

A STUDY ON EFFECT OF BODY MASS INDEX (BMI) ON PREGNANCY OUTCOME

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ABSTRACT

Background: There is rising concern to take needed measures in normalizing the weight gain in antenatal women. There are many negative effects on the pregnancy outcome in relation with BMI.

Aims: To study the incidence of abnormal BMI in the pregnant women attending antenatal outpatient clinic. To assess the effect on maternal outcome in relation with BMI. To correlate the perinatal outcome in relation with BMI.

Materials and methods: Prospective descriptive study conducted at Government maternity hospital (Osmania medical college), Hyderabad, Telangana. Total 1000 patients included in the study for a period of 2 years in Singleton gestation Follow-up and delivery. These women were then divided into 4 groups based on BMI categories.

Results: The study shows that the number of women belonging to abnormal BMI (53.8%) is high compared to those of normal BMI (46.2%). There is increased incidence of GDM and hypertensive disorders in overweight and obese women compared to underweight and normal group women. The incidence of low birth weight is highest in underweight group compared to other groups. The incidence of third stage complications like PPH, perineal injuries is higher in overweight and obese women, The incidence of macrosomia is higher in obese compared to overweight. The rate of postpartum infections and length of hospital stay is more in overweight and obese compared to other groups. The weight gain in all abnormal BMI groups is not satisfactory and resulted in various adverse outcomes.

Conclusion: This study explains the need of optimal weight gain and the necessity of pre-pregnancy counselling to spread awareness of importance of having a normal BMI.

Keywords: Body mass index (BMI), Underweight, Overweight, Obese.

INTRODUCTION

The body mass index (BMI), or Quetelet index is a term coined by Adolphe Quetelet. The BMI is calculated as weight in kilograms divided by the square of the height in meters (kg/m²). The nutritional status of a pregnant woman can be assessed by BMI. Both the extremes of BMI have adverse effects on the mother and the foetus. So, maintaining the right BMI is essential for the mother's health and for the growing foetus.

The increasing incidence of obesity among women worldwide has become one of the most significant public health concerns. High maternal body mass index (BMI) is related to adverse maternal pregnancy outcomes such as difficulty in achieving pregnancy, early and recurrent pregnancy loss. They have high incidence of pre-eclampsia, eclampsia, gestational diabetes mellitus, thrombo-embolic disease. Also, there is increased incidence of post term delivery, increased induction of labour, macrosomia, shoulder dystocia, operative vaginal deliveries and postpartum haemorrhage. Caesarean section rate also has increased in women with high BMI with associated anaesthesia challenges that include difficult epidural and spinal analgesia placement and complications from failed or difficult intubations and surgical complications like delayed wound healing, recurrent infections. The frequency of abdominal wound infections is directly related to BMI.^{1,2}

On the contrary, women with lower BMI are not without complications. They have increased incidence of anaemia, low birth weight babies, preterm delivery and increased perinatal morbidity and mortality. Optimal weight gain during pregnancy is essential to ensure enough nutrients for the development of foetus and to store enough nutrients in preparation for breast feeding. Insufficient weight gain can compromise the health of the foetus and cause preterm, or premature birth whereas excessive weight gain causes significantly larger for gestational age fetuses, postpartum weight retention, as well as increase the risk of requiring a caesarean section.^{3,4} we studied the incidence of abnormal BMI in the pregnant women attending antenatal outpatient clinic.

MATERIALS AND METHODS

Prospective descriptive study conducted at Government maternity hospital (Osmania medical college), Hyderabad, Telangana. Total 1000 patients included in the study for a period of 2 years

Inclusion Criteria: Singleton gestation Follow-up and delivery at our hospital.
Exclusion Criteria: Multiple gestation, Antenatal women with chronic diseases like chronic hypertension, diabetes, heart disease, epilepsy, tuberculosis, bronchial asthma.

Antenatal women coming to antenatal clinic, Government maternity hospital, Koti in the first trimester and singleton gestation who are planning to deliver in the same hospital were selected. They were informed about the study in detail and written consent was obtained. Detailed history was taken regarding name, age, area of residence and socioeconomic status. Obstetric history, past medical and surgical history, family history was taken in detail. General and systematic examination was done. Height in meters was measured by using standard charts. Women were made to stand erect without shoes, with both ankles together and with their heels, buttocks, occiput touching the wall. The head was held in such a position that the line joining the outer canthus of eye and tragus is horizontal line. Height was measured for all the women using the same chart.

Similarly, standard weighing machine was used to measure weight. Weight was noted in kilograms. Height in meters and weight in kilograms were used to calculate BMI.

These women were then divided into standard BMI categories.

1. BMI < 18.5 kg/m²
2. BMI 18.5 – 24.9 kg/m²
3. BMI 25- 29.9 kg/m²
4. BMI > 30 kg/m²

They were followed up throughout their antenatal period and their weight gain during pregnancy was also noted. All women were screened for GDM using OGCT and cutoff of 140 mg% was used and confirmation done with 75g OGTT. Their BP and urine albumin were checked during every antenatal checkup. Investigations – CBC, blood group, HIV, HbSAg, VDRL, Urine analysis, CT, BT were done for all patients. At least 3 ultrasound examinations were done for all patients. These women are followed up without any special intervention unless needed. Patients were advised in the beginning of the study to come for regular antenatal visits. If women end up in having cesarean section, they are given routine prophylactic antibiotics and are given parenteral antibiotics in post-operative period for 3 days. Regarding hospital stay, for normal vaginal delivery not more than 3 days, for assisted vaginal deliveries not more than 5 days and for cesarean section not more than 8 days. If its more than that it is considered as prolonged hospital stay.

Statistical

All the collected data is entered in the proforma and they were tabulated and analyzed and grouped depending on the outcome. Test chi square and fisher test were used for the statistical analysis. Critical value at 0.05 was significant. Maternal and fetal outcome was studied as follows:

Methods:

1. Antenatal period: Hypertension, Diabetes mellitus.

2. Labour:

- Gestational age at the time of delivery: preterm/term.
 - Spontaneous onset or Induced or elective cesarean section.
 - Mode of delivery: normal vaginal delivery or assisted vaginal delivery or cesarean section.
- Complications: postpartum hemorrhage or perineal injuries.

3. Neonatal outcome:

- Birth weight
- APGAR at 5 min
- NICU admission

4. Postpartum period:

- Length of hospital stay.
- Infections or wound gaping.

The antenatal women are categorized in regard to BMI, age, socioeconomic status and parity. The incidence of complications, onset of labor and mode of delivery and neonatal outcome are analyzed and tabulated.

RESULTS

Table 1: Categorisation of BMI

BMI category	Number	Percentage
Underweight (<18.5 kg/m ²)	118	11.8
Normal (18.5 – 24.9 kg/m ²)	462	46.2

Overweight (25 -29.9kg/m ²)	347	34.7
Obese (> 30kg/m ²)	73	7.3

This table shows the categories and distribution of BMI. Out of 1000 antenatal women, 46.2% are normal, 34.7% are overweight, 11.8% are underweight and 7.3% are obese.

Table 2: Incidence of GDM

	Underweight	Normal	Overweight	Obese	Chi- square	p-value
Incidence of GDM						
NIL	118(100)	442(95.6%)	319(91.9%)	44(60.2%)	110.98	<0.001
GDM	0	24(4.4%)	28(8.1%)	29(39.8%)		
Incidence of Hypertension						
NIL	116(98.3%)	428(92.6%)	296(85.3%)	57(78.1%)	28.44	<0.001
HTN	2(1.7%)	34(7.4%)	51(14.7%)	16(21.9%)		

The incidence is higher in obese being 39.8%, in normal group it is 4.4% and in overweight group it is 8.1%. p value is 0.0001 which is highly significant. The above illustration describes the incidence of Hypertension in obese as 21.9%, in overweight is 14.7%, normal is 7.4% and in underweight is 1.7% with a p value of <0.001 which is statistically significant.

Table-3: Incidence of various types of HTN

HTN	Underweight	Normal	Overweight	Obese	Chi- square	P- value
Total	2(1.7%)	34(7.4%)	51(14.7%)	16(21.9%)	2.136	0.9
GHTN	1(0.85%)	12(2.6%)	16(4.6%)	05(6.8%)		
Mild PE	1(0.85%)	11(2.5%)	12(3.5%)	04(5.5%)		
Severe PE		08(1.7%)	17(4.9%)	04(5.5%)		
Eclampsia		03(0.6%)	06(1.7%)	03(4.1%)		

The below table shows the incidence of all types of HTN are higher in obese and overweight compared to normal and underweight group. The incidence of GHTN is 6.8%, mild preeclampsia is 5.5%, severe PE is 5.5% and eclampsia is 4.1% in obese group antenatal women.

Table-4: Incidence of IUGR and Onset Of Labour

	Underweight	Normal	Overweight	Obese	Chi-square	P- value
IUGR	4(1.7%)	9(1.9%)	7(2.01%)	3(4.1%)	2.06	0.558
Spontaneous	111(94%)	422(91.4%)	293(84.4%)	58(79.5%)	17.92	0.000128
Induction	07(6%)	37(8%)	46(13.2%)	8(10.9%)		

Assisted vaginal delivery						
NVD	107(90.6%)	362(78.4%)	234(67.4%)	43(59%)	44.12	<0.001
ASVD	2(1.8%)	42(9%)	32(9.3%)	12(16.4%)		
LSCS	9(7.6%)	58(12.6%)	81(23.3%)	18(24.6%)		
Failed Induction						
Induction	7(6%)	37(8%)	46(13.2%)	8(10.9%)	12.21	0.057
Failed Induction	1(0.8%)	11(2.3%)	13(3.7%)	2(2.7%)		
Failed induction						
Total LSCS	9(7.3%)	58(12.6%)	81(23.3%)	18(24.6%)		
EMLSCS	9(100%)	52(89.6%)	73(90.1%)	11(61.2%)	67.77	<0.001
ELLSCS		6(10.3%)	8(9.9%)	7(38.8%)		
Indications for LSCS						
CPD	0	11(2.3%)	22(6.3%)	7(9.5%)		
Failed Induction	8(6.7%)	28(6.06%)	26(7.4%)	5(6.8%)	35.35	<0.001
Fetal Distress	1(0.8%)	10(2.1%)	14(4.03%)	2(2.7%)		
Others		9(1.9%)	19(5.4%)	4(5.4%)		

The table below shows the incidence of IUGR in obese as highest being 4.1%, in overweight as 2%, in normal is 1.9% and in underweight it is 1.7%. p value is 0.301 which is not significant. Rate on inductions and elective caesarean is more in overweight and obese compared to normal and overweight group with a p value of 0.000128 which is significant. Incidence of assisted vaginal delivery (instrumental delivery) and caesarean section rate is higher in overweight and obese when compared to normal and underweight with a p value of <0.001. Incidence of failed induction is comparatively higher in overweight and obese when compared to normal and underweight groups with a p value of 0.057 which is not significant.

Table-5: Gestational age at the time of delivery

GA	Underweight	Normal	Overweight	Obese	Chi- square	p-value
Term	109(92.3%)	435(94.1%)	326(93.9%)	67(91.7%)	1.006	0.779
Preterm	9(7.7%)	27(5.9%)	21(6.1%)	6(8.2%)		

The above table describes the incidence of preterm is almost similar in all groups but relatively higher in obese (8.2%) and underweight (7.7%) groups. In normal and overweight groups the incidence is 5.9% and 6.1% respectively. P value is 0.779 which is statistically not significant.

Table-6: Maternal and fetal complications

	Underweight	Normal	Overweight	Obese	Chi-square	P- value
postpartum hemorrhage	0	7(1.73%)	12(3.45%)	2(2.7%)	5.5	0.063

Perineal injuries	0	2(0.4%)	4(1.15%)	1(1.3%)	2.54	0.279
>4Kgs	0	0	4(1.15%)	3(4.1%)	13.17	0.00028
<2.5kgs	19(16.1%)	32(6.9%)	27(7.7%)	7(9.5%)	10.58	0.014
NICU Admission						
no	101(85.6%)	406(87.8%)	292(84.2%)	55(75.4%)	8.63	0.034
yes	17(14.4%)	56(12.1%)	55(15.8%)	18(24.6%)		
APGAR at 5 mins	8.1	8.5	8.7	8.3		
Postpartum Infection						
No	117(99.2%)	454(98.3%)	321(92.5%)	68(93.2%)	21.81	0.000071
Present	1(0.8%)	8(1.7%)	26(7.5%)	5(6.8%)		
Hospital Stay	20(16.9%)	74(16%)	79(22.8%)	24(32.8%)	14.2	0.0021

Incidence of postpartum hemorrhage is higher in overweight group being 3.45% followed by obese group in which it is 2.7%. p value is 0.063 which is not significant. Incidence of perineal injuries are more in obese (1.3%) and overweight (1.15%) due to incidence of macrosomia and instrumental deliveries in these categories with a p value of 0.279 which is not significant. Rate of macrosomia is high in obese (4.1%) and overweight (1.15%) and nil in normal and underweight category women. p value is 0.00028 which is statistically significant. Incidence of low birth weight is highest in underweight category women (16.1%) compared to other groups. In obese it is 9.5%, in overweight group it is 7.7% and in normal group 6.9% with a p value of 0.03 which is significant. Rate of NICU admission is higher in obese(24.6%) and overweight(15.8%) compared to underweight(14.4%) and normal(12.1%) groups. APGAR of babies at 5 min on an average is without any significant difference. The above illustration shows that the incidence of postpartum infection is higher in overweight (7.5%) and obese (6.8%) when compared to underweight and normal groups.

Table-7: Weight gain in all groups of women

Weight Gain in Kgs	Number of cases(percentages)
Underweight	
Low (<12.5)	82(69.4%)
Normal (12.5-18)	36(30.6%)
High (>18)	0
Normal BMI	
Low (<11.5)	39(8.4%)
Normal (11.5-16)	251(54.3%)
High (>16)	172(37.3%)
Overweight BMI	
Low (<7)	0
Normal (7-11.5)	166(47.8%)
High (>11.5)	181(52.2%)
Obese	

Low (<5)	0
Normal (5-9)	26(35.6)
High (>9)	47(64.4)

The above table describes that the weight gain is less in majority (69.4%) and optimal in 30.6%. There is normal weight gain in 54.3%, high in 37.3% and low in 8.4%. Weight gain in overweight group is high in majority being 52.2% and normal in 47.8%. The above table shows that the weight gain is high in majority (64.4%) and it is normal in 35.6%.

DISCUSSION

This study is about the effect of BMI on maternal and neonatal outcome. The study was done in Government maternity hospital, Hyderabad. The study was conducted on 1000 antenatal women who attended to antenatal clinic. They were categorised according to their BMI and follow up was done throughout the antenatal, intrapartum and postpartum period and maternal and neonatal outcome was analysed. Out of 1000 pregnant women in the study, 11.8% belonged in underweight, 46.2% in normal, 34.7% in overweight and 7.3% in obese categories. Abnormal BMI altogether is 53.8% which is more than the normal BMI group. Both extremes of BMI have their adverse effects on pregnancy. The incidence of various pathological conditions has been studied. In this discussion we can go through the negative influence of abnormal BMI in pregnant women.

In our study we have seen the incidence of GDM is highest in obese which is 39.8%. In overweight group it is 8.2% and in normal group it is 4.4%. In various studies on effects of BMI, there is proven higher incidence of GDM in obese group of individuals due to multiple factors. The incidence of hypertension is 21.9% in obese, 14.7% in overweight, 7.4% in normal and 1.7% in underweight group. They are again categorised depending upon the severity and type of hypertension as follows: the incidence of Gestational hypertension is 0.85% in underweight, 2.6% in normal, 4.6% in overweight and 6.8% in obese. The incidence of mild preeclampsia is 0.85% in underweight, 2.5% in normal, 3.5% in overweight and 5.5% in obese. Severe preeclampsia is seen in 1.7% in normal, 4.9% in overweight and 5.5% in obese. Eclampsia is seen as 0.6% in underweight, 1.7% in normal and 4.1% in obese.

The above findings conclude that the incidence of hypertension and also the severity is higher in overweight and obese group women. Previous research has found a strong association between increasing BMI and pregnancy induced hypertension.⁴ A meta-analysis of the risk of pre-eclampsia associated with maternal BMI. We also found a significantly lower risk of pre-eclampsia in underweight women {OR 0.6 (95% CI 0.5 – 0.7)}, a finding corroborated by Sebire et al.⁵

The incidence of IUGR is 1.7% in underweight, 1.9% in normal, 2% in overweight and 4.1% in obese. The occurrence of IUGR along with hypertensives is one of the causes of their relatively higher incidence in obese women. Several studies investigating the relationship of maternal obesity with fetal growth have shown that obese women have an 18 – 26% increased chance of delivering large for date infants, even after controlling for maternal diabetes.^{6,7,8}

The rate of induction is 6% in underweight, 8% in normal, 13.2% in overweight and 10.9% in obese. The rate of failed induction is 0.8% in underweight, 2.3% in normal, 3.7% in

overweight and 2.7% in obese. The induction and failed induction rates are higher in overweight and obese compared to normal and underweight.

The incidence of preterm delivery is 7.7% in underweight, 5.9% in normal, 6.1% in overweight and 8.3% in obese. Cnattingius⁹ found no association between preterm delivery before 37 weeks and prepregnancy weight, although the risk of very preterm delivery before 33 weeks was increased in overweight nulliparous women. This was corroborated by our results, which showed that the risk of preterm delivery before 33 weeks was higher in the obese group, but not in the morbidly obese. On the other hand, Sebire et al⁵ found that delivery before 32 weeks was significantly less likely in the obese.

The rate of caesarean section is 7.3% in underweight, 12.6% in normal, 23.3% in overweight and 24.6% in obese. The rate of caesarean is highest in obese group of women. The incidence of postpartum hemorrhage and perineal injuries respectively are 1.73%, 0.4% in normal; 3.45%, 1.15% in overweight; 2.7% and 1.3% in obese. The complications are more in obese and overweight women. The incidence of macrosomia is 1.15% in overweight and 4.1% in obese and absent in underweight and normal group women. The incidence of low birth weight is higher in underweight group being 16% and in remaining groups it is 6.9%, 7% and 9.5% respectively. The rate of postpartum infections is higher in obese and overweight being 6.8% and 7.5% respectively. In normal group it is 1.7% and in underweight it is 0.8%. The length of hospital stay is increased in obese and overweight compared to others.

Krishnamoorthy *et al*¹⁰ suggest that all pregnancies in obese women be acknowledged as high risk and managed according to strict guidelines. Management should include prepregnancy counselling to reduce weight; shared antenatal care and appropriate management of complications. The evidence for obesity as an important complication in pregnancy is mounting; it is time to inform practice based on this evidence.

In view of the above risks the American College of Obstetricians and Gynecologists (ACOG)⁶ has recommended as Preconception counseling for obese women who are planning a pregnancy. BMI should be recorded for all women at the initial prenatal visit. Information concerning the maternal and fetal risks of obesity in pregnancy should be provided. Overweight women (BMI 25-29.9) should be advised to gain no more than 15 to 25 pounds during pregnancy, and obese women (BMI = 30) no more than 15 pounds during pregnancy. Obese women should be offered nutrition consultation, and they should be encouraged to follow an exercise program. This should be continued after delivery. Screening for gestational diabetes at the initial prenatal visit with repeated screening later in pregnancy if the results are negative. Women with a BMI of 35 or greater who have preexisting medical conditions, such as hypertension or diabetes, may benefit from a cardiac evaluation. Consultation with Anesthesiology prior to delivery. Use of compression stockings, hydration, and early mobilization during and after cesarean delivery should be encouraged. Consultation with weight loss specialists before attempting another pregnancy. In addition studies show that wound complications in obese women undergoing cesarean delivery may be reduced by closure of the subcutaneous tissue in women with at least 2 centimeters of subcutaneous adipose tissue. Whereas, prophylactic use of subcutaneous drainage does not prevent

significant wound complications after cesarean delivery. A vertical skin incision appears to be associated with a higher rate of wound complications than a transverse incision.¹¹

Promoting A Healthy Lifestyle As noted above the American College of Obstetricians and Gynecologists (ACOG) recommends women at an unhealthy weight should be offered both nutrition consultation and an exercise Promoting A Healthy Lifestyle.¹²

Lastly, breast feeding can help patients to lose the weight gained during pregnancy, and may also have a small protective effect against childhood obesity. This study demonstrates that women overweight and obese are considered as high risk. The effect of maternal underweight on obstetric performance is less clear. Obesity is an Important area of interest on which no guidelines are available. Research and clinical trials are needed in field of obstetric towards evidence based care of obese women, which Necessitates Present Study.¹³

CONCLUSION

To conclude, pregnancy complications related to maternal BMI is one of the major growing problems. Maternal basal BMI has strong association with pregnancy complications and outcome. Both obese and overweight women have an increased incidence of gestational diabetes, hypertension, rates of induction, instrumental delivery, third stage complications, macrosomia, postpartum infections and prolonged hospital stay.

Preterm labour and low birth weight is associated with low BMI. As there is no adequate knowledge regarding the importance of having proper diet during pregnancy mainly in low socio economic class people, all attempts should be made to maintain a normal BMI in women of childbearing age. Pre-pregnancy counseling, health programs and appropriate multidisciplinary management should be done.

It appears that higher prepregnancy BMI had more adverse effects on obstetrics outcomes in our study. We should consider both prepregnancy BMI and gestational weight gain during follow-up in pregnancy and before pregnancy; women with high BMI should be advised to lose weight and not to gain much weight. Limited attention and interest in preconception counseling regarding risks of overweight or obesity by health care professionals were noted, which may contribute to women's unawareness of these risks on preconception health.

REFERENCES

1. Pi-Sunyer FX. Obesity: criteria and classification. Proceedings of the Nutrition Society. 2000 Nov;59(4):505-9. Roberto CA, Swinburn B, Hawkes C, et al. Patchy progress on obesity prevention: emerging examples, entrenched barriers, and new thinking. Lancet 2015; Volume:385 Issue:9985 Pages: 2400-2409.
2. Ogden CL, Carroll MD, Lawman HG, et al. Trends in Obesity Prevalence Among Children and Adolescents in the United States, 1988-1994 Through 2013- 2014. JAMA. 2016;315(21):2292–2299.
3. Marcel Bilger Eliza J. Kruger Eric A. Finkelstein 2017 Health economics: Measuring Socioeconomic Inequality in Obesity :2017: Volume26, Issue8 August.
4. Bhattacharya, S., Campbell, D. M., Liston, W. A., & Bhattacharya, S. Effect of Body Mass Index on pregnancy outcomes in nulliparous women delivering singleton babies. BMC public health,2007: 7, 168.

5. Sebire NJ, Jolly M, Harris JP, Regan L, Robinson S. Is maternal underweight really a risk factor for adverse pregnancy outcome? A population based study in London. *BJOG*. 2001;108:61–66.
6. Bianco AT, Smilen SW, Davis Y, Lopez S, Lapinski R, Lockwood CJ. Pregnancy outcome and weight gain recommendations for the morbidly obese woman. *Obstet Gynecol*. 1998;91:97–102
7. Baeten JM, Bukusi EA, Lambe M. Pregnancy complications and outcomes among overweight and obese nulliparous women. *Am J Public Health*. 2001;91:436–440.
8. Weiss JL, Malone FD, Emig D, Ball RH, Nyberg DA, Comstock CH, Saade G, Eddleman K, Carter SM, Craigo SD, Carr SR, D'Alton ME, FASTER Research Consortium. Obesity, obstetric complications and caesarean delivery rate – a population based screening study. *Am J Obstet Gynecol*. 2004;190:1091–1097.
9. Cnattingius S, Berfstrom R, Lipworth L, Kramer MS. Prepregnancy weight and the risk of adverse pregnancy outcomes. *N Engl J Med*. 1998;338:147–152.
10. Krishnamoorthy U, Schram CMH, Hill SR: Maternal obesity in pregnancy: is time for meaningful research to inform preventive and management strategies?. *BJOG*. 2006, 113: 1134-1140.
11. Institute of Medicine: Nutrition during pregnancy: part I: Weight gain. 1990, Washington DC. The National Academy of Sciences
12. Mota P , Pascoal AG , Carita AI , Bo K . The Immediate Effects on Inter-rectus Distance of Abdominal Crunch and Drawing-in Exercises During Pregnancy and the Postpartum Period . *Sports Phys Ther* 2015 ; 45 : 781 – 8 .
13. Cary GB , Quinn TJ . Exercise and lactation: are they compatible? *Can J ApplPhysiol* 2001 ; 26 : 55 – 75.