

A CROSS-SECTION STUDY ON ASSOCIATION OF PRE-PREGNANCY BODY MASS INDEX AND GESTATIONAL WEIGHT GAIN ON NEONATAL OUTCOME IN THE REGION OF TAMILNADU

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Abstract

BACKGROUND : Pre-pregnancy body mass index (PP-BMI) and weight gain during pregnancy play important roles in determining the pregnancy outcome. Gaining desirable gestational weight is considered to be effective in supporting the growth and development of the fetus and it may also influence the body composition in childhood and later life. The purpose of this retrospective study is to determine whether a women's PP-BMI and the maternal weight gain affects the neonatal outcomes from women accessing care from Primary health Centre.

OBJECTIVES : To estimate the association of pre-pregnancy Body Mass Index and weight gain during Pregnancy on neonatal outcome among women seeking PHC in the region of Tamilnadu.

METHODS : A cross sectional study was conducted from July to September 2021 among 105 mothers, whogave birth to newborn in the year2019 in Arakkonam Block using a pretested, semi structured, self-administered questionnaire. Data were entered in Excel and analyzed using SPSS version 21.

RESULTS : Only 29.5% of women gained weight as per the recommendations. Caesarean deliveries are seen more among women, whose pre-pregnancy BMI is Underweight and normal (57% and 65.4% respectively) than compared to overweight and obese (33% and 35% respectively). Obese women who gained weight less than recommended had high risk of giving birth to low birth weight babies($p < .05$).

CONCLUSION : Excess weight gain as well as low weight gain during pregnancy could advance to adverse pregnancy outcomes. The need for gaining adequate weight during pregnancy is highlighted. Especially for overweight and obese women, Preconception counseling on Lifestyle modifications to avoid excess weight gain and its impacts could be beneficial in Tamilnadu women.

KEYWORDS : Pre-pregnancy body mass index, Gestational weight gain and Neonatal outcome.

INTRODUCTION

The "Continuum of Care" for reproductive, maternal, newborn and child health (RMNCH) include integrated service delivery for mothers and children from pre-pregnancy to delivery, the immediate postnatal period, and childhood. RMNCH+A encompasses health problems across the life course from adolescent girls and women before and during pregnancy and delivery, to newborns and children. An important conceptual framework is the continuum-of-care approach in two dimensions. One dimension recognizes the links from mother to child and the need for health services across the stages of the life course. The other is the delivery of integrated preventive and therapeutic health interventions through service platforms ranging from the community to the primary health center and the hospital.¹

The Anemia Mukht Bharat launched in March 2018, similar to continuum of care (RMNCH), concentrate on reproductive age group. It has been designed to reduce prevalence of anemia among women in the reproductive age group (15-49 years) and pregnant mothers, thereby improving the maternal and neonatal outcome.²

Neonatal outcome is determined by several factors such as, maternal age, parity, pre-pregnancy BMI, weight gain during pregnancy, gestational age, and neonatal gender. Pre-pregnancy body mass index (BMI) and weight gain during pregnancy play important roles in determining the pregnancy outcome.³ According to National Family Health Survey-4 (NFHS, 2015-16), 22.9% of women in childbearing age in India are underweight (BMI $< 18.5 \text{ kg/m}^2$), whereas a rise has been observed from 12.6% (NFHS-3, 2005-06) to 20.7% among overweight/obese (BMI $\geq 25 \text{ kg/m}^2$) women (NFHS-4).⁴ Pre-pregnancy underweight (UW) has been shown to increase the risk of preterm birth and low birth weight (LBW) whereas pre-pregnancy overweight/obesity is a risk factor for gestational diabetes mellitus (GDM), gestational hypertension (GHTN), preeclampsia and



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neonatal outcome with increased birth weight (large for gestational age), macrosomia, abnormal APGAR score and admission to neonatal intensive care unit (NICU).⁵

Gaining desirable Gestational weight is considered to be effective in supporting the growth and development of the fetus and it may also influence the body composition in childhood and later life. In recent years, maternal pre-pregnancy body mass index (BMI) has increased, which reflects the overall hike in the prevalence of obesity. High pre-pregnancy BMI and/or excessive gestational weight gain (GWG) leads to negative implications and puts health of both mother and the infant at risk.

The pre-pregnancy BMI and weight gain will serve as a useful reference for prenatal services. Yet, there has been limited research on the gestational weight gain related to neonatal outcome from women accessing care from Primary Health Centre. The purpose of this retrospective study is to determine whether a women's BMI and the maternal weight gain affects the neonatal outcomes from women accessing care from Primary health Centre.

OBJECTIVE

To estimate the association of pre-pregnancy body mass index and gestational weight gain on neonatal outcome in the region of Tamilnadu.

METHODOLOGY

A cross sectional study was conducted over a period of three months from July to September 2021 among mothers, who gave birth to newborn in recent year 2019 in Arakkonam Block. The sample size was calculated to be 105, considering the prevalence rate of the mothers giving birth to normal weight newborn to be 50%, absolute precision of 10%, 10% to account for non-response rate. Ethical clearance was obtained from the Institutional Ethics Committee, Madras Medical College. Out of 45 HUD's Blocks in Tamilnadu, Arakkonam block was selected by simple random sampling method. Official permission to conduct the study was obtained from Directorate of Public Health and Preventive medicine, Deputy Director of Health Services, Ranipet District for conducting the study. All the mothers, who gave birth to newborn in the year 2019 in Arakkonam block were included in the study after obtaining written informed consent by universal sampling method.

METHODOLOGY

Study was conducted Among the 105 participant mothers, mean age of the participant was 24.50 ± 4 years.

Table 1 : Depicting socio demographic parameters among study participant(n=105)

S.NO	SOCIO DEMOGRAPHIC PARAMETERS		FREQUENCY	PERCENTAGE (%)
1	AGE	<25	64	61
		>25	41	39
2	EDUCATION	Primary school	9	8.6
		Middle school	5	4.7
		High school	28	26.7
		Higher secondary school	35	33.3
		Graduate	28	26.7
3	OCCUPATION	Employed	30	28.6
		Unemployed	75	71.4
4	SOCIO-ECONOMIC STATUS CLASS	Upper middle	9	8.5
		Lower middle	59	56.2
		Upper lower	37	35.3

Table (1) showing socio demographic parameters of the study participant. 60% of the study participant have completed either higher secondary school or degree. 28.6% of them were employed and all of them quit their job before reaching third trimester. Their socio-economic status was determined by modified Kuppaswamy's scale, 35.3% were belong to upper lower class, 56.2% were belong to lower middle class and 8.5% belong to upper middle class.

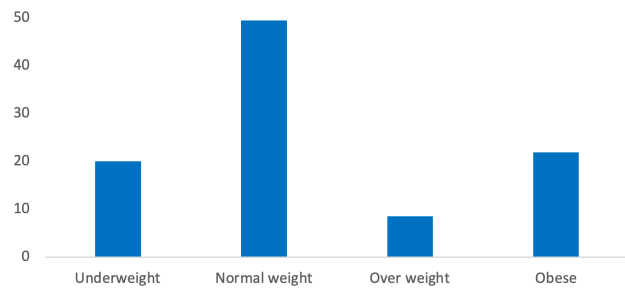


Figure 1 : Classification of body mass index based on Asia Pacific guidelines

Mean BMI was 21.96 ± 4.3 kg/m², and mean weight gain during pregnancy was 7.6 ± 2.6 kg. 49% of women were primipara, and 51% were multipara. Figure(1) shows 20 % (n = 21) were underweight, 49.5 % (n = 52) normal weight, 8.6 % (n = 9) overweight, and the rest 21.9% (n = 23) were obese.

Table (2) shows the clinical characteristics and pregnancy outcomes of the women categorized based on their BMI at first booking. Obese and overweight women were significantly older (26.04 ± 3.4 and 26.2 ± 3.2 years) than normal weight, and underweight women (24.8 ± 6.2 and 23.1 ± 3.5 years, $P < 0.05$, respectively). The mean birth weight of the infants born to normal weight, overweight, and obese women was found to be higher than birth weight of infants of underweight women (2.93 ± 0.30 , 2.78 ± 0.38 , 2.93 ± 0.35 and 2.74 ± 0.29 respectively). LSCS rates are higher in overweight and obese women (66.6% and 65.2%) than underweight and normal weight women (42.9% and 34.6%), $P < 0.05$ respectively.

Table 2 : Showing the clinical characteristics and pregnancy outcomes of the

CLINICAL PARAMETERS	UNDERWEIGHT (N=21)	NORMAL (N=52)	OVERWEIGHT (N=9)	OBESE (N=23)
Age	23.1±3.5	24.8±6.2	26.2±3.2	26.04±3.4
Weight at booking	41.4±4.2	50±4.8	53.6±2.9	68.2±7.7
Weight gain during pregnancy	8.4±2.9	7.7±2.8	6.8±2.7	6.9±1.7
BMI at booking	16.9±1.4	20.7±1.2	23.8±0.8	28.7±2.5
Mean birth weight	2.74±0.29	2.93±0.30	2.78±0.38	2.93±0.35
Preterm deliveries	1(4.8 %)	3(5.8 %)	2(22 %)	1(4.3 %)
Caesarean delivery	9(42.9 %)	18(34.6 %)	6(66.6 %)	15(65.2 %)
Low birth weight	4(19 %)	5(9.6 %)	2(22 %)	3(13 %)

Figure (2) shows weight gain during pregnancy across the different BMI categories. It was seen that 14% of underweight, 11.5% of normal weight, 11.1% overweight, and 95.7% obese women met the recommendations for weight gain.

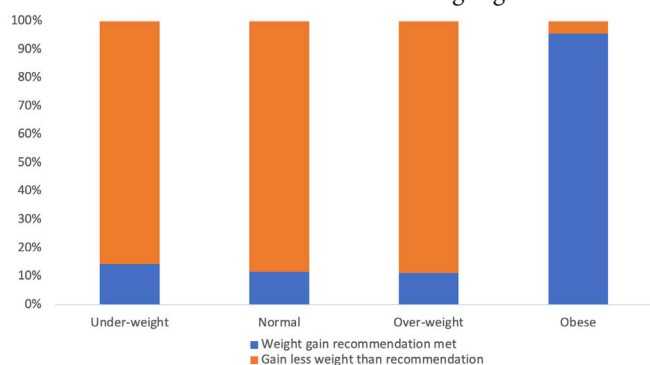


Figure 2 : Comparison of Gestational weight gain across different BMI categories

While majority of underweight (86%), normal weight women (88.5%), and overweight women (88.9%) gained weight less than recommended, among obese women 4.3% of them gained less than the recommended weight. Overall, only 29.5% women met the recommendations for weight gain.

Figure(3) showing the mean birth weight of the infants born to normal weight, overweight, and obese women was significantly higher than birth weight of infants of underweight women (2.93 ± 0.30 kg, 2.78 ± 0.38 kg, 2.92 ± 0.35 kg, and 2.74 ± 0.29 kg; P = 0.007, respectively).

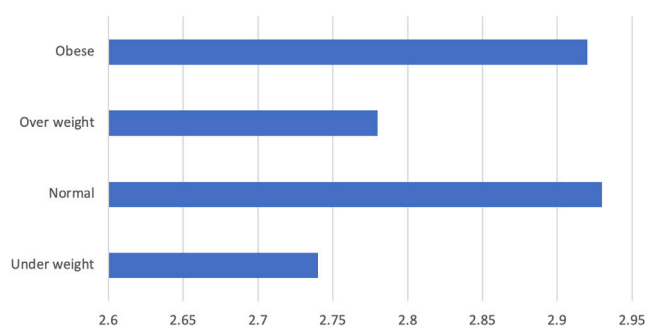


Figure 3 : Mean birth weight of the infant born to different BMI categories

INFERENCE STATISTICS

Using univariate analysis- Chi Square test was done and the association between Pre-pregnancy BMI and gestational weight gain with type of delivery underwent, presence of meconium stain in amniotic fluid, birth weight and admission in NICU. P value < 0.05 was taken as significant.

Table 3 : Association of Gestational weight gain with pregnancy outcomes: in women with insufficient weight gain

Parameter	Underweight		Normal		Overweight		Obese	
	OR	P	OR	P	OR	P	OR	P
Caesarean delivery	1.457 (.509 – 4.173)	.482	0.419 (.160 – 1.101)	.075	2.733 (.601 – 12.439)	.180	NA	.223
Low birth weight	1.567 (.413 – 5.945)	.505	0.366 (.104 – 1.293)	.110	1.867 (.329 – 10.593)	.475	NA	.022
Meconium-stained liquor	2.039 (.314 – 13.246)	.448	0.907 (.142 – 5.8793)	.918	NA	.420	NA	.786
NICU admission	0.963 (.094 – 9.856)	.975	0.591 (.078 – 4.450)	.606	3.000 (.274 – 32.875)	.347	NA	.810

From the above Table 3, the risk of giving low birth weight by a women, whose pre-pregnancy BMI under Obese category and gestational weight gain is not met as recommendation is significant (P<.05).

DISCUSSION

Only 29.5% of women gained weight as per the recommendations. Caesarean deliveries are seen more among women, whose pre-pregnancy BMI is overweight and obese (66.6% and 65.2% respectively) than compared to Underweight and normal (42.9% and 34.6% respectively). Obese women who gained less weight than recommended had increased risk of giving birth to low birth weight.

The initial guidelines by the IOM in 1930 recommended that pregnant women should gain 6.8 kg irrespective of weight status.⁷ Subsequently, with increasing prevalence of obesity and an increasing trend in birth of macrosomic infants, these guidelines were revised in 1990 and 2009.^{8,9} With overweight and obesity significantly contributing to the growing prevalence of large for gestational age infants and increasing the risk of pregnancy-related complications,10 the IOM published new guidelines in 2009.⁸ This new recommendation was based on WHO BMI categories and included a more restrictive range for weight gain for obese women. These guidelines took into account the risk of small for gestational age infants and preterm birth with inadequate GWG and increased risk for large for gestational age infants and cesarean section. Following the 2009 IOM publication, several studies were published supporting less weight gain,

especially in overweight and obese women.^{11,12,13,14} Studies from less developed Asian countries validating these guidelines are emerging, with very few studies from India.⁷

However, the WHO BMI categories that have been used to classify Europeans may not be appropriate for Asia Pacific population.¹⁵ This is because while in the Asian population, the prevalence of obesity may be lower than in Europe; the health risks associated with obesity occur at a lower BMI in Asians than compared to the West, thereby making WHO BMI categorization, less relevant to the Asian population.

Hence, in 2000, the Regional Office for the Western Pacific of WHO, the International Association for the Study of Obesity, and the International Obesity Task Force together released, the Asia-Pacific Perspective for redefining obesity suggesting diagnostic criteria to identify overweight and obesity in the Asian population.¹⁵ Hence, in this paper, we have employed the WHO Asia Pacific BMI criteria to classify pregnant women in our study. However, in the absence of national guidelines for weight gain recommendations during pregnancy, we have assessed the usefulness of the IOM weight gain recommendations for our population by studying the adverse pregnancy outcomes in women who gained weight above and below the recommended guidelines.

Maternal obesity is a risk factor for several pregnancy-related complications which may have adverse effects on both the mother and her infant. Obese women are at an increased risk of undergoing cesarean sections.¹⁶ Fetal overgrowth also is another major concern in obese women. Several other studies have also shown an association between increasing BMI, cesarean section, and macrosomia.^{17, 18} Moreover, the risk for macrosomic infants was found to be consistently higher in obese women who gained more weight, whereas the risk decreased when weight gain was below the recommended values.¹⁴

Cesarean section is usually influenced by several factors, such as practice behavior of the obstetrician or other pregnancy complications in obese women may necessitate the need for cesarean section. Results from our study show that overweight and obese women who gained weight as recommend were at a significantly ($P < .05$) higher risk of cesarean delivery. In contrary, Edwards et al.¹⁹ and Graham et al.²⁰ found that when stratified by maternal weight gain, there was no significant association between obesity and cesarean section

Underweight women are known to deliver preterm infants.²¹ In addition, underweight women gaining less weight than recommended were shown to be at two-fold risk of delivering low birth weight infants than those who met the

recommendations.²² Our results showed that though the risk for low birth weight in underweight women was high, it was not statistically significant. This could be because the number of underweight women studied is less. The other important finding in this study is that though a major proportion of normal weight and overweight women gained less weight than recommended, the less weight gain had a less risk for cesarean sections which is in contrast with previous studies which showed that these women had increased risk for such complications.^{12,23} This difference could be attributed mainly due to the different BMI criteria used.

CONCLUSION

Excess weight gain as well as low weight gain during pregnancy could advance to adverse pregnancy outcomes. The need for gaining adequate weight during pregnancy is highlighted. Especially for overweight and obese women, Preconception counseling on Lifestyle modifications to avoid excess weight gain and its impacts could be beneficial in Tamilnadu women.

LIMITATION

BMI classification should be based on pre-pregnancy weight ideally as seen in several studies and data are not available in routine AN records. In our study, we have used weight recorded in the antenatal records in early pregnancy which was the only feasible option for obtaining reliable information. Due to the retrospective design of the study, there was a massive amount of data missing which has decreased the size and power of the study.

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