsia, stillbirth, macrosomia, unexplained intrauterine death, instrumental and traumatic delivery leading to both maternal and fetal injuries, and increased risk of maternal and neonatal infections.

Indian data on GDM are scarce and do not give actual picture. Furthermore, there is no data regarding status of GDM in tribal population. Hence this study was undertaken to study the prevalence of GDM in tribal population and compare it with non-tribal counterparts. It has been demonstrated that perinatal and maternal morbidity associated with GDM can be reduced to a great extent by predicting GDM by knowing the presence of risk factors in the previous pregnancy and systemic approach for diagnosis and management of the disease.

Hence, the present study was conducted at Rajendra Institute of Medical Sciences, Ranchi to determine the prevalence of GDM and its associated risk factors in tribal population of Jharkhand. This is a tertiary care center which caters to the health requirement of the entire state.

Aims and objectives

Aim
The aim of the study was to determine the prevalence of GDM.

Primary objective
The primary objective of the study was to analyze its association with various risk factors.

Secondary objective
The secondary objective of the study was to determine maternal and fetal outcome in cases of GDM.

MATERIALS AND METHODS

Study type
This was a cross-sectional and prospective study.

Study place
All patients coming to outpatient department for antenatal care visit in the Department of Obstetrics and Gynaecology, Ranchi.

Study duration
The duration of the study was March 2019–February 2020.

Inclusion criteria
The study included antenatal women in 24th–28th week of gestation irrespective of maternal age and gravidity, presence or absence of clinical or historic risk factors for GDM, and irrespective of the time of last meal.

Exclusion criteria
The following criteria were excluded from the study: 1. Women on any medical condition or drug therapy that can alter blood glucose level or with pre-GDM. 2. Patient in labor 3. Patient with major chronic disease such as tuberculosis, malignancy, renal failure, congestive heart failure, and advanced liver failure.

Sampling method
Sample size was calculated for continuous outcome and means by the statistical formula as follow;

\[ n = \frac{z^2 \cdot p \cdot (1-p)}{d^2} \]

z = standard normal variate at level of significance (i.e., 1.96 for 95% confidence level)

p = Expected prevalence or proportion = 7% = 0.07 (since traditional prevalence is taken to be 5–7%) (3)

d = Precision = 0.05 (Type 1 error)

Therefore, \[ n = \frac{z^2 \cdot p \cdot (1-p)}{d^2} = \frac{(1.96)^2 \cdot 0.07 \cdot (1-0.07)}{(0.05)^2} = 100.035 = 100. \]

Detailed history of all patients was taken with emphasis on genetic and family history and history of previous pregnancies. All the patients were screened by the single step 75 g 2 h oral glucose tolerance test (OGTT) as recommended by the World Health Organization. 4 In the antenatal clinic, pregnant women after undergoing preliminary clinical examination were given 75 g oral glucose load and irrespective of time of the last meal. A venous sample was collected at 2 h for estimation of plasma glucose by glucose oxidase method. GDM was diagnosed if 2 h PG is ≥140 mg/dL.

RESULTS

Out of total 100 patients in study population, 11 were found to be having GDM. Thirty-three (33%) patients of the study population were tribal and remaining 67 (67%) were non-tribal; among 33 tribal patients, four patients had GDM. Hence, the prevalence of GDM in tribal population was 12.12% and 10.44% (7/67) in non-tribal population. The overall prevalence of GDM in the whole study population was found to be 11%.

The mean age of the study population without GDM was 25.75±4.2 years and for population with GDM was
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29.55±3.96. The correlation between the increasing age and prevalence of GDM was very significant in the whole study population. The prevalence of GDM was found to be increasing with age in the tribal population also but it is not statistically significant (P=0.002).

Twenty-eight (28%) of the patients were primigravida and remaining 72 (72%) patients were multigravida in the study population. Of these three primigravida and eight multigravida were found to have GDM (P=0.526). The prevalence of GDM was more in multigravida than in the primigravida in this study. The prevalence of GDM in multigravida was found to be 11.11% (8/72) while it was only 10.71% (3/28) in case of primigravida, mean body mass index (BMI) in the study population was found to be 23.28±3.61 kg/m² and for GDM population was 28±5.14 kg/m². The prevalence of GDM increased with BMI (P=0.007) (Tables 1 and 2).

Most patients of GDM were from upper middle class 45.45%, followed by lower middle class (27.27%) and upper lower class (18.18%). For the non-GDM patients, most patients were from upper lower class (55.055%), followed by upper middle (24.71%) (Table 3).

Only five patients out of 11 (45.45%), GDM had family history of h/o DM in first degree relative in whole study population. While out of 1 (25%) GDM patient in the tribal population, out of four patients (P=0.161) had family h/o DM in first degree relative, 4 out of 7 (57.14%) (P=0.213) non-tribal GDM patients had family history of DM. Association in first degree relative, 4 out of 7 (57.14%) (P=0.213) non-tribal GDM had family history of DM. Association of family h/o GDM was not found to be significant.

The prevalence of GDM was 12.12% in the tribal population as compared to non-tribal population (10.44%). This shows that the prevalence of GDM was almost comparable.

For the tribal population, there was no association of GDM with previous h/o GDM or previous congenital anomaly, but previous abortion, pre-eclampsia, pre-term delivery, intrauterine device (IUD), macrosomia, polyhydramnios, and obesity were also found to be significant (25% each) (P<0.05). Association with family h/o DM was not significant (P=0.161).

For the non-tribal population, GDM was significantly associated with the previous history of abortion (28.75%), congenital anomaly (14.29%), pre-term delivery (14.29%), IUD (14.29%), macrosomia (85.71%), polyhydramnios (71.4%), obesity (71.4%) and previous h/o DM (42.86%), and preeclampsia (42.86%) P<0.05 whereas association with family h/o DM was not significant (P=0.213).

The most prevalent risk factor in non-tribal population was history of macrosomia (85.71%) while least prevalent risk factors were congenital anomaly (14.29%) in the previous pregnancy, pre-term delivery (14.29%), and h/o IUD in previous pregnancy (14.29%). Risk factors in tribal GDM population (previous abortion, previous preterm delivery, IUD, macrosomia, polyhydramnios, obesity, and preeclampsia) had almost equal prevalence (25%). Association of family h/o GDM was not found to be significant, either in non-tribal or tribal GDM patients (Table 4).

In the present study, in majority (89.00%) of study subjects, result of 75 g OGTT was negative. Result of 75 g OGTT was positive in only 11 out of 100 study subjects (11.00%) (Table 5).

All patients of GDM were advised dietary management. Non-tribal with GDM were advised insulin (85.71%) and OHA (28.571%). Tribal with GDM 50% was advised insulin and 25% were advised OHA. Overall 100% patients were on dietary control, 72.72% patients were on insulin, and 27.27% were on OHA (Table 6).

Distribution of mode of delivery was comparable between study subjects without and with GDM (both tribal and non-tribal). Lower segment cesarean section (LSCS): 62.92% vs. 72.73%, respectively, vaginal: 37% versus 27.27%, respectively. In study subjects without GDM, 62.92% underwent LSCS and 37% had vaginal delivery (Table 7).

Proportion of study subjects with GDM had significantly higher incidence of IUD, infection, polyhydramnios, and preeclampsia as compared to study subjects without GDM. When comparing non-tribal with tribal GDM IUD (14.29% vs. 25%), infection (42.86%), polyhydramnios

| Table 1: Distribution of sociodemographic characteristics of study subjects |
|------------------|--------|--------|
| Ethnicity        | Frequency | Percentage |
| Tribal           | 33      | 33.00   |
| Non-tribal       | 67      | 67.00   |
| Parity           |         |         |
| Primi            | 28      | 28.00   |
| Multi            | 72      | 72.00   |
| Socioeconomic status |     |      |
| Upper middle     | 27      | 27.00   |
| Lower middle     | 13      | 13.00   |
| Upper lower      | 51      | 51.00   |
| Lower            | 9       | 9.00    |
| Age (years)      |         |         |
| Mean±SD          | 25.75±4.2 | 26 (22-29) |
| Median (25th-75th percentile) | 19-37 |
| Body mass index (kg/m²) | 23.28±3.61 | 22 (21-24) |
| Mean±SD          | 19-38   | 103 |
and we found the above data. The study subjects without GDM had less complications of IUD (4.49%), infection (5.62%), polyhydramnios (1.12%), and preeclampsia (4.49%) (Table 8).

Most patients with GDM delivered fetus with birth weight from 2.5 kg to 3.5 kg. Non-tribal and tribal without GDM also had most babies from 2.5 kg to 3.5 kg. Mean±SD of birth weight (kg) in study subjects without GDM for non-tribal and tribal was 2.62±0.66 and 2.52±0.55 and study subjects with GDM for non-tribal and tribal was 3±0.96 and 3±0.86, respectively. Hypoglycemia was significantly higher in tribal subjects with GDM (50%) as compared to non-tribal subjects with GDM (14.29%). There was only one case of congenital anomaly and birth injury in non-tribal population without GDM. There was 1 (25%) case of growth restriction in tribal population with GDM, 1 (14.29%) case in non-tribal GDM and 2 (3.33%) cases in non-tribal population without GDM.

### Table 2: Association of sociodemographic characteristics with GDM

| Sociodemographic characteristics | Study subjects without GDM (n=89) | Study subjects with GDM (n=11) | Total | P value |
|---------------------------------|-----------------------------------|-------------------------------|-------|--------|
| Ethnicity                       |                                   |                               |       |        |
| Tribal                          | 29                                | 4                             | 38    |        |
| Non-tribal                      | 60                                | 7                             | 67    |        |
| Parity                          |                                   |                               |       |        |
| Primi                           | 25                                | 3                             | 28    | 0.526  |
| Multi                           | 65                                | 8                             | 72    |        |
| Socioeconomic status            |                                   |                               |       |        |
| Upper middle                    | 22 (24.71%)                       | 5 (45.45%)                    | 27    | 0.0009 |
| Lower middle                    | 10 (11.23%)                       | 3 (27.27%)                    | 13    |        |
| Upper lower                     | 49 (55.055%)                      | 2 (18.18%)                    | 51    |        |
| Lower                           | 8 (8.98%)                         | 1 (9.09%)                     | 9     |        |
| Age (years)                     |                                   |                               |       |        |
| MeansSD                         | 25.75±4.2                         | 29.55±3.96                    | 25.85±4.35 | 0.002 |
| Median (25th–75th percentile)   | 26 (22–29)                        | 30 (26.5–32)                  | 26 (22–29) |      |
| Range                           | 19–37                             | 24–36                         | 19–37 |        |
| Body mass index (kg/m²)         |                                   |                               |       |        |
| MeansSD                         | 23.28±3.61                        | 28±5.14                       | 23.38±3.63 | 0.007*|
| Median (25th–75th percentile)   | 22 (21–24)                        | 26 (24–32.5)                  | 22 (21–24) |      |
| Range                           | 19–38                             | 22–37                         | 19–38 |        |

GDM: Gestational diabetes mellitus

### Table 3: Association of sociodemographic characteristics with GDM

| Risk factor          | Study subjects without GDM (n=89) | Study subjects with GDM (n=11) | Total | P value |
|----------------------|-----------------------------------|-------------------------------|-------|--------|
| Abortion             | 5                                 | 2 (28.75%)                    | 2     | 0.000  |
| Congenital anomaly   | 2                                 | 1 (14.29%)                    | 1     | 0.008  |
| Pre-term delivery    | 4                                 | 1 (14.29%)                    | 1     | 0.000  |
| IUD                  | 1                                 | 1 (14.29%)                    | 1     | 0.000  |
| Macrosomia           | 3                                 | 6 (85.71%)                    | 6     | 0.000  |
| Polyhydramnios       | 2                                 | 5 (71.4%)                     | 5     | 0.000  |
| Obesity              | 7                                 | 5 (71.4%)                     | 5     | 0.000  |
| Previous h/o GDM     | 4                                 | 3 (42.86%)                    | 3     | 0.000  |
| Family h/o DM        | 1                                 | 4 (57.14%)                    | 4     | 0.000  |
| Pre-eclampsia        | 3                                 | 3 (42.86%)                    | 3     | 0.000  |

GDM: Gestational diabetes mellitus, IUD: Intrauterine device

### Table 4: Distribution of result of 75 g OGTT of study subjects

| Result of 75 g OGTT | Frequency | Percentage |
|--------------------|-----------|------------|
| Negative           | 89        | 89.00      |
| Positive           | 11        | 11.00      |
| Total              | 100       | 100.00     |

OGTT: Oral glucose tolerance test

(57.14% vs. 75%), and pre-eclampsia (28.75% vs. 25%), we found the above data. The study subjects without GDM had less complications of IUD (4.49%), infection (5.62%), polyhydramnios (1.12%), and preeclampsia (4.49%) (Table 8).

Most patients with GDM delivered fetus with birth weight from 2.5 kg to 3.5 kg. Non-tribal and tribal without GDM also had most babies from 2.5 kg to 3.5 kg. Mean±SD of birth weight (kg) in study subjects without GDM for non-tribal and tribal was 2.62±0.66 and 2.52±0.55 and study subjects with GDM for non-tribal and tribal was 3±0.96 and 3±0.86, respectively. Hypoglycemia was significantly higher in tribal subjects with GDM (50%) as compared to non-tribal subjects with GDM (14.29%). There was only one case of congenital anomaly and birth injury in non-tribal population without GDM. There was 1 (25%) case of growth restriction in tribal population with GDM, 1 (14.29%) case in non-tribal GDM and 2 (3.33%) cases in non-tribal population without GDM.

### Table 5: Distribution of treatment for diabetes control of study subjects

| Treatment for diabetes control (n=11) | Non tribal with GDM | Tribal with GDM | Frequency |
|--------------------------------------|---------------------|-----------------|-----------|
| Diet                                 | 7 (100%)            | 4 (100%)        | 100%      |
| Insulin                              | 6 (85.71%)          | 2 (50%)         | 72.72%    |
| OHA                                  | 2 (28.571%)         | 1 (25%)         | 27.27%    |

GDM: Gestational diabetes mellitus
Admission in Neonatal intensive care unit (NICU): 28.57% versus 50%, respectively, for non-tribal GDM with tribal GDM. Distribution of reason of admission in NICU was comparable between non-tribal GDM study subjects with tribal GDM (Birth asphyxia: 28.57% vs. 50% respectively, Bir, Hyperbilirubinemia: 28.75% vs. 50%, respectively, Preterm: 14.29% vs. 25%, respectively). Tribal population with GDM had no case of intrauterine growth restriction (IUGR) or low birth weight.

### DISCUSSION

The present hospital-based prospective study was conducted on 100 pregnant women with the aim of determining GDM prevalence in tribal population of Jharkhand.

In the present study, GDM was seen in 11 cases (11%). Other studies have shown varied results. In the study by Desai and Sonawane, GDM was 17.5%, Saxena et al., was 7.87%, Tripathi et al., (7.8%), Sridhar and Nagmani (10.2%) by Diabetes in Pregnancy Study Group of India recommendation as a diagnostic test. The findings of our study and various studies show that the prevalence of GDM can varying as per the population type. Overall studies have reported a prevalence rate of 1–19% among pregnancies for GDM.

Thirty-three (33%) patients of the study population were tribal and remaining 67 (67%) were non-tribal. Among 33 tribal patients, four patients had GDM. Hence, the prevalence of GDM in tribal population in this study was 12.12% and 10.44% in non-tribal population. The prevalence of GDM in tribal population was found to be 14.63%, while it is 10.06% in non-tribal population as per study by Sharma et al., which was consistent with our study. The mean age of the study population without GDM was 25.75±4.2 years and for population with GDM was 29.55±3.96. This is consistent with the findings by Nayak et al., as women with GDM were older as compared to the non-GDM women (25.67 vs. 24.24, P=0.08); however, difference was not significant. Song et al., also found that women with GDM were significantly higher in age than those

| Mode of delivery | Study subjects without GDM (n=89) | Tribal subjects with GDM (n=4) | Non tribal subjects with GDM (n=7) |
|------------------|-------------------------------|-------------------------------|----------------------------------|
| LSCS             | 56 (62.92%)                   | 3 (75%)                       | 5 (71.42%)                       |
| Vaginal          | 33 (37%)                      | 1 (25%)                       | 2 (28.57%)                       |
| Total            | 89 (100%)                     | 11 (100%)                     | 100 (100%)                       |

GDM: Gestational diabetes mellitus, LSCS: Lower segment cesarean section

| Maternal outcome | Study subjects without GDM (n=89) | Non tribal subjects with GDM (n=7) | Tribal subjects with GDM (n=4) |
|------------------|----------------------------------|----------------------------------|-------------------------------|
| Miscarriage      | 0 (0%)                           | 0 (0%)                           | 0 (0%)                        |
| IUD              | 4 (4.49%)                        | 1 (14.29%)                       | 1 (25%)                       |
| Infection        | 5 (5.62%)                        | 3 (42.86%)                       | 2 (50%)                       |
| Polyhydramnios   | 1 (1.12%)                        | 4 (57.14%)                       | 3 (75%)                       |
| Pre-eclampsia    | 4 (4.49%)                        | 2 (28.57%)                       | 1 (25%)                       |

GDM: Gestational diabetes mellitus, IUD: Intrauterine device

| Fetal outcome | Non-tribal without GDM | Non-tribal with GDM | Tribal with GDM | Tribal without GDM |
|--------------|------------------------|---------------------|-----------------|--------------------|
| Birth weight |                        |                     |                 |                    |
| <1.5 kg      | 1 (1.67%)              | 1 (14.28%)          | 0               | 1 (3.44%)          |
| 1.5–<2.5 kg  | 10 (10.67%)            | 1 (14.28%)          | 1 (25%)         | 17 (58.6%)         |
| 2.5–3.5 kg   | 36 (30%)               | 4 (57.14%)          | 2 (50%)         | 20 (68.9%)         |
| >3.5 kg      | 5 (33.33%)             | 1 (14.28%)          | 1 (25%)         | 2 (6.89%)          |
| Means±SD     | 2.62±0.66              | 3±0.96              | 3±0.86          | 2.5±0.55           |
| Median (25th–75th) | 2.5 (2.225–3) | 3.3 (2.375–3.55) | 3.1 (2.375–3.35) | 2.3 (2.3–3) |
| Range        | 1–4.4                  | 1.25–4.4            | 1.24–4.2        | 1–4.2              |

| Fetal complications | Non-tribal without GDM | Non-tribal with GDM | Tribal with GDM | Tribal without GDM |
|---------------------|------------------------|---------------------|-----------------|--------------------|
| Congenital anomaly  | 1 (1.67%)              | 1 (14.29%)          | 1 (25%)         | 0                  |
| Growth restriction  | 2 (3.33%)              | 1 (14.29%)          | 1 (25%)         | 0                  |
| Birth injury        | 1 (1.67%)              | 0                   | 0               | 0                  |
| Hypoglycemia        | 0                      | 1 (14.29%)          | 2 (50%)         | 0                  |
| Admission in NICU   | 14 (23.3%)             | 2 (28.57%)          | 2 (50%)         | 10 (34.48%)        |

| Reason for NICU admission | Non-tribal without GDM | Non-tribal with GDM | Tribal with GDM | Tribal without GDM |
|---------------------------|------------------------|---------------------|-----------------|--------------------|
| Respiratory distress      | 0                      | 2 (50%)             | 2 (50%)         | 0                  |
| Congenital anomaly        | 1 (1.67%)              | 0                   | 0               | 0                  |
| Hyperbilirubinemia        | 3 (5%)                 | 2 (50%)             | 2 (50%)         | 2 (6.89%)          |
| IUGR                      | 2 (3.33%)              | 0                   | 1 (3.44%)       | 0                  |
| Low birth weight          | 1 (1.67%)              | 1 (14.29%)          | 1 (25%)         | 2 (6.89%)          |
| Pre-term                  | 7 (11.67%)             | 1 (14.29%)          | 1 (25%)         | 2 (6.89%)          |
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Mean BMI in the study population was found to be 23.28±3.61 kg/m² and for GDM population was 28.5±14 kg/m². The prevalence of GDM increased with BMI (P=0.007). Among other studies, Nayak et al.,\textsuperscript{10} also found similar findings, as women; however, difference was not significant. This is consistent with Song et al.,\textsuperscript{11} who also found that women with GDM were significantly higher BMI than those without GDM (21.5 vs. 20.5, P<0.001). Even Fareed et al.,\textsuperscript{11} found that women with GDM had significantly more cases with BMI 26–30 kg/m² (61 vs. 20) and >30 kg/m² (17 vs. 1) (P=0.0000001).

Most patients of GDM were from upper middle class (45.45%), followed by lower middle class (27.27%) and upper lower class (18.18%). For the non GDM patients, most patients were from upper lower class (55.055%), followed by upper middle (24.71%) (P=0.0009).

Swaminathan et al.,\textsuperscript{14} reported that majority of the women with gestational diabetes belonged to upper class (35%), Song et al.,\textsuperscript{11} found that there was no significant association between household income and GDM, Al-Shaikh et al.,\textsuperscript{13} reported that when GDM pregnant women were compared with without GDM women in terms of three variables (monthly income and ownership of house and car), there was a significant difference between two groups (P<0.001). Knowler et al.,\textsuperscript{16} also found significant association of GDM with lower socioeconomic status. In many studies from developed and developing countries, lower socioeconomic status was observed to be a risk factor for GDM due to insufficient access and quality of healthcare. Another risk factor is obesity. Women who have higher income can afford more food in pregnancy, resulting in obesity.\textsuperscript{11}

Twenty-eight (28%) of the patients were primigravida and remaining 72 (72%) patients were multigravida in the study population. Of these three primigravida and eight multigravida were found to have GDM (P=0.526). The prevalence of GDM was more in multigravida than in the primigravida in this study. The prevalence of GDM in multigravida was found to be 11.11% (8/72) while it was only 10.71% (3/28) in the case of primigravida. Nayak et al.,\textsuperscript{10} who also found similar findings, as women with GDM had comparable parity as compared to the non-GDM women (53% vs. 51%, P=0.34). Similar to this, Muche et al.,\textsuperscript{12} also reported that women with GDM were comparable in parity with that of non-GDM women as majority were nullipara in both groups (40.5% vs. 50.8%, P=0.052). However, Song et al.,\textsuperscript{11} found a significant association between parity and GDM. There were significantly more multipara in women with GDM (16.2% vs. 9.4%, P<0.001).

The parity, specifically grand multiparity (≥5 live births), had positive association with the incidence of diabetes. Nulliparity may be associated with diabetes due to underlying insulin resistance and beta-cell dysfunction.\textsuperscript{17}

The most prevalent risk factor in non-tribal population was history of macrosomia (85.71%) while least prevalent risk factors were congenital anomaly (14.29%) in previous pregnancy, pre-term delivery (14.29%), and h/o IUD in previous pregnancy (14.29%). Risk factors in tribal GDM population (previous abortion, previous pre-term delivery, IUD, macrosomia, polyhydramnios, obesity, and pre-eclampsia) had almost equal prevalence (25%). Association of family h/o GDM was not found to be significant, either in non-tribal or tribal GDM patients.

Among other studies, Swaminathan et al.,\textsuperscript{14} reported that in women with gestational diabetes, age was the strongest factor associated with GDM, followed by BMI, household wealth, caste, and hypertension. The OR for GDM was 2.37 for women aged ≥35 years in comparison to women of 15–19 years age. In women with BMI >27.5 kg/m², the OR for GD was 1.74 in comparison to those with BMI <18.5 kg/m². There was positive association between wealth and GDM, the OR being 2.27 for households in the highest wealth quartile in comparison to lowest. In a meta-analysis by Lee et al.,\textsuperscript{18} the risk factors of GDM were history of previous GDM; macrosomia; and congenital anomalies. Other risk factors were BMI ≥25 kg/m²; pregnancy-induced hypertension; family history of diabetes; history of stillbirth; polycystic ovary syndrome; history of abortion; age ≥25; multiparity ≥2; and history of preterm delivery. In a similar study by Li et al.,\textsuperscript{19} the risk factors for GDM were “advanced age (≥30 year), gestational BMI gain from pre-pregnancy to 15–20 weeks of gestation (25–30 kg/m²), history of GDM, and thyroid diseases.

Management and outcomes
All patients of GDM were advised dietary management. Non-tribal with GDM was advised insulin (85.71%) and OHA (28.571%). Among tribal with GDM, 50% were advised insulin and 25% were advised OHA. Overall 100% patients were on dietary control, 72.72% patients were on insulin, and 27.27% were on OHA.
In the previous studies also, dietary modification was the main component of treatment in women with GDM. In the study by Nayak et al.,\(^1\) most of the women were managed with lifestyle modification alone. Insulin was needed in 10% of the women.

Hirst et al.,\(^2\) reported that out of the 164 women diagnosed with GDM, 11 (6.7%) were on insulin by the time of delivery.

Distribution of mode of delivery was comparable between study subjects without and with GDM (both tribal and non-tribal) (LSHC: 62.92% vs. 72.73%, respectively, vaginal: 37% vs. 27.27%, respectively). In the study subjects without GDM, 62.92% underwent vaginal delivery. Tribal population with GDM had greater incidence of LSHC, which may be due to obstetrical causes.

Nayak et al.,\(^1\) who found that GDM mothers and non-GDM mothers had comparable primary LSHC (17% vs. 13.6%) and operative vaginal delivery (12% vs. 10.4%). O’Sullivan et al.,\(^3\) reported that when compared with the women without GDM, women with GDM had significantly more neonates with cesarean section (37.2% vs. 24.9%) and significantly lesser normal vaginal deliveries (57.9% vs. 51.4%). Muche et al.,\(^4\) also found that the risk of cesarean delivery was higher in pregnant women with GDM than women without GDM by 67.00%.

The previous studies by Metzger et al.,\(^5\) and Gorgal et al.,\(^6\) also demonstrated that the risk for cesarean delivery was high among GDM patients; for instance, GDM increased the incidence of CS from 30% to 35%.\(^1\) Although GDM alone is not an indication for CS before 38 weeks of gestation, it becomes evident that CS is a priority choice for many obstetricians due to different maternal and fetal complications arising from GDM. CS can prevent poor obstetric outcomes and be a life-saving procedure for both the mother and the fetus. However, there is a growing concern about unnecessary CS that leads to risks for maternal morbidity, neonatal death, and neonatal admissions into intensive care units.\(^10\)

Proportion of study subjects with GDM had significantly higher incidence of IUD, infection, polyhydramnios, and preeclampsia as compared to study subjects without GDM. When comparing non-tribal with tribal GDM IUD (14.29% vs. 25%), infection (42.86%), polyhydramnios (57.14% vs. 75%), and preeclampsia (28.75% vs. 25%), we found the above data. Study subjects without GDM had less complications of IUD (4.49%), infection (5.62%), polyhydramnios (1.12%), and pre-eclampsia (4.49%).

The trend of more complications in women with GDM is in line with the previous studies. Nayak et al.,\(^1\) also reported that women with GDM had significantly more polyhydramnios (6% vs. 0.5%), comparable hypertensive disorders of pregnancy (4.8% vs. 1.8%).

O’Sullivan et al.,\(^3\) that when compared with the women without GDM, women with GDM had gestational hypertension (13.8% vs. 7.5%), pre-eclampsia (6.3% vs. 4%) and polyhydramnios (3.4% vs. 0.8%). Fareed et al.,\(^7\) found that compared to women without GDM, those with GDM had more polyhydramnios (47 vs. 3), pre-term labor (23 vs. 5), pre-eclampsia (44 vs. 6), antepartum haemorrhage (6 vs. 1), IUGR (3 vs. 1), postpartum hemorrhage (1 vs. 0), and wound infection (1 vs. 1).

Most patients with GDM delivered fetus with birth weight from 2.5 kg to 3.5 kg. Non-tribal and tribal without GDM also had most babies from 2.5 kg to 3.5 kg. Mean±SD of birth weight (kg) in study subjects without GDM for non-tribal and tribal was 2.62±0.66 and 2.52±0.55 and study subjects with GDM for non-tribal and tribal was 3±0.96 and 3±0.86, respectively. Nayak et al.,\(^10\) reported that in comparison to the women without GDM, women with GDM had comparable mean birth weight (3.01 vs. 3 kg). Fareed et al.,\(^7\) found that women with GDM had significantly more cases with weight >4 kg (17 vs. 2) which was somewhat consistent with our study.

Hypoglycemia was significantly higher in tribal subjects with GDM (50%) as compared to non-tribal subjects with GDM (14.29%). There was only one case of congenital anomaly and birth injury in non-tribal population without GDM. There was 1 (25%) case of growth restriction in tribal population with GDM, 1 (14.29%) case in non-tribal GDM and 2 (3.33%) cases in non-tribal population without GDM.

O’Sullivan et al.,\(^3\) reported that when compared with the women without GDM, women with GDM had significantly more neonates with macrosomia (23.9% vs. 17%), neonatal hypoglycaemia (2.4% vs. 0.6%), and neonatal respiratory distress (3.6% vs. 1.8%), and comparable small for gestational age (5.8% vs. 4.4%), and neonatal jaundice (5.8% vs. 6.7%).

Fareed et al.,\(^7\) found that more neonatal complications were present in neonates of diabetic women. Prematurity and neonatal hypoglycaemia were present in 31% and 27% babies in GDM group. About 11% had birth asphyxia and 6% had jaundice. Fetal macrosomia was present among 17% neonates of GDM group and 2% of non-GDM group. Congenital deformity was present in 2% babies of GDM group and 1% of non-GDM group.

Admission in NICU: 28.57% vs. 50%, respectively, for non-tribal GDM with tribal GDM. Distribution of reason
of admission in NICU was comparable between non-tribal GDM study subjects with tribal GDM (Birth asphyxia: 28.57% vs. 50%, respectively, Hyperbilirubinemia: 28.75% vs. 50%, respectively, and Pre-term: 14.29% vs. 25%, respectively). Tribal population with GDM had no case of IUGR or low birth weight.

Nayak et al.,10 as in comparison to the women without GDM, also reported that women with GDM required more ICU admissions (10.8% vs. 4.1%).

O’Sullivan et al.,21 also found increased rate of NICU admissions in neonates born to women with GDM (26% vs. 9.1%). Fareed et al.,13 found that neonatal admission requirement was more in GDM group with 53% babies compared to 11% in non-GDM women. This could probably have a bias on the concerns or reasons for NICU admissions for these neonates as the occurrence of the neonatal complications responsible for causing NICU admissions were not different between the women with and without GDM. Overall, the presence of GDM carried an adverse fetomaternal outcomes. In this study, NICU admission was more for tribal GDM than for non-tribal GDM population. We could not find supportive studies to this finding.

Limitations of the study
1. Hemoglobin A1C as an additional marker was not assessed to evaluate GDM.
2. We could not find much supporting evidence about prevalence of GDM in tribal population of Jharkhand. In this study, we have produced various risk factors in GDM both in tribal and non-tribal patients as well as non-GDM patients. We could compare our findings with other studies which solely studied either non-GDM or GDM population.

CONCLUSION

The prevalence of GDM in tribal population was 12.12% (4/33) and 10.44% (7/67) in nontribal population. The overall prevalence of GDM in the whole study population was found to be 11%.

The prevalence of GDM was found to be increasing with age in the tribal population also but it is not statistically significant (P=0.002).

The prevalence of GDM in multigravida was found to be 11.11% (8/72) while it was only 10.71% (3/28) in case of primigravida. The prevalence of GDM increased with BMI (P=0.007).

The most prevalent risk factor in non-tribal population was history of macrosomia (85.71%) while least prevalent risk factors were congenital anomaly (14.29%) in previous pregnancy, pre-term delivery (14.29%), and h/o IUD I in previous pregnancy (14.29%).

Risk factors in tribal GDM population (previous abortion, previous preterm delivery, IUD, Macrosomia, polyhydramnios, obesity, and pre-eclampsia) had almost equal prevalence (25%). Association of family h/o GDM was not found to be significant, either in non-tribal or tribal GDM patients.

Insulin requirement was less for tribal than non-tribal GDM (50% vs. 85.71%).

When comparing maternal complications such as IUD (14.29% vs. 25%), infection (42.86%), polyhydramnios (57.14% vs. 75%), pre-eclampsia (28.75% vs. 25%) were more for non-tribal than tribals.

Hypoglycemia was significantly higher in tribal subjects with GDM (50%) as compared to non-tribal subjects with GDM (14.29%).

Admission in NICU was more in tribal GDM (50%) than non-tribal GDM (28.57%).

Tribal population in Jharkhand has very poor access to health-care services of the state. This study is first of its kind in our state which will set as an eye opener to further deliver better health-care facilities at grassroot level in Jharkhand.

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ID- Concept and design of the study and prepared first draft of manuscript; Interpreted the results; reviewed the literature and manuscript preparation, statistical analysis and interpretation, and preparation of manuscript; and AB- Concept, coordination, and revision of the manuscript.

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