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Pregnancy induced diabetes mellitus (Gestational diabetes mellitus) and Nutrition: A review

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Abstract
Pregnancy induced diabetes mellitus, commonly termed as gestational diabetes, can be described as intolerance in blood glucose levels and at times the diabetes during pregnancy may not show any external symptoms, remains completely asymptomatic. This is also reported that women suffering from GDM, commonly develop high risk of having diabetes Mellitus Type II, after their delivery. This review work reveals the pathophysiology, risk factors and dietary recommendations for reversing the symptoms associated with gestational diabetes.

Keywords: Glucose tolerance, glycaemic index, adipokines, insulin resistance, eclampsia, therapeutic diet

Introduction

Adipokines and inflammatory cytokines fluctuate during pregnancy, and there are also major changes in the humoral environment. Pregnancy is a complex metabolic state. Levels of oestrogen, progesterone, prolactin, cortisol, growth hormone, and oxidative stress indicators of TNF-, foetal, and leptin all significantly rise during pregnancy. To encourage foetal nutrition, reducing adiponectin during the second trimester increases the mother's insulin resistance (Barbour *et al*., 2007) [4].

Given the global obesity pandemic, the prevalence of gestational diabetes mellitus (GDM) is rising quickly and is expected to keep rising. Through genetic and environmental factors that are yet not fully understood, GDM has substantial negative effects on the health of both the present and future generations. The condition also places a heavy financial burden on healthcare systems, with variations in clinical practise frequently being dictated by resource constraints (Ferrara, 2007) [6].

Uncertainty still exists over the ideal period for screening and diagnostic thresholds for GDM.

New research indicates that metformin exposure during pregnancy may have a negative effect on the children of mothers with GDM. Long-term monitoring of kids who have taken metformin is still required to clarify these potential correlations and offer a more solid evidence base to guide therapeutic practise.

Baliutavičienė *et al*. (2012) [3] noted that the most frequent metabolic disorder during pregnancy is gestational diabetes mellitus (GDM). The prevalence is increasing and has been rising along with maternal obesity over the past few decades. Genetic and environmental factors have been linked in mechanistic and epidemiological studies to the complicated aetiology of GDM. For the mother, growing foetus, and offspring, GDM poses serious short- and long-term health concerns. This includes the significant risk of developing type 2 diabetes (T2DM) later in life and potential negative cardiometabolic phenotypes in the progeny. Uncertainty surrounds the clinically and economically best ways to screen for GDM. While pharmaceutical and lifestyle approaches have shown short-term promise in treating diabetes, it is still unknown how long-term exposure to antidiabetic drugs during pregnancy may affect the children (Khalua *et al*., 2019) [11].

In gestational diabetes mellitus (GDM), a hormone produced by the placenta interferes with the body's ability to use insulin properly. As opposed to being taken in by the cells, glucose accumulates in the blood (Nair *et al*., 2021) [16].

Contrary to type 1 diabetes, gestational diabetes is not brought on by a deficiency in insulin, but rather by other hormones produced throughout pregnancy that may reduce the effectiveness of insulin, a condition known as insulin resistance. After birth, gestational diabetes symptoms go away.

Gestational diabetes mellitus

According to American Diabetes Association (2006) [1], there are some suggestions as to why GDM develops, despite the fact that the aetiology is unknown.

A growing foetus receives nutrition and water from the placenta, which also creates a number of hormones to keep the pregnancy going. Oestrogen, cortisol, and human placental lactogen are a few of the hormones that can impede the action of insulin. This phenomenon, known as the contra-insulin effect, often starts between weeks 20 and 24 of pregnancy (Jainudeen and Hafez, 2000) [9].

The likelihood of developing insulin resistance increases as the placenta develops and more of these hormones are generated. Normally, the pancreas can produce extra insulin to combat insulin resistance, but gestational diabetes develops when there is insufficient insulin produced to counteract the impact of the placental hormones.

Risks factors associated with gestational diabetes mellitus

Although any woman can develop GDM during pregnancy, the following are some factors that may raise the risk (Shannon & Wong, 2010) [19].

- Overweight or obesity
- Family history of diabetes
- Having given birth previously to an infant weighing greater than 9 pounds
- Age (women who are older than 25 are at a greater risk for developing gestational diabetes than younger women)
- Race (women who are African-American, American Indian, Asian American, Hispanic or Latino, or Pacific Islander have a higher risk)
- Prediabetes, also known as impaired glucose tolerance

Although elevated urine glucose is frequently included as a risk factor, it is not thought to be a reliable sign of GDM.

Complications of gestational diabetes

Both the mother and the foetus are negatively impacted by gestational diabetes. Macrosomia, birth trauma, caesarean, polyhydramnios, preeclampsia, neonatal metabolic abnormalities, and late problems, such as type 2 diabetes mellitus in the mother during the postpartum period, are the most prevalent ones (Langer, 2015) [13].

Khalua *et al*. (2019) [11] reported that anxiety and depression are most common problems during pregnancy due to different type of factor.

Dietary and macronutrient pattern and gestational diabetes mellitus

Observational studies suggest that good diets can reduce the risk of GDM before and throughout pregnancy (Kinnunen *et al*., 2014; Guelinckx *et al*., 2010) [12, 7]. The risk of developing gestational diabetes is increased by an unsuitable mother's diet during pregnancy, such as a high fat consumption, a low intake of carbohydrates and fibre, and a diet with a high glycemic load (Saldana *et al*., 2004; Zhang *et al*., 2006) [18, 23].

He *et al*. (2015) [8] demonstrated that obtaining dietary fibre has a reverse connection with the risk of developing gestational diabetes in a cohort study on 3060 Chinese pregnant women whose food intake was assessed throughout 24-28 weeks of pregnancy.

Karamanos *et al*. (2014) [10] reported that in the prevention and treatment of gestational diabetes mellitus, there is rising evidence to support dietary patterns with a high intake of vegetarian foods (such as whole grains, fruits, vegetables, and nuts) and fish and a low intake of processed animal and fatty foods. The Mediterranean diet (Med Diet) is the nutritional pattern that has been mentioned.

Nutritional interventions

The most crucial form of treatment for gestational diabetes is dietary changes that are nutritional in nature. In all recent diabetes mellitus workshops and conferences (Metzger *et al*., 2007) [15].

The distribution of calories is dependent on optimal body weight. It is advised that women with normal body mass index consume 30 kcal per kilogramme of body weight, overweight women consume 24 kcal per kilogramme, and obese women consume 12 to 15 kcal per kilogramme. While calorie prescription should be tailored, pre-pregnancy weight, body mass index (BMI), gestational weight gain, and physical activity should all be taken into account (Crowther *et al*., 2005) [5]. According to nutrition assessment and the DRIs' recommendations, sufficient amounts of macronutrients should be given to sustain pregnancy.

Aronovitz and Metzger (2006) [2] noted that the recommended daily calorie intake for macronutrients is 20–20% protein, 35–40% fat, and 33–40% complex carbohydrates.

Probiotics

Interest in treating the microbial environment in the intestine, including the use of probiotics, has lately increased due to the significance of the intestinal microbial community in the development of disorders linked to dysbiosis (Lee and Bak, 2011; Tewari *et al*., 2019) [14, 20]

In general, patient should eat:

- Plenty of whole fruits and vegetables
- Moderate amounts of lean proteins and healthy fats
- Moderate amounts of whole grains, such as bread, cereal, pasta, and rice, plus starchy vegetables, such as corn and peas
- Fewer foods that have a lot of sugar, such as soft drinks, fruit juices, and pastries

Patient should eat three small- to moderate-sized meals and one or more snacks each day. Do not skip meals and snacks. Keep the amount and types of food (carbohydrates, fats, and proteins) about the same from day to day. This can help you keep your blood sugar stable.

Carbohydrates

- Less than half the calories should come from carbohydrates.
- Most carbohydrates are found in starchy or sugary foods. They include bread, rice, pasta, cereal, potatoes, peas, corn, fruit, fruit juice, milk, yogurt, cookies, candy, soda, and other sweets.
- High-fiber, whole-grain carbohydrates are healthy choices. These types of carbohydrates are called complex carbohydrates.
- Try to avoid eating simple carbohydrates, such as potatoes, french-fries, white rice, candy, soda, and other sweets. This is because they cause blood sugar to rise quickly after you eat such foods.
- Vegetables are good for health and blood sugar. Enjoy lots of them (Rasmussen *et al*., 2020) [17].

Grains, beans, and starchy vegetables

Eat 6 or more servings a day. One serving equals:

- 1 slice bread
- 1 ounce (28 grams) ready-to-eat cereal
- 1/2 cup (105 grams) cooked rice or pasta
- 1 English muffin

Choose foods loaded with vitamins, minerals, fibre, and healthy carbohydrates. They include (Rasmussen *et al*., 2020) [17]

- Whole-grain breads and crackers
- Whole grain cereals
- Whole grains, such as barley or oats
- Beans
- Brown or wild rice
- Whole-wheat pasta
- Starchy vegetables, such as corn and peas

Use whole-wheat or other whole-grain flours in cooking and baking. Eat more low-fat breads, such as tortillas, English muffins, and pita bread.

Vegetables

Eat 3 to 5 servings a day. One serving equals

- 1 cup (340 grams) leafy, green vegetables
- 1 cup (340 grams) cooked or chopped raw leafy vegetables
- 3/4 cup (255 grams) vegetable juice
- 1/2 cup (170 grams) of chopped vegetables, cooked or raw (Turok *et al*., 2003) [22].

Healthy vegetable choices include

- Fresh or frozen vegetables without added sauces, fats, or salt
- Dark green and deep yellow vegetables, such as spinach, broccoli, romaine lettuce, carrots, and peppers (Tieu *et al*., 2008) [21].

Fruits

Eat 2 to 4 servings a day. One serving equals:

- 1 medium whole fruit (such as a banana, apple, or orange)
- 1/2 cup (170 grams) chopped, frozen, cooked, or canned fruit
- 3/4 cup (180 milliliters) fruit juice

Healthy fruit choices include

- Whole fruits rather than juices. They have more fiber.
- Citrus fruits, such as oranges, grapefruits, and tangerines.
- Fruit juices without added sugar.
- Fresh fruits and juices. They are more nutritious than frozen or canned varieties.

Milk and dairy

Eat 4 servings of low-fat or non-fat dairy products a day. One serving equals:

- 1 cup (240 milliliters) milk or yogurt
- 1 1/2 oz (42 grams) natural cheese
- 2 oz (56 grams) processed cheese

Healthy dairy choices include

- Low-fat or non-fat milk or yogurt. Avoid yogurt with added sugar or artificial sweeteners.
- Dairy products are a great source of protein, calcium, and phosphorus.

Protein (meat, fish, dry beans, eggs, and nuts)

Eat 2 to 3 servings a day. One serving equals:

- 2 to 3 oz (55 to 84 grams) cooked meat, poultry, or fish
- 1/2 cup (170 grams) cooked beans
- 1 egg
- 2 tablespoons (30 grams) peanut butter

Healthy protein choices include

- Fish and poultry. Remove the skin from chicken and turkey.
- Lean cuts of beef, veal, pork, or wild game.
- Trim all visible fat from meat. Bake, roast, broil, grill, or boil instead of frying. Foods from this group are excellent sources of B vitamins, protein, iron, and zinc.

Sweets

- Sweets are high in fat and sugar, so limit how often eat them. Keep portion sizes small.
- Even sugar-free sweets may not be the best choice. This is because they may not be free of carbohydrates or calories.
- Ask for extra spoons or forks and split dessert with others.

Fats

In general, patient should limit intake of fatty foods.

- Go easy on butter, margarine, salad dressing, cooking oil, and desserts.
- Avoid fats high in saturated fat such as hamburger, cheese, bacon, and butter.
- Don't cut fats and oils from your diet entirely. They provide energy for growth and are essential for baby's brain development.
- Choose healthy oils, such as canola oil, olive oil, peanut oil, and safflower oil. Include nuts, avocados, and olives.

Conclusion

Making the diagnosis and treatment of gestational diabetes can reduce perinatal complications of the new born as well as mother. Nutritional management impacts a major role of treatment for GDM along with medications like insulin, glyburide and metformin which can also be used to the emphasize treatment. Foetal measurements can be affected by maternal glucose level which should be monitoring in the identification of pregnancies. After delivery the short-term diabetes risk in mothers can be elevated. Lifestyle modification is the one of the keys for treatment of GDM. Use of medications for diabetes prevention after GDM remains controversial.

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