Original Research Article

A retrospective observational study of maternal weight gain during pregnancy and correlation with fetomaternal outcome in women admitted to labour room in a tertiary care center of South Gujarat

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ABSTRACT

Background: Gestational weight gain (GWG) is an important determinant of maternal and neonatal health. Both excessive and inadequate GWG are associated with adverse outcomes. This study evaluated the correlation of GWG, based on Institute of Medicine (IOM) guidelines, with pregnancy outcomes across different body mass index (BMI) categories.
Methods: A retrospective observational study was conducted in the Department of Obstetrics and Gynaecology at a tertiary care centre in South Gujarat over one year. A total of 300 pregnant women were analysed for age, parity, BMI, GWG, and fetomaternal outcomes.
Results: Most participants were aged 19–35 years (95%), with primipara comprising 40.67%. Poor GWG was observed in 56% and normal GWG in 35.67%. Preterm labour was more frequent in underweight women (11.13%), while post-term delivery was higher in obese women (17.47%). Vaginal delivery predominated in poor GWG (72.62%), whereas lower segment caesarean section (LSCS) rates were greater in high BMI groups (36%). Low birth weight (<2.5 kg) was common with poor GWG (41.07%), while birth weight >2.5 kg was more frequent in normal (76.63%) and excessive GWG (88%). Anaemia was the leading comorbidity (132 cases), particularly in underweight women. GDM, hypertensive disorders, big bay, induction failure, operative delivery, and postpartum complications were associated with higher BMI and excessive GWG.
Conclusions: GWG followed pre-pregnancy BMI trends. Excessive GWG was linked with metabolic and obstetric complications, while below-recommended GWG increased risks of low birth weight, preterm delivery, and anaemia.

Keywords: Body mass index, Gestational weight gain, Preconceptional BMI, Foetal outcome

INTRODUCTION

In normal pregnancy, variable amount of weight gain is a constant phenomenon. The amount of weight gain during pregnancy can affect the immediate and future health of woman and her infant. Therefore, there should be an ideal weight gain during pregnancy to achieve a good pregnancy outcome. Ideal weight gain during pregnancy depends on pre-pregnancy body mass index (BMI).[1]

Maternal BMI during pregnancy is one of the important parameter which gives us the clue regarding maternal complications and foetal outcome. Routine weight measurement of pregnant women has now become accepted as one of the important tools of prenatal care. The women are weighed at their first antenatal visit to note the booking weight and height of the patient which is taken to calculate BMI.[2]

Gestational weight gain (GWG) is necessary for normal foetal development. In fact, that both inadequate and

excessive GWG is associated with negative foetal and neonatal outcome. So, the optimal gestational weight gain across the range of the pre-pregnancy maternal BMI is necessary.[3]

Obesity continues to rise in the prevalence around the globe. The global epidemic of obesity continues to grow at an alarming rate, crossing boundaries of age, race and gender. Indeed, it is now so common that it is replacing the more traditional public health care concerns including under nutrition and infectious disease as one of the most significant contributions to ill health.[4]

American College of Obstetricians and Gynaecologists (ACOG) to recommend that the body mass index to be recorded for all women at the initial prenatal visit and that information concerning the maternal and foetal risks of a very elevated BMI in pregnancy should be provided.[5]

The World Health Organization (WHO) in 2009 announced obesity in pregnancy as one of the important non-communicable diseases that threaten maternal and child health. Obese pregnant women are at increased risk of gestational diabetes, pre-eclampsia, infections, operative vaginal delivery and caesarean delivery. They are also at increased risk of wound infection and endometriosis. Their offspring's are at increased risk of birth defects, macrosomia and morbidity associated with subsequent child obesity.[6] In developing countries like India, they also face problems of malnutrition complications related to underweight are anaemia, premature rapture of membranes, low APGAR score, low birth weight babies, preterm delivery and increased perinatal mortality.[7]

The institutes of medicine (IOM) conclude that pre pregnancy BMI was an important predictor for foetal birth weight, independent GWG, and that pre-pregnancy BMI should be used to guide recommendations for gestational weight gain. Thus determine BMI became an integral part of the physical examination of pregnant women.[7,8]

METHODS

Study design

This was a retrospective observational study conducted in the Department of Obstetrics and Gynaecology at a tertiary care teaching hospital in South Gujarat over a period of 12 months (March 2024 to March 2025).

Selection criteria

A total of 300 consecutive women were included.

Inclusion criteria

Consenting pregnant women registered in the first trimester with a singleton pregnancy who delivered at the institute were included.

Exclusion criteria

Non-consenting women, multifetal gestations, women not registered in the first trimester, and those with pre-existing medical disorders such as diabetes mellitus, chronic hypertension, chronic kidney disease, connective tissue disorders, or thyroid dysfunction were excluded.

Study procedure

At enrolment, demographic and clinical details were recorded in a structured proforma. Maternal BMI was calculated at the time of first-trimester registration. Participants were followed through routine antenatal visits as per departmental protocol until delivery. Data on maternal weight gain, development of medical complications, course of labour, mode of delivery, and postpartum outcomes were collected. Neonatal outcomes including birth weight, Apgar scores, and need for neonatal intensive care unit (NICU) admission were also documented.

Statistical analysis

Data were analysed using statistical package for the social sciences (SPSS) version 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation, and categorical variables as frequencies or percentages. Associations between gestational weight gain categories and maternal and neonatal outcomes across BMI groups were assessed using chi-square test. A p value <0.05 was considered statistically significant.

The women were categorised into four groups according to their BMI as per WHO classification as Follows; Underweight: less than or equal to BMI 18 kg/m^2, normal: BMI >18.5-24.9 kg/m^2, overweight: BMI 25-29.9 kg/m^2, and obese: BMI: 30-34.9 kg/m^2.

Also, women were categorized into three group according her recommend total gestational weight gain during pregnancy according to their pre-pregnancy BMI like for - underweight: 12.5 to 18 kg, normal: 11.5 to 16 kg, overweight: 7 to 11.5 kg, and obese: 5 to 9 kg.

If subjects gain weight in this recommend range considered in normal GWG. If they gain less weight than recommended range considered in poor GWG. If subjects gain more weight than recommend range considered in excessive GWG.

RESULTS

Table 1 show that the majority of 60.67% (182 subjects) between 19 to 25 year of age, 35.67% (107) subjects between 26 to 35 year of age, 2% (6 subjects) are more than 35 year of age and only 5 subjects has less than 18 year of age had pregnancy. Majority of subjects are more than 95% are between 19 to 35 year of age. The majority

of subjects were primipara 122 (40.67%), 2nd para 107 (35.67%), and multipara and grand multipara were 66 (20%) and 5 (1.67%) respectively.

Table 2 show, the majority of normal and underweight BMI mothers had poor GWG (less than the IOM recommendation).

Overweight and obese mothers achieved predominantly normal weight gain during pregnancy. 56% (168) of women had poor GWG, 35.67% (107) achieved normal GWG, and only 8.33% (25) had excessive GWG. Poor GWG was highest in normal (116 cases) and underweight (46 cases) BMI groups. Overweight and obese categories showed relatively better adherence to recommended GWG.

Table 3 shows the majority of patients delivered at term pregnancy in all three groups. In underweight or poor GWG had more chance to went into preterm delivery, while women with obesity had higher chance of post-dated pregnancy.

As BMI increasing chance of prolongation of pregnancy also increasing and delivered at late term or post term, and also need to induction of labour in this category patients.

Table 4 data indicate that while spontaneous onset of labour was the most common mode of labour onset across all three categories, its proportion was slightly lower in women with normal and excessive gestational weight gain women. Additionally, the rate of failed labour increased progressively with higher body mass index, from 27.38% in the poor weight gain women group to 36% in the excessive weight gain group, suggesting a possible association between increased BMI and adverse labour outcomes.

Table 5 shows, there appears to be a notable association between maternal GWG and new born birth weight. Babies born from the mothers with poor GWG had a higher proportion of low birth weight (<2.5 kg) (41.07%) compared to those with normal (23.36%) and excessive GWG (12%). Conversely, normal and excessive GWG were associated with higher birth weights (≥2.5 kg).

This suggests that insufficient maternal weight gain during pregnancy increases the risk of delivered low-birth-weight baby, while adequate or excessive GWG is linked to higher birth weights. The p value for the association between GWG and birth weight is 0.0012. So this p value is less than 0.05, the association is statistically significant - meaning there's strong evidence that birth weight is associated with maternal GWG.

Table 1: Distribution of subjects according to age and parity (n=300).

Variables	Underweight	Normal	Overweight	Obese	Total	Percentage
Age (years)						
<18	2	2	1	0	5	1.67
19 to 25	49	107	19	7	182	60.67
26 to 35	28	48	22	9	107	35.67
>35	0	1	2	3	6	2
Parity						
Primipara	38	68	13	3	122	40.67
Secondpara	27	56	18	6	107	35.67
Multipara	14	33	11	8	66	22
Grandmultipara	0	1	2	2	5	1.67
1st trimester BMI	79	158	44	19	300	100

Table 2: Correlation of 1st trimester BMI with total weight gain during pregnancy (n=300).

1st trimester BMI	Poor GWG	Normal GWG	Excessive GWG	Total
Underweight	46	33	0	79
Normal	116	35	7	158
Overweight	6	25	13	44
Obese	0	14	5	19
Total (%)	168 (56)	107 (35.67)	25 (8.33)	300

Table 3: Correlation of gestational age at delivery with body mass index (n=300).

Gestational age at delivery	Underweight (BMI <18.5) (%)	Normal (BMI 18.5 to 24.9) (%)	Overweight/obese (BMI >25) (%)	Total
Preterm	8 (10.13)	11 (6.97)	5 (7.93)	24
Term	64 (8.1)	126 (79.74)	47 (74.60)	237

Continued.

Gestational age at delivery	Underweight (BMI <18.5) (%)	Normal (BMI 18.5 to 24.9) (%)	Overweight/obese (BMI >25) (%)	Total
Post term/postdate	7 (8.87)	21 (13.29)	11 (17.47)	39
Total	79	158	63	300

Table 4: Correlation of labour outcomes with gestational weight gain during pregnancy (n=300).

Onset of labour	Poor GWG	Normal GWG	Excessive GWG	Total
Spontaneous	125	74	18	217
Induction	43	33	7	83
Successful vaginal delivery (%)	122 (72.62)	75 (70)	16 (64)	213
LSCS (%)	46 (27.38)	32 (30)	9 (36)	87
Total	168	107	25	300

Table 5: Correlation of birth weight with total gestational weight gain during pregnancy (n=300).

Baby weight (kg)	Poor GWG (%)	Normal GWG (%)	Excessive GWG (%)	Total
Less than 1.5	2 (1.19)	0	0	2
1.5–2.5	67 (39.88)	25 (23.36)	3 (12)	95
2.5–3.5	98 (58.33)	80 (74.76)	19 (76)	197
More than 3.5	1 (0.56)	2 (1.87)	3 (12)	6
Total	168	107	25	300

In my study, anaemia was most common antenatal morbidity and more common in underweight women (57 cases), with a significant association (p=0.0035). Hypertensive disorders and GDM were more frequent in overweight/obese women (10 and 5 cases, respectively), also statistically significant (p=0.0015 and p=0.015).

Oligohydramnios and foetal distress were more frequent in underweight women. Macrosomia-related complications (2nd stage CPD, meconium-stained liquor, NPOL) were more observed in overweight/obese women.

Table 6: Correction between subjects' morbidity with body mass index.

Antenatal morbidity	Under-weight	Nor-mal	Overwe-ight/obese
Anemia	57	55	20
Hypertensive disorder	3	5	10
Gestational diabetes mellitus	1	3	5
Oligohydramnios	3	7	5
Polyhydramnios	0	2	1
IUGR	4	2	0
IUFD	0	0	1
NPOL	0	3	4
2nd stage CPD	0	1	4
Meconium stain liquor	4	6	8
Fetal distress	8	9	4

DISCUSSION

In this retrospective observational study of 300 pregnant women, we assessed the correlation of GWG, stratified according to IOM recommendations, with maternal and perinatal outcomes across different BMI categories.

Maternal age and parity

The majority of women in our study were in the age group of 19–25 years (60.7%), and more than 95% were between 19–35 years, which reflects the typical reproductive age distribution of Indian women. Similar demographic trends have been reported by Singh et al and Sharma et al, where most subjects belonged to younger age groups.[9]

Primipara women constituted the largest group (40.67%), 2nd para 107 (35.67%), while multipara was 66 (20%) and grand multipara were only 5 (1.67%). 2nd para 107 (35.67%), while multipara was 66 (20%) and grand multipara were only 5 (1.67%).

Gestational weight gain patterns

We observed that more than half of the women (56%) had inadequate GWG, while only 8.3% had excessive GWG. This high prevalence of poor GWG is consistent with findings from other low- and middle-income countries, where under nutrition and inadequate dietary intake remain prevalent.[11] Conversely, overweight and obese women in our study were more likely to achieve normal GWG.

Pregnancy outcomes (gestational age at delivery)

Most women delivered at term across all BMI categories. However, poor GWG was associated with higher preterm birth rates (10.1%), while excessive GWG was linked with increased post-term pregnancy (17.4%). This pattern is comparable with the results of Chen et al, who reported that inadequate GWG increased the risk of spontaneous preterm birth, while excessive GWG predisposed to post-dated pregnancy and labour induction.[12]

Mode of delivery

The rate of caesarean delivery in our study increased with increasing GWG, being highest in the excessive GWG group (36%). This observation is consistent with multiple studies that demonstrated a positive association between maternal obesity/excessive GWG and higher caesarean section rates, largely due to failed induction, cephalopelvic disproportion, and labour dystocia.[13] Conversely, poor GWG was associated with a slightly higher rate of vaginal delivery.

Foetal outcomes

In our study, low birth weight (LBW) was significantly higher among women with poor GWG (41.1%) compared to those with normal (23.3%) and excessive (12%) GWG. This correlates with the established evidence that inadequate maternal weight gain is a strong predictor of intrauterine growth restriction and LBW.[7,14]

On the other hand, macrosomia-related complications such as cephalopelvic disproportion, meconium-stained liquor, and prolonged labour were more frequent among overweight/obese women, in agreement with previous studies.[15]

Maternal complications

Anaemia was more common among underweight women in our study, while hypertensive disorders and gestational diabetes were significantly more frequent among overweight/obese women. This supports the well-established link between maternal under nutrition and anaemia and between obesity and metabolic complications during pregnancy.[16,17]

Oligohydramnios and foetal distress were more often seen in underweight/normal BMI groups, possibly due to suboptimal placental function in cases of inadequate maternal nutrition.

Comparison with global guidelines

Our findings reinforce the relevance of the IOM GWG guidelines even in the South Asian population, although a higher proportion of women in India tend to have inadequate GWG due to baseline nutritional deficits. Similar conclusions were drawn by studies from South-East Asia, highlighting the need for region-specific GWG recommendations.[18]

Limitations

It is observational study with small sample size. Also, exclusion of outside delivery and emergency patients in our study.

CONCLUSION

BMI plays a significant role in pregnancy outcome. In this study we correlated the preconceptional BMI with various pregnancy outcomes. High BMI is associated with increased incidence of big baby, GDM, gestational hypertension, instrumental delivery, and caesarean delivery. There is significant association of underweight BMI with anaemia and low birth weight. Present study results, together with existing literature, suggest an independent role of abnormal BMI as a determinant of adverse pregnancy outcomes.

REFERENCES

1. Simas TAM, Waring ME, Sullivan GM, Liao X, Rosal MC, Hardy JR, et al. Institute of Medicine 2009 gestational weight gain guideline knowledge: survey of obstetrics/gynecology and family medicine residents of the United States. Birth. 2013;40(3):237-46.
2. Ehrenberg HM, Dierker L, Milluzzi C, Mercer BM. Low maternal weight, failure to thrive in pregnancy, and adverse pregnancy outcomes. Am J Obstet Gynecol. 2003;189(6):1726-30.
3. Abu-Saad K, Fraser D. Maternal nutrition and birth outcomes. Epidemiol Rev. 2010;32(1):5-25.
4. World Health Organization. Obesity: preventing and managing the global epidemic. Report of a WHO consultation. World Health Organ Tech Rep Ser. 2000;894:1-253.
5. American College of Obstetricians and Gynecologists. Committee Opinion No. 549: Obesity in pregnancy. Obstet Gynecol. 2013;121(1):213-7.
6. Lee SE, Talegawkar SA, Merialdi M, Caulfield LE. Dietary intakes of women during pregnancy in low- and middle-income countries. Public Health Nutr. 2013;16(8):1340-53.
7. Institute of Medicine (US) and National Research Council (US) Committee to Reexamine IOM Pregnancy Weight Guidelines. Weight Gain During Pregnancy: Reexamining the Guidelines. Washington (DC): National Academies Press. 2009.
8. Ekblad U, Grenman S. Maternal weight, weight gain during pregnancy and pregnancy outcome. Int J Gynaecol Obstet. 1992;39(4):277-83.

9. Singh S, Gupta R, Sharma S. Maternal demographic profile and perinatal outcome: a prospective study in North India. Int J Reprod Contracept Obstet Gynecol. 2019;8(5):1907-12.
10. Sharma R, Kapoor A, Bansal P. Maternal age and parity: influence on pregnancy outcome in Indian women. Int J Reprod Contracept Obstet Gynecol. 2020;9(3):978-83.
11. Kumar A, Jain S, Singh S. Maternal nutrition and gestational weight gain in low- and middle-income countries: a review. Int J Gynecol Obstet. 2018;143(1):9-14.
12. Chen CN, Chuang LM, Yang WS. Prepregnancy body mass index, gestational weight gain, and birth weight: a population-based survey in Taiwan. Asia Pac J Clin Nutr. 2011;20(4):513-9.
13. Crane JM, White J, Murphy P, Burrage L, Hutchens D. The effect of gestational weight gain by body mass index on maternal and neonatal outcomes. J Obstet Gynaecol Can. 2009;31(1):28-35.
14. Han Z, Lutsiv O, Mulla S, Rosen A, Beyene J, McDonald SD; Knowledge Synthesis Group. Low gestational weight gain and the risk of preterm birth and low birth weight: a systematic review and meta-analysis. Acta Obstet Gynecol Scand. 2011;90(9):935-54.
15. Nohr EA, Vaeth M, Baker JL, Sørensen TI, Olsen J, Rasmussen KM. Combined associations of prepregnancy body mass index and gestational weight gain with the outcome of pregnancy. Am J Clin Nutr. 2008;87(6):1750-9.
16. World Health Organization. Guideline: Daily iron and folic acid supplementation in pregnant women. 2012. Available at: https://www.who.int/tools/elena/interventions/daily-iron-pregnancy. Accessed on 12 May 2025.
17. Catalano PM, Shankar K. Obesity and pregnancy: mechanisms of short term and long-term adverse consequences for mother and child. BMJ. 2017;356:j1.
18. Subramaniam N, Venkatesan S, Ramya S. Maternal BMI, gestational weight gain and pregnancy outcome in South East Asian population. Int J Reprod Contracept Obstet Gynecol. 2018;7(9):3640-6.