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Original Research Article

Determination of Maternal Weight Gain and Fetal Outcome in Relation to Pre-pregnant Body Mass Index

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Abstract

Background: *Worldwide there is increasing incidence of obesity among women and is related to adverse maternal pregnancy outcome such as Gestational hypertension, Gestational diabetes, Preeclampsia, cesarean section and on fetal birth weight. Considering this with the effects on pregnancy outcome and fetal outcome, this study is to bring out the association of maternal pre-pregnant Body Mass Index (BMI) and weight gain to south Indian setup. Objective: 1.To study the association between pre-pregnant BMI with maternal weight gain during pregnancy and fetal birth outcomes. 2. Relationship between hypertension and diabetes with weight gain.*

Methods: *We studied 250 pregnant women at Velammal medical college Hospital and calculated their pre-pregnant BMI and Average weight gain during pregnancy; we also collected risk factors and complications during pregnancy and the fetal weight at birth. We analyzed the relationship between pre-pregnant BMI with average weight gain during pregnancy, weight gain with risk factors and complications, weight gain with fetal birth weight.*

Results: *The average weight gain during pregnancy in our study was 9 Kg. and average fetal birth weight was 2.8 Kg.*

Conclusion: *This study shows that pre-pregnant BMI is not related to risk factors during pregnancy except gestational diabetes and pre eclampsia with a marginal increase in overweight and obese category. There was a linear correlation with increase in cesarean section rate in obese group.*

Keywords: *Pre-pregnant. Body Mass Index. Obesity. Weight gain. Birth weight.*

Introduction

Obesity is a global health problem and has its implication on pregnancy and its outcome. The associations are increase in miscarriage, anomalies, gestational diabetes, hypertension, instrumental delivery, increase in cesarean section rate and increased maternal morbidity and mortality.[1]

It is generally accepted that women should not try to lose weight during pregnancy; hence aim is to

limit the weight gain during pregnancy. The WHO cut points for average weight gain during pregnancy Table 1.

Pre-pregnancy low BMI have an increased risk of preterm and low birth weight baby[3] and also causes obesity and hypertension in offspring[4]. Pre-pregnancy increased BMI have an increase in risk of Gestational hypertension and hypertension in pregnancy[5,6]; it also increases the risk of cesarean section, infection, hemorrhage and maternal mortality during deliver[7,8]

Several studies have shown that higher the Pre-pregnancy BMI, lower the pregnancy weight gain[9,10]. Studies have shown that gestational diabetes and gestational hypertension is also independent of pre-pregnancy BMI[11].The present study is to evaluate the average maternal weight gain during pregnancy in relation to pre-pregnancy BMI and t find out the risk factors and fetal weight at birth.

Materials and Methods

This prospective observational study was conducted in Velammal Medical College, Madurai, Obstetrics and Gynecology department among 250 pregnant women with a singleton pregnancy in cephalic presentation. . Patients were included in the study after obtaining consent and study was conducted after Ethical clearance.

Data were collected from the patient, their height and weight recorded when Urine pregnancy test was positive, BMI was calculated by the formula weight in Kg/ Height in $m^{2.}$ Patients were followed during pregnancy and their average weight gain was noted, risk factors like gestational diabetes, hypertension, and the mode of delivery were noted. Fetal birth weight and post- delivery wound infections were followed-up. These women are categorized according to WHO BMI standards and the results were analyzed for each group.

Exclusion criteria were: Mal-presentations, placenta previa, cardiac and endocrine disorders, those who do not know pre-pregnancy weight.

All the data were analyzed by Statistical Package for Social Science/Statistical Product and Service Solutions (SPSS) computer software. Pearson Chi-square test was used to find out any significant statistical relation between the variables. A p-value < 0.05 was considered to be significant, p <0.01 is highly significant and p>0.05 is considered as non-significant.

Results

A total of 250 pregnant women were selected among inclusion and exclusion criteria. Among them 19 cases (7.6%) had BMI <18.5, 89 cases (35.6%) under BMI 18.6-24.9, 87 cases (34.8%) under BMI overweight 25-29.9 and 55 cases (22%) in obese category of BMI >30.

The average weight gain in our study was 9 kg during pregnancy and in each category is, in underweight about 10.7 Kg, in normal BMI group it was 9.9 Kg, overweight patients gained about 8.2 Kg and obese group of 8 Kg (Table 2, Table 3and Fig1). Thus, average weight gain in our study is significant with p value 0.000

The average fetal weight in our study area and population is 2.82Kg. The fetal birth weight in each group is shown in Table 2, Table 3 and Fig2. It shows that fetal weight gain in underweight group is less (2.65 kg) whereas in overweight group (2.86kg) and obese group it is 2.85kg proving increase in maternal Pre-pregnant BMI increases the fetal weight during birth (Table3 and Fig2).

There was no correlation with the risk factors and Pre-pregnancy BMI in our study. Gestational Diabetes and Pre-eclampsia was slightly higher in overweight and obese group. Comparison of risk factors with each category is shown in table 4. There was an increase in cesarean section rate in obese group, out of 55 women in obese group, 13 cases had normal delivery, 20 cases (8%) had primary LSCS and 22 cases (8.8%) had repeat LSCS Fig3. There was no post- delivery wound infections in any category of patients.

Table 1: The 2009 Institute of Medicine recommendation for total weight gain for pregnant women

BMI ($Kg/m^{2)}$	Recommended weight gain(Kg)
<18.5	12.5 to 18
18.5 to 24.9	11.5 to 16
25 to 29.9	7 to 11.5
>30	5-9

Table 2: Descriptive form for average weight gain during pregnancy

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Age	Underweight	Normal	-3.097*	1.087	.024	-5.91	-.29
		Overweight	-3.538*	1.089	.007	-6.36	-.72
		Obese	-4.186*	1.144	.002	-7.15	-1.23
	Normal	Underweight	3.097*	1.087	.024	.29	5.91
		Overweight	-.441	.648	.904	-2.12	1.24
		Obese	-1.089	.738	.454	-3.00	.82
	Overweight	Underweight	3.538*	1.089	.007	.72	6.36
		Normal	.441	.648	.904	-1.24	2.12
		Obese	-.647	.741	.818	-2.56	1.27
	Obese	Underweight	4.186*	1.144	.002	1.23	7.15
		Normal	1.089	.738	.454	-.82	3.00
		Overweight	.647	.741	.818	-1.27	2.56
Avgwt gain	Underweight	Normal	.7818	.6819	.661	-.982	2.546
		Overweight	2.4495*	.6833	.002	.682	4.217
		Obese	2.6878*	.7181	.001	.830	4.545
	Normal	Underweight	-.7818	.6819	.661	-2.546	.982
		Overweight	1.6677*	.4068	.000	.615	2.720
		Obese	1.9060*	.4628	.000	.709	3.103
	Overweight	Underweight	-2.4495*	.6833	.002	-4.217	-.682
		Normal	-1.6677*	.4068	.000	-2.720	-.615
		Obese	.2383	.4648	.956	-.964	1.441
	Obese	Underweight	-2.6878*	.7181	.001	-4.545	-.830
		Normal	-1.9060*	.4628	.000	-3.103	-.709
		Overweight	-.2383	.4648	.956	-1.441	.964

*. The mean difference is significant at the 0.05 level.

Table 3: Comparison with group

		Sum of Squares	df	Mean Square	F	Sig.
Age	Between Groups	258.151	3	86.050	4.653	.003
	Within Groups	4549.449	246	18.494		
	Total	4807.600	249			
Avgwt gain	Between Groups	232.357	3	77.452	10.637	.000
	Within Groups	1791.178	246	7.281		
	Total	2023.535	249			
Fetal Weight	Between Groups	.796	3	.265	1.364	.254
	Within Groups	47.840	246	.194		
	Total	48.636	249			

Table 4: Complications during Pregnancy in each Group

		BMI Range								Total	
		Underweight		Normal		Overweight		Obese			
		Count	% of Total	Count	% of Total	Count	% of Total	Count	% of Total	Count	% of Total
Complication	Anaemia	0	0.0%	0	0.0%	0	0.0%	3	1.2%	3	1.2%
	BOH/GHT	0	0.0%	1	.4%	0	0.0%	0	0.0%	1	.4%
	Chronic HT	0	0.0%	1	.4%	0	0.0%	2	.8%	3	1.2%
	GDM	0	0.0%	3	1.2%	4	1.6%	1	.4%	8	3.2%
	GDM /Fibroid	0	0.0%	0	0.0%	1	.4%	0	0.0%	1	.4%
	GHT	0	0.0%	2	.8%	1	.4%	3	1.2%	6	2.4%
	GHT/Anaemia	0	0.0%	0	0.0%	1	.4%	0	0.0%	1	.4%
	GHT/IUGR	0	0.0%	0	0.0%	1	.4%	0	0.0%	1	.4%
	GTH/oligo	0	0.0%	0	0.0%	0	0.0%	1	.4%	1	.4%
	IUGR	1	.4%	1	.4%	0	0.0%	0	0.0%	2	.8%
	Nil	16	6.4%	75	30.0 %	75	30.0 %	41	16.4%	207	82.8%
	Oligohydramnios	1	.4%	3	1.2%	2	.8%	2	.8%	8	3.2%
	Pre Eclampsia	1	.4%	3	1.2%	2	.8%	2	.8%	8	3.2%
Total		19	7.6%	89	35.6 %	87	34.8 %	55	22.0%	250	100.0%

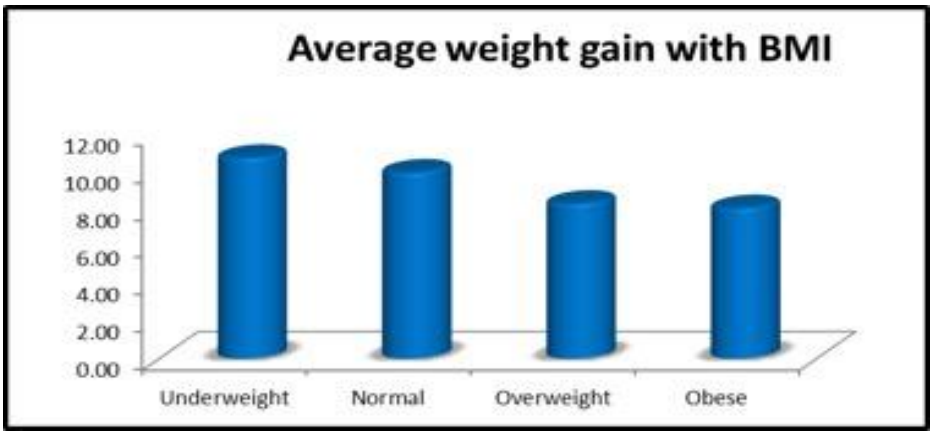

Figure 1: Average weight gain during pregnancy decreases as pre-pregnant BMI is more

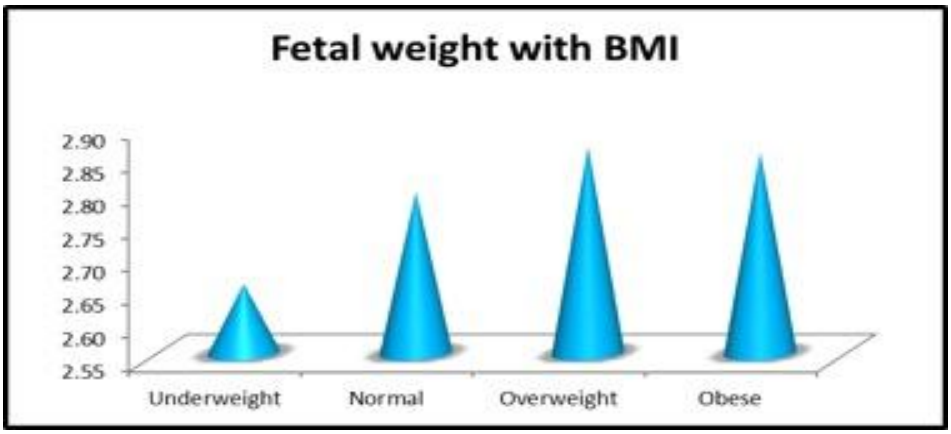

Figure 2: More the Pre-pregnant BMI more the fetal weight at birth

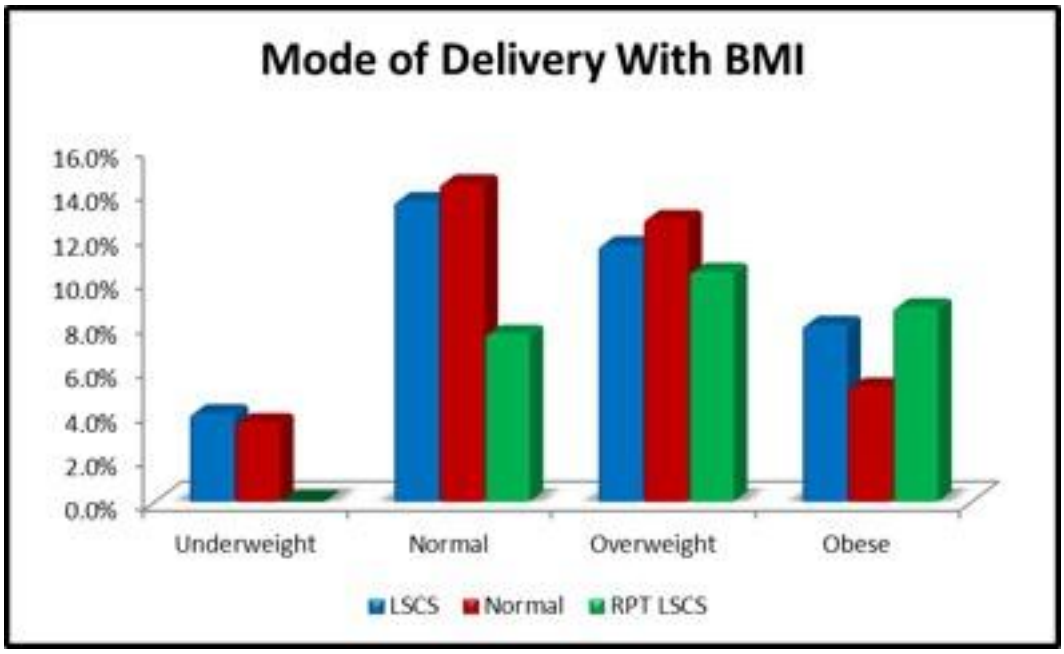

Figure 3: Increase in caesarean section rate in obese group

Discussion

The results from the current studypresent that weight gain was slightly lower when pre-pregnancy BMI was higher. Obese women gained 9 Kg average weight throughout pregnancy whereas under-weight women gained about 10.7 Kg. This can be because of routine dietary advice by consultants or personal efforts not to gain too much weight. Similar study by Barbara H et all[12] showed that the average weight gain was 10.9, 10.2, 8.4 and 4.3 Kg in lean, normal weight, overweight and obese group respectively.

Our study shows that risk factors like Gestational diabetes and pre-eclampsia have no co-relation with maternal pre-pregnant BMI. This is in consistent with previous study shown that gestational diabetes and gestational hypertension is independent of pre-pregnancy BMI[11]. Other studies showed that hypertension and gestational diabetes were more common in obese group[13]. Increased average weight gain during pregnancy also showed increase in gestational hypertension. In contrast Nohr et all[14] study showed that there is less weight gain during pregnancy in women with gestational diabetes , may be because of dietary advice given to these patients.

The rate of successful vaginal delivery decreases when the pre-pregnant BMI is overweight or obese. Obese women are at risk for complications during delivery. A meta- analysis of 33 studies showed that the odds ratio of cesarean section were 1.46, 2.05, and 2.89 among overweight, obese and severely obese group respectively when compared to normal pre-pregnant BMI[15]. According to Ehrenberg et all[16] there was 2-3 fold increase in cesarean delivery rate in obese group when compared to women with normal pre-pregnant BMI. Our study showed a similar result that there is increase in cesarean section rate in obese and overweight group in comparison with normal weight gain.

In addition to increase in operative delivery obese group also have risk of wound infections and thromboembolic events. They also have anesthetic complications like failed intubation[17]. Our study did not show any risk of wound infections or any other post-operative complications.

The 'fetal origin' theory states that changes in fetal nutrition results in developmental changes that change the structure, physiology and metabolism resulting in overweight or obesity in adulthood[18]. Malnutrition or over-nutrition in the mother have a linear correlation on the weight of the offspring and also have a risk of obesity in adulthood. The incidence of big baby and macrosomia was higher in women with obesity

and those who gain more weight during pregnancy. Johnson et al[19], reported a retrospective cohort study which shows that there is higher incidence of macrosomia and increased cesarean section rate in women who gain more weight during pregnancy[20]. Our study also showed that the fetal weight gain was more in obese and overweight group in comparison with normal and underweight group whose fetal birth weight was less.

Conclusion

The incidence of maternal obesity and its risk conditions increases at an alarming rate, but still there is a lacuna in clinical care for such women. Thus strategies to improve awareness among public regarding the risks of maternal obesity and weight gain during pregnancy on offspring's are required.

This study shows that pre-pregnant BMI is not related to risk factors during pregnancy except gestational diabetes and pre eclampsia with a marginal increase in overweight and obese category. There was a linear correlation with increase in cesarean section rate in obese group, average weight gain during pregnancy. Therefore it is important to have an ideal pre-pregnant BMI of 18.5 to 24.9. The American College of Obstetrics and Gynecologist proved that 80% of them routinely counsel patients about their weight control, but only 35% believe that it has an effect[21].

Limitations: This study was performed for a small group and did not include age, education and socioeconomic status which can have an effect on Pre-pregnant BMI and average weight gain during pregnancy.

Consent: Obtained

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