

A Study on Maternal Body Mass Index Effect on Pregnancy Outcomes

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Abstract

Background: Early pregnancy Body Mass Index (BMI) and weight gain during pregnancy are important predictors of adverse pregnancy outcomes. BMI is widely accepted as a better measure of underweight or overweight than weight alone. The developing countries including India are facing a dual burden of undernutrition and obesity.

Aim and Objective: This study aim to study to evaluate the effect of body weight on pregnancy outcome in our Indian population.

Materials and Method: This was a prospective observational study conducted at Department of OBG for the duration of one year in the CAIMS, Karimnagar. Study comprised of 120 patients who have consented for the study within the first 12 weeks of gestation. The patients were included after fulfilled exclusion and inclusion criteria.

Results: A Prospective observational study comprising 120 antenatal women with singleton uncomplicated pregnancies, booked at CAIMS Hospital within the first 12 weeks of pregnancy. mean age of the study population was 25.78±24.8 years and among the group it was not statistically significant. 55% of the patients were having multi gravida, among all the pregnant women 52.50% of the women gained weight between 8 to 13 Kg, 10.80% patients were preterm, 6.70% PIH, 11.70% PROM, 2.50% had IUGR, polyhydramnios, 8.30% oligohydramnios.

Conclusion: After analysing the data we conclude that majority of antenatal patients being catered in our hospital have normal BMI. Adverse maternal and perinatal outcomes are seen more commonly with the extremes of BMI.

Keywords: Body Mass Index, Weight Gain, IUGR, Overweight.

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Introduction

Early pregnancy BMI and weight gain during pregnancy are important predictors of adverse pregnancy outcomes. The problems during pregnancy were more related to low BMI previously, but with changing lifestyle, obesity is increasing rapidly especially in urban set ups and may become a major health problem in the future. The developing countries like India are facing a dual burden of nutritional problems, with undernourished and underweight women on one side and overweight and obese women on the other side. We were yet struggling to eradicate undernutrition and anemia from our country and we are already facing an epidemic of obesity in the 21st century probably due to the transition from traditional diets and lifestyles to western diets.

The worldwide prevalence of obesity is reaching pandemic proportions. The WHO had estimated that in 2016, more than 1.9 billion adults worldwide (39%) were overweight, and over 650 million (13%) were obese. [1] According the National Family Health Survey [NFHS] in India 52% of the women had normal Body Mass Index (BMI) during 2005-06. 36% of the women were undernourished [2] and 13% of the women were overweight or obese. NFHS-4 states that

in 2015-16 frequency of obese people has doubled in the last 10 years [3]

Maternal nutritional status before and during pregnancy has a significant influence on the fetal development, the health of the newborn, and its development. Complications related to maternal obesity are classified into two groups: on the one hand, those that affect the mother, and which result in gestational diabetes, preeclampsia, cesarean section, postpartum hemorrhage, and wound infections; on the other hand, complications that affect the fetus, newborn, and child development, which includes macrosomia [4], prematurity, and fetal death in utero.

BMI is widely accepted as a better measure of under or overweight than weight alone. It is an index of weight- for- height and is calculated by dividing a person's weight in kilograms by square of height in meters (kg/m²). Many studies have been done in the Western countries whereas only few studies have been done on the Asian population. Hence the need of the study is to evaluate the effect of body weight on pregnancy outcome in our Indian population. By performing this study it would be possible to evaluate the association between BMI and its adverse effect on pregnancy outcome.

Table 1: WHO and Asia Pacific classification of nutritional status based on BMI.

Nutritional Status	Who Criteria BMI Cut-Off	Asian Criteria BMI Cut off
Underweight	<18.5	<18.5
Normal	18.5-24.9	18.5-22.9
Overweight	25-29.9	23-24.9
Pre-Obese	-	25-29.9
Obese	≥30	≥30
Obese Type 1 (Obese)	30-40	30-40
Obese Type 2 (Morbid Obese)	40.1-50	40.1-50
Obese Type 3 (Super Obese)	>50	>50

Material and Methods

This was a prospective observational study conducted at Department of OBG for the

duration of one year in the CAIMS, Karimnagar. Study comprised of 120 patients who have consented for the study within the first 12 weeks of gestation. The criteria of inclusion and exclusion as given bellow.

❖ **INCLUSION CRITERIA:**

- Antenatal patients only
- Booking in the first trimester of pregnancy
- Singleton pregnancy

❖ **EXCLUSION CRITERIA:**

- Patients with pre-existing medical disorders like Chronic hypertension, overt diabetes, over hypothyroidism and connective tissue disorders such as SLE.
- Multiple pregnancy
- No antenatal visits in the first trimester of pregnancy

❖ **Methods**

Women with singleton uncomplicated pregnancies, booked at PSG Hospital within the first 12 weeks of gestation were included in my study. Informed consent was taken. With the help of a pre-designed

questionnaire, basic information including weight and height was collected in the first checkup and BMI calculated accordingly.

Patients were divided into 4 groups such as

- ❖ Underweight (<18.5 kg/m²)
- ❖ Normal (18.5-24.9)
- ❖ Overweight (25-29.9)
- ❖ Obese (30 and above)

BMI was calculated using the formula $\text{weight(kg)} / \text{height}^2(\text{m}^2)$ (QUETELET'S Index). Weight gain during each visit was recorded and development of any antenatal complications throughout pregnancy was noted down. Information regarding postnatal complications, gestational age at delivery and also birth weight and Apgar score of the neonate was collected from the case sheets following delivery.

Results :

A Prospective observational study comprising 120 antenatal women with singleton uncomplicated pregnancies, booked at CAIMS Hospital within the first 12 weeks of pregnancy.

Table 1 : Basic parameters distribution according to Body Mass Index.

	Body Mass Index				
	Normal (n=63)	Overweight (n=28)	Obese (n=14)	Underweight (n=15)	Total (n=120)
Age in Years					
Mean ± SD	25.48±3.93	26.43±4.85	26.93±3.75	24.8±3.40	25.78±4.09
< 20 Years	2(1.70%)	1(0.80%)	0(0%)	1(0.80%)	4(3.30%)
21 - 25 Years	31(25.80%)	12(10%)	4(3.30%)	8(6.70%)	55(45.80%)
26 - 30 Years	23(19.20%)	9(7.50%)	6(5.0%)	5(4.20%)	43(35.80%)
> 30 Years	7(5.80%)	6(5%)	4(3.30%)	1(0.80%)	18(15.0%)
Gestational Score					
Primi Gravida	31(25.80%)	6(5.0%)	8(6.70%)	9(7.50%)	54(45.0%)
Multi Gravida	32(26.70%)	22(18.30%)	6(5.0%)	6(5.0%)	66(55.0%)
Gestational Age					
Term	59(49.20%)	23(19.20%)	13(10.80%)	12(10.0%)	107(89.20%)
Preterm	4(3.30%)	5(4.20%)	1(0.80%)	3(2.50%)	13(10.80%)

Above table shows the basic parameters of study population, mean age of the study population was 25.78 ± 24.8 years and mean age distribution was statistically not significant (p -value = 0.393). 55% of the patients were having multi gravida and

association with BMI distribution was statistically significant (P -value = 0.03). we have found 89.20% pregnancy were term pregnancies, association with BMI was statistically not significant (P -value = 0.236)

Table 2: Distribution of weight gain during pregnancy according to BMI.

Weight Gain	Body Mass Index				
	Normal (n=63)	Overweight (n=28)	Obese (n=14)	Underweight (n=15)	Total (n=120)
< 8	9(7.50%)	4(3.30%)	1(0.80%)	4(3.30%)	18(15.0%)
8 to 13	39(35.50%)	18(15.0%)	2(1.70%)	4(3.30%)	63(52.50%)
>13	15(12.50%)	6(5.0%)	11(9.20%)	7(5.80%)	39(32.50%)

Among all the pregnant women 52.50% of the women gained weight between 8 to 13 Kg followed by 32.50% weight of > 13 Kg. It means that out of all 80% of the women gained their weight more than 8 Kg and this weight gain distribution with BMI index was statistically significant (Chi-square = 20.59, P -value = 0.001)

Table 3: Distribution of weight gain during pregnancy according to BMI.

	Body Mass Index				
	Normal (n=63)	Overweight (n=28)	Obese (n=14)	Underweight (n=15)	Total (n=120)
Vaginal Delivery					
Vaginal Delivery(VD)	17(14.20%)	19(15.80%)	6(5.0%)	3(2.50%)	45(37.50%)
Uncomplicated Vaginal Delivery(UVD)	39(32.50%)	9(7.50%)	6(5.0%)	11(9.20%)	65(54.20%)
Complicated Vaginal Delivery(CVD)	7(5.80%)	0(0%)	2(1.70%)	1(0.80%)	10(8.30%)
LSCS					
LSCS	45(37.50%)	9(7.50%)	8(6.70%)	12(10.0%)	74(61.70%)
Emergency LSCS	10(8.30%)	9(7.50%)	4(3.30%)	3(2.50%)	26(21.70%)
Elective LSCS	8(6.70%)	10(8.30%)	2(1.70%)	0(0%)	20(16.70%)

Among all the patients many patients had one or more than one antenatal complications were observed 10.80% patients were preterm, 6.70% PIH, 11.70% PROM, 2.50% had IUGR, polyhydramnios, 8.30% oligohydramnios. Comparing percentages

within BMI category, antenatal complications were observed in 20-10% of patients in all categories of BMI except in obese category where all patients developed either single or multiple complications.(Table 4)

Table 4: Distribution of Antenatal parameters according to BMI.

	Body Mass Index				
	Normal (n=63)	Overweight (n=28)	Obese (n=14)	Underweight (n=15)	Total (n=120)
PIH					
Negative	62(51.70%)	25(20.80%)	11(9.20%)	14(11.70%)	112(93.30%)
Positive	1(0.80%)	3(2.50%)	3(2.50%)	1(0.80%)	8(6.70%)
Anaemia					
Negative	60(50.0%)	25(20.80%)	14(11.70%)	12(10.0%)	111(92.50%)
Positive	3(2.50%)	3(2.50%)	0(0%)	3(2.50%)	9(7.50%)
Membrane Status					
Rupture of Membrane(ROM)	55(45.80%)	21(17.50%)	12(10.0%)	13(10.80%)	101(84.20%)
Premature rupture of Membrane(PROM)	7(5.80%)	5(4.20%)	1(0.80%)	1(0.80%)	14(11.70%)
Preterm premature rupture of Membrane(PPROM)	1(0.80%)	2(1.70%)	1(0.80%)	1(0.80%)	5(4.20%)
Liquor Volume					
Normal	60(50.0%)	24(20.0%)	12(10.0%)	11(9.20%)	107(89.20%)
Polyhydraminos	0(0%)	2(1.70%)	1(0.80%)	0(0%)	3(2.50%)
Oligohydraminos	3(2.50%)	2(1.70%)	1(0.80%)	4(3.30%)	10(8.30%)
Pyrexia					
Negative	62(51.70%)	27(22.50%)	14(11.70%)	15(12.50%)	118(98.30%)
Positive	1(0.80%)	1(0.80%)	0(0%)	0(0%)	2(1.70%)

Table 5: Distribution of Antenatal parameters according to BMI

	Body Mass Index				
	Normal (n=63)	Overweight (n=28)	Obese (n=14)	Underweight (n=15)	Total (n=120)
Birth Weight					
Appropriate for Gestational Age(AGA)	57(47.50%)	24(20.0%)	7(5.80%)	8(6.70%)	96(80.0%)
Large for Gestational Age(LGA)	0(0%)	0(0%)	3(2.50%)	0(0%)	3(2.50%)
Small for gestational Age(SGA)	6(5.0%)	4(3.30%)	4(3.30%)	7(5.80%)	21(17.50%)
APGAR Score					
> 4	0(0%)	0(0%)	0(0%)	1(0.80%)	1(0.80%)
4 – 7	3(2.50%)	4(3.30%)	10(8.30%)	4(3.30%)	21(17.50%)
>7	60(50.0%)	24(20.0%)	4(3.30%)	10(8.30%)	98(81.20%)

Discussion:

A Prospective observational study comprising 120 antenatal women with singleton uncomplicated pregnancies, booked our hospital within the first 12 weeks of gestation.

The age of the subjects in the present study were in the range of 18– 40 years. The mean age of the subjects was 25.78 ± 4.09 years.

In the study, 45% of the study population were nullipara and 55% were multipara. 89.20 % of the subjects were term patients with gestational age 37- 40 weeks and 10.80 % of the subjects were preterm patients with gestational age less than 37 weeks.

It was seen that 15 % of the subjects showed a weight gain of 0 – 7 kg. 52.50 % of the subjects showed a weight gain of 8 – 13 kg during pregnancy. 32.50 % of the women showed a weight gain of more than 13 kg.

The study comprised women, who were divided into four BMI groups based on their early pregnancy BMI. The BMI at presentation of $<18.5 \text{ kg/m}^2$ was seen in 12.5% of the population. BMI between $18.5 - 24.9 \text{ kg/m}^2$ was seen in 52.5% of the women. BMI between $25.0 - 29.9 \text{ kg/m}^2$ was seen in 23.33 % of the women. BMI of 30 kg/m^2 and above was seen in 11.60 % of the women.

Maximum weight gain was noticed in a large number of obese individuals, whereas minimum weight gain was seen in underweight women. Association of gestational weight gain and BMI was done using Chi- square tests and it was seen that weight gain was significantly associated with early pregnancy BMI. ($p < 0.01$) A similar study done by Ihunnya O Frederick et al, observed that obese women gained more weight while underweight women gained less weight in pregnancy $p < 0.001$. [5] In

another study by J.E.Brown et al, results suggested that underweight women who gained less weight in pregnancy had a lower birth weight neonate and obese women delivered big babies. [6] Therefore adequate weight gain is of critical importance during pregnancy, the deficiency or excess of which leads to adverse pregnancy outcomes.

In the current study, it was seen that 0.8 % of the subjects belonging to the Normal and underweight BMI group developed PIH. 2.5 % in the overweight and Obese BMI group developed PIH.

Maximum number of obese patients (2.5 %) developed PIH, compared to women of normal BMI(0.8 %) Analysis was done using Chi-square, which showed a strong association between increasing BMI and PIH. ($p < 0.01$) A similar study done by Meenakshi, Srivastava Reena(FOGSI) [7] showed that obese women were associated with adverse outcomes like PIH with a $p < 0.05$.

It was observed that, 2.5 % with Normal BMI, overweight and underweight developed anemia. No patients in the obese group developed anemia.

Analysis was done using Chi square, which showed a significant association between low BMI and anemia in my study. ($p < 0.05$). A study done by Adam I, [8] on 1136 showed that 26.5% of the underweight women developed anemia with a significant association between anemia and low BMI being $p < 0.05$

Importance has to be given, because ours is a developing country, and the incidence of Anemia is high especially in the rural areas.

In the current study, 1.7 % of the overweight patients had Polyhydraminos, whereas 0.8 % of the obese patients had polyhydraminos when compared to patients belonging to the normal BMI group(0%). In the underweight category, none of the patients had

polyhydraminos, but maximum number of patients in the underweight group had oligohydraminos(3.30 %) when compared with the normal BMI category (2.5 %).

It was seen that maximum number of patients with increased BMI had polyhydraminos, whereas maximum number of underweight patients had oligohydraminos.

Using Chi - square test, it was found that there was an association between BMI and liquor volume.($p < 0.05$). [9]

It was observed that maximum risk of oligohydraminos was seen in the Underweight group compared with normal BMI.

Results showed that 4.20 % of the overweight patients had PROM whereas 0.8% of the obese patients had PROM when compared to patients belonging to the normal BMI group who comprised of 5.80 %. In the underweight category, 0.80 % of the patients had PROM, when compared with normal BMI women(5.80 %) . [10]

From the results, it can be seen that there was no significant difference in various BMI groups regarding PROM in the study ($p = 0.43$) A similar study done by Meenakshi, Srivastava Reena(FOGSI) [7] showed that no significant difference was noted among obese women regarding PROM with a $p > 0.05$.

Regarding PPRM, results showed that 1.70 % of the overweight patients had PPRM, whereas 0.80 % of the obese patients had PPRM. In the underweight category, 0.80 % of the patients had PPRM.

In the study, it was seen that subjects in the normal(32.50%) and underweight(9.20%) groups had a higher percentage of uncomplicated vaginal deliveries when compared to the overweight(7.50%) and obese(5%) groups. But the maximum number of patients having

a complicated vaginal delivery fell in the normal

Using chi-square analysis, it was found that there was a strong association between BMI and vaginal delivery. ($P < 0.05$) A study done on 215 women by Meenakshi, Srivastava Reena (FOGSI) [7] showed that 18 obese women were associated with complicated vaginal dekuverues with a $p < 0.05$

In my study it can be seen that a much higher percentage of overweight (15.80%) and Normal (15%) subjects have had C section either in the form of emergency or elective when compared to normal group individuals.

Using Chi square analysis, it was found that there was a strong association between BMI and Cesarean section.($p < 0.05$). A study done on 215 women by Meenakshi, Srivastava Reena(FOGSI) [1]

In the present study, it was seen that maximum percentage of LGA babies were born to obese women(2.50%) compared to women with normal BMI. Likewise maximum percentage of SGA babies were born to women in the underweight group(5.80%) when compared to other groups. Results showed that there was a significant association between lower BMI and low birth weight and obesity and high birth weight. ($p < 0.001$). Similar findings were noted in a study by Ihunnaya O Frederick et al[9] and J.E.Brown et al [6] with $p < 0.001$ and p value 0.0009 respectively.

In my study, it was seen that low Apgar score was seen in babies born to Underweight (0.80%) when compared to women in the normal BMI

Pearson Chi square analysis showed that showed a highly significant association between BMI and Apgar score ($p < 0.001$).

Conclusion :

From Analysis and observation of above data we can concluded that It was observed that overweight and obese women gained more weight than women with normal BMI, and least weight was gained by underweight women. The relative risk of various pregnancy outcomes that a patient with high or low BMI can develop was also evaluated and the results were justified. Utmost importance needs to be given to BMI and the patterns of weight gain during pregnancy, as they are modifiable risk factors of adverse pregnancy outcomes. One should have basic knowledge and awareness regarding the symptoms and signs of adverse pregnancy outcomes. A better understanding of the complex interrelations between the mother and fetus has led to a vast improvement on antenatal recommendations.

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