Original Research Paper

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EFFECT OF BODY MASS INDEX (BMI) IN EARLY PREGNANCY ON MATERNAL AND PERINATAL OUTCOME IN PRIMIGRAVIDA DELIVERING SINGLETON BABIES: AN OBSERVATIONAL STUDY

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KEYWORDS :

INTRODUCTION

Body mass index is defined as a value derived from weight and height of a person. It is also called as Quetelet's index. BMI = WEIGHT (in kilograms) / SQUARE OF HEIGHT (in meters). According to WHO and NIH guidelines BMI of individuals are classified as

WEIGHT STATUS	BODY MASS INDEX
Underweight	<18.5
Normal range	18.5–24.9
Overweight	25.0–29.9
Obese	>/=30
Class1	30–34.9
Class2	35–39.9
Class3	>/=40

Nowadays obesity exacerbates many health problems such as type2 diabetes mellitus, coronary heart disease, respiratory complications, osteoarthritis, etc. and BMI is helpful correlating marker of the same. Therefore, is a predictor of longevity.[1]It is important to study effect of maternal BMI on pregnancy and perinatal outcome as fetus is completely dependent on mother for growth and nourishment. Hence maternal BMI is also known as predictor of nutritional status of pregnant mother and development of the baby. It depends upon many factors such as influence of the environment, socioeconomic status of parents, nutrition of mother, education of mother, pre-pregnancy weight, genetic predisposition, etc. It is found that low maternal BMI is associated with increased risk of abortions, fetal growth restriction (FGR), new borns with low APGAR score, perinatal deaths.

Adverse effects of obesity in mothers are Gestational hypertension, Preeclampsia, Miscarriage, Gestational diabetes mellitus, Thromboembolism, Repeated lscs, Stillbirths, Poor labour outcome, Prolonged labour, less likely, Postdatism, Postpartum haemorrhage, Increase in need for induction of labour, Wound infection. Adverse effects of obesity in neonates leads to large for gestational age, Congenital anomalies, Early neonatal deaths. Therefore, ACOG committee recommends that obese women should reduce the in weight before planning .[3] Following measures are helpful to reduce obesity related complications in pregnancy: Pre-pregnancy counselling by experts, Lifestyle modifications. Use of calorie restricted diet and exercise Use of approved medications for weight loss and approved bariatric surgeries.

AIMS AND OBJECTIVES

- To analyse the effect of BMI in early pregnancy on maternal outcome.
- To analyse the effect of maternal BMI on perinatal outcome.

MATERIAL AND METHODOLOGY

This is a prospective observational study conducted in Department of Obstetrics and Gynecology in Indira Gandhi Government Medical College and Hospital, Nagpur, India from 2019 to 2020, after getting approval from Institutional Ethics Committee. Study population included patients coming in Antenatal Care OPD in the hospital and sample size was 400.

Inclusion criteria:

Patients willing to participate, primigravida with singleton pregnancy coming for ANC, Registration in first trimester and Age between 18-35 years.

Exclusion criteria:

Multiple pregnancy, multipara patients, congenital malformations, known medical disorders and migration from selected region.

Data was collected during first ANC registration, regular ANC visits, during labor, during deliveries, during post-partum period. The cases were categorized according to WHO BMI classification. Patients were followed up regularly with their antenatal care routine investigations and obstetric ultrasonography according to their gestational age. High risk factors such as gestational hypertension, gestational diabetes, abnormal weight gain was checked. Mode of delivery (vaginal / caesarian section), wound infection, hospital stay was noted. Perinatal out come data was collected according to birth weight of baby, APGAR score, duration of NICU admission. After collecting all the information, association of BMI in early pregnancy with all pre-decided variables studied.

The association of the variables which were quantitative in nature, analyzed using ANOVA test. The association of the variables which were qualitative in nature, analyzed using FISHER'S EXACT test. For statistical significance, p value of less than 0.05 was considered significant.

Study subjects were classified **according to age** in 4 groups. Out of 400 cases, 235 belonged to 21-25 years (58.75%). 81 cases belonged to 26-30 years (20.25%). 76 were of 26-27 years (19%) and 8 cases were of 31-35years(2%).

Out of 400 cases, maximum that is 230 cases belong to normal BMI group (57.5%). 118 cases belong to overweight group (29.5%). 25 cases belong to obese class 1 group (6.25%). 22 cases belong to underweight group (5.5%). Only 5 cases belong to obese class 2 group (1.25%).

Table no 1: Association of maternal outcomes with respect to BMI in present study

Maternal outcomes	<18.5 (Underweight)	18.5-24.99 (Normal BMI)	25-29.99 (Overweight)	30-34.99 (Obese class 1)	35-39.99 (Obese class 2)	P value
Preterm delivery	11(50%)	8(3.48%)	10(8.47%)	6(24%)	3(60%)	<0.0001
Gestational diabetes	0(0%)	1(0.43%)	32(27.12%)	13(52%)	1(20%)	<0.0001
Hypertensive disorder	0(0%)	5(2.17%)	62(52.54%)	17(68%)	5(100%)	<0.0001
Induction of labour	0(0%)	8(3.48%)	49(41.53%)	11(44%)	3(60%)	<0.0001
Full term normal vaginal delivery	10(45.45%)	216(93.91%)	79(66.95%)	8(32%)	0(0%)	<0.0001
Full term normal vaginal delivery (assisted)	0(0%)	0(0%)	3(2.54%)	0(0%)	0(0%)	<0.0001
LSCS	1(4.55%)	8(3.48%)	36(30.51%)	16(64%)	5(100%)	<0.0001
Hospital stay >7 days	11(50%)	15(6.52%)	28(23.73%)	13(52%)	4(80%)	<0.0001
Wound infection	0(0%)	1(0.43%)	4(3.39%)	3(12%)	1(20%)	<0.0001

Association of gestational age at delivery with body mass index, In underweight group, out of 22 cases, 11 cases had **preterm delivery**(50%). In obese class 2 (5) cases 3 cases had preterm delivery (60%). Therefore, rate of preterm deliveries were high in underweight and obese class 2 and was statistically significant (p value <0.0001). It shows extremes of BMI can cause preterm deliveries.

On observing **gestational diabetes** with BMI- Of normal BMI, only 1 had gestational diabetes (0.43%). Of overweight, 32 had gestational diabetes (27.12%). From obese class 1, 13 cases had gestational diabetes (52%). And from obese class 2 group, 1 had gestational diabetes (20%). This states that as BMI increases, risk of gestational diabetes increases (p value <0.0001) and is significant.

On associating **hypertensive disorder** with body mass index, 62 cases of overweight group (52.54%), 17 (68%) of obese class 1 and 100% of obese class 2 group had hypertensive disorder. p value for this association is less than 0.001, which is significant. 53 cases of overweight group, developed gestational hypertension (85.48%), one (1.61%) mild pre-eclampsia, 5 (8.06%) severe pre-eclampsia and 3 developed eclampsia(4.84%).

On studying **induction of labor (IOL**) with respect to BMI, none of underweight, of normal BMI group 8 (3.48%), 49 (41.53%) of overweight group, 11 (44%) of obese class 1 and 3(60%) of obese class 2 underwent IOL. Therefore, we can conclude that as BMI increases incidence of IOL increases (p <0.0001).

3.39% cases of overweight group had **wound infection**. 12% cases of obese class 1group had wound infection. 20% cases of obese class 2 group had wound infection. Therefore, we can conclude that as BMI increases risk of wound infection increases with p value <0.001 which is significant.

Table no 2: Association of neonatal outcomes with respect to BMI

Neonatal outcomes	<18.5 (Underweight)	18.5-24.99 (Normal BMI)	25-29.99 (Overweight)	30-34.99 (Obese class 1)	35-39.99 (Obese class 2)	P value
Low birth weight	22 (100%)	90 (39.13%)	49 (41.53%)	16 (64%)	3 (60%)	<0.0001
Normal birth weight	0 (0%)	140 (60.87%)	66 (55.93%)	7 (28%)	0 (0%)	<0.0001
Macrosomia	0 (0%)	0 (0%)	3 (2.54%)	2 (8%)	0 (0%)	<0.0001
APGAR < 7 at 5 minutes	10 (45.45%)	10 (4.35%)	15 (12.71%)	8 (32%)	3 (60%)	<0.0001
NICU admissions	16 (72.73%)	16 (6.96%)	21 (17.80%)	13 (52%)	3 (60%)	<0.0001

Low birth weight babies were seen in 100% cases of underweight group. 39.13% cases of normal BMI group. 41.53% cases of overweight group. 64% cases of obese class 1 group. 60% cases of obese class 2 group. 60.87% cases of normal BMI group, 55.93% cases of overweight group, 28% cases of obese class 1 group were seen to have normal birthweight babies. 2.54% cases of overweight group, 8% cases of obese class 1 group were seen to have macrosomia babies. We can conclude that underweight group cases have high risk to have low birth weight babies. As BMI increases incidence of high birth weight babies increases. P value <0.001which is significant.

On associating **APGAR score with BMI**, for APGAR score less than 7: In underweight group, 45.45% babies were having APGAR calculated in 5 min was less than 7. In normal BMI group, it was 4.35%. In overweight, it was 12.71%. In obese class 1, it was 32%. In obese class 2, it was 60%.

72.73% of babies in underweight group had **NICU admission**. 6.96% of normal BMI group, 17.8% babies of overweight, 52% of obese class 1 and 60% of obese class 2 had history of NICU admission. So, BMI increases, risk of NICU admission increases and BMI decreases, the risk of NICU admission increases. P value < 0.001 i.e., significant.

DISCUSSION

Various studies found that pre-pregnancy maternal weight is helpful in assessing the risk of adverse pregnancy outcome. Underweight women more likely to deliver preterm babies and low birthweight babies. Overweight and obese women unequivocally have reproductive disadvantages. Obesity causes insulin resistance due to which low grade inflammation occur in fat, also epithelial dysfunction occur which ultimately leads to the central cause for preeclampsia.

On observing the distribution of present study with respect to age compared to a bunch of studies, following was observed:

Table no 3: Distribution of age with respect to various studies

STUDY	AGEINCIDENCE
Present study	21-25 (58.75%)
H SAshokKumar,et al	21-30 (65.45%)
HamidehPakniatet al	21-30 (49.4%)
SohineeBhattacharya et al	21-30 (58.06%)
NishuBhushanetal	21-25 (52.08%)
RScott-Pillai et al	25-30 (52.5%)

On observing distribution of cases with respect to BMI, In the present study, maximum cases or 57.5% were in normal BMI group(BMI 18.5-24.99), 29.5% cases were in overweight group (BMI 25-29.99) which is comparable to below mentioned studies.

Table no 4: Distribution of BMI with respect to various studies

STUDY	<18.5	18.5-24.9	25-29.99	30-34.99	>35
ShahlaYazdani, et al	12.8%	41.2%	35.6%	9.8%	0.6%
Ashok kumar et al	29.09%	33.06%	24.54%	9.09%	3.63%
Sohinee Bhattaet al[6]	11.7%	58.1%	21.9%	7.7%	0.6%
R Scott-Pillai et al[2]	2.8%	52.5%	27.8%	11%	3.9%
Vasudha Sawant et al	30%	34.5%	25.4%	10%	-
Present study	5.5%	57.5%	29.5%	6.25%	1.25%

For preterm delivery, In **Shahla Yazdani etal** study, it was found that women with BMI above normal had high percentage of preterm labour. As per **Sohinee Bhattacharya etal** there was no difference. **R.Scott Pillai etal** found that women with BMI above normal had high incidence.

For gestational diabetes, **Ashok Kumar et al** studied that women in normal BMI group and overweight group had high incidence of gestational diabetes mellitus. **Pooja M. Shah et al** studied that, there was high incidence of gestational diabetes in women with BMI above normal. **R. Scott Pillai et al** studied that obese women had high incidence of gestational diabetes. **Nishu Bhushan et al** said, the incidence of Gestational diabetes was high incases with BMI above normal. And, in the present study as BMI increases, incidence of gestational diabetes increased which was high in obese class 1 group than overweight group, which is comparable to that of below studies.

Shahla Yazdani etal reported that incidence of hypertensive disorders increases with increase in BMI above normal. According to **Ashok Kumar etal** the women who were Overweight/ obese/ morbidly obese had significantly high incidence of gestational hypertension, pre-eclampsia. **Pooja M. Shah et al, Hamideh Pakniat et al** and **Nishu Bhushan et al** found that incidence of chronic hypertension (11%) and pre-eclampsia (29.6%) was high in cases having BMI above normal. In **Sohinee Bhattacharya et al** study, incidence of pre-eclampsia was doubled with each 5 to 7 Kg/m2 increase in pre-pregnancy BMI. Also, there was a 3 times higher incidence of pre-eclampsia in obese (BMI 30 to 39.9 Kg/m2) and a 7 times higher incidence in morbidly obese (BMI > 40 Kg/m2) women and lower incidence of pre-eclampsiain underweight women.

Table no 5: Distribution of BMI with respect to preterm delivery, gestational diabetes and hypertensive disorder in various studies (I- <18.5, II- 18.5 to 24.99, III- 25 to 29.99, IV- 30-34.99, V- >35; values are in percentages)

Study	Preterm deliveries					Gestational diabetes					Hypertensive disorders				
	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V
Shahla Yazdani et al	1.6	22.2	4.7	6.1	0						3.9	4.6	8.7	12.2	3.3
Sohinee Bhatacharya et al	12.1	10.9	10.8	13.1	20.4						3.3	5	8.1	14.7	28.2
R. Scott Pillai et al. (odds ratio)	1.2	1	1.1	1.3	1.3	0.3	1	1.7	3.7	6	0.9	1	1.9	3.5	5
H. S. AshokKumar et al						0	13.5	3.7	0	0	2.7	3.7	20	25	-
Pooja M. Shah et al[9]						-	-	-	5.2	0	-	-	-	21	50
Hamideh Pakniat, et al						1.1	1	3.3	5.5	-	1.4	2.1	4.2	9.7	-
Present study	50	3.48	8.47	24	60	0	0.43	27.12	52	20	0	2.17	52.5	68	100

On comparing induction of labor with respect to BMI. **Shahla Yazdani et al** studied that women with BMI below normal were associated with lower incidence of induction.**Pooja M. Shah et al** said that maximum cases in the group with BMI above normal were induced. **Sohinee Bhattacharya et al** reported that with increasein BMI above normal, induction of labor increased. **R. Scott Pillai et a**l studied that incidence of induction of labour was high in overweight, obeseclass1and obese class 2 groups.

In **Shahla Yazdani et al, AshokKumaretal, Kamel et al, Pooja M.Shah etal** and **Hamideh Pakniat et al** study, incidence of LSCS was high in obese class1 group followed by overweight group. In **Jain Deepika et al** study, incidence of LSCS was high in overweight followed by obese group. **R. Scott Pillai et al** studied that women in overweight, obese class1 and class 2 had higher incidence of undergoing caesarean section.

Table no 6: Distribution of BMI with respect to induction of labour, full term normal delivery and lower segment cesarean section in various studies (I- <18.5, II- 18.5 to 24.99, III- 25 to 29.99, IV- 30-34.99, V- >35; values are in percentages)

Study	Induction of labour					Full term normal delivery					Lower segment cesarean section				
	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V
Shahla Yazdani et al	20.3	23.8	28.9	40.9	50						8.6	14.3	19.9	25.5	7.6
Pooja M. Shah et al	-	-	-	19	15	-	-	-	47.6	50				16	6
Sohinee Bhatta et al	24	27.2	33.4	42.8	49						11.3	16.4	24.1	30.8	42.7
R.Scott Pillai et al (odds ratio)	0.9	1	1.2	1.3	1.4	1	1	0.8	0.7	0.6	0.8	1.4	1.8	2.5	2.8
AshokKumar et al						86.2	80.5	68	55.5	76.7	13.8	19.5	32	44.5	23.3
Nishu Bhushan et al						81	64	55			17	32	37	-	-
Hamideh Pakniat et al											31	40.7	46.2	57.3	-
Jain Deepika et al[10]											-	22	57	-	-
Present study	0	3.48	41.5	44	60	45.4	93.9	66.9	32	0					

Ashok Kumar etal, Jain Deepika etal, Nishu Bhushan et al and**R.Scott Pillai etal** found that incidence of lowbirth weight babies was high in underweight group. **Pooja M. Shah etal** found that incidence of low-birth-weight babies was high in obese class 2 group. While in study by **Sohinee Bhattacharya etal** underweight and obese class 2 group both had high incidence of low birthweight babies.

Kamel et al study reported that there was high incidence of low APGAR score in overweight group. **R. Scott Pillai et al** observed that low APGAR score was more frequent in overweight and obese class1group.**AshokKumar etal, R. Scott Pillai et al, Pooja M. Shah, etal** and **Vasudha Sawant, et al** studied that NICU admissions were more frequent in overweight, obese class 1 and obese class 2. In **Nishu Bhushan et al** study, number of NICU admissions increased significantly with increase in BMI above normal.

CONCLUSION

This study shows that maternal BMI in first trimester affects maternal and foetal outcome. BMI below normal is associated with low birth weight babies while above normal is associated with gestational diabetes mellitus, hypertensive disorders, induction of labor, cesarean sections, wound infection, long hospital stay, macrosomic babies, low APGAR scores, NICU admissions.

So, pre-conceptional counselling has a big role regarding optimization of prepregnancy BMI. All women in reproductive age group should get adequate pre-conceptional counselling to attain normal BMI before conception. Also, obese women should not lose weight during pregnancy due to the risk of ketosis.

Health care professional should screen pregnant women with abnormal BMI for above risk factors and delivery should be conducted in well-equipped tertiary care center.

The small sample size and short span of study are the limitations of this study.

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Informed consent- The study was started after taking consent of subjects.

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