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Correlation of obesity and underweight with fetomaternal outcome

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Abstract: *The World Health Organisation (WHO) categorises a BMI equal or greater than 25 as 'overweight', equal or greater than 30 as 'obese' and equal to or less than 18.5 as 'underweight'* ***Objective****: This study was conducted to study impact of underweight and obese women and their weight gain during pregnancy on fetomaternal outcome.* ***Method:*** *This is a prospective, non-interventional, observational study on 500 women (BMI between 20 and 30 were excluded). Women attending GVPIHC & MT OPD with singleton pregnancy at or before 16 weeks were included and BMI calculated in early pregnancy. Their weight gain during pregnancy was noted. Any complications in the mother or Neonatal were noted.****Results:*** *Incidence of obesity in our institute was 17% and that of underweight was 19%. Pre-Eclampsia, Gestational hypertensions, Gestational Diabetes mellitus, Antepartum hemorrhage, all were more common among obese women, while anemia and Fetal Growth rate babies were more common in the underweight. Post-dated pregnancy, induction of labor, cesarean delivery, and postpartum complications were more common in obese women. Fetal complications were also higher in obese patients.* ***Conclusion:*** *Lower as well as higher pre-pregnancy BMI is an independent risk factor that is associated with increased morbidity and mortality in both the mother and the fetus.*
Keywords: *Pregnancy, Obesity, Underweight, BMI, FGR*

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I. Introduction

Overweight/obesity in women of childbearing age is a serious public-health problem, especially in "developing" countries. In China, from 1992 to 2010, the prevalence of overweight or obesity in women aged 18–44 years increased from 16.8% to 26.4% and from 3.1% to 9.0%, respectively [1]. Worryingly, these estimates of prevalence are higher in "developed" nations. In the UK, the prevalence of maternal obesity has more than doubled from 7.6% to 15.6% from 1989 to 2007; respectively .Obesity is attaining the status of global epidemic worldwide. Overall, in 2014, about 13 % of the world's adult populations (11% of men and 15% of women) were obese. In 2014, more than 1.9 billion adults, 18 years and above, were overweight. Of these, over 600 million were obese[1,2]. According to National Family Health Survey (NFHS)[2], the percentage of married women (15-49 years) who are overweight or obese increased from 11 % (NFHS 2) to 15% (NFHS 3). Undernutrition is more prevalent in rural areas, whereas obesity is three times higher in urban area.

India is unique as it suffers from a dual burden of obesity and malnutrition. More than one-third (36%) women have BMI lower than 18.5. In India, a higher number of malnourished women reside in Chhattisgarh, Bihar, and Jharkhand, whereas most of the obese women are from Punjab, Delhi, and Kerala[3]

The World Health Organisation (WHO) categorises a BMI equal or greater than 25 as 'overweight', equal or greater than 30 as 'obese' , and equal than or less than 18.5 as 'underweight'[3]

Obesity during pregnancy carries a higher risk (1.32 times) of morbidity and mortality for both mother and the fetus. On the other hand, underweight is associated with FGR & anemia, and PIH. Weight gain during pregnancy has a recommended range throughout 40 weeks of pregnancy. If the weight gain is more or less than the proposed, it is associated with an adverse outcome for both the mother and the baby [4]

II. Material and Method

This was a prospective, observational study on 500 pregnant underweight women with BMI less than 19.9 and obese women with BMI more than 30 at Gayatri Vidya Parishad Institute of Health care & Medical Technology, Visakhapatnam

Sample size :500.

- As per study of Agarwal et. Al. [23] Incidence of IUGR in obese is 7:4% and in underweight it is 0%. In underweight incidence was assumed 3% sample size was calculated by using following formula

N=(q1+p2q2)(Z-alfa/2+Z1-beta)square÷(p2-p2)

In present study we enrolled 352 underweight and 148 obese subjects.

Inclusion criteria: Singleton pregnancy at/before 16 weeks of gestational age (before any significant impact of weight gain).

Exclusion criteria:

Women with BMI 20-29.9,
Multiple pregnancies,
Major structural anomaly and
Medical complications such as diabetes and hypertension.

BMI was calculated and women were categorized into 5 groups:
Group A, Underweight <19.9 kg/m^2;
Group B, Normal = 20-24.9 kg/m^2 (excluded);
Group C, Overweight = 25-29.9 kg/m^2 (excluded);
Group D, Obese = 30-34.9 kg/m^2;
Group E, Morbidly obese > 35 kg/m^2 (no woman was in this group).

In both groups, weight gain was noted according to Institute of Medicine (IOM)[5] criteria on regular basis till delivery, along with the complications and outcome. The outcomes of labor and delivery were compared between both groups.

Statistical Analysis: Descriptive statistics were calculated for all study variables. Continuous variables were presented as the mean and standard deviation, while categorical data were calculated as percentage. Bi-variate analysis was done to examine the association between pre-pregnancy BMI and fetomaternal outcomes. The data were analyzed statistically using SPSS version 21.0 software. Chi square test/ fishers exact test was used as the test of significance. A p value of <0.05 was considered significant.

III. Results

A total of 1200 women were enrolled in this study from January 2017 to August 2018. After applying inclusion and exclusion criteria, 500 women were included in the study sample. Among these 500 women, 352 were obese and 148 were underweight. There was not a single woman in the morbidly obese group.

Women who were obese before pregnancy had a mean age of 22 year obese women were mostly from Madhurawada and Visakhapatnam area, as compared to lean women with mean age of 18-19 years. Lean women were mostly from rural area nearby Marikivalasa who were working in Private organizations & House wifes.

Table 1 Comparison of weight gain and mode of delivery in both groups

	Obese (N = 148)		Under Weight (N = 352)		P-value
	Count	%	Count	%	
Weight gain					
Below normal	21	14%	99	28%	<0.001
Normal	84	57%	145	41%	0.001
Above normal	43	29%	107	31%	0.76
Mode of Delivery					
Vaginal	66	44%	252	72%	<0.001
LSCS	82	56%	100	28%	<0.001
Labor Process					
Spontaneous	68	46%	296	84%	<0.001
Induced	80	54%	56	16%	<0.001

Table 2: Comparison of maternal & fetal complications in both groups

	Obese (N = 148)		Under Weight (N = 352)		P-value
	Count	%	Count	%	
Meternal Complication					
Gestational Diabetes mellitus	9	6%	7	2%	0.02
Macrosomia	10	7%	4	1%	<0.001
PRE-Eclampsia	43	29%	45	13%	<0.001
Geststional Hypertension	32	21%	46	13%	0.02
Fetal Growth Rate	12	8%	22	6%	0.45
Anemia	12	8%	38	11%	0.36
APH	13	8%	18	5%	0.12
Fetal Weight					
<2KG	14	10%	31	9%	0.82
2-3 KG	43	29%	233	66%	<0.001
3-4 KG	75	51%	88	25%	<0.001
>4KG	16	11%	0	0%	<0.001
Fetal Complications					
Still birth	10	7%	6	2%	0.003
Early neonatal death	5	3%	7	2%	0.35

An interesting observation was that a higher total weight gain in pregnancy led to more antenatal complications (Table 3). Preterm as well as post-term delivery is more common in the obese women. Anemia was more prevalent in lean women, whereas postpartum complications such as PPH and infections & Operative delivery were frequently seen in obese women.

IV. Discussion

Pregnancy is a valuable event in the life of a woman. During pregnancy, a woman often visits the antenatal clinics. Small and simple parameter like weight gain over the past visit is often ignored by the busy obstetricians. Ideal weight gain is an important factor for a good feto-maternal outcome. Obesity is emerging as an epidemic worldwide. We were surprised to see the incidence of obesity in the antenatal woman as 15%, not too far behind from that of the U.S, where it is 18% in some antenatal clinics [6.] Incidence of underweight was 17%, almost similar to that of obesity.

Table-3 Comparison of time of delivery between the two groups

	Obese (N = 148)		Under Weight (N = 352)		P-value
	Count	%	Count	%	
Preterm	27	18%	50	14%	0.25
Term	80	54%	240	68%	0.003
Post-term	41	28%	62	18%	0.01

Although pregnancy complications in obese women are well documented, the evidence in relation to problems of underweight is less clear[7.] In this study, we have compared both the extremes of BMI with fetomaternal outcome.

In 2009, IOM put forth new guidelines regarding the gestational weight gain in relation to BMI[5.] The pregnancy and gestational weight gain, whether excessive or inadequate, are associated with a poor fetomaternal outcome.

The women in our study were mostly 18-19 years old in the underweight group and 22 years old in the obese group. They usually had unplanned pregnancy and low awareness about nutrition and its impact on pregnancy.

Evidence across different obstetric populations is consistent that increased prepregnancy BMI associates with increased obstetric interventions such as labor induction and surgical interventions[8,9.] In support of these reports, Table 1 results showed that intranatal problems such as induction and cesarean section were more likely in the obese group. Increase in the risk of cesarean section rate after induction was independent of

obstetric complications and confounding factors. One hypothesis for increased risk of cesarean section after induction includes altered uterine contractility combined with dysfunctional labor. Furthermore, priming the myometrium for transitioning from quiescence to contractility may be altered with increased BMI and adipose tissue mass [10]

After adjusting for all confounding factors, we found positive association of BMI with Gestational Diabetes mellitus, pre-eclampsia, Gestational Hypertension, and APH (Table 2). Nan Li et al.[11] and other previous studies concluded that obesity is associated with adverse pregnancy outcomes such as Gestational Diabetes mellitus and pregnancy-induced hypertension.

Consistent with the previous results, we found significantly high incidence of still birth with high BMI. Single most common modifiable factor for still birth in developed world is maternal obesity[12.] According to Auckland prospective stillbirth study[13,] obesity is an independent risk factor.

We found a significant correlation of obese women with fetal weight. The same has been shown in other study. Maternal obesity is a strong predictor of fetal birth weight or large for gestational age[14,15,16,17] Recently, Modi et al.[18] have shown that increasing maternal BMI is associated with the increasing abdominal and intra hepatocellular lipid content in neonatal offspring. It was observed that with the increase in abdominal circumference, neonatal morbidity increased.

We found significantly high proportion of mothers whose weight gain during pregnancy is above normal are with various complication in comparison to those mothers whose weight gain in pregnancy is normal or below normal except incidence of FGR is high in mothers with low weight gain there is positive association between gestational weight gain and Gestational Diabetes mellitus, Macrosomia, Gestational Hypertension, & Pre-eclampsia. As data is catagorical, chi-square test is applicable. This association was consistent with the previous results [11.]

Table 3 showed that incidences of preterm and post-term delivery both are high in the obese group. However, data supporting the preterm delivery in obesity are less conclusive [19,20,21] A recent meta-analysis provided evidence that the association between preterm birth and obesity may vary depending upon the subtype of preterm births [22]

Obesity and excess weight gain are associated with preterm birth, Macrosomia, and stillbirth, while underweight BMI and low weight gain have been associated with small for gestation or Fetal Growth rate and preterm births.

Among studies related to risk factors for PPH, BMI is rarely considered as a risk factor for PPH. In these studies, results are inconsistent with the one showing no association of BMI with PPH[23,] but others showing positive association [24.]Our study is very much similar with study done by Agrawal S.et.al.and Ray JG[23-25]

There is a direct impact of high or low BMI on hospital admission and short-term costs to the health services.

V. Conclusion

In our study, we observed that both groups correlated well with various adverse fetomaternal outcomes. Apart from deleterious impact on pregnancy, obesity may also affect clinical decision for the management of labor and delivery, which ultimately may have repercussion on health care cost and maternity services. Thus, not only the antenatal period, but the intranatal as well as the postnatal period may be adversely affected in relation to BMI.

There is a lack of studies on underweight pregnant women. Our study shows its association with anemia only. Given a choice, obesity is more commonly associated with worse fetomaternal outcome. Weight is a very simple parameter which can be easily measured. So weight gain during pregnancy is an important clinical parameter to be followed. Identifying an obese or an underweight pregnant woman allows a proper planning throughout the antenatal period for any risk management. So referral to a dietician for dietary assessment and counseling should be considered for both lean and obese women.[26]

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