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The Impact of Personalized Nutritional Support on Complications and Pregnancy Outcomes in Advanced Maternal Age Women with Gestational Diabetes Mellitus

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Abstract: *Objective*: To explore the clinical effect of personalized nutritional support in elderly women with gestational diabetes (GDM), and explore its impact on the incidence of maternal complications and pregnancy outcomes. *Methods*: A total of 90 elderly pregnant women with gestational diabetes who were delivered in our hospital from January 2023 to January 2024 were selected as the research objects. They were randomly divided into an observation group and a control group, with 45 cases in each group. The control group only received routine pregnancy care and basic nutrition guidance, while the observation group received personalized nutrition support on this basis. Compare the blood glucose control, incidence of pregnancy complications, pregnancy outcomes, and neonatal outcomes between two groups of parturient. Result: After intervention, the fasting blood glucose (FPG), 2-hour postprandial blood glucose (2hPG), and glycated hemoglobin (HbA1c) of the observation group were significantly lower than those of the control group, and the differences were statistically significant ($p < 0.05$); The incidence of complications such as gestational hypertension syndrome, polyhydramnios, premature rupture of membranes, and postpartum hemorrhage in the observation group was significantly lower than that in the control group, and the difference was statistically significant ($p < 0.05$); The cesarean section rate in the observation group was significantly lower than that in the control group, and the incidence of adverse neonatal outcomes such as fetal distress, macrosomia, neonatal asphyxia, and neonatal hypoglycemia in the observation group was significantly lower than that in the control group, with statistical significance ($p < 0.05$). *Conclusion:* Individualized nutritional support for elderly women with gestational diabetes can effectively improve the level of maternal blood sugar control, reduce the incidence of complications during pregnancy, and improve the outcome of pregnancy and neonatal outcomes, which is of high clinical value.

Keywords: Personalized nutritional support; Elderly parturient; Gestational diabetes; Complication; Pregnancy outcome; Newborn outcome

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1. Introduction

With the adjustment of China's birth policy and changes in social attitudes towards marriage and childbirth, the proportion of elderly mothers (aged ≥ 35) has been increasing year by year. Due to physiological characteristics such as ovarian function decline and body metabolic capacity decline, the incidence of complications during pregnancy is much higher than that of the right age women. Gestational diabetes Mellitus (GDM) is one of the more common types. Nutritional treatment is the basis of comprehensive treatment for gestational diabetes. Scientific nutritional support can control blood sugar and reduce complications. However, traditional basic nutrition guidance lacks specificity and cannot meet the nutritional needs of different individuals, resulting in unsatisfactory intervention effects. Personalized nutritional support is a specific nutritional plan determined based on individual differences such as age, weight, gestational age, blood sugar levels, dietary habits, and physical condition of patients, which is more targeted and effective. In this study, 90 elderly women with gestational diabetes were selected as the research object to observe the impact of personalized nutritional support on the complications and pregnancy outcomes of elderly women with gestational diabetes, providing reference for clinical intervention. The report is as follows [1].

2. Materials and methods

2.1. Clinical data

From January 2023 to January 2024, 90 elderly women with gestational diabetes who underwent prenatal examination and gave birth in our hospital were selected as the study subjects.

2.1.1. Inclusion criteria

(1) Age ≥ 35 years old

(2) Meet the diagnostic criteria of GDM in the Guidelines for the Diagnosis and Treatment of diabetes in Pregnancy (2023 Edition)

(3) Singleton pregnancy

(4) Gestational weeks between 24 and 28 weeks

(4) First diagnosis of GDM

(5) Informed consent of patients and their families and signing of informed consent

2.1.2. Exclusion criteria

(1) Diabetes (type 1 or type 2) was diagnosed before pregnancy;

(2) Combined with other serious underlying diseases such as hypertension, heart disease, kidney disease, liver disease, etc;

(3) Combined with other pregnancy complications such as abnormal thyroid function during pregnancy and intrahepatic cholestasis of pregnancy [2].

2.1.3. Study group

Using a random number table method, 90 patients were divided into an observation group and a control group, with 45 patients in each group. The patients in the observation group were aged 35–42 years, with an average age of 37.85 ± 2.13 years, gestational weeks of 24–28 weeks, and an average gestational week of 25.92 ± 1.05 weeks.

The control group patients were aged 35–43 years, with an average age of (38.02 ± 2.21) years; The gestational weeks are 24–28 weeks, with an average gestational week of (26.05 ± 1.12) weeks. There was no statistically significant difference ($p > 0.05$) in general clinical data such as age, gestational age, pre pregnancy BMI, and parity between the two groups of patients, indicating comparability. This study was conducted by the Medical Ethics Committee of our university [3].

2.2. Methods

Both groups receive routine prenatal care, including regular prenatal checkups, prenatal health education (knowledge about prenatal care and GDM diseases), moderate exercise guidance (30 minutes of walking per day, 3–5 yoga sessions per week for pregnant women), and blood glucose monitoring guidance (fasting and 2-hour blood glucose monitoring after three meals per day).

The control group received basic nutrition guidance on the basis of routine pregnancy care, and nursing staff distributed GDM nutrition diet promotion manuals to patients, briefly introducing dietary precautions such as controlling total calories, eating less high sugar and high-fat foods, and eating more dietary fiber, without developing personalized nutrition plans [4].

The observation group received personalized nutritional support on the basis of the control group. The specific measures are as follows:

(1) Establish a personalized nutritional support group, consisting of obstetricians, nutritionists, and responsible nurses, with clear responsibilities. Obstetricians are responsible for evaluating the patient's condition and pregnancy status, nutritionists are responsible for developing nutritional plans, and responsible nurses are responsible for implementing and following up.

(2) Comprehensive nutritional assessment: After the diagnosis of GDM, the nutrition team conducts a comprehensive nutritional assessment of the patient, inquiring in detail about the patient's dietary habits, dietary preferences, past medical history, allergy history, etc. The patient's physical indicators such as height, weight, and abdominal circumference are measured [5]. Combined with the patient's gestational age and blood glucose levels (fasting, 2-hour postprandial blood glucose, and HbA1c), the total daily calorie intake is calculated. The calculation standard for total calories varies depending on the patient's pre pregnancy BMI and gestational age. For those with normal pre pregnancy BMI (18.5–23.9 kg/m^2), 30 kcal/kg of calories are given daily in early pregnancy, 35 kcal/kg of calories are given daily in mid pregnancy, and 35–40 kcal/kg of calories are given daily in late pregnancy; For those who are overweight before pregnancy (24.0–27.9 kg/m^2), they should consume 25 kcal/kg of calories per day in early pregnancy, 30 kcal/kg of calories per day in mid pregnancy, and 30–35 kcal/kg of calories per day in late pregnancy; Individuals with pre pregnancy obesity (≥ 28.0 kg/m^2) should consume 20 kcal/kg of calories per day in early pregnancy, 25 kcal/kg of calories per day in mid pregnancy, and 25–30 kcal/kg of calories per day in late pregnancy.

(3) Develop personalized nutrition plans, arrange the proportion of the three major nutrients reasonably according to the nutritional evaluation results, with carbohydrates accounting for 50% to 60% of total calories, mainly composed of complex carbohydrates such as coarse grains, miscellaneous beans, and potatoes, and avoid the intake of refined sugars; Protein accounts for 15% to 20% of total calories. Choose high-quality proteins such as fish, poultry, eggs, lean meat, dairy products, soy products, etc; Fats account for 20% to 30% of total calories, mainly unsaturated fatty acids such as olive oil, nuts, and deep-

sea fish [6]. Reduce the intake of saturated and trans fatty acids. Ensure a dietary fiber intake of 25–30 g, eat more fresh vegetables and fruits (choose low GI fruits such as apples, pears, strawberries, etc., with a daily intake of 200–350 g). Reasonably arrange meals and adopt a "three meals three-time system", where breakfast accounts for 10% to 15% of total calories, lunch accounts for 25% to 30%, and dinner accounts for 20% to 25%. Additional meals are added at 10 am, 3 pm, and 8 pm each time, with each additional meal accounting for 5% to 10% of total calories, to prevent the occurrence of hypoglycemia.

(4) Implementation and adjustment of nutrition plan: The responsible nurse explains the specific content of the nutrition plan to the patient and their family, and guides the patient to correctly record the diet diary, including the types, quantities, and meal times of the food consumed daily. Nutritionists adjust their nutritional plans based on patients' weekly blood glucose monitoring results, dietary diaries, weight changes, and other factors [7].

2.3. Observation indicators

(1) Blood glucose control status

Venous blood samples were collected from two groups of patients before intervention (when diagnosed with GDM) and after intervention (one week before delivery). Fasting blood glucose (FPG) and 2-hour postprandial blood glucose (2hPG) were measured using a fully automated biochemical analyzer, and glycated hemoglobin (HbA1c) was detected using high-performance liquid chromatography.

(2) Incidence of complications during pregnancy

Record the occurrence of complications such as gestational hypertension syndrome (blood pressure ≥ 140/90 mmHg), polyhydramnios (vertical depth of the maximum dark zone of amniotic fluid ≥ 8 cm or amniotic fluid index ≥ 25 cm), premature rupture of membranes (natural rupture of membranes before delivery), and postpartum hemorrhage (24-hour postpartum hemorrhage ≥ 500 mL) in two groups of patients.

(3) Pregnancy outcome

Record the occurrence of delivery methods (cesarean section, natural delivery) and fetal distress (bradycardia or tachycardia with reduced fetal movement) in two groups of patients.

(4) Compare the birth weight, macrosomia (birth weight ≥ 4000 g), neonatal asphyxia (Apgar score < 7), and neonatal hypoglycemia (blood glucose < 2.2 mmol/L within 24 hours after birth) between two groups of newborns [8].

2.4. Statistical methods

Input the data of this group into SPSS21.0 software for processing and analysis. The quantitative data is represented by ($\bar{x} \pm s$) and *t*-test is used; Count data is expressed in % and chi square test is used. *p* is less than 0.05, which is statistically significant.

3. Results

3.1. Comparison of blood glucose control between two groups of patients before and after intervention

Before intervention, there was no statistically significant difference in FPG, 2hPG, and HbA1c levels between the

two groups of patients ($p > 0.05$); After intervention, the above blood glucose levels were significantly reduced in both groups of patients, and the observation group was significantly lower than the control group, with a statistically significant difference ($p < 0.05$) [9]. The specific statistical results are shown in **Table 1**.

Table 1. Comparison of blood glucose control before and after intervention between two groups of patients

Group	case	FPG (mmol/L) pre-intervention	FPG (mmol/L) post-intervention	2hPG (mmol/L) pre-intervention	2hPG (mmol/L) post-intervention	HbA1c (%) pre-intervention	HbA1c (%) post-intervention
Observation group	45	5.82 ± 0.63	4.82 ± 0.51	9.25 ± 1.02	6.31 ± 0.75	6.52 ± 0.48	5.61 ± 0.35
Control group	45	5.78 ± 0.65	5.76 ± 0.63	9.31 ± 1.05	7.85 ± 0.82	6.48 ± 0.51	6.23 ± 0.42
t	-	0.325	7.623	0.287	9.451	0.401	7.782
p	-	0.746	< 0.001	0.775	< 0.001	0.689	< 0.001

3.2. Comparison of the incidence of pregnancy complications between two groups of patients

The incidence of pregnancy complications in the observation group was 8.89%, significantly lower than the 28.89% in the control group, and the difference was statistically significant ($p < 0.05$). The specific results are shown in **Table 2**.

Table 2. Comparison of incidence of pregnancy complications between two groups of patients

Group	Case	Pregnancy induced hypertension syndrome	Polyhydramnios	Premature rupture of membranes	Postpartum hemorrhage	Total incidence rate (%)
Observation group	45	1 (2.22)	1 (2.22)	1 (2.22)	1 (2.22)	4 (8.89)
Control group	45	3 (6.67)	4 (8.89)	3 (6.67)	2 (4.44)	12 (28.89)
χ^2	-	-	-	-	-	6.400
p	-	-	-	-	-	0.011

3.3. Comparison of pregnancy outcomes between two groups of patients

The cesarean section rate in the observation group was 31.11%, significantly lower than the 55.56% in the control group; The incidence of fetal distress in the observation group was 4.44%, significantly lower than the 17.78% in the control group, and the differences were statistically significant ($p < 0.05$). The specific results are shown in **Table 3**.

Table 3. Comparison of pregnancy outcomes between two groups of patients

Group	Case	Cesarean section (n,%)	Natural childbirth (n,%)	Fetal distress (n,%)
Observation group	45	14 (31.11)	31 (68.89)	2 (4.44)
Control group	45	25 (55.56)	20 (44.44)	8 (17.78)
χ^2	-	5.934	-	4.050
p	-	0.015	-	0.044

3.4. Comparison of outcomes between two groups of newborns

The birth weight of newborns in the observation group was significantly lower than that in the control group. The incidence of macrosomia, neonatal asphyxia, and neonatal hypoglycemia was 6.67%, which was significantly lower than that of the control group (22.22%), and the differences were statistically significant ($p < 0.05$) [10]. The specific results are shown in **Table 4**.

Table 4. Comparison of neonatal outcomes between two groups

Group	Case	Birth weight ($\bar{x} \pm s$, g)	Giant (n,%)	Neonatal asphyxia (n,%)	Neonatal hypoglycemia (n,%)	Total incidence of adverse outcomes (%)
Observation group	45	3256.82 ± 312.54	1 (2.22)	1 (2.22)	1 (2.22)	3 (6.67)
Control group	45	3689.75 ± 356.82	4 (8.89)	3 (6.67)	3 (6.67)	10 (22.22)
t/χ^2	-	6.025	-	-	-	4.594
p	-	< 0.001	-	-	-	0.032

5. Discussion

Gestational diabetes is one of the common complications of pregnancy in elderly women. The occurrence of this disease is closely related to insulin resistance, insulin secretion deficiency and malnutrition. Due to the decline in physiological function and insulin sensitivity, as well as the antagonistic effect of hormones such as progesterone and estrogen secreted by the placenta during pregnancy on insulin, it becomes more difficult for elderly mothers to control their blood sugar [11]. If blood sugar remains at a high level for a long time, it can cause metabolic disorders in the mother, increase the risk of complications such as gestational hypertension syndrome and polyhydramnios, and also have adverse effects on fetal development through the placenta, leading to adverse consequences such as macrosomia and fetal distress. Therefore, it is necessary to strengthen the nutritional management of elderly pregnant women with GDM, improve blood sugar control levels, and ensure the safety of mother and baby. Traditional nutrition guidance mostly uses unified dietary recommendations, without considering individual differences of patients, and cannot meet the nutritional needs of different patients, resulting in poor blood sugar control effects. Personalized nutrition support takes “individualization” as its core, and through comprehensive evaluation of the patient’s physical condition, blood sugar levels, dietary habits, and other factors, develops an exclusive nutrition plan that can more accurately control total calorie intake, allocate nutrient ratios appropriately, and effectively improve blood sugar control levels [12]. From the results of this study, it can be seen that the FPG, 2hPG, and HbA1c levels in the observation group were significantly lower than those in the control group after intervention ($p < 0.05$).

The occurrence of complications during pregnancy is closely related to the level of blood glucose control, and the higher the blood glucose level, the greater the risk of complications. Personalized nutritional support can effectively control blood sugar and reduce the occurrence of complications during pregnancy. The results of this study showed that the incidence of pregnancy complications in the observation group was significantly lower at 8.89% compared to the control group at 28.89% ($p < 0.05$) [13]. The incidence of gestational hypertension syndrome is significantly reduced, possibly due to personalized nutritional support controlling total calorie intake, reducing fat accumulation, and lowering vascular wall pressure. The control of blood sugar has a significant impact on both pregnancy and neonatal outcomes. Poor blood sugar control can keep the fetus in a high blood sugar environment

for a long time, stimulating the secretion of insulin and promoting fetal growth and development, leading to an increase in the incidence of macrosomia. However, macrosomia can also increase the risk of cesarean section and fetal distress. At the same time, newborns will be released from the high blood sugar environment of the mother after birth, and insulin secretion will still be at a high level, which is prone to neonatal hypoglycemia [14]. From the research results, it can be seen that the cesarean section rate, fetal distress rate, and incidence of adverse neonatal outcomes in the observation group were significantly lower than those in the control group ($p < 0.05$), and the birth weight of newborns was significantly lower than that in the control group ($p < 0.05$). Personalized nutrition support requires multidisciplinary teamwork to complete tasks such as nutritional assessment, development, implementation, and modification. Obstetricians, nutritionists, and responsible nurses each complete their own tasks [15].

6. Conclusion

To sum up, personalized nutritional support for elderly women with diabetes in pregnancy can improve their blood sugar control level, reduce the incidence of complications in pregnancy, reduce the cesarean section rate and the incidence of adverse neonatal outcomes, and improve pregnancy outcomes [16].

Disclosure statement

The author declares no conflict of interest.

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