



MATERNAL BODY MASS INDEX (BMI) ON PREGNANCY AND PERINATAL OUTCOMES.

Gynaecology

Dr. Chandrakala Murthy

III yr Post graduate, Dept. Of Obstetrics & Gynaecology, Yenepoya Medical College, Mangalore. Karnataka.

Dr. Annie Rajaratnam.*

Associate Professor, Dept. Of Obstetrics & Gynaecology, Yenepoya Medical College, Mangalore. Karnataka. *Corresponding Author

ABSTRACT

Maternal obesity has been associated with adverse pregnancy outcomes such as pre-eclampsia, eclampsia, pre and post-term delivery, induction of labor, macrosomia, increased rate of caesarean sections and post-partum hemorrhage. The aim of our study was to determine the maternal risk in terms of antepartum, intrapartum, postpartum complications and perinatal outcome in relation to extremes of maternal Body Mass Index (BMI). A total of 100 patients were studied and followed up till delivery. Any adverse pregnancy and perinatal outcomes were noted and the data was analyzed using Chi-square tests and percentages. Women with an above-normal BMI had a higher incidence of pre-eclampsia, induction of labor, caesarean section, pre-term labor, and macrosomia than women with a normal BMI (controls). Thus increased BMI increases the incidence of induction of labor, caesarean section, pre-term labor and macrosomia. The BMI of women in the first trimester of pregnancy is associated with the risk of adverse pregnancy and perinatal outcomes.

KEYWORDS

Body mass index, gestational diabetes mellitus, gestational hypertension, preeclampsia, induction of labour and macrosomia.

Introduction:

The increasing incidence of obesity among women worldwide¹ has become one of the most significant public health concerns.² Overweight and obesity are risk factors for non-communicable diseases (NCD's) and therefore important targets for health promotion and prevention. Increasing prevalence of NCD's, is due to growing urbanization and related changes in lifestyle such as changes in diet, physical activity, smoking habits and alcohol use.^{2,3}

In the latest report, the World Health Organization (WHO) has indicated that approximately 1.6 billion adults are overweight and around 400 million are obese. Obesity thus becomes a major contributor for global burden of chronic diseases and disabilities.² Most of the developing countries including India are now facing a double burden because of extreme socioeconomic distribution. On one side, there is overweight and obesity which has reached epidemic proportions and on the other there is underweight and undernourishment. In India, 26% of pregnant women are overweight and 8% are obese.³

The increasing prevalence of overweight and obesity in women of reproductive age is related to adverse maternal pregnancy outcomes during pregnancy, delivery and the postpartum period for both mother and offspring, such as anaemia, gestational hypertension, pre-eclampsia, eclampsia, gestational diabetes mellitus (GDM), thromboembolic disorders, pre- and post-term delivery, induction of labor, cesarean delivery, postpartum hemorrhage, macrosomia, maternal, perinatal and infant deaths.^{3,4}

Aims and Objectives :

1. To determine the maternal complications in antepartum, intrapartum, and postpartum with association to extremes of maternal BMI.
2. To determine the perinatal outcome in relation to extremes of maternal BMI.

Inclusion criteria:

1. Primigravida and multigravida with singleton pregnancy.
2. Booked cases with their first visit before 12 weeks of gestation.
3. No history of any medical disorders.

Exclusion criteria:

1. Multiple pregnancy.
2. Presence or history of any medical disorder such as diabetes mellitus, chronic hypertension,

cardiac or endocrine disorders and surgical conditions.

3. Previous caesarean delivery.

Materials & Methods:

This was a prospective cohort study conducted in a tertiary care centre from Jan 2016 to Dec 2017. A total of 100 pregnant women both primi and multigravida with a singleton uncomplicated pregnancy with cephalic presentation was included in study. Detailed general physical and systemic examination was performed. Baseline routine investigations were done. All patients under the study were counselled to have follow-up visits as per the standard protocol till delivery. The data about the following pregnancy outcomes were collected during labour and birth: pre-eclampsia, induction of labour, caesarean section, preterm delivery, postdate delivery, weight and apgar scores of the babies were also assessed. Neonatal intensive care unit (NICU) admissions were recorded. Gestational age was calculated from the first day of the Last Menstrual Period (LMP) or taken from the dating ultrasound scan that was performed before 12 weeks of pregnancy. The BMI was calculated based on the formula weight (kgs) / height (m²). The women were categorized into five sub groups according to their first trimester BMI as follows: (According to the WHO and NIH guidelines).

Underweight: BMI ≤ 19.9 kg/m ²	Group 1
Normal : BMI of 20-24.9 kg/m ²	Group 2
Over weight : BMI of 25-29.9 kg/m ²	Group 3
Obese : BMI of 30 -34.9 kg/m ²	Group 4
Morbid obese: BMI > 35 kg/m ²	Group 5

The group with a normal BMI (20 - 24.9 kg/m²) was used as reference group for the analysis.

The obstetrical outcomes studied:

- Miscarriage.
- Impaired glucose tolerance (IGT) & GDM.
- Gestational hypertension.
- Pre-eclampsia / Eclampsia.
- Anaemia.
- Preterm delivery.
- Mode of delivery.
- Postpartum complications.

The neonatal outcomes studied:

- Birth weight.
- NICU admission.
- Perinatal death.

Statistical analysis:

Data on categorical variables were presented by frequencies and percentages and Pearson's Chi Square test for categorical variables were used to examine pregnancy and perinatal outcomes by BMI categories.

Results:

A total of 100 pregnant women were enrolled in our study. **Table 1** includes details on Groups, Categories and BMI. **Table 2** shows number of cases and categories in each group out of which 7% of the cases were underweight, 47% had normal weight, 35% were overweight, 8% were obese and 3% were morbidly obesity. The most common age at first antenatal visit was 21-30 years as depicted in **Table 3**. **Table 4** shows 46% were nulliparous and 54% multiparous.

Table 1: Category and group of patients based on BMI

Group	Category	BMI
1	Underweight	≤18.5 kg/m ²
2	Normal	18.5-24.9 kg/m ²
3	Overweight	25-29.9 kg/m ²
4	Obese	30-34.9 kg/m ²
5	Morbidly obese	≥35 kg/m ²

Table 2: Number of cases in each group

Group	BMI	Category	Number of cases
1	≤18.5kg/m ²	Underweight	7 (7%)
2	18.5-24.9 kg/m ²	Normal	47 (47%)
3	25-29.9 kg/m ²	Overweight	35 (44%)
4	30-34.9 kg/m ²	Obese	8 (2%)
5	≥35 kg/m ²	Morbidly obese	3 (3%)

Table 3: Age-wise distribution

Group	BMI	<20	21-30	31-35	Total
1	<18.5	0	6	1	7
2	18.5-24.9 kg/m ²	4	36	7	47
3	25-29.9 kg/m ²	3	28	4	35
4	30-34.9 kg/m ²	0	2	6	8
5	≥35 kg/m ²	0	1	2	3
	Total	7	73	20	100

Table 4: BMI Category based on parity

Group	BMI	Primigravida	2-3	≥ 4	Total
1	<18.5	(1) 14.3%	(4) 57.1%	(2) 28.6%	(7) 100%
2	18.5-24.9 kg/m ²	(25) 53.2%	(15) 31.9%	(7) 15.9%	(47) 100%
3	25-29.9 kg/m ²	(20) 57.14%	(12) 34.28%	(3) 8.57%	(35) 100%
4	30-34.9 kg/m ²	0	(2) 25%	(6) 75%	(8) 100%
5	≥35 kg/m ²	0	(1) 33.33%	(2) 66.66%	3 (100%)
	Total	46	34	20	100

Table 5: Complications during antepartum period

Complications	BMI Category				≥ 35	P value
	<18.5	18.5-24.9	25-29.9	30-34.9		
Antepartum haemorrhage	1 14.2 %	0 0.0%	2 5.7%	0 0.0%	0	0.004
Gestational diabetes mellitus	0 0.0%	1 2.1%	14 40%	0 0.0%	3 100%	0.001
Gestational hypertension	0 0.0%	0 0.0%	12 34.28%	4 50%	0	0.001
Pre-eclampsia	0 0.0%	0 0.0%	5 14.28%	2 25%	0	0.73
Eclampsia	0 0.0%	0 0.0%	3 8.57%	0 0.0%	0	0.000
Anaemia	4 57.1 %	0 0.0%	0 0.0%	0 0.0%	0	0.000

Compared to normal BMI, complications such as gestational

hypertension, gestational diabetes mellitus, pre-eclampsia and eclampsia were more common in Group 3,4 and 5. Anaemia was more common in Group 1 as depicted in **Table 5**.

Table 6: BMI- Mode of delivery and pregnancy outcomes

Pregnancy outcomes	BMI Category				≥ 35 n=3
	<18.5 n=7	18.5-24.9 n=47	25-29.9 n=35	30-34.9 n=8	
Spontaneous labour	6 85.7%	43 99.5%	16 45.7%	2 25%	1 33%
Induction of labour	1 14.3%	4 8.5%	19 54.28%	6 75%	2 66.6%
Normal delivery	6 85.7%	46 97.9%	14 40.0%	3 37.5%	1 33.33%
Caesarean section	1 14.28%	1 2.1%	21 60%	5 62.5%	2 66.6%
Preterm delivery	2 28.5%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
Post term delivery	0 0.0%	0 0.0%	2 5.7%	0 0.0%	1 33.3%
Postpartum haemorrhage	0 28.6%	0 0.0%	3 8.57%	1 12.5%	0 0.0%
Wound infections	0	0	8 22.85%	3 37.5%	1 33.3%

* Percentages and totals are based on responses

In comparison to women with normal BMI in Group 2, induction of labour, caesarean delivery postpartum haemorrhage and wound infection were more common in Group 2,3,4 & 5 respectively as mentioned in **Table 6**.

Table 7: Maternal BMI and birth weight

Birth weight	BMI				
	<18.5 n=7	18.5-24.9 n=47	25-29.9 n=35	30-34.9 n=8	≥ 35 n=3
< 2.5kg	5 71.4%	2 28.6%	0 0.0%	0 0.0%	0 0.0%
2.6- 3.5 kg.	2 4.3%	43 91.5%	2 4.2%	0 0.0%	1 100.0%
3.6-3.9	13 37.14%	3 8.5%	17 48.5%	2 5.71%	2 100.0%
≥ 4	0 0.0%	6 75%	2 25%	2 0.0%	1 100.0%
Mean birth weight	2.42	3.1	3.4	3.48	3.7
Total Count	20	57	21	2	100

*Mean birth weight was 3.48 kg

Table 8: BMI Categories by perinatal out comes

Perinatal outcomes	BMI Category				
	<18.5 n=7	18.5-24.9 n=47	25-29.9 n=35	30-34.9 n=8	≥ 40 n=3
Low birth weight	1 7.1%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
Macrosomia	0 0.0%	0 0.0%	2 5.71%	2 25%	1 33.3%
Apgar score >7 after 1 minute	4 0.0%	4 0.0%	11 31.4%	5 62.5%	0 0.0%
Apgar score >7 after 5 minute	0 0.0%	0 0.0%	4 1.3%	0 0.0%	2 66.6%
NICU	3 42.8%	4 8.5%	15 42.8%	5 0.0%	2 66.6%
Respiratory distress	3 42.8%	4 85	13 37.1%	3 37.5%	2 66.6%
Syndrome	0 0.0%	0 0.0%	2 5.7%	2 25%	0 0.0%
Meconium Aspiration Syndrome	1 14.2%	0 0.0%	0 0.0%	0 25%	0 0.0%

Deaths	1	0	0	0	0
	14.2%	0.0%	0.0%	25%	0.0%

*NICU admission were more common in Group 3,4 and

Discussion:

Our study shows an increased risk of cesarean sections, pregnancy induced hypertension (PIH), gestational diabetes mellitus and macrosomia for women with overweight or obesity. We noticed that the incidence of pre-eclampsia is increased with BMI which was similar to the findings by Robinson and Leonie et. al.⁵ Comparison of induction of labour in cases and reference groups showed that a lower BMI was associated with a lower induction of labour. This was similar to the results obtained by Ushakiran.⁶ There was no difference between cases and control groups in our study in regard to post-dated delivery which correlated well with a study by Seligman.⁷ BMI in the first trimester was related to birth weight. The maximum rate of macrosomia was found in obese / morbidly obese group of cases and it was minimal in BMI < normal. This was a similar picture in studies conducted studies by Ushakiran⁶ and Bhattacharya.⁸ Low APGAR score and NICU admissions were more frequent in BMI groups 3, 4 and 5. Scott-Pillai et al.⁹ also had similar findings in his study. Perinatal deaths were more common in underweight category because of low birth weight (LBW) and severe perinatal asphyxia which is similar to a study conducted by Cunningham.¹⁰

Conclusion:

This research demonstrates that maternal BMI is an important risk factor of pre-eclampsia. An increased BMI increases the incidence of induction of labour, caesarean section and macrosomia. Therefore it is advisable for pregnant woman to maintain a normal BMI between 20-24, before and during pregnancy by consulting their physician or a dietician prior to getting pregnant.

References:

1. Ng M, Fleming T, Robinson M, et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: A systematic analysis for the Global Burden of Disease Study 2013. *Lancet* 2014;6736:1-16.
2. Cecchini M, Sassi F, Lauer JA, Lee YY, Guajardo-Barron V, Chisholm D. Tackling of unhealthy diets, physical inactivity, and obesity: health effects and cost effectiveness. *Lancet* 2010;376:1775-1784.
3. Dalal S, Beunza JJ, Volmink J, et al. Non-communicable diseases in sub-Saharan Africa: what we know now. *Int J Epidemiol* 2011;40:885-901.
4. World Health Organization. Global Status Report on Noncommunicable Diseases 2010. Geneva: World Health Organization; 2011.5
5. Robinson HE, Dconnell CM, Joseph KS, Mcleod NL. Maternal outcomes in Pregnancies complicated by obesity. *Obstetric & Gynecology*. 2005;160(6):1357-1364.
6. Usha Kiran TS, Hemmadi S, Bethel J, Evans J. Outcome of pregnancy in a women with an increased body mass index. *Int. J of Obs and Gyn*. 2005;112(6):768-772.
7. Seligman LC, Duncan B, Branchtein L, Laio DS, Mengue SS, Schmidt MI. Obesity and gestational. Weight gain: Cesarean delivery and labor complications. *Rev Saude Publica*. 2006.
8. Bhattacharya S, Campbell DM, Liston WA, Bhattacharya S. Effect of body mass index on pregnancy outcomes in nulliparous women delivering singleton babies. *BMC Public Health* 2007;7:168.
9. Scott-Pillai R, Spence D, Cardwell CR, Hunter A, Holmes VA. The impact of body mass index on maternal and neonatal outcomes: a retrospective study in a UK obstetric population, 2004-2011. *Brit J Obs & Gyn*. 2013;120(8):932-9.
10. Cunningham CE, Teale GR. A profile of body mass index in a large rural Victorian obstetric cohort. *Med J Aust* 2013;198:39-42.