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Original Research Article

## Effect of gestational weight gain on pregnancy outcome of Indian mothers

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### ABSTRACT

**Background:** Gestational weight gain (GWG) and pre-pregnancy body mass index (BMI) play important roles in determining the pregnancy outcome. The weight gain recommendations by the IOM are based on Western WHO BMI cut-offs, making it difficult to generalize their findings to Asian Indians. We aimed to compare GWG among healthy pregnant women across different BMI with the IOM guidelines-2009. We also aimed to evaluate associated fetomaternal outcomes with GWG among the pregnant women enrolled in the study.

**Methods:** A retrospective cohort study conducted at department of obstetrics and gynecology, from April 2019 to November 2019. Postnatal mothers whose weight was registered at first trimester of pregnancy and at term and delivered in SSG hospital were included. According to IOM Women were divided into: Group 1 less than recommended weight gain and Group 2 recommended weight gain.

**Results:** Significant difference was seen in the baby weight between the two groups ( $p$  value  $<0.05$ ). 92.75% of babies had low birth weight in Group 1 as compared to 42.21% in Group 2. On performing univariate logistic regression, significant association was seen between GWG and low birth weight ( $p <0.05$ ), no association was seen between GWG and caesarean ( $p$  value  $>0.05$ ), and no association was seen between GWG and preterm deliveries ( $p >0.05$ ).

**Conclusions:** Majority of patients in the both groups had term delivery. Women gaining less than recommended weight gain during pregnancy had new born with significantly lower birth weight. There was no association of mode of deliveries and GWG.

**Keywords:** Gestational weight gain, Indian, Pregnancy outcome

### INTRODUCTION

Gestational weight gain (GWG) is an important determinant of pregnancy and birth outcome.<sup>1</sup> The institute of medicine (IOM) pointed out the amount of appropriate GWG based on BMI before pregnancy and recommended to gain more weight in pregnant women with low BMI and less GWG in women with high BMI.<sup>2</sup>

Some studies have reported that excessive weight gain during pregnancy is related to an atypical increase in fetal growth, neonatal macrosomia, gestational diabetes mellitus and caesarean section while low GWG has been

linked to a higher incidence of preterm delivery and LBW.<sup>3,4</sup> One large study based on Indian participants has reported that Normal and overweight women who gained weight less than recommended have low risk for caesarean section and macrosomia. However, they have a higher (statistically insignificant) risk for low birth weight and preterm birth. It also shows that shows only 30% women gained weight as per IOM recommendation.<sup>5</sup>

So GWG can serve as an early marker for at-risk pregnancies. Most of the current evidence on BMI and GWG is from Western or high-income countries while

data among women of developing countries like India is inadequate to generate recommendations. Given the importance of maternal pre-pregnancy anthropometric characteristics and GWG on pregnancy and birth outcomes, it is important to explore these factors in women of developing countries like India.

## METHODS

This is a retrospective cohort study in postnatal mothers whose weight was registered at first trimester of pregnancy and at term and delivered in SSG hospital were included, Data related to height, weight, and GWG was noted. Women were divided into: Group 1 (those achieving less than the recommended weight gain) and Group 2 (those achieving equal to the recommended weight gain) were evaluated for inclusion in the study. Total 1104 women (in which 552 women in Group 1 and 552 women in Group 2) to estimate the difference of incidence of LBW by 4% (< IOM 8% assumption, ≥ IOM 4% assumption) with 80% power and 95% confidence interval were included over a time period of 1 year from April 2019 to November 2019.

### Inclusion criteria

- Postnatal mothers whose height and weight are documented within first trimester pregnancy and at term or just before delivery
- Postnatal mothers with singleton pregnancy taken Antenatal care at SSGH and who delivered at SSG Hospital.

### Exclusion criteria

- Postnatal mothers not giving consent to participate in the study
- Postnatal mothers having multiple gestation
- Postnatal mothers who is known case of cardiac disease, severe anemia, diabetes mellitus, chronic hypertension.

### Study procedure

During the study period, after obtaining informed consent to be a part of the study, data from the case records of postnatal ward were collected in the proforma for all the postnatal mothers who fulfilled inclusion and exclusion criteria.

Weight and height and 1<sup>st</sup> and 3<sup>rd</sup> trimester weight were obtained from ANC case record and BMI was calculated according to that. Both weight measurements were to be done in ANC OPD on the same weighing scale (Scale-Tech) by trained nursing staff. GWG was extracted from those records. All of them were divided in different BMI categories according to IOM classification.

In the present study, in terms of GWG, women were divided into two groups.

Group 1: Pregnant women achieving less than the recommended weight gain.

Group 2: Pregnant women achieving equal to the recommended weight gain.

All the mothers should have taken regular ANC and delivered at SSG hospital only.

The following details about delivery were noted from the case record.

- Mode of delivery (vaginal delivery/LSCS)
- Gestational age at delivery (term/pre term)
- Birth weight of baby (normal birth weight or LBW).

The outcomes of interest were weight of the baby, mode of delivery and time of delivery and GWG. Logistic regression will be done to control true confounding variables.

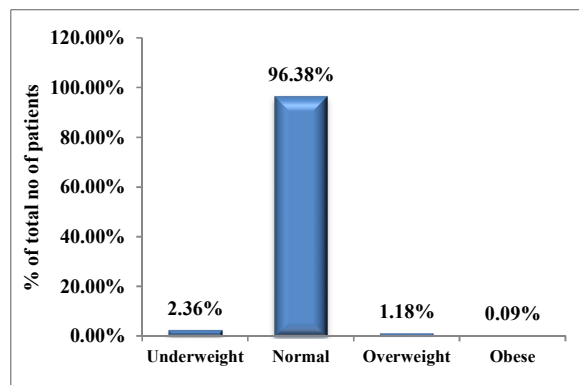
Confounding variables like maternal age, socioeconomic status, the number of previous gravidity and parity, number of previous caesarean sections were controlled using logistic regression model for data analysis.

## RESULTS

In the present study, majority (90.58%) of patients were in the age group of 21-30 years. Only 4.26% of patients were ≤ 20 years and 5.16% of patients belonged to 31-40 years. Mean value of age of study subjects was 25.95±3.02 years (Table 1).

**Table 1: Distribution of age of study subjects.**

Age distribution in years	Frequency	%
≤ 20	47	4.26%
21-30	1000	90.58%
31-40	57	5.16%
Mean±SD	25.95±3.02	
Median (IQR)	26 (24-28)	



**Figure 1: Distribution according to weight of study subjects.**

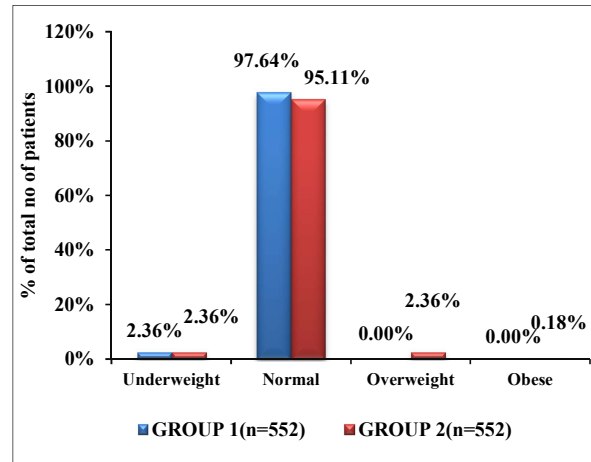
In the present study, majority (96.38%) of patients had normal BMI. Only 2.36% of patients were underweight, 1.18% of patients were overweight and 1 out of 1104 patients was obese. Mean value of BMI, height and weight of study subjects was  $21.19 \pm 1.73 \text{ kg/m}^2$ ,  $156.36 \pm 6.65 \text{ cm}$  and  $51.88 \pm 5.6 \text{ kg}$  (Table 2) (Figure 1).

**Table 2: Distribution of anthropometric parameters of study subjects.**

Anthropometric parameters	Frequency	%
<b>Body mass index at admission (<math>\text{kg/m}^2</math>)</b>		
Underweight	26	2.36%
Normal	1064	96.38%
Overweight	13	1.18%
Obese	1	0.09%
Mean $\pm$ SD	$21.19 \pm 1.73$	
Median (IQR)	21 (19.900-22.300)	
<b>Height (in cm)</b>		
Mean $\pm$ SD	$156.36 \pm 6.65$	
Median (IQR)	157 (151-161)	
<b>Weight at 1 trimester</b>		
Mean $\pm$ SD	$51.88 \pm 5.6$	
Median (IQR)	51.5 (48.700-55.150)	

In the present study, majority (88.86%) of patients had term delivery. Preterm delivery occurred in only 11.14%

of patients. Mean value of gestational age of study subjects was  $38.57 \pm 1.24$  weeks (Table 3) (Figure 2).



**Figure 2: Comparison of body mass index at admission between Group 1 and Group 2.**

On performing univariate logistic regression, no association was seen between gestational weight gain and caesarean (p value > 0.05). Risk of caesarean was comparable between patients who gained and who did not gain recommended weight (Table 4).

**Table 3: Comparison of anthropometric parameters between Group 1 and Group 2.**

Anthropometric parameters	Groups		Total	p value
	Group 1 (n = 552)	Group 2 (n = 552)		
<b>Body mass index at admission (<math>\text{kg/m}^2</math>)</b>				
Underweight	13 (2.36%)	13 (2.36%)	26 (2.36%)	0.003*
Normal	539 (97.64%)	525 (95.11%)	1064 (96.38%)	
Overweight	0 (0.00%)	13 (2.36%)	13 (1.18%)	
Obese	0 (0.00%)	1 (0.18%)	1 (0.09%)	0.001#
Mean $\pm$ SD	$20.98 \pm 1.55$		$21.19 \pm 1.73$	
Median (IQR)	20.9 (19.700-22)		21 (19.900-22.300)	
<b>Height (in cm)</b>				
Mean $\pm$ SD	$156.05 \pm 6.41$		$156.36 \pm 6.65$	0.17#
Median (IQR)	157 (150-160)		157 (151-161)	
<b>Weight at 1 trimester</b>				
Mean $\pm$ SD	$51.18 \pm 5.2$		$51.88 \pm 5.6$	0.0002#
Median (IQR)	51.2 (48.350-54)		51.5 (48.700-55.150)	

\*Chi square test, #Mann Whitney test (as the data set was not normally distributed so median was used for comparison).

**Table 4: Univariate logistic regression to determine association of gestational weight gain with caesarean.**

	Beta coefficient	Standard error	p value	Odds ratio	95% CI for odds ratio	
					Lower	Upper
<b>Recommended/less recommended</b>						
Less recommended				1.00		
Recommended	0.000	0.149	1.000	1.00	0.746	1.340

**Table 5: Univariate logistic regression to determine association of gestational weight gain with low birth weight.**

	Beta coefficient	Standard error	p value	Odds ratio	95% CI for odds ratio	
					Lower	Upper
<b>Recommended/less recommended</b>						
Less recommended				1.00		
Recommended	-2.864	0.185	< 0.0001	0.057	0.040	0.082

**Table 6: Univariate logistic regression to determine association of gestational weight gain with preterm.**

	Beta coefficient	Standard error	p value	Odds ratio	95% CI for odds ratio	
					Lower	Upper
<b>Group 1/Group 2</b>						
Group 1				1.00		
Group 2	0.202	0.192	0.293	1.224	0.840	1.783

On performing univariate logistic regression, significant association was seen between gestational weight gain and low birth weight (p value <0.05). Women who gained recommended weight had significantly 94.3% lower risk of low birth weight as compared to women who did not gain recommended weight with odds ratio of 0.057 (Table 5).

On performing univariate logistic regression, no association was seen between gestational weight gain and preterm (p value >0.05). Risk of preterm was comparable between patients who gained and who did not gain recommended weight (Table 6).

## DISCUSSION

The role of GWG during the pregnancy holds an important role in the outcome of the pregnancy and neonate. The pre-pregnancy BMI is the basis to decide the adequate weight gain recommendation for the pregnant women.

Although there are standard IOM guidelines to assess and evaluate the maternal weight and recommended GWG, its application may be affected by the ethnicity and the country as the general built of women in developing and developed country differs.

There are very few studies on Indian women assessing the GWG and its effects on the fetomaternal outcomes. Thus, study did this study in the department of Obstetrics and Gynecology, postnatal ward of SSG hospital for a period of 8 months where a total of 1104 Postnatal mothers whose weight is registered at first trimester of pregnancy and at term and delivered in SSG hospital were assessed for GWG.

Compared to this study, Doherty in their study classified 331 women as underweight (11.7%), 1982 normal (69.9%), 326 overweight (11.5%), and 188 as obese (6.6%) Sebire studied a total of 287, 213 completed singleton pregnancies which included 176, 923 (61.6%)

normal weight (BMI 20-24.9), 79, 014(27.5%) moderately obese (BMI 25-29.9) and 31, 276(10.9%) very obese (BMI > or = 30) women.<sup>6,7</sup>

In another study by Waring et al, women had an average pre-pregnancy BMI of 25.2 kg/m<sup>2</sup> and gained an average of 33 pounds during pregnancy. Eighteen percent of women had inadequate GWG, 26% gained appropriately, and 56% gained excessively.<sup>8</sup>

In an Indian study by Bhavadharini B et al, mean age of pregnant women was 27.4±4 years, mean BMI was 25.1±4.8 kg/m<sup>2</sup>, and mean weight gain during pregnancy was 8.8±4.8 kg. It was seen that 30.5% of underweight, 23.4% of normal weight, 22.5% overweight, and 37.1% obese women met the recommendations for weight gain. While majority of underweight (66.2%), normal weight women (69.4%), and overweight women (68.8%) gained weight less than recommended, among obese women, 28.5% of them gained more weight and 34.4% of them gained less than the recommended weight.<sup>5</sup>

On comparison between the women who gained recommended weight gain and those who gained less than recommended gestational weight, study found that significant difference was seen in the baby weight between the two groups (p value < 0.05). 92.75% of babies had low birth weight in less than recommended weight gain group as compared to 42.21% in recommended weight gain group. So, it can be concluded that incidence of low birth weight babies was significantly higher in women with less than recommended weight gain as compared to women with recommended weight gain. On performing univariate logistic regression, we found that women who gained recommended weight had significantly 94.3% lower risk of low birth weight as compared to women who did not gain recommended weight with odds ratio of 0.057.

Apart from that we found no significant difference between the preterm/term distribution, mode of delivery and type of labor between the two groups (p value >0.05).

Study findings were in line with Wills AK study who reported a higher percentage (26%) of low birth weight infants among women who gained less weight than recommended.<sup>9</sup> Compared to this study, Bhavadharini B et al found that normal weight and overweight women who gained less weight than recommended had statistically insignificant risk of both low birth weight and preterm birth. Underweight women are known to deliver preterm infants. In addition, underweight women gaining less weight than recommended can have high risk of delivering low birth weight infants as was seen in this study.

The mode of delivery such as caesarean 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 caesarean section. Results from this study were in line with Edwards et al and Graham et al, who also found that when stratified by maternal weight gain, there was no significant association between GWG and caesarean section.<sup>10,11</sup> However, Seligman et al, reported that greater weight gain among during pregnancy was particularly associated with higher risk of caesarean sections.<sup>12</sup> Study reported no statistically significant association of GWG with preterm labor. Not many studies have reported on weight gain and its association to preterm labor. Study findings were in line with Zhong et al, who showed that association between GWG and preterm labor lacked statistical significance.<sup>13</sup>

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