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A Study on the Correlation of Body Mass Management During Pregnancy with Adverse Pregnancy Outcomes and Labor Progression

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Abstract: *Objective:* To investigate the effects of body mass management during pregnancy on adverse pregnancy outcomes, duration of labor, and neonatal birth weight. *Methods:* 472 pregnant women who visited Beijing Anzhen Hospital from January to December 2023 were selected, and the pregnant women were divided into 236 each in the observation group and the control group. Body mass of pregnant women was measured and BMI was calculated in early and late pregnancy respectively, and the pregnant women in the control group were guided by routine management, while the observation group was guided by body mass management during pregnancy. The growth of maternal body mass, mode of delivery, postpartum hemorrhage, neonatal score, neonatal blood glucose at birth, and umbilical artery blood, as well as the comparison of the duration of labor, were observed. *Results:* The observation group was significantly better than the control group in terms of mode of delivery, postpartum hemorrhage, and body mass growth, with statistically significant differences ($P < 0.05$), and there was no statistical significance in terms of neonatal scores, neonatal blood glucose at birth, and umbilical artery blood ($P > 0.05$); the time of the first stage of labor and the time of the second stage of labor of the mothers in the observation group was significantly better than that of the control group, with statistical differences ($P < 0.05$), and the time of the third stage of labor of the mothers in the observation group was statistically better than that of the control group. There was no statistically significant difference between the time of the third stage of labor in the observation group and the control group ($P > 0.05$), and the time of the total stage of labor in the observation group was statistically better than that in the control group ($P < 0.05$). *Conclusion:* Body mass management during pregnancy can effectively improve maternal control of weight gain, reduce labor time, and decrease the occurrence of adverse pregnancy outcomes.

Keywords: Pregnancy; Body mass management; Adverse pregnancy outcome; Labor duration

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1. Introduction

With the improvement of living standards, overnutrition and weight gain of pregnant women are very common in China. Excessive obesity or overweight can increase the risk of pregnancy, as well as lead to a series

of problems during labor and delivery, such as obstructed labor, neonatal asphyxia, and low birth weight babies [1,2]. Some studies have shown that the risk of hypertensive disorders in pregnancy increases when the body mass index (BMI) of pregnant women is > 24.0 kg/m^2; the risk of congenital malformations in fetuses significantly increases when the BMI is > 28.0 kg/m^2 [3]; and the rate of intrauterine growth retardation is positively correlated with the body mass of pregnant women [4]. Therefore, the implementation of scientific and rational nutritional management of pregnant women during pregnancy will help to reduce the incidence of adverse maternal and fetal outcomes. Due to the lack of scientific and systematic methods of guidance, many pregnant women are unable to obtain sufficient nutrients to meet fetal and their needs during pregnancy, which is one of the main causes of various adverse pregnancy outcomes. In recent years, scholars at home and abroad have recognized the importance of body mass management during pregnancy in reducing the incidence of complications during pregnancy and improving perinatal survival [5,6]. The American College of Obstetricians and Gynecologists (ACOG) recommends prenatal nutritional management to prevent obesity during pregnancy and promote healthy births by monitoring and adjusting energy intake during pregnancy [7]. At present, scientific body mass management interventions for pregnant women have not been carried out in our clinic. This study analyzes the changing characteristics of pre-pregnancy body mass index (BMI), mid-pregnancy body mass index (FBM), and 6-month postpartum body mass index (MFM), explores their impact on adverse pregnancy outcomes, and provides a basis for developing personalized nutritional programs during pregnancy.

2. Materials and methods

2.1. General information

472 pregnant women who attended our hospital from January to December 2023 were selected, and the pregnant women were divided into the observation group and the control group of 236 each. There was no statistically significant difference in the comparison of age, gestation period, weight, and number of pregnancies in each group, as shown in **Table 1**.

Inclusion criteria: (1) Mothers between the ages of 18–45 years; (2) Full-term pregnancy, singleton; (3) No serious medical or surgical diseases; (4) No mental disorders, able to communicate normally; (5) Willing to participate in this study, signing the informed consent form.

Exclusion criteria: (1) Multiple pregnancies or pregnancy complications; (2) History of obstetric or gynecological surgery; (3) Cognitive impairment or verbal communication disorders; (4) Unwillingness to participate in this study.

Table 1. Comparison of general information

	Control group (*n* = 236)	**Observation group (*n* = 236)**	***t***	***P***
Age (years)	29.06 ± 1.33	28.98 ± 1.34	0.644	>0.05
Gestation (weeks)	38.72 ± 1.01	38.91 ± 1.03	1.735	>0.05
Weight (kg)	58.12 ± 3.15	58.01 ± 3.12	0.381	>0.05
gestation period	1.68 ± 0.31	1.73 ± 0.31	1.752	>0.05
Pre-pregnancy body mass (kg/m^2)	17.98 ± 1.57	18.01 ± 1.48	0.214	>0.05

2.2. Methods

The pregnant women's body mass was measured and the BMI value was calculated in the early and late stages of pregnancy respectively. The human energy consumption table recommended by the American Diabetes

Association (ADA) was used to assess pregnant women's energy intake, and their total energy intake and energy consumption were calculated. Based on these methods, the energy balance of pregnant women was calculated and corresponding recommendations were provided, such as increasing or decreasing energy intake. The pregnant women in the control group received guidance through conventional management, while the observation group received guidance based on body mass management during pregnancy.

(1) Early pregnancy (1–12 weeks): According to the pre-pregnancy BMI value, provide reasonable dietary guidance, recommending an increase in daily water intake and protein and vitamin-rich foods while reducing high-fat foods.

(2) Mid-pregnancy (12–22 weeks): Based on the pre-pregnancy BMI value, provide appropriate exercise guidance, recommending at least three sessions of moderate-intensity aerobic exercise per week, each session lasting 30–60 minutes.

(3) Late pregnancy (23–26 weeks): According to the pre-pregnancy BMI value, provide appropriate dietary control and exercise guidance. Recommend maintaining a normal rate of weight gain during pregnancy, avoiding excessive weight gain, reducing the consumption of sweets and greasy foods, not limiting the intake of staple foods, and appropriately supplementing with seafood.

2.3. Observation indicators

The growth of maternal body mass, mode of delivery, postpartum hemorrhage, neonatal score, neonatal blood glucose at birth, umbilical artery blood, and the comparison of the duration of labor were observed.

2.4. Statistical methods

The results of the study were imported into SPSS22.0 software to analyze the data. Count data were expressed as percentages, and the χ^2 test was used for comparison between groups. Measurement data were expressed as mean ± standard deviation (SD), and the *t*-test was used for comparison between groups, and the difference was considered significant at $P < 0.05$.

3. Results

3.1. Comparison of adverse labor outcomes between the two groups

The observation group was significantly better than the control group in terms of mode of delivery and postpartum hemorrhage and body mass growth, and the differences were statistically significant ($P < 0.05$), and there was no statistically significant difference in terms of neonatal scores and neonatal blood glucose at birth as well as umbilical arterial blood ($P > 0.05$), as shown in **Table 2**.

Table 2. Comparison of adverse birth outcomes between the two groups

		Observation group (n = 236)	Control group (n = 236)	t / χ^2	P
Body mass gain (kg/m^2)		8.36 ± 1.36	10.24 ± 1.45	14.528	0.000
Mode of delivery	Cesarean section [n (%)]	21 (8.90)	56 (23.73)	19.010	0.000
	Natural delivery [n (%)]	215 (91.10)	180 (76.27)		
Postpartum hemorrhage		170.66 ± 41.03	215.64 ± 40.39	7.812	0.00
Neonatal score		9.26 ± 0.45	9.21 ± 0.26	0.931	>0.05
Neonatal blood glucose at birth		3.21 ± 0.08	3.22 ± 0.10	0.896	>0.05
Umbilical artery blood		7.26 ± 0.12	7.22 ± 0.65	0.614	>0.05

3.2. Comparison of the labor process between the two groups

The time of the first stage of labor and the time of the second stage of labor of the women in the observation group were significantly better than that of the control group with statistical differences ($P < 0.05$), there was no statistical difference in the time of the third stage of labor between the women in the observation group and the control group ($P > 0.05$), and the time of the total stage of labor of the women in the observation group was better than that of the control group with statistical differences ($P < 0.05$), as shown in **Table 3**.

Table 3. Comparison of labor duration between the two groups

	Observation group (n = 236)	Control group (n = 236)	t	P
First stage of labor (h)	4.24 ± 1.32	3.87 ± 1.07	3.345	0.000
Second stage of labor (h)	1.62 ± 0.36	1.41 ± 0.36	6.337	0.000
Third stage of labor (h)	0.69 ± 0.44	0.64 ± 0.43	1.239	< 0.05
Labor duration (h)	6.62 ± 1.36	6.01 ± 2.36	3.440	0.000

4. Discussion

At present, the proportion of pregnant women who are overweight or obese is high in China, leading to a yearly increase in the incidence of gestational diabetes, gestational hypertension, and other diseases, which seriously affect the safety of mothers and infants. Some studies have shown that pre-pregnancy obese people, especially those with pre-pregnancy body mass between 25.0 and 34.9 kg/m^2, have significantly higher neonatal birth body mass and body composition than those with normal weight [8]. Therefore, guidance on reasonable diet and exercise during pregnancy can help control the growth of maternal body mass and reduce the risk of perinatal complications.

The results of this study showed that the body mass growth of the observation group (8.36 ± 1.36 kg/m^2) was significantly better than that of the control group (10.24 ± 1.45 kg/m^2; $P < 0.05$), which indicates that after the pregnant women in the observation group took effective measures to manage their body mass during pregnancy, the body mass index of the pregnancy could be effectively controlled, preventing the occurrence of adverse pregnancy outcomes and decreasing the production of macrosomic babies.

This study also found that pregnant women in the observation group had a shorter delivery time, and the average time of the third stage of labor was 0.64 ± 0.43 h, which was statistically significant compared with the 0.69 ± 0.44 h in the control group ($P < 0.05$). Moreover, the cesarean section rate of the observation group was 8.90%, which was significantly lower than the cesarean section rate of 23.73% in the control group, and the difference was statistically significant ($P < 0.05$), which indicated that pregnant women of the observation group, due to the effective control of the body mass of the pregnancy, had a relatively good state of health, and were able to tolerate a longer period without experiencing lack of stamina, which was able to shorten the time for the uterine mouth to open up and increase the forceps usage probability and the rate of normal labor. From the above studies, it can be concluded that scientific weight management of pregnant women can not only reduce the risk of adverse outcomes such as hypertensive syndrome of pregnancy, preeclampsia, anemia, and intrauterine growth restriction but also shorten the duration of labor, increase the rate of normal delivery, and reduce the rate of cesarean delivery. Xing *et al*. [9] showed that excessive weight gain or excessive weight gain during pregnancy is closely related to the increased risk of adverse pregnancy outcomes, and reasonable body mass management can reduce the risk of adverse pregnancy outcomes, such as preterm labor and macrosomia. Meanwhile, body mass management during pregnancy can also help to improve pregnancy complications in

pregnant women, such as gestational hypertension and gestational diabetes. Ding [10] found that body mass management during pregnancy has an important impact on the progress of labor, and reasonable weight gain is conducive to the dilatation of the birth canal and the smooth delivery of the fetus, thus shortening the labor process and reducing the risk of obstructed labor and cesarean section. On the contrary, excessive weight gain may lead to an increase in the resistance of the birth canal, prolonging the labor process and increasing the difficulty of delivery. Ding *et al*. [11] found that there are numerous factors affecting the management of body mass during pregnancy, including the pregnant woman's age, height, pre-pregnancy weight, nutritional intake during pregnancy, exercise habits, and psychological state. In addition, socioeconomic status, cultural background, and healthcare level also have an impact on body mass management during pregnancy.

To improve body mass management during pregnancy and reduce adverse pregnancy outcomes and labor problems, the following interventions are recommended: (1) strengthening health education during pregnancy to increase pregnant women's awareness of and attention to body mass management [12]; (2) formulating personalized diet plans to control caloric intake and ensure balanced nutrition; encouraging pregnant women to engage in moderate exercises, such as walking and yoga for pregnant women, to enhance their physical fitness and control their weight; (3) regularly weight monitoring and prenatal checkups are conducted to detect and solve weight management problems in time; (4) the training of healthcare personnel is strengthened to improve their ability to guide body mass management during pregnancy.

In summary, body mass management during pregnancy can effectively improve maternal control of weight gain, reduce the time of labor and delivery, and decrease the occurrence of adverse pregnancy outcomes. Of course, there are some shortcomings in this study: (1) the sample size is small, and most of them are non-randomized surveys, so it is not possible to obtain rigorous conclusions, so it does not have the value of widespread dissemination; (2) this paper only analyzes the differences between the delivery time of mothers, the opening of the uterine cavity, forceps assisted delivery, and the weight of newborns under two different delivery methods by comparing and analyzing the differences between the two methods of delivery, and it does not take into account the other factors affecting the duration of labor and the weight of the newborns. Therefore, to better evaluate the impact of body mass management during pregnancy on maternal outcomes, in-depth studies should be conducted with more clinical data. Future studies can further explore the best programs and practice patterns of body mass management during pregnancy to provide pregnant women with more scientific and effective guidance on weight management. It is also necessary to pay attention to the influence of socioeconomic status, cultural background, and other factors on body mass management during pregnancy, thereby improving the prevalence and effectiveness of body mass management during pregnancy.

Disclosure statement

The authors declare no conflict of interest.

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