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Original Article

# Prevalence of Gestational Diabetes and Pregnancy Outcome of antenatal patients in Ilorin.

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## Abstract

**Background:** Gestational Diabetes mellitus (GDM) is fast becoming an important cause of maternal and perinatal morbidity and mortality. The objective of this study is to assess the prevalence and the perinatal outcome of gestational diabetes in an antenatal population.

**Methodology:** This was a cross-sectional study. The patients were pregnant women between 24-28 weeks of gestation without a prior diagnosis of diabetes mellitus. The consenting women were evaluated using fasting plasma glucose and oral glucose tolerance testing using 75 grams of glucose in 300ml of water orally.

**Results:** Two hundred and fifteen women participated in the study and the prevalence of GDM was 9%. The mean fasting plasma glucose was 4.04mmol/l at the time of the Oral glucose tolerance test (OGTT) and 5.78mmol/l after the oral glucose load. When compared with pregnant normoglycaemic patients, GDM patients had significantly fewer vaginal deliveries (p=0.05), higher birth weight(3.71kg), and more neonatal admissions (50%)

**Conclusions.** Gestational diabetes mellitus is an important disease entity, and it is a cause of maternal and perinatal morbidities.

**Keywords**: Hyperglycaemia, Diabetes Mellitus, Glucose, Pregnancy

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## Introduction

Gestational diabetes mellitus is carbohydrate intolerance resulting in hyperglycaemia of variable severity with first onset or recognition in pregnancy. It may be asymptomatic or present as overt diabetes mellitus.[1,2,3]The definition of this condition pre-supposes that the individual may have unrecognized diabetes mellitus, or may have developed the diabetes mellitus coincidentally with the pregnancy.[4,5]In the post-partum state, unresolved gestational diabetes mellitus can progress to Type 2 diabetes mellitus and its sequelae.[4,5] It has been associated with adverse pregnancy outcomes.[6] Untreated disease can be disastrous to the developing foetus, leading to an increase in miscarriages, congenital malformations, foetal macrosomia, increased risk of preterm deliveries, and shoulder dystocia. Other problems such as perinatal asphyxia, electrolyte imbalances, and hypoglycemia can occur after delivery. The mother is also at risk of vaginal lacerations, operative deliveries, and postpartum hemorrhage.[7-10]

Gestational diabetes is a global problem, though the prevalence is not known in many countries, it is assumed to reflect the prevalence of pre-diabetes and Type 2 diabetes in the populations studied. [3]Prevalence ranging between 1.1%-14.3% has been reported in developed nations such as Australia and the USA.[2],[11,12] In developing nations, including Nigeria, most studies quote prevalence between 0.15%-4.8%. [8, 13]Theprevalence is expected to rise as a result of the increasing prevalence of risk factors such as obesity in the gravid population.[14]

The most appropriate time for diagnosis remains controversial, however, the World Health Organization recommends universal testing for gestational diabetes mellitus for all pregnant women within 24-28 gestational ages because of the asymptomatic nature and absence of classical risk factors.[15, 16]To detect gestational diabetes mellitus, the World Health Organization and International Association of Diabetes and Pregnancy Study Groups (IADPSG) recommended a two-phase strategy for diagnosing and classifying hyperglycaemia in pregnancy based on the 'hyperglycaemia and adverse outcome' (HAPO) study. This includes an initial phase of testing with fasting blood glucose assessment and a second phase which involves a 2-hour 75g Oral Glucose Tolerance Test at 24-28weeks.[17-19] The new recommendation has the potential for a more meticulous detection and prevention of perinatal and maternal adverse outcomes that have not been extensively studied.

According to the Centers for Disease Control and Prevention,[2,5,20] the prevalence of Type 2 diabetes mellitus is on the increase and the upward trend is also impacting negatively on Gestational Diabetes Mellitus. The human and material cost of managing gestational diabetes mellitus is huge, hence evaluation of women presenting for antenatal care for gestational diabetes mellitus will help to detect and treat this condition early enough to prevent and minimize the adverse pregnancy outcomes related to it.

The diagnosis is challenging because of the absence of symptoms and signs of disease, unlike overt diabetes mellitus which usually presents with established clinical features. The presence of GDM predisposes the foetus to adverse perinatal outcomes, and consequently, in addition, there are increased maternal morbidities. While there are straightforward protocols for screening and management of diabetes mellitus in the general population, the management of GDM remains controversial, [4]as more

women are at increasing risk of acquiring the disease, it is imperative to document the trends in our environment, to better manage women in the antenatal period.

## Methodology

The study was carried out at the University of Ilorin Teaching Hospital, Ilorin in Nigeria. Ethical clearance and approval (ERC PAN/2015/07/1439)were obtained from the Ethics review committee of the teaching hospital, on the 23rd of July 2015. This is a large teaching hospital that offers primary and secondary health care services in addition to its primary role as a tertiary care provider. Recruitment of women for the study was done at the antenatal clinic of the hospital commencing with a proforma which recorded the demographic factors known to influence the outcome of pregnancy such as age, ethnicity, parity, pre-existing medical illnesses, body weight, and body mass index, this was taken at the time of screening for study and family history of diabetes mellitus. (see appendix). A random sampling of consenting women with singlet on live intrauterine gestation who presented for antenatal clinic at 24- 28 weeks gestation was done, they had routine fasting plasma glucose measured after an overnight fast of at least eight hours. The aim is to identify women who had pre-existing diabetes mellitus and exclude them from the study population. These women were managed appropriately for pre-existing diabetes mellitus in conjunction with the endocrinologist. The other exclusion criteria were the presence of congenital anomalies and intrauterine foetal death. GDM was defined as carbohydrate intolerance resulting in hyperglycaemia of variable severity with first onset or recognition in pregnancy, based on the 2013 WHO criteria.[21]

Women with fasting plasma glucose levels of ≤6.9mmol/l proceeded to the second phase of the screening. Below are the WHO criteria used for the study:

Fasting plasma glucose = 5.1-6.9mmol/l (92-125mg/dl)
1-hour post 75g oral glucose load > 10.0mmol/l (180mg/dl)
2-hour post 75g oral glucose load 8.5-11.0mmol/l (153-199mg/dl).[21]

A repeat fasting plasma glucose and oral glucose tolerance test was done a week later. This was done using 75 grams of anhydrous glucose dissolved in 300ml of water, they had this drink over a period of 5minutes. The blood samples obtained were analyzed in the laboratory using diagnostic kits manufactured by Agappe Diagnostics Switzerland GmbH.[22] This kit works on the principle of glucose oxidation by the glucose oxidase enzyme. Following the plasma glucose analysis, the results were communicated to the participants, those who were discovered to have gestational diabetes mellitus were monitored and appropriate therapy was commenced on an individualized basis. They were monitored till delivery and the intrapartum and postpartum states were monitored and documented in the proforma.

The data was analyzed using the Statistical Package for Social Sciences software (SPSS) version 21. Chi-square analysis and odds ratios with 95% confidence intervals were used to compare proportions and Samples t-test the difference between continuous data. Probability (p) values less than 0.05 were accepted as statistically significant and Pearson's correlation coefficient was used to determine the strength of the relationship between the variables.

## Results

The recruitments of patients for the study were done over a period of seven months. 215 women participated in the study. Out of the total number of women screened for this study, 20 had gestational diabetes mellitus while 195 were normoglycaemic. This gives a prevalence of 9%. The age range was 20-42 years, and the mean age was 29.62 years.

The range of the fasting plasma glucose done at screening was 2.0mmol/l -6.10 mmol/l with a mean of 3.87± 0.70. During the conduct of the oral glucose tolerance test, the range of the fasting plasma glucose was 2.2-7.9mmol/l with a mean of 4.04 ±0.73mmol/l blood samples were taken two hours after the administration of the 75grams of glucose solution ranging between 3.4mmol/l -15.7mmol/l with a mean of 5.78±1.65mmol/l. A repeat fasting plasma glucose conducted between 36-38weeks, showed that the range of fasting plasma glucose was increased at this gestational age but it was not statistically significant.

**Table I. Perinatal outcome**

| Variables | Frequency (N=215) | Percent |
|---|---|---|
| **GA at Delivery (Weeks)** | | |
| Range | 31 – 42 | |
| Mean ± SD | 38.89 ± 1.82 | |
| 28 – 36 | 14 | 6.5 |
| 37 – 42 | 201 | 93.5 |
| **Onset of labor** | | |
| Spontaneous | 193 | 89.8 |
| Induction | 22 | 10.2 |
| **Mode of delivery** | | |
| Spontaneous vaginal delivery | 161 | 74.9 |
| Instrumental vaginal delivery | 15 | 7.0 |
| Caesarean section | 39 | 18.1 |
| **Birth Weight** | | |
| Range | 1.70 – 4.90 | |
| Mean ± SD | 3.38 ± 0.46 | |
| **APGAR at 1st minute** | | |
| Range | 3 – 8 | |
| Mean ± SD | 5.42 ± 1.27 | |
| ≤ 6 | 171 | 79.5 |
| ≥7 | 44 | 20.5 |
| **APGAR at 5th minute** | | |
| Range | 3 – 9 | |
| Mean ± SD | 8.40 ± 1.04 | |
| ≤ 6 | 18 | 8.4 |
| ≥7 | 197 | 91.6 |
| **Neonatal Outcome** | | |
| Alive | 213 | 99.1 |
| Dead | 2 | 0.9 |
| **Birth Injuries** | | |
| Yes | 6 | 2.8 |
| No | 209 | 97.2 |
| **Type of Birth Injury (N=6)** | | |
| Asphyxia | 1 | 16.7 |
| Humeral Fracture | 2 | 33.3 |
| Neurological | 1 | 16.7 |
| Subconjunctival hemorrhage | 2 | 33.3 |

| | |
|---|---|
| **Mean random sugar for babies with macrosomia(mmol/l)** | 3.63±0.47 (2.90-4.70) |

The participants delivered between 31-42 weeks. There were 14(6.5%) cases of preterm delivery. The onset of labour was spontaneous in 193(89.8%) of the cases, and 22(10.2%) had induction of labour, however, spontaneous vaginal delivery was achieved in 161 women, accounting for 74.9%, 15(7%) had an instrumental vaginal delivery and 39(18.1%) had a caesarean section. The birth weight ranged between 1.7kg-4.9kg with a Mean±SD of 3.38±0.46kg. The fifth-minute Apgar score of 7 and above was seen in 197(97.2%) of the babies born while those with Apgar scores of 6 and below were 18(8.4%).

There were two cases of intrauterine foetal death, both were preterm deliveries accounting for 0.9% of all the deliveries, and the gross examination of the fetuses yielded no information about the cause of the demise, unfortunately, an autopsy was not done. Six babies sustained birth injuries, constituting 2.8%, and the various injuries were 1 case of perinatal asphyxia, 2 cases of humeral fractures, 1 case of Erb's palsy, and 2 cases of sub-conjunctival haemorrhage. Thirty-seven (17.2%) of the neonates required NICU admission, and the duration of admission ranged between 1-9 days. Those who stayed for less than 2 days were 13 and the remaining, twenty-four stayed for more than 2days. The mean random blood glucose for the macrosomic babies was 3.63 ± 0.47mmol/l, and the range was 2.90 – 4.70mmol/l.

**Table II** Perinatal Outcome

| Variables | Frequency (N=215) | Percent |
|---|---|---|
| **NICU Admission** | | |
| Yes | 37 | 17.2 |
| No | 178 | 82.8 |
| **NICU Duration of Admission in Days (N=37)** | | |
| Range | 1 – 9 | |
| Mean ± SD | 2.62 ± 1.92 | |
| < 2 | 13 | 35.1 |
| ≥ 2 | 24 | 64.9 |

Preterm delivery was proportionally higher in women with gestational diabetes (15%) compared with normoglycaemic women (5.6%). The mean birth weight (in kilograms) of the babies born to women with gestational diabetes mellitus was higher (3.71 ± 0.55) than those with normal glycaemic values (3.34±0.44). The mode of delivery had statistical significance, with women with GDM having a more caesarean section (45%) compared with the total number of deliveries, unlike those who were normoglycaemic; caesarean section was done in 15.4%. The statistical significance was < 0. 004.The NICU admission was also statistically significant (<0.001).

## Discussion

Gestational diabetes mellitus is a well-described disease affecting a significant population of pregnant women globally. In this study, the prevalence of GDM was 9%. This was within the range for gestational diabetes mellitus obtainable in most parts of the world. It was similar to the value obtained by Olarinoye et al in Ilorin and Anzaku AS in Jos Nigeria.[23,24] Some reported varying values across centers in Nigeria.[8] In Nigeria, like most other African nations, the national prevalence of Diabetes mellitus and by extension gestational diabetes is unknown, primarily because of the paucity of research into the condition.[25]Notably, this study used the new WHO criteria which have not been adopted by most centers, and in spite of the different criteria used, the prevalence of gestational diabetes mellitus was within the range obtained earlier in this environment. The mean fasting plasma glucose values in the women showed an expected rise as the gestational age increased. Plasma glucose samples were taken at the initial screening, during the OGTT, and late in the third trimester. This correlates with the fact that insulin resistance increases with advancing gestation, [1,2,26] thus women who are at risk or diagnosed with gestational diabetes will benefit from scheduled monitoring of plasma glucose throughout the pregnancy in order to detect anomalies.

The relationship between GDM and perinatal outcome was statistically significant, similar outcomes were also noticed with the mode of delivery, birth weight, and NICU admissions. Caesarean delivery accounted for 45% of all those who had GDM, whereas, in those who had normoglycaemia, 15.4% had caesarean delivery. Pregnancies complicated with gestational diabetes mellitus are associated with operative deliveries, [1, 2]The indications for caesarean deliveries in the participants with GDM were for obstetric reasons and included fetal macrosomia. This is because the birth weight of the babies born to women with GDM was higher than those whose blood glucose levels were normal. The mean birth weight obtained did not qualify to be described as macrosomia, in women with GDM. Foetal macrosomia has been found to occur more in women with glucose intolerance, once fetal macrosomia is suspected, further investigation is needed to determine if diabetes mellitus is present.[1,2]

**Table III:** Relationship between GDM and Perinatal Outcome

| **Variables** | **Blood Glucose** | | | **t/$\chi^2$** | ***p*-value** |
|---|---|---|---|---|---|
| | **Normal Blood Glucose n=195 (%)** | **Gestational Diabetes Mellitus n=20 (%)** | **Total N=215** | | |
| **GA at Delivery weeks** | | | | | |
| Mean ± SD | 38.91 ± 1.84 | 38.65 ± 1.66 | 215 | 0.608 | 0.544 |
| 28 – 36 | 11 (5.6) | 3 (15.0) | 14 | | |
| 37 – 42 | 184 (94.4) | 17 (85.0) | 201 | 1.299$^{Y}$ | 0.254 |
| **Onset of labor** | | | | | |
| Spontaneous | 176 (90.3) | 17 (85.0) | 193 | 0.123 | 0.726 |
| Induced | 19 (9.7) | 3 (15.0) | 22 | | |
| **Mode of Delivery** | | | | | |
| SVD | 153 (78.5) | 8 (40.0) | 161 | 11.266$^{Y}$ | 0.004* |
| Instrumental Delivery | 12 (6.2) | 3 (15.0) | 15 | | |
| Caesarean Section | 30 (15.4) | 9 (45.0) | 39 | | |
| **Birth Weight** | | | | | |
| Mean ± SD | 3.34 ± 0.44 | 3.71 ± 0.55 | 215 | -3.387 | 0.001* |
| **APGAR at 1$^{st}$ Minute** | | | | | |
| ≤ 6 | 153 (78.5) | 18 (90.0) | 171 | 0.860$^{Y}$ | 0.354 |
| ≥7 | 42 (21.5) | 2 (10.0) | 44 | | |

| | | | | | |
|---|---|---|---|---|---|
| **APGAR at 5th Minute** | | | | | |
| ≤ 6 | 16 (8.2) | 2 (10.0) | 18 | 0.022[Y] | 0.882 |
| ≥7 | 179 (91.8) | 18 (90.0) | 197 | | |
| **Neonatal Outcome** | | | | | |
| Alive | 194 (99.99) | 19 (99.9) | 213 | 0.590[Y] | 0.442 |
| Dead | 1 (0.01) | 1 (0.1) | 2 | | |
| **NICU Admission** | | | | | |
| Yes | 27 (13.8) | 10 (50.0) | 37 | 14.201[Y] | < 0.001* |
| No | 168 (86.2) | 10 (50.0) | 178 | | |
| **Birth Injuries** | | | | | |
| Yes | 4 (2.1) | 2 (10.0) | 6 | 4.225 | 0.039* |
| No | 191 (97.9) | 18 (90.0) | 209 | | |
| **Duration of NICU Admission (N=37)** | | | | | |
| < 2days | 7 (25.9) | 6 (60.0) | 13 | 2.373[Y] | 0.123 |
| ≥ 2days | 20 (74.1) | 4 (40.0) | 24 | | |

**$\chi^2$: Chi square; Y: Yates Correction; *: Statistically Significant (i.*ep* value < 0.05)**

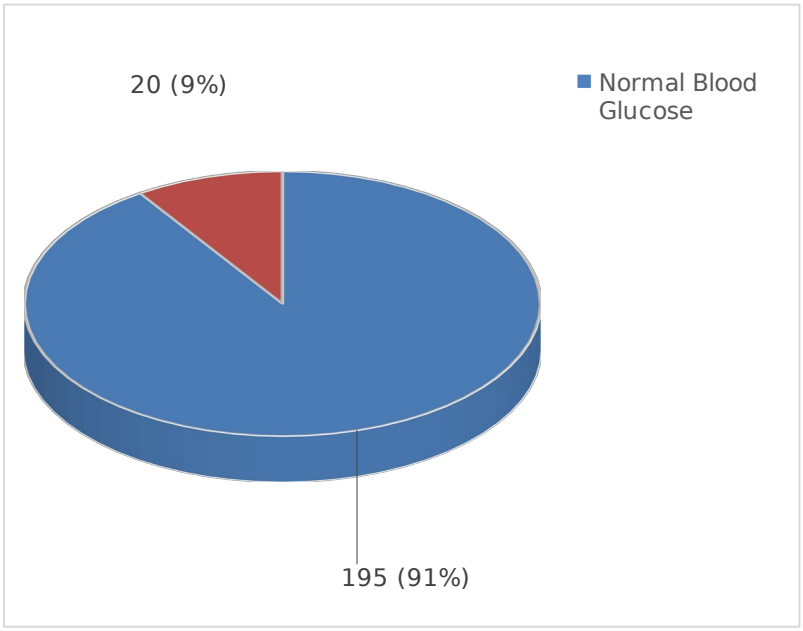


**Figure I: Prevalence of Gestational Diabetes Mellitus**

The admissions into the NICU were statistically significant (p=0.001), the reasons for the admissions were varied, 50 % (10) of all the babies born to women with GDM needed admissions in comparison with 13.8 %(27) of those with normoglycaemia needed NICU admission. A similar finding has been observed in a previous study.[27] Babies born to women with GDM are known to experience more perinatal morbidities in comparison with babies born to normoglycaemic patients. Even though the neonatal admissions for babies born to women with GDM were higher, the incidence of perinatal injuries was not higher in them. Six babies sustained birth injuries in all and twowere in those with GDM, this was not statistically significant(p=0.039). The occurrence of birth injuries is low in well-controlled gestational diabetes, unlike poorly controlled diabetes mellitus.[27] It is also less common in gestational diabetes mellitus compared with overt diabetes, especially in centers with standard obstetric practice where care is anticipatory. All the babies eventually recovered fully.

## Conclusions

Gestational diabetes mellitus has been demonstrated as an important clinical condition with a high prevalence in the studied population. Early diagnosis and follow-up in pregnancy are important. There is a need to incorporate routine screening into antenatal protocols to prevent the morbidities that can arise from it.

Conflicts Of Interests

The authors have no conflict of interest to declare.

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