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Cross sectional study of gestational diabetes in Guelma

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the most merciful , All praise and thanks be

to Allah the Almighty for granting us the strength and guidance to complete this work

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Dedication

I lovingly dedicate this dessertation to:

*Whom I consider everything in my life, my dear **parents**, for their*

endless love, affection, prayers that make me able to get such success and honor.

hope I made them proud.

*My beloved siblings **Abdallah**, **Hassan**, **Adel** and **Saida** for being always by my side, may God bless them all.*

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Praise be to Allah, out of love, gratitude, and appreciation for the beginning and the end.
"and May Allah's peace and blessings be upon the noblest of creation, our master Muhammad, the most honorable of messengers."
With all my love, I dedicate my success and graduation :
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Dedication

بِسْمِ اللَّـهِ الرَّحْمَـٰنِ الرَّحِيمِ

With all my feelings of respect and gratitude, I dedicate this work

To my mother ***« Sandra »,*** *your endless love, patience, and encouragement have been my greatest blessings. Your strength and wisdom have guided me through every step of my journey*

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With all my love and appreciation,

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Abstract

Gestational diabetes mellitus (GDM) is a type of diabetes that develops during pregnancy and typically disappears after childbirth.

The present work is cross-sectional study based on structured questionnaire including : demographic characteristics, medical history, lifestyle factors, and pregnancy outcomes. It involved 180 pregnant women aged between 17 to 47 years old, aimed to identify the prevalence of GDM and to examine its association with many factors in Guelma.

The results indicate that Out of the 180 participants, 19% were diagnosed with GDM. The analysis of the questionnaire data revealed that several risk factors were associated with the development of GDM. This included maternal age (≥25 years), obesity (pre-pregnancy BMI ≥30 kg/m²), and family history of diabetes. Additionally, physical activity and high carbohydrate intake were identified as modifiable risk factors. The findings underscore the importance of early screening and intervention, particularly for women with identified risk factors.

Keywords: pregnancy, Gestational diabetes mellitus, prevalence, risk factors, cross-sectional study.

Résumé

Le diabète gestationnel sucré (DG) est un type de diabète qui se développe pendant la grossesse et disparaît généralement après l'accouchement.

Le présent travail est une étude transversale basée sur un questionnaire structuré comprenant : les caractéristiques démographiques, les antécédents médicaux, les facteurs de mode de vie et les résultats de la grossesse.180 femmes enceintes ont été recrutées âgées de 17 à 47 ans, L'objectif était d'identifier la prévalence de la DG et d'examiner son association avec de nombreux facteurs à Guelma.

Parmi les 180 participantes, 19 % ont reçu un diagnostic de DG. L'analyse des données du questionnaire a révélé que plusieurs facteurs de risque étaient associés au développement du DG. Ceux-ci comprend l'âge de la mère (≥25 ans), l'obésité (IMC de 30 kg/m² avant la grossesse) et les antécédents familiaux de diabète. De plus, l'activité physique et l'apport élevé en glucides ont été identifiés comme des facteurs de risque modifiables. Les résultats soulignent l'importance du dépistage et de l'intervention précoces, en particulier pour les femmes présentant des facteurs de risque identifiés.

Mots clés: Grossesse, diabète gestationnel sucré, prévalence, facteurs de risque, étude transversale.

ملخص

سكري الحمل هو نوع من مرض السكري يتطور أثناء الحمل ويختفي عادة بعد الولادة.

العمل الحالي هوعبارة عن دراسة مقطعية تستند إلى استبيان منظم تشمل الخصائص الديموغرافية، التاريخ الطبي، عوامل نمط الحياة ونتائج الحمل. شاركت 180 امرأة حامل تتراوح أعمارهن بين 17 و47 عامًا، بهدف تحديد انتشار سكري الحمل وارتباطه بالعديد من العوامل في قالمة.

تشير النتائج إلى أنه من بين 180 مشاركة، 19% تم تشخيصهن بمرض سكري الحمل. وكشف تحليل بيانات الاستبيان أن عدة عوامل خطر ترتبط بظهورسكري الحمل. وشمل ذلك سن الأم (≥ 25 سنوات)، والسمنة (مؤشر كتلة الجسم قبل الحمل ≥ 30 كغ/م²)، والتاريخ العائلي لمرض السكري. بالإضافة إلى ذلك، تم تحديد النشاط البدني وارتفاع تناول الكربوهيدرات كعوامل خطر قابلة للتعديل. تؤكد النتائج على أهمية الفحص والتدخل المبكرين، لا سيما بالنسبة للنساء اللواتي لديهن عوامل خطر محددة.

الكلمات الرئيسية: الحمل، سكري الحمل، الانتشار، عوامل الخطر، دراسة مقطعية.

List of abbreviations

GDM : Gestational diabetes mellitus

DM : Diabetes mellitus

PRE-GDM : Pre-gestational diabetes mellitus

T1D : Type 1 diabetes

T2D : Type 2 diabetes

IR : Insulin resistance

HPL : Placental lactogenic hormone

FFAs : Free fatty acids

BMI : Body mass index

OGTT : Oral glucose tolerance test

RDS : Respiratory distress syndrome

WHO : World health organisation

RCH : Rectocolitr hymoragique*

C-section : Cesarean Section

EL : Endothelial lipase

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Introduction

Introduction

According to the world health organization, pregnancy is defined as the term used to describe the period in which a fetus develops inside a woman's womb or uterus. It usually lasts about 40 weeks, or just over 9 months, as measured from the last menstrual period to delivery. Health care providers refer to three segments of pregnancy, called trimesters (Napso *et al.*, 2018).

Maternal physiology if not well adapted can result in pregnancy issues such gestational diabetes, preeclampsia, fetal growth restriction, fetal overgrowth, and preterm birth, all of which can have an immediate negative impact on the health of the fetus and the mother.(Napso *et al.*,2018).

According to estimates, gestational diabetes mellitus affected 9-25% of pregnancies worldwide (Alejandro *et al.*,2020), with gestational diabetes mellitus accounting for 86.4% of these instances. Furthermore, given the concurrently rising rates of pre-gestational obesity and excessive weight gain during pregnancy, a rise in the prevalence of gestational diabetes mellitus consequences is anticipated (Ortiz *et al.*,2021).

Because it is a risk factor for type 2 diabetes and is associated with fetal-maternal morbidity, gestational diabetes which has long been underdiagnosed and underestimated—now plays a significant role in diabetology (Bensalem *et al.*,2015).

The Aim of the present study was to investigate the prevalence , risk factors , and associated complications of gestational diabetes among pregnant women in the region of Guelma .Our document is divided into two parts, first a theoretical section represented by definition, mechanism and physiological changes that occur during pregnancy and gestational diabetes. The second part represents the practical work in which we conducted a descriptive cross sectional study based on a questionnaire and distributed the findings outcomes according to multiple risk factors. The analysis of the questionnaire data revealed that several risk factors were associated with the development of GDM. This included maternal age (≥25 years), obesity (pre-pregnancy BMI ≥30 kg/m²), and family history of diabetes.

Theoretical part

1) Pre-gestational diabetes

1.1) Definition of diabetes

It refers to a group of metabolic disorders brought on by partial or complete insulin deficiency and linked to hyperglycemia (Egan and Dinneen, 2019).

Insulin-producing beta cells in the islets of Langerhans of the pancreas are constantly adjusting their hormone release levels in response to the glucose environment. When diabetes mellitus (DM) occurs, insulin either does not function at all or acts poorly (insulin resistance), which raises blood sugar levels (Sapra and Bhandari, 2023).

1.2) Types of pre-gestational diabetes

1.2.1) type 1 diabetes

Type 1 diabetes (T1D) is the most common form of diabetes in young people (Zemba *et al.*, 2023)

The hallmark of T1D is the autoimmune devastation of insulin-producing β cells in the pancreas by macrophages and CD4+ and CD8+ T lymphocytes that invade the islets. It typically results in complete insulin insufficiency (Figure1). Approximately 10% of all cases of diabetes are caused by this condition (Gillespie, 2006).

According to estimates, 0.5% of people in the general population are at risk. The risk is increased by a personal history of type 1 diabetes-related disorders (autoimmune disorders) as well as a family history of the disease (Pasarica *et al.*, 2021).

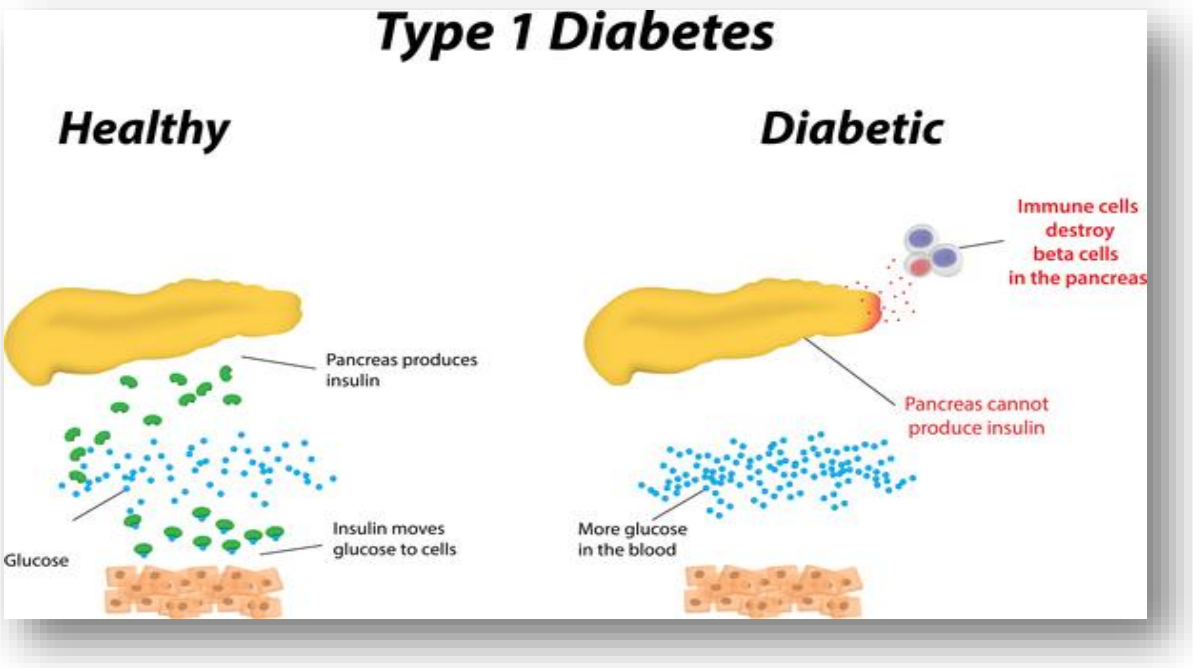

Figure 1: Beta cells in normal person and in type 1diabetes [1]

1.2.2) Type 2 diabetes

Type 2 diabetes (T2DM) accounts for approximately 90% of cases of DM due to tissue insulin resistance (IR), insufficient insulin secretion by pancreatic islet β-cells, and an inadequate compensatory insulin secretory response (Figure2) ; [2].

It's defined by hyperglycemia, which can be brought on by decreased insulin secretion, insulin resistance, or an increased liver output of glucose, alone or in combination (Rizvi *et al.*, 2016). Its pathogenesis and evolution are undoubtedly varied, influenced by both genetic and environmental factors (Riddle *et al.*, 2021).

Also among the risk factors are drugs, family history, obesity, and lifestyle choices (Rizvi *et al.*, 2016).

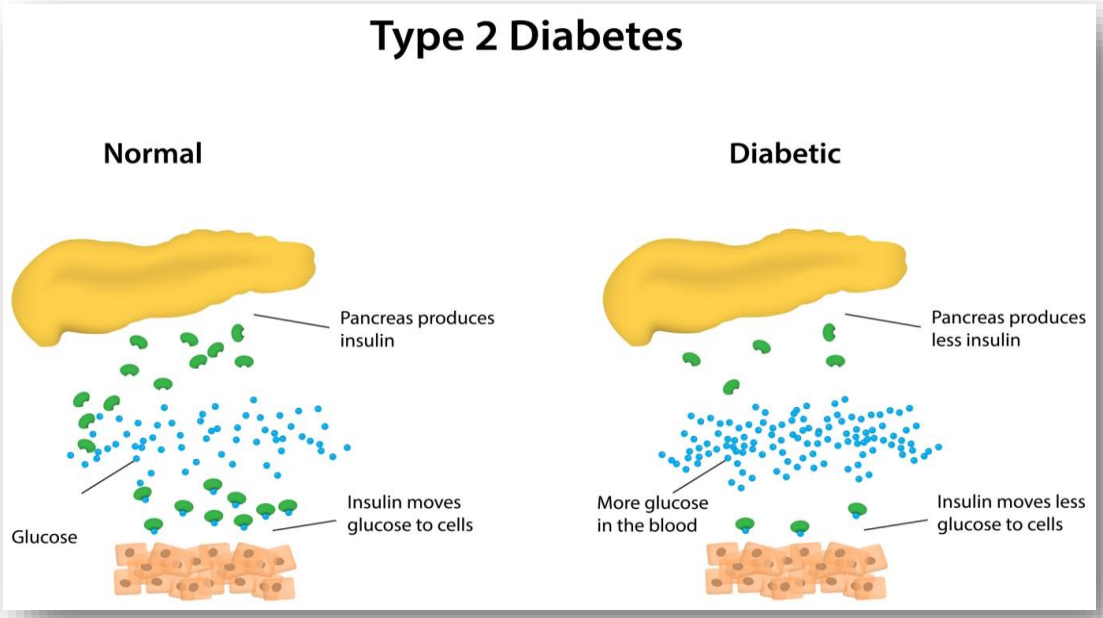

Figure 2 : Beta cells in normal person and in type 2 diabetes [3]

2) Gestational Diabetes Mellitus

2.1) Definition

GMD is a common pregnancy complication in which women without a history of diabetes develop spontaneous hyperglycemia during pregnancy (Plows *et al.*, 2018).

The most prevalent metabolic illness, GDM can strike up to 25% of pregnant women between weeks 24 and 28 of their pregnancy (Lewandowska, 2021).

Numerous unfavorable pregnancy outcomes—for both the mother and the fetus—are linked to this illness (Sweeting *et al.*, 2022).

2.2) Modification of the carbohydrate metabolism in healthy pregnant women

Pregnancy is characterized by metabolic acceleration, consisting of an anabolic phase and a subsequent catabolic phase, which maintain the energy flow necessary for fetus growth (Parrettini *et al.*, 2020).

A physiological, gradual, and reversible insulin resistance linked to reactive hyperinsulinism occurs throughout a typical pregnancy (Kampmann *et al.*, 2019).

2.2.1) Metabolic glycoregulation in pregnant women

The initial functional change observed during pregnancy is a rise in fasting insulin levels. The early phase of pregnancy is characterized by an anabolic state. After meals, the mother stores energy reserves in adipose tissue with the help of placental hormones. Maternal anabolism remains dominant for up to 22 weeks of amenorrhea (Lelarge, 2016).

Around the middle of the second trimester, the catabolic phase begins. While maternal storage is preserved, the fetus's energy needs come first.

Elevated blood levels of hormones (Figure3), specifically cortisol, progesterone, and placental lactogen, cause an increase in insulin resistance throughout the second and third trimesters of pregnancy (Meykiechel *et al.*, 2023).

2.2.2) Hormonal variations in healthy pregnant women

A multitude of hormones with physiological effects on the mother are secreted by the placenta during gestation (Figure3), making it an extremely active endocrine organ (Napso *et al.*, 2018).

These hormones swiftly tweak nutrient metabolism to favor the growing fetus needs. To stave off detrimental hypoglycemia between meals, a storage system must kick in promptly during pregnancy, ensuring the mothers reserves aren’t depleted by her unborn child. Carbohydrate balance in the mother is finely regulated by maternal hormones, working to ramp up fat storage, curtail energy usage, and prolong glucose processing (Jee and Sawal, 2024).

- **Estrogen and progesterone**

The corpus luteum produces progesterone and estrogen throughout the first 10 weeks of pregnancy. Following implantation, the placenta starts to generate these two steroid hormones at progressively higher concentrations, which peak in the final trimester. Progesterone and estrogen levels sharply decline in the early postpartum period (Costa, 2015).

Apart from the placenta, the ovaries and, to a lesser degree, the liver, muscle, bone, and brain are other organs that release estrogen during pregnancy [4].

- **Cortisol**

The hormone temporarily boosts energy levels by flooding the body with more glucose. Under stress, the livers gluconeogenesis facilitates the cortisol hormones access to glucose stored in protein reserves, so blocking the body's ability to produce insulin and preventing glucose storage. Nonetheless, the body retains its overall resistance to insulin when cortisol levels increase (Graham *et al.*, 2019) ;[5].

- **Placental lactogenic hormone (HPL)**

It is a hormone with numerous similarities to prolactin that is released by the placenta. In addition to promoting the production of milk, it aids in the development of fetal tissues and annexes. On the thirteenth day of pregnancy, the syncytiotrophoblast begins to secrete it.

Its content steadilyrises until the 36th week, at which point it somewhat declines until the 40th week, reflecting placental function. It possesses mammo trophic, lactogenic, and luteotropic qualities. Because of its somatotropic effects, fetal development is aided. Moreover, it demonstrates hyperglycemic, proteolytic, and lipolytic action. When fetal distress is detected and a reduction in plasma content indicates intrauterine growth retardation, the measurement has predictive significance (Sibiak et al., 2020);[6].

It's been proposed that HPL plays a significant role in the development of insulin resistance in humans (Dirar and Doupis, 2017).

Prolactine

During pregnancy, prolactin, a hormone secreted by the pituitary gland, plays a crucial role in preparing the breasts for lactation by stimulating breast tissue growth, promoting colostrum production, and suppressing ovulation to maintain pregnancy. Additionally, prolactin contributes to maternal bonding and regulates fluid balance to support the increased fluid requirements during pregnancy and lactation [7]

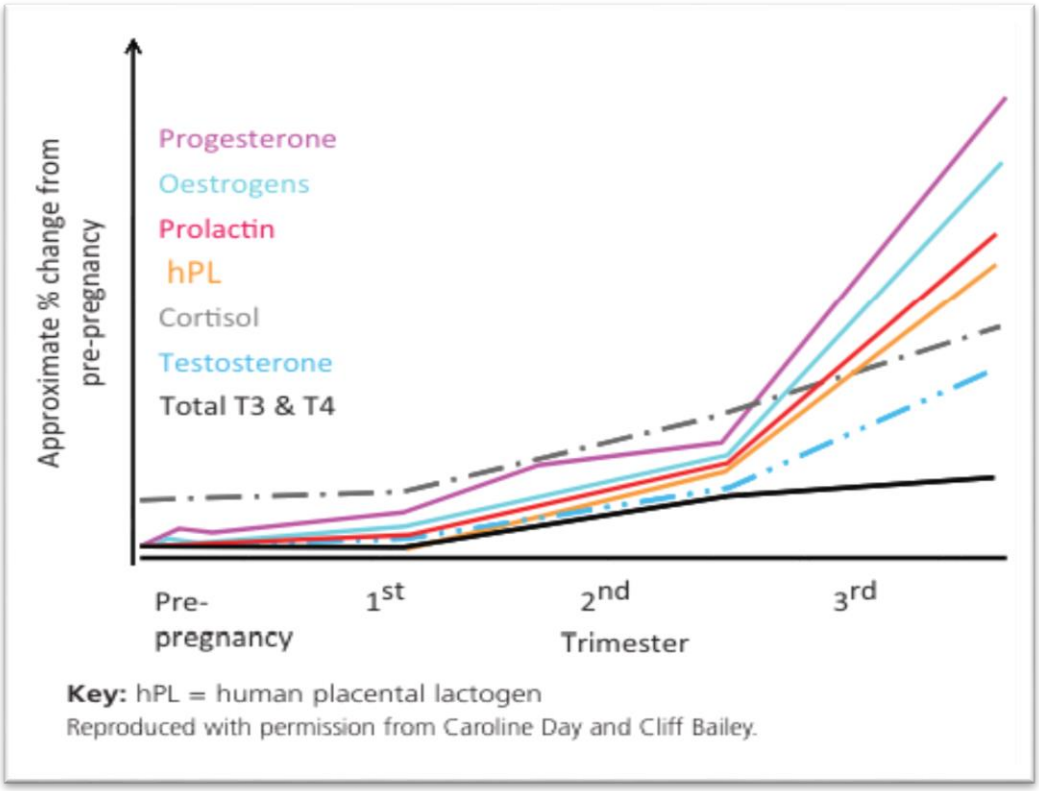

Figure 3: Hormonal changes that can influence glucose homeostasis in pregnancy (Lindsay,2009).

2.3) pathophysiology of Gestational Diabetes

It's been proposed that HPL plays a significant role in the development of insulin resistance in humans (Dirar and Doupis, 2017).

The pathophysiology of GDM includes both tissue insulin resistance and β-cell impairment, as GDM is typically caused by β-cell malfunction on a background of persistent insulin resistance throughout pregnancy. These conditions are typically present before conception and may worsen over time, increasing the chance of developing type 2 diabetes after childbirth (Plows *et al.,* 2018).

2.3.1) Insulin resistance

A physiological phenomenon known as maternal insulin resistance arises in order to sustain the fetal energy supply throughout gestation. While most people manage this metabolic adaptation, some women get GDM (Choudhury and Devi Rajeswari, 2021)

When cells stop responding to insulin as effectively, they develop insulin resistance. The major transporter that brings glucose into cells for energy, glucose transporter 4 (GLUT4), is inadequately translocated across the plasma membrane as a result of insulin signaling failure, which is the molecular basis of insulin resistance (Plows *et al.,* 2018).

When compared to normal pregnancy, GDM reduces the rate of insulin-stimulated glucose absorption by 54% (Catalano, 2013)

In GDM, Lactogen (HPL), increased levels of growth hormone and cortisol, the release of insulinase from the placenta, and higher estrogen and progesterone all contribute to the development of insulin resistance during pregnancy (Choudhury and Devi Rajeswari, 2021). Therefore, HPL is considered a powerful antagonist to insulin activity during pregnancy (Rassie *et al.,*2022)..

2.3.2) Beta cell dysfunction

β-cells' main job is to respond to a glucose load by storing and secreting insulin. β-cell dysfunction is defined as when β-cells are unable to detect blood glucose levels accurately or to produce enough insulin in response. It is believed that prolonged and excessive insulin production in response to chronic fuel excess causes β-cell malfunction (Plows *et al.,* 2018). Insulin resistance worsens β-cell dysfunction. When insulin-stimulated glucose uptake decreases, it can lead to hyperglycemia, putting extra strain on β-cells to produce more insulin in response. The direct impact of high glucose levels on β-cell failure is known as glucotoxicity (Plows *et al.,* 2018).

Figure4 shows a linkage diagram between β-cell malfunction, insulin resistance, and GDM.

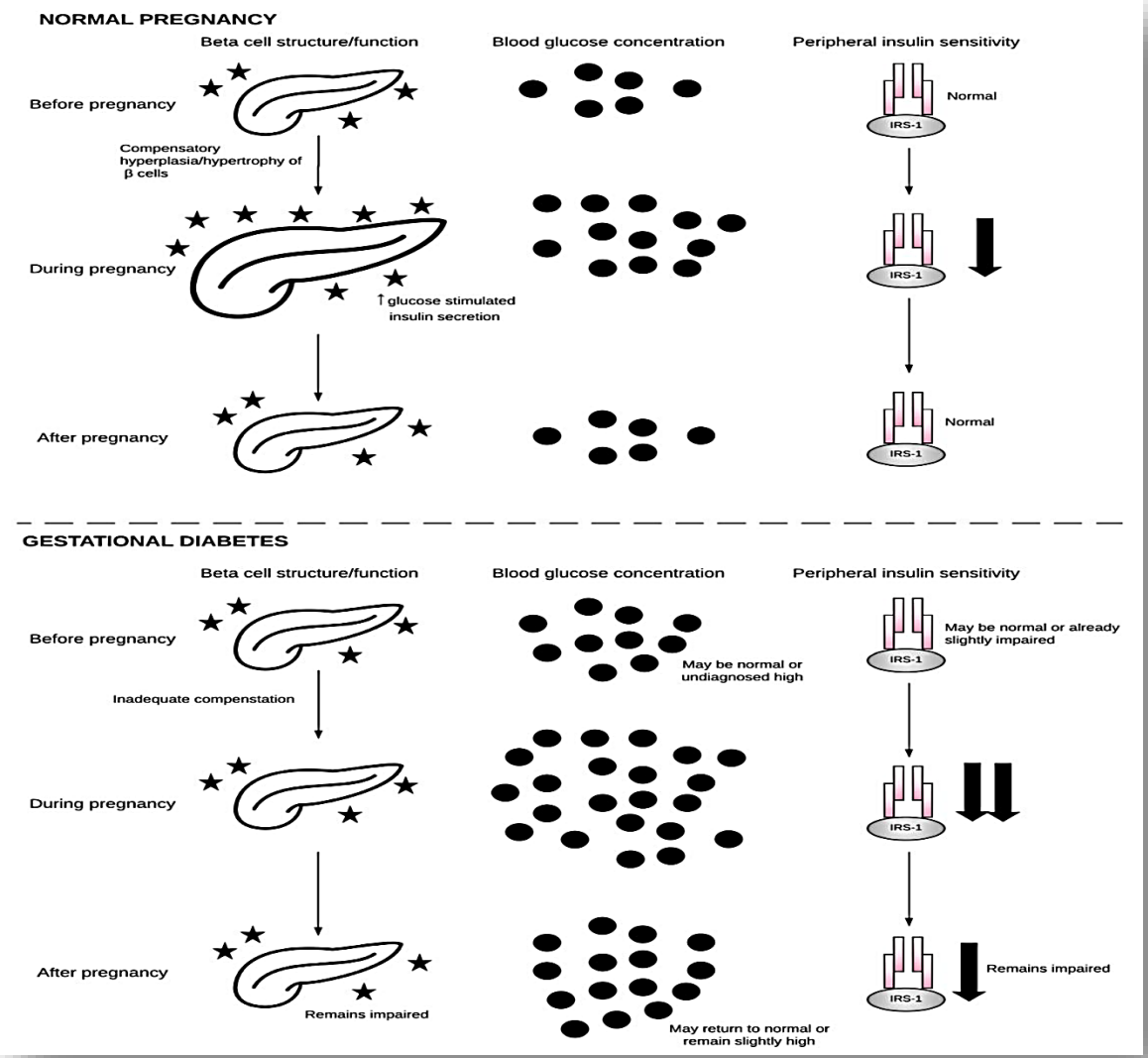

Figure 4 : β-cell, blood glucose, and insulin sensitivity during normal pregnancy and GDM (Plows et al.,2018).

2.4) Pathophysiology of fetal in GDM

The primary macronutrient that supports fetal growth is maternal glucose (McIntyre *et al.*, 2019)**.** (Figure5)

Long-term exposure to hyperglycemia and/or certain amino acids (such as leucine and arginine) during fetal development can cause hyperinsulinemia (Plows *et al.*, 2018)

Free fatty acids (FFAs) that come from mother lipoproteins are lipolyzed on the placental surface with the help of endothelial lipase (EL). Only a tiny percentage of these FFAs, though, cross the placenta and enter the fetal FFA pool. Rather, hepatic de novo lipogenesis, which uses excess maternal glucose as a precursor, produces most fetal FFAs. Maternal overnutrition affects this process.

Triglyceride synthesis is stimulated by fetal insulin, which leads to the synthesis of fat in the white adipocytes of the fetus (McIntyre et *al.*, 2019).

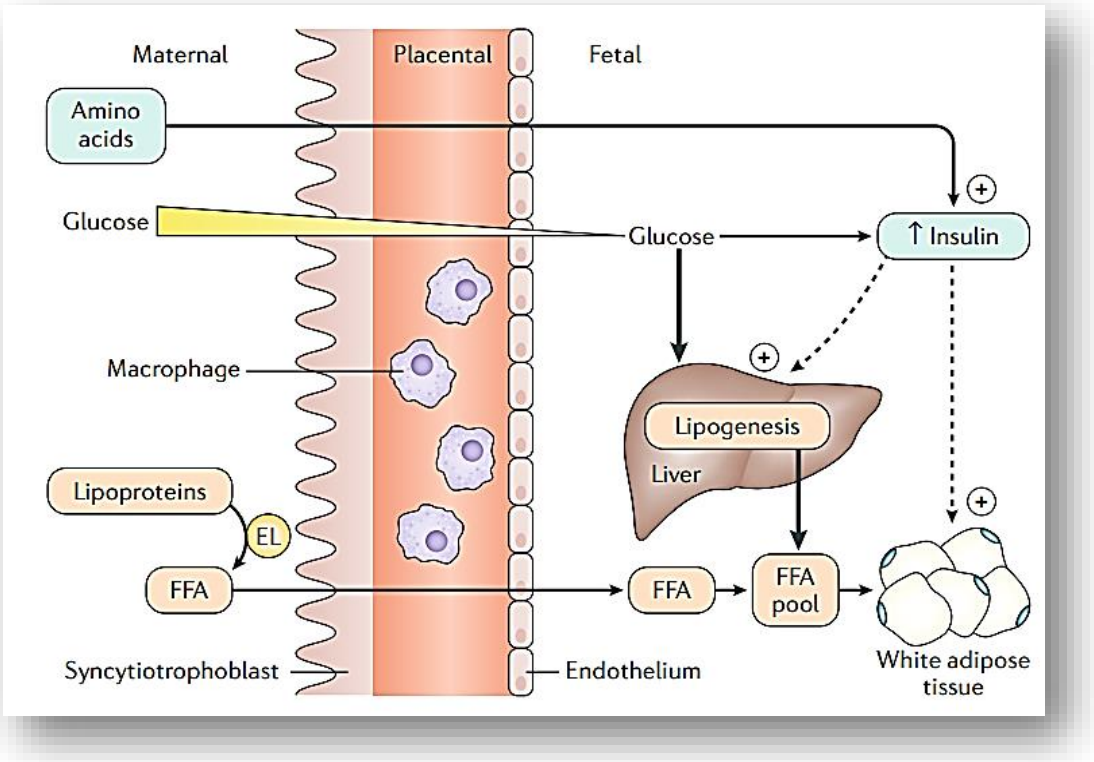

Figure 5: Pathophysiology of fetal in GDM (McIntyre *et al.*, 2019).

2.5) Risk factors of gestational diabetes

Certain women are more susceptible to gestational diabetes. There are two categories of identified risk factors for GDM, variables with a high impact and factors with a low impact.

- **High impact**

Maternal age

When the pregnant woman is over 35 years old, the risk of GDM increases (*He et al.*, 2022);(Deng *et al.*, 2022).

Obesity

Women with a body mass index (BMI) over 30 kg/m2 have a higher risk of developing gestational diabetes due to increased insulin resistance. Specifically, adipose tissue, particularly when situated in the abdominal region, is associated with an augmented release of substances that impact insulin sensitivity, including non-esterified fatty acids, glycerol, certain hormones, and cytokines (Yen *et al.,* 2019).

Ethnic background

Compared to women of European origin, women from specific ethnic backgrounds such as South Asian, African American, Hispanic, Native American, and Pacific Islander have a greater frequency ofGDM. The aforementioned elevated risk is ascribed to a genetic predisposition, dietary practices, and lifestyle elements that are characteristic of these cultures (Spanakis and Golden, 2013).

Family History of Diabetes

A family history of diabetes, especially among first-degree relatives (parents or siblings), elevates the likelihood of developing GDM. Genetic factors may contribute to insulin resistance and impaired glucose tolerance inaffected individuals (Chen *et al.,* 2015 ; Plows *et al.,* 2018).

Personal history of gestational diabetes

The prevalence increases to 50% in women who had previously developed GDM during a pregnancy [8].

Fetal macrosomy history

Birth weight of a child weighing more than 4 kg [8].

- **Low impact**

Maternal multiparity

Multiple pregnancies are a risk factor for GDM, however they have a lower influence than other variables such as obesity, advanced mother age, a family history of diabetes, and ethnicity. While many pregnancies can contribute to increased maternal metabolism and insulin resistance, resulting in a tiny increase in GDM risk with each successive pregnancy, their influence is minor when compared to other major risk factors.

Still, multiparity should be taken into account when determining the total risk of gestational diabetes. (Egeland and Irgens, 2001)

Lifestyle habits

While unhealthy lifestyle habits like poor diet,and lack of physical activity, , can contribute to GDM risk, their impact is generally considered less significant compared to other factors. Nonetheless, promoting healthy habits during pregnancy is crucial for reducing overall gestational diabetes risk and improving maternal and fetal outcomes (Zhang and Ning, 2011).

2.6) Symptoms of gestational diabetes

GDM typically remains asymptomatic. In most instances, the condition is identified solely through blood sugar level screenings conducted during gestational diabetes testing. However, elevated blood sugar levels (hyperglycemia) may induce symptoms in some women including : increased thirst, frequent urination, dry mouth, fatigue, blurred vision and genital itching or thrush.

Nevertheless, these symptoms can also be commonplace during pregnancy and may not invariably indicate GDM. It is through a blood sample that it will be possible to detect an abnormal increase in blood sugar levels (Hammoud et al., 2012);[9].

2.7) Detection and diagnosis

It is important to do a serious risk assessment for GDM development at the very first prenatal appointment,such as glucose testing as soon as possible if they have a strong family history of diabetes or glycosuria, a personal history of GDM, or significant obesity. If these women are found not to have GDM at the initial screening, they should have another test, usually between weeks 24 and 28 of pregnancy. The diagnosis of GDM was based on the two-hour 75 g oral glucose tolerance test (75 g OGTT). (Chen *et al.*, 2015); (Lewandowska, 2021). Blood sugar levels that are equal to or lower than (1.40g/L) one hour after consuming the glucose solution are typically considered normal for the glucose screening test.

If a pregnant woman's blood glucose level exceeds (1.40g/L), the next step is typically the oral glucose tolerance test (OGTT). This test helps determine if the woman has GDM.

Abnormal blood values for a 2-hour 75-gram oral glucose tolerance test representing in table 1

Table 1: Abnormal blood values for 75-gram OGTT(Alfadhli, 2015)

Fasting **Before a meal (preprandial)**	**1 hour after a meal** **(postprandial)**	**2 hour after a meal** **(postprandial)**
greater than 0.919 g/L	greater than 1.802 g/L	greater than 1.531g/L

2.8) Complications of gestational diabetes

Many consequences may arise from GDM. These can be broadly classified as effects on the mother and child, which can be identified at any point throughout the pregnancy, at birth, or much later on (Lindsay, 2009).

2.8.1) Maternal complications

- **Short term complications**

Polyhydramnios (Excessive Amniotic Fluid)

GDM may result in polyhydramnios, marked by an abnormal buildup of amniotic fluid. This condition heightens the chances of preterm labor, premature membrane rupture, and related complications (Preda *et al.,* 2022);[10].

Preeclampsia and Hypertension

Women diagnosed with GDM face a higher likelihood of developing preeclampsia, marked by elevated blood pressure and organ damage indicators. which can lead to complications for both the mother and the baby (Braunthal and Brateanu, 2019).

Increased Risk of Cesarean Section (C-Section)

GDM increases the likelihood of requiring a cesarean delivery due to factors such as fetal macrosomia, shoulder dystocia, and other birth complications associated with larger babies (Gorgal *et al.,* 2011).

- **Long term complications**

Cardiovascular Disease

Postpartum metabolic syndrome and cardiovascular disease risk are increased in women with GDM. Several risk factors, such as central obesity, hypertension, insulin resistance, and dyslipidemia, are associated with metabolic syndrome (Sheiner, 2020).

Malignancies

Women having a history of GDM may be more vulnerable to long-term cancer development in the future; these women were more likely to be hospitalized for cancer years after giving birth. There is substantial evidence linking GDM to an increased risk of breast, ovarian, and/or endometrial cancer (Sheiner, 2020).

Ophthalmic Disease

GDM is regarded as a significant long-term risk factor for ocular morbidity (Sheiner, 2020).

Future type 2 diabetes

Women who have already experienced GDM are more likely to experience it during any subsequent pregnancies. Additionally more susceptible to type 2 diabetes as they age (Walker *et al.,* 2020) ; (Dennison *et al.,* 2021).

2.8.2) Fetal complications

Macrosomia

The mother's blood provides the fetus with every food it needs. When there is an excess of glucose in the mother's blood, the fetus's pancreas detects this and tries to use the extra glucose by producing more insulin. The excess glucose is transformed into fat by the fetus. A fetus can create all the insulin it requires, even in the presence of GDM in the mother. The fetus becomes abnormally large (referred to as macrosomia) because to the combination of high insulin levels in the fetus and high blood glucose levels in the mother, which leads to significant fat deposits [11].

Hypoglycemia

This issue arises when the mother has continuously high blood sugar, which causes the fetus to have elevated insulin levels in its bloodstream. The newborn's blood sugar level drops dramatically after birth because it no longer receives its mother's high blood sugar levels, even if it still has a high insulin level. (Begum *et al.,* 2018) ; (Arimitsu *et al.,* 2023).

Stillbirth

Is the loss of a baby following 20 weeks of pregnancy (Rosenstein *et al.,* 2012); (Tabatabaee *et al.,* 2020).

Type 2 diabetes and obesity

Are conditions that babies are more likely to have later in life (Mantzorou *et al.,* 2023).

Respiratory Distress Syndrome (RDS)

Babies born to mothers with GDM have an increased risk of RDS, a condition characterized by difficulty breathing due to immature lung development. This can result from exposure to elevated maternal blood glucose levels in utero [12].

2.9) Treatment of gestational diabetes

2.9.1) Lifestyle Intervention

The goal of treating GDM is to reverse hyperglycemia and lower the chance of the unfavorable pregnancy outcomes that are linked to it (Alfadhli *et al.*, 2015).

A key element of managing GDM is lifestyle change (Table 2), which includes food modification, physical exercise, and weight control (Johns *et al.*, 2018).

Table 2: Therapy through lifestyle modification Intervention

(McIntyre et al.,2019);[13];[14].

Lifestyle Intervention	
Diet	**Physical activity**
- Follow easy daily suggestions such as consuming a variety of meals, including fresh fruits and vegetables. - Divide meals into several meals and snacks per day.	- For a woman with GDM, moderate exercise for at least 30 minutes a day is advised. - Light activity, such as walking, swimming, and cycling.

2.9.2) Pharmacological Therapy

It is necessary to add glucose lowering medication if lifestyle modifications alone are not sufficient to meet blood glucose objectives. The treatment used is usually either insulin or oral medications (Table 3) (Poolsup *et al* .,2014).

Insulin is usually injected several times a day (Johns *et al.,* 2018). The daily demand for insulin is 0.7 units/kg in the first trimester, 0.8 units/kg in the second trimester, and 0.9 to 1.0 units/kg in the third trimester (Rodriguez et Mahdy,2023)

Table 3: Therapy using pharmaceuticals (McIntyre et al., 2019);[13];[14].

Pharmacological Therapy	
Insulin	**Oral medications**
- The gold standard for treating hyperglycemia is insulin.	- Metformin is the oral hypoglycemic medicine that is being explored as an alternative to insulin in treating people with GDM. - Based on cost and convenience, metformin may be selected in certain instances.

Practical part

Material and method

1) Study objectives

The objective of the present study is to investigate the prevalence of GDM within a specific population at a particular point in time. This type of study aims to assess the proportion of pregnant women with GDM at the time of assessment. This investigation aims also to highlight the main factors that could be influencing the appearance of diabetes in pregnant women.

2) Type of study

A cross-sectional, descriptive, questionnaire-based survey study was conducted in Guelma. It involved 180 pregnant women and was conducted during two months (March and April 2024). Data collection took place in five different locations, at the Specialized Public Foundation for Mothers and Children, the Public Foundation for the Heliopolis Centre, the Oumeddour Tunis Centre, and various private clinics (Gynecological and obstetric clinic).

3) Study Population

For this study, we aimed to include pregnant women overall. Patients with GDM were incorporated no matter their age or time of diagnosis.

4) Data collection

We collected data by distributing a systematically structured questionnaire (AppendixX) to 180 pregnant women. The document was written in Arabic to ensure the comprehension of all the participants regardless their educational level.

In addition, during the distribution of the questionnaire, the ladies were assisted in case they needed explanation or help filling the document.

The questionnaire was organized in four sections as follows:

Section 1: Demographic Information

- Age
- Weigh
- Height
- Number of Pregnancies
- Place of residence (Urban/Rural)

Section 2: Medical History

- Having gestational diabetes
- Diagnosis Week
- History of diabetes before pregnancy or pre-diabetes

- History of gestational diabetes in previous pregnancies or pre-gestational diabetes
- Other chronic disease
- Overweight before pregnancy
- Fetal weight gain
- Type of birth
- Family History of Diabetes

Section 3: Lifestyle and eating habits

- Physical activity
- Eating habits
- Nutritional advices

Section 4: Management of gestational diabetes

- Number of times of blood sugar measurement
- The highest and lowest value
- Meeting nutritionist

5) Measurements of Anthropometry

The aim of taking height and weight is to calculate the body mass index of each sample expressed in the following equation weight in kilograms dividing the length square by meter.

$$\text{BMI} = \text{weight (kg)} / \text{Height}^2 \text{(m)}$$

According to the WHO, the BMI was divided into four groups: (Weir et Jan,2023); [15]

BMI = <18.5 for underweight

BMI = 18.5–24.9 is the normal weight

BMI = 25–29.9 Overweight

BMI of 30 or greater indicates Obesity

6) Statistical analysis

Microsoft excel 2013 was used to conduct the descriptive analysis, which involved calculating percentages, mean, standard deviations, and graph mapping. The quantitative results are presented as means ±SD.

Results and discussion

1) The distribution of the outcomes based on respondents' responses to the survey

1.1) Epidemiological characteristics of the sample

1.1.1) Maternal age

The sample collected represents 180 pregnant women between the ages of 17 and 52 years old. In order to organize the sample, participants were divided into 6 age groups (Table 4). There is a decrease in the number of women belonging to [17-22] by 3%,and women aged [23-28] represent 26%, Women aged [29-34] were 38% dominant followed by women aged [35-40] with 27%, then the [41-46] age group with 5% and most recently women aged [47-52], representing the lowest 1%.

The average age of the participants was estimated to be 32 ±5.7 years.

Table 4: Distribution of participants by age

Age group	[17-22]	[23-28]	[29-34]	[35-40]	[41-46]	[47-52]*
Effective	5	47	69	49	9	1
Percentage (%)	3%	26%	38%	27%	5%	1%

* Corresponds to one woman at the age of 47 years old.

1.1.2) Description of the population according to the BMI

The results of the BMI are represented in figure 6 below. Only 1% of the participants are classified as underweight, and 33 % of them have a normal BMI, while 43% are classed in the overweight category. The participants having a BMI superior than 30 are 23 % and they represent the obesity category.

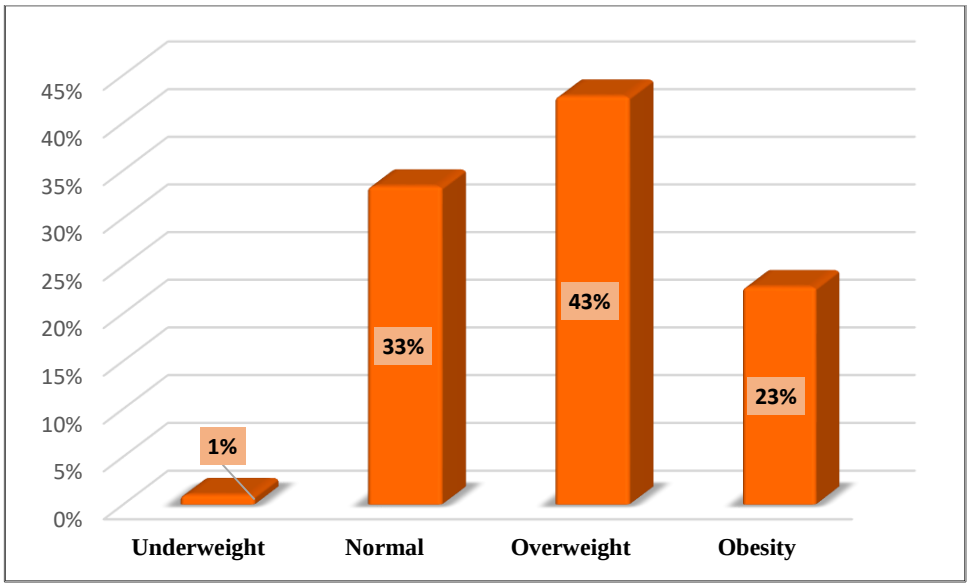

Figure 6: Distribution of participants according to the BMI

1.1.3) Number of pregnancies

According to data analysis, the largest proportion of pregnant women appears to be concentrated in the first and second pregnancy, accounting for a large proportion of the total pregnant women, reaching 27% and 35%, respectively. This is followed by women in the third pregnancy by up to 24%. It is noted that there is a gradual decrease in the proportion of women in the fourth pregnancy at 10%, finally women with 5 pregnances and more are 4% (Figure7).

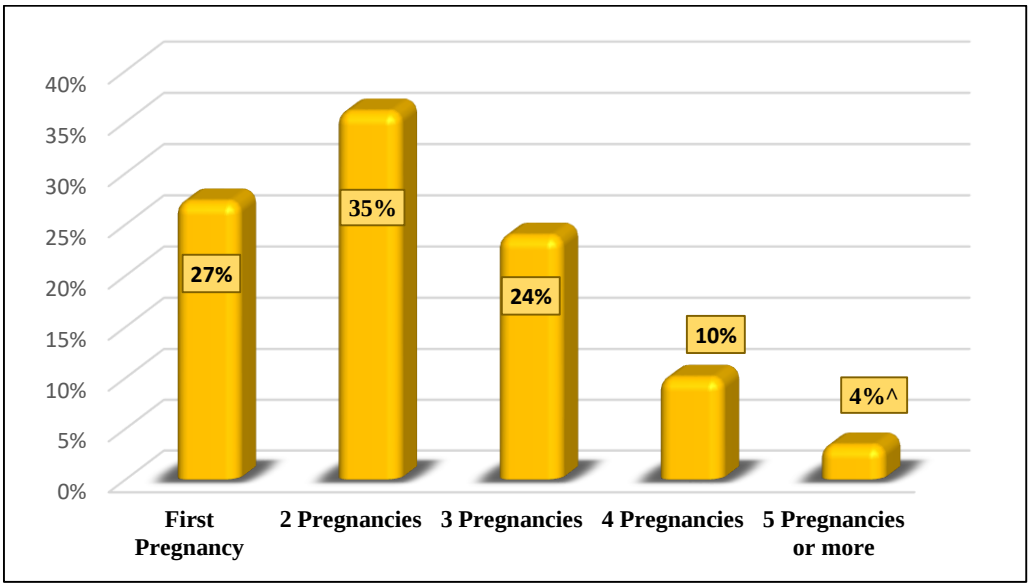

Figure 7: Participant distribution according to number of pregnancies

^: Indicates the total number of women who have undergone 5 pregnancies or more; specifically, 2% for women in their fifth pregnancy, followed by 1% for women in their sixth pregnancy, and 1% also for women in their eighth pregnancy.

1.1.4) Settlement of all participants

The figure below (Figure8) shows the settlement of participants, noting that 53% of the participants are from the city (Guelma) however 47% are from rural areas.

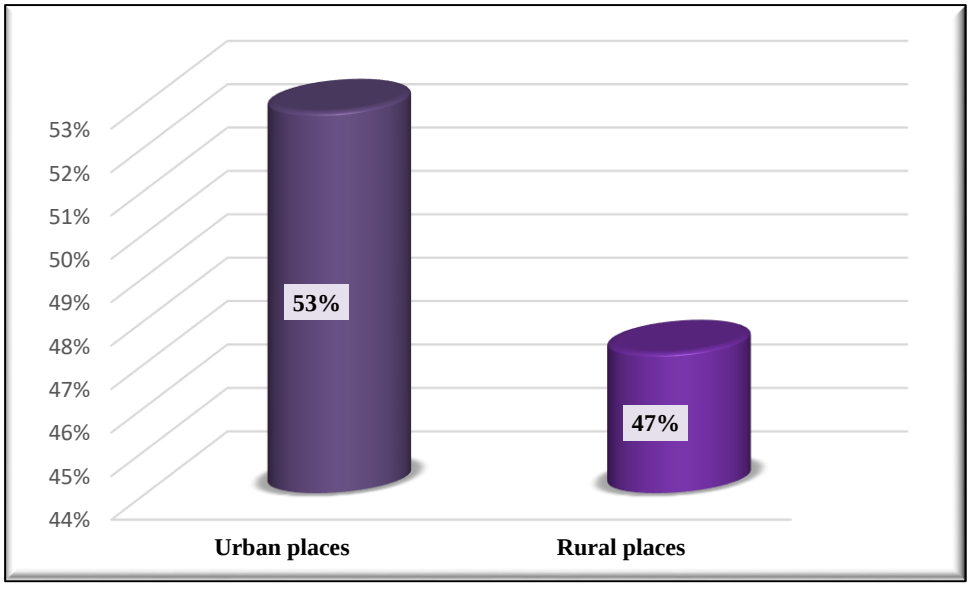

Figure 8: Pregnant women's distribution according to settlement

1.1.5) Prevalence of diabetes

According to our results, the prevalence of women who developed GDM during their pregnancy is 19% (33), however, 3% of the participants had pre-diabetes mellitus (Figure9), while the other 78% of the pregnant women were healthy.

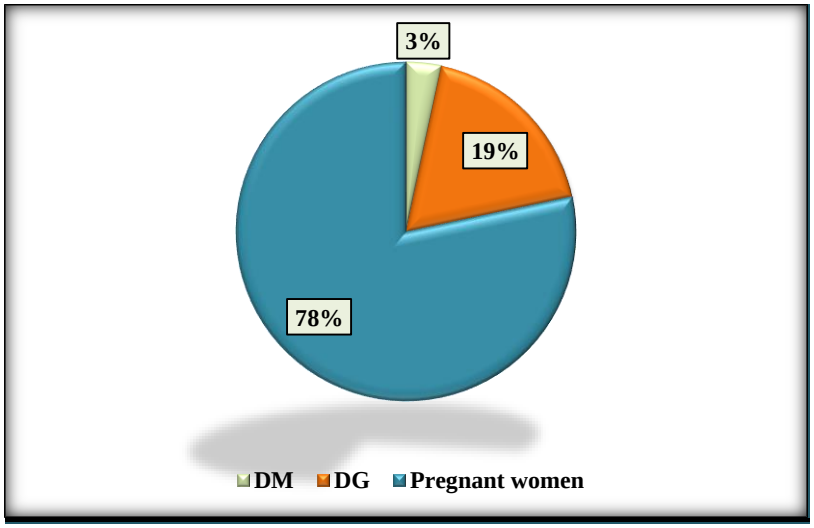

Figure 9: Distribution of participants according to state of health

1.2) Description of women with GDM

1.2.1) Age

In the current investigation, the 33 patients have an age between 20 to 45 years old. Participants were categorized into 5 age groups (Table 5). Women aged [20-24] representing the smallest proportion at 6%. The age group between 25 to 29 years exhibited dominance at 28 % followed by 24 % for those aged between 30 and 34 years and 40 to 45 years. Finally, 18 % of patients belonging to the age group from 35 to 39 years old.

The average age of the participants was estimated to be 33,4 ± 6.3 years.

Table 5: Distribution of patients of GDM by age

Age group	[20-24]	[25-29]	[30-34]	[35-39]	[40-45]
Effective	2	9	8	6	8
Percentage %	6%	28%	24%	18%	24%

1.2.2) Description of women with GDM according to the BMI

The pregnant women with GDM were divided into three categories based on their BMI (Figure 10). 24% of patients have a normal BMI while 33% are classed in the overweight class. The patients belonging to the obesity class represent 43%.

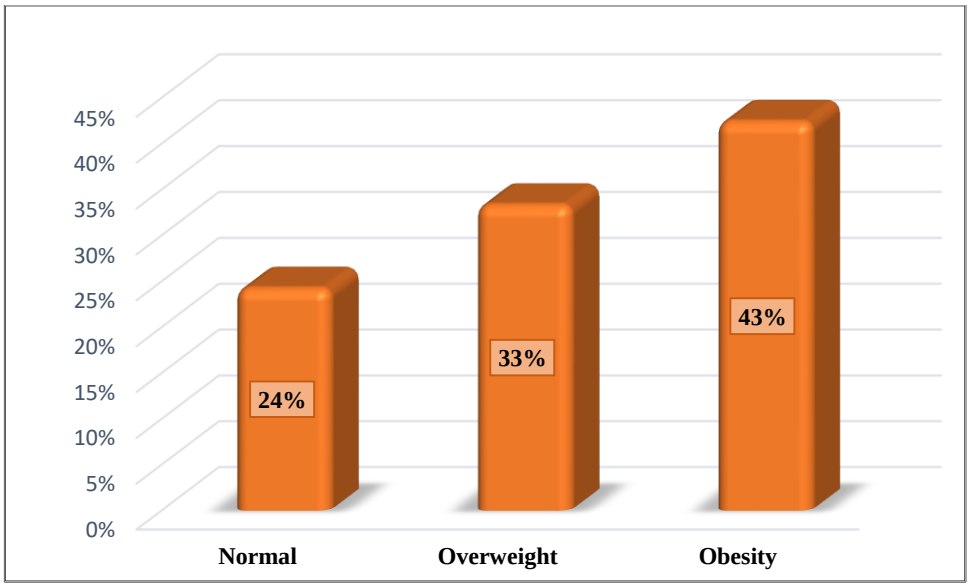

Figure 10: Distribution of pregnant women with GDM according to the BMI

1.2.3) Number of pregnances

The sample collected from our study shows that the largest proportion of pregnant women with GDM had their second and third pregnancies, with ratios reaching 39% and 21%, respectively. Then, the fourth and first pregnancy comes with 18% and 15%, respectively followed by women who had their fifth pregnancy with 6% (Figure11).

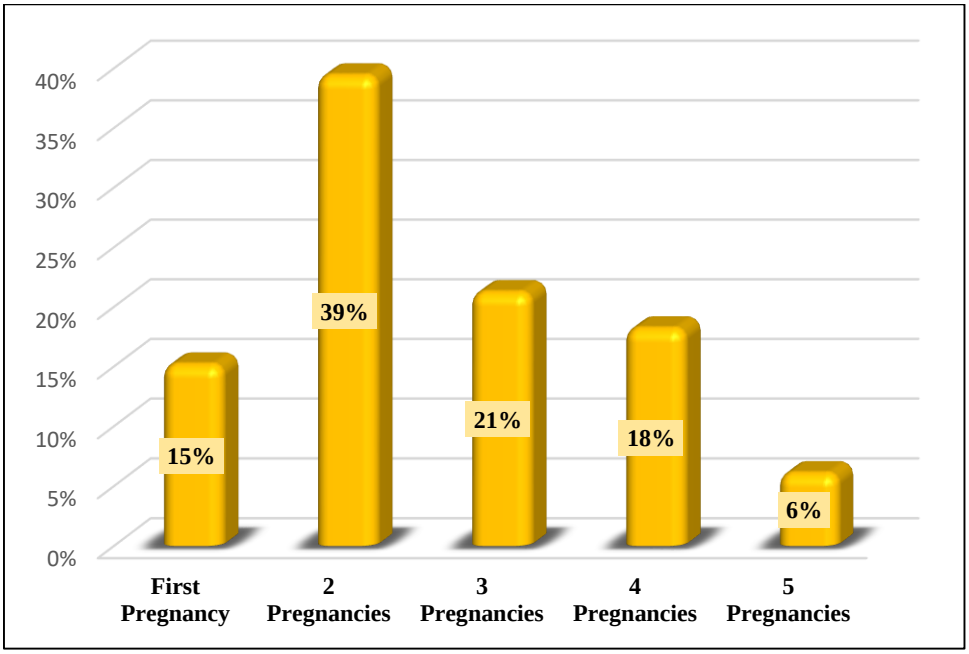

Figure 11: Distribution of women according to the number of pregnancies

1.2.4) Geographical distribution of pregnant women with GDM

Our study on gestational diabetes patients focused specifically on Guelma city (urban areas) and its surrounding municipalities (rural areas). The findings revealed that 19% of affected women reside in urban areas, while 17% are residents of rural areas.

On the other hand, 83% of healthy women reside in rural areas and 8% in urban areas (Table 6).

Table 6: Proportion of pregnant women in urban versus rural areas

Variables n (%)	**Total frequency of participant n (%) N= 180**	**GDM**	
		No	Yes
Rural areas	85 (47%)	70 (83%)	15 (17%)
Urban areas	95 (53%)	77 (81%)	18 (19%)

n: number of participants

1.2.5) Time of diagnosis with GDM

The data show (Figure12) that the largest percentage of gestational diabetes cases appear in the first trimester, from the first week to the twelfth week of pregnancy, reaching 48% of the total cases. While the percentage decreases slightly in the second trimester from 13 weeks to 26 weeks to 45%,. The diagnosis of GDM in the third trimester, from 27 weeks to 40 weeks, represents only 6% of the cases.

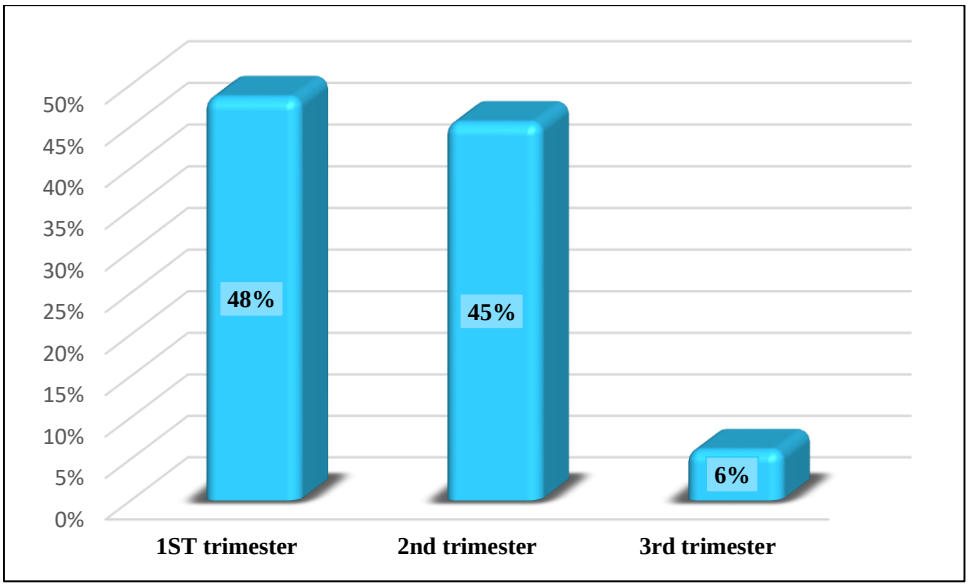

Figure 12: Distribution of patients according to the time of diagnosis with GDM

1.2.6) Pathologies during the course of pregnancy

According to the data analysis, 30% of the participants declared developing some pathologies during the course of their pregnancy, Whereas the largest percentage of them (70%) do not suffer from any other disease. (Figure13).

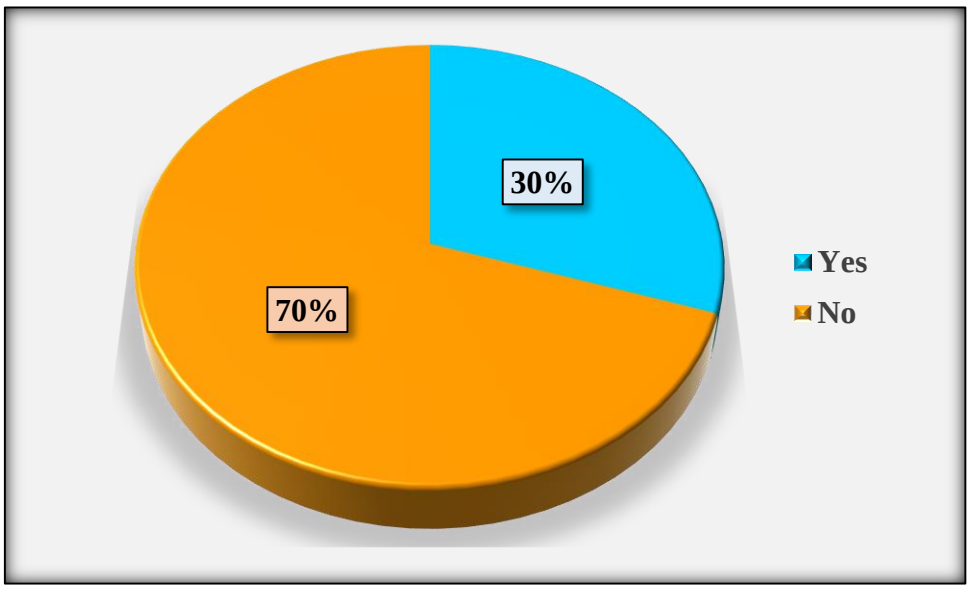

Figure 13: Distribution of women with GDM according to appearance of pathologies

Based on our results, Hypertension is the most prevalent disease among women with GDM, reaching 50%. Anemia, Hernias, osteoporosis, RCH and thyroid problems comes after, with 10% for each one (Figure 14).

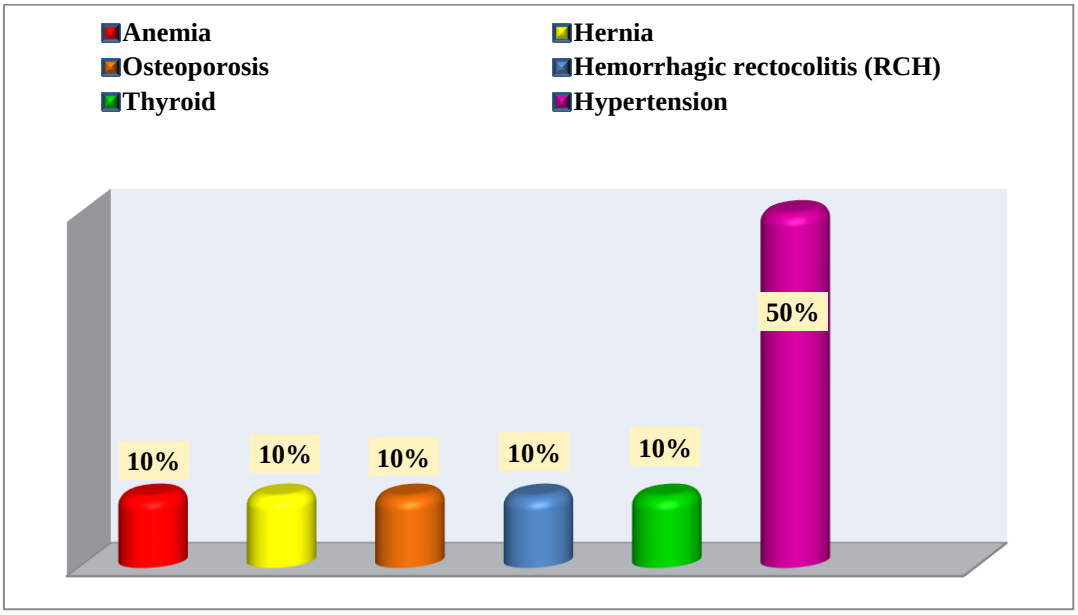

Figure 14: Distribution of patients according to the appearance pathologies during pregnancy

1.2.7) The fetus weight

In this sample of patients, Data indicate that 58 % of women with GDM have normal weight embryos. The proportion of fetus with excess weight (macrosomia) represent 42% (Figure15).

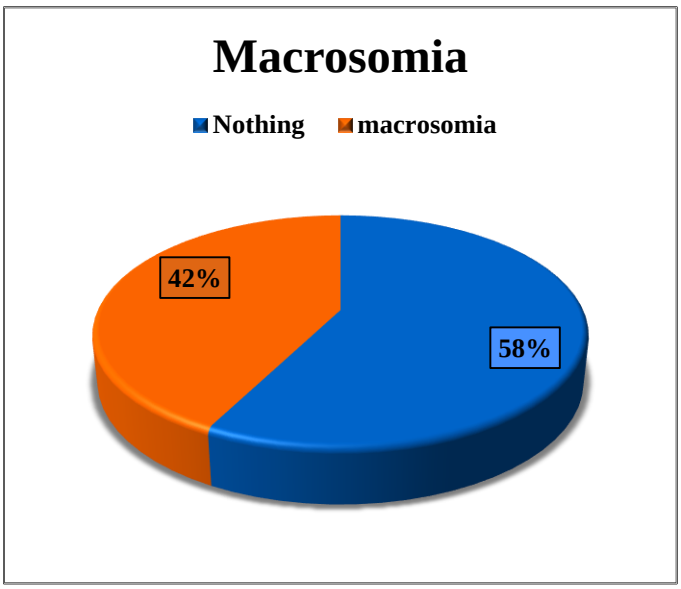

Figure 15: Distribution of fetus according to their weight

1.2.8) The nature of birth

The table 7 shows the methods of childbirth in women with GDM according to their treating doctors. The data show that C-section is the most common method in 43% of cases. It is followed by a 39% natural birth. 18% pregnant women have not yet had their birth method determined.

Table 7: Distribution of patients by mode of delivery

The nature of birth	Cesarean	Natural	Don't know
Effective	14	13	6
Percentage %	43%	39%	18%

1.2.9) Family history of diabetes

In our study, we note that 66% women have a family history of diabetes while 34% did not have it (Figure 16).

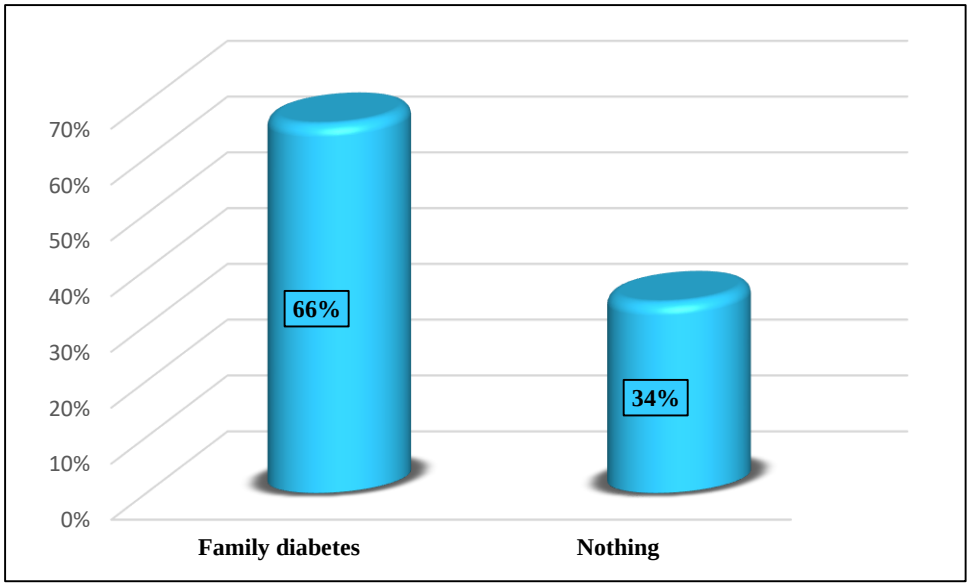

Figure 16: Distribution of women according to their family history of diabetes and absence of it

Based on the results of the family history of diabetes (Figure17), women with diabetic mothers make up the highest percentage of cases at 41%. They are followed by women whose fathers are 32% affected. Women with both parents are 14% affected. Next comes women who have another relative who is 9% affected, then 4% siblings.

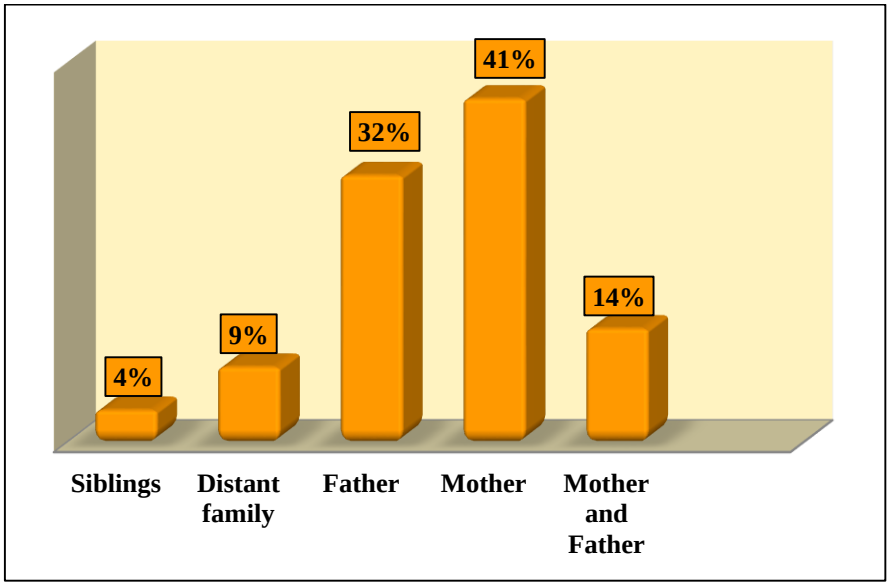

Figure 17: Participant's distribution according to family history of DM

1.2.10) Physical activity

Regarding the frequence of practicing physical activity, women with GDM were divided into 3 groups (Figure 18). 40% do not exercise at all, 36 % exercise regularly and 24 % do physical activity occasionally.

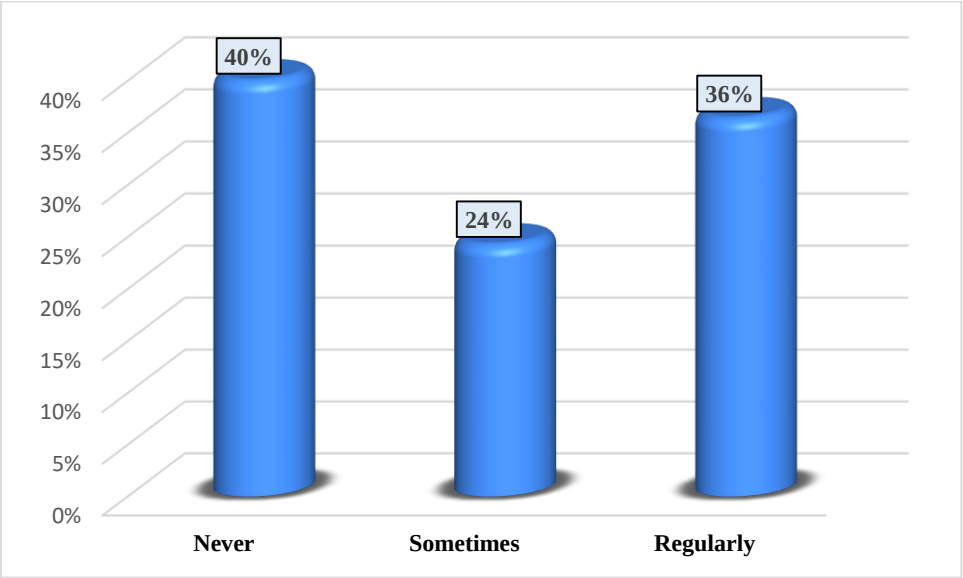

Figure 18: Distribution of subjects based on physical activity

1.2.11) Dietary habits of women with GDM

The figure19 shows the distribution of pregnant women according to their diet. The largest segment of pregnant women has a healthy diet, constituting 55% of the total, followed by women who follow a normal diet (42%). Women who follow an unhealthy diet make up 3% of cases.

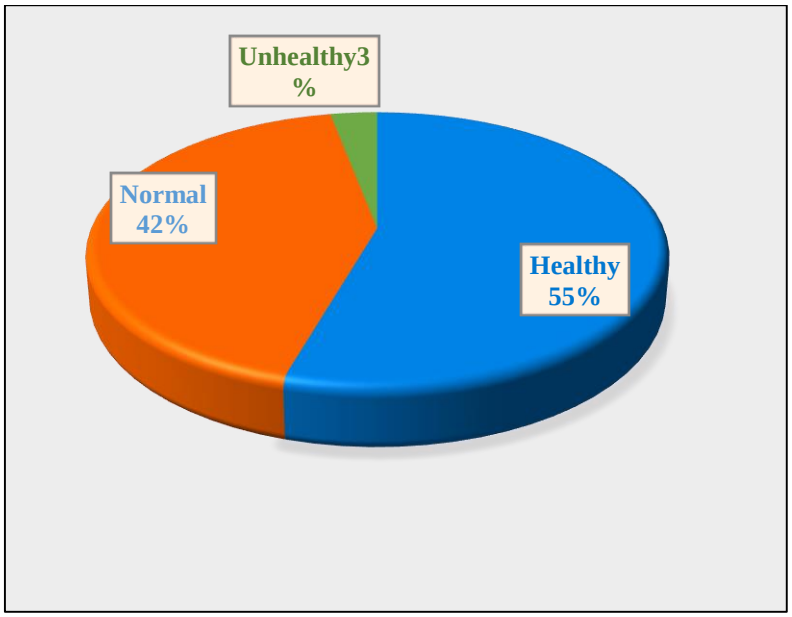

Figure 19: Infected women's distribution based on dietary habits

1.2.12) Consulting nutritionist

Figure 20 represents women with GDM who consulted or not a nutritionist during their pregnancy. The results show that the majority of patients consulted a nutritionist during pregnancy, reaching 76%, while the remaining 24% did not.

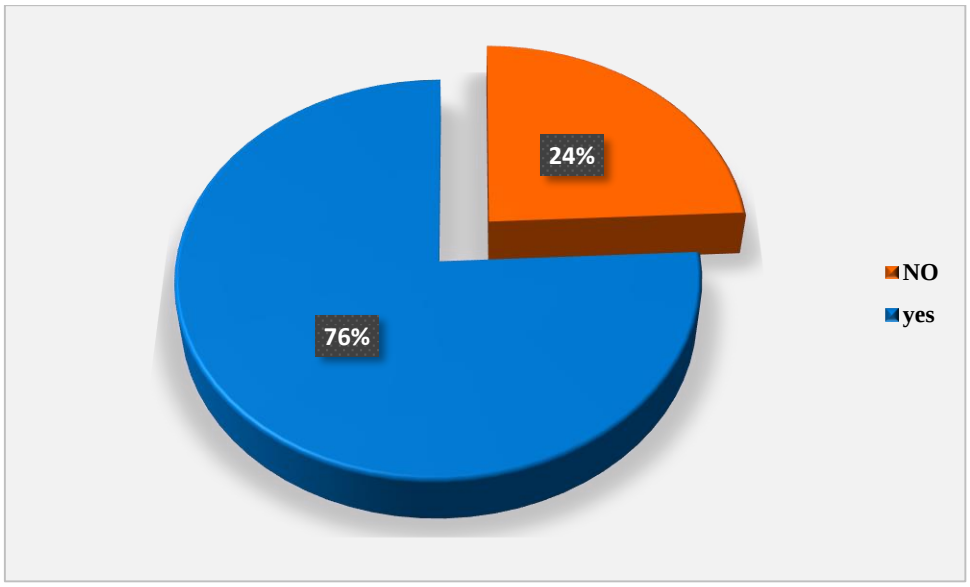

Figure 20: A relative study of affected women about following a nutritionist

1.2.13) Treatment of GDM

The figure below illustrates the distribution of treatment methods used for gestational diabetes management according to our results (Figure 21). With 48% of pregnant women are relying on changing their diet to manage blood sugar levels. Data shows that 30% of women need a combination of diets and insulin use to control pregnancy diabetes, then 10% of women use insulin as their primary treatment. A combination of diets, insulin, and medicines is followed by 9% of women and 3% of women do not follow any treatment.

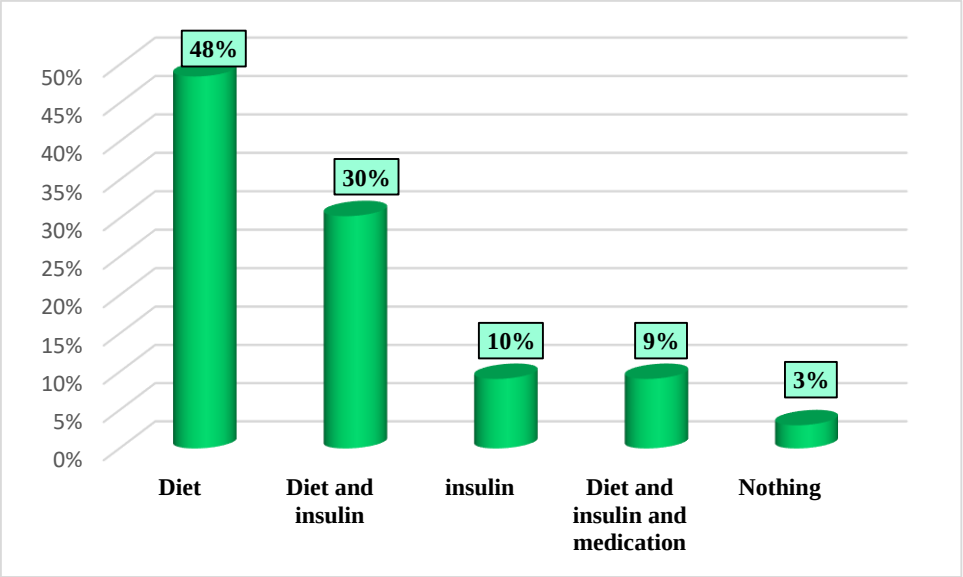

Figure 21: Diverse distribution of treatment methods used to manage GDM

In the present work, we conducted a cross-sectional study of the prevalence of GDM in the city of Guelma (Algeria). This type of studies has certain limitations and bias that we are aware of; especially the subjectivity of the answers. We distributed randomly an anonymous questionnaire to 180 pregnant women in five facilities during two months. The prevalence of GDM among pregnant women in the city of Guelma was estimated at 19 %.

Many studies in the literature exhibited close results to ours. For example, a cross-sectional study conducted in Cameron during three months reported that the incidence of GDM was 19.5%. In addition, a GDM prevalence survey in Beijing revealed that the frequency of GDM was 19.7% (Feng et al., 2017) ; (Egbe et al., 2018).

In contradiction to our results, a Prospective Population-Based Study in Tianjin, China, revealed a prevalence of 8.1% in the participants (Leng *et al.*, 2015).

According to a cross-sectional analytic study in Tanzania, the prevalence was much higher, reaching 27,9% (Mukuve *et al.*, 2020).

The fluctuations in the prevalence can be related to the limitations associated with the cross sectional studies. This type of studies is observational and analyzes data from a population at a single point in time. Unlike other types of observational studies, cross-sectional studies do not follow individuals up over time (Wang and Cheng, 2020).

For the age of patients, it ranged from 20 to 45 years old, with a predominance of women aged over 25 years old (28%). The average age was 33,4 ± 6.3 years.

Pregnant women aged between 25-29 years represent the majority and they are more likely to have GDM (28%) followed by women aged 30 to 34 and 40 to 45 years old with 24% for both.

Our results are similar to the findings in previous studies in Asia and Europe (Lee *et al.*,2018) ; (Gao *et al.*,2022).

For instance, in Turkey, a study showed that the prevalence of GDM in women aged >30 years was greater than that of women aged ≤ 30 years. In Spain, there was a predominance of women with GDM over 35 years old with 11.3%. In Nepal the majority of women with GDM were of maternal age >30 years (66.34%), (Akgöl et al ., 2017) ; (Singh Yadavand., 2022) ; (Orós., 2023). .

Previous studies have mainly focused on the high-risk factors of GDM, and have confirmed that advanced age is a risk factor for GDM (Dept, 2017) ; (Balagopalan *et al.,* 2021) ; (Karasneh et al., 2021).

As for the BMI, we found that 43% of women who developed GDM during pregnancy have a high BMI (≥ 30 kg/m^2). Unfortunately, during the collection of our data, most women were not able to provide us with their pre-pregnancy weight. This enabled us to determine the BMI before pregnancy.

It has been reported that during the first half of pregnancy, BMI can be used as a reliable risk factor to assess GDM, especially in some situations where the pre-pregnancy BMI is not available. (Fattah *et al.,* 2010).

Studies have reported an association between increased BMI and GDM. It has been shown that women with a higher BMI in the first half of pregnancy were at higher risk for GDM. (Yong et al., 2020) ; (Rahnemaei *et al.,* 2022) ; (Zhang *et al.,* 2022).

In our study, the results demonstrate that 39% of patients had their second pregnancy.

Many investigations suggested that the number of pregnancies had no effect on the risk of GDM. It has been suggested that higher numbers of pregnancies are an independent risk factor for GDM. The association between number of pregnancies and GDM was more prominent among women who were ≥30 years old or with a pre-pregnancy BMI > 24kg/m^2 (Duman et al.,2015) ; (Liu et al.,2020).

According to our results, women living in urban areas (19%) were more likely to have GDM compared to those in rural areas (17%), the prevalence in our rural population is incompatible with the previous studies who found a low prevalence of GDM in rural communities (ranging from 1% to13.2 %),(Mwanri *et al.*,2013) in Tanzania and (Xu *et al.*,2017) in China and (Choudhury et Rajeswari,2021) in india. Yet, it is much lower than a few other studies in Bangladesh (27.4%) (Mazumder *et al.*,2022).

For the diagnosis of GDM, it has been discovered in 48% of patients during their first trimester and 45% of patients during the second trimester. It is a study in 2022 found that the diagnosis of GDM was almost 2–3 times greater among women in the first trimester group than to those in the second and third trimester (Mazumder *et al.*,2022).

It is conventional to screen all pregnant women for GDM, typically at 24–28 weeks gestation. (Quaresima *et al.*,2020). (Hillier *et al.*,2020).

In our series, the results revealed that hypertension is the most common pathology in patients with a frequency of 50%, as compared to only 10% of the women that had developed other pathologies like Anemia, Hernia, and Thyroid. It's the same with the studies done in Uganda. This could be attributed to the variation in diagnostic criteria. Taking insulin has also been linked to an increase in hypertensive diseases (Tobia *et al.*, 2011) ; (Martis *et al.*, 2018) ; (Ochieng *et al.*, 2022).

Regarding fetal macrosomia, it is defined as a birth weight ≥ 4,000 g. It is mainly due to the increased insulin resistance of the mother leading to elevated blood glucose levels. This excess glucose crosses the placenta into the foetal circulation, where it is stored as body fat, causing macrosomia. It affects 12% of newborns of normal women and 15-45% of newborns of women with gestational diabetes mellitus (GDM). (Kc *et al.*,2015).

In conformity to that, our study revealed that the incidence of macrosomia among fetals of pregnant women with GDM in Guelma was 42%.

The risks associated with macrosomia are cesarean delivery, postpartum hemorrhage, and vaginal lacerations (Júnior *et al.*, 2017).

In the same context, the prevalence of programmed C-section in our work was 43%.

The prevalence is in accordance with the percentage of fetal macrosomia.

Macrosomia is one of the risk factors for problems during vaginal birth, which frequently results in the need for a cesarean section to protect the safety of both the mother and the infant (Hyg,2021).

For the infant, macrosomia increases the risk of shoulder dystocia, clavicle fractures, and brachial plexus injuries and increases the rate of admissions to the neonatal intensive care unit (Júnior *et al.*,2017).

Our study showed that a family history of DM is associated with GDM (66% of mothers have a family history of DM). The prevalence of having GDM with a diabetic mother or father is 41% and 32%, respectively, and 14% for both diabetic mother and father. Under the findings of Tabak and his collaborators, they found a statistically significant higher risk of GDM for maternal diabetes (Tabak *et al.,* 2009).

Several studies were similar to our findings, showing that family history of DM is one of the most prominent risk factors for GDM (Erem *et al.,* 2014) ; (Chamia *et al.,* 2020) ; (Lewandowska, 2021)

Along the same line, a prospective cohort study included 1129 pregnant women showed that the ones with first, second, or both first and second-degree relatives with T2DM had a markedly increased risk of GDM compared to those with negative family history (Monod *et al.,* 2023).

Based on the results of our investigation, 40% of women with reduced physical activity had GDM by while 36%. of women with high levels of physical activity had GDM.

Some researchers reported that no apparent difference was observed in the risk of GDM development for women receiving intervention in exercise compared to women who did not receive any intervention (Bain *et al.,* 2015).

Contrariwise, according to several studies, higher physical activity programs reduce the risk of GDM. (Russo *et al.,* 2015) ; (Muche *et al.,* 2019) ; (Doi *et al.,* 2020).

According to a systematic review published in 2024, there is a dose-response relationship between higher levels of physical activity in both the first and second trimesters and reduced risk of GDM; the relationship is stronger in the first trimester (Xie *et al.,* 2024).

Our study reported that there is a great reliance on diets as a first step in managing gestational diabetes 48%, followed by diet and insulin 30%, Insulin Only 10% and 9% of women use insulin, diets, and medications in combination.

This was similar to previous studies which found that the majority of women with GDM follow only a diet, and then a proportion of them have a specific diet and insulin. Finally, only a small ratio has a combination between diet, insulin, and medications (Bas-Lando *et al.*, 2014) ; (Bianchi *et al.*, 2018) ; (Lee *et al.*, 2019).

In the United States and Canada, insulin is advised as the first-line pharmacological treatment for GDM, but in the United Kingdom, oral medication is the recommended course of action until a significant elevation of blood glucose levels occurs (Johns *et al.*, 2018).

On the other hand, patients find oral drugs appealing because of their enhanced adherence, equivalent effectiveness, ease of administration, and reduced cost (Thorkelson *et al.*, 2016).

A retrospective cohort research was conducted at Qatar's Women's Hospital, comparing GDM women to normoglycemic controls found that treatment with metformin reduces maternal weight gain, the risk of macrosomia and neonatal hypoglycemia compared to diet alone(Bashir *et al.*, 2019).

The possible reason why the majority of women depend only on diet is that changing one's diet can help many women control their diabetes throughout pregnancy. By spreading meals throughout the day and consuming less simple carbohydrates in order to maintain stable blood sugar levels. The use of insulin and other medicines may reflect that diets alone may not be sufficient in many cases to adjust sugar levels. This illustrates the many requirements that each woman with gestational diabetes has her state of health and the development of her pregnancy diabetes.

Conclusion

Conclusion

GDM is one of the most common complications of pregnancy and poses risks to both women and their children.

This cross-sectional study has shed light on various aspects of GDM within the population of Guelma. Through meticulous data collection and description, we identified several associations between maternal characteristics, lifestyle factors, and the prevalence of GDM.

The findings of our study point out that the prevalence of GDM was 19% in the studied areas with the most affected age group of 25 - 29 years. High-risk groups of GDM in pregnant women were those in second pregnancy, with high BMI (≥ 30 kg/m^2) and those who have family history of DM. Lifestyle habits such as low physical activity and high carbohydrate intake were found to contribute to the risk of developing GDM.

The results underscore the importance of early screening and intervention strategies to manage GDM and mitigate adverse outcomes for both mother and child.

However, Public health strategies should prioritize education on lifestyle modifications, promoting physical activity, and dietary adjustments to mitigate the risk factors associated with GDM.

Addressing these factors through comprehensive prenatal care can improve maternal and fetal health outcomes, reducing the overall burden of gestational diabetes in Guelma. In addition, targeted education could play a critical role in reducing the incidence of gestational diabetes and improving maternal and fetal outcomes.

Perspectives and limitations

This descriptive, comprehensive study contributes to understand the prevalence and associations of GDM within a specific population at a single point in time in Guelma.

This study can identify associations but cannot establish causality. Therefore, they cannot definitively determine if certain factors cause or contribute to GDM, because reported data, can be subject to recall bias. Participants may not accurately remember or report past exposures or behaviors, leading to inaccurate associations. Furthermore; a specific and developed statistical tests should be ran like multivariate logistic regression analysis. It is a formula used to predict the relationships between dependent and independent variables.

In addition, the study's sample size of 180 participants, while providing useful information, may not be large enough to generalize the findings to all pregnant women in Guelma. A larger sample size would increase the reliability and generalizability of the results.

By identifying key risk factors such as maternal age (≥25 ans), obesity, and family history of diabetes, the study highlights the need for targeted screening and intervention programs.

the study identifies potential risk factors and their relationship to GDM that can guide results for further research and preventive strategies as well as making hypotheses that researchers can develop and test in longitudinal and experimental studies, and lays the groundwork to evaluate the effectiveness of different intervention strategies.

The association between adjustable risk factors such as reduced physical activity and high carbohydrate intake and GDM confirms the potential benefits of lifestyle interventions. Public health initiatives focused on promoting healthy eating and physical activity among pregnant women can reduce the occurrence of GDM.

To conclude, Future research should focus on longitudinal studies to further understand the long-term impacts of GDM and the effectiveness of various intervention strategies.

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List of attachments

دراسة حول سكري الحمل "استبيان"

أولا شكرا لك على مشاركتك في دراستنا الخاصة بسكري الحمل، جابتك مهمة لفهم هذه الحالة بشكل أفضل وتحسين الرعاية الصحية، جميع المعلومات المقدمة ستبقى سرية.

القسم 1: معلومات عامة

كم عمرك؟ .....

كم وزنك؟ .....

كم طولك؟ .....

كم طفل لديك؟ .....

مكان الإقامة؟ (بلدية / ولاية) .....

القسم 2: التاريخ الطبي

هل أنت مصابة بسكري الحمل؟ نعم ☐ لا ☐

في أي أسبوع من الحمل تم تشخيص حالتك بسكري الحمل؟

.....

هل كان لديك تاريخ من مرض السكري قبل الحمل؟ نعم ☐ لا ☐

هل لديك تاريخ من الإصابة بسكري الحمل في حالات الحمل السابقة؟ نعم ☐ لا ☐

هل لديك أي حالات طبية مزمنة أخرى؟ نعم ☐ لا ☐

إذا نعم ماهي؟ .....

هل كنتِ تعانين من زيادة في الوزن قبل الحمل؟ نعم ☐ لا ☐

هل كان لديك ارتفاع في وزن الجنين خلال الحمل؟ نعم ☐ لا ☐

هل ستكون الولادة طبيعية او قيصرية؟ طبيعية ☐ قيصرية ☐ لا أعلم ☐

هل لديك أحد من افراد العائلة مصاب بمرض السكري؟ نعم ☐ لا ☐

من من أفراد العائلة؟ الاب ☐ الام ☐

في أي عمر ظهر عنده المرض؟

.....

القسم 3: نمط الحياة وعادات الاكل

هل تمارسين النشاط البدني بانتظام خلال فترة الحمل؟ نعم ☐ لا ☐ أحيانا ☐

كيف تصفين نظامك الغذائي اثناء الحمل؟ صحي ☐ غير صحي ☐ عادي ☐

هل تلقيت نصيحة غذائية محددة تتعلق بسكري الحمل؟

.....

القسم 4: إدارة سكري الحمل

كم مرة تقوم بقياس نسبة السكر في الدم؟

.....

هل تلقيت العلاج بالأنسولين او الادوية الفموية او حمية غذائية؟ انسولين ☐ ادوية ☐ حمية غذائية ☐

هل التقيت بأخصائي تغذية او أخصائي سكري لإدارة سكري الحمل؟ نعم ☐ لا ☐

ختاما اشكرك جزيل الشكر على مشاركتك ستساعد اجابتك على فهم وإدارة سكري الحمل، إذا كان لديك تعليقات إضافية فلا تتردد في مشاركتها ادناه.