

Progress in the study of the effects of medical nutrition therapy on adverse pregnancy outcomes in patients with gestational diabetes mellitus and their offspring

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Abstract: Gestational diabetes mellitus (GDM) belongs to a particular type of diabetes mellitus. Not only are patients with GDM at a more significant risk of converting to diabetes mellitus later in life, but GDM can also have both short-term and long-term effects on the health of the mother and child, such as congenital anomalies, spontaneous abortions, macrosomia, preterm labor, excessive amniotic fluid, and many other adverse outcomes. Medical nutrition therapy (MNT) interventions for patients with GDM can be extremely beneficial to the pregnancy outcomes of GDM patients and their offspring by helping them to act on their individual and clear health goals and adopt healthy behaviors. The article starts from the effect of MNT on the pregnancy outcome of GDM patients and their offspring, reviews the latest research progress on the adverse pregnancy outcome of GDM patients and their offspring, and analyzes the problems and importance of medical nutrition therapy for GDM patients with the aim of better promoting the outcome of GDM patients' mothers and infants, and reaching the long-term effect of MNT.

Keywords: Medical Nutrition Therapy, Gestational Diabetic Patients, Adverse Pregnancy Outcomes, Offspring Effects.

1. Introduction

Gestational diabetes mellitus is an endocrine-metabolic disease specific to pregnancy in women that first occurs or is detected as a result of the effects of conception and is most often diagnosed in mid-pregnancy. Screening for GDM is recommended at 24-28 weeks of pregnancy by the International Diabetes Federation (IDF). According to the official website of the International Diabetes Federation, in 2023, 21.1 million newborns worldwide will be affected by hyperglycemia during their mother's pregnancy, accounting for 16.7% of newborns. According to the comparison of data reported by the International Diabetes Federation in 2017, 1.84 million newborns worldwide were affected by hyperglycemia during their mother's pregnancy, accounting for 13.9% of newborns, indicating that the incidence of gestational diabetes is on the rise.[1] Failure to intervene in a timely manner can lead to the emergence of negative pregnancy outcomes such as preterm labor, cesarean section, spontaneous abortion, excessive amniotic fluid, postpartum hemorrhage, macrosomia, and neonatal hypoglycemia; The offspring are at high risk of developing obesity and diabetes during childhood, adolescence and adulthood, which can create a lot of healthcare burden. According to the survey, patients with GDM

often suffer from the problem of irrational diet structure, such as overconsumption of high-calorie and high-protein foods, blindly taking health care products and supplements, and excessive intake of fruits, which will easily lead to over-nutrition during pregnancy, poor blood glucose control, and rapid and excessive weight gain of pregnant women. MNT is the foundation of comprehensive diabetes treatment and the primary treatment for pregnant women with GDM to control blood glucose, which is mainly based on the actual situation of the patient's own dietary program, and provide them with relevant dietary and nutritional health education, which can reduce the incidence of adverse pregnancy outcomes in patients with GDM. This article provides a review of recent years regarding the impact of the control and management of GDM on negative pregnancy outcomes and offspring from a nutritional perspective, based on the pathogenesis and physiologic characteristics of GDM, in order to prevent complications resulting from GDM.

2. Research about Gestational Diabetes Mellitus

2.1. Pathogenesis of Gestational Diabetes Mellitus (GDM)

GDM is categorized into two types: type 1 and type 2. Type 1 requires only dietary control and exercise to achieve blood glucose levels, while type 2 requires medication in addition to dietary control and exercise. The fetus must use glucose for energy in the mother's body, and the glucose requirement increases. During the period of mid to late pregnancy, there is increased insulin resistance and a relative lack of insulin secretion in the pregnant woman's body, and the pregnant woman's need for insulin increases, and for pregnant women with limited insulin secretion, they are unable to compensate for that physiologic condition during pregnancy, resulting in elevated blood glucose and leading to the development of GDM.[2]

2.2. Risk factors for GDM

Obese women have lower than normal weight women insulin sensitivity and insulin sensitivity in pregnant women with GDM decreases with increasing gestational age, according to Endo S et al [3]. Sugiyama T et al. [4] found that the more preconception BMI and weight increase during pregnancy, the higher risk of negative neonatal pregnancy outcomes. Chu SY et al [5]. found that women who were overweight in the first trimester of pregnancy had an increased risk of developing GDM. A study by MOOSAZADEH M et al. [6] found that the risk of GDM in pregnant women with a strong family history of diabetes mellitus and hypertension was 3.46 and 2.65 times higher than that in pregnant women without a family history. Aldasouqi et al. [7] showed that pregnant women's risk of developing GDM was related to age, with pregnant women having a significantly higher risk of developing GDM with an increase in their average age. Cheng J H et al. [8] found that women with GDM in a previous pregnancy have approximately a 50% risk of recurring GDM.

In summary, obesity, older gestational age, faster and more weight gain during pregnancy, a family history of diabetes mellitus, hypertension, and GDM in a previous pregnancy are risk factors for gestational diabetes mellitus, which have a greater probability of leading to adverse pregnancy outcomes, thus increasing the social and medical burden, and we should have early detection, prevention, and nutritional assessment and MNT for GDM.

2.3. GDM testing standards

Currently, the main international health organizations that issue authoritative standards for the diagnosis of GDM are WHO, IADPSG and the International Federation of Obstetrics and Gynecology. However, the IADPSG criteria are mostly used because they are widely recognized by the ADA, the Endocrine Society, FIGO, the Gestational Diabetes Association of Australasia, the Japanese Diabetes Association, the Ministry of Health of China, and the European Committee of Obstetrics and Gynecology. Currently, the diagnosis of diabetes mellitus is made by oral glucose tolerance test, which needs to be fasted for at least 8 hours before the examination. During the test, 300ml of liquid with 75 g of glucose is taken orally, and the blood glucose level of the pregnant woman is measured before taking glucose and 1 and 2 hours

after glucose is taken, respectively: fasting blood glucose ≥ 5.1 mmol/L; 1 hour postprandial blood glucose ≥ 10.0 mmol/L; and 2 hours postprandial Blood glucose value ≥ 8.5 mmol/L, any point of blood glucose value is abnormal, can be diagnosed as GDM.[9]

2.4. *Clinical manifestations of GDM*

The International Diabetes Federation (IDF) states on its official website that gestational diabetes is usually asymptomatic, with some pregnant women experiencing increased thirst and urination, weakness, blurred vision, nausea, and frequent infections.

2.5. *Complications of GDM*

It is found that, high maternal blood glucose puts the fetus in a hyperglycemic environment, increased osmotic diuresis leads to excess amniotic fluid, and finally leads to an increased risk of neonatal macrosomia, leading to adverse pregnancy outcomes. The frequency of premature rupture of membranes and preterm labor was higher in women with GDM than in normal pregnant women. It is found that pregnant women with GDM have a significantly higher incidence of hypertensive disorders of pregnancy than normal healthy pregnant women.

In summary, GDM causes numerous complications, and increases the incidence of negative pregnancy outcomes for infant and mother.

2.6. *Medical Nutrition Therapy (MNT) for GDM*

The American Diabetes Association (ADA) recommends that MNT for pregnant women with GDM needs to provide enough nutrients for fetal and maternal health, as well as to achieve normal glycemic levels in the absence of ketosis and to provide sufficient amounts of energy to allow for appropriate weight gain during pregnancy, to improve the quality of maternal delivery, and to improve pregnancy outcomes. According to the International Maternity Alliance, a low GI diet can lower postprandial blood glucose levels, reduce the frequency of insulin use, and decrease the incidence of low birth weight and macrosomia. GI diets of various food types vary widely among individuals, and women with GDM should avoid high-GI foods or consume them in small amounts at specific times.

Dietary arrangements for gestational diabetes should be small, frequent and regular, which is very important for blood glucose control. For patients on insulin regimens, meal times and carbohydrate intake need to be consistent throughout the day to avoid glycemic instability and hypoglycemia. For GDM patients, the dietary arrangement should be small meals, regular meals, and regular quantities, which is very important for the control of blood glucose. For patients on insulin regimens, meal times and carbohydrate intake need to be consistent throughout the day to avoid glycemic instability and hypoglycemia. MNT should provide effective control of carbohydrate, fat and protein calories, ensuring that the intake ratios are 55%-65%, 25%-30% and 15%-20%, respectively. The energy percentage of the three meals is 10-15%, 30% and 30% respectively, and the energy of each additional meal is controlled at 5%-10% to ensure the stability of blood glucose and not cause hypoglycemia.

2.7. *Impact of MNT on GDM*

MNT is a clinical approach to nutritional interventions for specific diseases, based on evidence-based individualized nutritional treatment plans. Including individualized nutritional assessment of patients, development of appropriate nutritional intervention plans and monitoring over a period of time. In recent years, many clinicians have paid great attention to and deeply explored the scientific and effectiveness of MNT on the clinical efficacy of patients with GDM.

Based on related literatures, it is demonstrated that the number of pregnant women receiving MNT increased from 2008 to 2012, and that MNT was effective in improving the glycemic index and body weight of pregnant women with GDM, lowering lipid levels, and decreasing the incidence of maternal and neonatal complications, resulting in a favorable outcome of the pregnancy. MNT reduced the frequency of newborns presenting with underweight and macrosomia and medical nutrition therapy reduces the frequency of neonatal ICU admissions and deaths. MNT reduces the need for insulin in

pregnant women with GDM and frequency of gestational hypertensive disorders. It is also found that VD has the ability to improve insulin resistance, reduce fasting glucose and fasting serum insulin in patients with GDM without affecting lipid metabolism in the body.

In summary, MNT can achieve specialized, specific and individualized therapeutic effects, which can completely provide sufficient nutrition for both the mother and the fetus, as well as enable the pregnant women to have appropriate body weight during pregnancy, maintain the blood glucose of pregnant women with GDM in the normal range, avoid the occurrence of hypoglycemia and improve the adverse pregnancy outcomes.

3. Conclusion

Identifying high-risk factors for the development of GDM and early screening are beneficial in combating GDM and improving pregnancy outcomes. MNT can modify adverse pregnancy outcomes, can lead to healthier patients and their offspring, and reduces the incidence of disease. At the same time of giving MNT to GDM patients, we should also strengthen the observation of their psychological status, improve the patients' bad mood, and also enhance their degree of cooperation with the treatment, which can ensure that the medical nutritional therapy can be implemented smoothly, and can also guarantee the therapeutic effect. Clinical medicine should pay more attention to MNT and utilize MNT approaches to effectively treat GDM and reduce the global burden of disease at its source.

References

- [1] Cho N.H., Shaw J.E., Karuranga S., et al. (2018) IDF Diabetes Atlas: Global estimates of diabetes prevalence for 2017 and projections for 2045. *Diabetes Research and Clinical Practice*, 138: 271-281.
- [2] Kuhl C. (1991) Insulin secretion and insulin resistance in pregnancy and GDM: Implications for diagnosis and management. *Diabetes*, 2: 18-24.
- [3] Endo S., Maeda K., Suto M., et al. (2006) Differences in insulin sensitivity in pregnant women with overweight and gestational diabetes mellitus. *Gynecological Endocrinology*, 22 (6), 343-349.
- [4] Sugiyama T., Metoki H., Hamada H., et al. (2014) A retrospective multi-institutional study of treatment for mild gestational diabetes in Japan. *Diabetes Research and Clinical Practice*, 103(3): 412-418.
- [5] Chu S.Y., Callaghan W.M., Kim S.Y., et al. (2007) Maternal obesity and risk of gestational diabetes mellitus. *Diabetes Care*, 30: 2070-6.
- [6] Moosazadeh M., Asemi Z., Lankarani K.B., et al. (2017) Family history of diabetes and the risk of gestational diabetes mellitus in Iran: a systematic review and meta-analysis. *Diabetes & Metabolic Syndrome Clinical Research & Reviews*, 11(1): 99-104.
- [7] Aldasouqi S.A., Solomon D.J., Bokhari S.A., et al. (2008) Glycohemoglobin A1c: a promising screening tool in gestational diabetes mellitus. *International Journal of Diabetes in Developing Countries*, 28(4): 121-124.
- [8] Cheng J. (2013) Study on the risk factors of gestational diabetes mellitus and its impact on pregnancy outcome of mother and baby. *Journal of Clinical Rational Drug Use*, 6(12): 19-19.
- [9] Wei Y., Yang H. (2018) Perspectives on diagnostic strategies for hyperglycemia in pregnancy: dealing with the barriers and challenges in China. *Diabetes Research and Clinical Practice*, 145: 84-87.