

Effect of Maternal Body Mass Index on Pregnancy Outcome

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Abstract

Introduction: Body weight is double edged sword, underweight as well as overweight are responsible for various medical illnesses, overweight pregnant women are more prone to gestational hypertension, preeclampsia, gestational diabetes mellitus, macrosomia, operative deliveries, wound infection, respiratory problems. Underweight pregnant women are more prone for anemia, preterm birth, intra uterine growth retardation, low birth weight babies.

Objective: To determine maternal and perinatal risk in over weight as well as underweight pregnant women.

Method: This is an observational study, conducted over a period of 4 months. Total 127 pregnant women admitted in hospital were included in the study as per inclusion criteria, their BMI was calculated and then all women grouped as per WHO guide lines, all patients were followed till delivery and again till the date of discharge and their obstetrics outcome was noted.

Result: Most of the patients were from the age group of 21-30, In our study we found that women with low BMI were associated with anemia, oligohydroamnios, preterm delivery, low birth babies, while women with high BMI were associated with gestational diabetes mellitus(GDM), pregnancy induced hypertension(PIH), instrumental vaginal deliveries, cesarean deliveries(LSCS), high birth weight babies, wound complications, respiratory tract infections.

Conclusion: It was concluded from our study that extremes of maternal BMI is related to adverse fetomaternal outcome, thus fetomaternal outcome can be improved significantly by prevention and treatment of overweight as well as underweight in pregnant women.

Keywords: Body Mass Index (BMI), overweight, underweight, maternal outcome, neonatal outcome.

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Introduction

Body weight is double edged sword, underweight as well as overweight are responsible for many medical illnesses. In the latest report, the WHO has indicated that approximately 1.6 billion adults are

overweight and around 400 million are obese [1].

Obesity as thus becomes a major contributor for global burden of chronic diseases and disabilities [2].

In India overweight and obese pregnant women are mostly seen in urban areas while underweight pregnant women can be seen in rural and or backward areas. In India 26% of pregnant women are overweight and 8 % are obese [3].

Present study's aim is to correlate maternal BMI with fetomaternal outcomes. BMI, body mass index (quetelet index) is a value derived from the weight and height of an individual [4]. BMI is calculated by dividing body weight in kilogram by square of body height in meters, so the unit will be Kg/m².

Low maternal BMI is related with low birth weight babies with its consequences like neuro developmental and growth impairment, neonatal jaundice, infections and feeding problems.

High maternal BMI is related with high incidence of PIH, GDM, pre and post term labour, macrosomia, induction of labour, instrumental vaginal and caesarean deliveries, post-partum hemorrhage (PPH), respiratory problems. There is increased incidence of anemia, delivery of preterm, low birth weight and growth retarded babies in underweight mothers.

In the developing countries treatment and prevention of maternal underweight and overweight may help in reducing maternal and child health [5].

Furthermore, it has been shown that low APGAR score and perinatal deaths are more common in neonates of obese women [6,7].

Material and Methods

This was an observational study conducted in department of obstetrics & gynaecology, JNU Medical College and Hospital, Jaipur, Rajasthan

Inclusion Criteria

Booked Primigravida (with singleton pregnancy), having first trimester hospital visit with documented first trimester's body weight

Exclusion Criteria

Multigravida

Primigravida (with multiple pregnancy)

Unbooked primigravida (not having documented first trimester's body weight)

Patients were selected as per the inclusion criteria. A total number of 127 pregnant women admitting for delivery were enrolled for study.

A complete history regarding present and past illness recorded and through clinical examination was performed. Base line routine investigations were done. Height of patient was taken by means of standard methodology described by Lohman *et al* [8]. Documented weight of patient in first trimester taken from Ante Natal Card and BMI of patients was calculated. Patients were divided in to five groups based on BMI (as per WHO and NICE guidelines) these patients followed till delivery and again till the date of discharge.

Table 1: BMI groups as per WHO guidelines.

| | |
|-------------------------|-----------------------------|
| Group 1 (underweight) | ≤19.8kg/m ² |
| Group2 (normal) | 19.9-24.9 kg/m ² |
| Group3 (overweight) | 25-29.9kg/m ² |
| Group4 (obese) | 30-34.9kg/2 |
| Group5 (morbidly obese) | ≥35 kg/m ² |

The obstetric outcomes were studied. Ante-partum and intra-partum complications-PIH, GDM, anemia, preterm delivery, ante partum hemorrhage (APH), premature rupture of membrane (PROM), cephalo pelvic disproportion (CPD), non-progress of labour (NPOL), oligohydroamnios, polyhydroamnios, big baby, fetal distress were noted.

Mode of deliveries-normal vaginal delivery, instrumental vaginal delivery or lower segment cesarean section (LSCS) noted.

Post-Partum complications- wound infection, (PPH), urinary tract infection (UTI), respiratory tract infection (RTI) noted.

The neonatal outcomes - Birth weight, Maturity of the neonates, NICU admission, respiratory distress (RD), neonatal jaundice (NNJ) and perinatal death noted.

All the findings then correlated with maternal BMI.

Results

Table 2: Distribution of patients by different categories of BMI.

| Group | BMI(Kg/m ²) | Frequency | Percentage |
|---------------|-------------------------|-----------|------------|
| Group 1(n=44) | <19.8 | 44 | 34.64% |
| Group 2(n=60) | 19.9-24.9 | 60 | 76.2% |
| Group 3(n=22) | 25-29.9 | 22 | 17.32% |
| Group 4(n=1) | 30-34.9 | 1 | 00.78% |
| Group 5(n=0) | >=35 | 0 | 00.0% |

Table 3: Age wise distribution of patients in different BMI groups.

| Group | Age in years | | |
|---------|--------------|-------------|-----------|
| | <20 years | 21-30 years | >31 years |
| 1(n=44) | 12(27.27%) | 32(72.72%) | 0(0.00%) |
| 2(n=60) | 11(18.33%) | 48(80.0%) | 1(1.6%) |
| 3(n=22) | 1(4.54%) | 20(90.9%) | 1(4.54%) |
| 4(n=1) | 0(0.00%) | 1(100%) | 0(0.00%) |
| 5(n=0) | 0(0.00%) | 0(0.00%) | 0(0.00%) |

Table 4: Ante-partum complications in different BMI groups.

| ANC Complications | Group | | | | |
|------------------------------|-------------------|-------------------|-------------------|------------------|------------------|
| | Group-1 (n=44) | Group-2 (n=60) | Group-3 (n=22) | Group-4 (n=1) | Group-5 (n=0) |
| ANEMIA | 18(40.90%) | 15(25%) | 2(9.09%) | 0 | 0 |
| GHT and PREECLAMPSIA | 4(9.09%) | 15(25.0%) | 4(18.18%) | 1(100.0%) | 0 |
| GDM | 0 | 0(0.00%) | 1(4.54%) | 0 | 0 |
| HYPO THYROIDISM | 0 | 3(5.00%) | 6(27.27%) | 0 | 0 |
| IUGR | 1(2.27%) | 2(3.33%) | 0 | 0 | 0 |
| OLIGOHYDRAMNIOS | 5(11.36%) | 7(11.66%) | 1(4.54%) | 0 | 0 |
| CPD | 2(4.54%) | 8(13.33%) | 3(13.63%) | 0 | 0 |
| FETAL DISTRESS | 7(15.9%) | 16(26.66%) | 4(18.18%) | 0 | 0 |
| NPOL | 4(9.09%) | 10(16.66%) | 4(18.18%) | 1(100.0%) | 0 |
| POST DATED | 5(11.36%) | 4(6.66%) | 0(0.00%) | 1(100.0%) | 0 |
| APH | 2(4.54%) | 0(0.00%) | 1(4.54%) | 0 | 0 |
| PROM | 8(18.18%) | 4(6.66%) | 5(22.72%) | 0 | 0 |
| NON-CEPHALIC PRESENTATION | 1(2.27%) | 2(3.33%) | 1(4.54%) | 0 | 0 |
| IUD | 0 | 0 | 1(4.54%) | 0 | 0 |
| PRETERM | 6 | 2 | 0 | 0 | 0 |

Table 5: Mode of delivery in different BMI groups

| BMI Group | Mode of delivery | | |
|---------------|------------------|-------------------|------------|
| | Normal Delivery | Ventouse Delivery | LSCS |
| Group-1(n=44) | 23(52.27%) | 1(2.27%) | 20(45.45%) |
| Group-2(n=60) | 18(30.0%) | 2(3.33%) | 40(66.66%) |
| Group-3(n=22) | 2(9.09%) | 3(13.63%) | 17(77.27%) |
| Group-4(n=1) | 0(0.00%) | 0(0.00%) | 1(100.00%) |
| Group-5(n=0) | 0(0.00%) | 0(0.00%) | 0(0.00%) |

Table 7: Birth weight of the babies in different BMI groups.

| Groups | Birth Weight of babies | | | |
|---------------|------------------------|------------|------------|----------|
| | <2.5kg | 2.6-3kg | 3.1-3.5 kg | >3.6kg |
| Group-1(n=44) | 16(36.36%) | 24(54.54%) | 4(9.09%) | 0 |
| Group-2(n=60) | 15(25.0%) | 29(48.33%) | 14(23.33%) | 2(3.33%) |
| Group-3(n=22) | 6(27.27%) | 9(40.90%) | 7(31.81%) | 0 |
| Group-4(n=1) | 0 | 1(100.0%) | 0 | 0 |
| Group-5(n=0) | 0 | 0 | 0 | 0 |

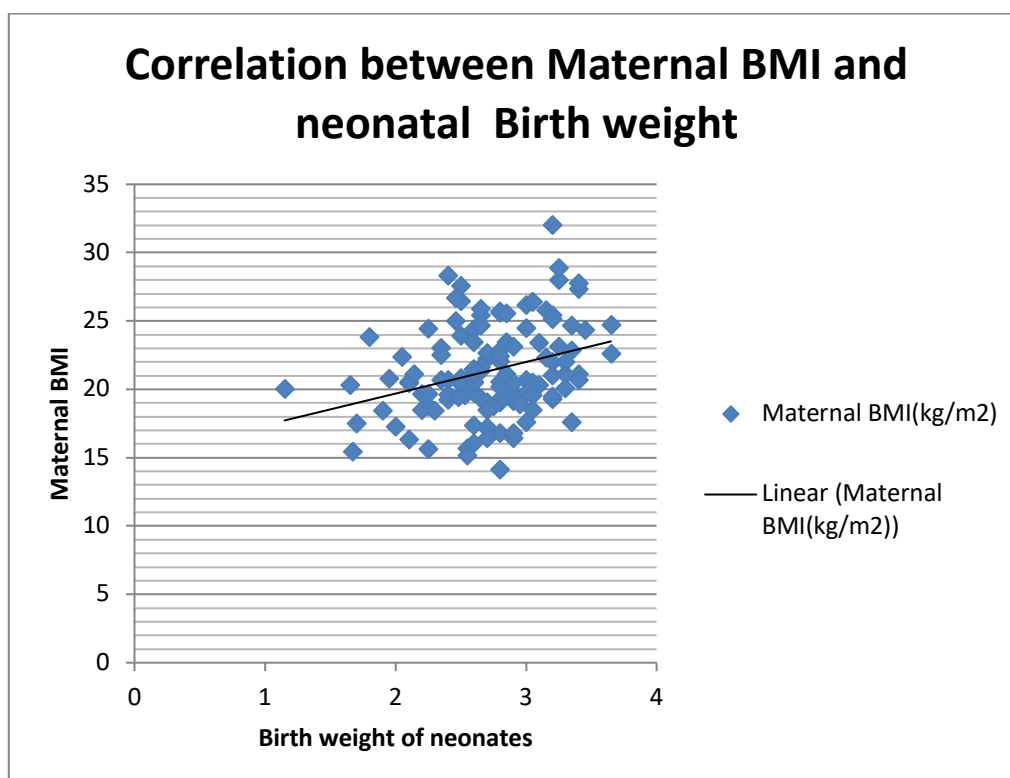


Figure 1

Table 7: Neonatal outcomes in different BMI groups.

| Groups | IUGR | PRETERM | R. D. | N. N. J. | DEATH | APGAR<= 7 |
|---------------|-----------|------------|-----------|-------------|--------------------|-----------|
| Group 1(n=44) | 1 (2.27%) | 6 (13.63%) | 1 (2.27%) | 9 (20.45%) | 1(2.27%) (preterm) | 3 (6.81%) |
| Group 2(n=60) | 2 (3.33%) | 2 (3.33%) | 5 (8.33%) | 10 (16.66%) | 0 | 3 (5.0%) |

| | | | | | | |
|---------------|---|---|-----------|-----------|---|-----------|
| Group 3(n=22) | 0 | 0 | 2 (9.09%) | 2 (9.09%) | 1(4.54%) (aspiration on 3 rd day after delivery) | 1 (4.54%) |
| Group 4(n=1) | 0 | 0 | 0 | 0 | 0 | 0 |
| Group5(n=0) | 0 | 0 | 0 | 0 | 0 | 0 |

Table 8: Postpartum complications

| BMI group | Group-1(n=44) | Group-2(n=60) | Group-3(n=22) | Group-4(n=1) | Group-5(n=0) |
|------------------|---------------|---------------|---------------|--------------|--------------|
| Nil complication | 41(93.18%) | 57(95.0%) | 9(40.90%) | 1(100.0%) | 0 |
| Perineal injury | 0 | 0 | 0 | 0 | 0 |
| PPH | 1(2.27%) | 1(1.66%) | 1(4.54%) | 0 | 0 |
| UTI | 2(4.54%) | 1(1.66%) | 3(13.63%) | 0 | 0 |
| RTI | 0 | 1(1.66%) | 3(13.63%) | 0 | 0 |
| Wound infection | 0 | 0 | 4(18.18%) | 0 | 0 |
| Cervical injury | 0 | 0 | 2(9.09%) | 0 | 0 |

A total 127 pregnant women fulfilling the inclusion criteria were studied.

Out of 127 women, 44(34.64%) were from BMI group-1 (underweight), 60(76.2%) from BMI group-2 (normal), 22 (17.32%) from BMI group-3 (overweight), 1 (0.78%) from BMI group-4 (obese) and none from BMI group-5.

Maximum number of women were in the age group of 21 to 30 years. 72.72%, 80.0%, 90.9% and 100% women were in the age group of 21-30years respectively from BMI group-1, group-2, group-3 and in group-4.

In BMI group-1 anemia was more prevalent (40%) followed by PROM in 18.18%, fetal distress in 15.9%, oligohydroamnios in 11.36%, PIH and NPOL in 9.09%, APH and CPD in 4.54%, and IUGR in 2.27% women.

In group -2 most common ante-partum complication seen was PIH (25%), while most common intra-partum complication was fetal distress, NPOL in 16.66%, PROM in 6.66%, IUGR in 3.33%, oligohydroamnios in 11.66%, CPD in 13.33%, post-dated & hypothyroidism in 5% women.

In group-3 hypothyroidism was seen in 27.27% women, PROM in 22.72%,

NPOL, fetal distress and PIH in 18.18%, post-dated, DM, APH, oligohydroamnios and IUD in 4.54% women.

In BMI group-4 only one woman was there in this group, she was having postdated pregnancy, PIH and NPOL.

In group 1, 2 and 3 normal deliveries were 52.27%, 30%, 9.09% respectively and cesarean deliveries were 45.45%, 66.66%, 77.27% respectively. One patient from group 4 had cesarean section.

Birth weight < 2.5 kg seen mostly in group one while birth weight >3.1 kg mostly seen in group three.

Wound infection (18.18%) and RTI (13.63%) were seen in BMI group 3 women, but no such complications occurred in women of group 1.

IUGR, preterm, NNJ and babies with APGAR ≤7 were more in women from BMI group 1.

Discussion

In our study most common age group was 21 to 30 years (reproductive age), similar findings were seen in the study done by HS Ashok Kumar *et al* [1]

In our study 34.64%, 76.2%, 17.32% and 0.78% women were from BMI group

1,2,3,and 4 respectively, in the study done by Bharpoda NY *et al* [9] 33%, 46%, 16% and 5% women were from group 1, 2, 3 and 4 respectively. In the study done by HS Ashok Kumar *et al* [1] 29.09%, 33.063%, 24.54% and 9.09% women were from BMI group 1, 2, 3, and 4 respectively, and 3.63% women were morbidly obese. In our study and in the study done by Bharpoda NY *et al*, no patient was morbidly obese [9] Thus our study shows that major problem in our patient profile is that of underweight not of obesity.

In our study we observed that anemia was more common in underweight and normal women (40.90%, 25%), in the studies of HS Ashok Kumar *et al* (31.25%, 18.91%), and Singh P *et al* (16.52%,16.66%) also anemia was more common in BMI group 1 and 2 women.[1,4]

Oligohydroamnios was more commonly seen in underweight women. It may be because of maternal anemia and low maternal weight.

GDM was seen in one overweight (4.54%) woman in our study. In the study done by HS Ashok Kumar *et al*, GDM was seen in BMI group 2 and 3 women (in 5.4% and 7.4% women)[1], in the study done by Singh P *et al*, GDM was seen in BMI group 2, 3, 4 and 5 (in 0.82%, 1.66%, 9.52% and 3.33% women) [4]. Gestational hypertension (GHT) and preeclampsia were seen in 9.09%, 25.0%, 9.09%, 100% in BMI group 1, 2, 3 and 4 respectively during our study period (but no eclampsia in primigravida reported in that particular period of study). In the study of HS Ashok Kumar *et al*, 9.37%, 8.1%, 18.5%, 40% and 50%, women from BMI group 1, 2, 3, 4 and 5 had GHT and preeclampsia, they also reported eclampsia in one patient from group 5 [1]. In our study preeclapsia in higher groups was associated with higher BP, one patient also had HELP (hemolysis,

elevated liver enzymes and low platelets) syndrome belonging from group 3. This shows that severity of PIH increases with increase of maternal BMI.

Hypothyroidism was more common in overweight women in our study.

APH was seen in 4.54% in group 1 (placenta Previa) and 3(abruption placenta secondary to severe preeclampsia) women in our study. In HS Ashok Kumar *et al* [1] one case (10%) of APH was seen in BMI group 4[1]. In the study of Singh P *et al* APH was seen in 1.65%, 3.32%, 4.76%, 33.33% women belonging from group 2, 3, 4 and 5 [4].

NPOL was seen in 9.09%, 16.66%, 18.18%, 100% women BMI group 1, 2, 3 and 4 in our study. In the study done by Shah PM *et al*, 5.26%women from class I had NPOL [10]. This shows that NPOL is more common in overweight women in comparison to underweight women.

CPD was seen more in group 3 women as compare to group 1 women. This is because of more short statured women in higher BMI group along with stocky build and increase soft tissue occupying the maternal birth passage leading to NPOL, CPD.

In contrast to various studies, in our study post-dated pregnancy were more common in underweight women (11.36%) as compare to overweight women (4.54%).

PROM, fetal distress, noncephalic presentation showed no predilection to any BMI groups.

IUGR was seen in group 1 (2.27%) and group 2 (3.33%) women.

In our study we observed that instrumental and cesarean deliveries were more in overweight women in comparison to normal and underweight women. Various others studies had also shown similar findings [1,9].

Table 9: Different studies

| GROUP | OUR STUDY | NORMAL DELIVERY%/LSCS% | | | |
|-------|-------------|---------------------------------|------------------------------|---------------------------|--------------------------|
| | | HS Ashok Kumar <i>et al</i> [1] | Bharpoda NY <i>et al</i> [9] | Shah PM <i>et al</i> [10] | Singh P <i>et al</i> [4] |
| 1 | 54.55/45.45 | 86.20/13.8 | 66.67/27.27 | | |
| 2 | 33.34/66.66 | 80.5/19.5 | 80.43/19.56 | | 59.50/25.61 |
| 3 | 22.73/77.27 | 68/32 | 75/25 | | 48.33/26.67 |
| 4 | 0/100 | 55.5/44.5 | 40/60 | 0/100 | 48.61/33.33 |

Baby birth weight < 2.5 kg, were more common in underweight women. Similar findings were seen in HS Ashok Kumar *et al*, Han *et al*, and Kanadys *et al*, Wieslaw Maciej Kanadys [1,11-13].

While birth weight >3.1 kg were more common in overweight women. Similar outcomes seen in other studies like HS Ashok Kumar *et al*, NY Bharpoda *et al*, Bianco *et al*, Cedegren, cIssacs *et al* [1,9,14-16]. IUGR (2.27%), Preterm (13.63%), neonatal jaundice (20.45%) were seen more in Group –I women as compare to Group-III (IUGR and preterm in none and NNJ in (9.09%) and Group IV (IUGR, preterm, and NNJ in none) women.

Respiratory distress in newborn was seen more in Group III women (9.09%) as compare to Group I women (2.27%). Neonates with APGAR < 7 were more in BMI Group I women in our study. This may be because of maternal jeopardy (low weight and associated anemia) secondarily leading to fetal jeopardy.

Post-partum complications were seen more in Group III in the form of wound infections and gaping (18.18%), UTI (13.63%) and RTI (13.63%). In the study done by HS Ashok Kumar *et al* prevalence of wound infection were same in Group I, II, and IV, while RTI was common in Group II and UTI was common in Group III women[1]. In the study done by Singh P *et al*, Shah PM *et al* and Dasgupta *et al*, post LSCS wound problem were also more in over weight and obese women [4,10,17]. This is because of increase fat layer in abdomen, decrease physical activity of overweight women as compare to lean and thin underweight women.

Post-Partum hemorrhage showed no significant association with different BMI groups in our study, PPH that were reported occurred because of low platelet counts not because of atonicity, as in our institution we use to give per rectal misoprost tablet 600 microgram and 10 unit oxytocin drip for 8 to 10 hours post-delivery in all high risk women . In contrast to the our study, in the study done by Singh P *et al* and Pillai R *et al*, PPH was seen more in obese women in comparison to normal women [4,18].

In our study none had perineal laceration, because we use to give liberal episiotomy in all primigravida with crowning of head. In the study done by HS Ashok Kumar *et al*, perineal laceration were seen in 2and3 women belonging from groups 2 and 3 respectively [1]. Cervical injury seen in 2 women from BMI group 3, delivered with difficulty by Ventouse delivery in 2nd stage arrest and foetal distress.

Early neonatal death occurred in one neonate (6 days after birth because of complications of prematurity in NICU) of one underweight women (delivered by emergency pre term LSCS done for placenta praevia, severe oligohydroamnios, hydrocephalus with bleeding per vagina).

One neonatal death occurred of an overweight woman's neonate, 3rd day post-delivery because of aspiration.

Conclusion

We conclude that deviation of maternal BMI from normal correlates directly with unfavorable fetomaternal outcome. Underweight pregnant women were more prone to pregnancy associated complications like anemia, oligohydroamnios, IUGR, preterm

delivery, low birth weight babies. Overweight pregnant women had more complications like gestational hypertension, preeclampsia, gestational diabetes mellitus, hypothyroidism, instrumental vaginal delivery, caesarean section, large for gestational age babies, postpartum complications like urinary tract infections, respiratory tract infections, wound infections etc. So maintaining an optimum weight, BMI and nutritional status during antenatal period, proper antenatal checkups, necessary investigations, optimum medicines and supplementations during pregnancy can help in preventing many pregnancies associated complications and lower the fetomaternal morbidity.

So attainment of normal BMI should be one of the goals of preconceptional counseling. Proper treatment of pregnant women with low BMI so as to improve weight, hemoglobin and oligohydroamnios Advice to be given to them regarding intake of high protein diet like lentils and legumes (not necessary Non – Vegetarian, costly diet). Though government is providing iron and folic acid tablets free of cost still anemia is prevalent specially in low socioeconomic status women, government should opt for deworming also by providing tablets for deworming free of cost to all pregnant women. Advice to be given to pregnant women with high BMI regarding dietary restriction (avoid intake of junk food) and importance of physical activity, exercise and yoga to bring down the maternal weight and secondarily perinatal morbidity and mortality.

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