VIA MEDICA

ORIGINAL PAPER / OBSTETRICS

Ginekologia Polska
2019, vol. 90, no. 1, 46–49

ISSN 0017–0011

DOI: 10.5603/GP.2019.0007

Effects of nutritional nursing intervention based on glycemic load in patients with gestational diabetes mellitus

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ABSTRACT

Objectives: To determine the effects of nutritional nursing intervention based on glycemic load (GL) for patients with gestational diabetes mellitus.

Material and methods: One hundred thirty-four patients diagnosed with gestational diabetes mellitus at our hospital were selected from March 2015 to March 2017 and randomly divided into the observation (n = 67) and control groups (n = 67). All of the patients in the observation and control groups received conventional nutritional nursing. In addition, the patients in the observation group received nutritional nursing intervention based on GL. The changes in blood glucose levels and pregnancy outcomes were compared between the two groups after intervention.

Results: There were significant differences in fasting blood glucose (FBG) and the 2h postprandial glucose (2hPG) levels between the two groups ($P < 0.05$). There was a lower incidence of premature delivery, fetal macrosomia, eclampsia, pregnancy hypertension syndrome, and fetal distress in the observation group.

Conclusions: Nutritional nursing intervention based on GL is more effective than traditional nutritional nursing for patients with gestational diabetes, and can effectively control the blood glucose level, reduce the incidence of pregnant complications, and improve the pregnancy outcome. Thus, nutritional nursing intervention based on GL deserves to be popularized.

Key words: gestational diabetes mellitus; glycemic load; nutritional nursing; pregnancy outcome

Ginekologia Polska 2019; 90, 1: 46–49

INTRODUCTION

Gestational diabetes mellitus (GDM), defined as glucose intolerance with onset or first recognition during pregnancy [1], causes a heavy burden on patients, families, and society. Nutrition nursing is an economic and effective means to manage GDDM. Genetic studies have shown that food exchange servings based on the glycemic load (GL) is more effective than traditional food exchange servings i for patients with type 2 diabetes mellitus [2, 3]. The traditional nutrition treatment strictly limits the role of nutrition nursing because there is a focus on moderation and spacing of carbohydrate intake. According to traditional nutrition, patients cannot distinguish the differences in response to the GL and insulin resulting from equivalent food in the food exchange table after a meal, and cannot consider the impact of food processing and maturity on preparing food. The GL is a combination of the quality and quantity of carbohydrate intake to assess the overall glycemic effect of the diet. In the current study, a total of 134 GDM pregnant women were given nutritional nursing intervention based on the GL concept between March 2015 and March 2017 to determine the effect of blood glucose on pregnancy outcome.

MATERIALS AND METHODS

Clinical material

One hundred thirty-four women who were diagnosed with GDM based on the standards of medical care in diabetes [4], were recruited between March 2015 and March

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2017 for this study. The inclusion criteria were as follows: (1) singleton gestation; (2) no metabolic disease, and no liver and kidney dysfunction; (3) no history of diabetes before pregnancy; (4) junior high school diploma or above; (5) no diabetes health education from professional nutrition physicians; and (6) no use of insulin.

All of the selected patients signed informed consent and were randomly divided into 2 groups by registration order into a traditional food exchange group (control group [n = 67]) and the food exchange group based on the concept of GL (observation group [n = 67]). There was no statistically significant difference in maternal age, gestational age, maternal height and weight, literacy, and family medical history between the two groups. The perinatal outcomes of the mother and offspring were followed through delivery by the obstetric nutritionist and physicians.

Diagnostic criteria

According to the diagnostic criteria recommended by the International Association of Diabetes and Pregnancy Study Group (IADPSG) [5] in 2010, the oral glucose tolerance test (OGTT) using 75g glucose considered that any of the following thresholds should be met or exceeded: fasting plasma glucose, 5.1 mmol/L; 1-hour plasma glucose, and 10.0 mmol/L; and 2-hour plasma glucose, 8.5 mmol/L.

Intervention methods

All pregnant women were given personalized diet guidance at the time of diagnosis. Based on the ideal weight, the actual weight gain, and eating habits of pregnant women, a reasonable diet plan, diet control, and proper exercise were recommended. Patients were treated with insulin if an ideal blood glucose level was not achieved. All diet-guided pregnant women were advised to eat small meals 5 or 6 meals a day, to avoid overeating, and to engage in an appropriate amount of exercise.

The control group was counseled according to the traditional food exchange method and the observation group was counseled by the food exchange method based on the concept of blood GL. According to nutritional equilibrium theory and the food exchange principle, the fixed nutrition recipes of the GL group adjusted the heat of food by the GL, as follows: GL = glycemic index (GI)× carbohydrate content/100, where a GL > 20 indicates a high-GL food, a GL10~20 indicates a moderate-GL food, and a GL < 10 indicates a low-GL food. The pregnant women were instructed how to calculate calories in different activity states and pregnancy status to assure the amount of food that should be eaten compared with the fixed diet.

Two groups of pregnant women were followed by the obstetric professional dietitian and physicians regularly (1 visit every 1~2 weeks). According to the current weight, gestational age, fetal size, and blood glucose level, the calorie intake was calculated and adjusted as needed.

The fasting blood glucose (FBG) and 2-h postprandial blood glucose (2hPBG) levels were determined in pregnant women after 2 weeks of intervention.

Evaluation index

The FBG and 2hPBG levels were measured before intervention and at 37 weeks gestation. At the same time, fetal heart tracing and maternal and infant outcomes, including preterm delivery, fetal macrosomia, eclampsia , pregnancy hypertension syndrome, and fetal distress were recorded.

Statistical methods

Data are described as the mean ± SD for measurement data or frequency [%] for enumeration data. The measurement data were analyzed by independent sample t-tests between the two groups and the enumeration data by chi-square tests before and after intervention.

RESULTS

There was no statistical difference in the FBG level between the two groups before intervention (P > 0.05), but there was a significant decrease in the FBG level after intervention. The FBG level was statistically significant lower in the GL group than the TFE (*Traditional Food Exchange*) group (P < 0.05). The same findings were observed with respect to the 2hPBG level (Tab. 1).

While not statistically significant (P > 0.05), differences in the rate of adverse pregnancy outcomes, such as preterm de-

Table 1. Comparison of blood glucose before and after intervention between the two groups($\bar{x} \pm s$)

Group	cases	FBG*		2h PG	
		Before intervention	After intervention	Before intervention	After intervention
TFE	67	6.68 ± 0.57	5.55 ± 0. 12	10.03 ± 0.64	7.98 ± 1.21
GL	67	6.71 ± 0.61	5.12 ± 0. 60	10.01 ± 0.64	7.41 ± 2.03
T		-0.274	5.535	0.235	5.807
P		0.05	< 0.05	0.05	< 0.05

*fasting blood glucose; :2-hour postprandial glucose

Table 2. Comparison of pregnancy outcome between two groups (N = 134)

Groups	Cases	Premature delivery	Fetal macrosomia	Eclampsia	Pregnancy hypertension syndrome	Fetal distress
TFE	67	13 (19.4)	2 (3.0)	1 (1.5)	2 (3.0)	3 (4.5)
GL	67	6 (9.0)	1 (1.5)	0 (0.0)	0 (0.0)	5 (7.5)

livery, fetal macrosomia, eclampsia, pregnancy hypertension syndrome, and fetal distress, existed between participants between the two groups following the intervention (Tab. 2).

DISCUSSION

GDM is one of the most common complications in obstetrics departments. The pathogenesis is now considered to be due to placental hormones, such as estrogen, progesterone, and human placental lactogen (HPL), which lead to insulin resistance and high blood glucose. Insulin resistance and hyperinsulinemia induce vascular changes, resulting in thickening of the basement membrane of the capillary wall and aggravation of renal ischemia, which may promote the occurrence of hypertension and other diseases in pregnancy. A number of studies have shown that the hyperglycemic state in pregnant women increases the proliferation of fetal islet cells, increases insulin secretion, promotes the synthesis of fetal protein and fat, and inhibits the decomposition of glycogen, resulting in an increased incidence of macrosomia and other adverse pregnancy outcomes. In addition, GDM can cause a variety of diseases, such as polyuria. Indeed, the hypertonic fluid environment can lead to high permeability diuresis. The glucose concentration in amniotic fluid is elevated, which can stimulate the amnion to increase secretion of amniotic fluid, which results in polyhydramnios. An elevated insulin fetal environment reduces pulmonary surfactant, which delays maturation of fetal lungs. Therefore, the blood glucose level should be controlled in the normal range to reduce the incidence of complications among mothers and infants. A number of clinical studies have reported that the blood glucose level of most patients with GDM can be controlled in the normal range by diet, Therefore, nutrition programs are receiving more and more attention by clinicians. Nutritional intervention depends on the success of diet education. Some scholars have suggested that dietary education for patients with DM, letting the patient master the correct knowledge and skills of diet, is the primary means to promote a reasonable diet and healthy behavior, which is the most economic and effective health care strategy.

The food exchange serving, which is the traditional method, is used clinically to control the blood glucose level of patients with DM. The method does not include the effects of food cooking methods and the maturity of food on blood glucose. Thus, changes in the blood glucose response cannot be truly reflected in application, although it is easy to operate. In 1997, the concept of blood GL was suggested by Salmerón. GL is the product of the available amount of carbohydrate and the blood glycemic index (GI) in food [6]. GL reflects the response to blood glucose because the quality of carbohydrate in food and the effect of the total amount of carbohydrates on the response to blood glucose is included [7]. Guo et al. [8] reported that most of the GL in the diet is provided by cereal food based on the dietary habits of Chinese people. Therefore, it is of great significance to introduce the concept of GL in the nutritional treatment of patients with DM to improve the curative effect of nutritional therapy in China.

Dombrowski et al. [9] designed the International Scale of Glycemic Load on the basis of summing up the research of others in 2002. Because the food types and cooking methods in China are very different from foreign countries, these data cannot be applied to pregnancies in Chinese patients as the basis for the choice of food for DM. This study mainly used the food exchange serving based on the GL concept to be more consistent with Chinese physical attributes. It has been reported that this method of diet treatment, which lowers and stabilizes blood glucose in patients with DM, had a better effect than the traditional food exchange serving, but has not been determined for patients with GDM. The current study used food exchange servings based on GL concept, which was professional, scientific, reasonable, and easy-to-operate; thus, suitable for housewives. Pregnant women could receive nutrition knowledge in the process of food matching and production according to the fixed recipe, which is conducive to self-management.

The results of this study showed that the two groups of nutrition methods reduced the blood glucose level in gravidas with GDM. Food exchange serving based on GL yielded significant differences from the traditional method, thus indicating that the food exchange serving method is more effective based on the GL, which could lead to better blood glucose level control, improved insulin resistance, reduce the incidence of abnormal glucose metabolism during pregnancy, and improve perinatal outcome

Acknowledgment

None.

Conflicts of Interest

No conflict of interests to declare.

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