



# Breastfeeding and Gestational Diabetes: Overview in México

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## Abstract

Gestational diabetes mellitus is defined as glucose intolerance first detected during pregnancy. Maternal obesity and gestational diabetes mellitus have been associated with more difficulties in the establishment and duration of breastfeeding among mothers with gestational diabetes mellitus who have a body mass index above their healthy, normal weight counterparts; plus the large number of social and economic factors that prevent the establishment of satisfactory breastfeeding, makes it essential to provide systematic support, especially in the first days of life, remembering that breastfeeding in turn reduces the risk of diabetes in women. Mexico is a middle-high income Latin American country; studies conducted in metropolitan areas with larger populations indicate that exclusive breastfeeding is often initiated, but it is difficult to continue it; together with the increase in the prevalence of obesity and diabetes mellitus in the population, it is of great importance to integrate maternal and child nutrition policies focused on the prevention of obesity and chronic diseases, as well as practices that contribute to the promotion and support to mothers to achieve successful breastfeeding, at least during the first 6 months of life.

**Keywords:** Gestational diabetes, Insulin resistance, Breastfeeding

**Abbreviations:** GDM: Gestational Diabetes Mellitus; BMI: Body Mass Index; T2DM: Type 2 Diabetes Mellitus; MeSH: Medical Subject Headings; PubMed: Public/Publisher MEDLINE; Medline: Medical Literature Analysis and Retrieval System online; OGCT: Oral Glucose Challenge Test; HbA1c: Hemoglobin A1c; HAPOFUS: Hyperglycemia and Adverse Pregnancy Outcome Follow-up Study; WHO: World Health Organization; rRNA: Ribosomal Ribonucleic Acid

## Introduction

Diabetes is defined as elevated blood glucose levels caused by a failure in insulin secretion or due to abnormalities in biological

function. It is one of the most prevalent metabolic diseases in the world.<sup>1</sup> Gestational diabetes mellitus (GDM) is defined as the first glucose intolerance detected during pregnancy. It is a type of insulin resistance, which occurs and is first diagnosed during the second or third trimester of pregnancy and whose prevalence increases directly proportional to that of obesity in the population. It is the leading health condition in pregnant women and can affect up to 25% of women during pregnancy; and whose occurrence depends on race, ethnicity, age, body composition, as well as diagnostic criteria.<sup>1</sup> During pregnancy, the metabolic status changes significantly, which affects insulin action and sensitivity. This effect is amplified in the second half of pregnancy due to insulin resistance and sub-

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sequent hyperglycemia.<sup>1</sup> The risk of GDM increases if women are older than 25 years, have a history of having had gestational diabetes in their last pregnancy, or have a history of type 2 diabetes mellitus (T2DM) and polycystic ovary syndrome (PCOS).<sup>1</sup> Diabetes during pregnancy is associated with a significantly increased risk of adverse maternal and neonatal outcomes; including preeclampsia, preterm labor, need for induction of labor and cesarean delivery, as well as increased long-term risks of T2DM, metabolic syndrome, and cardiovascular disease. For women identified to have prediabetes, intensive lifestyle intervention and metformin have been shown to prevent or delay progression to T2DM.<sup>2,3</sup>

Moreover, intrauterine exposure of the newborn to gestational diabetes mellitus increases the risk of complications; including stillbirth, macrosomia and trauma at delivery and long-term risk of metabolic disease.<sup>2</sup>

Excessive gestational weight gain during pregnancy was found to increase the incidence of excess body mass in the infant, reaching nearly 20% by 2 years of age. Their occurrence should be monitored and prevention of these factors should become the main objective of childhood obesity prevention programs. The occurrence of these factors may warrant intensive screening to diagnose early stages of metabolic disorders in offspring, including in adulthood.<sup>4</sup>

## Methods

This study used bibliography to find out authors, journals and year of publication that mention specific items; such as gestational diabetes mellitus, breastfeeding, and the impact of gestational diabetes mellitus on breastfeeding, gestational diabetes mellitus in México. The bibliography also covered the region in which the country is located, individual documents, journals and other sources such as the internet and government statements on public health and epidemiology.

## Selection criteria

Identification of relevant publications about the topic Sequential application of keywords compatible with the MeSH descriptor and its MeSH Descriptor and its corresponding Spanish name, including gestational diabetes, breastfeeding Titles, abstracts and long-form publications were reviewed to define the selected articles.

## Literature search strategy

Electronic searches of databases such as Pub Med (<https://pubmed.ncbi.nlm.nih.gov>), MeSH (<https://www.ncbi.nlm.nih.gov/mesh>), and Medline were made using keywords in various combinations to improve the search

## Results and Discussion

Maternal obesity and gestational diabetes have been associated

with poor breast-feeding, initiation and duration of breast-feeding among mothers who had a body mass index (BMI) above the normal range. That is why mothers with gestational diabetes mellitus require ongoing support from trained breastfeeding health professionals to preserve and improve breastfeeding initiation and duration, considering all the implications for the proper growth and development of infants, as well as the reduction of metabolic risk for mother and child.

## Gestational diabetes in México

In Mexico, according to the National Center for Gender Equity and Reproductive Health; from the few records that exist, it is estimated that the prevalence of gestational diabetes mellitus increases up to 30%, depending on the criteria used for diagnosis, and complicates 8 to 12% of pregnancies.<sup>5,6</sup> The number of diabetes mellitus increases considerably and it is known that about 60% of women with gestational diabetes in 2 in 5 to 10 years after delivery will have T2DM.<sup>7</sup> It is important to establish the risk factors for each patient. Pregnant women are classified into three risk groups:

**Low risk:** age less than 25 years, low-risk ethnic group, normal birth weight, no family history of diabetes, BMI less than 25kg/m<sup>2</sup>, no history of previous pregnancy complications.

**Intermediate or moderate risk:** all those women who cannot be classified as low or high risk, in whom an intentional search for GDM should be performed between 24 and 28 weeks of gestation.

**High risk:** GDM in previous pregnancy, history of newborn weighing >4kg, first-degree family history of diabetes, obesity (BMI >30kg/m<sup>2</sup>), hypertension, polyhydramnios, orbits, glycosuria in current pregnancy, polycystic ovary syndrome. Perform an intentional search for gestational diabetes mellitus from the first prenatal visit and glucose screening or oral glucose tolerance curve.<sup>5,6</sup>

Regarding the methodology for the diagnosis of GDM, it is recommended to perform screening with the presence of risk factors or fasting blood glucose  $\geq 85$ mg/dL; women with a positive result should undergo an Oral Glucose Challenge Test (OGCT) with 75g and its determination in 2hr, using the diagnostic criteria of one or more altered values, fasting  $\geq 100$ mg/dL and two hours  $\geq 140$ mg/dL; a strategy that leads to a better cost-benefit ratio.<sup>5,6</sup> Care at delivery should be provided at the second or third level of care. Capillary glucose should be monitored on an individualized basis for all women in labor and until resolution (between 1 to every 4 hours). Glucose levels should be maintained between 70-130mg/dL, as hyperglycemia at birth carries a high risk of hypoglycemia in the newborn. Labor should be permanently monitored with cardiocographic recording and the route of resolution of the pregnancy should be determined according to the obstetric or maternal condition.<sup>5,6</sup>

Women with GDM should be reclassified between 6 and 12 weeks after the end of pregnancy, with a OGCT with a 75g glucose load and sampling every hour for 2 hours (OGCT-75g-2h) at the first level of care:

**Normal:** fasting glucose less than 100mg/dL and or 2hr post-load less than 140mg/dL  
**Prediabetes:** fasting glucose between 100 and 125mg/dL and/or 2hr post-load between 140 and 199mg/dL.

**T2DM:** fasting glucose greater than or equal to 126mg/dL and/or 2hr post-load greater than 200mg/dL. In case the woman does not go for consultation between 6 and 12 weeks after the end of pregnancy, reclassification can be done between 13 weeks and up to one year after delivery with fasting glucose or hemoglobin A1c (HbA1c).<sup>5,6</sup> In the case of HbA1c, it is reclassified as normal if it is less than 5.7%, prediabetes between 5.7 and 6.4%, and diabetes if it is greater than or equal to 6.5%. The follow-up of women with a history of GDM should include a fasting glucose and/or HbA1c every year and ideally, if available, an annual OGCT-75g-2h determination.<sup>5,6</sup>

### Impact of gestational diabetes in breastfeeding

Breastfeeding during the first semester of life is crucial, since it provides all the nutritional, cellular and microbial requirements for the newborn's metabolic, immunological, and neurological development.<sup>8</sup> Infant nutrition has a major impact on child health and plays an important role in survival. In low- and middle-income countries, infants who are not breastfed are 6 to 10 times more likely to die in the first few months than those who are breastfed.<sup>9</sup> It also has a significant influence in reducing morbidity from infectious diseases; especially gastrointestinal and respiratory diseases. It may also confer protection against several other short- and long-term conditions, including otitis, allergic rhinitis, obesity and T2DM. The Hyperglycemia and Adverse Pregnancy Outcome Follow-up Study (HAPOFUS) followed 4,160 women and found, 10 years after the original study, that the children of mothers with higher blood glucose levels who had not received treatment during pregnancy had higher rates of obesity and higher blood glucose levels, and the presence of impaired glucose tolerance in them was twice as high as in the group of children of mothers with normal blood glucose levels; it also showed an increase in insulin resistance in these children. Thus, it is clear that hyperglycemia has an impact that goes beyond the perinatal period.<sup>10</sup>

In a review conducted by Pinheiro,<sup>11</sup> the conclusion is obtained that the majority of women who were overweight/obese and had GDM presented the highest risk of delay in the initiation of breastfeeding, compared to those apparently healthy mothers.<sup>11</sup> There are several factors that directly impact the successful adequacy of exclusive breastfeeding, which may include mode of delivery, parity, maternal age and education, smoking habit, ethnicity the presence

of nipple sores and pain, complications during pregnancy, infant health, and environmental factors such as hospital practices and the mother's social support network.<sup>11,12</sup> A cross-sectional study by Saedi, concluded that the strongest predictors of poor breastfeeding practices at discharge were planned feeding method, educational level, employment status and gestational age were: mode of delivery, maternal obesity, gestational diabetes and maternal hypertension were significantly associated with exclusive breastfeeding at discharge ( $p < 0.05$ ).<sup>12</sup> There was no significant relationship between neonatal weight and gestational age with exclusive breastfeeding at discharge ( $p < 0.05$ ), but there was a significant association between gestational age and exclusive breastfeeding at discharge ( $p = 0.042$ ).<sup>12</sup>

Therefore breastfeeding is recommended and encouraged for women who have gestational diabetes mellitus. However, several researchers have suggested lower rates and earlier cessation of breastfeeding in the first 6 months among these women. The initiation of breastfeeding among women with gestational diabetes mellitus also appears to be lower in relation to healthy women.<sup>12</sup> Breastfeeding involves substantial energy consumption, with 480kcal/day required regularly during lactation. In general, breastfeeding is considered to exert an ameliorative effect on glucose metabolism not only through weight loss during lactation, but also through improved insulin sensitivity.<sup>13</sup> A retrospective study by Yasuhi,<sup>13</sup> evaluates whether or not high-intensity breastfeeding reduces the incidence of abnormal glucose tolerance and similarly the effect of high-intensity breastfeeding (defined as the condition in which infants were fed breast milk alone or approximately 80% or more of the volume at 6-8 weeks and 6 months postpartum) on insulin resistance during the first postpartum year; concluding that high-intensity breastfeeding  $\geq 6$  months had a protective effect against the development of abnormal glucose tolerance during the first postpartum year by improving insulin resistance, independent of obesity and postpartum weight change. Therefore, high intensity breastfeeding for  $\geq 6$  months postpartum should be recommended in women with gestational diabetes.<sup>13</sup>

### Breastfeeding in México: A General Overview

Mexico is an upper-middle-income country that has experienced a worrisome decline in breastfeeding indicators, especially among those in the most disadvantaged socioeconomic level. According to Mexico's National Health and Nutrition Survey, the prevalence of exclusive breastfeeding among children under 6 months was 14.4% in 2012, indicating a decrease in what was reported in 2006 (22.3%).<sup>14</sup> Poverty is an important determinant of health and nutrition. In 2016, 20.7 million Mexican children and adolescents were poor; children under 5 years of age were the most affected by extreme poverty. 23.3% of poor children and adolescents do not have access to healthy and nutritious food. Moderate and severe

food insecurity affects 22.6% of Mexican households; in which an inadequate diet remains a huge challenge. Inequalities, urbanization and culture are also powerful influences that come together to reflect the complexity of the health and nutritional status of the Mexican child population<sup>15</sup>

By the year of 2016, it was clear that child nutrition would form a priority part of the Mexican public health agenda, integrating maternal and child nutrition policies focused on the prevention of obesity and chronic diseases, and that such policies should be fortified; and by the year of 2018, a recovery of all breastfeeding indicators was reported, with a prevalence of 28.6% for exclusive breastfeeding.<sup>15</sup> Exclusive breastfeeding is defined as the practice of only feeding breast milk to an infant for the first 6 months of life (without the addition of any other type of food or water); such practice has the greatest potential impact on infant mortality than any other prevention intervention. Similarly, other practices that contribute in the adequacy of optimal breastfeeding are initiation of breastfeeding within the first hour of life and continuation of breastfeeding until 2 years of age or as far as possible beyond.<sup>16</sup> One of the main conclusions of the urban consumption study "What and How Mexican Urban Population Eat" in 2015, a cross-sectional, multistage, stratified study that shows that in surveys conducted in representative areas of Mexican urban areas, that exclusive breastfeeding is often initiated, but continuing; it is difficult, probably because women have to return to work, coupled with other social, cultural and economic barriers. Breastfeeding seems to be implemented along with the introduction of infant formula and/or other types of milk.<sup>15</sup>

A recent analysis of breastfeeding protection, promotion and support systems in Mexico; the results of which showed that physicians and nursing professionals in primary care clinics in Mexico had a low baseline knowledge and skills base to promote and support breastfeeding. Which highlights the need for in-service training to improve breastfeeding knowledge and skills in health professionals.<sup>14,17</sup> This could justify the recommendation proposed by an expert committee in Mexico on the need to increase the coverage and quality of breastfeeding in-service training of health professionals to address the serious breastfeeding situation in the country.<sup>14,17</sup> Breastfeeding is one of the main affordable and modifiable maternal health interventions that protect against infant stunting. Since during fetal life and early childhood it provides an important window of opportunity for better health during adulthood.<sup>15,18</sup>

### **Mexican Overview: Impact of Gestational Diabetes Mellitus on Breastfeeding**

Exclusive human milk is the best alternative for feeding newborns. Mothers with DMG may have more problems in achieving successful breastfeeding, so systematic support is essential, especially in the first days of life, remembering that breastfeeding re-

duces the risk of diabetes in women.<sup>18</sup> One postpartum intervention that may protect against diabetes is breastfeeding because of its potential role in restoring maternal metabolism after pregnancy. However, the role of breastfeeding on maternal diabetes risk has not been investigated in Latin American populations, where breastfeeding rates are suboptimal and the incidence of diabetes is increasing.<sup>19,20</sup>

A World Health Organization (WHO) systematic review found that breastfed infants were 35% less likely to develop subsequent type of diabetes. Women with GDM who breastfed for at least 3 months had lower risk of postpartum diabetes. However, previous studies have suggested unfavorable results for breastfeeding practices, in terms of shorter duration and less likelihood of being exclusively breastfed in mothers with GDM compared with mothers without GDM. High rates of obesity and obstetric complications among women with GDM may explain some of the breastfeeding difficulties; in addition, infants born to mothers with GDM are more likely to be born by cesarean section, preterm delivery, and suffer from low birth weight or macrosomia, and subsequent intensive care. As a result, breastfeeding rates in mothers with GDM are lower than those without GDM.<sup>16,20,21</sup>

A prospective cohort study by Mazariegos,<sup>19</sup> found that an average of 6 to 12 months of breastfeeding per child was associated with a lower incidence of diabetes. Women who breastfed an average of 6 to 12 months had a 27% (95% confidence interval) lower rate of developing diabetes, and it was observed that the incidence of maternal diabetes no longer decreased after an average of 12 months of breastfeeding per child. The non-linear association could be explained by the fact that after 12 months of age the frequency and intensity of breastfeeding decrease since breast milk provides only one third of the energy needs in children aged 12 and 24 months.<sup>19</sup>

On the other hand, a study by Gámez-Valdéz. Reported a differential analysis of microbiota composition in colostrum samples from Mexican mothers affected with obesity or GDM; whose study cohort includes mothers with obesity and mothers with GDM. Colostrum samples were collected within the first 24 hours after birth, using 16S rRNA amplicon sequencing to quantitatively characterize the microbial diversity of the samples; obtaining as a result, that the presence of *Corynebacterium* 1, *Anaerococcus*, *Staphylococcus* and *Prevotella* type bacteria were more abundant in samples from mothers with GDM than in their healthy counterparts.<sup>8</sup> The importance of this study lies in the fact that colostrum is ideally the first postnatal maternal fluid in contact with the newborn's gastrointestinal system; therefore, the identification of differences in its microbial composition could be correlated with aberrant infant intestinal colonization and further explain dysfunctions in the immune and gastrointestinal systems; demonstrating that the impact of GDM on breastfeeding may have implications beyond the nutritional.<sup>8</sup>

The successful adequacy of breastfeeding is of utmost importance in addition to the metabolic, social and environmental risk factors during the first 1,000 days of life that could lead to malnutrition or, on the contrary, to childhood overweight and obesity.<sup>18</sup> In order to examine the association between breastfeeding and child stunting, a study was conducted by Campos, comparing between never breastfed infants, those who received any breastfeeding for <6 months and any breastfeeding for ≥6 months and other individual and environmental factors (defined as length/height-for-age z-score for sex below -2 standard deviations from the median of the WHO child growth standards) in the Mexican population. In the total sample, 12.3% of children were stunted and 71.1% were breastfed for ≥6 months. Breastfeeding, in any form, and being female were consistent protective factors against child stunting. In contrast, low child birth weight, low maternal height, higher number of children under 5 years of age per household, and moderate to severe food insecurity were consistent risk factors for child stunting worldwide. All models, concluding that efforts to reduce chronic child undernutrition in Mexico should include prenatal care strategies aimed at preventing low birth weight offspring, particularly among women with chronic diseases and during the gestational period (such as diabetes mellitus), women of short stature, households with severe food insecurity, families with a higher number of children under 5 years of age, and indigenous communities. Postnatal components should include multilevel strategies to support breastfeeding.<sup>18-21</sup>

## Conclusion

Adequacy of exclusive breastfeeding is less common in mothers with GDM compared to other mothers; they are less likely to exclusively breastfeed their infants and tend to have a shorter duration of breastfeeding. Mothers with GDM require ongoing support from trained breastfeeding health professionals to preserve and improve breastfeeding initiation and duration. This is of utmost importance in conjunction with metabolic, social and environmental risk factors during the first 1,000 days of life. There are a wide range of variables that also influence the establishment or not of successful breastfeeding, together with GDM and breastfeeding; for example demographic characteristics (maternal age, marital status, race, education, income and residence), maternal and newborn factors (pre-pregnancy body mass index, parity, gestational age, gestational weight gain, type of delivery, Apgar score, sex of infant, birth weight and admission of infant to the intensive care unit), maternal care during pregnancy and delivery (adequate prenatal care, prenatal classes and medical care at delivery). Nutrition and child care should be part of the Mexican research and public health agenda; with the strategy to prevent obesity and chronic diseases, such as diabetes mellitus. Perinatal health should be prioritized; quality prenatal care and the provision of tools and information for daily

life challenges, e.g. breastfeeding, perceived information about infant care, complementary feeding practices, and healthy eating.

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## Conflict of interests

Authors declare that they do not have any conflict of interest.

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