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Evaluation of nutritional treatment for gestational diabetes with anemia

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Abstract: **In this study, we planned to explore the effect of nutritional therapy on the improvement of gestational diabetes mellitus (GDM) with anemia and its impact on pregnancy outcomes, and to provide a reference for the reasonable diet of patients with GDM and anemia. 137 subjects with gestational diabetes and anemia were collected among the pregnant women undergoing obstetric examination and delivery in the obstetrics department of Qingdao University Affiliated Hospital. These subjects were randomly divided into the intervention group (n = 75) and the control group (n = 62). The intervention group was given individualized nutritional treatment according to the weight growth, dietary intake, blood glucose and hemoglobin (Hb), while the control group was only given routine obstetric examinations and general health education. There were no significant differences between the intervention group and the control group in age, gestational week, and pre - pregnancy BMI before nutritional treatment (P > 0.05). After nutritional treatment, the fasting blood glucose (FBG), 1 - hour postprandial blood glucose (1hPG) and 2 - hour postprandial blood glucose (2hPG) decreased and hemoglobin increased in the intervention group (P < 0.05). The weight gained during pregnancy was lower than the intervention group (P < 0.05) compared with the control group, and the incidence of premature rupture of membranes (PROM), cesarean sectionand giant fetus (≥ 4000 g) were lower (P < 0.05). For patients with GDM and anemia, nutritional therapy was conducive to controlling blood glucose, increasing hemoglobin, allowing reasonable weight gain during pregnancy, and reducing the incidence of caesarean section, PROM and giant fetus.**

Keywords: Gestational diabetes; Anemia; Nutritional therapy; Blood glucose; Hemoglobin

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1. Introduction

GDM and anaemia are common complications during pregnancy, which seriously affect the health of pregnant women and offspring. GDM is the abnormal glucose metabolism disease which is first detected during pregnancy. The prevalence of GDM varied widely in different countries and regions, ranging from 0.6% to 15% [1], and the prevalence of Asian countries reached 3.0% to 21.2% [2]. GDM increased not only the incidence of pregnancy complications such as hypertension during pregnancy, oligohydramnios, PROM, etc., but also fetal intrauterine developmental abnormalities, neonatal deformities, giant children, neonatal respiratory distress syndrome, etc. It may even increased the mother and offspring's risk of diabetes and other chronic diseases [3-5]. Anemia during pregnancy means that the hemoglobin level of pregnant woman is less than 110 g/L [6, 7]. Stevens et al. surveyed pregnant women in 107 countries around the world and found that the prevalence of anemia in pregnant women was 38% [8], and that was 43% and 9% in developing and developed countries, respectively [9]. Anemia during pregnancy seriously affected pregnancy outcomes, caused premature delivery, postpartum hemorrhage, PROM, low birth weight, fetal distress, etc., and even endangered the lives of pregnant women and fetuses [10-13].

High energy, high fat, and low meat intake are the main dietary factors in patients with GDM and anemia. Many studies observed the interrelationship between diabetes and anemia, and the coexistence of the two diseases had an important impact on the overall health of patients, so it was also received increasing attention [14, 15]. A nested case-control study conducted by Loutradis et al. found that patients with diabetes were 1.44 times more likely to suffer anemia than non-diabetics [16]. A cohort study of 3015 diabetic patients in the United States found that approximately 8.1% of patients had anemia [17]. A multi-center study in China found that 13.6% of patients had anemia among 7,606 patients with gestational diabetes[18].

At present, although the nutritional treatment of GDM and anemia during pregnancy have been studied at home and abroad, the research results are not uniform. In addition, there was still a lack of research on the therapeutic effect of nutritional therapy on GDM combined anemia. This study

provided guidance for the treatment and prevention of GDM combined anemia by observing the effect of nutritional therapy on blood glucose, hemoglobin, weight gain and pregnancy outcomes.

2. Methods

2.1. Research objects

137 pregnant women with GDM and anemia were recruited from pregnant women undergoing obstetric examinations and childbirth in the obstetrics department of Qingdao University Affiliated Hospital from January 2018 to June 2019. These subjects were randomly divided into the intervention group (n = 75) and the control group (n = 62). These subjects had no smoking and drinking history, and no previous diabetes, hypertension, liver or kidney diseases. All subjects participated voluntarily and signed informed consent.

2.2. Nutritional treatment methods

2.2.1. Dietary guidance

The pre-pregnancy body mass index (BMI), weight gained, life and eating habits, daily dietary intake were obtained through questionnaire surveys and 24-hour diet surveys on patients. The total daily energy required by the patient based on the pre-pregnancy BMI were shown in Table 1. The energy supply ratios of carbohydrates, proteins, and fats were distributed according to 50% ~ 60%, 15% ~ 20%, and 25% ~ 30%, respectively. The staple foods were mostly foods with low glycemic index (GI), such as potatoes, oats, buckwheat, etc. The sources of protein were mainly eggs, milk, lean meat, seafood, soy products, and high-quality protein accounts for more than 50% of the total protein throughout the day. The fruits do not exceed 250 g per day. Low-GI fruits were mainly used for meals. Vegetables intake were mainly dark green vegetables, not less than 500 g per day. Vegetable oils such as peanut oil and corn oil were used as cooking oil. The daily amount should not exceed 25 g. The cooking method such as frying and oiling should be avoided, and the intake of nuts should be limited. Patients were instructed to choose their own foods based on various types of food intake determined daily to avoid strict restrictions.

Table 1. Daily energy requirement based on BMI

BMI (kg/m2)	Energy coefficient (kcal/kg)	Average daily energy requirement (kcal)
< 18.5	35 ~ 40	2000 ~ 2300
18.5 ~ 24.9	30 ~ 35	1800 ~ 2100
≥ 25.0	25 ~ 30	1500 ~ 1800

2.2.2. Exercise guidance

These subjects performed no less than 30 minutes of moderate-intensity physical activities per day, such as walking, brisk walking, swimming, playing ball, dancing, yoga, and various household chores. After each meal, exercise was done for 30 minutes and then rest for 30 minutes. Heart rates were monitored to avoid hypoglycemia. In addition, all subjects were instructed to keep a dietary record and weight monitoring.

2.3. Observation indicators

Blood glucose and hemoglobin values: Before nutrition treatment and two weeks after treatment, FBG, 1hPG, 2hPG and hemoglobin value of subjects were recorded.

Weight gained during pregnancy: The weight gained during pregnancy was the difference between the weight before delivery and the weight before pregnancy.

Pregnancy outcome: Pregnancy outcome-related indicators, including the incidence of complications such as preterm birth, PROM, cesarean sectionand giant fetus.

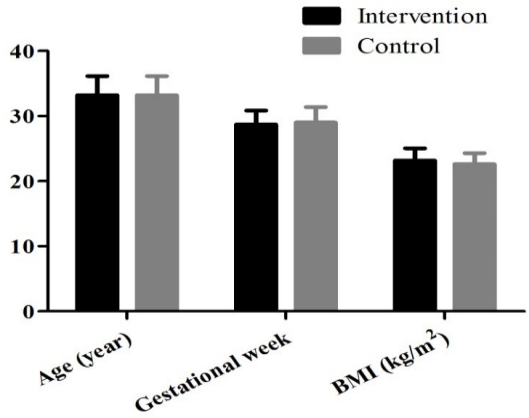

Figure 1. Basic situation of the intervention group and control group before nutrition treatment.

2.4. Statistical methods

Data analysis was performed using SPSS 22.0 statistical software. Continuous variables (age,

gestational week, pre-pregnancy BMI, weight gain during pregnancy, blood glucose, hemoglobin) were described using mean ± standard deviation, and comparison between the two groups was performed using t test. The prevalence of complications such as preterm birth, PROM, cesarean section, and gigantic infants were described in terms of number and percentage. Chi-square test was used for comparison between the two groups. Inspection level $\alpha = 0.05$.

3. Results

3.1. Basic situation before nutrition treatment

The basic conditions of the intervention and control groups before nutrition treatment are shown in Figure 1. Before nutrition treatment, there were no significant differences in the BMI between the intervention group and the control group in age, gestational week, and pre-pregnancy ($P > 0.05$).

3.2. The FBG, 1hPG, 2hPG and Hb in the intervention and control groups

The FBG, 1hPG, 2hPG and Hb in the intervention and control groups were shown in Figure 2. Before nutrition treatment, there was no difference in the FBG, 1hPG, 2hPG and Hb between the intervention group and the control group ($P > 0.05$). After nutritional treatment, the FBG, 1hPG and 2hPG in the intervention group were lower than these in the control group, and the Hb was higher than the control group ($P < 0.05$). The FBG, 1hPG, 2hPG in the intervention group decreased after nutritional treatment, and the Hb increased ($P < 0.05$). The FBG, 1hPG, 2hPG and Hb in the control group had no significant differences before and after nutritional treatment ($P > 0.05$).

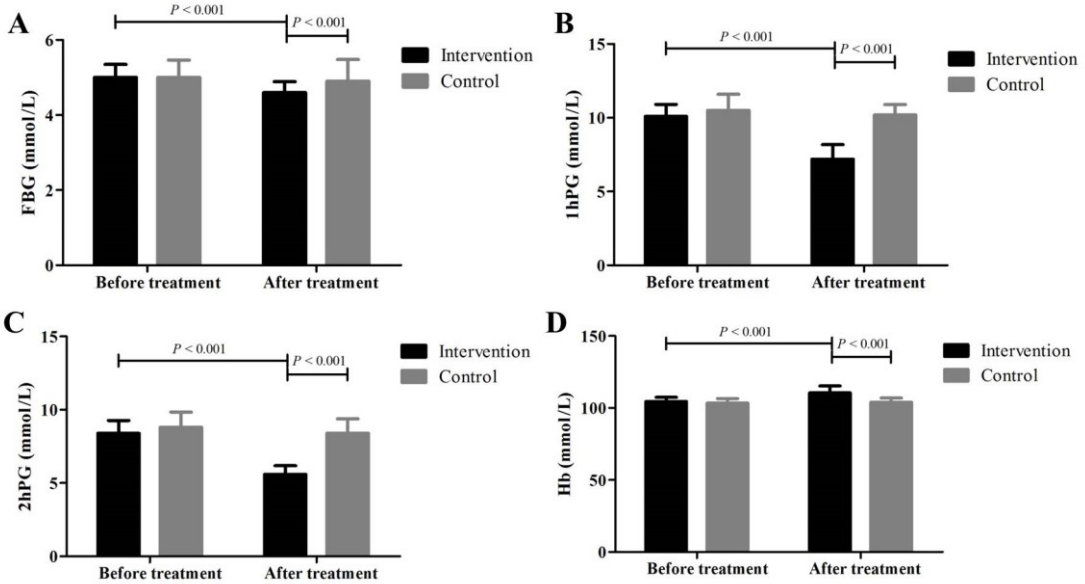

Figure 2. The FBG, 1hPG, 2hPG and Hb in the intervention and control groups.

3.3. Weight gained during pregnancy and pregnancy outcomes

The weight gained during pregnancy and pregnancy outcome in the intervention and control groups are shown in Figure 3. The average weight gained during pregnancy in the intervention and control groups was 13.5 ± 8.2 kg and 18.7 ± 9.5 kg, respectively. The weight gained during pregnancy in the intervention group was significantly lower than that in the control group ($P < 0.05$). The incidences of PROM, cesarean section and giant fetus in the intervention group were significantly lower than these in the control group ($P < 0.05$).

4. Discussion

This study showed that after nutritional treatment, the blood glucose level of patients with GDM and anemia was significantly controlled and the hemoglobin level was significantly increased, which indicated that nutritional treatment is an effective measure for GDM and anemia. Medical nutrition therapy plays an important role in the management of GDM. Last century, the American Diabetes Association proposed that nutritional therapy has been recognized as the most effective measure for GDM and the cornerstone of GDM [19,20]. The main purpose of MNT was to enable pregnant women to control blood glucose while maintaining reasonable weight gain and nutritional status, and to

prevent the occurrence of ketosis. Iron deficiency is the most common cause of anemia during pregnancy. Studies have shown that dietary guidance can increase iron intake and iron absorption [21]. Meat, especially red meat, is rich in heme iron, which is more conducive to absorption by the body [22]. Therefore, when dietary iron intake can meet the physiological needs of pregnant women, it should be obtained from the diet first, which is also the most economical and practical method.

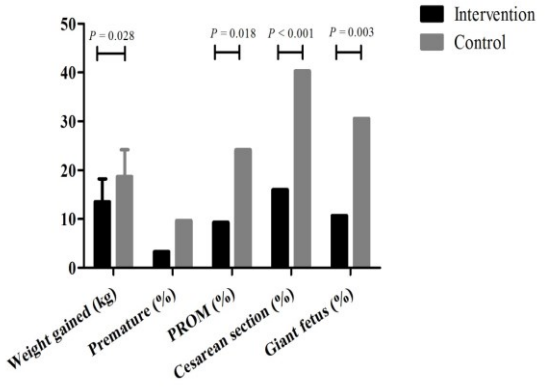

Figure 3. Weight gained during pregnancy and pregnancy outcome in the intervention and control groups.

This study found that patients with GDM and anemia who were given nutritional guidance combined with dietary guidance and exercise guidance found that their weight gain during pregnancy was basically controlled within the normal range, and it could effectively reduce the complications of PROM, cesarean section, and giant fetus, improve pregnancy outcomes. This results were similar to some research at home and abroad. A randomized controlled study of 50 to 55 minutes with moderate aerobic exercise given to pregnant women 3 times a week, found that exercise during pregnancy can reduce pregnant women's excessive weight gain [23]. Another clinical trial found that pregnant women who were given a diet of whole grains, low fat, low cholesterol, and adequate vegetables followed up to childbirth, and found that the incidence of cesarean section and macrosomia were lower [24]. A meta-analysis found that medical nutrition therapy combined with physical exercise can not only control the blood sugar of pregnant women, but also reduce the birth weight of infants and reduce the incidence of babies [25].

This study used a randomized clinical trial to observe the effect of nutritional therapy on the improvement of GDM and anemia, and to provide guidance for the prevention and treatment of GDM and anemia patients. Prior to enrollment, all the subjects informed consent to the trial and there was no significant difference in balance, but there were still some mixed factors, such as the educational level of the subject, family income, psychological factors, history of illness, history of abortion, etc. These factors should be improved in future research.

5. Conclusion

In conclusion, nutritional therapy is the basis of GDM and anemia treatment. Reasonable nutrition treatment can help pregnant women to correct their diet structure and form good sports and living habits. For GDM with anemia, nutritional therapy can effectively control blood glucose and improve hemoglobin, maintain a reasonable weight growth, and reduce the incidence of adverse pregnancy outcomes such as caesarean section, premature rupture of membranes and giant fetus.

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