DETERMINATION OF GESTATIONAL DIABETES MELLITUS RISK STATUS AMONG PREGNANT WOMEN ATTENDING PRIMARY HEALTHCARE FACILITIES IN EGOR AND OVIA NORTH EAST LGA.

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A PROJECT WORK SUBMITTED TO THE DEPARTMENT OF CLINICAL , FACULTY OF PHARMACY, UNIVERSITY OF BENIN, BENIN CITY IN PARTIAL FULFILMENT OF THE REQIREMENTS FOR THE AWARD OF THE DOCTOR OF PHARMACY (PHARM.D) DEGREE

DEPARTMENT OF CLINICAL PHARMACY

FACULTY OF PHARMACY

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CERTIFICATION

This is to confirm that the research presented in this project work was conducted by **Lawrence Itohan** with matriculation number **PHA1908536** .The study was undertaken within the Department of Clinical Pharmacy and Pharmacy Practice, Faculty of Pharmacy, University of Benin, Benin-City, in partial fulfillment of the requirements for the award of Doctor of Pharmacy (Pharm.D) programme.

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(HEAD OF DEPARTMENT)

DEDICATION

This project is lovingly dedicated to my family members whose steadfast prayers and support have continually strengthened me over the years.

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I am deeply thankful to Almighty God for the gift of life and for His unwavering mercy, love, and guidance, which have sustained me throughout this academic journey.

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ABSTRACT

Background: Gestational Diabetes Mellitus (GDM) is a glucose intolerance disorder first recognized during pregnancy and is associated with adverse maternal and neonatal outcomes such as preeclampsia, macrosomia, and neonatal hypoglycemia. The global burden of GDM is rising, including in Nigeria, yet screening remains inadequate in many primary healthcare (PHC) settings.

Objective: This study assessed the risk status and associated factors of GDM among pregnant women attending PHC centers in Egor and Ovia North-East Local Government Areas of Edo State.

Methods: A descriptive cross-sectional design was employed. Pregnant women attending antenatal clinics at selected PHC facilities were recruited using convenience sampling. Data were collected through structured questionnaires on demographic, obstetric, and lifestyle factors, alongside a nine-item GDM risk assessment tool. Descriptive statistics and internal consistency testing (Cronbach's alpha) were used for analysis.

Results: Most respondents were aged 26–35 years. Based on the risk assessment tool, 74.7% were low risk, 22.4% moderate risk, and 2.9% high risk for GDM. Significant predictors included maternal age, pre-pregnancy body mass index, family history of diabetes or hypertension, and previous obstetric complications. Sociodemographic factors such as marital status, education, and occupation were not significantly associated. Regular exercise and healthy diets were linked to lower GDM risk. The risk assessment tool showed good reliability (Cronbach's alpha = 0.702).

Conclusion: Early identification of at-risk women through effective screening and timely antenatal care can improve maternal and neonatal outcomes. Integrating GDM risk assessment, counseling, and lifestyle education into PHC services is strongly recommended.

Keywords: Gestational Diabetes Mellitus, Risk Factors, Primary Healthcare, Maternal Health

CHAPTER ONE

INTRODUCTION

1.0 BACKGROUND OF THE STUDY

Gestational diabetes mellitus (GDM) is clinically defined as impaired glucose intolerance that initially occurs and manifests during pregnancy. This metabolic condition significantly increases the likelihood of poor birth outcomes (Larebo & Ermolo, 2021). It is a medical condition in which a hormone made by the placenta prevents the body from using insulin effectively, unlike type 1 diabetes. Gestational diabetes is not caused by a lack of insulin but by other hormones produced during pregnancy that can make insulin less effective, a condition referred to as insulin resistance (Larebo & Ermolo, 2021).

Globally, gestational diabetes mellitus prevalence has been reported to range from 1% to 28%, with variations largely attributed to differences in screening methods, diagnostic standards, ethnicity, race, and maternal age (Nguyen et al., 2018). 'A prospective study among women reported a prevalence of 16.7% in Nigeria' (Basil et al., 2023), while a meta-analysis estimated the overall prevalence of GDM in Africa to be 13.6% (Muche, Olayemi & Gete, 2019). Kampmann et al. (2015) noted that information on the prevalence and risk factors of GDM in developing countries, such as Nigeria, remains limited, largely due to insufficient research funding. Consequently, this scarcity of data makes it challenging for healthcare planners and policymakers to give GDM the necessary attention. (Kampmann et al. 2015)

Several pregnancy-related complications are increased by gestational diabetes mellitus, such as preeclampsia, cesarean section delivery, macrosomia, neonatal hypoglycemia, and jaundice (Kampmann et al., 2015). Women who have **Gestational Diabetes Mellitus (GDM)** are at a greater risk of developing **type 2 diabetes** later on. Additionally, their children have

an increased likelihood of experiencing **obesity** and **type 2 diabetes** as they grow older. (Noctor & Dunne, 2015; Sheiner, 2020).

Several factors have been identified as contributing to the likelihood of developing Gestational Diabetes Mellitus (GDM). These include obesity and overweight (BMI > 25) (Gomez et al., 2023; Powe & Carter, 2021), a previous history of gestational diabetes or type 2 diabetes (Monod et al., 2023), family history of diabetes (Amiri et al., 2021; Cypryk et al., 2008; Giannakou et al., 2019; NICE, 2020; Xia et al., 2025), and advanced maternal age, particularly in women older than 25 years. Other risk factors include a sedentary lifestyle, belonging to high-risk ethnic groups such as Asians and Africans, especially those with hypertension (Yuen et al., 2018), previous delivery of macrosomia babies (newborn weight > 4 kg), and polycystic ovarian syndrome (Choudhury & Rajeswari, 2022; Lawrence, Wall & Bloomfield, 2019; Lee et al., 2018).

Preventing and properly managing GDM are essential to minimize its associated morbidity and complications. It is advisable for women who are capable of having children, particularly those with existing risk factors for Gestational Diabetes Mellitus (GDM), to carefully plan their pregnancies and consult with healthcare providers beforehand. Maintaining healthy blood sugar levels before and throughout the entire pregnancy helps to decrease the likelihood of negative health consequences for both the mother and the baby (American Diabetes Association, 2020). Lifestyle modification, which includes appropriate nutrition and regular physical activity, remains the first-line strategy for both prevention and management of GDM. Nutritional therapy emphasizes individualized dietary planning based on energy requirements, blood glucose monitoring, and appropriate weight gain (Chao et al., 2019; Morris et al., 2020). Physical activity, including aerobic and strengthening exercises, has also been shown to improve glucose homeostasis and insulin sensitivity (Mitanchez et al., 2020).

For women who fail to achieve adequate glycemic control through diet and exercise, pharmacological therapy is recommended. Insulin remains the safest and most effective medication for GDM management (Landon et al., 2009; Elsayed et al., 2024). Various insulin preparations, including fast-acting, intermediate, and long-acting types such as insulin detemir, have been found safe for use during pregnancy (Caughey et al., 2018; Society of Maternal-Fetal Medicine, 2018; Mathiesen et al., 2017). Oral antidiabetic agents such as metformin and glibenclamide (glyburide) may be considered in cases where insulin is unavailable or declined, although both drugs cross the placenta, with no evidence of teratogenicity (Hod et al., 2008).

GDM poses significant maternal and neonatal health risks, including complications that may arise during **delivery**, an increased risk of developing **type 2 diabetes**, the onset of **preeclampsia** (high blood pressure and organ damage after 20 weeks of pregnancy), and a higher likelihood of experiencing **cardiovascular disease** in the future. (Al Bekai et al., 2025; Mahmoud et al., 2024; Mora-Ortiz & Rivas-Garcia, 2024; Choudhury & Devi Rajeswari, 2021; Theodorou et al., 2024). These complications highlight the need for early identification and management of at-risk women.

In Nigeria, despite the increased burden of gestational diabetes mellitus, research on the risk factors, assessment practices, and prevalence among pregnant women remains inadequate, particularly at the primary health care level. The need for data-driven strategies to identify and manage at-risk women is therefore imperative. This study is to assess the risk assessment status of gestational diabetes mellitus among pregnant women attending antenatal clinics in Primary Health Care (PHC) centers in Egor and Ovia North East Local Government Areas. The findings from this study are expected to contribute to improved screening, prevention, and management of GDM, thereby enhancing maternal and fetal health outcomes.

1.1 STATEMENT OF THE PROBLEM

Gestational Diabetes Mellitus (GDM), a condition where pregnant women develop high blood sugar, is becoming more frequent globally, with a noticeable rise in cases, especially within low- and middle-income nations. In Nigeria, the burden of gestational diabetes mellitus is not well reported due to limited routine screening and poor awareness among expectant mothers and healthcare providers, especially at the primary healthcare level (Obi et al., 2019). This has resulted in many cases remaining undiagnosed, which increases the risk of maternal and neonatal health complications such as hypertensive disorders, obstructed labor, stillbirth, and neonatal hypoglycemia (Gasim, 2012)

Globally, gestational diabetes mellitus remains a significant public health concern, contributing to adverse pregnancy outcomes such as preeclampsia, cesarean delivery, macrosomia, and hypoglycemia (Kampmann et al., 2015). In the long term, both affected mothers and their children are predisposed to develop type 2 diabetes mellitus and obesity (Noctor & Dunne, 2015; Sheiner, 2020). Despite its increasing prevalence, there remains inadequate information on the prevalence, risk factors, and assessment practices of gestational diabetes mellitus in Nigeria, largely due to insufficient research and weak screening systems (Kampmann et al., 2015).

Primary Health Care (PHC) facilities serve as the initial access point for medical care for most expectant mothers, especially those living in semi-urban and rural regions. This makes them crucial for the prompt detection and treatment of Gestational Diabetes Mellitus (GDM). However, regular risk evaluation and screening for GDM are frequently overlooked because of challenges such as inadequate diagnostic tools (a lack of proper equipment), limited training among healthcare personnel, and low awareness among patients about the condition and the need for screening. (Dirar & Doupis, 2017). In such settings, the absence of

structured risk assessment and management strategies poses a significant challenge, placing both maternal and neonatal outcomes at risk (Kampmann et al., 2015).

Therefore, there is a pressing need to evaluate the risk status of gestational diabetes mellitus among pregnant women attending antenatal clinics in Primary Health Care (PHC) centers in Egor and Ovia North East Local Government Areas of Edo State. The findings from this study will provide evidence to guide early detection, strengthen screening protocols, and support policy interventions aimed at improving maternal healthcare delivery and reducing gestational diabetes mellitus-related complications.

1.2 LITERATURE REVIEW

Gestational diabetes mellitus (GDM) refers to glucose intolerance first identified during pregnancy, and it poses several immediate and long-term risks for both the mother and the developing fetus. Worldwide, the occurrence of gestational diabetes mellitus has been steadily increasing, largely driven by rises in maternal age, excess body weight, and reduced physical activity. In Nigeria, the true extent of gestational diabetes mellitus is not well documented, especially within primary healthcare settings. This chapter provides a review of existing studies on the prevalence, determinants, and management of gestational diabetes mellitus, with particular focus on Nigeria and the wider sub-Saharan African region.

1.3 Overview of Gestational Diabetes Mellitus (GDM)

Gestational diabetes mellitus is described by both the American Diabetes Association and the World Health Organization as elevated blood glucose levels that are first identified during pregnancy, most commonly between the twenty-fourth and twenty-eighth weeks of gestation. This condition is a major contributor to health complications affecting both the mother and the baby and is associated with a higher likelihood of developing type 2 diabetes in the future

for both the woman and her child. (American Diabetes Association, 2020; World Health Organization, 2019).

Gestational diabetes mellitus develops when pregnancy hormones produced by the placenta cause insulin resistance, reducing glucose uptake by maternal tissues and leading to elevated blood glucose levels. Although most women can compensate through increased insulin production, some cannot, resulting in gestational diabetes mellitus.

1.4 Prevalence of GDM in Nigeria

Reported rates of gestational diabetes mellitus differ considerably across countries and studies, largely because of variations in screening approaches, diagnostic standards, and characteristics of the populations investigated. Reviews of available literature estimate that the prevalence of GDM in Africa falls between roughly 9% and 14% (Muche, Olayemi & Gete, 2019). In Nigeria, findings from different studies show a wide range as well, with values from about 5% and reaching up to 20% in some urban and semi-urban settings (Kampmann et al., 2015).

Despite these figures, a substantial number of cases still go unrecognized, mainly due to the lack of routine screening, poor awareness, and inadequate diagnostic capacity within primary healthcare facilities.

1.5 Risk Factors Associated with GDM

A number of factors have been linked to the development of gestational diabetes mellitus, involving both modifiable and non-modifiable influences. Excess body weight before pregnancy, particularly when the body mass index (BMI) is above 25kg/m2, has been shown to markedly increase the likelihood of gestational diabetes mellitus (Gomez et al., 2023; Powe and Carter, 2021). A family history of diabetes, especially among first-degree relatives, also heightens vulnerability to the condition (Amiri et al., 2021; Giannakou et al., 2019; National Institute for Health and Care Excellence [NICE], 2020). Advancing maternal age is another important determinant, with women older than 25 years, particularly those above 35, facing a higher risk. Physical inactivity further contributes by promoting obesity and insulin resistance. Evidence also indicates that certain ethnic groups, including African and Asian populations, have greater susceptibility to gestational diabetes mellitus (Yuen et al., 2018). In addition, a previous delivery of a macrosomic infant weighing more than 4 kilograms is considered a predictive indicator. Women diagnosed with polycystic ovarian syndrome (PCOS) are similarly at higher risk because of increased insulin resistance associated with the condition (Choudhury and Rajeswari, 2022). These determinants are particularly significant in the Nigerian context, where lifestyle patterns, demographic characteristics, and genetic predispositions collectively influence the rising prevalence of gestational diabetes mellitus.

1.6 Awareness and Knowledge of Gestational diabetes mellitus Among Pregnant Women

Research conducted in Esan West and Esan Central LGAs of Edo State revealed that while the majority of pregnant women (88.3%) had good general knowledge of gestational diabetes mellitus though awareness of specific risk factors and complications was limited (Okunbor et

al., 2021). Low awareness among women and healthcare workers remains a major barrier to early detection and management, especially in primary healthcare settings.

1.7 Prevention and Management of Gestational Diabetes Mellitus

1.7.1 Lifestyle Modification (Non-Pharmacological Therapy)

Lifestyle modification is the first-line approach for both preventing and managing gestational diabetes mellitus. It includes nutrition therapy and physical activity. Pre-pregnancy counseling and proper glycemic control reduce the complications and adverse pregnancy outcomes (American Diabetes Association, 2020).

Nutritional Therapy:

Appropriate dietary therapy plays a fundamental role in achieving and sustaining optimal blood glucose control. promoting appropriate weight gain and ensuring healthy fetal development. Even when pharmacological therapy becomes necessary, adherence to dietary guidelines remains fundamental (American Diabetes Association, 2020).

An individualized nutrition plan that considers pre-pregnancy body mass index (BMI), self-monitoring of blood glucose, and a woman's dietary preferences is essential for effective management (Chao et al., 2019; Morris et al., 2020). According to the American Diabetes Association (ADA), carbohydrates should provide about 40 to 50 percent of total daily energy intake, with a minimum of 180 grams per day, ideally obtained from foods with a low glycemic index. Proteins are expected to contribute roughly 30 percent of overall caloric intake, which corresponds to approximately 1.3 grams per kilogram of body weight each day. Fats should account for about 25 to 30 percent of daily energy, while the intake of saturated fats should be kept to a minimum. Eating smaller, more frequent meals throughout the day, including a bedtime snack, is advised to reduce the risk of hypoglycemia (McIntyre et al., 2019). A balanced diet that emphasizes fruits, vegetables, whole grains, poultry, fish, and nuts is also encouraged (Mitanchez et al., 2020).

Physical Activity

Regular exercise, including aerobic and strengthening activities, enhances insulin sensitivity, controls maternal weight gain, and improves glucose tolerance (Mitanchez et al., 2020).

1.7.2 Pharmacological Therapy

When lifestyle modification alone is insufficient to achieve the desired blood glucose levels, the introduction of pharmacological treatment becomes necessary (Landon et al., 2009; Elsayed et al., 2024). Insulin remains the primary and most reliable treatment option for gestational diabetes mellitus, as its safety and effectiveness during pregnancy are well established (Nguyen et al., 2018). Rapid-acting and long-acting insulin analogues, such as insulin aspart and insulin detemir, are often recommended because they provide improved glycemic regulation (Mathiesen et al., 2017). Oral antidiabetic medications, including metformin and glibenclamide (also known as glyburide), may be considered when insulin therapy is not feasible or acceptable. Although these agents cross the placenta, current research indicates that they do not pose significant teratogenic risks (Hod et al., 2008). Women who are predisposed to gestational diabetes mellitus are encouraged to maintain healthy blood glucose levels and adopt favorable lifestyle practices even before conception to reduce the likelihood of complications.

1.8 Consequences of Gestational Diabetes Mellitus

Appropriate prevention and management of gestational diabetes mellitus are essential for reducing the range of maternal and neonatal complications associated with the condition. One important concern is the risk of delivery-related problems. Pregnant women affected by gestational diabetes mellitus have a higher likelihood of giving birth to infants with macrosomia, which increases the chances of shoulder dystocia, perineal lacerations, maternal hemorrhage, and the need for caesarean delivery (Beta et al., 2019; Lucas et al., 2021; Mendez-Figueroa et al., 2021). Additionally, a history of gestational diabetes mellitus significantly elevates the long-term risk of developing type 2 diabetes, with evidence suggesting a tenfold increase compared to women who had normoglycemic pregnancies (Vounzoulaki et al., 2020; Bellamy et al., 2009). The condition is also linked to an increased likelihood of preeclampsia and various cardiovascular complications, both during pregnancy and in the years following delivery (Choudhury and Devi Rajeswari, 2021; Theodorou et al., 2024; Mora-Ortiz and Rivas-Garcia, 2024).

1.9 Summary of Literature Review

The literature reveals that GDM poses significant health challenges globally and within Nigeria. Despite its rising prevalence, awareness, and screening at the primary healthcare level remain inadequate. The risk factors for gestational diabetes mellitus comprise pre-pregnancy obesity, a positive family history of diabetes, advanced maternal age, and limited engagement in regular physical activity. Early identification through routine risk assessment, lifestyle modification, and appropriate management is essential to prevent complications.

1.10 Justification of the Study

This study will contribute valuable data on the risk assessment status of GDM among pregnant women in Edo State. The findings will:

- Identify key risk factors and their relationship with socio-demographic characteristics.

- Highlight existing gaps in screening and risk assessment practices at the PHC level.
- Provide evidence-based recommendations to strengthen antenatal care practices.
- Guide healthcare policymakers and practitioners in developing standardized GDM risk assessment tools and protocols.
- Ultimately, improve early detection, management, and maternal and neonatal health outcomes.

1.11 Scope of the Study

This research focuses on pregnant women receiving antenatal care at selected Primary Health Care centers located in Egor and Ovia North-East Local Government Areas of Edo State. It focuses on identifying risk factors, assessing their association with socio-demographic and clinical characteristics, and providing recommendations for integrating GDM risk assessment into routine antenatal care.

1.12 Objectives of the Study

General Objective

To assess the risk assessment status of gestational diabetes mellitus (GDM) among pregnant women attending antenatal clinics in Primary Health Care (PHC) centers in Egor and Ovia North East Local Government Areas, Edo State.

Specific Objectives

1. To determine the Gestational Diabetes Risk Status among pregnant women attending Primary Healthcare facilities.
2. To assess the association between socio-demographic and clinical characteristics of the respondents and their gestational diabetes mellitus risk status.
3. To show the correlation between some clinical variables of the respondents and GDM risk status

4. To determine the reliability of the modified GDM risk assessment tool

CHAPTER TWO

METHODS

2.1 Study Setting

This research was carried out among pregnant women who visited antenatal clinics at chosen Primary Health Care (PHC) centers within Ovia North East and Egor Local Government Areas (LGAs) in Edo State, Nigeria. These Primary HealthCare facilities represent the first level of contact between the community and the healthcare system, providing essential maternal, neonatal, as well as maternal and child health services, encompassing antenatal, delivery, and postnatal care.

2.2 Study Area

The study was carried out in selected Primary Health Care (PHC) facilities located within Ovia North-East and Egor Local Government Areas (LGAs) of Edo State, Nigeria. Ovia North-East LGA is situated in the southern part of Edo State and consists predominantly of semi-urban and rural communities. The area is largely characterized by agricultural and trading activities, and most women rely on public PHC centers as their primary source of antenatal care services.

In contrast, Egor LGA is located within the Benin City metropolitan area and is comparatively more urbanized, with improved access to healthcare facilities and a relatively higher literacy level among women attending antenatal clinics.

The inclusion of both LGAs provided a balanced representation of rural and urban populations within the state, providing a suitable context to examine the risk factors for gestational diabetes mellitus (GDM) and to assess the efficiency of current antenatal screening and counseling services.

2.3 Study Design

A descriptive cross-sectional study design was employed, which was suitable for gathering data at a single point in time from a specific population. This approach facilitated the evaluation of risk factors linked to gestational diabetes mellitus (GDM) and allowed for the analysis of relationships between socio-demographic and clinical characteristics of pregnant women attending antenatal clinics. Using this design, the study determined the prevalence of GDM risk factors and examined their associations with factors such as maternal age, body mass index (BMI), family history of diabetes, obstetric history, and lifestyle behaviors.

2.4 Study Population

Pparticipants of the study were pregnant women attending antenatal clinics at selected Primary Health Care centers in Egor and Ovia North-East Local Government Areas (LGAs) of Edo State.

2.4.1 Inclusion Criteria

Eligible participants included pregnant women, irrespective of gestational age or trimester, who were aged 18 years and above. Inclusion was limited to those registered for antenatal care at one of the selected Primary HealthCare facilities in the study area. Participants were required to demonstrate the ability and willingness to provide informed consent and to communicate effectively in English, Pidgin English, or the local Edo language. Only women who possessed knowledge of, or documented records of, their pre-pregnancy body weight were considered eligible for inclusion.

2.4.2 Exclusion Criteria

Women were excluded from participation if they had a pre-existing diagnosis of diabetes mellitus before the index pregnancy (Type 1 or Type 2). Those unable to provide informed consent due to severe illness, mental incapacity, or cognitive impairment were also excluded. In addition, women with incomplete antenatal registration records or missing pre-pregnancy weight data necessary for risk assessment were not included in the study.

2.5 Sample Size Determination

The sample size was calculated using Cochran's formula for estimating sample size in studies assessing proportions:

$$n = \frac{Z^2 \cdot p(1-p)}{e^2}$$

Where:

- Z= 1.96 (Z-score for 95% confidence interval)
- p= estimated prevalence of GDM in Nigeria (0.167 or 16.7%)
- e= margin of error (0.05)

Substituting the values:

$$n = \frac{(1.96)^2 \times 0.167(1-0.167)}{(0.05)^2} = \frac{3.8416 \times 0.139161}{0.0025} = 213.83$$

Therefore, the minimum sample size was approximately 214 participants. To account for non-response and incomplete data, the final sample size was increased to 226 respondents.

2.6 Sampling Technique

The Primary Health Care facilities were selected using a convenience sampling method, and the same approach was applied to recruit participants for the study. This method was used to

enable the researcher to include pregnant women who were available and willing to participate during their routine antenatal clinic visits.

Data were collected from five different Primary Health Care facilities, each operating on distinct antenatal clinic days. Two of the facilities conducted their clinics on Tuesdays, another two held theirs on Thursdays, while one of the facilities had its clinic sessions every Monday. The researcher attended each facility on its respective clinic days for a period of two weeks, resulting in approximately eight weeks (two months) of data collection in total.

Before data collection commenced at each facility, eligible pregnant women were informed about the purpose of the study, and the pregnant women who agreed to participate were given a written informed consent form to fill out. Data were gathered through a structured questionnaire administered by an interviewer. The researcher conducted one-on-one interviews with each participant, asking the questions directly and documenting their responses on the questionnaire. This approach ensured clarity of understanding, improved response accuracy, and facilitated effective data collection from women with varying literacy levels.

2.7 Ethical Considerations

Ethical clearance for the study was secured from the Edo State Ministry of Health before data collection. Participants were fully informed about the study's objectives and provided written informed consent before taking part. Confidentiality of information was strictly maintained throughout the research process, and all data were anonymized to ensure respondents' privacy. Participation was entirely voluntary, and respondents were informed that they could discontinue the interview or decline to answer any question at any point if they felt uncomfortable.

2.8 Limitations of the Study

This study had certain limitations that should be acknowledged. Recall bias may have occurred, as some respondents might not have accurately remembered their pre-pregnancy weight or lifestyle habits, which could affect the reliability of the body mass index (BMI) and related risk data. Selection bias is also possible, since the study was limited to pregnant women attending public Primary Health Care facilities, thereby excluding those who seek care in private facilities or do not attend antenatal clinics at all. Consequently, the findings may not be generalizable to populations outside Ovia North-East and Egor Local Government Areas or to different healthcare settings. In addition, some of the information obtained was self-reported, particularly variables such as pre-pregnancy weight and dietary habits, which may have introduced minor inaccuracies.

2.9 Data Collection Instrument

Data were collected using a structured, interviewer-administered questionnaire, which was developed from a review of existing literature and adapted from the Gestational Diabetes Mellitus (GDM) Risk Assessment Tool by the American Diabetes Association (ADA, 2023). The questionnaire was designed to capture comprehensive information on socio-demographic, clinical, obstetric, and lifestyle variables that influence GDM risk among pregnant women.

The instrument consisted of four major sections. The first section obtained background information on respondents' age, educational level, occupation, marital status, and ethnicity. Age was measured in completed years and later grouped for analysis. Educational level ranged from no formal education to tertiary education, while occupation was categorized as employed, self-employed, or unemployed. Marital status was also assessed to explore its influence on maternal health outcomes. These socio-demographic factors provided insight into how background characteristics affect GDM risk and health-seeking behaviors.

The second section of the questionnaire addressed obstetric and medical history, gathering data on parity, gravidity, family history of diabetes, history of hypertension or cardiovascular disease, and prior pregnancy outcomes, including stillbirth, miscarriage, or delivery of a baby weighing 4 kg or more. These factors were crucial for identifying women with genetic predispositions or previous obstetric complications that could elevate the risk of developing gestational diabetes mellitus.

The third section addressed lifestyle and clinical factors, including physical activity patterns, dietary habits, and clinical indicators such as BMI. Questions explored the respondents' level of physical activity, such as walking, light exercises, or daily mobility, as well as the frequency of consuming fruits, vegetables, and balanced meals. Pre-pregnancy BMI was computed using self-reported or documented weight and height to assess obesity-related GDM risk. These lifestyle indicators provided a practical reflection of modifiable behaviors that can influence GDM development.

The final section incorporated a modified GDM Risk Assessment Scoring Tool developed specifically for this study. The GDM risk assessment tool included nine variables, such as age, BMI, family history of diabetes, hypertension, obstetric history, physical activity, and dietary habits. Each item was scored based on the risk level. The instrument included nine key items representing major risk factors for **gestational diabetes mellitus**, each assigned a score. The total possible score was 12, with scores of 0–4 indicating low risk, 5–8 indicating moderate risk, and 9–12 indicating high risk. Reliability testing using Cronbach's alpha produced a coefficient of 0.702, reflecting good internal consistency. These findings demonstrated that the modified **gestational diabetes mellitus Risk Assessment Tool** was a reliable and valid measure for evaluating the risk of gestational diabetes mellitus among the pregnant women in the study.

2.10 Data Collection Procedure

Data collection was carried out by the researcher and assisted by trained undergraduate students. The questionnaires were administered face-to-face during antenatal clinic sessions. Each participant's responses were recorded immediately after obtaining informed consent. Completed questionnaires were reviewed daily by the researcher for accuracy and completeness before data entry and analysis.

2.11 Data Analysis

The collected data were coded and entered into **Statistical Package for the Social Sciences (SPSS) version 27** for analysis. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize the socio-demographic and clinical characteristics of the participants. Inferential statistics, such as Chi-square tests and correlation analyses, were performed to examine associations between categorical variables and **gestational diabetes mellitus risk factors**. Statistical significance was set at $p < 0.05$.

CHAPTER THREE

RESULTS

3.0 Summary of Results

A total of 226 pregnant women participated in this study. Table 3.1 presents the social demographic characteristics of the respondents. Most of the pregnant women (86.3%) were married, while 13.7% were single. More than half (54.0%) were of Edo ethnicity, followed by Igbo (16.8%) and Yoruba (16.4%). With regard to occupation, 62.8% were self-employed, 18.6% were employed, and another 18.6% were unemployed. Almost half (49.1%) of the respondents had completed secondary education, 31.0% had tertiary education, 17.3% had primary education, and 2.7% had no formal education.

The age of the respondents ranged from 18 to 41 years, with an average age of 28.12 ± 5.26 years. This indicates that most participants were in their late twenties, corresponding to the prime reproductive age group in Table 3.1 below.

Table 3.1a: Descriptive Statistics (Age) (n = 226)

Variable	Minimum	Maximum	Mean	Standard Deviation
Age (years)	18	41	28.12	± 5.26

Table 3.1b: Socio-demographic (n = 226)

Variable	Frequency (n)	Percentage (%)
Marital Status		
Married	195	86.3
Single	31	13.7
Ethnicity		
Edo	122	54.0
Hausa	21	9.3
Igbo	38	16.8
Niger Delta	8	3.5
Yoruba	37	16.4
Occupation		
Employed	42	18.6
Self-employed	142	62.8
Unemployed	42	18.6
Educational Level		
None	6	2.7
Primary	39	17.3
Secondary	111	49.1
Tertiary	70	31.0

3.2 Clinical history

This section describes the clinical features of the pregnant women who took part in the study. Variables analyzed include pre-pregnancy Body Mass Index (BMI), family and obstetric history, physical activity, dietary habits, and gestational age at booking and during data collection. These features offer insights into the overall health and reproductive profile of the participants, which is essential for understanding their risk of developing Gestational Diabetes Mellitus (GDM).

The calculated pre-pregnancy BMI of the respondents ranged from 17.57 to 32.23 kg/m², with a mean of 21.80 ± 2.35 kg/m², indicating that most women were within the normal BMI range (18.5–24.9 kg/m²). The majority of respondents (69.9%) had a normal BMI, while 7.1% were overweight, and 23.0% did not provide enough data for BMI calculation. Approximately 20.8% of participants reported a family history of diabetes, while 25.2% had relatives with hypertension or heart disease. Only 10.2% had a previous history of elevated blood glucose, and 13.7% reported previous miscarriage or stillbirth. Similarly, 15.9% of women had previously delivered a large baby (≥4 kg), and 9.7% reported a history of polycystic ovarian syndrome (PCOS).
A majority (83.2%) engaged in regular physical activity, and 87.6% reported maintaining a healthy diet during pregnancy.
The average gestational age at first antenatal booking was 16.86 ± 5.79 weeks, while the current mean gestational age at the time of data collection was 29.30 ± 5.96 weeks, suggesting most respondents were in their third trimester. The risk status for GDM among participants ranged from 0 to 10, with a mean score of 3.264 ± 2.27 and a median of 3, indicating that most women were at a low to moderate risk of developing GDM.

Table 3.2a: Descriptive Statistics of Clinical Variables

Variable	Minimum	Maximum	Mean	Standard Deviation
Pre-pregnancy Body Mass Index (kg/m²)	17.57	32.23	21.80	± 2.35 (n=174)
GDM Risk Status level	0	10	3.264	±2.27(n=174)
Gestational Age at First Antenatal Booking (weeks)	5	31	16.86	± 5.79 (n=226)
Current Gestational Age (weeks)	8	42	29.30	± 5.96 (n=226)

Table 3.2b: Distribution of Respondents by Clinical and Health-related Characteristics (n = 226)

Variable	Frequency (n)	Percentage (%)
BMI Category (kg/m²)		
<25 (Normal weight)	158	69.9
25–34.5 (Overweight)	16	7.1
N/A	52	23.0
Family History of Diabetes		
Yes	47	20.8
No	179	79.2
Family History of Hypertension or heart disease		
Yes	57	25.2
No	169	74.8
History of Elevated Blood Glucose		
Yes	23	10.2
No	203	89.8
History of Miscarriage or Stillbirth		
Yes	31	13.7
No	195	86.3
Previous Delivery of a Large Baby (≥4 kg)		
Yes	36	15.9

Variable	Frequency (n)	Percentage (%)
No	190	84.1
History of Polycystic Ovarian Syndrome (PCOS)		
Yes	22	9.7
No	204	90.3
Engagement in Regular Physical Activity		
Yes	188	83.2
No	38	16.8
Healthy Dietary Practice During Pregnancy		
Daily	198	87.6
Occasionally	28	12.4

Table 3.2c: Distribution of GDM Risk Status among Respondents

GDM Risk Status	Frequency (n)	Percentage (%)
Low Risk	130	74.7
Moderate Risk	39	22.4
High Risk	5	2.9
Total	174	100.0

The majority of respondents (74.7%) were classified as low risk for gestational diabetes mellitus (GDM), while 22.4% were at moderate risk and only 2.9% were at high risk.

3.3 Association Between Socio-Demographic and Clinical Variables with Gestational Diabetes Mellitus (GDM) Risk Status

Fisher's Exact Test was performed to assess the relationship between selected socio-demographic and clinical characteristics of the respondents and their risk status for gestational diabetes mellitus (GDM). A significance level of 0.05 was used to determine statistical significance. The results are shown in Table 3.3.

Table 3.3: Association Between Categorical Variables and GDM Risk Status (n = 174)

Variable		Low Risk (n)	Moderate Risk (n)	High Risk (n)	Fisher's value	p-Value
Marital Status	Single	8	3	0	0.467	0.797
	Married	122	36	5		
Occupation	Employed	24	10	2	3.283	0.524
	Self-employed	88	26	3		
	Unemployed	18	3	0		
Educational Level	None	2	1	0	8.583	0.214
	Primary	21	6	3		
	Secondary	61	14	1		
	Tertiary	46	18	1		
Ethnicity	Edo	78	16	2	11.090	0.104
	Hausa	6	6	1		
	Igbo	19	7	1		
	Niger Delta	5	0	0		
	Yoruba	22	10	1		
Family History of Diabetes	No	117	12	0	69.650	0.000*
	Yes	13	27	5		
Elevated Blood Glucose During Pregnancy	No	125	26	1	44.762	0.000*
	Yes	5	13	4		
Family History of Hypertension/Heart Disease	No	113	8	0	74.217	0.000*
	Yes	17	31	5		
Regular Physical Activity	Yes	115	27	4	8.275	0.016*
	No	15	12	1		
Healthy Dietary Practice	Daily	125	30	0	53.402	0.000*
	Occasionally	5	9	5		

The Fisher's Exact Test revealed statistically significant associations between GDM risk status and several clinical and lifestyle factors, including family history of diabetes ($p < 0.001$), elevated blood glucose during pregnancy ($p < 0.001$), family history of hypertension or heart disease ($p < 0.001$), engagement in regular physical activity ($p = 0.016$), and frequency of healthy dietary practice ($p < 0.001$).

In contrast, socio-demographic factors such as marital status, occupation, educational level, and ethnicity were not significantly associated with GDM risk status ($p > 0.05$). These findings suggest that biological and behavioral health factors play a more direct role in determining gestational diabetes risk than social characteristics.

3.4 Correlation Between Selected Variables and Gestational Diabetes Mellitus (GDM) Risk Status

Following the assessment of associations between socio-demographic and clinical characteristics and **gestational diabetes mellitus** risk, a Pearson correlation analysis was carried out to evaluate the strength and direction of relationships between selected continuous variables—maternal age, pre-pregnancy Body Mass Index (BMI), and parity—and **gestational diabetes mellitus** risk status among the participants.

This analysis provides insight into how increasing values of these variables may influence and **gestational diabetes mellitus** risk levels.

Table 3.4: Correlation Between Selected Variables and GDM Risk Status (n = 174)

Variables	Pearson Correlation (r)	p-Value (2-tailed)
Age Group	0.408**	<0.001
Calculated Body Mass Index (BMI)	0.566**	<0.001
Number of Biological Children (Parity)	0.483**	<0.001

As shown in Table 3.4, all three variables—maternal age, pre-pregnancy BMI, and parity—exhibited **significant positive correlations** with GDM risk status. Maternal age ($r = 0.408$, $p < 0.001$) showed a moderate positive correlation, indicating that older pregnant women were more likely to fall within higher GDM risk categories. Pre-pregnancy BMI ($r = 0.566$, $p < 0.001$) demonstrated a stronger positive relationship, suggesting that women with higher body mass indices were at greater risk of developing GDM. Similarly, parity ($r = 0.483$, $p < 0.001$) was positively correlated with the risk of GDM, indicating that women with more previous pregnancies tended to have higher GDM risk scores.

These findings collectively indicate that increasing maternal age, greater body weight, and higher parity are all significant predictors of an elevated risk of GDM. The results underscore the importance of early screening and lifestyle interventions—particularly for overweight, multiparous, or older pregnant women—to mitigate the potential metabolic complications associated with gestational diabetes mellitus.

RELIABILITY OF THE GDM RISK ASSESSMENT TOOL

To determine the internal consistency of the Gestational Diabetes Mellitus (GDM) Risk Assessment Tool, the reliability of the nine-item scale was assessed using **Cronbach's Alpha** in SPSS. The analysis involved 174 respondents with complete data on all items. The summary of the reliability test is presented in Table 3.5

Table 3.5.: Reliability Statistics for GDM Risk Assessment Tool (n = 174)

Reliability Measure	**Value**
Cronbach's Alpha	**0.702**
Cronbach's Alpha (Standardized Items)	**0.732**
Number of Items	**9**
Corrected Item-Total Correlation Range	**0.072 – 0.494**
Overall Decision	**Reliable**

The internal consistency of the nine-item Gestational Diabetes Mellitus (GDM) Risk Assessment Tool was evaluated using **Cronbach's Alpha**, yielding a coefficient of **0.702**, which indicates an **acceptable level of reliability** for exploratory research.

CHAPTER FOUR

DISCUSSION

4.1 Risk Status of Gestational Diabetes Mellitus among Pregnant Women

Findings from this study revealed that most of the pregnant women attending primary healthcare facilities were at a low risk of developing gestational diabetes mellitus, while only a small proportion were found to be at moderate or high risk. This distribution indicates that although the general population of expectant mothers may have limited exposure to major predisposing factors, there remains a significant subgroup requiring closer monitoring. The low proportion of high-risk women may also reflect the younger age range and relatively normal pre-pregnancy body mass index observed among the respondents.

Maternal age and pre-pregnancy weight are important determinants of gestational diabetes mellitus risk. Women aged thirty-five years and above were more likely to fall within the moderate or high-risk category, while those below twenty-five years were mostly low risk. Increasing maternal age has been associated with reduced insulin sensitivity and a higher risk of developing glucose intolerance during pregnancy (Choudhury & Rajeswari, 2022; American Diabetes Association [ADA], 2020). The predominance of respondents with a normal body mass index may have contributed to the overall low risk observed in the study population.

The results further highlight the importance of routine antenatal screening using validated risk-assessment tools in primary healthcare centers. Identifying women at moderate or high risk early enables the implementation of timely interventions such as dietary counseling, lifestyle modification, and glucose monitoring to prevent complications during pregnancy and childbirth.

4.2 Association Between Socio-Demographic and Clinical Characteristics and Risk Status

In examining associations between socio-demographic and clinical characteristics, this study found that only maternal age had a significant relationship with gestational diabetes mellitus risk status. Other socio-demographic factors, including marital status, educational attainment, and occupation, did not show statistically significant associations. This finding suggests that biological and metabolic factors play a more direct role in influencing gestational diabetes risk than social characteristics, although socio-demographic factors may indirectly influence health behaviors and access to care. Among the clinical variables, a family history of diabetes and hypertension showed a strong association with an increased risk of gestational diabetes mellitus. This observation is consistent with previous studies highlighting the influence of genetic and metabolic predispositions on the development of gestational diabetes mellitus (Amiri et al., 2021; Giannakou et al., 2019). Women who reported such histories were more likely to fall into the moderate or high-risk categories, underscoring the need for targeted screening among those with familial metabolic conditions. Lifestyle factors, including regular physical activity and adherence to healthy dietary practices, were linked to lower risk levels. Participants who engaged in daily exercise and maintained balanced diets were mainly classified in the low-risk group. These findings support existing evidence that lifestyle modification is a key preventive measure for gestational diabetes mellitus (Mitanchez et al., 2020; Chao et al., 2019). Strengthening nutrition counseling and monitoring physical activity levels during antenatal visits will help sustain these protective effects.

4.3 Correlation Between Selected Clinical Variables and Risk Status

The study found a positive correlation between gestational diabetes mellitus risk and certain clinical variables, including maternal age, body mass index, and parity. Higher values of

these variables were associated with an increased likelihood of developing **gestational diabetes mellitus**. The link with maternal age reflects the natural decline in glucose tolerance over time, whereas the association with body mass index highlights the impact of excess adipose tissue in contributing to insulin resistance (Powe & Carter, 2021).

Similarly, women with higher parity exhibited increased risk, suggesting that repeated pregnancies may contribute to metabolic strain and reduced insulin sensitivity over time.

These findings indicate that screening and preventive education should prioritize women who are older, overweight, or have had multiple pregnancies. Routine counseling at the community level could help women of reproductive age maintain optimal weight and adopt healthy habits before conception. Incorporating pre-pregnancy and inter-pregnancy counseling into maternal care programs would further minimize metabolic complications in subsequent pregnancies.

The results of this study align with previous findings from Nigeria and other African countries. A meta-analysis by Muche, Olayemi, and Gete (2019) reported a pooled prevalence of **gestational diabetes mellitus** in Africa of approximately 13.6%, identifying obesity, family history of diabetes, and advanced maternal age as key risk factors. Similarly, studies by Kampmann et al. (2015) and Basil et al. (2023) observed comparable patterns in Nigerian populations, highlighting that late antenatal booking, excessive gestational weight gain, and pre-existing hypertension elevate risk. Parallel associations between lifestyle behaviors and **gestational diabetes mellitus** risk have also been reported globally. Mitanchez et al. (2020) demonstrated that adequate nutrition and regular exercise significantly reduce the likelihood of glucose intolerance, while Choudhury and Rajeswari (2022) highlighted the role of obesity and sedentary behavior as major contributors to the rising incidence of the

condition. The consistency between these earlier studies and the current findings confirms that both biological and lifestyle factors jointly influence gestational diabetes risk.

4.4 Reliability of the Modified Gestational Diabetes Mellitus Risk Assessment Tool

The modified nine-item **gestational diabetes mellitus** risk assessment tool employed in this study showed acceptable internal consistency, with a Cronbach's alpha of 0.702. This level of reliability suggests that the instrument effectively measures related constructs and can be confidently utilized in routine antenatal care. Its straightforward design and structured scoring system make it particularly appropriate for primary healthcare settings where access to advanced diagnostic tests may be limited. By categorizing women into low, moderate, and high-risk groups, the tool provides an efficient method to guide early clinical decisions and identify patients who require closer monitoring or referral for confirmatory testing. Incorporating such standardized risk-assessment tools into community clinics could improve early detection, enhance data collection, and strengthen the delivery of maternal healthcare services.

Limitations of the Study

This study was conducted exclusively in primary healthcare facilities within Egor and Ovia North-East Local Government Areas of Edo State, which may limit the generalizability of the findings to other regions or private healthcare settings. The cross-sectional design also restricts the ability to infer causality, as exposures and outcomes were measured at a single point in time. Furthermore, reliance on self-reported data regarding diet and physical activity may have introduced some response bias. Despite these limitations, the study provides valuable insights into risk factors for gestational diabetes mellitus, protective lifestyle behaviors, and the practical applicability of a reliable, low-cost risk-assessment tool that can be incorporated into antenatal care programs in primary healthcare settings.

CHAPTER FIVE

CONCLUSION

The study found that most pregnant women attending primary healthcare centers were classified as low risk (74.7%) for **gestational diabetes mellitus**, while 22.4% were at moderate risk and 2.9% were at high risk. Significant predictors of **gestational diabetes mellitus** included maternal age, pre-pregnancy body mass index, family history of diabetes or hypertension, and previous obstetric history. In contrast, socio-demographic variables such as marital status, educational level, and occupation were not significantly associated with risk. Protective lifestyle behaviors, including regular physical activity and adherence to a healthy diet, were linked to lower risk, highlighting the importance of both clinical and lifestyle factors in determining **gestational diabetes mellitus** risk among pregnant women.

The study also demonstrated that the modified nine-item **gestational diabetes mellitus** risk assessment tool is reliable, with a Cronbach's alpha of 0.702, and can be effectively utilized in primary healthcare settings for early identification of at-risk women. Implementing early risk assessment, targeted counseling, and appropriate referrals to secondary or tertiary healthcare facilities are key strategies for improving maternal and neonatal outcomes.

Women identified as moderate or high risk should receive focused counseling on modifiable factors, including body weight management, diet, and physical activity, and be linked to established referral pathways for further diagnostic screening and management.

Several implications for practice arise from these findings. Primary healthcare workers should incorporate systematic risk assessment into routine antenatal registration for all pregnant women, ensuring that high-risk groups are identified early. Health education programs should emphasize timely antenatal booking (before 12 weeks of gestation) and

provide guidance on nutrition, physical activity, and healthy lifestyle choices. Continuous training of primary healthcare staff on the use of risk assessment tools, interpretation of scores, counseling strategies, and documentation practices is essential. Policymakers and health authorities should adopt standardized gestational diabetes mellitus (GDM) risk assessment protocols across public antenatal clinics and allocate adequate resources for staff training, dissemination of tools, and data management systems. At the community level, pregnant women should be encouraged to disclose relevant family medical history, participate actively in educational programs, and adopt recommended lifestyle behaviors to reduce risk.

Despite the study's contributions, several gaps remain that warrant further attention. Longitudinal follow-up of women classified as moderate or high risk is necessary to determine the actual incidence of gestational diabetes mellitus (GDM) and related pregnancy outcomes. Qualitative studies exploring barriers to early antenatal booking would inform targeted interventions to improve early uptake of care. Further investigations should assess the predictive validity of the nine-item tool compared with diagnostic testing using the oral glucose tolerance test. Additionally, genetic and epigenetic studies in Nigerian and West African populations could provide deeper insight into biological susceptibility to gestational diabetes mellitus (GDM). Interventional research testing lifestyle modification programs in primary healthcare settings could determine effective strategies to prevent progression from moderate risk to gestational diabetes mellitus (GDM).

In conclusion, early identification of at-risk women using validated risk assessment tools, coupled with targeted counseling, appropriate referral, and public health education, is critical for reducing the burden of gestational diabetes mellitus. Implementing structured risk assessment and education programs in primary healthcare settings will enhance early

detection, improve maternal and neonatal outcomes, and contribute to healthier pregnancies in Edo State and similar contexts.

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APPENDIX

DATA COLLECTION TOOL

Title: Questionnaire on Risk Assessment of Gestational Diabetes in Pregnant Women Attending Primary healthcare facilities in Ovia North East and Egor local government areas in Edo.

Section A: Socio-Demographic Data

1. How old are you_____ ( ) years

   Age: [ ]

2. Marital status:

   Single [ ] Married [ ] Divorced [ ] Widowed [ ]

3. Occupation:

   Unemployed [ ] employed [ ] (self or public/civil servant)

   Self-employed; Skilled [ ] Unskilled [ ]

4. Education level:

   None [ ] Primary [ ] Secondary [ ] Tertiary [ ]

5. Religion: Christian [ ] Muslim [ ] Traditional [ ] Other : [ ]

6. Ethnic group: Bini [ ] Hausa [ ] Yoruba [ ] Igbo [ ] Others: _____

Section B: Biometric and Clinical data

7. Height_____ ( ) m

8. Present weight_____(kg)

9. Do you know your pre-pregnancy weight: Yes [ ] No [ ] If yes, what was it_____

10. Calculated pre-pregnancy BMI _____(kg/m^2)

11. Blood pressure____(mmHg).

12. Gestational age as at first booking for antenatal clinic visit_____(weeks)

13. Current gestational age: _____ (weeks)

14. Do you have a mother, father, sister, or brother with diabetes? Yes [ ] No[ ]

15. Have you or any family member ever been diagnosed with an elevated blood glucose level during pregnancy?

    Yes [ ] No [ ]

16. Family history of high blood pressure or any heart disease condition Yes [ ] No[ ]

    Section C: Pregnancy History

17. Number of pregnancies (Gravidity): _____
18. Number of biological children (Parity): _____
19. Any history of miscarriage or stillbirth? [ ] Yes [ ] No.
20. Previous large baby (≥4kg)? [ ] Yes [ ] No
21. Do you or any of your family members have any history of polycystic ovarian syndrome? Yes or NO
22. Any complications in previous pregnancies? [ ] Yes [ ] No
    If yes, specify: _____
23. **Section D: Lifestyle and Attitude** Do you engage in regular physical activity? (such as walking around, trekking, and breathing exercises).

    Yes [ ] No[ ]

24. Do you smoke? Yes [ ] No[ ]
25. Do you stay close to a smoker? Yes [ ] No[ ]
26. What is your relationship with the smoker Parents [ ] Husband [ ] Siblings[ ]
27. Do you take alcohol: Yes [ ] No[ ]
28. Have you changed your diet since becoming pregnant? Yes [ ] No[ ]
29. Do you engage in healthy diet in this pregnancy (e.g. Fruits, Vegetables) Others _____
30. Do you believe gestational diabetes mellitus can be prevented? Yes [ ] No [ ] Not sure[ ]
31. Would you be willing to adjust your lifestyle if at risk of gestational diabetes mellitus at any point in this pregnancy? Yes [ ] No[ ]

How old are you?	>35yrs =2	26-35=1	≤=25=0
What is your BMI (kg/m^2)	≥35 = 2	25-34.9 = 1	<25 = 0
Do you have a mother, father, sister, or brother with diabetes?	Yes=1	No=0	
Have you ever been diagnosed with high blood pressure or any heart disease condition?	Yes=1	No=0	
Have you or any member of your family ever been diagnosed with elevated blood glucose during pregnancy?	Yes=1	No=0	
Have you ever experienced stillbirth, spontaneous abortion of unknown cause, delivered of baby with≥ 4kg, or been diagnosed with polycystic ovarian syndrome?	Yes=1	No=0	
How many pregnancies/deliveries have you had?	≥2=2	1=1	None=0
Are you physically active? (such as walking around, short distances to the grocery shop, and engaging in breathing exercises) How often do you eat vegetables and fruits?	Yes=0 Daily = 0	No=1 Once a while = 1	

GDM RISK ASSESSMENT TOOL