

COMPLEX CARBOHYDRATES AND GESTATIONAL DIABETES CONTROL WITHOUT INSULIN

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ABSTRACT

Gestational diabetes (GDM) is hyperglycemia that is recognized for the first time during pregnancy. GDM is associated with a wide range of short- and long-term adverse health consequences for both mother and offspring. Historically, insulin has been the therapeutic agent of choice for controlling hyperglycemia in pregnant women. However, difficulty in medication administration with multiple daily injections, the potential for hypoglycemia, and increase in appetite and weight make this therapeutic option cumbersome for many pregnant patients. We want to present an overview of the lifestyle adjustments that can be advised in the management of GDM in this research. The diet for women with GDM should include enough macronutrients and micronutrients to promote the foetus' development while also limiting postprandial glucose excursions and encouraging normal maternal gestational weight gain. Carbohydrate consumption determines blood glucose excursions and hyperglycemic episodes. Nutritional counseling should thus concentrate on the kind, quantity, and distribution of carbohydrates in the diet. So, in this article, we tried to study the treatment of gestational diabetes without the use of insulin. Continued research is needed to understand and develop tools to facilitate patient adherence to treatment goals, individualize interventions and improve outcomes.

Keywords: Diabetes, Insulin, Carbohydrates, Diet, Nutrients.

I. INTRODUCTION

Gestational Diabetes is a type of diabetes that only pregnant women are susceptible to developing. Gestational, in reality, refers to the time of pregnancy. Gestational diabetes occurs when a pregnant woman develops diabetes or hyperglycemia for the first time. Gestational diabetes mellitus (abbreviated GDM) is the medical term for this condition. Gestational diabetes can only be explained with a basic understanding of diabetes. The complications of gestational diabetes might be catastrophic if they are not managed. If you have gestational diabetes, the best method to ensure a safe pregnancy is to adhere to your doctor's treatment plan.

If gestational diabetes is not addressed, it might cause major health complications. If you have gestational diabetes, the best method to ensure a safe pregnancy is to adhere to your doctor's treatment plan.

Recall that gestational diabetes is unique to pregnant women. There are many physical changes that occur during pregnancy. Pregnancy, in this situation, had an effect on your metabolism. During pregnancy, your insulin is unable to complete its job. Your cells can't use the sugar in your blood because your body can't move it out of your blood and into them.

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II. EPIDEMIOLOGY AND PATHOPHYSIOLOGY OF GESTATIONAL DIABETES

Epidemiology

In different locations of India, the prevalence of gestational diabetes has been observed to range from 3.8 percent to 17.9 percent. Because of the huge range of living situations, socioeconomic levels, and dietary habits in India, it is impossible to forecast any standard prevalence levels of GDM. The American Diabetes Association (ADA), the International Association of Diabetes and Pregnancy Study Group (IADPSG), and the Diabetes in Pregnancy Study Group of India (DIPSI) have all suggested that GDM screening be made mandatory. In India, where diabetes is highly common, the chances of discovering preexisting diabetes with screening are fairly high. Despite the high incidence of GDM in Indian women, pregnant women are not routinely screened for the disease as part of the standard prenatal care.

Pathophysiology

In pregnancy, insulin resistance begins to build as early as the second trimester and continues to rise into the third trimester. Insulin sensitivity decreases by about 50 percent in late pregnancy. Placental hormones, which have been shown to reduce insulin sensitivity, are also a major factor to insulin resistance. Post-delivery changes in insulin resistance suggest a role for placental hormones in the process. These hormones are produced by the placental lactogen (formerly known as human placental lactogen) and are bound and released by HCS (HCS, formerly known as human placental lactogen). HCS increases insulin production in the foetus and reduces glucose uptake in the mother's peripheral tissues. Insulin resistance can be caused by an increase in hormone synthesis when the placenta grows

in size during pregnancy. Normal pregnancies in non-diabetic women compensate for the loss of glucose tolerance by increasing beta cell size through first and second phase insulin responses. This extra insulin secretory potential is lacking in women, which leads to GDM. GDM-related beta-cell failure can fall into one of three categories: One or more of the following: Autoimmune, monogenic, or occurring on a background of insulin resistance (as is most common).

III. REASON FOR AVOIDANCE OF INSULIN

There are several hormones that inhibit insulin from acting properly in the placenta, the system of capillaries that carries nutrition, blood, and water from mother to foetus. It's known as insulin resistance. In order to maintain a normal metabolic rate, the placenta's hormones must be overcome by three times the normal quantity of insulin.

A healthy blood sugar level for most women is maintained by the additional insulin produced by the pancreas. It's very uncommon for 5% of pregnant women to have blood sugar levels that are too high even with the extra insulin they receive. Gestational diabetes or elevated blood sugar occurs throughout the second and third trimesters of pregnancy. In order to detect the effects of insulin resistance on your body, testing for gestational diabetes is typically performed between the 24th and 28th weeks of pregnancy.

IV. EFFECTS OF GESTATIONAL DIABETES

Gestational diabetes can cause a variety of health issues, including the following. If you have gestational diabetes, it does not mean that you will experience any of these issues at all.

- Babies with macrosomia have larger than average bodies. Large-bodied

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babies can be damaged during natural delivery and may need to be delivered via caesarean section if it is the only option. In these babies, the most common problem is shoulder dystocia.

- When a baby's blood sugar is too low, it's called hypoglycemia. As soon as possible, you may need to begin nursing to provide the baby's body with the glucose it needs. If you are unable to begin feedings, the baby may need to receive glucose through a thin, plastic tube inserted into his or her arm.
- Babies with jaundice have a yellowish appearance to their skin and white areas of their eyes. The baby's jaundice isn't a big deal if it's taken care of properly.
- a condition in which a baby has difficulty breathing, known as respiratory distress syndrome (RDS). RDS may necessitate the use of oxygen or other breathing aids for the baby.
- This could induce twitching or cramping in the baby's muscles if the baby has low levels of calcium and magnesium in their blood. Taking calcium and magnesium supplements can help alleviate the symptoms of this disease.

V. RELATION AMONG CARBOHYDRATES, GLYCAEMIC INDEX, AND GLYCAEMIC LOAD

Although carbohydrates are an important source of energy, they have a higher PPG than other macronutrients. Because an increase in PPG has been linked to a diet high in CHO [55

percent], it is advisable to limit CHO consumption in GDM. However, limiting CHO intake is not required to reduce PPG. PPG excessive increases can be prevented by slowing down the digestion and absorption of CHO. In addition to the total amount of CHOs, the type of CHO has an impact on blood glucose levels.. When it comes to digestibility and absorption, the length of CHO polymers may play a role.

In order to understand the impact of different foods on glycaemic response, glycaemic index (GI) and glycaemic load (GL) are used. Consuming CHO-containing meals results in an alteration of PPG, which causes the GR. When we talk about "available CHO," we're talking about how much CHO gets digested, absorbed, and used by the body. Glycaemic index (GI) is the proportion of the Glycaemic Response (GR) caused by 50 grammes of food with 50 grammes of glucose (CHO) (generally glucose or white wheat bread). High GI meals, such as rice and potatoes, cause a rapid rise in glycaemia, which then lowers quickly. Because they include CHOs that take longer to break down, fruits and dairy are termed low-glycemic index foods (LGI). These foods are considered high-glycemic index (GI) foods, which means that they contain a lot of carbohydrates that are quickly processed and digested. In contrast, LGI meals are digested and processed more slowly, with a GI 55. As a result, GI is a standardised measure of GR, defined by a measured amount of CHO, and it is compared to a reference diet. In addition, it can serve as a gauge for the quality of CHO. The GL is an indicator of both the quality and quantity of CHO. When the GI is multiplied by the amount of accessible CHO in the food, the GL is determined ($GL = GI \times \text{available CHO/food}$). It is simple to compare the glycemic load of various foods, meals, and diets using their GL values. For the first time, the term "GI" was used to describe a soldier. GI tables based on the reference approach produced by the International Organization for

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Standardization (ISO) are still in use. In addition to being used to classify and compare single items, GI is now being used to classify and compare mixed meals and complete diets.

It is true that the weighted average of the GI of each food in a meal or diet is calculated, taking into account the quantity of CHO in it, in clinical studies and in clinical settings.

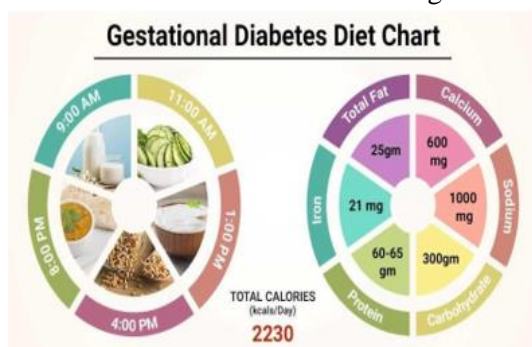


Figure 1: Diet chart for Gestational Diabetes patients

A further way to gauge the nutritional value of food is to look at the amount of nondigestible dietary fibre (DF), a plant-based CHO. Fruits, vegetables, and legumes all contain DF, which is a water-soluble substance. Soluble DF slows digestion, reduces PPG absorption, and lowers cholesterol intake. Wholegrain bread and cereals include insoluble DF, as do nuts and wholegrain bread. Potato and rice are rich in resistant starch. Reducing the metabolic activity of DF and resistant starch is impossible.

VI. ROLE OF DIETARY CARBOHYDRATES IN GDM

Both the mother and the foetus require 175 grammes of dietary carbohydrates (CHO) per day, including 28 grammes of dietary fibre. It is generally known that dietary CHO have the biggest impact on blood glucose levels, which is why women with GDM should pay extra attention to the amount and type of CHO they consume. A wide range of dietary carbohydrates (CHO) have varying impacts on

blood glucose levels and other physiological reactions. Dietary sugars such as sucrose and glucose are quickly digested and absorbed in the small intestine, resulting in a spike in blood glucose levels that can be dangerous. In some cases, the structure of dietary CHO makes them difficult or impossible to digest, and this results in a smaller or delayed rise in blood glucose levels (e.g., low glycemic index, LGI). In the small and large intestines, nondigestible CHO components (fibre) can give physiological benefits such as stimulation of incretin synthesis, energy source for colonic bacteria, and regular bowel motions.

Increased glucose transport to the foetus is associated with greater postprandial glucose responses, according to early studies. Hyperglycemia is also substantially associated with newborn size and/or obesity. Studies have also shown that the overall amount of CHO or the type of CHO ingested might have a significant impact on the maternal glucose responses. When sucrose and maltodextrin are replaced with more slowly digestible CHO in animal models of gestational diabetes, the detrimental effects of high-GI sucrose and maltodextrin on the pathophysiology of GDM can be reversed (i.e., isomaltulose and resistant maltodextrins). This means that in order to optimise maternal fasting and postprandial glucose levels during gestational diabetes mellitus (GDM), current dietary recommendations propose either restricting CHO intake or substituting HGI CHO with slower-digesting alternatives.

Nutritional strategies for avoiding gestational diabetes mellitus (GDM) have been studied. It is common for pregnant women to combine increased physical activity with calorie restriction by reducing or modifying the kind of CHO consumed in order to reduce or halt weight gain. There is a wide range of research and conclusions that have been drawn from it. Pregnant women who were overweight or

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obese were randomly assigned to either routine care or an intensive lifestyle intervention that included guidance to minimize intake of refined CHO in the LIMIT trial before 20 weeks of gestation, with over 2000 participants. LGA, RDS, and length of hospital stay were all lower in babies whose mothers participated in the intensive lifestyle intervention. A study of 139 women at highrisk of GDM found that those who followed a low-GI diet required less insulin to maintain normal blood sugar levels ($p = 0.007$).

VII. REQUIREMENTS AND DISTRIBUTION OF NUTRIENTS DURING PREGNANCY

Although there is no universal consensus on the exact calorie requirements during the three trimesters, a separate estimate of daily energy requirements during pregnancy is based on trimesters. Women with GDM, like those with NGTP, may have a wide range of total energy requirements, hence each patient should be weighed often during pregnancy.

Table 1: Additional daily calorie requirements during pregnancy

Trimester	NNR	IOM
1 st Trimester	1103 kcal	0 kcal
2 nd Trimester	329 kcal	340 kcal
3 rd Trimester	537 kcal	452 kcal

Table 2: Recommendation of specific micronutrients in pregnancy

Micronutrient	NNR	IOM
Folic acid, $\mu\text{g/day}$	500	600
25-Hydroxyvitamin D, $\mu\text{g/day}$	10	5
Calcium, mg/day	900	1000
Iron, mg/day	40	27

Meal Frequency and Carbohydrate Distribution

To avoid excessive food consumption at the same time, a daily meal frequency of three

main meals and two–three short meals or snacks is advised to avoid significant amounts of carbohydrate and, thus, lower the postprandial blood glucose seen in Figure 1.

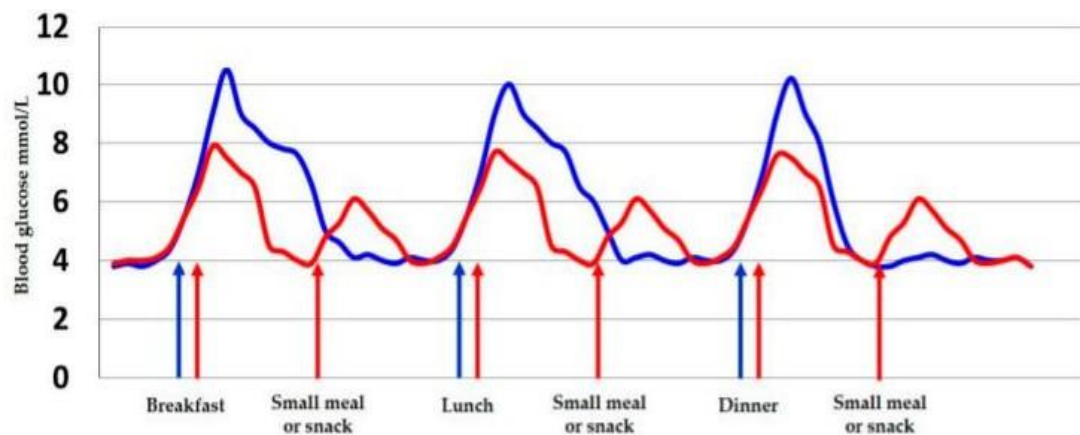


Figure 2: The blood glucose levels according to different strategies for daily food intake. Blue curve illustrates the normal meal pattern and red curve illustrates meal pattern in women with gestational diabetes mellitus (GDM) to avoid excessive blood glucose fluctuations and to preserve the planned number of calories to be ingested. Blue arrows: Three main meals. Red arrows: three main meals and three snacks.

VIII. TREATMENT FOR GESTATIONAL DIABETES WITH HELP OF PROPER DIET

The goal of gestational diabetes treatment is to keep blood glucose levels in pregnant women who don't have the disease at the same level as those who don't. Special food planning and organised physical activity are always part of the therapy, as are daily blood glucose monitoring and insulin shots.

The American Diabetes Association recommends the following objectives for women who acquire gestational diabetes during pregnancy if you're measuring your blood glucose. For each person, more or less severe glycemic targets may be suitable.

- Before a meal (preprandial): 95 mg/dl or less
- One hour after a meal (postprandial): 140 mg/dl or less
- Two hours after a meal (postprandial): 120 mg/dl or less

If you've been diagnosed with gestational diabetes, you'll need assistance from your doctor, nurse educator, and other members of your health care team to adjust your treatment as necessary. For you, the expectant woman, good therapy reduces the danger of a caesarean section birth, which may be necessary in the case of particularly big newborns.

Following your treatment plan will ensure a successful pregnancy and birth, as well as assist your baby avoid future health problems.

Dietary Guidelines for gestational diabetes

It's critical to see a qualified dietician have your diet evaluated. The quantity of carbs you require at meals and snacks will be calculated by the nutritionist. You'll also learn how to keep track of carbs.

The following are some food suggestions to help you maintain a healthy blood sugar level:

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Each day, divide your diet into three meals and two or three snacks.

When you eat too much at once, your blood sugar levels might skyrocket. It is critical that you do not miss meals. You have higher nutritional demands during pregnancy, and your baby requires a well-balanced diet.

Consume enough amounts of starch.

It's crucial not to eat too many starchy meals since they ultimately transform into glucose. Starch, on the other hand, should be provided in every meal. One cup of total carbohydrate each meal, or two slices of bread, is a fair quantity.

One cup of milk at a time should be consumed.

Milk is a nutritious food that is high in calcium. Milk, on the other hand, is a liquid carbohydrate, and drinking too much at once might cause your blood sugar to spike.

Fruit servings should be limited.

Fruit is a nutritious food, yet it contains a lot of natural sugars. One to three servings of fruit per day are permissible, but only one at a time. One very little piece of fruit, half of a big piece of fruit, or around a one-half cup of mixed fruit is a portion of fruit. Fruit that has been bottled in syrup should not be consumed.

Breakfast is crucial.

Because of regular hormone swings, blood sugar regulation might be challenging in the morning.

Refined cereals, fruits, and even milk may be difficult to digest in the morning. You should not consume these meals for breakfast if your post-breakfast blood sugar level rises too significantly after eating them. Breakfasts that

include carbs and protein are generally the most well tolerated. Fruit juice should be avoided.

A glass of juice necessitates the use of numerous fruits. Juice is a rich carbohydrate source. Juice may swiftly elevate blood sugar levels due to its liquid nature.

Limit your intake of sweets and desserts.

Carbohydrates are commonly found in cakes, cookies, sweets, and pastries. These meals frequently contain a lot of fat and provide relatively little nutrients. Also, stay away from any sugar-sweetened drinks including conventional sodas.

Stay away from added sugars

Add no sugar, honey, or syrup to your meals.

IX. CONCLUSION

Obstetricians, gynaecologists, dietitians, paediatricians, cardiovascular specialists, nephrologists, ophthalmologists, and nursing personnel all play a role in the care of gestational diabetes. Obstetricians and endocrinologists are still grappling with how to best treat GDM. So one can treat it with proper nutritional diet according to requirement of their body.

Dietary counselling should be delivered to all women with GDM by a professional dietician, as it is the cornerstone of GDM therapy. The influence of nutrition on blood glucose is critical for reducing difficulties later in life, such as delivery issues, caesarean section, LGA-babies, and type 2 diabetes. The lady should be given instructions on how to build a diversified diet and avoid hyperglycemia. Carbohydrate consumption should be prioritised since the type, quantity, and distribution of carbohydrate are all critical factors in postprandial blood glucose levels.

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