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Dietary Patterns and Nutritional Interventions for Gestational Diabetes Mellitus: A Narrative Review

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Abstract. Gestational diabetes (GEM) poses a serious threat to both maternal and infant health, and dietary therapy is the core management approach for it. This review focuses on synthesizing recent clinical studies of the GEM dietary management and summarizes various effective dietary patterns. Through the looking back of the literature, this text analyzes the similarities and differences among international guidelines, discussing the relationship between the risk of gestational diabetes and core nutrients, such as fatty acids and dietary fiber, and assesses some dietary therapy methods like DASH and Low-GI diets. The result of the literature review points out that the DASH diet is the therapy method that has the most significant effects on blood glucose controlling and pregnancy outcomes improving. A Low-GI diet can lower the blood glucose after the meals and decrease the risk of fetal macrosomia and premature birth. The Mediterranean diet also has a promising future in lowering the morbidity of gestational diabetes. The goal of this review is to provide a diet guide that is based on reality and discover some new research directions in the future.

Keywords: Gestational Diabetes, Nutritional Interventions, Pregnancy Diet, Nutritional Therapy

1. Introduction

Gestational diabetes is defined as the first finding or appearance of glucose intolerance, usually diagnosed in the middle or late periods of pregnancy, and the patient has no previous history of diabetes [1]. Nowadays, the morbidity of gestational diabetes in the world is keeping rising, and now it is affecting about 13.4% of pregnancies in the world [2]. This situation constitutes a risk of the short-term and long-term health of the mothers and infants. The complications of gestational diabetes include preeclampsia, the rising risk of caesarean section, and type 2 diabetes, which may happen in the future [3]. Also, the complications of infants include fetal macrosomia, premature birth, and neonatal hypoglycemia [4].

The medical nutrition therapy is considered the basic method of the administration of gestational diabetes. The American Diabetes Association suggests that all women with gestational diabetes should accept the individual nutrition counseling [1]. However, there are a large number of diets in real life, and the relative efficiency between different diet methods is not clear. The reviews before already proved that diet interventions can lower the risk of gestational diabetes, but the intervention characteristics have significant differences [5].

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This review has a main focus on the conformity of the literature about the clinical research on gestational diabetes, summing up the effective diet methods. Also, it is giving some suggestions and dietary guidelines to dieticians and obstetricians, and providing the theoretical foundation for individual diet plans.

2. Dietary patterns and guidelines

2.1. The general principle of GDM medical nutrition therapy

One of the main ideas of therapy for gestational diabetes is to maintain euglycemia, provide enough nutrition for maternal and child health, and support appropriate weight gain during pregnancy [1]. Advice from the American Diabetes Association is to maintain the same amount of carbohydrate intake in different meals, emphasizing the quality of carbohydrates but not only quantity [1]. A review in 2024 has found that a high-fiber diet can reduce the risk of gestational diabetes and a lower weight of newborns [6].

2.2. DASH diet

Dietary approaches to stop hypertension, such as DASH diet, highlight the high intake of fruits, vegetables, whole grains, lean meat protein and light dairy products while limiting the intake of saturated fat, cholesterol, and sodium. A review in 2025 found that the DASH diet is connected to a decrease in glycosylated hemoglobin, an improvement in lipid profile, and a decrease in the incidence rate of fetal macrosomia [7]. Moreover, another analysis proved that the DASH diet is the most effective intervention measure of blood glucose control, which can significantly reduce the fasting blood glucose, blood glucose two hours after the meal, and the insulin resistance index. At the same time, it can reduce the risk of fetal macrosomia and cesarean section [8].

2.3. Low-GI diet

The low-glycemic index diet emphasizes choosing carbohydrates that can produce slower and lower blood glucose changes, such as whole grains and legumes. A low-GI diet can help regulate the level of blood glucose after meals and reduce the demand for insulin [7]. Compared to a standard diet, a low-GI diet reduces the risks of fetal macrosomia and premature birth more significantly [8]. What's more, adherence to a low-GI diet is connected to a lower risk of gestational diabetes and the overweight gain during pregnancy [6].

2.4. Mediterranean diet

The characteristic of the Mediterranean diet is the excessive intake of fruits, vegetables, beans, whole grains, nuts and olive oil; the appropriate intake of fish and poultry meat, and a small intake of red meat. In a clinical test, the group of pregnant women who have a Mediterranean diet has a lower average incidence rate of gestational diabetes that is 15.2%, and it is lower than the 18.5% of the control group; the rates of urinary tract infection, and high blood pressure are also decreased [9]. The reduce of the incidence of gestational diabetes is rely on the compliance of the Mediterranean diet [10]. The Mediterranean diet is connected to the lower incidence rate of gestational diabetes and the premature birth and the overweight of newborns [6].

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3. The relationship between nutrients and the risk of GDM

3.1. Carbohydrates

The quality and quantity of carbohydrates are the most crucial factors in the administration of gestational diabetes. A high-fiber diet can help control the blood glucose before meals and after meals, and decrease the demand of insulin therapy [11]. The United States Department of Agriculture's nutrition evidence system review has a conclusion that a lower risk of gestational diabetes is connected to the dietary pattern that intakes more vegetables, fruits, beans, nuts, whole grains, and a small amounts of red meat, sugar and saturated fat [12].

The glycemic index of the carbohydrates is another key factor. The rate of absorption of carbohydrates with a lower glycemic index is slower, resulting in a more stable reaction of the blood glucose level after meals. In addition, carbohydrates with a high glycemic index, such as refined grains, will cause a rapid rise in blood glucose, and aggravate insulin resistance. The use of lower glycemic index foods to replace the high glycemic index foods can significantly improve the blood glucose control after meals of patients with type 2 diabetes and gestational diabetes [8]. Moreover, the total allocation of carbohydrates is vital. The carbohydrates should be divided among the three meals evenly, avoiding the large quantities of intake in a short period, which contributes to maintaining the blood glucose stable during the whole day. Although the high-quality carbohydrates have a limited curative effect on gestational diabetes, it can reduce the demand for insulin [13]. For the population who have a high risk of gestational diabetes, the diet with high-quality carbohydrates can only reduce the weight gain during pregnancy and the risk of premature delivery but cannot guard against the occurrence of gestational diabetes [13].

3.2. Fatty acids

The composition of dietary fatty acids affects the risk of gestational diabetes. There are different effects of different fatty acids. The rise of serum palmitic acid level has a positive correlation of the risk of gestational diabetes. The proportion of plasma palmitic acid has a positive correlation with the gestational diabetes, while plasma stearic acid, arachidonic acid, docosanoic acid and lignoceric acid have a negative correlation with it [13]. What's more, the serum of the patients with gestational diabetes not only has a higher percentage of palmitic acid, but also has an increasing percentage of saturated fatty acids in serum, and the percentage of unsaturated fatty acids decreases [13].

About the long-chain polyunsaturated fatty acids, especially the effects of DHA and EPA, there still exist some disputes. Some researches found that DHA cannot guard against gestational diabetes. For the patients who already confirmed gestational diabetes, intaking DHA and EPA can reduce the blood glucose, blood fat and insulin resistance level [13]. The total fat, which includes triglyceride and cholesterol, is the independent risk factor of the adverse pregnancy outcomes of the patients with gestational diabetes. The high-total-fat diet might raise the risk of gestational diabetes, and using polyunsaturated fatty acids and monounsaturated fatty acids to replace saturated acids can lower this risk [13].

3.3. Dietary fiber

The high-quantity intake of dietary fiber reflects the protective effect on gestational diabetes. An analysis proved that the high-quantity intake of fiber is connected to the improvement of blood glucose control and lower demand for insulin in women with gestational diabetes [11].

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A high dietary fiber diet is the main method to prevent the different types of diabetes [13]. Supplementation and soluble fiber can reduce the risk of gestational diabetes in obese women. Although high-quantity intake of dietary fiber can help in preventing and treat gestational diabetes, different research gives different suggestions. The foods that are rich in dietary fiber, such as beans, whole grains and vegetables, can reduce the risk of gestational diabetes; however, the excessive quantity intake of fruits, potatoes and fruit juice is connected to the increased risk of gestational diabetes [13]. In 2023, there is one study that discovers the protective mechanism, which is that butyrate mediates the protective effect of high fermentable fibers on placental inflammation in gestational diabetes [14].

4. Practical application and future outlook

4.1. Intervention measures

An effective prevention and administration of gestational diabetes needs a comprehensive method, including intervention during preconception and early pregnancy, pregnancy weight management and individualized nutrition consultation.

The best period for people to prevent gestational diabetes starts at preconception. The weight before pregnancy is of vital importance because overweight and obesity before pregnancy are reparable factors with a high risk to cause gestational diabetes. The IOM suggests that females with normal body weight should have a weight gain of about 11.5-16 kilograms, and overweight females need to have a weight gain of about 7-11.5 kilograms; obese females should control their weight gain during pregnancy to 5-9 kilograms [5].

Excessive weight gain during pregnancy is a risk factor for gestational diabetes. Many dietary methods can restrict the weight gain during pregnancy, but there is no reduction in the incidence rate of gestational diabetes, which reflects that the limitation of weight gain during pregnancy is not enough to prevent gestational diabetes [15]. The diet intervention can decrease the incidence rate of gestational diabetes by about 27%, and the diet intervention combined with exercise intervention lowers the risk by about 18%. Moreover, the exercise intervention carried out in a group setting or within a medical institution is more effective than the individual form of interventions [5].

For nutrition counseling, registered dietitians and healthcare professionals need to follow the patients' cultural backgrounds, dietary habits, and personal preferences to adjust the diet plan. An effective prevention usually includes the nutritional support provided by nutritionists and key food intake [7]. However, it is not certain whether these approaches can be promoted in clinical treatment. At the same time, the plant-based diet is becoming a method that has promising prospects; one study including 1756 patients of gestational diabetes has found that a higher plant-based diet index is connected to a lower numerical value in the continuous blood glucose monitoring [16].

4.2. The challenges of patient compliance and how to improve it

The dietary management of gestational diabetes can bring a significant burden to patients. The study involving 109 pregnant women with gestational diabetes revealed that about 53.2% of interviewees consider that the diet of diabetes management made their daily life more difficult because of the demand for time and economic increase [17]. The women who need insulin therapy have more difficulty maintaining the normal blood glucose levels compared to women who only need diet and exercise management [17]. What's more, a fast-eating speed is associated with an increased incidence of gestational diabetes compared to a slower eating speed [13]. Also, the food cravings

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during early pregnancy might be connected to the food intake; the desire for salty food may reflect a lower risk of gestational diabetes while the desire for sweet food does not change the risk [13].

To improve the compliance of patients, there are some methods. Firstly, simplified dietary advice. The use of "MyPlate", which has vegetables about half of the plate, and carbohydrates and proteins each accounting for one quarter, reduces the cognitive burden. RADIEL research in Finland used this method and successfully reduced about 39% incidence of gestational diabetes [15]. Secondly, people can use digital health tools. Mobile applications, test message reminders and the social media groups can provide continuous support and encouragement. Moreover, the intervention from groups can give encouragement when they proceed with diet and exercise interventions, and it has a better effect than the individual interventions [5]. The review also found that the medical staff had a more positive experience in caring for the group, and they consider that they can use the time more efficiently [5]. Last but not least, the diet plan should follow the cultural backgrounds and dietary habits. For example, the widespread adoption of the Mediterranean diet in the UK will face challenges because people's acknowledgement of this dietary method has some limitations [15].

5. Conclusion

In conclusion, the DASH diet has the strongest evidence in the improvement of blood glucose and the reduction of adverse pregnancy outcomes. The low-GI diet can decrease the blood glucose level after meals and the risk of fetal macrosomia and premature birth; the Mediterranean diet shows a favorable development foreground at decrease the incidence of gestational diabetes and improving the pregnancy outcomes. The high-fiber diet can improve the fasting blood glucose and blood glucose after meals; a plant-based diet is connected to the blood glucose indicators, which have all improved. For fatty acids, the increased intake percentage of triglyceride, cholesterol and saturated fatty acid will increase the risk of gestational diabetes. The faster eating speed and the desire for sweet food during the early pregnancy might increase the risk of gestational diabetes. However, the dietary management will bring burdens to patients, and their compliance with the plan is a challenge. The exercise and diet intervention under a setting and medical establishment is more effective than individual background.

Although this review summarizes the research that has informative value, it still has limitations. Different researches have high differences, and there is a risk of bias. People from different countries and cultures do not have enough representativeness. Also, there are a few studies that assess the long-term outcomes after pregnancy, and most of the research did not report the data of patients' compliance, which limits the accuracy of the assessment. What's more, there are different diagnostic criteria in different research studies, influencing the quality of the evidence integration.

For future research, they should follow a main focus. Firstly, scientists could develop standard dietary plans that can adapt to different cultures, and start the research that is more rigorous to assess the long-term outcomes of pregnancy. Secondly, they can study the beneficial mechanism of specific dietary patterns, such as the regulation of gut microbiota and so on. What's more, there should be some methods that focus on the patients, solving the realistic obstacle of dietary compliance; the exploration of the best dietary pattern for people from different places and races can improve the management of gestational diabetes in the world.

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