A Study on the Effect of Pre-Pregnancy Body Mass Index and Gestational Weight Gain on Pregnancy and Neonatal Outcome

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ABSTRACT

BACKGROUND

Obesity has become a global epidemic. Maternal overweight and obesity is now a major challenge to the treating obstetricians. We intended to find the effect of pre pregnancy body mass index (BMI) and gestational weight gain during pregnancy on maternal and neonatal outcome.

METHODS

300 women with singleton pregnancy and spontaneous conception, who attended antenatal outpatient department (OPD) in our tertiary hospital, were included in this study after informed consent. The rate of gestational weight gain was calculated by subtracting the pre pregnancy weight from the final weight of the mother during last antenatal visit or during delivery. They were followed up and their maternal and perinatal outcomes such as anaemia, gestational hypertension, gestational diabetes, preterm labour, past dates, and intrauterine growth restriction, low birth weight, large for gestation, caesarean delivery and neonatal intensive care admission were studied.

RESULTS

The mean age of the woman in this study was 24 ± 2 years. Of them, 13 % (n = 39) of women were underweight. 40 % (n = 120) of women were of normal BMI. 33 % (n = 99) of women were overweight. 14 % (n = 52) of women were obese. Maternal complications such as anaemia, preterm labour and intrauterine growth restriction were significantly common in underweight woman and inadequate gestational weight gain woman. Gestational diabetes, gestational hypertension, large for gestation baby and Caesarean deliveries were more in pre pregnancy obese woman and excess gestational weight gain woman.

CONCLUSIONS

An appropriate maternal pre pregnancy body mass index of 18.5 to 22.9 Kg / m² at conception followed by an appropriate gestational weight gain (10 to 14 Kg) during pregnancy has a better maternal and neonatal outcome.

KEY WORDS

Body Mass Index, Gestational Weight Gain, Maternal Outcome, and Neonatal Outcome, Obese

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BACKGROUND

Despite the advancement in medical field, the rate of pregnancy complications and maternal mortality is still on the rise. There has been a dramatic increase in the prevalence of overweight and obesity worldwide. Obesity has become a global epidemic. Maternal overweight and obesity is now a major challenge to the treating obstetricians. Accumulation of excess body fat is obesity. Obesity can be diagnosed by various markers such as body mass index, waist to hip circumference, skin fold thickness, etc.¹

Maternal overweight and obesity has a negative impact for both mother and the fetus. The overweight and obese mother is at the risk of abortion, preeclampsia, gestational diabetes, past dates, increased caesarean delivery, postpartum haemorrhage, puerperal infection and thromboembolism.²⁻⁵ The fetus is at the risk of increased congenital anomaly, macrosomia, stillbirth, perinatal morbidity and mortality. Obesity is also the risk factor for many familial health problems such as diabetes, hypertension, coronary artery disease, etc.

Malnourished mother has adverse effect on the mother and the fetus. Underweight BMI women are at the risk of anaemia, intrauterine growth retardation, and small for gestation age babies. Hence the nutritional status of the woman in reproductive age and gestational weight gain during pregnancy plays a major role in the maternal and neonatal outcome. The rate of gestational weight gain was calculated by subtracting the pre pregnancy weight from the final weight of the mother during last antenatal visit or during delivery.

According to Institute of Medicine (IOM) weight gain recommendations for pregnancy, gestational weight gain was classified into Inadequate weight gain: less than 11.5 Kg, Normal weight gain: 11.5 to 16 Kg and Excessive weight gain: more than 16 Kg.

Body mass index is defined as the body mass in kilograms divided by the square of body height in metres. It is expressed as Kg / m². According to the Asian Pacific classification of BMI, people are classified as underweight < 18.5 Kg / m², normal weight 18.5 to 22.9 Kg / m², overweight 23.0 to 24.9 Kg / m² and obese ≥ 25 Kg / m².

We intend to find the effect of pre pregnancy BMI and gestational weight gain on maternal and neonatal outcome.

METHODS

This was a prospective observational study done over one year from January 2019 to February 2020 in a tertiary hospital in Salem district of Tamilnadu. 300 women with singleton pregnancy with spontaneous conception who attended antenatal OPD in first trimester were included in the study. Multiple pregnancy, assisted reproductive technique conception, past or present medical disorders and those not willing for follow up were excluded. After informed consent, the women were included in the study. Those with known pre-pregnancy weight, pre pregnancy BMI was calculated using the formula BMI = weight in kilograms / height in metre square. The rate of gestational weight gain was calculated by subtracting the pre pregnancy weight from the final weight of the mother during last antenatal visit or during delivery.

They were followed up until delivery and their maternal and perinatal outcomes such as anaemia, gestational hypertension, gestational diabetes, preterm labour, past dates, intrauterine growth restriction, low birth weight, neonatal intensive care admission, respiratory distress syndrome, meconium stained liquor and large for gestational age were studied.

Statistical Analysis

The statistical analysis was done using SPSS 23. The data analysed were expressed in number, frequency and percentage. The chi square test of significance was applied. The P-value less than 0.005 considered as statistically significant. The sample size was calculated using Open Epi software version 3. The sample size was calculated at 95 % confidence interval and 5 % error and it came out 300.

RESULTS

300 women were included in this study. The mean age of the participants in this study was 24 ± 2 years. Table 1 describes the distribution of age in study participants. 41 % (n = 123) of women were in the age group of 21 to 25 years. 30 % (n = 90) of women were in the age group of 26 to 30 years. 22 % (n = 66) of women were in the age group of less than 20 years. 7 % (n = 21) of women were in the age group of more than 30 years.

Age Group (Years)	N = 300, n (%)
< 20	66 (22)
21 – 25	123 (41)
26 – 30	90 (30)
> 30	21 (7)

Table 1. Age Distribution

Table 2 describes the distribution of gravida in the study participants. 48 % (n = 144) of women were primigravida. 25 % (n = 75) of women were second gravida and 24 % (n = 72) of women were third gravida.

Gravida	N = 300, n (%)
1	144 (48)
2	75 (25)
3	72 (24)
> 3	9 (3)

Table 2. Distribution of Gravida

Table 3 describes the distribution of maternal BMI in the study participants. 13 % (n = 39) of women were underweight. 40 % (n = 120) of women were of normal BMI. 33 % (n = 99) of women were overweight. 14 % (n = 52) of women were obese.

BMI (Kg / m ²)	N = 300, n (%)
Underweight <18.5	39 (13)
Normal 18.5 TO 22.9	120 (40)
Overweight 23.0 TO 24.9	99 (33)
Obese ≥ 25	52 (14)

Table 3. BMI Distribution

Gestational Weight Gain (GWG)	N = 300, n (%)
Inadequate weight gain < 11.5 Kg	102 (34)
Normal weight gain 11.5 - 16 Kg	87 (29)
Excess weight gain >16 Kg	111 (37)

Table 4. Gestational Weight Gain (GWG) during Pregnancy

Table 5 describes the maternal complications. Anaemia was more common 50.9 % with inadequate GWG women followed by 27.6 % in normal GWG women and 13.5 % in excess weight gain women. ($P = 0.07$) statistically significant. Gestational hypertension was found in 30.6 % with excess weight gain women followed by 24.1 % with normal GWG and 6.8 % with inadequate GWG women. Gestational diabetes was found in 19 % of excess weight gain women. Preterm birth was more common in inadequate GWG women 29.4 % ($P = 0.04$) statistically significant. Past dates were more in excess GWG women 22.5 % followed by normal GWG women 10.3 %. Intrauterine growth restriction was found in 13.72 % of inadequate GWG women.

Complications	GWG Less Than 11.5 Kg N = 102 n (%)	GWG 11.5 to 16 Kg N = 87 n (%)	GWG More Than 16 Kg N = 111 n (%)	P-Value
Anaemia	52 (50.9 %)	24 (27.6)	15 (13.5 %)	0.07
Gestational hypertension	7 (6.86 %)	21 (24.1 %)	34 (30.6 %)	0.7
Gestational diabetes	nil	9 (10.3 %)	21 (19 %)	0.6
Preterm	30 (29.4 %)	nil	10 (9 %)	0.04
Past dates	nil	9 (10.3 %)	25 (22.5 %)	0.5
IUGR	14 (13.72 %)	nil	nil	0.88

Table 5. Maternal Complications

The rate of Caesarean delivery was more in excess gestational weight gain woman followed by normal and inadequate gestational weight gain women contributing 35 %, 23.2 % and 20 % respectively. There was no postpartum haemorrhage or wound infection.

Preterm and low birth weight neonates were common in inadequate GWG women. Large for gestation age babies was seen in excess GWG women 22 %. Neonatal intensive care admission was required in 18 % of excess GWG women followed by 8 % in inadequate GWG women. The P value was not statistically significant. Meconium stained liquor was found in 13.2 % in excess GWG women.

DISCUSSION

Maternal nutrition plays a major role in nutrition for the baby. Both malnutrition and obesity have detrimental effect both to the mother and fetus. In the present study, mean age of the study population was 24 ± 2 years. Anaemia was significantly common in inadequate GWG women ($P = 0.07$). Gestational hypertension and gestational diabetes were more common in excess gestational weight gain woman. However, it was not statistically significant. In studies done by Uebe K et al. Abenhaim HA, John J, Athukorala C, Murakmi M et al. there was significant association of gestational diabetes and gestational hypertension in obese and excess GWG woman.⁶⁻⁹

In studies done by Park JH, Tsai LH, Bhattacharya S et al. obese and excess gestational weight gain woman were at increased risk of gestational hypertension, preeclampsia, gestational diabetes, preterm labour, macrosomia, induction of labour and Caesarean delivery.¹⁰⁻¹³ Tharihalli and

Thathagari found significant increase in pregnancy-induced hypertension (PIH) with increase in maternal obesity.¹⁴ Frederick et al. reported that for every 1 Kg / m² rise in pre-pregnancy BMI there is 8 % increase in preeclampsia.¹⁵

Caesarean delivery was more, 35 % in obese and excess GWG woman in this study. Cedergren, Denison, Doherty and Callaway et al. also reported increased Caesarean delivery with overweight and obese woman.¹⁶⁻¹⁹ In Denison et al. study, the high maternal BMI was associated increased likelihood of postdates and its complications.¹⁷

In the present study intrauterine growth restriction, preterm deliveries, neonatal intensive care admission were significantly higher in underweight woman. The P-values was statistically significant. In studies done by Murakmi M, Abenhaim HA and Sahu MT et al. there was significant association of underweight women with low birthweight, small for gestation age and intrauterine growth restriction infants.^{9,10,20} In studies done by Abenhaim HA, Athukorala C et al. concluded that increased pre pregnancy BMI was associated with increased adverse pregnancy outcomes.^{7,9} Tsai IH et al. concluded that an appropriate maternal BMI (18.5 - 24 Kg / m²) at conception with appropriate weight gain (10 - 14 Kg) during pregnancy has good maternal and fetal outcome.

The present study shows that both under nutrition and obese maternal BMI and excess GWG during pregnancy had adverse maternal and fetal outcomes. The results of this study emphasize the importance of good nutritional status of the woman before and during pregnancy for achieving the healthy pregnancy outcome. Maintaining normal BMI before pregnancy has good maternal and neonatal outcome in future.

CONCLUSIONS

Body mass index plays a major role in fertility, pregnancy and delivery. Underweight and obese women are at risk of maternal and fetal complications. Hence, pre pregnancy counselling should be given to women to maintain normal BMI. Lifestyle modification and weight reduction is advised in obese and overweight women. Thus, appropriate pre-pregnancy BMI and appropriate gestational weight gain during pregnancy has good impact on maternal and neonatal outcome.

Limitations

Small sample size. This study adds to the existing knowledge that inadequate and excess gestational weight gain during pregnancy has negative impact on the mother and fetus. Hence, pre pregnancy counselling should be given to woman of reproductive age to maintain normal BMI to achieve healthy pregnancy and childbirth.

Data sharing statement provided by the authors is available with the full text of this article at jemds.com.

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