



Original Research Article

Effect of pre-pregnancy body mass index and gestational weight gain on fetal outcome

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ABSTRACT

Background: Fetal development and growth in uterus is most critical. Most commonly used indicator is birth weight for determining well-being of infant. Body mass index (BMI) of mother before pregnancy, pregnancy weight gain, and other factors related to behavior, socio-cultural as well as genetics influence the birth weight.

Objective: To study effect of pre-pregnancy BMI and gestational weight gain on fetal outcome

Materials and Methods: Hospital-based follow-up study was carried out among 189 antenatal women. Gestational age, weight, height, BMI and fetal growth were recorded. Regular sonography was carried out to rule out fetal congenital abnormalities and fetal well-being. Daily fetal movement count, fetal heart rate monitoring was carried out daily. Estimation of the “total pregnancy weight gain” was done by subtracting last measured weight before delivery from weight recorded at first visit in first trimester. Birth weight of the neonate was recorded within 24 hours of delivery.

Results: BMI before pregnancy was normal in Majority (75.1%). Underweight women earlier to conception had either normal Gestational weight gain (GWG) or less than normal GWG. Their babies also had significantly low average birth weight compared to either normal weight females or overweight and obese before conception. Overweight and obese females before conception had higher incidence of gestational diabetes (GDM) and cesarean section. Normal weight females before conception had higher incidence of Pregnancy induced hypertension.

Conclusion: Being underweight before conception is a risk factor for low birth weight babies whereas being overweight and obese before pregnancy is a risk factor for GDM.

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1. Introduction

In human life cycle, the most critical period is during the fetal development. Most commonly used indicator is the birth weight for determining the wellbeing of the infant. Body mass index (BMI) before conception of the mother, more gain in the weight while pregnant, other factors related to behavior, socio-cultural as well as genetics are the different factors that influence the birth weight. Dietary factors also contribute significantly in the birth weight of the

child. “Fetal growth and development are also influenced by the nutrition of the mother.”¹

BMI before the pregnancy cannot be modified and difficult to measure except in cohort studies. But, weight gain during pregnancy which is not normal is considered as a risk factor for fetal outcome which is not normal. It can be modified. But, again weight gain during pregnancy is not very specific as it varies for one woman herself throughout the pregnancy. Even then it can be used to predict the complications of the pregnancy and outcome of the fetus.²

“Institute of Medicine, USA in 1990, said that BMI before conception should be used as a starting point

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to consider the weight gain that takes place while pregnant.” These recommendations were later accepted by the American College of Obstetricians and Gynecologists (ACOG).³ Using these recommendations, we get more incidence of obesity during pregnancy.⁴

“The conference of Institute of Medicine in 2006 concluded that more evidence is required on this subject to prove what are the detailed effects of excess gain in the weight during pregnancy.⁵ Some experts in this field agreed⁶ but some have disagreed.⁷

Women who are underweight before pregnancy need to gain more weight compared to their normal BMI counterparts to match the ideal birth weight. Institute of Medicine has recommended them to gain as much as 18 kg during their pregnancy for the underweight women.⁸ Obesity before pregnancy leads to many complications like gestational diabetes, pre-eclampsia, thrombo embolic episodes, labor abnormalities, increased incidence for cesarean section delivery and many more post-partum complications. “Hence, the ACOG recommended that at first visit of the pregnancy women, the BMI should be recorded. Those with overweight and obese women should be counseled for possible complications and motivated for healthy lifestyle.”^{9,10}

Taking all above discussion into consideration, present study was conducted. The objective was “to study the effect of pre-pregnancy body mass index and gestational weight gain on fetal outcome.”

2. Materials and Methods

A hospital based follow up study was carried out among 189 antenatal women registered from October 2013 to October 2014 at Little Flower Hospital. Sample size of 132 was calculated taking 95% confidence interval with 4.18 as the standard deviation of an attribute in the population and absolute precision of 5% of the mean (0.714). During the study period, we were able to include 189 women. All women for the present study were selected by purposive sampling technique.

3. Inclusion criteria

1. All pregnant women of 19-35 years having gestational age < 8 weeks.
2. Singleton pregnancy and consenting to participate in the study.

3.1. Exclusion criteria

1. Women with any known medical or obstetric problems during the index pregnancy.
2. Multiple pregnancy.
3. Irregular antenatal visits.

A pre designed, pre tested study questionnaire was used to collect the data on age, parity, education etc. Last menstrual period was used to determine Gestational age. It was cross checked with ultrasound measurement. If the discrepancy was more than two weeks, then the ultrasound age was taken into consideration. During routine antenatal check-up, weight, pallor, pulse, blood pressure and fetal growth were assessed and recorded. Baseline investigations like hemoglobin, blood group, Rh factor, HIV, VDRL, HbSAg were carried out. Regular sonography was carried out as routine test to rule out fetal congenital abnormalities and for fetal wellbeing. Vigilant antenatal surveillance was done for high risk mothers with bi-weekly cardiotocography. “Daily fetal movement count, heart rate monitoring was done.”

Initially weight was recorded at the first visit in the first trimester. Then the weight was again recorded just before the delivery. The first weight was subtracted from the later to get the overall gain in the weight while pregnant. Birth weight of the neonate was recorded within 24 hours of delivery using the pre-zeroed electronic balance with the baby naked to the nearest of five gm. APGAR score was estimated at five min after delivery.

3.2. Statistical analysis

Microsoft Excel worksheet was used for the data entry. Proportions, mean and standard deviation were calculated. Chi square test was applied for proportions and analysis of variance test (F test) for difference in the mean values in >2 groups. $P < 0.05$ was taken as significant.

4. Results

There were only two women with underweight before pregnancy. Weight was normal in 75.1% before conception and 23.8% were either overweight or obese before conception. (Table 1)

Women with pre-pregnancy underweight had either normal GWG or less than normal GWG but no one had more than normal. In the normal pre-pregnancy BMI category, 51.4% had less than normal GWG, 45.8% had normal GWG and only 2.8% had more than normal GWG. In the Overweight and obese, only one woman had GWG < normal (< 7 kg), 62.2% had Normal GWG (7 – 11.5 kg) and 35.6% had GWG > normal (> 11.5 kg). Thus, it is seen from the above table that as the pre-pregnancy BMI increased, the incidence of the GWG more than normal increased. (Table 2)

The differences between mean GWG among the underweight females before conception, normal and overweight or obese were not significant statistically. (Table 3)

The mean birth weight was lowest in females who were underweight before conception compared to other categories. This difference was found to be statistically

Table 1: Distribution of antenatal women as per pre-pregnancy BMI

Pre pregnancy BMI	Number	%
Underweight	2	1.1
Normal	142	75.1
Overweight and obese	45	23.8
Total	189	100

Table 2: Gestational weight gain (GWG) in different categories of pre-pregnancy BMI

Pre pregnancy BMI	Gestational weight gain categories	Number	%
Underweight	GWG < normal (<12.5 kg)	1	50
	Normal GWG (12.5 – 18 kg)	1	50
	GWG > normal (> 18 kg)	0	0
Normal	GWG < normal (<11.5 kg)	73	51.4
	Normal GWG (11.5 – 16 kg)	65	45.8
	GWG > normal (> 16 kg)	4	2.8
Overweight and obese	GWG < normal (< 7 kg)	1	2.2
	Normal GWG (7 – 11.5 kg)	28	62.2
	GWG > normal (> 11.5 kg)	16	35.6

Table 3: Association between the pre-pregnancy BMI and gestational weight gain

Pre-pregnancy BMI	Number	%	Mean GWG	+ 2SD	F	P
Underweight	2	1.1	11.0	2.8	1.38	0.255
Normal	142	75.1	11.6	2.5		
Overweight and obese	45	23.8	10.9	2.2		

Table 4: Association between pre-pregnancy BMI and birth weight

Pre-pregnancy BMI	Number	%	Mean birth weight	+ 2SD	F	P
Underweight	2	1.1	2.2	0	4.12	0.018
Normal	142	75.1	3.0	0.4		
Overweight and obese	45	23.8	3.1	0.3		

Table 5: Effect of pre-pregnancy BMI on gestational diabetes (GDM), pregnancy induced hypertension (PIH) and mode of delivery

Variables	Pre-pregnancy BMI	Number	%
Gestational diabetes	Underweight	0	0
	Normal	7	4.9
	Overweight and obese	3	6.7
Pregnancy induced hypertension	Underweight	0	0
	Normal	4	2.8
	Overweight and obese	1	2.2
Cesarean section	Underweight	1	50
	Normal	62	43.7
	Overweight and obese	25	55.6

significant ($p < 0.05$). (Table 4)

The incidence of GDM was more in females who were overweight and obese before conception i.e. 6.7%. The incidence of PIH was more in females who were normal weight before conception. Incidence of cesarean deliver was also more in females who were overweight and obese before conception i.e. 55.6%. (Table 5)

5. Discussion

In the present study, Majority of the women that is 75.1% had normal body mass index before the pregnancy. Women in the present study who were underweight before the pregnancy had either normal Gestational weight gain or less than normal GWG. These women with lower than normal BMI had babies with birth weight lower compared to other categories (females with normal and overweight or obese categories before conception). Females who were

overweight or obese before conception had more incidence of GDM and LSCS.

Ross JL et al¹¹ reported that infant birth weight was correlated with the lower BMI in women before pregnancy. They also reported a positive correlation between weight gain during pregnancy and infant birth weight. We found similar findings.

We observed that, 23.8% of women had high body mass index of which only 0.5% women had less gestational weight gain than recommended. 14.8% of women had recommended weight gain and 8.5% had more than that of recommended. Crane JM et al¹² and Stotland NE et al¹³ from their study concluded that pre pregnancy BMI determines the GWG.

In the present study, most of the women with high BMI before conception had recommended weight gain. It was observed that women with low BMI before conception had less GWG; women with normal BMI before conception had near to normal gain in the weight. Vahratian A et al¹⁴ recommended that “the rate of GWG between 20 weeks of delivery was about 0.5 kg/week with wide range.” We also report results which are similar to this particular research.

A study on BMI before conception and pregnancy outcome shows that “obesity before conception is a risk factor for GDM, PIH, induction of the labor and more amount of the LSCS.”¹⁵ We also found that pre-pregnancy overweight and obesity had higher incidence of gestational diabetes and resulted in more proportion of cesarean section deliveries.

6. Conclusion

Gestational weight gain among majority of women had recommended weight gain. As women in underweight BMI group were only two, definite conclusion on underweight BMI and less gestational weight gain can-not be commented. Women with recommended weight gain had better outcome. Overweight and obese pre-pregnant status was not associated with gestational diabetes. Rate of cesarean section was more in high pre-pregnancy BMI group.

7. Source of Funding

None.

8. Conflict of Interest

None.

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