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Original Research Article

Assessment of the Pattern of Weight Gain in Pregnant Women and Effect on Maternal and Neonatal Outcome: A Comparative Observational Study

Mamta Rani

Senior Resident, Department of Obstetrics and Gynaecology, Bhagwan Mahavir Institute of medical Sciences, Pawapuri, Nalanda, Bihar, India

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Corresponding author: Dr. Mamta Rani

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Abstract

Aim: The aim of the present study was to assess the pattern of weight gain in pregnant women and effect on maternal and neonatal outcome in Bihar region.

Methods: The present study was conducted at BMIMS, PAWAPURI, Nalanda, Bihar, India for two years and 1000 women were enrolled in the study. In the present study, only single pregnancy outcomes were investigated. Pre-pregnancy BMIs were classified into 4 types namely: underweight, normal, overweight and obese women.

Results: There were significant differences in age, educational levels, occupations and family member among the 4 pre-pregnancy BMI groups. In maternal outcomes, there were significant differences in the delivery mode, GDM and Gestational Hypertension (GHp) among the 4 pre-pregnancy BMI groups. For neonatal outcomes, there were significant differences in birth weights and GA among the 4 prepregnancy BMI groups.

Conclusion: Overweight and obesity before pregnancy and excessive GWG were linked to an increased risk of GDM, GHp, macrosomia and LGA. In clinical practice, physicians can guide pregnant women to manage and control weight gain during pregnancy in order to reduce the risk of adverse pregnancy outcomes. Women of childbearing age can be advised on the importance of maintaining an optimal BMI when planning to become pregnant. The risk for adverse maternal and infant outcomes varied by gestational weight gain and across the range of prepregnancy weights.

Keywords: Gestational weight gain, Pre-pregnancy BMI, Maternal outcomes, Neonatal outcomes.

Introduction

Gestational weight gain has been found to be related to the risk of pregnancy complications, maternal post-partum weight retention, and obesity in offspring.[1-3] Gestational weight gain reflects multiple characteristics, including maternal fat accumulation, fluid expansion, and the growth of the fetus, placenta, and uterus.[4] Gestational weight gain is necessary to ensure a healthy fetus, but excessive gestational weight gain has been associated with adverse outcomes. Higher pre-pregnancy body mass index (BMI; calculated as weight in kilograms divided by height in meters squared) also has been associated with lower gestational weight

gain and increased risk for adverse maternal and infant outcomes. Therefore, optimal gestational weight gain ranges should account for pre-pregnancy BMI.[5,6]

In particular, prematurity is one of the common outcomes of multiple gestations and adds a substantial burden on the health care system.[7,8] According to a reliable estimate, while twin pregnancies constitute only around 3–4% of all birth globally, they contribute to more than one-fifth (20%) of the burden of preterm births.[9,10] Among a multitude of factors that could potentially impact pregnancy outcomes, one of the readily modifiable factors is gestational weight gain.[1,11] The nutritional status of mothers-to-be is believed to be a good predictor of perinatal and adverse long-term outcomes for both the infant and the mother.[12] Being overweight or obese before becoming pregnancy are high risk factors for GDM, hypertensive syndrome and disorders of fetal growth.[13,14] In contrast, underweight pregnant women are at an increased risk of preterm birth (PB) and for delivering small-for-gestational-age (SGA) newborns.[15,16]

In addition, women who present with inadequate weight gain may experience complications such as anemia[17], PB1, low birth weight (LBW)[18] and SGA[19], whereas women with excessive weight gain are more likely to develop GDM[20], Gestational Hypertension (GHp)[21], preeclampsia[22] and the need for caesarean sections.[23] Therefore, it is of particular relevance to study the effects of pre-pregnancy BMI and GWG on pregnancy and the newborn, and to develop a reasonable pregnancy weight control plan. Most of the current evidence on pre-pregnancy BMI and GWG values comes from Western or high income countries.

The aim of the present study was to assess the pattern of weight gain in pregnant women and effect on maternal and neonatal outcome in Bihar region.

Materials and Methods

The present study was conducted at BMIMS, PAWAPURI, Nalanda, Bihar, India for two years and 1000 women were enrolled in the study. In the present study, only single pregnancy outcomes were investigated. Pre-pregnancy BMIs were classified into 4 types namely: underweight, normal, overweight and obese women.

The inclusion criteria of the study:

1. Pregnancy ≤12 gestational weeks.
2. Maternity files had been established in hospital.
3. Regular birth inspection.
4. Online completion of the survey.
5. Signing of informed consent.

Exclusion criteria:

1. Pregnancy > 12 gestational weeks.
2. Those who could not have regular birth inspection.
3. Floating population who did not live in the local area for a long time.
4. Those who have contraindications to pregnancy such as gynecological tumors.

Data Collection

We collected socio-demographic data from pregnant women surveys including race, age, education level, living region, census register type, occupation, family member, self-income and family-income. We also measured the heights and weights of the women at their first prenatal examination, including their weights recorded at the last prenatal examination (data obtained from the prenatal examination information of the physician survey). Maternal outcomes from the physician survey including gestational weeks, delivery mode, maternal complications (e.g., anemia, premature membrane rupture, gestational diabetes mellitus and hypertension) were collected by physicians at the 6-week postpartum follow-ups. Neonatal outcomes from the physician survey including low and normal birth weights, macrosomia and small,

normal or large size for gestational age (GA) were collected during physicians' home visits to the mother's home at the sixth week postpartum.

Standard Measurements

Physicians in the centers involved in the study collected anthropometric data. Mothers' weights and heights were measured in light clothing but with no shoes on. Height was measured to the nearest 0.1 cm with a ruler and weight to the nearest 0.01 kg using calibrated electronic scales. Blood pressure was measured using a standard sphygmomanometer. The presiding physicians entered all relevant data into the hospital's electronic medical records system. BMI (kg/m2) values before pregnancy were calculated by measuring the height and weight of pregnant women at their first prenatal examination (pregnancy ≤12 gestational weeks).

Statistical Analyses

Data were collected and analyzed using Microsoft Office Excel 2007 and SPSS Statistics for Windows (Version 25.0, IBM Corp, NY, US). The classification index describes the number and percentage of various types, and the chi-squared test or the exact probability method (if the chi-squared test was not appropriate) was employed for comparisons between groups. A cumulative logistic regression model was employed to correct the effect of confounding factors in order to analyze the sociodemographic characteristics affecting the BMI values before pregnancy and GWG. A P-value < 0.05 was considered to be a significant finding.

Results

Table 1: Comparison of socio-demographic characteristics in the four pre-pregnancy BMI groups

	Under weight	**Normal weight**	**Over weight**	**Obese**	**P-value**
N (%)	**150 (15)**	**700 (70)**	**130 (13)**	**20 (2)**	< 0.001
Age (years)					
< 20	17	21	4	2	
~ 20	24	70	13	1	
~ 25	75	340	52	8	
~ 30	30	210	39	6	
~ 35	3	50	20	2	
≥ 40	1	9	2	1	
Education level					< 0.001
Elementary school or below	2	10	5	0	
Middle school	18	105	26	4	
High school	27	140	28	4	
College or university	90	385	65	8	
Postgraduate degree	10	60	6	4	
PhD degree	3	10	0	0	
Census register type					0.520
Urban	60	280	52	8	
Rural	90	420	78	12	
Occupation					0.032
Unemployed	45	210	35	8	
Managerial workers	15	70	13	2	

Professional and technical workers	24	105	40	2	
Clerical workers	18	70	15	2	
Merchant or service workers	30	140	10	1	
Farming workers	4	45	7	1	
Others	14	200	10	4	
Family member					0.082
1	2	40	13	0	
2	32	210	30	12	
3	30	140	20	2	
4	30	120	18	2	
5	20	100	16	2	
≥ 6	36	90	33	2	

There were significant differences in age, educational levels, occupations and family member among the 4 pre-pregnancy BMI groups.

Table 2: Comparison of maternal and neonatal outcomes in the four pre-pregnancy BMI groups

	Under weight (N = 150)	**Normal weight (N = 700)**	**Over weight (N = 130)**	**Obese (N = 20)**	**P-value**
Maternal outcomes					0.220
Gestational weeks					
≥ 28 and < 37	10	75	20	6	
≥ 37 and < 42	140	620	110	14	
≥ 42	0	5	0	0	
Delivery mode					< 0.001
Eutocia	90	360	60	6	
Caesarean section	50	240	85	12	
Midwifery practice	10	100	5	2	
Maternal complications Anemia					0.220
No	135	600	115	16	
Yes	15	100	15	6 4	
PROM					0.128
No	140	650	120	18	
Yes	10	50	10	2	
GDM					< 0.001
No	138	660	100	16	
Yes	12	40	30	4	
GHp					< 0.001
No	144	670	115	18	
Yes	6	30	15	2	
Neonatal outcomes Birth weight					< 0.001
Low birth weight	15	70	10	2	
Normal birth weight	120	600	100	16	
Macrosomia	15	30	20	2	
Gestational age (GA)					< 0.001
Small for GA	15	70	13	0	

Normal GA	130	560	91	16	
Large for GA	5	70	26	4	

In maternal outcomes, there were significant differences in the delivery mode, GDM and GHp among the 4 pre-pregnancy BMI groups. For neonatal outcomes, there were significant differences in birth weights and GA among the 4 prepregnancy BMI groups.

Discussion

Obesity has become a serious global public health issue and has consequences for nearly all areas of medicine. Within obstetrics, obesity not only has direct implications for the health of a pregnancy but also impacts on the weight of the child in infancy and beyond. As such, maternal weight may influence the prevalence and severity of obesity in future generations. Pregnancy has been identified as a key time to target a weight control or weight loss strategy to help curb the rapidly growing obesity epidemic. In addition, if delivered sensitively, pregnancy may be a good time to target health behavior changes by using the extra motivation women tend to have at this time to maximize the health of their child.

Maternal prepregnancy BMI and to a lesser extent gestational weight gain, are associated with risks of adverse maternal and infant adverse outcomes. Gestational weight gain ranges that were associated with lower risks for adverse outcomes were 14.0kg to less than 16.0 kg for women categorized as being underweight; 10.0kg to less than 18.0kg for normal weight; 2.0kg to less than 16.0 kg for overweight; 2.0 kg to less than6.0kg for obesitygrade1; weight loss or gain of0kg to less than 4.0kg for obesity grade 2; and weight gain of 0 kg to less than 6.0 kg for obesity grade 3. Gestational weight gain outside these ranges was associated with adverse outcomes. However, discriminative performance of gestational weight gain with adverse maternal and infant outcomes was low to moderate. Prepregnancy BMI was more strongly associated with adverse maternal and infant outcomes than the amount of gestational weight gain. Prepregnancy BMI is significantly associated with pregnancy complications and offspring obesity and also is associated with gestational weight gain.[5,6]

Pregnancy is a crucial life event when interventions to challenge the growing trend of obesity may be most effective. The mother may be more than usually accepting of change that would benefit the health of her unborn child. The benefits of weight management in pregnancy are numerous. Normal pregnancy has been implicated in the development of obesity in women having healthy weight previously.[24] Controlling weight at this time is not only important to prevent future complications of obesity for the woman herself, but also to improve the health of the pregnancy, and the neonate. Numerous adverse effects of obesity during pregnancy have been reported by many. Associations include an increased risk of miscarriage, congenital malformations, hypertension, gestational diabetes, pre-eclampsia, anesthetic complications, vaginal birth after cesarean (VBAC) failure, instrumental delivery, macrosomia and maternal death.[25] Controlling weight in association with pregnancy will therefore impact many areas of adult, obstetric and neonatal healthcare. In our survey, it was established that pregnant women aged < 20 years and > 25 years old did not control prepregnancy BMIs within the normal range compared with the 20–25 year old age group. Studies have shown that too early and too late delivery increased the risk of adverse pregnancy outcomes[26,27] and also the risk of malformations.[28,29] Therefore, women of these age groups should be recommended to control their weight within the normal range before pregnancy.

GDM can seriously threaten the health of mothers and offspring.[30] Although the pathogenesis remains unclear, related studies have shown that insulin resistance is mainly caused by a series of physiological and pathological changes during pregnancy.[31] Adipose tissue is resistant to insulin action, resulting in lower levels of insulin receptors in fat[32,33] and the number of insulin receptors in the body gradually decreases with increasing BMI. Therefore, regardless of pregnancy, individuals with BMIs have a greater risk of being diabetic than those with low BMIs. At the same time, due to physiological changes in the pattern of glucose metabolism during pregnancy, glucose tolerance is reduced[34], which further amplifies the risk of developing diabetes for pregnant women with high BMIs. Being overweight and obese before pregnancy was proven to increase the risk of GHp in the present study. The possible mechanism is that has been weight increase leads to the accumulation of estrogen in the body due to the accumulation of fat. By mediating aldosterone secretion, sodium retention is caused by the renin angiotensin system or by directly increasing the recollection of the renal tubules, resulting in hypertension.[35] Being overweight and obese before pregnancy, and unacceptable weight gain during pregnancy may lead to increased concentrations of glucose, amino acids and free fatty acids in pregnant women[36], thereby increasing the risk of abnormal infant weight at birth. Therefore, pre-pregnancy BMI and GWG have similar roles in infant size. Research led by Tiffany et al.[37] showed that regardless of the prepregnancy body mass index, controlling weight gain during pregnancy is of great significance for reducing the risk of SGA and LGA. Therefore, it is of great importance to pay attention to pre-pregnancy BMIs and GWGs to ensure normal birth weights of newborns.

Conclusion

Overweight and obesity before pregnancy and excessive GWG were linked to an increased risk of GDM, GHp, macrosomia and LGA. In clinical practice, physicians can guide pregnant women to manage and control weight gain during pregnancy in order to reduce the risk of adverse pregnancy outcomes. Women of childbearing age can be advised on the importance of maintaining an optimal BMI when planning to become pregnant. The risk for adverse maternal and infant outcomes varied by gestational weight gain and across the range of prepregnancy weights. The estimates of optimal gestational weight gain may inform prenatal counseling; however, the optimal gestational weight gain ranges had limited predictive value for the outcomes assessed.

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