Effects of nutritional management intervention on gestational weight gain and perinatal outcome

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ABSTRACT

Objectives: To evaluate whether nutritional management intervention can prevent excessive weight gain during pregnancy and improve perinatal outcomes.

Methods: This cross-sectional study included 276 pregnant women undergoing prenatal care between June 2010 and December 2011 at the Obstetrics and Gynecology Department of the Second Affiliate Hospital of the ChongQing University of Medical Sciences, Chongqing, China. Of them, 131 women received individualized nutritional management in addition to routine prenatal care (intervention group), and 145 women received only routine prenatal care (control group). The primary study outcome was gestational weight gain (GWG). Secondary outcomes included birth weight, Apgar score, and incidence of pregnancy complications.

Results: Baseline demographic characteristics of the 2 groups were the same. The average GWG was higher in the control group (12.57±4.62 kg) compared with the intervention group (7.58±1.59 kg; p=0.000). The incidence rate of preeclampsia was 3.1% and gestational diabetes was 3.8% for the intervention group, compared with 11% for preeclampsia and 14.5% gestational diabetes for the control group (p<0.05). The incidence rates of premature rupture of membranes, preterm labor, birth weight, birth of a newborn, and major congenital anomalies did not significantly differ between the 2 groups.

Conclusion: Nutritional management intervention prevented excessive GWG and improved perinatal outcomes. These results support the hypothesis that nutritional management intervention can decrease the rate of complications experienced by expecting mothers.

Observational studies have reported that maternal nutrition intake during pregnancy can affect fetal growth and development and can adversely affect maternal and infant outcomes.[1] Particularly, high gestational weight gain (GWG) during early pregnancy has been associated with child obesity. Weight gain between pregnancies can increase the risk of gestational diabetes mellitus (GDM) and other pregnancy complications. It is a strong predictor for high birth weight and obesity in infancy and adulthood. In addition to the health risks for mother and baby, obesity, and excessive GWG can put demands on the healthcare system. Although research has shown that reduced weight gain or even weight loss may be of benefit during pregnancy; it is possible that the mother or baby could be harmed as a result of gestational weight loss. The antenatal period is considered an ideal time for intervention as mothers are motivated to make changes that will optimize their and their baby's outcomes. Moreover, as the maternal and fetal nutritional requirements during pregnancy are constantly changing, a dynamic, individualized nutritional management plan is needed to achieve optimal nutrition status for both mother and child, to improve perinatal outcomes. Regular contact with health professionals during obstetric care facilitates weight management intervention. Therefore, the primary goal of this study was to evaluate the ability of individualized nutrition management intervention during pregnancy to improve perinatal outcomes and to decrease the proportion of women who exceed recommendations for GWG.

Methods.

Prospective study population. Women who received prenatal care between June 2010 and December 2011 as outpatients of the Obstetrics and Gynecology Department of the Second Affiliate Hospital of the ChongQing University of Medical Sciences, Chongqing, China were eligible for this study. The body mass index (BMI) categories used were based on cutoffs described by the Institute of Medicine.[2] The participant BMIs were calculated on the basis of self-reported weights and heights at the last menstrual period. These values were confirmed at the first obstetric visit (<13 weeks of gestation).

Inclusion criteria for this study were as follows: gestational age <13 weeks, non-smoking adult >18 years, singleton pregnancy, and intention to receive prenatal care and complete the pregnancy at our institution. Exclusion criteria were as follows: previous history of GDM or other concomitant disease (namely, type 2 diabetes mellitus, pre-pregnancy hypertension,and renal, immunologic, or hepatic diseases). The study was performed in accordance with the principles of the Helsinki Declaration. Ethical approval was obtained from the Second Affiliate Hospital of the ChongQing University of Medical Sciences. All participants provided written informed consent before participating in this study.

Individual nutrition management intervention and assessment. Both groups were monitored throughout the study by an obstetrician. Women were divided into 2 groups. The intervention group received individualized nutritional management intervention in addition to routine prenatal care. If a woman did not want to receive the intervention, then she was invited to withdraw from the study. The control group received only routine prenatal care. Women in the intervention group underwent intensive obstetric care. They had monthly obstetric visits up to week 28, biweekly visits from week 28 to week 36, and weekly visits until the end of the pregnancy. Women in the intervention groups were included in a medical nutrition program. Their total energy intake was modified according to the progression of pregnancy every 4 weeks, with energy requirements being individually estimated according to each mother's BMI, weight, and obstetric condition. Women in the control group received the same initial information regarding the purpose and content of this study as the intervention group. However, no additional intervention was provided. For both groups, antenatal and perinatal data were obtained from the patients' medical records and hospital database.

Statistical methods. All statistical analyses were performed using Statistical Package for Socia Sciences 17.0 for Windows. Prior to analysis, all data were tested for normality. For descriptive analyses of differences between the intervention and control groups, a simple Student's t-test and 95% confidence intervals (CIs) were used. Dichotomous variables were tested using a x^2 test.

Results.

Baseline characteristics of participants. There were no significant differences in baseline characteristics between the 2 groups (**Table 1**).

1) Dietary intake and weight development. Women in the intervention group followed the dietary instructions regarding the recommended macronutrient composition of their diet and successfully limited their energy intake. The fat and carbohydrate percentages of the diet were decreased, and the proportion of protein was increased. As a result, the intervention group gained less weight than the control group (**Figure 1**).

2) Pregnancy complications and fetal outcome. Pregnancy complications and fetal outcomes reported for both groups are listed in **Table 2**. There were significant differences in the incidence rates of preeclampsia and GDM between the groups. No cases of neonatal asphyxia were reported in either group.

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Discussion.

There has been a misconception that increased food consumption is needed for the growing fetus during pregnancy. In China, the cesarean section rate has been increasing, primarily due to increases in

Table 1 - Baseline characteristics of 276 pregnant women undergoing prenatal care.

Baseline characteristics	Intervention group (n=131)	Control group (n=145)	*P*-value
Maternal age, y	27.3±6.08	27.1±6.12	0.913
Gestational age (weeks)	10.1±2.63	10.5±2.46	0.821
BMI (kg/cm^2)	21.8±3.08	22.9±2.94	0.435
Nulliparous (%)	82 (63)	88 (61)	0.745
SBP (mm Hg)	108.26±11.08	106.43±10.27	0.671
DBP (mm Hg)	68.11±9.08	66.72±8.79	0.658

BMI - body mass index, SBP - systolic blood pressure, DBP - diastolic blood pressure

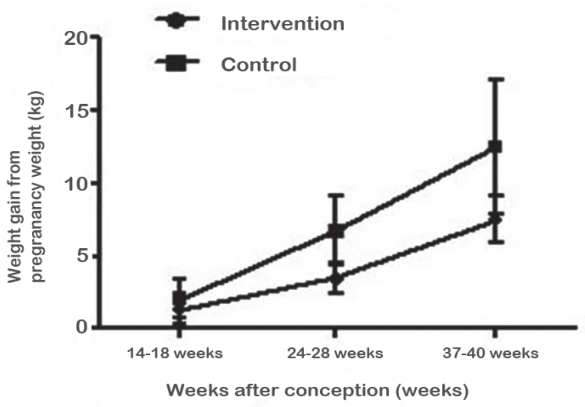

Figure 1 - Gestational weight gain for the intervention group versus the control group from early pregnancy to term. The mean weight ± standard deviation is shown.

Table 2 - Fetal outcome and incidence of complications among 276 pregnant women undergoing prenatal care.

Outcome and incidence	Intervention group (n=131)	Control group (n=145)	*P*-value
Birth outcome at delivery (mean±SD)			
Birth weight (g)	3361±465	3495±439	0.467
Infant length (cm)	50.5±1.1	50.8±1.9	0.921
Gestational age (d)	278±9	279±10	0.409
Macrosomia (%)	1 (0.8)	8 (5.5)	0.026
Incidence of pregnancy and birth complications (%)			
GDM	5 (3.8)	21 (14.5)	0.002
Preeclamsia	4 (3.1)	16 (11.0)	0.011
PROM	3 (2.3)	5 (3.4)	0.567
Preterm labor	2 (1.5)	3 (2.1)	0.736

GDM - gestational diabetes mellitus, PROM - premature rupture of membranes.

neonatal weight. This phenomenon currently represents a serious clinical problem. Addressing nutrition in obstetrics not only involves a consideration of the quantity of food consumed, but also the balance between nutrition and the incidence of obstetric complications and newborn health.

In this study, an individualized diet intervention was found to be effective in reducing GWG. This diet included a low glycemic diet of unprocessed whole grains, fruits, beans, and vegetables. In China, a progressive increase in the incidence of obesity has been identified as a risk factor for adverse maternal, fetal, and neonatal outcomes. Accumulating evidence suggests that obesity increases the risk of GDM,[3-5] hypertensive diseases (including preeclampsia), and other pregnancy complications.[6,7] Maternal obesity can lead to a higher weight for children during infancy and increase severity of obesity in future generations.[8] The results of the present study demonstrate that alternative medical nutrition approaches for the management of pregnancy weight have the potential to decrease weight-related morbidities.

Pregnancy is a complex physiological process that requires various nutrients to address the needs of both the mother and fetus.[9] Hypertension during pregnancy has been hypothesized to be due to an excess of nutrition, or to a lack of fat or certain nutrients, such as calcium and selenium.[10] Although a specific mechanism remains to be elucidated, nutritional management in pregnancy can prevent hypertension disorders, premature rupture of the membranes, postpartum hemorrhage, GDM, and anemia.[11-13] The results also suggest that an intensive and sustained obstetric-nutritional prenatal care program may contribute to a noticeable decrease in maternal and newborn adverse outcomes, especially the risk for GDM and preeclampsia.

Although birth weight did not significantly differ between the 2 groups, the incidence of macrosomia was significantly reduced for the intervention group compared with the control group. Macrosomia can increase the risk of diabetes or obesity during adulthood.[14] Additional complications associated with macrosomia include metabolic abnormalities, compromised antioxidant status, disruption of the immune system, and metabolic syndrome during adulthood. Some previous studies have examined the effects of nutritional management interventions on prenatal outcomes and GWG. However, there is no unified standard for how to take individualized nutrition management. To decrease the incidence rates of pregnancy complications and cesarean sections, this aspect may be a key point in future research of pregnancy management.

Study limitations. This study has some limitations. The sample size was relatively small, and the results were obtained for the specific Chongqing population of women in China. Additional research is needed to examine the effectiveness of this BMI-based approach within the context of prenatal care.

In conclusion, this study indicates that nutritional intervention can facilitate the control of GWG, improve perinatal outcomes, and reduce the incidence of pregnancy complications, such as preeclampsia and GDM. There were no adverse effects on fetal growth or the incidence of pregnancy or birth complications. Management of maternal weight should be included in routine prenatal care, to facilitate interventions and guidance regarding maternal nutrition, with the goal of reducing the incidence of fetal diseases and improving the quality of obstetric care. Further studies with larger sample sizes are needed to confirm these results and to research the ideal individualized nutritional intervention.

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