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The Effect of Standardized Nutritional Care Combined with Exercise Intervention in Patients with Gestational Diabetes Mellitus and Its Effect on FPG, 2hPG, and HbA1c Levels

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Abstract: *Objective:* To study the application effect of standardized nutritional care combined with exercise intervention in patients with gestational diabetes mellitus and the effect on fasting blood glucose (FPG), 2-hour postprandial blood glucose (2hPG), and glycated hemoglobin (HbA1c) levels. *Methods:* Ninety cases of gestational diabetes mellitus diagnosed between June 2022 and June 2023 were selected and randomly divided into two groups of 45 cases each. The control group received conventional intervention, while the observation group received combined standardized nutritional care and exercise intervention. Blood glucose levels, adverse pregnancy outcomes, and adverse neonatal outcomes were compared. *Results:* On the day before delivery, the FPG, 2hPG, and HbA1c levels of patients in the observation group were lower than those of patients in the control group ($P < 0.05$). The incidence of adverse pregnancy outcomes (4.44%) and adverse neonatal outcomes (2.22%) in the observation group was lower than in the control group ($P < 0.05$). *Conclusion:* The blood glucose levels of gestational diabetes mellitus patients can be controlled through standardized nutritional care and exercise interventions, leading to improved pregnancy and neonatal outcomes.

Keywords: Gestational diabetes mellitus; Standardized nutritional care; Exercise intervention; FPG; 2hPG; HbA1c

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1. Introduction

Gestational diabetes mellitus refers to normal glucose metabolism before pregnancy, with diabetic symptoms appearing during pregnancy. Routine examinations during pregnancy generally require a glucose tolerance test between 24 and 28 weeks, at which time blood glucose levels can be assessed to confirm the diagnosis of gestational diabetes mellitus. Gestational diabetes mellitus is a relatively common complication of pregnancy, which can lead to excess amniotic fluid, resulting in intrauterine hypoxia of the fetus, and secondary complications such as miscarriage, preterm delivery, and other adverse pregnancy outcomes [1]. Timely intervention and active control of blood glucose are essential to improve pregnancy outcomes.

Nutrition and exercise significantly impact blood glucose levels, and controlling blood glucose through these methods is relatively direct and low-cost. However, it is crucial that the intervention methods are scientific and reasonable to avoid further harm to maternal and fetal health. This study investigates the effect of standardized nutritional care combined with exercise intervention in patients with gestational diabetes mellitus. The analysis focuses on blood glucose levels, adverse pregnancy outcomes, and adverse neonatal outcomes. The study includes 90 patients diagnosed with gestational diabetes mellitus at Lianyungang Maternal and Child Health Hospital between June 2022 and June 2023.

2. Materials and methods

2.1. General information

Ninety cases of gestational diabetes mellitus were selected as the study subjects and divided into two groups by random method, 45 cases each in the control group and the observation group. The age of the control group ranged from 22 to 35 (mean: 28.14 ± 3.19) years old, the gestational week at the time of diagnosis ranged from 24 to 28 (mean: 26.12 ± 1.19) weeks, and the BMI ranged from 22 to 27 (mean: 24.13 ± 2.01) kg/m^2, and there were 27 cases of multiparous mothers and 18 cases of primigravid mothers. The age of the observation group ranged from 21 to 36 (mean: 28.29 ± 3.10) years old, the gestational week at the time of diagnosis ranged from 24 to 28 (mean: 26.34 ± 1.11) weeks, and the BMI ranged from 22 to 28 (mean: 24.29 ± 2.12) kg/m^2, and there were 28 cases of multiparous mothers and 17 cases of primigravida. The general information of both groups was comparable ($P > 0.05$).

2.2. Inclusion and exclusion criteria

Inclusion criteria: (1) Meeting the clinical diagnostic criteria of gestational diabetes, referring to the 2015 International Federation of Gynecology and Obstetrics (FIGO) Interpretation of Guidelines for the Diagnosis and Treatment of Diabetes Mellitus in Gestation [2]; (2) Singleton births; (3) No other pregnancy complications, such as gestational hypertension, etc.; (4) Normal cognitive function and clear state of consciousness; and (5) Complete obstetric examination data and postnatal data.

Exclusion criteria: (1) Not delivered in Lianyungang Maternal and Child Health Hospital or lost in contact during the middle of the delivery; (2) Signs of preterm labor or premonitory miscarriage before enrolment; and (3) Combination of serious physical diseases, such as malignant tumors.

2.3. Methods

The control group received routine interventions, which included regular monitoring of maternal and fetal indicators such as weight, abdominal circumference, fetal heart sounds, and amniotic fluid levels. Educational materials, including brochures and PPT presentations, were used to disseminate information about gestational diabetes. Attention was given to the emotional state of the patients, providing timely support and interventions from the time of enrollment until the day before delivery.

The observation group, in addition to receiving the standard interventions given to the control group, was provided with standardized nutritional care and exercise interventions.

(1) Standardized nutritional care: Professionals conducted nutrition and weight management classes to introduce knowledge about gestational diabetes, including its etiology, symptoms, risks, and effective blood glucose control methods. They also explained standardized nutritional nursing interventions and weight control through exercise management. The importance of actively controlling blood glucose

was emphasized, and dietary guidelines were provided in the form of free manuals for patients to reference at any time. Dietary guidance included: (a) Eating light meals with more green vegetables to increase dietary fiber; (b) Avoiding spicy foods, chicken skin, and animal offal; (c) Refraining from overeating, with recommendations to eat smaller, more frequent meals; (d) Controlling the intake of high-sugar fruits and ensuring timely supplementation of calcium and vitamin D; (e) Regulating the amount of staple foods while allowing for personal taste preferences. An individualized nutritional plan was formulated based on clinical examination results (e.g., blood glucose and urine ketone levels), age, BMI, gestation week, and dietary preferences. The goal was to maintain a reasonable rate of weight gain during pregnancy. For patients within the standard weight range, a daily calorie intake of 125–145 kJ/kg was recommended. If pre-pregnancy weight was more than 10% below the standard, the intake was increased to 145–165 kJ/kg. For those exceeding the standard weight by more than 20%, intake was controlled at approximately 100 kJ/kg. The caloric composition included a 5.5:2.5:2.0 ratio of carbohydrates, primary unsaturated fatty acids, and proteins, respectively. Patients were advised to keep a daily diet diary, noting food names, amounts, meal times, and any abnormal reactions such as satiety, bloating, or abdominal pain, to discuss with their doctor during follow-ups.

(2) Exercise intervention: Appropriate and reasonable exercise during pregnancy benefits both fetal development and maternal health. For patients with gestational diabetes, exercise programs were developed based on gestational weeks and physical condition, primarily focusing on aerobic exercises such as pregnancy workouts and brisk walking. In late pregnancy, non-weight-bearing exercises were recommended. The exercise intensity was controlled to ensure safety, with gradual increases in frequency, starting with three times a week. The best time for exercise was one to two hours after meals, with each session lasting about 30 minutes. Warm-up and cool-down activities, such as stretching and massages, were included. Comfortable shoes and clothing were recommended, and having family members accompany the exercise was advised. If possible, exercises like swimming and pregnancy yoga were conducted under professional guidance, along with simple daily chores.

2.4. Observation indicators

(1) Blood glucose levels: Comparison of the blood glucose levels of both groups at admission and the day before delivery, including fasting blood glucose (FPG), 2-hour postprandial blood glucose (2hPG), and glycated hemoglobin (HbA1c).

(2) Adverse pregnancy outcomes: Statistics on adverse pregnancy outcomes such as amniotic fluid anomalies, premature rupture of membranes, and postpartum hemorrhage.

(3) Adverse neonatal outcomes: Statistics on adverse neonatal outcomes including preterm births, macrosomia, and respiratory distress syndrome.

2.5. Statistical analysis

Data were analyzed using SPSS version 25.0 statistical software. The *t*-test was used for the measurement data that conformed to the normal distribution and the data were expressed as mean ± standard deviation). The χ^2 test was used for the count data and the data were expressed as [*n* (%)]. A *P*-value of less than 0.05 indicated that the difference was statistically significant.

3. Results

3.1. Blood glucose level

As shown in **Table 1**, the blood glucose levels of patients in both groups were relatively high at the time of admission ($P > 0.05$), and on the day before delivery, the blood glucose levels of both groups were lower than at the time of admission, but the observation group was significantly lower than the control group ($P < 0.05$).

Table 1. Blood glucose levels (mean ± SD)

Group	FPG (mmol/L)		2hPG (mmol/L)		HbA1c (%)	
	Admission	Day before delivery	Admission	Day before delivery	Admission	Day before delivery
Control group ($n = 45$)	7.15 ± 1.11	5.68 ± 1.13*	9.91 ± 1.64	7.10 ± 1.29*	9.19 ± 1.28	6.34 ± 1.20*
Observation group ($n = 45$)	7.18 ± 1.16	5.05 ± 1.10*	9.97 ± 1.58	6.51 ± 1.13*	9.25 ± 1.20	5.59 ± 1.14*
t	0.125	2.680	0.177	2.308	0.229	3.040
P	0.901	0.009	0.860	0.023	0.819	0.003

*Compared to the levels during admission, $P < 0.05$.

3.2. Adverse pregnancy outcomes

As shown in **Table 2**, the incidence of adverse pregnancy outcomes in the observation group was significantly lower than that in the control group, ($P < 0.05$).

Table 2. Adverse pregnancy outcomes [n (%)]

Group	Excessive amniotic fluid	Premature rupture of membranes	Postpartum haemorrhage	Total
Control group ($n = 45$)	3 (6.67)	2 (4.44)	3 (6.67)	8 (17.78)
Observation group ($n = 45$)	0 (0.00)	1 (2.22)	1 (2.22)	2 (4.44)
χ^2	-	-	-	4.050
P	-	-	-	0.044

3.3. Adverse neonatal outcomes

As shown in **Table 3**, the incidence of adverse neonatal outcomes in the observation group was significantly lower than that in the control group ($P < 0.05$).

Table 3. Adverse neonatal outcomes [n (%)]

Group	Premature babies	Macrosomia	Respiratory distress syndrome	Total
Control group ($n = 45$)	2 (4.44)	3 (6.67)	1 (2.22)	6 (13.33)
Observation group ($n = 45$)	0 (0.00)	1 (2.22)	0 (0.00)	1 (2.22)
χ^2	-	-	-	3.873
P	-	-	-	0.049

4. Discussion

After the reform and opening up, influenced by reproductive concepts, family conditions, and other factors, there has been increasing attention to nutrition during pregnancy. Consequently, some pregnant women are prone to over-nutrition, which may lead to gestational diabetes mellitus (GDM) and other complications. GDM

is primarily characterized by hyperglycemia, which can cause vascular lesions [3] and even endanger the lives of both mother and fetus. Active control of blood glucose is therefore crucial for improving pregnancy outcomes. Conventional nursing methods are relatively simple and effective in controlling blood glucose. However, with evolving medical concepts, nursing has gradually shifted from a disease-oriented approach to a people-oriented one, emphasizing the importance of the individual [4].

For patients with GDM, nutritional intervention and exercise guidance are very important. Standardized nutritional care involves guiding patients toward a scientific, standardized, and reasonable diet to ensure sufficient nutrition and energy. This approach combines patients' blood glucose levels, pregnancy weeks, and dietary preferences to develop a dietary plan. By disseminating knowledge about the disease through multiple channels, misconceptions can be corrected, and patient compliance can be improved [5,6]. Encouraging patients to maintain dietary diaries helps physicians adjust intervention plans and enhances insulin sensitivity through standardized nutritional care [7,8]. Additionally, reasonable and scientific exercise interventions promote glucose consumption and control body weight, leading to better blood glucose control.

The results show that the blood glucose levels of patients in the observation group on the day before delivery were lower than those in the control group. Standardized nutritional care ensures sufficient nutritional intake without causing hyperglycemia due to overnutrition. Exercise interventions enhance glucose uptake and utilization by skeletal muscles, improve insulin sensitivity [9,10], regulate the mother's physical state, and further control blood glucose levels. Exercise also positively impacts mental health, making patients feel energetic and happy, which contributes to better blood glucose control [11,12]. Comparing the incidence of adverse pregnancy outcomes and neonatal outcomes between the two groups, the observation group showed lower rates. GDM can lead to adverse neonatal outcomes such as macrosomia and preterm birth, as well as complications like excessive amniotic fluid. Standardized nutritional care and scientific interventions, considering individual variability, ensure adequate and reasonable nutritional intake. Coupled with scientific exercise interventions, this approach controls the rate of body weight growth and reduces complications [13,14].

A comprehensive analysis indicates that standardized nutritional care and exercise intervention for patients with GDM effectively reduce blood glucose levels and improve pregnancy outcomes, yielding more satisfactory results.

Disclosure statement

The author declares no conflict of interest.

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