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NEONATAL COMPLICATIONS CONCERNING MATERNAL MORBIDITY: GESTATIONAL DIABETES

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SUMMARY
Monitoring this morbidity brings with it the need at the public health level to emphasize regular monitoring through prenatal care, aiming for early diagnosis and treatment for Obstetric Diabetes (OD) or Diabetes*Mellitus*Gestational (GDM), thus being able to reduce complications for the mother and fetus. The present study aims to analyze these results between fetal or neonatal complications in women with GDM, bringing outcomes such as premature births, birth weight, neonatal morbidity and mortality, and the synergistic effect of concomitant risk factors and poor obstetric results. A literary review was carried out using the databases: Online Medical Literature Search and Analysis System*(MEDLINE/PUBMED*), Nursing Database - Brazilian Bibliography (BDENF), *Web of Science*and Library*Cochrane*(*SCOPUS*), CAPES Journals and Latin American and Caribbean Literature in Health Sciences (LILACS). The research was carried out using descriptors combined with the help of the operator*boolean "and"*. In view of the searches, it was possible to verify that the authors corroborate each other regarding the main neonatal outcomes: Complications include fetal macrosomia, birth injuries, increased cesarean section rates, neonatal hospitalizations, neonatal hypoglycemia, neonatal respiratory distress syndrome (RDS) , prematurity and fetal death. It is concluded that for the mother, the impacts such as the risk of infections related to the urinary system are high, as well as hemorrhage in the postpartum period and laceration of the vaginal canal. For children, hypoglycemia, prematurity and fetal macrosomia are some of the complications resulting from diabetes.
Key words: Diabetes. Gestational diabetes. Neonatal outcomes.

ABSTRACT
The monitoring of this morbidity brings with it the need at public health level to emphasize regular monitoring through prenatal care, aiming at early diagnosis and treatment for Obstetric Diabetes (OD) or gestational diabetes mellitus (GDM), thus being able to reduce complications for the binomial mother and fetus. The aim of this study is to analyze these results among fetal or neonatal complications in women with GDM, bringing in the outcomes of premature birth, birth weight, neonatal morbidity and mortality, and the synergistic effect of concomitant risk factors and poor obstetric outcomes. A literature review was carried out using the following databases: Online Medical Literature Search and Analysis System (MEDLINE/PUBMED), Nursing Database - Brazilian Bibliography (BDENF), Web of Science and Cochrane Library (SCOPUS), CAPES Journals and Latin American and Caribbean Health Sciences Literature (LILACS). The search was carried out using descriptors combined with the Boolean operator "and". From the searches, it was possible to see that the authors corroborate each other in relation to the main neonatal outcomes: Complications include fetal macrosomia, birth injuries, increased caesarean section rates, neonatal hospitalizations, neonatal hypoglycemia, neonatal respiratory distress syndrome (RDS), prematurity and fetal death. It can be concluded that for the mother the impacts, such as the risk of urinary system infections, are high, as well as bleeding in the postpartum period and tearing of the vaginal canal. For the child, hypoglycemia, prematurity and fetal

Macrosomia are some of the complications resulting from diabetes.
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1. INTRODUCTION

Increased blood glucose levels (hyperglycemia) is a failure in the production or action of insulin, which leads to the development of the metabolic disease Diabetes*Mellitus*(DM). One of the manifestations of the disease is characterized as any degree of glucose intolerance and during pregnancy it is called Diabetes. *Mellitus*Gestational (GDM), which can occur with the first recognition of pregnancy and, in general, resolves after the moment of birth. Its diagnosis in most casesoccursnthe second or third trimester of pregnancy, being one of the most common metabolic disorders associated with an increase in maternal-fetal morbidity (MORAES,*et al.*, 2020;GIARLLARIELLI*et al.*, 2023).

Monitoring this morbidity brings with it the need at the public health level to emphasize regular monitoring through prenatal care,aiming at early diagnosis and treatment forObstetric Diabetes (OD) or GDM, thus being able to reduce complications for the binomial mother and fetus (RIBEIRO*et al*,.2020; RABBIT*et al.*, 2024).

ANDAlthough diagnostic and therapeutic methods are already well established in the literature, they are not always performed early or adequately, causing a delay in starting medications and prolonging the period of maternal exposure.Oand fetal hyperglycemia (MUZY,*et al.*, 2021).In 2002, the World Health Organization estimated a total of 171 million (2.8%) people with DM in the world population, and predicts that this number will increase to 366 million (4.4%) by 2030.

Among the main risk factors for the development of Gestational Diabetes, excessive weight, increased weight during pregnancy, an age group greater than or equal to 35 years old, a family history of diabetes and complications in other pregnancies should be highlighted. However, regardless of the presence or absence of risk factors, all pregnant women must undergo a glycemic test during prenatal care. To confirm the diagnosis, the 75g OGTT is performed with three samples: fasting, after 1 hour and after 2 hours of ingesting the liquid with 75 grams of glucose, and must be performed between the 24th and 28th week of pregnancy (KAPPEL*et al.*, 2013).

Therefore, it is essential to understand that Gestational Diabetes causes complications for both the pregnant woman and the baby's health, and it is necessary to discuss and evaluate the diagnosis and treatment process, so that these problems can be reduced. In view of this, unmonitored hyperglycemia can cause a risk of pre-eclampsia, difficulty in performing a vaginal birth, as well as premature birth. It is worth highlighting that the risks increase proportionally to the glycemic index, with the period between the 24th and 28th week of pregnancy being most worrying (AMERICAN DIABETES ASSOCIATION, 2016; BRASIL, 2012).

Furthermore, a child whose mother had diabetes during pregnancy will be more prone to developing diabetes.*Mellitus*Type II and obesity during growth. Therefore, the implementation of policies and campaigns for healthy habits and quality of life becomes essential, especially for pregnant women, considering that this way it will be possible to prevent this disease in the long term (DONAZAR-EZCURRA*et al.*,2017).

Given the above, some questions were raised: “What are the possible complications and more occur as a result of GDM?”.

2 LITERATURE REVIEW

2.1 DIABETES*MELLITUS*

The International Diabetes Federation (FID) has drawn attention to the economic impact of diabetes since its first edition in 2000. The first global and country- and region-specific estimates of diabetes-related healthcare expenditure were published in the second edition in 2003 with full details on the methods used, estimates and projections updated in the third edition (FID, 2017).

Diabetes*Mellitus*(DM) is predominantly considered a metabolic condition due to changes in glycemic control. Diabetes increases the risk of several other diseases, therefore, a large part of morbidity and mortality is caused by coronary artery disease, cerebrovascular disease, stroke

cerebral, congestive heart failure, peripheral arterial disease and sudden cardiac death (KHALEDI *et al.*, 2019).

In general, its complications are a leading cause of morbidity and mortality in the United States and contribute substantially to the high costs of healthcare worldwide. According to the literature and the Brazilian Diabetes Society, we can expect a continued increase in the incidence of diabetes as the population ages, with a continued increase in adult obesity rates, and an increase in the population of minority groups that are at high risk. risk of diabetes. Additionally, rising rates of childhood obesity and the increasing diagnosis of type II diabetes (formerly "adult-onset diabetes") among children and young adults has become an increasingly serious health crisis, which will result in more people getting diabetes for most of their lives (JAMES et al., 2003; KAPPEL, 2012; BRASIL, 2006; SBD, 2019a, 2019b).

In developed countries, the cure and prevention of type II diabetes have become relevant and a priority, but even so, it is expected to become a more serious problem in developing countries due to the trend of urbanization and consequently changes in lifestyle. and food (WHO, 2016; IDF, 2017; SBD, 2019b). Already the Brazil,has occupied a place among the countries with the highest number of people who do not yet know that they are affected by the disease, and is in first place with the highest number of diabetic people in South America, withaverage of approximately 48,000 deaths of people agedin20It is 60 years old (IDF, 2017; SBD, 2019ª; 2019b).

2.2 DIABETES PATHOPHYSIOLOGY AND RISK FACTORS

Although the pathogenesis of diabetes is complex, several factors have been identified that increase the risk of the disease. Risk factors for type I diabetes include family history, race (with whites at higher risk than other racial or ethnic groups), and certain viral infections during childhood. And the risk factors for type II diabetes are more diverse, some are modifiable and others are not (XU*et al*, 2019; OLDONI*et al*, 2021).

Non-modifiable risk factors for type II diabetes include age, race or ethnicity, family history (genetic predisposition), history of gestational diabetes and low birth weight, with the incidence and prevalence of diabetes increasing with age. The Centers for Disease Control and Prevention reported in 2005 that the prevalence of diabetes among people ages 20 and older was 20.6 million (9.6% of people in that age group), and the prevalence of diabetes has increased with age (10.3 million people aged 60 or over, or 20.9% of people in that age group had diabetes) (BHASKAR*et al*, 2021).

Modifiable or lifestyle risk factors include increased body mass index (BMI), physical inactivity, poor nutrition, hypertension, smoking and alcohol consumption, among others. Increased BMI is consistently shown to be one of the strongest risk factors for developing diabetes. Furthermore, the distribution of body fat and specifically an increase in the waist/hip ratio increases a person's risk of diabetes (LIMA*et al.*, 2016; LEME, 2023).

Based on the WHO, the subtypes: type I (diabetes*mellitus*insulin-dependent), type II (diabetes *mellitus*non-insulin dependent) other specific types and diabetes*mellitus*gestational. Type I or juvenile diabetes results from cellular autoimmune-mediated destruction of the β cells of the pancreas. However, type II or adult-onset diabetes results from the development of insulin resistance and affected individuals are usually insulin deficient. In modern medicine, the beneficial effects of standard medications on glycemic levels are well documented, the preventive activity of medications against the progressive nature of diabetes and its complications has been modest but not always effective (WHO, 2016; SBD, 2019ª; 2019b).

The co-existence of these manifestations of the disease has high risk factors related to cardiovascular diseases due to insulin resistance, a key characteristic of these complications. This metabolic anomaly, which is induced in the vast majority of cases by obesity, especially given the increase in visceral fat, and the increase in inflammation and hypoadiponectinemia, causes mortality rates and complications that lead to death (BARBOSA, 2017; DA CONCEAÇÃO ; DA SILVA, 2017;

Characterized by glucose intolerance at various levels, gestational diabetes (GD) occurs in around 7% of pregnancies due to complications associated with hyperglycemia diagnosed in the second half of the gestational period, although in some cases it is also detected early in pregnancy.

(ADA, 2007, 2011; SBD, 2015, 2016).

The relevant point is that GD screening is the only standard medical practice that applies glucose intolerance screening to healthy individuals. Regardless of the glucose thresholds that are used to diagnose GD, patients are relatively young individuals whose glucose levels are at the upper end of the population distribution during pregnancy (BENNETT *et al*, 2017).

A small minority of these women have glucose levels that would be diagnostic of diabetes outside of pregnancy. The vast majority have lower glucose levels when diagnosed with GD, but are at high risk of developing diabetes after pregnancy (LEME, 2023).

Pregnancy is typically assisted by progressive insulin resistance that begins near the middle of pregnancy and progresses through the third trimester to levels approaching the insulin resistance seen in type II diabetes. Insulin resistance during pregnancy may result from a combination of increased maternal adiposity and the insulin-desensitizing effects of hormones produced by the placenta. The rapid reduction in insulin resistance after birth suggests an important contribution of placental hormones (CHRIST-CRAIN *et al.*, 2019).

Potential mechanisms underlying the normal insulin resistance of pregnancy are related to the deficiency of pancreatic β cells that normally increase their insulin secretion to compensate for the insulin resistance of pregnancy. As a result, changes in circulating glucose levels throughout pregnancy are quite small compared to the large changes in insulin sensitivity. Thus, robust plasticity of β cellular function in the face of progressive insulin resistance is the hallmark of normal glucose regulation during pregnancy (BOSI *et al*, 2009).

Like all forms of hyperglycemia, GD results from an endogenous insulin supply that is inadequate to meet tissue demand for insulin. Inadequate insulin secretion is most easily demonstrated in late pregnancy, when insulin requirements are uniformly high and differ only slightly between normal women and women with GD. In contrast, insulin responses to nutrients are much lower in women with GD. One potential pathology for GD is a limitation in the pancreatic β-cell reserve that manifests as hyperglycemia only when insulin secretion does not increase to match the increased insulin requirements in late pregnancy. At first glance, studies conducted outside of pregnancy seem to support this scenario (LENZEN, 2008).

2.3 NEONATAL OUTCOME

Scientific research on the topic of gestational diabetes is growing exponentially due to the presence of complications associated with the mother-fetus binomial. From these studies, the great impact of GD in the gestational period is noted, as well as the gradual increase of the disease in recent years, which enhances the search for neonatal outcomes related to the diagnosis of GD and lack of glycemic control, in order to highlight the importance of early diagnosis and monitoring of the disease, thus corroborating the reduction of damage (FERNANDES *et al.*, 2012).

In relation to GDM, there are some common outcomes in neonates such as increased risk of prematurity, metabolic and growth imbalances, fetal macrosomia (birth weight greater than 4 kilos), hyperbilirubinemia and increased risk of intrauterine fetal death and neonatal death. The way in which these effects of GD occur are not yet well defined, however it is observed that hyperglycemia in utero can cause fetal dependence, and lead to postpartum hypoglycemia and consequently brain damage (THEVARAJAH and SIMMONS, 2019).

When it comes to Diabetes *Mellitus* Type II, complications for the fetus are well established in scientific studies, which show an increased risk of prematurity, miscarriage and pre-eclampsia, fetal macrosomia, premature amniorrhexis and shoulder dystocia during the birth period (COUTO *et al.,* 2022). Furthermore, according to the Brazilian Federation of Gynecology and Obstetrics (FEBRASGO) in its 2020 publication, children of mothers diagnosed with diabetes have a greater risk of developing respiratory distress syndrome, hypoglycemia and the presence of malformations in the fetus, if treatment is not carried out. appropriately, which is why the importance of monitoring and promoting quality treatment stands out (JUNQUEIRA *et al.*, 2021).

3. MATERIAL AND METHOD

This is an integrative review using the methodology of formulating the research question, developing strategies with the objective of obtaining the necessary data from the articles that integrate the results, a guiding question was used "What are the impacts caused by diabetes on neonatal outcomes?" .

The search was carried out in the main databases: Latin American and Caribbean Literature in Health Sciences (LILACS), *Medical Literature and Retrivial System onLine* (MEDLINE/PubMed®), and Virtual Health Library (VHL).

The following were used as descriptors in the search strategy. *MESH* (*Medical Subject Headings*) and DeCs (Health Sciences Descriptors). The search strategy followed the operator's criteria *boolean* "*AND*" which performs combination of terms.

The terms 5 used were diabetes "*AND*" Gestational diabetes "*AND*" neonatal outcomes, during the months of January to April 2024. As inclusion criteria, articles with up to 5 years of publication, articles with systematic or integrative literature review methodology and full text were used. The exclusion criteria were articles with more than 5 years of publication, articles with a methodology contrary to that investigated and incomplete texts. The results were presented through a sampling table, presenting title/ author/year, important points and neonatal outcomes.

3. RESULTS AND DISCUSSION

The search for articles resulted in 213 articles, of which 58 were excluded because they did not meet the criteria, 64 were selected by reading the title, then the summary and, finally, 37 were selected and read in full and included in this review.

The composition of the results of the sampling frame included 5 studies, selected according to the criteria defined in the methodology. All included studies were carefully analyzed and are relevant to our work (Table 1).

Table 1: Summary of the main findings highlighted by title/author/year, main points and outcomes neonatal.

Title/author and year	Important points	Neonatal outcomes
M orbidity and mortality of newborns born to women with Diabetes *Mellitus* Gestational (DMG)/SARTARELLI It is SALES, 2023.	Problems arising from complications of diabetes have also led to increased rates of cesarean section and macrosomia in the long term, which can lead to DM2, metabolic syndrome and cardiovascular disease.	It increases the incidence in subsequent pregnancies of amniotic fluid disorders and fetal macrosomia, also a direct association with respiratory distress, congenital malformations, large for gestational age (LGA), congenital thrombophilia and neonatal hypoglycemia.
Outcomes neonatal adverse It is factors associated among pregnant women with diabetes *mellitus* gestational and usual risk/ROCHA et al, 2024.	In 37% of pregnant women already mentioned at least one miscarriage in previous pregnancies, the outcome was higher than in groups with usual gestational risk.	As a result of GDM, macrosomia, neonatal death occur, in the 5-minute Apgar assessment, borderline prematurity, the development of hyperglycemia and hyperinsulinemia in the fetus is possible, which in turn manifests itself in fetal growth and increased fat deposition in the chest. and in the abdomen, it is possible that birth can occur before 37 weeks and is still considered a factor that determines neonatal morbidity. there are also several neonatal complications (respiratory distress syndrome, jaundice, sepsis, hypoglycemia and neonatal death, increasing the length of hospital stay and the need for care in the Intensive Care Unit).

To the consequences from the obesity at the development in gestational diabetes and its complications during pregnancy and childbirth/DE ARAGÃO et al., 2024.	With adequate monitoring, it is possible to keep diabetes under control during you exams prenatal routine. However, If left untreated, it can lead to complications for both the mother	To the repercussions at the fetus include excessive fetal growth, prolonged labor, premature birth and neonatal hypoglycemia. Low Apgar score (OR 3.2, 95% CI 1.1-10.0 P=0.03).
Comparison of Maternal and Fetal Outcomes in Parturients With and Without a Diagnosis of Gestational Diabetes/ FREITAS et al., 2019.	Pregnant women with GD have a high chance of developing DM2 after giving birth, which also shows a higher risk of developing hypertensive disorders during pregnancy.	Complications include fetal macrosomia, birth injuries, increased cesarean section rates, neonatal hospitalizations, neonatal hypoglycemia, neonatal respiratory distress syndrome (RDS), prematurity, and fetal death.
Main complications of obesity during pregnancy and their impact factors: literature review/ SILVA et al., 2024.	Obesity during pregnancy poses considerable risks to maternal and fetal health. Because it is completely linked to conditions such as Gestational diabetes, hypertension, pre-eclampsia.	Intrauterine exposure to an obesogenic environment was associated with an increased risk of fetal macrosomia, congenital malformations and respiratory and metabolic complications in the newborn, as well as premature birth, fetal growth restriction and birth complications.

Source: Authors themselves, 2024.

It was noticed when reading these articles that they all converge on the same problems, results such as macrosomia, neonatal death, borderline prematurity, hyperglycemia and hyperinsulinemia in the fetus, impaired fetal growth and a high rate of neonatal morbidity. According to Silva *et al.*, 2017, complications such as respiratory distress syndrome, jaundice, sepsis, hypoglycemia and neonatal death are still possible, increasing the length of stay and the need for care in the Intensive Care Unit.

The authors agree that the most commonly occurring complications are: Complications include fetal macrosomia, birth injuries, increased rates of cesarean sections, neonatal hospitalizations, neonatal hypoglycemia, neonatal respiratory distress syndrome (RDS), prematurity and fetal death (AMARAL *et al.*, 2015).

In view of this, it is possible to see that the biggest problem reported in the literature is neonatal outcomes due to health problems, even though treatment and companionship is possible, something still causes these women to have late prenatal care and a significant increase in risk factors, requiring further study on the topic.

FINAL CONSIDERATIONS

From the study carried out, it is concluded that Gestational Diabetes and Diabetes *Mellitus* type II trigger negative outcomes for both the mother and the child, given the complications present in both. Therefore, impacts such as the risk of infections related to the urinary system, as well as the presence of hemorrhage in the postpartum period and laceration of the vaginal canal, stand out for the mother. For children, hypoglycemia, prematurity and fetal macrosomia are some of the complications resulting from diabetes.

Therefore, the importance of investments for the promotion and implementation of rapid and effective diagnoses is clear, allowing quality treatment, as well as thorough monitoring ensuring adequate glycemic control throughout the prenatal period, since this is the main mechanism for reducing damage caused by fetal hyperglycemia. Additionally, clinical trials Randomized studies are necessary to better elucidate this association, and propose strategies to reduce prematurity rates in diabetic pregnant women, minimizing obstetric and neonatal complications.

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