Study of the Association Between Early Pregnancy Bmi and Gestational Weight Gain in Relation to Neonatal Birth Weight

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ABSTRACT Birth weight plays an important role in infant mortality and morbidity, childhood development and adult health. Low birth weight has a risk of type 2 diabetes and ischemic heart diseases in later life. Macrosomia increases the risk of caesarean section, delivery complications (i.e. shoulder dystocia) and subsequent childhood obesity. By doing this study, it would be possible to investigate the independent and combined association between early pregnancy BMI and infant birth weight, after controlling other maternal factors. 110 Patients with Singleton Uncomplicated Pregnancy [12 Weeks of Pregnancy and Delivering at Term with No antenatal complications] booked at Dr. D. Y. Patil Hospital, Kolhapur were included in the study. Their booking BMI, every ANC visit and overall pregnancy outcome was studied with the help of pre designed questionnaires. It has been seen that: 1. Lower BMI is significantly associated with lower birth weight.2.Increased weight gain in 2nd & 3rd Trimester is proportional to increased birth weight. The study findings support the need to balance pre pregnancy weight and gestational wt gain against risk of LBW and Macrosomia among lean and obese women. With proper counselling and advice about proper nutrition, weight gain and physical activity can come up with recommended range of wt gain and better neonatal outcome.

INTRODUCTION

Birth weight plays an important role in infant mortality and morbidity, childhood development and adult health. Low birth weight is a significant risk factor for adverse health outcomes, including many childhood diseases. Reduced birth weight is related to the risk of type 2 diabetes and ischaemic heart diseases in later life. At the other end of the birth weight spectrum, macrosomia increases the risk of caesarean section delivery, delivery complications (i.e. shoulder dystocia) and subsequent childhood obesity. The First Lady, Michelle Obama has promoted her "Let's Move Program" for controlling the Childhood Obesity Epidemic with 5 easy steps

- Move Everyday
- Try a new Fruit or Veggie
- Drink Lots of Water
- Do jumping jack to break up TV time
- Help make dinner

So Let's Move from beginning during ANC period to keep a check on BMI and neonatal outcome and help the First Lady to achieve her goals.

METHODOLOGY

In the present study, 110 pregnant women with singleton uncomplicated pregnancy, booked at Dr. D.Y. Patil Hospital, Kolhapur, by 12 weeks of pregnancy and delivering at term, were studied during the period of May 2013 to May 2015. The criteria taken into consideration for the study were as follows:

Study Design - This study was an observational correlational study with a sample size of minimum 110 cases.

Inclusion Criteria - Singleton uncomplicated pregnancy, booked for regular antenatal care by 12 weeks of pregnancy.

Exclusion criteria – Those having:

- Hypertension (PIH)

- Endocrinal problems (DM, THYROID)
- Multiple gestation
- Preterm delivery (before 37 completed weeks)
- Any medical illness complicating pregnancy

Methodology - Women with singleton pregnancy booked by 12 weeks of pregnancy and delivered at term, with no antenatal complications were included in the study. Informed consent was obtained from all participants. Participants were required to complete a questionnaire, which was given to them during their first visit. These questionnaires included basic information (name, age, occupation, education) of the participant and spouse, weight and height recorded at the first visit, weight gain throughout pregnancy, weight at 37 weeks of gestation, obstetric history (parity, any medical disorders complicating pregnancy, heart disease, preeclampsia, endocrine disorders), past and family history of any medical disorders, lifestyle factors like diet (veg /non veg) and any addictive habits. During the participant's antenatal check-ups detailed history and examination was done. Weight of the participant was recorded throughout every antenatal check-up. Information about the gestational age at delivery and birth weight of the neonate were collected from the case sheet following delivery. During the study, if patient developed any medical or obstetric complications, they were excluded from the study and new participants were included to maintain the sample size of 110.

RESULTS

Table 1: Weight gain according to BMI

Weight Gain In Kg	BMI (Kg/m²)				P Value
	<18.5	18.50-24.9	25.0-29.9	30.0 & above	
2nd Trimester	3.27±0.43	3.17±0.40	3.78±0.51	4.14±0.42	<0.001
3rd Trimester	4.03±0.30	4.28±0.50	4.89±0.49	5.09±0.29	<0.001
Total WT Gain	7.30±0.57	7.45±0.69	8.68±0.77	9.24±0.48	<0.001

Results are Mean Weight Gain

Table 2: Correlation of Birth weight with BMI

BMI (kg/m²)	No.	Birth weight (kg)				
		<2.50	2.50-2.99	3.00-3.49	3.50-3.99	4.0 & above
<18.5	32	29 (90.6%)	3 (9.4%)	0	0	0
18.5-24.9	39	0	22 (56.4%)	17 (43.6%)	0	0
25.0-29.9	28	0	0	13 (46.4%)	15 (53.6%)	0
30.0 & above	11	0	0	0	7 (63.6%)	4 (36.4%)
Total	110	29 (26.4%)	25 (22.7%)	30 (27.3%)	22 (20%)	4 (3.6%)
Inference	BMI is significantly associated with Birth Weight					

Table 3: Mean values of birth weight according to total weight gain

Total Weight Gain (Kg)	Birth weight (kg)	
	Min-Max	Mean±SD
6.0-6.9	2.12-3.63	2.56±0.56
7.0-7.9	2.00-3.35	2.66±0.38
8.0-8.9	2.31-4.14	3.04±0.55
9.0 & above	2.37-4.21	3.58±0.37
Inference	Increasing Total Weight Gain is positively and significantly associated with Increasing Birth Weight with P<0.001	

Table 4: Correlation of Gestational weight gain (net weight) and birth weight based on IOM weight gain recommendations

Weight Gain Based on IOM recommendation	Mean±SD		Correlation b/w WT Gain & Birth WT(Kg)	
	WT Gain (Kg)	Birth WT (Kg)	r value	p value
Weight Gain below Recommendation	7.37±0.66	2.66±0.39	0.276	<0.001
Weight Gain within Recommendation	8.81±0.52	3.61±0.23	0.232	<0.001
Weight Gain above Recommendation	10.00±0.00	4.07±0.10	0.045	<0.001

Table 5: Pearson correlation between early pregnancy BMI with weight gain and birth weight

Pair	Pearson Correlation	P Value
BMI and Weight Gain 2nd Trimester	0.515022294	<0.001
BMI and Weight Gain 3rd Trimester	0.668043661	<0.001
BMI and Total Weight Gain	0.694710955	<0.001
BMI and Birth Weight (Kg)	0.956813012	<0.001

Table 6: Correlation of Baseline variable with Weight Gain and Birth Weight

Variables	Mean±SD		Weight Gain Vs Birth Weight (Kg)	
	Weight Gain (Kg)	Birth Weight (Kg)	r value	p value
Socio-Economic Variables				
Lower Class	7.95±0.90	3.04±0.62	0.737	<0.001
Lower Middle	7.83±1.03	3.01±0.56	0.683	<0.001
Upper Middle	8.02±0.84	2.97±0.62	0.686	<0.001
Education Level				
< 12Yrs In School	7.83±1.01	3.07±0.56	0.646	<0.001
> 12Yrs In School	7.95±0.94	2.96±0.60	0.736	<0.001
Working Status				
Housewife	7.85±1.02	3.00±0.59	0.682	<0.001
Working	7.98±0.86	3.01±0.56	0.694	<0.001
Parity				
Nullipara	7.97±0.96	3.02±0.57	0.706	<0.001
Multipara	7.81±0.98	2.98±0.60	0.656	<0.001
BMI (Kg/m²)				
< 18.5	7.30±0.57	2.32±0.14	0.356	<0.001
18.5 - 24.9	7.45±0.69	2.93±0.28	0.189	<0.001
25.0 - 29.9	8.68±0.77	3.55±0.19	0.127	<0.001
30.0 & above	9.24±0.48	3.90±0.18	0.425	<0.001

DISCUSSION

The women in our study were divided into four BMI groups based on their early pregnancy BMI. The BMI at presentation of <18.5kg/m2 was seen in 29.0% of our study population. BMI between 18.5-24.9kg/m2 was seen in 35.5% of the women. BMI between 25.0-29.9kg/m2 was seen in 25.5% of the women. BMI of 30kg/m2 and above was seen in 10.0% of the women. Mean BMI±SD was 23.13±4.44. Majority of the women (35.5%) in our study population belonged to the normal BMI group and a small population (10.0%) belonged to the obese category. But it is unfortunate that there were 29.1% women in the underweight category.

It was seen that 90.6% of women in the lean group had birth weight less than 2.5kg whereas 63.6% in obese group had birth weight between 3.5 to 3.99kg. While in the normal BMI group, 43.6% had babies with birth weight of 3.0 – 3.49kg and 56.4% had babies with birth weight between 2.5 - 2.99kg where as in over weight group, 53.6% had babies with birth weight of 3.5 – 3.99kg and 46.4% between 3.0 – 3.49kg.

The net weight gain in the present study was seen to range between 6-10kg, the average being 7.90kg, similar to average weight gain recommended by Rode et al. When total weight gain was around 6-7kg the mean birth weight was 2.56±0.56, whereas when weight gain was above 9kg the mean birth weight was 3.58±0.37. Thus it was seen that increasing total weight gain is positively and significantly associated with increasing birth weight with p<0.001.

In the present study gestational weight gain was also studied using the three category approach (level of compliance with IOM guidelines). It was observed that 2.7% gained weight above the IOM recommendations, 65.5% gained weight below the IOM recommendations and 31.8%

gained weight within IOM recommendations

It was also noted that when weight gain was within the IOM recommendations babies had average birth weight of 3.61±0.23kg whereas when weight gain was below recommendations average birth weight was 2.66±0.39kg. But when the weight gain was above IOM recommendations there was no macrosomia seen, average birth weight being 4.07±0.10kg. This could be because the sample size of women who gained weight above the IOM recommendations was too small and the weight they gained was only 0.5 – 1.5kg above IOM recommendations for proper analysis to be made. Further study in this area in a larger group is needed to see if this association is of significance.

Interpretation of our results were limited by several factors, a relatively small sample size being one of them. Though the number of women enrolled in the beginning of study was high, women had to drop out of the study if they developed any complications like preeclampsia, GDM. As the incidence of both these complications were high with increasing BMI, more in the overweight and obese group, the sample size in these two groups reduced, thus making it difficult to interpret the results.

Early pregnancy BMI measures were based on weight at first booking visit <12 weeks period of gestation, though weight gain was almost negligible in 1st trimester, some variation of 0.5–1.0kg was noted in women who booked by 10–12 weeks.

Weight gain in this study is based on information at 37 weeks of gestation, i.e. for women delivering 2-3 weeks later total weight gain in pregnancy could be higher.41

The relationship between pre-pregnancy BMI and fetal growth is biologically plausible, although the direct pathway by which pre-pregnancy BMI influences infant birth weight is not known. In a review of the relationship between maternal BMI, energy intake and pregnancy outcomes

CONCLUSION
Pre pregnancy body mass index and gestational weight gain influence neonatal birth weight and play significant roles in adverse pregnancy outcomes including low birth weight and macrosomia. In this study we examined the association of maternal weight gain on infant birth weight in the four BMI groups and we tested the IOM recommendations in this population.

The study shows weight gain in pregnancy is significantly increased with increasing BMI. The results of our study suggest that maternal pre pregnancy BMI is positively associated with neonatal birth weight, after adjustment for other maternal characteristics

It was seen in our study that increasing total weight gain was positively and significantly associated with increasing birth weight. It was further observed that weight gain in 3rd trimester contributed more to birth weight.

The study findings support the need to balance pre pregnancy weight and gestational weight gain against risk of LBW and Macrosomia among lean and obese women.

Counselling and Advice-proper nutrition, weight gain and physical activity can come up with recommended range of weight gain and with better neonatal outcome.

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