Impact of Gestational Weight Gain on Pregnancy Outcome

Original Article

Reham Elkhateeb and Enas Moustafa

Department of Obstetrics and Gynecology, Faculty of Medicine, Minia University, Egypt

ABSTRACT

Introduction: Guidelines identified relationships between the mother, the baby, and gestational weight gain (GWG). However, these guidelines were predicated on a lower general population body mass index (BMI) with little racial diversity. This study's objective was to assess how GWG in expecting mothers with various prepregnancy BMI affected the course of their pregnancies.

Material and Methods: A cross-sectional study was carried out at the Maternity Hospital, Faculty of Medicine, Minia University. The medical records of 550 pregnant women were analyzed for this study from individuals who began attending the antenatal care unit at the outpatient clinics.

Result: Obese women have significantly higher weight gain and BMI increase during pregnancy than non-obese women. Weight gain >13kg was significantly higher in obese than non-obese women

Conclusion: Obese women have significantly higher age, higher fetal birth weight, higher weight gain, and BMI increase than non-obese women. Medical, obstetric, and fetal complications were significantly higher in obese than non-obese women.

Key Words: BMI; fetal complications; gestational weight gain; maternal complications.

Received: 10 October 2022, **Accepted:** 27 October 2022

Corresponding Author: Reham Elkhateeb, Department of Obstetrics and Gynecology, Faculty of Medicine, Minia University, Egypt, **Tel.:** +20 10 9065 0463, **E-mail:** rehamelkhateeb68@gmail.com

ISSN: 2090-7265, February 2023, Vol.13, No. 1

INTRODUCTION

Excessive and insufficient gestational weight gain (GWG) is commonly connected with adverse maternal and fetal outcomes, including small for gestational age (SGA), large for gestational age (LGA), macrosomia, cesarean delivery, gestational diabetes mellitus (GDM), preeclampsia, postpartum weight retention, and long-term sequelae like offspring obesity[1]. The maternal body mass index (BMI) is categorized as follows; underweight (<18.5), normal weight (18.5 - 24.9), overweight (25 - 29.9), and obese (≥30)[2].

Guidelines established maternal and fetal relationships with GWG but were based on lower general population BMI with a lack of ethnic variety. The American College of Obstetricians and Gynecologists supports the Institute of Medicine (IOM) guidelines; however, they are not always followed. GWG below the recommendations was reported to increase the risk for impaired fetal growth, low birth weight (LBW), and preterm births. On the other hand, excess GWG was found to be associated with gestational hypertension, preeclampsia, GDM, complicated deliveries, macrosomia[3], as well as adverse long-term outcomes in the offspring, such as impaired cardiometabolic profile[4].

MATERIAL AND METHODS

The study was carried out at the Maternity Hospital, Faculty of Medicine Minia University. Five hundred fifty medical records of pregnant women who attended prenatal care units at outpatient clinics from April 2021 were reviewed as a part of this study after being approved by the ethical committee board.

Inclusion Criteria were availability of the prepregnancy weight and height, singleton pregnancy, and prepregnancy BMI, categorized according to World Health Organization criteria. In contrast, exclusion criteria were prepregnancy known medical disorders (e.g., hypertension, diabetes mellitus, anemia), congenital fetal malformation, cases that were indicated for early termination of pregnancy, IUFD, drugs that affect maternal weight as corticosteroids, and patients that had not returned to regular antenatal care visits.

Patients underwent complete history taking, general examination, and abdominal and local clinical examination. According to the WHO classification, the patients' prepregnancy BMI

DOI:10.21608/ebwhj.2022.167997.1212

$$\left(\frac{Weight\ in\ kg}{(Height\ in\ meters)^2}\right)$$

were categorized into three groups: Group 1: 18.5- 24 kg/m2, Group 2: 25- 29.9 kg/m2, Group 3: >30 kg/m2. Group 3 was classified to: Class 1: 30- 34 kg/m2 Moderate, Class 2:35- 39.9 kg/m2 severe and Class 3: >40 kg/m2 very severe

Documentation of weight gain during antenatal care visits was done till the time of delivery. The maternal and fetal outcomes were correlated to GWG. We analyzed the maternal medical disorders (GDM, hypertension, anemia, cholecystitis, vulvovaginitis, UTI), obstetric disorders (LGA, SGA, premature rupture of membranes, and preterm labor), mode and time of delivery, and neonatal outcomes.

Data management and Statistical Analysis

Using Microsoft Excel software, data from historical records, routine clinical examinations, laboratory investigations, and outcome measures were coded, entered, and analyzed. Following that, data were added to the statistical analysis program "Statistical Package for the Social Sciences" (SPSS v. 25). Data was presented in terms of mean ± standard deviation, median, and range, or frequencies and percentages when appropriate. Comparison of numerical variables between the study groups for independent samples was made using the Student t-test. For comparing categorical data, a Chi-square test was performed. The exact test was used when the expected frequency was less than 5. *P value* was set at <0.05 for significant results and <0.001 for highly significant results.

RESULTS

The current study included 550 pregnant women aged between 18 and 42 years. Regarding parity, 25.8% were para 1, 21.6% were para 2, 14% were para 3, and 8.4% were ≥ para 4. Most of the participants were delivered via CS (58.9%). Their marriage duration ranged between 1-25 years, as shown in (Table 1). The weight and BMI of all participants during the first and second visits were demonstrated in (Table 2). The weight gain and the BMI increase were calculated and shown in (Table 2).

Table 1: Descriptive clinical data of the studied population

		The study population (n=550)
Age (years)	Mean ± SD Median [Range]	25.28 ± 5.15 24 [18 - 42]
Parity	0 1 2 3 ≥4	166 (30.2%) 142 (25.8%) 119 (21.6%) 77 (14.0%) 46 (8.4%)
Marriage duration (year)	Mean ± SD Median [Range]	5.47 ± 4.75 4 [1 - 25]
Mode of delivery	NVD CS	226 (41.1%) 324 (58.9%)

Table 2: Descriptive anthropometric data of the studied population

		The study population (n=550)
Weight at the first visit	Mean ± SD Median [Range]	66.97 ± 10.69 65.62 [41.2–106.45]
Weight at the Second visit	Mean ± SD Median [Range]	76.87 ± 14.03 77.1 [33.64–122.24]
Weight gain	Mean ± SD Median [Range]	10.01 ± 8.53 10.24 [10.99–41.46]
BMI at the first visit	Mean ± SD Median [Range]	25.99 ± 15.26 25.5 [16.3–41.9]
BMI at the second visit	Mean ± SD Median [Range]	29.82 ± 5.18 29.7 [14-47]
BMI increase	Mean ± SD Median [Range]	3.83 ± 3.43 4 [9.3–16.4]
BMI category	18.5-24.9 25-29.9 ≥ 30	238 (43.27%) 222 (40.36%) 90 (16.36%)
Obesity category	30-34.9 35-39.9 ≥ 40	80 (14.55%) 7 (1.26%) 3 (0.55%)
Birth weight	Mean ± SD Median [Range]	3.07 ± 1.32 3.1 [2.5-5.3]

Among our included women, 72% developed complications; the most common complications were infant complications at 59.6%, medical complications at 40.7%, obstetric complications at 37.8%, SGA at 32%, and LGA at 27.6%. The most common medical complication was UTI at 27.8%, anemia at 23.6%, vulvovaginitis at 17.5%, DM at 6.4%, hypertension at 2.2%, and cholecystitis at 1.3%. The most common obstetric complication was PROM at 15.4%, malpresentation at 19.3%, and preterm labor at 11.4%, as shown in (Table 3).

Table 3: Complications of the studied population

	The study population (n=550)
Develop complication	396 (72%)
Medical complication	224 (40.7%)
DM	35 (6.4%)
Hypertension	12 (2.2%)
Anemia	130 (23.6%)
Cholecystitis	7 (1.3%)
Vulvovaginitis	96 (17.5%)
UTI	153 (27.8%)
Obstetric complication	208 (37.8%)
PROM	85 (15.4%)
Malpresentation	106 (19.3%)
Preterm labor	63 (11.4%)
LGA	152 (27.6%)
SGA	176 (32%)
Infant complications	328 (59.6%)

NB: Some patients presented with more than one complication

Obese women have significantly higher weight gain and BMI increase during pregnancy than non-obese women. Weight gain >13 kg was significantly higher in obsess than in non-obsess women, as shown in (Table 4). However, there was no statistically significant difference in weight gain and BMI increase during pregnancy in relation to obesity severity (Figure 1).

Medical, obstetric, and fetal complications were significantly higher in obese than non-obese women, while SGA was significantly higher in non-obese than obese women, as shown in (Table 5). DM, hypertension, cholecystitis, PROM, and infant complications were significantly higher in severely obese women than in moderate-obese women (Figure 2).

Table 4: Comparison of weight gain in relation to BMI categories

	Group I "BMI 18.5-24.9" (n=238)	Group II "BMI 25-29.9" (n=222)	Group III "BMI ≥ 30" (n=90)	One way ANOVA, Kruskal-wallis test	
				f	*p-value*
Weight gain	9.80 ± 9.11 (10.90 - 41.46)	9.83 ± 7.96 (10.94 - 32.19)	12.23 ± 8.03 (10.99 - 34.86)	3.855	0.022
BMI increase	3.80 ± 3.56 (5.5 - 16.4)	3.82 ± 3.32 (9.3 - 13.4)	4.68 ± 3.25 (8.2 - 12.5)	3.695	0.025
Weight gain					
• Wt loss	36 (15.1%)	33 (14.9%)	5 (5.5%)	12.765	0.012
• Wt gain <13kg	113 (47.5%)	123 (55.4%)	42 (46.7%)		
• Wt gain >13kg	89 (37.4%)	66 (29.7%)	43 (47.8%)		

Table 5: comparison of complications in relation to BMI categories

	Group I "BMI 18.5-24.9" (n=238)	Group II "BMI 25-29.9" (n=222)	Group III "BMI ≥ 30" (n=90)	Chi-square test	
				X2	*p-value*
Develop complication	100 (42.0%)	216 (97.3%)	80 (88.9%)	189.34	<0.001
Medical complication	19 (8.0%)	128 (57.7%)	77 (85.6%)	209.25	<0.001
DM	4 (1.7%)	5 (2.3%)	26 (28.9%)	91.69	<0.001
Hypertension	1 (0.4%)	2 (0.9%)	9 (10.0%)	30.94	<0.001
Anemia	15 (6.3%)	40 (18.0%)	75 (83.3%)	221.20	<0.001
Cholecystitis	0 (0%)	0 (0.0%)	7 (7.8%)	36.24	<0.001
Valvovaginitis	18 (7.6%)	16 (7.2%)	62 (68.9%)	197.59	<0.001
UTI	12 (5%)	71 (32%)	70 (77.8%)	175.28	<0.001
Obstetric complication	17 (7.1%)	117 (52.7%)	74 (82.2%)	191.61	<0.001
PROM	12 (5.0%)	51 (23%)	22 (24.4%)	34.92	<0.001
Malpresentation	5 (2.1%)	57 (25.7%)	44 (48.9%)	101.70	<0.001
Preterm labor	12 (5.0%)	19 (8.6%)	32 (35.6%)	63.03	<0.001
LGA	19 (8.0%)	62 (27.9%)	71 (78.9%)	164.19	<0.001
SGA	72 (30.3%)	87 (39.2%)	17 (18.9%)	12.72	0.002
Infant complications	32 (13.4%)	216 (97.3%)	80 (88.9%)	373.76	<0.001

NB: Some patients presented with more than one complication

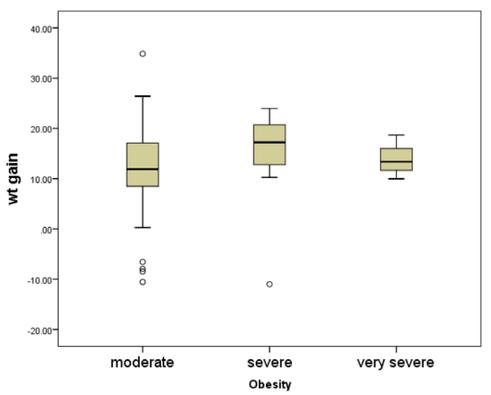

Fig. 1: Weight gain in relation to obesity severity

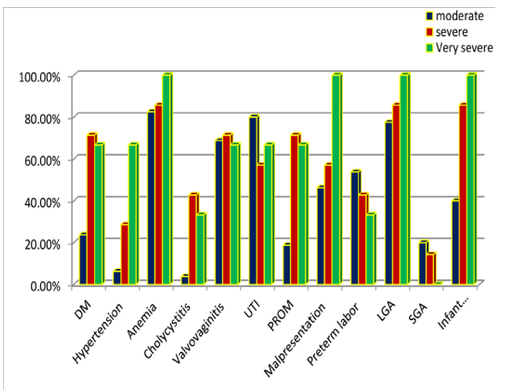

Fig. 2: Complications in relation to BMI

DISCUSSION

It is widely established that both high and low levels of GWG have been linked to unfavorable pregnancy outcomes[4]. This study aimed to assess the correlation between maternal and fetal complications with GWG.

In line with the current study, Aji *et al*.[5] aimed to identify the variables influencing 195 pregnant women's total GWG, prepregnancy BMI (PP BMI), and pregnancy outcomes. They discovered that the pregnant women's average age was 29.7 ± 5.6 years. The majority of the women had prepregnancy BMIs that were within the normal range, with the underweight group coming in second at 46.7% and 43.1%, respectively. Most of them had an inadequate GWG status compared to the GWG recommendation. The mean gestational duration was 38.88±1.91 weeks. Meanwhile, birth weight was in the normal range at > 2500 g.

Also, Chung[6] examined the relationships between prepregnancy BMI and GWG and perinatal and maternal outcomes to identify risk factors for adverse outcomes. Among 465 women who participated in the study, 439 (94.4%) gave birth after 37 weeks of pregnancy and 26 (5.6%) before. According to prepregnancy BMI, 15 (3.2%) women were obese, 60 (12.9%) women were pre-obesity, 61 (13.1%) women were underweight, and 329 (70.8%) women were normal weight. In terms of overall GWG, 157 (33.8%), 194 (41.7%), and 114 (24.5%) women were insufficient, normal, and excessive, respectively.

In the current study, a comparison of age and anthropometric data in relation to BMI categories showed that obese women have significantly higher age, weight, and BMI at the second visit and fetal birth weight than non-obese women.

In agreement with the current study, Aji *et al*.[5] reported that total GWG and birth weight were significantly correlated with the prepregnancy BMI category. Also, Wang *et al*.[7] reported that obese women have significantly higher age, weight, and fetal birth weight than non-obese women. In addition, Sun *et al*.[8] reported that obese women were significantly older in age and had higher fetal birth weight than non-obese women.

In the current study, a comparison of weight gain in relation to BMI categories showed that obese women have significantly higher weight gain and BMI increase during pregnancy than non-obese women. Weight gain >13kg was significantly higher in obsess than non-obsess women.

The current study also showed no statistically significant difference in weight gain and BMI increase during pregnancy in relation to obesity severity. In agreement with our results, Thompson *et al*.[9] revealed no statistically significant correlation between GWG and obesity severity. In contrast to our results, Bodnar *et al*.[10] reported that the prevalence of excessive GWG declined, and weight loss increased as obesity became more severe. This disagreement with our results may be due to the differences in sample size, inclusion criteria, and genetic factors.

The present study comparison of complications in relation to BMI categories showed that Medical, obstetric, fetal complications, and LGA were significantly higher in obese than non-obese women, while SGA was significantly higher in non-obese than obese women.

This was supported by Chen *et al*.[11] reported that the prevalence rates of all negative perinatal outcomes, with the exception of preterm delivery and low birth weight (LBW) newborns, were steadily rising, ranging from underweight to obesity status. On the contrary, Chung[6] reported no significant correlation between the prepregnancy BMI category and maternal and fetal complications outcomes. The disagreement may be attributed to the variation in sample size and inclusion criteria.

In the present work, a comparison of complications in relation to weight changes during pregnancy showed that medical, obstetric, and infant complications were significantly higher in weight loss and weight gain > 13kg. Cholecystitis and LGA were significantly higher in the weight gain > 13kg group than in other groups, while anemia and SGA were significantly higher in the weight loss group than in other groups.

This was confirmed by Xi *et al*.[12], who found that high GWG (above IOM limits) was inversely related to preterm delivery, low birth weight, and SGA while positively correlated with macrosomia, LGA, and low Apgar scores.

Also, Chen *et al*.[11] found that the excessive GWG group had significantly greater adjusted risks of GHTN, preeclampsia, cesarean birth, and macrosomia than the sufficient GWG group. However, Aji *et al*.[5] reported that there was no significant correlation between the Institute of Medicine (IOM) weight gain recommendation and SGA, but there was a significant correlation with LBW < 2.50 kg and macrosomia> 4.0 kg. The disagreement may be caused by the various study settings and sample sizes.

Also, Chung[6] reported no significant differences in outcome, maternal and fetal complications, between normal GWG, inadequate GWG, or excessive GWG categories, except that CS was significantly more common in excessive GWG. On the other hand, low birth weight was more common in the group of inadequate GWG. The discrepancy may result from different inclusion criteria and sample sizes. Excessive GWG is linked to significantly higher risks of poor perinatal outcomes. Excessive GWG

could be linked to more adverse effects on the mother than the fetus and is associated with markedly increased risks of bad perinatal outcomes like pregnancy complications, cesarean delivery, and postpartum retaining weight[13,14,15].

CONCLUSION

Obese women have statistically significant higher age, higher fetal birth weight, higher weight gain, and BMI increase than non-obese women. Medical, obstetric, and fetal complications were significantly higher in obese than non-obese women, while SGA was statistically significantly higher in the non-obese group. DM, hypertension, cholecystitis, and PROM were significantly higher in severely obese women than in moderate-obese women.

CONFLICT OF INTERESTS

There are no conflicts of interest.

REFERENCES

1. Hrolfsdottir L, Rytter D, Olsen SF, Bech BH, Maslova E, Henriksen TB, Halldorsson TI. Gestational weight gain in normal weight women and offspring cardio-metabolic risk factors at 20 years of age. International Journal of Obesity. 2015 Apr;39(4):671-6.

2. Rasmussen KM, Abrams B, Bodnar LM, Butte NF, Catalano PM, Siega-Riz AM. Recommendations for weight gain during pregnancy in the context of the obesity epidemic. Obstetrics and gynecology. 2010 Nov;116(5):1191.

3. Lau EY, Liu J, Archer E, McDonald SM, Liu J. Maternal weight gain in pregnancy and risk of obesity among offspring: a systematic review. Journal of obesity. 2014 Oct 2;2014.

4. Gaillard R, Steegers EA, Franco OH, Hofman A, Jaddoe VW. Maternal weight gain in different periods of pregnancy and childhood cardio-metabolic outcomes. The Generation R Study. International journal of obesity. 2015 Apr;39(4):677-85.

5. Aji AS, Lipoeto NI, Yusrawati Y, Malik SG, Kusmayanti NA, Susanto I, Majidah NM, Nurunniyah S, Alfiana RD, Wahyuningsih W, Vimaleswaran KS. Association between prepregnancy body mass index and gestational weight gain on pregnancy outcomes: a cohort study in Indonesian pregnant women. BMC pregnancy and childbirth. 2022 Dec;22(1):1-2.

6. Chung, H. K. (2022). Association of prepregnancy body mass index and gestational weight gain with pregnancy outcomes. Hong Kong J Gynaecol Obstet Midwifery; 22(2):66-72.

7. Wang Y, Ma H, Feng Y, Zhan Y, Wu S, Cai S, Shi Y, Chen Y, Ma L, Jiang Y. Association among prepregnancy body mass index, gestational weight gain and neonatal birth weight: a prospective cohort study in China. BMC pregnancy and childbirth. 2020 Dec;20(1):1-9.

8. Sun Y, Shen Z, Zhan Y, Wang Y, Ma S, Zhang S, Liu J, Wu S, Feng Y, Chen Y, Cai S. Effects of prepregnancy body mass index and gestational weight gain on maternal and infant complications. BMC pregnancy and childbirth. 2020 Dec;20(1):1-3.

9. Thompson AM, Thompson JA. An evaluation of whether a gestational weight gain of 5 to 9 kg for obese women optimizes maternal and neonatal health risks. BMC pregnancy and childbirth. 2019 Dec;19(1):1-8.

10. Bodnar LM, Siega-Riz AM, Simhan HN, Himes KP, Abrams B. Severe obesity, gestational weight gain, and adverse birth outcomes. The American journal of clinical nutrition. 2010 Jun 1;91(6):1642-8.

11. Chen CN, Chen HS, Hsu HC. Maternal prepregnancy body mass index, gestational weight gain, and risk of adverse perinatal outcomes in Taiwan: a population-based birth cohort study. International journal of environmental research and public health. 2020 Feb;17(4):1221.

12. Xi B, Liu X, Wang H, Yang L, Zhao M, Magnussen CG. Associations between gestational weight gain and adverse birth outcomes: a population-based retrospective cohort study of 9 million mother-infant pairs. Frontiers in nutrition. 2022 Feb 14:104.

13. Voerman E, Santos S, Inskip H, Amiano P, Barros H, Charles MA, Chatzi L, Chrousos GP, Corpeleijn E, Crozier S, Doyon M. Association of gestational weight gain with adverse maternal and infant outcomes. Jama. 2019 May 7;321(17):1702-15.

14. Walker R, Bennett C, Blumfield M, Gwini S, Ma J, Wang F, Wan Y, Truby H. Attenuating pregnancy weight gain—what works and why: a systematic review and meta-analysis. Nutrients. 2018 Jul 22;10(7):944.

15. Paul KH, Graham ML, Olson CM. The web of risk factors for excessive gestational weight gain in low income women. Maternal and child health journal. 2013 Feb;17(2):344-51.