Effect of Individualized Nutritional Therapy Combined with Low-intensity Continuous Exercise on Pregnancy Outcomes in Patients with Gestational Diabetes

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Abstract: Objective: To study the effect of individualized nutrition therapy combined with low intensity continuous exercise on gestational diabetes mellitus (GDM) control and pregnancy outcome. Methods: A total of 72 GDM patients diagnosed and treated in our hospital from October 2022 to October 2023 were randomly divided into an observation group and a control group. Individualized nutritional therapy combined with low-intensity continuous exercise therapy and conventional therapy were given, respectively. The blood glucose level, biochemical indexes, depression score, anxiety score and pregnancy outcome of the patients were observed and compared. Results: After individualized nutrition therapy combined with low-intensity continuous exercise, compared with the control group, the levels of fasting blood glucose, 2h postprandional blood glucose, glycated protein, albumin, total cholesterol, and triacylglycerol of the patients in the observation group were significantly reduced, and the depression and anxiety of the patients in the observation group were significantly alleviated, and the pregnancy complications were significantly reduced. Conclusion: Individualized nutrition therapy combined with low-intensity continuous exercise can effectively control gestational diabetes and improve pregnancy outcomes.

***Keywords*:** individualized nutritional therapy, low-intensity continuous exercise, GDM, control, pregnancy outcome

1. Introduction

Gestational diabetes mellitus refers to abnormal glucose tolerance of different degrees that occurs or is first discovered during pregnancy. It is a relatively common obstetric complication in clinical practice[1] and an increasingly serious public health problem worldwide, threatening the health of pregnant women and fetuses. In the past few decades, due to economic development and improvement of living standards, coupled with changes in lifestyle and increasing Westernization, characterized by changes in dietary patterns and lack of exercise, coupled with an emphasis on GDM screening, the prevalence of GDM in China has increased significantly[2]. Medication and diet therapy are commonly used to control the blood sugar level in patients with GDM. This article aims to explore the effect of individual nutrition therapy combined with low-intensity continuous exercise on the control of gestational diabetes and pregnancy outcome, and to clarify the clinical significance of this treatment.

2. Materials and methods

2.1 Research objects

In this research, 72 GDM patients diagnosed and treated in our hospital from October 2022 to October 2023 were selected as research objects, and the patients were divided into an observation group and a control group by random number table method, with 36 cases in each group. Patients in observation group ranged in age from 21 to 41 (on average 28.67±5.23) years, the gestational age was 13-32 (on average 25.06±5.68) weeks and the body weight was 58~76 (on average 67.08±3.79) kg, while those of control groups were 22~40 (on average 30.89±6.00), 11~33 (on average 23.42±5.77) weeks and 58~78 (on average 65.61±5.71)kg, respectively. There was no significant difference in clinical data between the two groups of patients ($P>0.05$), indicating comparability. The patients all agree to participate and have signed inform consents in advance.

2.2 Inclusion and exclusion criteria

Inclusion criteria: Patients diagnosed as gestational diabetes; Single pregnancy patients; Informed consent of patients and their families.

Exclusion criteria: GDM patients; Patients with mental illness; Patients with heart disease; Patients with thyroid disease.

2.3 Therapy methods

Patients in both groups were treated with oral conventional hypoglycemic drugs, and the drugs and doses used were consistent. Control group patients were given routine low-intensity continuous exercise guidance, mainly jogging, taijiquan, walking in the park, etc. Each activity time was about 45 minutes, 3 times/day. Patients in the observation group were given personalized nutritional treatment on the basis of exercise guidance in the control group. Firstly, the diet of the patient was investigated, and the energy coefficient was controlled according to the body mass index of the patient. The daily energy intake coefficient of the prepregnancy body mass index ≥25, 18.5~24.9 and <18.5 kg/ m^2 should be controlled at 25~30, 30~35 and 33~38 kcal/kg, respectively, to ensure the moderate increase in body mass during pregnancy. hen guide gestational diabetes patients with each meal intake of quantitative carbohydrates, lipids, protein and the equivalent amount and proportion of control, so that daily carbohydrate intake accounted for 50% to 60% of the total calories, daily lipid intake should account for 20% to 25% of the total calories, including no more than 7% of saturated fatty acids; The daily protein intake should be controlled at 1.2-1.5 g/ (kg·d), accounting for 20% to 25% of the total calories. In addition, patients were instructed to eat less and more meals, reduce energy intake at meals, and give energy intake between meals and before going to bed, in which the energy of breakfast, middle and evening meals was controlled at 10%-15%, 30% and 30% of the total daily energy intake respectively, and the energy between meals and extra meals before going to bed accounted for 5%-10%, respectively, to control the overall daily energy intake. In addition, it is recommended to consume 25 to 30 g of dietary fiber per day, and match different foods according to the actual situation of patients.

2.4 Observation indicators

Fasting blood glucose, 2h postprandial blood glucose and glycosylated hemoglobin levels were compared between the two groups before and after care. The biochemical indexes of the two groups were evaluated according to albumin, total cholesterol and triacylglycerol before and after treatment. Self-rating Depression Scale (SDS) and self-rating Anxiety Scale (SAS) were used to evaluate the depression and anxiety status of the patients. The outcomes of neonatal respiratory distress syndrome, macrosomia, premature delivery and postpartum hemorrhage were observed and recorded.

2.5 Statistical analysis

SPSS21.0 software was used to process the data. Measurement data were expressed as ($\bar{x}$±s), and counting data were expressed as %. Differences between groups were compared by T-test or χ^2 test. P<0.05 indicated that the difference was statistically significant.

3. Results

3.1 Comparison of blood glucose levels

As shown in Table 1, the fasting blood glucose, 2h postprandial blood glucose and glycated hemoglobin of the two groups after treatment were all lower than before treatment (P<0.05), and the observation group was significantly lower than the control group, as is shown in Table 1.

Table 1. Comparison of Blood Glucose Levels between the Two Groups [($\bar{x}$±s), mmol/L]

	The fasting blood glucose		2h postprandial blood glucose		Glycated hemoglobin	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Observation group	8.00±0.97	5.15±0.38***	15.30±1.42	9.29±0.67***	9.54±1.37	6.09±0.63***
Control group	8.24±0.19	5.94±0.18***	15.10±0.92	13.61±0.52***	9.53±0.86	7.53±1.32***
t	1.374	11.23	0.703	23.47	0.059	5.904
P	0.174	<0.001	0.484	<0.001	0.953	<0.001

***P<0.001

3.2 Comparison of biochemical indicators

The biochemical indexes of albumin, total cholesterol and triacylglycerol after treatment were lower than before treatment, and the differences were statistically significant (P<0.05). After treatment, the biochemical indexes of albumin, total cholesterol and triacylglycerol in the observation group were lower than those in the control group, and the differences were statistically significant (P<0.05), as is shown in Table 2:

Table 2. Comparison of blood glucose levels between the two groups ($\bar{x}$±s)

	Albumin (g/L)		Total cholesterol(mmol/L)		Triacylglycerol (mmol/L)	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Observation group	43.03±1.96	39.92±2.17***	7.01±1.21	3.67±0.20***	2.93±0.55	1.98±0.26***
Control group	43.87±1.69	41.38±1.61***	7.01±1.16	5.04±1.03***	2.77±0.60	2.11±0.26***
t	1.957	3.243	0.033	7.871	1.210	2.037
P	0.054	0.0018	0.974	<0.001	0.230	0.046

***P<0.001

3.3 Comparison of anxiety and depression scores

After treatment, the anxiety and depression in both groups were significantly lower than before treatment (P<0.05), and the observation group was significantly lower than the control group (P<0.05), as is shown in Table 3:

Table 3. Comparison of anxiety and depression scores between the two groups ($\bar{x}$±s)

	SAS		SDS	
	Before treatment	After treatment	Before treatment	After treatment
Observation group	57.34±2.96	35.43±0.88***	59.56±3.31	36.05±1.92***
Control group	57.88±2.83	42.14±1.57***	60.17±3.31	45.42±2.04***
t	0.783	22.35	0.77	20.11
P	0.436	<0.001	0.440	<0.001

***P<0.001

3.4 Comparison of pregnancy complication outcome

The incidence of neonatal respiratory distress syndrome, macrosomia, premature delivery and postpartum hemorrhage in observation group were significantly lower than those in control group, with statistical significance (P<0.05), as is shown in Table 4.

Table 4. Comparison of pregnancy complication outcome between the two groups

	n	Neonatal respiratory distress syndrome (n, %)	Macrosomia (n, %)	Premature delivery (n, %)	Postpartum hemorrhage (n, %)
Observation group	36	0(0)	1(2.8%)	0(0)	0(0)
Control group	36	3(8.3%)	6(16.7%)	4(11.1%)	3(8.3%)
t		4.533			
P		<0.001			

4. Discussion

GDM is the most common type of diabetes, mainly caused by insulin resistance and relative insufficiency of insulin secretion[3]. Gestational diabetes is one of the most common complications in pregnant women. Early detection of at-risk groups can help with prevention and intervention to reduce the risk of GDM and adverse perinatal outcomes. Therefore, it is of great significance to pay attention to the prevention and intervention of GDM in China. Lifestyle interventions, including dietary interventions and physical exercise, are the first-line prevention strategies for the prevention and intervention of GDM. As many as 70-85% of people diagnosed with gestational diabetes can be controlled with appropriate physical activity, diet and lifestyle changes[4].

The study found that healthy dietary interventions and physical exercise reduced pregnancy weight gain, but had no effect on reducing fasting blood glucose[5]. In addition, physical exercise is a non-invasive treatment option for the prevention and management of GDM. In this study, personalized nutrition therapy combined with low-intensity continuous exercise was used to manage GDM patients. The results showed that this method could significantly change the blood glucose level and biochemical indexes of patients, and the clinical effect was significant.

Gestational diabetes mellitus patients will be in a state of depression and anxiety due to long-term hyperglycemia and long-term use of hypoglycemic drugs. This study compared the SAS and SDS scores of the two groups of patients and found that after personalized nutrition treatment and low-intensity exercise, the depression and anxiety of GDM patients were

significantly relieved.

The blood sugar level of pregnant women will directly affect the prognosis of pregnancy. For patients with gestational diabetes, when the blood sugar level of the body is high for a long time, it will lead to a significant increase in the risk of massive bleeding, labor injury, difficult labor, cesarean section, etc., and it will also increase the incidence of small for gestational age, fetal distress, and giant babies. In this study, after treatment, the probability of neonatal respiratory distress syndrome, macrosomia, preterm delivery and postpartum hemorrhage was significantly reduced, indicating that this method can effectively alleviate pregnancy complications in GDM patients and improve pregnancy outcomes.

In summary, providing low personalized nutrition treatment for gestational diabetes patients combined with low-intensity exercise can not only effectively control their blood sugar levels, but also improve the outcome of the mother and child, which is worth promoting.

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