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Original Research Article

Gestational weight gain and its association with birth outcomes among pregnant women attending a tertiary care hospital in Eastern India

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ABSTRACT

Background: Gestational weight gain (GWG) is an important determinant of maternal and neonatal outcomes. Both inadequate and excessive GWG are associated with adverse birth outcomes. Objectives were to assess GWG and examine its association with selected birth outcomes.
Methods: A hospital-based prospective observational study was conducted among 220 pregnant women attending a tertiary care hospital in Eastern India. GWG was classified as per institute of medicine guidelines and birth outcomes were analyzed.
Results: Inadequate GWG was significantly associated with low birth weight and preterm delivery, while excessive GWG was associated with macrosomia and increased caesarean section rates.
Conclusions: Suboptimal GWG is significantly associated with adverse birth outcomes.

Keywords: Gestational weight gain, Birth outcomes, Pregnancy

INTRODUCTION

Gestational weight gain (GWG) reflects maternal nutritional status and physiological adaptation during pregnancy. Optimal GWG is essential for favourable maternal and neonatal outcomes. Deviations from recommended GWG have been associated with low birth weight, preterm delivery, macrosomia, and increased operative deliveries.[1]

The institute of medicine provides BMI-specific recommendations for GWG.[2] However, adherence remains suboptimal in low- and middle-income countries.[3] India faces a dual burden of maternal undernutrition and overnutrition, making GWG monitoring particularly relevant.[4]

Objectives

Objective were to assess GWG and examine its association with selected birth outcomes.

METHODS

Study design

It was a hospital-based prospective observational study design.

Study area

Study carried out at Hitech Medical College and Hospital, Bhubaneswar, Odisha.

Study period

Study conducted for six months (1st November 2024 to 30th April 2025).

Study population

Pregnant women attending the antenatal clinic and delivering at the study hospital were selected for study.

Inclusion criteria

Patients with singleton pregnancy, gestational age ≥28 weeks, willingness to participate were included in study.

Exclusion criteria

Patients with multiple pregnancies, pre-existing diabetes mellitus or hypertension, thyroid disorders and other chronic medical illnesses were excluded from study.

Sample size calculation

Sample size was calculated using the formula:

$n=Z^2pq/d^2$

Assuming a prevalence of inadequate GWG of 40% based on previous Indian studies, with 95% confidence interval (Z=1.96) and absolute precision of 6%, the calculated sample size was 256.[10] Considering feasibility and a possible non-response rate of 10%, a minimum sample size of 200 was required. A total of 220 pregnant women were included.

Data collection

Data on maternal age, parity, education, socioeconomic status, and antenatal records were collected using a predesigned proforma. Pre-pregnancy weight was self-reported, and final pregnancy weight was recorded during the third trimester. GWG was calculated as the difference between these two measurements.

Operational definitions

GWG was categorized as inadequate, adequate, or excessive based on IOM guidelines.[3]

Outcome variables

Outcome variables were birth weight, gestational age at delivery and mode of delivery.

Statistical analysis

Data were analysed using SPSS version 20. Categorical variables were expressed as proportions. Chi-square test and multivariate logistic regression were applied. A $p<0.05$ was considered statistically significant.

RESULTS

A total of 220 pregnant women were analysed. Based on IOM criteria, 39.1% had inadequate GWG, 42.3% had adequate GWG, and 18.6% had excessive GWG.

This Table 1 summarizes the baseline demographic and obstetric characteristics of the study population. A majority of participants were aged 25 years or older, and nearly half were primigravidae. Most women had a normal pre-pregnancy BMI, though a considerable proportion were underweighted or overweight.

This Table 2 presents the distribution of gestational weight gain categories based on institute of medicine guidelines. Inadequate GWG was the most frequent category, indicating suboptimal weight gain during pregnancy.

This Table 3 depicts the association between GWG categories and neonatal outcomes. Inadequate GWG was associated with a higher proportion of low birth weight and preterm births, while excessive GWG was associated with a markedly higher proportion of macrosomia.

This Table 4 presents adjusted odds ratios for adverse birth outcomes after controlling for confounders. Inadequate GWG significantly increased the risk of low birth weight and preterm birth, whereas excessive GWG independently increased the risk of macrosomia and the caesarean section.

Table 1: Demographic characteristics of study participants, (n=220).

Variables	N	Percentage (%)
Age <25 years	92	41.8
Age ≥25 years	128	58.2
Primigravida	104	47.3
Multigravida	116	52.7
Underweight	54	24.5
Normal BMI (kg/m^2)	126	57.3
Overweight/obese	40	18.2

Table 2: Distribution of the GWG categories, (n=220).

GWG category	N
Inadequate GWG	86
Adequate GWG	93
Excessive GWG	41

Table 3: Association between gestational weight gain and birth outcomes.

GWG category	Low birth weight, N (%)	Normal birth weight, N (%)	Macrosomia, N (%)	Preterm birth, N (%)
Inadequate GWG	30 (34.9)	50 (58.1)	6 (7.0)	16 (18.6)
Adequate GWG	10 (10.8)	77 (82.8)	6 (6.4)	6 (6.5)
Excessive GWG	3 (7.3)	28 (68.3)	10 (24.4)	3 (7.3)

Table 4: Multivariate logistic regression analysis for adverse birth outcomes.

Factors	Adjusted odds ratio	95% CI	P value
Inadequate GWG-low birth weight	2.8	1.5-5.1	<0.001
Inadequate GWG-preterm birth	2.3	1.2-4.4	0.01
Excessive GWG-macrosomia	3.1	1.5-6.4	0.002
Excessive GWG-caesarean section	2.4	1.3-4.6	0.006

DISCUSSION

The present study provides comprehensive evidence on the pattern of GWG and its association with birth outcomes among pregnant women attending a tertiary care hospital in Eastern India. A key observation of this study is the high prevalence of suboptimal gestational weight gain, with nearly three-fifths of women exhibiting either inadequate or excessive GWG. This finding is consistent with previous literature highlighting poor adherence to recommended gestational weight gain guidelines, particularly in low- and middle-income countries.[1-4]

Inadequate gestational weight gain was significantly associated with low birth weight and preterm delivery in the present study. Inadequate GWG may reflect insufficient maternal caloric intake, micronutrient deficiencies, or suboptimal placental development, which adversely affect fetal growth and gestational duration.[1,14] Similar associations have been reported by Siega-Riz et al who demonstrated an increased risk of low birth weight and preterm birth among women gaining less than the institute of medicine recommendations.[6] Ota et al also reported that inadequate GWG was a strong predictor of adverse neonatal outcomes in Asian populations, underscoring the role of ethnic and regional factors in modifying pregnancy outcomes.[7] Studies by Nohr et al further support these findings, emphasizing the combined effect of pre-pregnancy BMI and inadequate GWG on fetal growth restriction.[10]

Excessive gestational weight gain in this study showed a strong association with macrosomia and increased caesarean section rates. Excess GWG contributes to fetal overgrowth through increased maternal insulin resistance, enhanced placental nutrient transfer, and greater fetal adiposity.[8,13] Goldstein et al in a large systematic review and meta-analysis, reported a consistent association between excessive GWG and macrosomia, shoulder dystocia, and operative deliveries.[8] Similar findings were observed by Sharma et al who reported higher caesarean section rates among women with excessive GWG, particularly among those with normal or overweight pre-pregnancy BMI.[9] Population-level data from Deputy et al also demonstrate rising trends of excessive GWG and its association with adverse maternal and neonatal outcomes.[11]

The findings of the present study highlight the dual burden of maternal undernutrition and overnutrition in pregnancy, which remains a major public health concern in India and other low- and middle-income countries.[3,5,14] While inadequate GWG increases the risk of fetal growth restriction, low birth weight, and prematurity, excessive GWG predisposes to delivery complications and long-term metabolic consequences for both the mother and the offspring.[8,12,14] Evidence suggests that both extremes of GWG may also influence the future risk of childhood obesity and non-communicable diseases, further amplifying their public health significance.[12,15]

These findings underscore the importance of routine monitoring of gestational weight gain as an integral component of antenatal care. International and national guidelines emphasize the need for individualized counselling based on pre-pregnancy BMI, nutritional status, and gestational age.[2,4] Incorporating structured nutritional counselling, lifestyle modification, and regular weight monitoring into routine antenatal services may help optimize GWG and improve pregnancy outcomes, as advocated by global health agencies.[4,15]

Limitations

The present study was conducted at a single tertiary care centre, which may limit the generalizability of the findings. Pre-pregnancy weight was self-reported, introducing the possibility of recall bias. Additionally, dietary intake, physical activity levels, and gestational diabetes status during pregnancy were not assessed, which could have provided further insight into the observed associations.

CONCLUSION

Both inadequate and excessive gestational weight gain were significantly associated with adverse birth outcomes. Integrating gestational weight monitoring and counselling into routine antenatal care is essential.

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