

Insulin Resistance and Dietary Management Strategies in Gestational Diabetes

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ABSTRACT

Gestational diabetes is a common complication of pregnancy, and the relationship between insulin resistance and dietary management strategies has always been a hot topic of research. This article uses controlled experiments to further explore the mechanism of insulin resistance in patients with gestational diabetes and the impact of dietary management strategies on its treatment. It can be seen from experimental data that dietary management strategies play a very important role in the treatment of patients with gestational diabetes. Research and data show that reasonable dietary control can effectively control blood sugar levels in patients with gestational diabetes and reduce the possibility of fetal complications. And according to the individual differences of patients, customized individualized dietary management strategies can improve the treatment effect. However, in-depth research is still needed to improve the prevention and treatment of gestational diabetes to reduce the impact of gestational diabetes on mothers and babies.

Keywords: Dietary Management Strategy, Gestational Diabetes, Insulin Resistance, Personalized

1. Introduction

Pregnancy is a stage that most women will go through, and a temporary high blood sugar disease called gestational diabetes may occur during pregnancy. In recent years, the incidence of gestational diabetes has gradually increased and has become a global public health problem. Data shows that nearly one million pregnant women around the world are diagnosed with gestational diabetes every year during pregnancy. Gestational diabetes not only adversely affects the health of pregnant women, but may also lead to various complications in the fetus. Changes in insulin resistance in pregnant women during pregnancy lead to the inability to fully utilize insulin in the body, resulting in an increase in blood sugar levels, leading to gestational diabetes [1-2]. During the treatment process, dietary management strategies play a vital role in the treatment of gestational diabetes. Through reasonable dietary control, patients can control blood sugar levels, reduce the incidence of complications, and improve the health of the fetus. Traditional dietary management strategies mainly limit total energy and carbohydrate intake and increase dietary fiber and protein intake. However, with the continuous advancement of science and technology, more and more studies have shown that personalized dietary management strategies are more effective in the treatment of gestational diabetes.

The purpose of this article is to explore the relationship between insulin resistance and dietary management strategies in gestational diabetes, and to explore the practical application of personalized dietary management strategies in patients with gestational diabetes. By conducting controlled experimental studies and analyzing experimental data, we explore the actual changes in hormones in patients with gestational diabetes caused by dietary management strategies, so as to treat and improve blood sugar levels in patients with gestational diabetes. The results of this study will provide important theoretical and experimental basis for the prevention and treatment of gestational diabetes. It is believed that through in-depth research on the insulin resistance mechanism of gestational diabetes and individualized dietary management strategies, we can provide better health protection for pregnant women, reduce the incidence of fetal complications, and improve fetal health.

The organization structure of this article is as follows: Chapter 2 provides relevant research on insulin resistance and dietary management strategies in gestational diabetes. Chapter 3 introduces the causes, epidemiology and how to treat gestational diabetes through personalized dietary management strategies. Chapter 4 describes how to conduct experiments to determine whether a treatment is effective. Finally, Chapter 5 summarizes and proposes future research directions.

2. Related Work

At present, many relevant scientific researchers have conducted research on insulin resistance and dietary management strategies for gestational diabetes. Ma Xiuying selected 171 pregnant women and divided them into a normal glucose tolerance group and a gestational diabetes group based on the OGTT (Oral Glucose Tolerance Test) results, collected the patient's clinical data and performed fluorescence quantitative PCR (Polymerase Chain Reaction) to measure the level of plasma long non-coding RNA (Ribonucleic acid) GAS5 (growth arrest-specific transcript 5), and conducted comparative analysis, concluded that the plasma long non-coding RNA GAS5 level in patients with gestational diabetes was reduced, which was related to the insulin resistance in patients with gestational diabetes [3]. Yang Yamei selected 120 cases as samples for this study, and after implementing random and even grouping, the control group received routine care, and the observation group received personalized dietary guidance combined with aerobic exercise for targeted care, and concluded that it was very important to help obese pregnant women before pregnancy better avoid gestational diabetes and hypertension and to effectively prevent them [4]. Ding Lihuan analyzed the incidence rate of gestational diabetes by implementing effective pregnancy management and dietary control for patients, and concluded that effective pregnancy management and dietary control for patients with gestational diabetes could help reduce the incidence of cesarean section in pregnant women [5]. The above-mentioned research results provide ideas and powerful help for this article's research on insulin resistance and dietary management strategies for gestational diabetes.

3. Insulin Resistance and Dietary Management Strategies for Gestational Diabetes

3.1 Definition and Epidemiology

Gestational Diabetes Mellitus (GDM) is a special pregnancy complication, which refers to the occurrence of symptoms consistent with the diagnostic criteria for diabetes in the second and third trimesters of pregnancy in pregnant women with no previous history of diabetes [6-7]. It is the main category of clinical pregnant women with diabetes, accounting for more than 90% of all pregnant women with diabetes [8-9]. Its pathogenesis is due to a series of physiological changes in the mother's body during pregnancy. The main way for the fetus to obtain energy is to obtain glucose from the mother through the placenta. However, as the length of pregnancy increases, the fetus's demand for glucose gradually increases, and the renal plasma flow and glomerular filtration capacity during pregnancy are both enhanced. However, the rate of sugar reabsorption by the renal tubules will not increase accordingly, which may lead to increased sugar excretion in some pregnant women. In addition, in the middle and late stages of pregnancy, the amount of substances that antagonize insulin in pregnant women increases, so that the sensitivity of pregnant women to insulin will decrease with the increase of pregnancy, resulting in a relative lack of insulin secretion, which may increase the possibility of pregnant women suffering from GDM [10-11]. Although most pregnant women with GDM can return their blood sugar to normal levels after delivery, failure to control GDM during pregnancy will have serious consequences for the fetus and itself. Relevant clinical data show that pregnant women with GDM are prone to abnormal fetal development, and the probability of miscarriage in pregnant women with GDM is 15% to 30%, which is 3 to 5 times that of pregnant women with normal pregnancy, and the incidence of fetal macrosomia is as high as 25% to 42%. Therefore, how to control the blood sugar level in pregnant women during GDM is the focus of this article [12-13].

Insulin resistance is one of the important mechanisms leading to the occurrence of GDM. Under normal

circumstances, insulin combines with the insulin receptor on the cell membrane to promote the uptake and utilization of glucose and maintain the stability of blood sugar levels in the body [14-15]. But during pregnancy, insulin resistance is enhanced due to the secretion of progesterone. These hormones interfere with insulin receptor signaling, making them less responsive to insulin, resulting in a weakened biological effect of insulin. Increased insulin resistance will further lead to increased insulin secretion. In a state of insulin resistance, pancreatic islet cells will produce more insulin in order to maintain the stability of blood sugar in the body. However, due to certain limitations in the function of the human body's beta cells, they cannot always synthesize and secrete insulin. When pancreatic islet cells can no longer meet the demand for insulin in the body, GDM will occur [16-17]. Therefore, effectively controlling blood sugar levels in pregnant women with GDM and minimizing the damage caused by hyperglycemia to the fetus and mother are the basic principles for clinical treatment and intervention in GDM [18].

3.2 Diet Management Strategies

The risk of gestational diabetes can be effectively controlled by adopting reasonable dietary management strategies to ensure the health and safety of mothers and infants [19-20]. A reasonable dietary management strategy is achieved by controlling food intake and selecting healthy foods to maintain blood sugar levels. The intake proportions of various substances are shown in Figure 1.

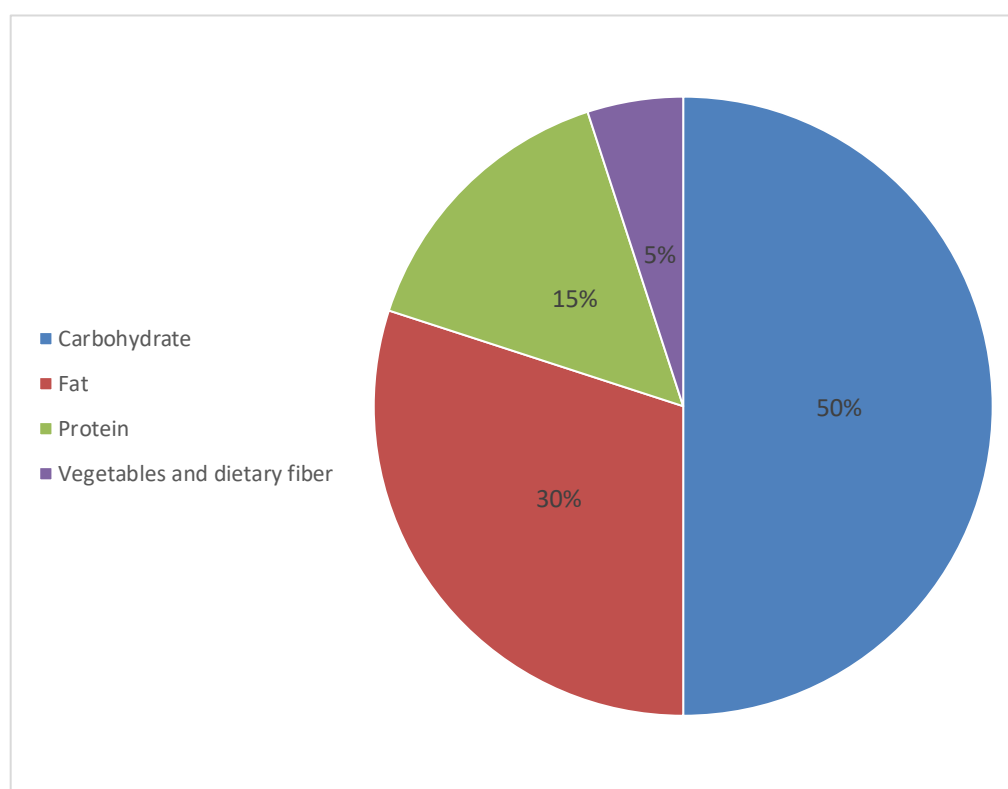


Figure 1. Intake proportion chart

It is worth noting that the proportion in Figure 1 is only an approximation and has a range of fluctuations. The actual intake proportion should be slightly adjusted based on the individual situation, the guidance of a nutritionist, and the advice of a physician.

First of all, pregnant women should follow the advice of doctors or nutritionists to ensure a balanced carbohydrate, fat, and protein content in each meal, eat in separate meals, and avoid high-sugar and high-fat foods to reduce the possibility of blood sugar spikes in the body. Secondly, pregnant women should also

strictly control the sugar content in their diet during pregnancy. Pregnant women should avoid fruits and drinks with high sugar content, such as candies, cakes, desserts, milk tea, etc., and choose foods with naturally lower sugar content, such as fresh fruits and vegetables, to ensure nutritional health while avoiding high blood sugar levels. In addition, pregnant women also need to consume an appropriate amount of dietary fiber during pregnancy. Dietary fiber can delay the absorption of food consumption and help stabilize blood sugar levels. Pregnant women can choose foods rich in dietary fiber such as whole grains, beans, vegetables and fruits. Therefore, dietary management has a multifaceted impact on insulin resistance. It can improve insulin sensitivity and regulate insulin secretion by controlling the blood sugar content and insulin levels in the body, increasing the intake of dietary fiber and protein, and other ways. The use of reasonable dietary management is of great significance in preventing and improving resistance-related diseases.

4. Results and Analysis

4.1 Experimental Design

80 patients with gestational diabetes were selected and divided into a control group and an experimental group by random allocation, with the number of people in each group being 40. There were 16 multiparous women and 24 primiparous women in both groups. There was no significant difference in the basic information of the two groups of study subjects. Errors can be ruled out, so they are comparable. The cases selected for this study have been approved by the ethics committee.

The control group will adopt basic treatment and care methods, that is, regular blood sugar, urine routine, fetal and other aspects of testing, and will be given oral metformin hydrochloride sustained-release tablets or insulin injections and other measures based on their actual blood sugar changes, and will tell the patients what they should pay attention to, hoping that they can actively cooperate with the treatment. In the experiment, personalized diet management strategies will be added to the control group. The main contents are: ① The nutritionist calculates the body mass index based on the pregnant woman's pre-pregnancy height and weight, selects an appropriate energy coefficient, and calculates the daily calories required by each pregnant woman, of which carbohydrates provide 55% to 60% of the required capacity, and three meals and three snacks a day. ② Providing patients with foods with a lower glycemic index, try to focus on whole grains, and consume less rice and white flour. ③ Making a reasonable nutritional mix and choose vegetables with lower sugar content, use statistical analysis software to process the data obtained statistically.

4.2 Analysis of Experimental Results

The dietary control compliance of the two groups of gestational diabetes patients was counted and evaluated. The compliance was divided into very compliance, relatively compliance, compliance and non-compliance. The statistical results are shown in Figure 2.

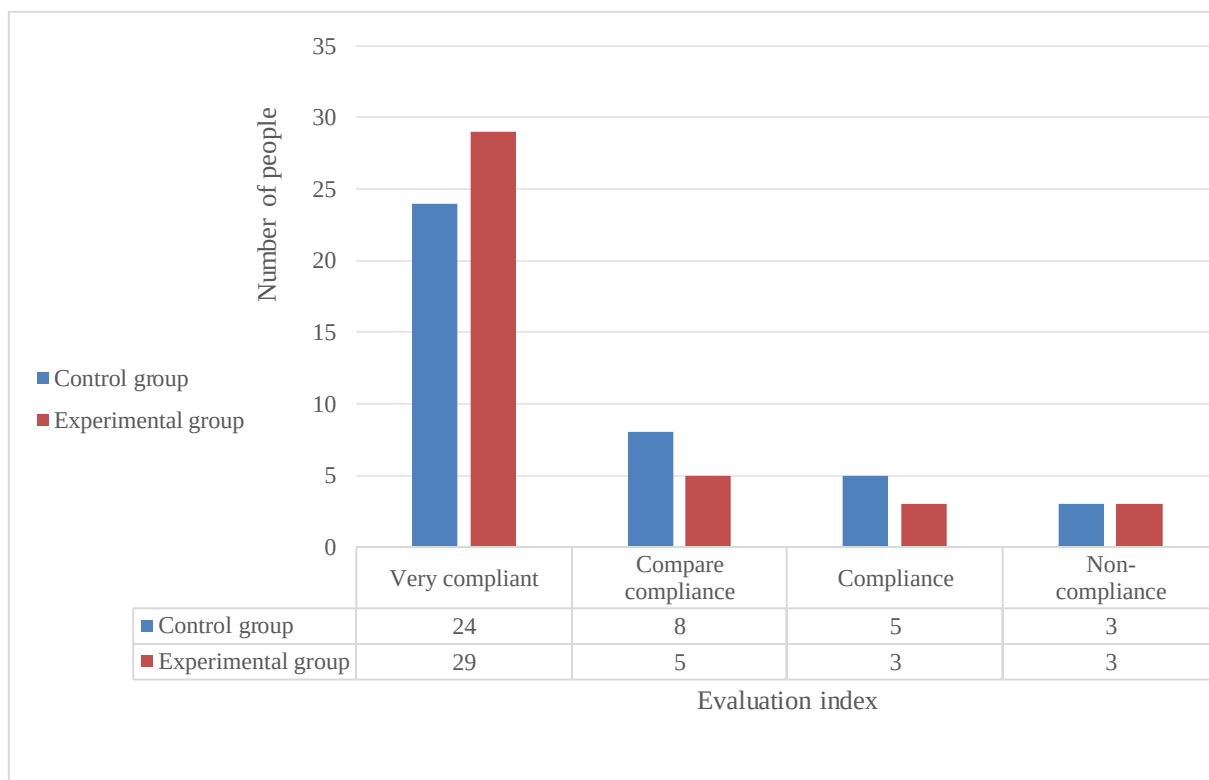


Figure 2. Patient compliance results

From the analysis in Figure 2, it can be seen that the vast majority of gestational diabetes patients will strictly abide by the personalized dietary management strategy, but only a small number of people are non-compliant with the personalized dietary management strategy. This situation had no significant impact on the blood sugar levels and insulin resistance of the two groups of patients collected later before delivery.

The blood glucose data on admission and delivery are shown in Table 1, the insulin resistance data on admission and delivery are shown in Table 2, and the pregnancy outcomes of gestational diabetes patients are shown in Figure 3.

Table 1. Blood glucose control of two groups of patients before delivery ($\bar{x} \pm a$)

Group	Time	FPG(nmol/L)	2hPG(nm/L)
Control Group (n=40)	On Admission	7.61±0.28	9.91±2.26
	Before Delivery	7.15±0.23	9.21±1.14
	T	13.61	2.37
	P	0.00	0.00
Experimental Group (n=40)	On Admission	7.71±0.23	9.99±2.01
	Before Delivery	5.12±0.18*	7.04±1.65*
	T	56.61	7.41

	P	0.00	0.00
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Table 2. Insulin resistance status of two groups of patients before delivery ($\bar{x} \pm a$)

Group	Time	HOMA – I R	FINS(mU/L)
Control Group (n=40)	On Admission	4.21±1.25	17.25±3.54
	Before Delivery	3.75±0.79	15.68±3.36
	T	1.58	1.84
	P	0.03	0.04
Experimental Group (n=40)	On Admission	3.88±1.15	17.18±3.75
	Before Delivery	2.75±0.88*	11.51±2.45*
	T	5.05	8.25
	P	0.00	0.00

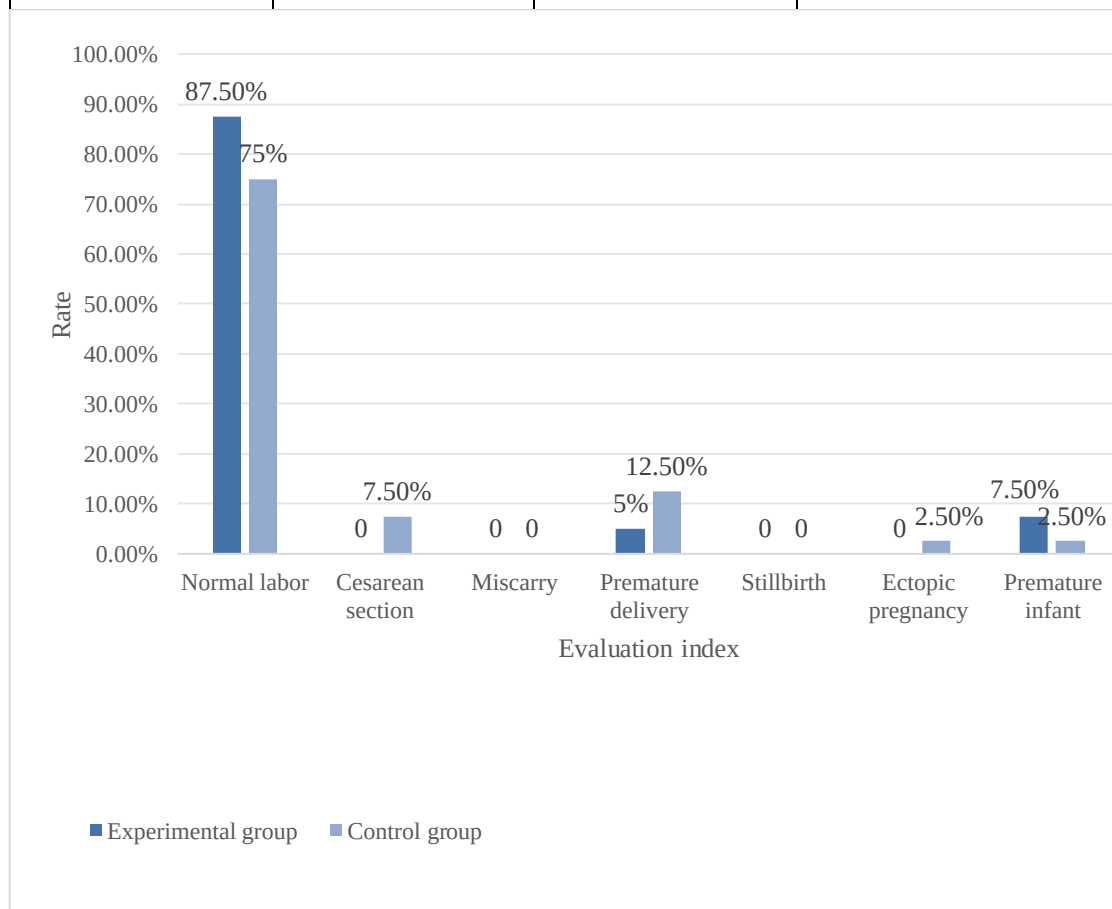


Figure 3. Comparison of pregnancy conditions

From the data in Table 1 and Table 2, it can be seen that the blood sugar levels and insulin resistance of the two groups of patients when entering the hospital and before delivery. The blood sugar and insulin resistance in the experimental group were much lower than those in the control group. Therefore, it is feasible to reduce blood sugar and insulin resistance in GDM patients through dietary management strategies. By analyzing Figure 3, it can be seen that through personalized dietary management strategies for patients with gestational diabetes, the possibility of accidents for mothers and babies can be greatly reduced, and serious situations such as miscarriages and stillbirths can be avoided, thereby ensuring the safety and health of mothers and babies.

5. Conclusion

When conducting research on insulin resistance in gestational diabetes, this article proposes the use of dietary management strategies for treatment, and adopts controlled experiments to determine whether diet management strategies have an effect on insulin resistance in gestational diabetes. Experimental results show that the implementation of dietary management strategies plays an important role in the treatment of gestational diabetes. Therefore, reasonable diet control can be used to reduce blood sugar fluctuations in GDM patients, thereby reducing insulin resistance and reducing the risk of cesarean section, polyhydramnios, and postpartum infections. At the same time, it can also reduce the occurrence of other complications in the fetus to a certain extent, ensuring the safety of mother and baby. In addition, more detailed personalized treatment strategies can be developed based on the genetic background and metabolic characteristics of different patients, thereby reducing the risk of maternal and fetal complications and improving the patient's quality of life.

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