

Study on the Impact of Early Pregnancy Preeclampsia Screening and Personalized Intervention on Adverse Pregnancy Outcomes in Obese Pregnant Women

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Abstract: *Objective:* To investigate the preventive effects of early pregnancy preeclampsia screening combined with personalized intervention on gestational diseases and adverse pregnancy outcomes in obese pregnant women. *Methods:* A retrospective analysis was conducted on the differences in clinical intervention effects among 67 obese pregnant women in early pregnancy (from June 2023 to February 2025). All subjects underwent early pregnancy preeclampsia screening and were subsequently grouped based on differences in gestational health intervention plans. The clinical effects of conventional intervention (control group, 33 cases) and personalized intervention (study group, 34 cases) were compared. *Results:* Compared with the control group, the SQHMP score increased in the study group after intervention, and the weight gain at 20 weeks of gestation and before delivery decreased ($P < 0.05$). Compared with the control group, the study group had a higher rate of normal delivery and lower incidences of gestational diseases and adverse pregnancy outcomes after intervention ($P < 0.05$). *Conclusion:* Personalized intervention during pregnancy for obese pregnant women based on the results of early pregnancy preeclampsia screening can maintain healthy weight gain during pregnancy, assist in developing self-management skills during pregnancy, and reduce the risk of gestational diseases and adverse pregnancy outcomes.

Keywords: Preeclampsia screening; Personalized intervention; Obese pregnant women; Pregnancy outcomes; Maternal health during pregnancy

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1. Introduction

Preeclampsia, a severe idiopathic disease in pregnant women, typically manifests after the 20th week of gestation, characterized primarily by new-onset or worsening hypertension and proteinuria. In some patients, the progression of the disease can lead to eclampsia during pregnancy, increasing the risk of maternal and fetal mortality, as well as adverse pregnancy outcomes^[1,2]. Studies indicate that the etiological factors of preeclampsia are complex, with

obese pregnant women being a high-risk group for the disease. Therefore, it is essential to strengthen disease screening and health management for this specific group of pregnant women within the framework of maternal health management during pregnancy, thereby enhancing the safety of their pregnancy and childbirth, as well as the quality of their delivery outcomes ^[3]. In current clinical management of preeclampsia, the risk of this pregnancy-related disease in pregnant women is primarily determined through early pregnancy preeclampsia screening. Based on the results of risk screening, targeted pharmacological interventions are implemented to reduce the actual risk of preeclampsia occurrence ^[4]. However, a review of past experiences in maternal health care for obese pregnant women has revealed that, due to their low levels of self-management skills regarding maternal health during pregnancy and the lack of personalized health intervention measures, the actual effectiveness of managing and preventing preeclampsia and other pregnancy-related diseases is limited. Therefore, it is necessary to improve relevant management content to enhance pregnancy safety and delivery quality ^[5]. Consequently, to investigate the preventive effects of early pregnancy preeclampsia screening combined with personalized interventions on pregnancy-related diseases and adverse pregnancy outcomes in obese pregnant women, a study was specifically conducted, the details of which are as follows.

2. Materials and methods

2.1. Clinical data

Inclusion criteria: Pre-pregnancy BMI ≥ 24.0 kg/m²; gestational age ≤ 14 weeks, singleton pregnancy, aged between 20 and 38 years; informed consent and voluntary participation in the study. Exclusion criteria: Presence of primary hypertension, hypertension, or (and) thyroid dysfunction; multiple pregnancy; fetal structural developmental abnormalities indicated during prenatal check-ups or termination of pregnancy due to other factors during pregnancy; presence of severe infectious or communicable diseases; previously diagnosed with gestational hypertension, diabetes, or other related conditions; presence of cognitive or psychiatric disorders; loss to follow-up or voluntary withdrawal from the study during the research period; incomplete prenatal check-up data.

A retrospective analysis was conducted to evaluate the differences in clinical intervention effects among 67 obese pregnant women in early pregnancy (from June 2023 to February 2025) at the Perinatal Health Clinic of Gaoyou Maternal and Child Health Hospital. All study subjects underwent early pregnancy screening for preeclampsia and were subsequently grouped based on differences in pregnancy health intervention protocols after screening, including a control group of 33 cases and a study group of 34 cases. There were no statistically significant differences in clinical data between the groups ($P > 0.05$), indicating that the study results were comparable. See **Table 1** for details.

Table 1. Comparison of clinical data

Baseline Characteristic	Control Group/33	Study Group/34	t / χ^2	P
Age (years, mean \pm SD)	29.04 \pm 2.75	29.12 \pm 3.04	0.113	0.911
BMI (kg/m ² , mean \pm SD)	25.52 \pm 0.82	25.65 \pm 0.71	0.694	0.489
Gestational Age (weeks, mean \pm SD)	12.05 \pm 0.58	12.11 \pm 0.55	0.435	0.665
Parity (n, %)			0.119	0.729
Primipara	21 (63.64)	23 (67.65)		
Multipara	12 (36.36)	11 (32.35)		

2.2. Methods

Screening for preeclampsia in early pregnancy: This involves conducting risk factor screening for preeclampsia in obese pregnant women based on the content of the maternal clinical care manual, as needed. The screening covers conditions such as gestational hypertension, immune system disorders, primary hypertension, and renal dysfunction, among others. Subsequently, pregnant women are arranged to have venous blood samples collected for serum placental growth factor testing (≤ 60 pg/mL), and measurements of mean arterial pressure (≥ 105 mmHg) and uterine artery pulsatility index (> 2.25) under resting conditions are completed. If any risk factors are indicated by disease screening or clinical examination indicators, it suggests a high risk of preeclampsia, and targeted pharmacological preventive interventions are implemented for those at high risk.

Control group: Receiving routine interventions. Based on the results of preeclampsia screening, pregnant women at moderate and high risk are organized to receive health education about the disease and are guided to actively complete clinical pharmacological interventions and cooperate with pregnancy health management to assist in controlling the risk of preeclampsia. For pregnant women at low risk, after providing disease education, guidance on diet and exercise during pregnancy is given, and they are instructed to undergo regular prenatal check-ups to confirm changes in the risk of preeclampsia and to adjust pregnancy health care measures in a timely manner.

Study group: Receiving personalized interventions.

- (1) Formulation of intervention plans: After pregnant women complete preeclampsia risk screening, based on a summary of past experience in managing preeclampsia in pregnant women, the actual clinical intervention needs of obese pregnant women at different risk levels are analyzed to develop and refine an intervention management plan, providing a guiding basis for achieving positive intervention outcomes.
- (2) Health education: After pregnant women have completed the preeclampsia risk screening, the unit should organize pregnant women from the same group to be admitted to the hospital for health education in the form of group meetings. Doctors and head nurses (nurses) should collaborate to provide comprehensive education on the correlation between preeclampsia onset and obesity, as well as the hazards of the disease. They should also introduce in detail the various intervention measures involved during pregnancy and the objectives (or projects) of these interventions, thereby enhancing pregnant women's foundational knowledge of health interventions during pregnancy.
- (3) Weight management: Based on the body mass data monitored on the day of the preeclampsia risk screening for pregnant women, and considering the changes in fetal body mass and nutritional supply needs at different stages of intrauterine development, individualized healthy body mass change charts should be provided to pregnant women during pregnancy. Additionally, individualized healthy diet plans and guidance on exercise during pregnancy should be developed and distributed. Pregnant women and their families are required to actively cooperate in managing body weight during pregnancy based on the aforementioned intervention plans, thereby improving the overall health quality during pregnancy.
- (4) Development of self-management behaviors: After completing the preeclampsia risk screening, the unit should add pregnant women to WeChat groups to receive guidance on self-management behaviors throughout pregnancy. Short videos should be used to instruct pregnant women on fetal monitoring skills, and they should monitor and report their morning blood pressure readings daily. For those requiring pharmacological interventions, they should be asked to clock in and report after taking their medication each day to develop good medication-taking habits. During this period, pregnant women should be

notified to be admitted to the hospital for follow-up examinations every 4 weeks and to cooperate with related prenatal check-ups as planned to promptly detect symptoms of preeclampsia and facilitate targeted clinical interventions.

2.3. Observation indicators

- (1) Gestational weight gain: Based on the pre-pregnancy body mass and the body mass monitoring results at 20 weeks of gestation and the last prenatal check-up before delivery in each group, the mean weight gain at different stages of pregnancy in each group was calculated.
- (2) Self-care management score: Assessed using the Self-rating Questionnaire of Healthcare Management for Pregnancy (SQHMP), which includes four domains: fetal monitoring, daily life, compliance with medical advice, and self-protection, with a total of 25 items. Scores were assigned using a Likert 5-point scale, with higher scores indicating a higher level of self-care management ability^[6].
- (3) Mode of delivery: The proportion of each mode of delivery, including spontaneous vaginal delivery, assisted vaginal delivery, and cesarean section, was statistically analyzed in each group.
- (4) Incidence of gestational diseases: The overall incidence of gestational diseases during clinical intervention in each group was statistically analyzed, including gestational hypertension, gestational diabetes mellitus, and preeclampsia.
- (5) Incidence of adverse pregnancy outcomes: The overall incidence of adverse pregnancy outcomes during pregnancy in each group was statistically analyzed, including premature birth, placental abruption, macrosomia, neonatal asphyxia, and postpartum hemorrhage.

2.4. Statistical methods

SPSS 24.0 software was used; for mean \pm standard deviation (SD) data, t-tests were performed; for n (%) data, chi-square tests/rank-sum tests were conducted; a statistically significant difference was considered when $P < 0.05$.

3. Results

3.1. Comparison of gestational weight gain and self-care management scores

The results in **Table 2** show no significant differences in weight gain or self-care management scores between the two groups before intervention ($P > 0.05$). By the 20th week of pregnancy and before delivery, the study group demonstrated significantly lower weight gain ($P < 0.05$) and significantly higher self-care management scores ($P < 0.001$) compared to the control group. These findings indicate that the intervention was effective in promoting appropriate gestational weight control and enhancing self-care management.

Table 2. Comparison of gestational weight gain and self-care management scores (mean \pm SD)

Group/n	Weight Gain (kg)			SQHMP (Score)		
	Pre-intervention	Week 20 of Pregnancy	Pre-delivery	Pre-intervention	Week 20 of Pregnancy	Pre-delivery
Control/33	1.92 \pm 0.81	8.52 \pm 2.05	5.05 \pm 1.75	51.36 \pm 6.52	79.35 \pm 7.65	92.36 \pm 9.75
Study/34	1.95 \pm 0.78	7.31 \pm 1.76	4.12 \pm 1.45	51.41 \pm 6.48	88.36 \pm 8.51	102.41 \pm 9.89
<i>t</i>	0.154	2.595	2.372	0.031	4.553	4.188
<i>P</i>	0.878	0.012	0.021	0.975	< 0.001	< 0.001

3.2. Comparison of delivery modes

The distribution of delivery modes differed significantly between groups ($P = 0.021$). The study group had a higher proportion of vaginal deliveries and lower proportions of operative vaginal and cesarean deliveries compared to the control group (See **Table 3**).

Table 3. Comparison of delivery modes (n, %)

Group (n)	Vaginal Delivery	Operative Vaginal Delivery	Cesarean Section
Control group (n = 33)	17 (51.52)	3 (9.09)	13 (39.39)
Study group (n = 34)	27 (79.41)	1 (2.94)	6 (17.65)
χ^2 (Z)	2.311		
P	0.021		

3.3. Comparison of incidence rates of pregnancy-related diseases

Table 4 presents a comparison of pregnancy-related disease incidence between the study and control groups. The total incidence was significantly lower in the study group (8.82%) than in the control group (30.30%), with a statistically significant difference ($\chi^2 = 4.941$, $P = 0.026$). Specifically, the study group showed lower rates of gestational hypertension (5.88% vs. 18.18%) and gestational diabetes (2.94% vs. 9.09%), and no cases of eclampsia were observed.

Table 4. Comparison of incidence rates of pregnancy-related diseases (n, %)

Group	Gestational Hypertension	Gestational Diabetes	Eclampsia	Total Incidence
Control group (n = 33)	6 (18.18)	3 (9.09)	1 (3.03)	10 (30.30)
Study group (n = 34)	2 (5.88)	1 (2.94)	0	3 (8.82)
χ^2				4.941
P value				0.026

3.4. Comparison of incidence rates of adverse pregnancy outcomes

Table 5 presents a comparison of the incidence of adverse pregnancy outcomes between the study and control groups. The total incidence was significantly lower in the study group (14.71%) than in the control group (36.36%) ($\chi^2 = 4.148$, $P = 0.042$). Notably, the study group reported zero cases of placental abruption and postpartum hemorrhage.

Table 5. Comparison of incidence rates of adverse pregnancy outcomes (n, %)

Group	Preterm Birth	Placental Abruption	Macrosomia	Neonatal Asphyxia	Postpartum Hemorrhage	Total Incidence
Control group (n = 33)	5 (15.15)	2 (6.06)	2 (6.06)	2 (6.06)	1 (3.03)	12 (36.36)
Study group (n = 34)	2 (5.88)	0	1 (2.94)	2 (5.88)	0	5 (14.71)
χ^2						4.148
P value						0.042

4. Discussion

Clinical studies have indicated a close correlation between obesity and the onset of preeclampsia, with obesity being a primary risk factor for such pregnancy-related diseases. Research on the clinical prognosis of preeclampsia has highlighted that the disease significantly increases the risk of short-term morbidity and mortality in both mothers and infants. Therefore, strengthening risk screening and management for preeclampsia in obese pregnant women is of positive significance for ensuring the safety of their pregnancies and maintaining the quality of childbirth. However, it is also necessary to improve comprehensive health intervention measures for high-risk populations during pregnancy while conducting preeclampsia risk screening, in order to optimize the actual intervention effects^[7,8].

Through summarizing past experiences in managing health interventions during pregnancy, it was found that while routine prenatal care interventions can improve and manage maternal health to a certain extent, these interventions only have a general applicability to pregnant women with a relatively good basic health condition. They lack specificity and feasibility for the health management of obese pregnant women at risk of preeclampsia. Therefore, prenatal health interventions should be adjusted for obese pregnant women to improve their pregnancy health while actively preventing the onset of preeclampsia^[9,10].

The study results indicated that compared to the control group, the intervention group showed an increase in the SQHMP score after the intervention, along with a significant reduction in weight gain at 20 weeks of gestation and before delivery, with statistically significant differences ($P < 0.05$). Analysis revealed that the combined implementation of preeclampsia screening and personalized interventions, after clarifying the risk levels and factors of preeclampsia in obese pregnant women, could help these women understand their risk of developing preeclampsia, the potential harms, and the importance of intervention through improved health education, comprehensive weight management throughout pregnancy, and interventions to foster self-management behaviors. This, in turn, provides a feasible foundation for achieving various aspects of prenatal health management^[11,12]. During the implementation of personalized interventions, it was observed that all pregnant women achieved healthy weight gain and effectively developed self-management behaviors after the full-course intervention, meeting the needs of preeclampsia risk management^[13].

Compared with the control group, the study group showed an increased rate of normal delivery and a decreased incidence of pregnancy-related diseases and adverse pregnancy outcomes after intervention, with statistically significant differences ($P < 0.05$). Analysis revealed that, compared to pregnant women with a normal BMI, obese pregnant women had a significantly higher risk of developing preeclampsia. Moreover, factors such as weight gain during pregnancy and changes in endocrine levels, influenced by obesity, further increase the risk of pregnancy-related diseases in pregnant women, affecting the safety of pregnancy and childbirth. Therefore, implementing active and feasible health intervention management during pregnancy for obese pregnant women is of great significance^[14,15]. After reviewing the effectiveness of personalized interventions in this study, it was found that individualized pregnancy weight management and the cultivation of comprehensive self-health management capabilities, based on the individual differences among obese pregnant women, could effectively prevent various pregnancy-related disease risks in obese pregnant women through comprehensive health management. This approach not only enhanced the safety of pregnancy for both mothers and infants but also helped reduce the cesarean section rate and improve the postpartum rehabilitation quality of relevant pregnant women^[16,17].

5. Conclusion

In summary, personalized intervention for obese pregnant women based on early pregnancy preeclampsia screening results can maintain healthy weight gain during pregnancy. Assisting in the development of self-management skills during pregnancy, it can reduce the risk of pregnancy-related diseases and adverse pregnancy outcomes.

Disclosure statement

The authors declare no conflict of interest.

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