Annals of Neonatology Journal

OPEN ACCESS
ISSN: 2636-3596

Original Article

Optimal Gestational Weight Gain According to Pre-Pregnancy Body Mass Index That Reduces Fetal and Maternal Complications: A Prospective-Cross Sectional Study

Mamdouh Tawfeek Hamdy, Reham Refaat Taha, Enas Mostafa Mohammed, Noura Elbashier Nour eldien*
DOI: 10.21608/anj.2023.287102
***Correspondence:** Department of obstetrics & gynecology, faculty of Medicine, Minia University, Egypt
Email: aayatmoftah@gmail.com
Full list of author information is available at the end of the article.

Abstract

Background: Guidelines identified maternal and infant relationships with gestational weight gain but were based on lower general population BMI with limited ethnic diversity.

Aim: was to evaluate the effects of gestational weight gain on pregnancy outcomes in pregnant women with different pre-pregnancy body mass index (BMI) to establish optimal GWG for each BMI category.

Subjects and methods: This is a prospective study carried out by follow up 550 cases of pre-pregnant women who attended antenatal care unit at the department of obstetrics and gynecology from the first of April 2021 to tle last of December 2022. The patients were categorized according to pre pregnancy BMI according to WHO classification into three groups: Group I: 18.5- 24 kg/m^2, Group II: 25- 29.9 kg/m^2 and Group III: >30 kg/m^2. Group III was classified to: Class 1: 30- 34 kg/m^2 Moderate, Class 2:35- 39.9 kg/m^2 severe and Class 3: >40 kg/m^2 very severe according to body mass index (BMI).

Results: Obese females have statistically significant higher weight gain and BMI increase during pregnancy than non-obese females. Weight gain >13kg was statistically significant higher in obsess than non-obsess females. Among our included females 32.36% develop complications; the commonest complications were medical complications 25.09% followed by infant complications in 23.37%. The commonest infant complication was LGA in 16.7%.

Conclusions: obese females have statistically significant higher age, higher fetal birth weight, higher weight gain and BMI increase than non-obese females. Medical, obstetric, fetal complications and LGA were statistically significant higher in obese than non-obese females.

Key words: Gestational weight gain; pregnancy; BMI; fetal ;maternal; complications

Introduction

Excessive and insufficient gestational weight gain have been associated with adverse pregnancy outcomes, including small for gestational age (SGA), large for gestational age (LGA), macrosomia, cesarean delivery, gestational diabetes mellitus (GDM), preeclampsia, postpartum weight retention, offspring obesity [1].

Categories of maternal body mass index (BMI; calculated as weight in kilograms divided by height in meters squared; BMI for underweight, <18.5; normal weight, 18.5-24.9; overweight, 25-29.9; and obese, ≥30 [2].

Guidelines identified maternal and infant relationships with gestational weight gain but were based on lower general population BMI with limited ethnic diversity. IOM guidelines are endorsed by the American College of Obstetricians and Gynecologists, although they are not universally implemented. GWG below the recommendations was reported to increase the risk for low birth weight (LBW), impaired fetal growth and preterm births. While excess GWG was found to be associated with gestational hypertension, gestational diabetes mellitus, preeclampsia, complicated deliveries, macrosomia [3], as well as adverse cardiometabolic profile in the offspring [4].

Aim of the Work: The aim of this study was to evaluate the effects of gestational weight gain on pregnancy outcomes in pregnant women with different pre-pregnancy body mass index (BMI) to establish optimal GWG for each BMI category.

Methods

The study had been conducted at the Department of Obstetrics and Gynecology, Faculty of Medicine Minia University. This prospective study was carried out by follow up 550 cases of prepregnant women who attended to antenatal care unit at the Department of Obstetrics and Gynecology, Faculty of Medicine Minia University starting from 1st of April 2021 after being approved by

the ethical committee board of the department

Inclusion Criteria for study group: Singleton pregnancy and available pre-pregnant weight and maternal height and pre-pregnancy BMI were categorized according to World Health Organization criteria.

Exclusion Criteria for groups: Pre pregnancy known medical disorder. e. g. HTN, Diabetis, anemia, congenital fetal malformation, cases that were indicated for early TOP, IUFD, drugs that affect maternal weight as Corticosteroid and patient that not returned to regular ANC visits will be excluded from the study.

Methods: Patients were subjected to:

Complete history taking: Personal history including: Name, Age, marital state, addres. Menstrual history: including age of Menarche, menstrual disturbance, dysmenorrhea, related symptoms. Obstetrics history: Detailed obstetric sheet was taken for each delivery e.g. Order of delivery, mode of delivery, complications and outcomes of pregnancy, history: of chronic diseases and medication, past history of HTN, DM, family history of similar condition or diabetes, history of allergy to any medication and surgical history of operation.

Examination: General examination: Vital signs (Blood pressure, Temperature, Heart rate, Respiratory rate), Signs of (Pallor, Cyanosis, Jaundice, and Lymph node enlargement). Auscultation: FHS is heard by sonicaid as early as 10th week of pregnancy. FHS is heard by pinard (fetal stethoscope) after the 20th week of pregnancy.

The patients were cateogarized according to pre pregnancy BMI according to WHO classification into three groups:

Group 1: 18.5- 24 kg/m^2, Group 2: 25-29.9 kg/m^2 وGroup 3: >30 kg/m^2. Group 3 was classified to: Class 1: 30- 34 kg/m^2 Moderate, Class 2:35- 39.9 kg/m^2 severe and Class 3: >40 kg/m^2 very severe according to body mass index (BMI):

$$\frac{\textbf{Weight in Kg}}{(\textbf{Height in meters})^2}$$

Documentation of weight gain during antenatal care visits till the time of delivery.

The outcome regarding maternal and fetal outcome were correlated to GWG.

Outcome: GDM, Hypertension and Anaemia. Surgical disorders: Cholysistitis and V-V. Obstetric disorders :LGA, SGA, ROM, PE and PT-L, Mal-presentation, mode and time of delivery and neonatal out come

Ethical Consideration: Study protocol had been submitted for approval by Institutional Review Board, Minia university. department of obstetrics and gynecology, faculty of Medicine, Minia niversity, consent had been obtained from each participant sharing in the study.

Ethical considerations

The ethical committee of Minia College of medicine approved the study. Study information sheet was provided for all participants before they signed written informed consent. The study was carried out in accordance with the guidelines of the Declaration of Helsinki. Objectives and methods and possible outcomes of study were explained to every participant to boost response rate. Confidentiality, anonymity, and withdrawal were assured.

Statistical analysis

Data collected throughout history, basic clinical examination, laboratory investigations and outcome measures coded, entered and analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 20.0) (Statistical Package for the Social Sciences) software for analysis. the following tests were used to test differences for significance;., correlation by Pearson's correlation or Spearman's . P value was set at <0.05 for significant results & <0.001 for high significant result.

Results

The current study included 550 pregnant females, their age ranged between 18 – 42 years; 30.1% of them were primigravida and 25.3% were multigravida ≥ 4., %.69.8% have high education, 99.5% are of moderate socioeconomic status, 58.9% are delivered via CS and most of them 87.3% were delivered at hospital. Their marriage duration ranged between 1 – 25 years with mean value of 5.47 ± 4.75 years. 10.5% have history of previous abortion. (Table1)

Among our included females 32.36% develop complications; the commonest complications were medical complications 25.09% followed by infant complications in 23.37%, then obstetric complications in 19.3%, The commonest medical complication was UTI in7.45% followed by valvovaginitis in 6.01%, anemia in5.45% then then DM in 4.01%, hypertension in 1.8% and lastly cholycystitis in 0.36%. The commonest infant complication was LGA in 16.7%.

The commonest obstetric complication was PROM in 10.7% followed by preterm labor in 5.45% and lastly mal-presentation in 3.09%.

In group 1 the optimum weight gain is 15-16.9 kg, in group 2 the optimum weight gain is 13-14.9 kg, in group 3 the optimum weight gain is 10-12.9 kg.Medical, obstetric, fetal complications and LGA were statistically significant higher in obese than non-obese females. While SGA was statistically significant higher in non-obese than obese females. (Table 3)

Medical, obstetrics and infant complications were statistically significant higher in weight loss and weight gain > 13kg group than in average weight gain group < 13kg. cholesystitis and LGA were statistically significant higher in weight gain > 13kg group than other groups while anemia and SGA were statistically significant higher in weight loss group than other groups. (Table 4)

There is no statistically significant difference in weight gain and BMI

increase during pregnancy in relation to obesity severity. (Figure 1)

Medical, obstetric, fetal complications and LGA were statistically significant higher in obese than non-obese females, While SGA was statistically significant higher in non-obese than obese females. (Table 5)

DM, hypertension, cholycystitis, PROM infant complications were statistically significant higher in severe obese than moderate-obese females. (Figure 2).

Discussion

Gestational weight gain reflects multiple characteristics, including maternal fat accumulation, fluid expansion, and the growth of the fetus, placenta, and uterus. Gestational weight gain is necessary to ensure a healthy fetus, but excessive gestational weight gain has been associated with adverse outcomes [4].

The main aim of this study was to assess correlation between maternal and fetal complication with gestational weight gain.

This prospective study was conducted in the antenatal care unit at the Department of Obstetrics and Gynecology, Faculty of Medicine Minia University. This study was follow up 550 cases of pregnant women. All patients were divided into 3 groups according to BMI: Group 1 (18.5-24 kg/m2), Group 2 (25- 29.9 kg/m2) and Group 3 (>30 kg/m2) furthermore, Group 3 was classified to Class 1 (30- 34 kg/m2) Moderate obesity, Class 2 (35-39.9 kg/m2) severe obesity and Class 3 (>40 kg/m2) very severe obesity.

The current study included 550 pregnant females, their age ranged between 18 – 42 years; 30.1% of them were primigravida and 25.3% were multigravida ≥ 4. Regarding parity,. 69.8% have high education, 99.5% are of moderate socioeconomic status, 58.9% are delivered via CS and most of them 87.3% were delivered at hospital. Their marriage duration ranged between 1 – 25 years with mean value of 5.47 ± 4.75 years. 10.5% have history of previous abortion.

We also found that the mean value of BMI at 1st visit was 25.99 ± 15.26 and the mean value of BMI at 2nd visit was 29.82 ± 5.18. BMI increase ranged between -9.3-16.4 with mean value of 3.83 ± 3.43. The birth weight mean value was 3.07 ± 1.32 kg. 43.3% of included females have BMI of 18.5-24.9, 40.4% have BMI of 25-29.9 while 16.4% has BMI ≥ 30. Among obese females, 14.5% have BMI 30-34.9, 1.3% has BMI of 35-39.9 and 0.5% has BMI of ≥ 40.

In line with the current study Aji et al., [5] aimed to determine the factors affecting total GWG, Pre-pregnancy BMI (PP BMI) and pregnancy outcomes among 195 pregnant women. This study found that the mean age of the pregnant women was 29.7±5.6 years. Most of the women's PP BMI was in the normal range, followed by the underweight category, at 46.7% and 43.1%, respectively. The majority had an inadequate GWG status compared to the GWG recommendation. The average energy intake was 2,433.5±706.7 kcal/day, less than the recommended energy adequacy rate in the third trimester, which should be 2,500 kcal/day. Just over half of the pregnant women, or 50.8%, had low knowledge about maternal nutrition, while only 20.5% had a high level of such knowledge. The mean gestational duration was 38.88±1.91 weeks. Meanwhile, the pregnant women delivered more boy than girl infants, at 56.92% and 43.08%, respectively. Mean birth weight was in the normal range at > 2,500 g; however, head circumference and birth length were below the normal ranges at 35 cm and < 50 cm, respectively.

Also, Chung, [6] aimed to evaluate the associations of pre-pregnancy body mass index (BMI) and GWG with perinatal and maternal outcomes and to identify risk factors for poor perinatal/maternal outcomes. The study enrolled 465 women, of them, 439 (94.4%) delivered after 37 weeks of gestation and 26 (5.6%) delivered before 37 weeks of

gestation. In terms of pre-pregnancy BMI, 61 (13.1%) women were underweight, 329 (70.8%) women were normal weight, 60 (12.9%) women were pre-obese, and 15 (3.2%) women were obese. In terms of total GWG, 157 (33.8%) women were inadequate, 194 (41.7%) women were normal, and 114 (24.5%) women were excessive.

In the current study comparison of age and anthropometric data in relation to BMI categories, showed that obese females have statistically significant higher age, weight and BMI at 2nd visit, and fetal birth weight than non-obese females.

In agreement with the current study Aji et al., [5] reported that total gestational weight gain as well as Birth weight were significantly associated with pre-pregnancy BMI category.

As well, Chung, [6] reported that compared with women with normal weight, women with underweight were younger (29.33 vs 30.28, p=0.020), and women with obesity were older (31.60 vs 30.28, p=0.005), and women with pre-obesity had a higher parity (0.55 vs 0.35, p=0.009) and more caesarean sections (0.17 vs 0.05, p=0.048).

Also, Wang et al., [7] reported that obese female have statistically significant higher age, weight and fetal birth weight than non-obese females.

In addition, Sun et al., [8] reported that obese female were significantly older age, and higher fetal birth weight than non-obese females

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

In agreement with the present study Aji et al., [5] reported that obese female have statistically significant higher gestational weight gain than non-obese females.

As well, Wang et al., [7] reported that t obese female have statistically significant higher gestational weight gain than non-obese females.

Also, the current study was supported by Chung, [6] who reported that compared with women with normal weight, women with pre-obesity had a lower percentage of normal GWG (26.7% vs 42.6%, p=0.021), whereas women with underweight had a lower percentage of excessive GWG (9.8% vs 23.1%, p=0.020) and women with pre-obesity had a higher percentage of excessive GWG (46.7% vs 23.1%, p<0.001).

The current study showed also that there is 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 that there was no statistically significant correlation between gestational weight gain and obesity severity.

In contrast to our results Bodnar et al., [10] reported that the prevalence of excessive gestational weight gain declined, and weight loss increased, as obesity became more severe. This was in disagreement with our results may be due to the differences in sample size and inclusion criteria as well as genetic factors.

In the present study comparison of complications in relation to BMI categories, showed that Medical, obstetric, fetal complications and LGA were statistically significant higher in obese than non-obese females, While SGA was statistically significant higher in non-obese than obese females.

This was supported by Chen et al., [11] reported that there were consistently increased prevalence rates of all adverse perinatal outcomes from underweight to obese status, except for the outcomes of preterm birth and LBW infants. The incidence of LBW infants in women with underweight status was the highest compared with the incidence associated with other categories. After controlling for the confounding factors, the adjusted

odds ratios (aORs) for the risks of GDM, GHTN, preeclampsia, cesarean delivery, preterm birth, and macrosomia were significantly higher in women with prepregnancy overweight and obese status than in women with normal weight.

However, Aji et al., [5] reported that there was no significant correlation between pre-pregnancy BMI category and GA at delivery, delivery mode, LBW < 2.50 kg, Macrosomia > 4.0 kg or SGA. The disagreement may be due to the difference in sample size and study settings.

Also, Chung, [6] reported that there was no significant correlation between pre-pregnancy BMI category and outcome, maternal and fetal complications. The disagreement may be due to the difference in sample size and inclusion criteria.

In the present work comparison of complications in relation to weight changes during pregnancy, showed that Medical, obstetric and infant complications were statistically significant higher in weight loss and weight gain > 13kg group than in average weight gain group < 13kg. cholecystitis and LGA were statistically significant higher in weight gain > 13kg group than other groups while anemia and SGA were statistically significant higher in weight loss group than other groups.

This was supported by Xi et al., [12] who revealed that insufficient GWG (below Institute of Medicine (IOM) guidelines) was positively associated with preterm birth, low birth weight, SGA and low Apgar score, while it was inversely associated with macrosomia and LGA. In addition, excessive GWG (above IOM guidelines) was positively associated with macrosomia, LGA and low Apgar score, while it was inversely associated with preterm birth, low birth weight and SGA.

Also, Chen et al., [11] revealed that the adjusted risks of GHTN, preeclampsia, cesarean delivery, and macrosomia were significantly higher in the excessive

GWG group than in the adequate GWG group (excessive GWG: GHTN aOR = 2.51, 95% CI = 1.94–3.25; preeclampsia aOR = 3.17, 95% CI = 2.04–4.93; cesarean delivery aOR = 1.53, 95% CI = 1.42–1.65; macrosomia aOR = 2.66, 95% CI = 2.11–3.36). In contrast, the adjusted risks of preterm birth and LBW were significantly higher in the inadequate GWG group than in the adequate GWG group (inadequate GWG: preterm aOR = 1.67, 95% CI = 1.47–1.91; LBW aOR = 2.26, 95% CI = 1.95–2.62).

However, Aji et al., [5] reported that there was no significant correlation between Institute of Medicine (IOM) weight gain recommendation and GA at delivery, delivery mode, or SGA but there was significant correlation with LBW < 2.50 kg and Macrosomia > 4.0 kg. The disagreement may be due to the difference in sample size and study settings.

Also, Chung, [6] reported that there was no significant difference between normal gestational weight gain (GWG), inadequate GWG, or excessive GWG categories and outcome, maternal and fetal complications, except for CS was significantly higher in excessive GWG and low birth weight was more prevalent in inadequate GWG. This disagreement may be due to the difference in sample size and inclusion criteria.

Conclusions

In the current study we found that obese females have statistically significant higher age, higher fetal birth weight, higher weight gain and BMI increase than non-obese females. Medical, obstetric, fetal complications and LGA were statistically significant higher in obese than non-obese females, while SGA was statistically significant higher in non-obese than obese females. DM, hypertension, cholycystitis, PROM infant complications were statistically significant higher in severe obese than moderate-obese females.

Acknowledgements

The authors expressed their thanks for the help and support of the staff members (physicians,

nurses, and office workers) of the obstetric/gynaecology departments at Minia University Hospital.

Author's contributions

All authors participated the study design, performed the experiments, collected and analyzed the data, drafted the manuscript, and confirmed the authenticity of all the raw data. All authors read approved the final draft of the manuscript.

Conflict of interest

The authors have no conflict of interests to declare.

Funding

This study received no special funding and was totally funded by the authors.

Author's details

Department of obstetrics & gynecology, faculty of Medicine, Minia University, Egypt

Date received: 18th April 2023, accepted 5th June 2023

References

1- Hrolfsdottir, L., Rytter D. Olsen, S. F., Bech, B. H., Maslova, E., Henriksen, T. B., et al. Gestational weight gain in normal weight women and offspring cardio-metabolic risk factors at 20 years of age. International Journal of Obesity 2015, 39(4), 671-676.

2- Rasmussen, K. M., Abrams, B., Bodnar, L. M., Butte, N. F., Catalano, P. M., Siega-Riz, A. M. Recommendations for weight gain during pregnancy in the context of the obesity epidemic. Obstetrics and gynecology 2010, 116(5), 1191.

3- Lau, E. Y., Liu, J., Archer, E., McDonald, S. M., Liu, J. Maternal weight gain in pregnancy and risk of obesity among offspring: a systematic review. Journal of obesity 2014; 3:68-79

4- Gaillard, R., Steegers, E A. P., Franco, O. H., Hofman, A., Jaddoe, V. W. V. Maternal weight gain in different periods of pregnancy and childhood cardio-metabolic outcomes. The Generation R Study. International journal of obesity 2015, 39(4), 677-685.

5- Aji, A. S., Lipoeto, N. I., Yusrawati, Y., Malik, S. G., Kusmayanti, N. A., Susanto, I., et al. Association between pre-pregnancy body mass index and gestational weight gain on pregnancy outcomes: a cohort study in Indonesian pregnant women. BMC pregnancy and childbirth 2022, 22(1), 1-12.

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

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

8- Sun, Y., Shen, Z., Zhan, Y., Wang, Y., Ma, S., Zhang, S., et al. Effects of pre-pregnancy body mass index and gestational weight gain on maternal and infant complications. BMC pregnancy and childbirth 2020, 20(1), 390.

9- Thompson, A. M., Thompson, J. A. 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, 19(1), 1-8.

10- Bodnar, L. M., Siega-Riz, A. M., Simhan, H. N., Himes, K. P., Abrams, B. Severe obesity, gestational weight gain, and adverse birth outcomes. The American journal of clinical nutrition 2010, 91(6), 1642-1648.

11- Chen, C. N., Chen, H. S., Hsu, H. C. 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, 17(4), 1221.

12- Xi, B., Liu, X., Wang, H., Yang, L., Zhao, M., Magnussen, C. G. 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; 104.

Table (1): Descriptive clinical data of the studied population

Item		**No.= 550**
Age (years)	**Range**	18 - 42
	Median [IQR]	24 [8]
	Mean ± SD	25.28 ± 5.15
Gravidity	**1**	165 (30.1%)
	2	130 (23.7%)
	3	114 (20.8%)
	≥4	139 (25.3%)
Education	**High education**	384 (69.8%)
	Intermediate school	140 (25.5%)
	Non educated	26 (4.7%)
Occupation	**Working**	10 (1.8%)
	House wife	540 (98.2%)
Socioeconomic status	**Low**	3 (0.5%)
	moderate	547 (99.5%)
Marriage duration (year)	**Range**	1 - 25
	Median [IQR]	4 [6.13]
	Mean ± SD	5.47 ± 4.75
Previous delivery	**PG**	90 (16.4%)
	NVD	222 (40.4%)
	CS	238 (43.3%)
Mode of delivery	**NVD**	226 (41.1%)
	CS	324 (58.9%)
Place of delivery	**Home**	19 (3.5%)
	Private clinic	51 (9.3%)
	Hospital	480 (87.3%)
Previous abortion	**1**	40 (7.3%)
	2	12 (2.2%)
	3	5 (0.9%)
	4	1 (0.2%)

Table (2): Occurrence rate (%) of participants with adverse pregnancy outcomes in each sublayer among the 4 pre-pregnancy BMI groups

Item	Number of participants with adverse pregnancy/total					
	Group I No.= 50		Group II No.=67		Group III No.=61	
	N	%	N	%	N	%
Weight gain <2kg	1	2.00%	7	10.45%	6	9.84%
Weight gain 2-3.9kg	1	2.00%	3	4.48%	2	3.28%
Weight gain 4-5.9kg	2	4.00%	5	7.46%	2	3.28%
Weight gain 6-7.9kg	7	14.00%	5	7.46%	4	6.56%
Weight gain 8-9.9kg	7	14.00%	6	8.96%	6	9.84%
Weight gain 10-12.9kg	5	10.00%	6	8.96%	3	4.92%
Weight gain 13-14.9Kg	4	8.00%	3	4.48%	10	16.39%
Weight gain 15-16.9kg	2	4.00%	10	14.93%	7	11.48%
Weight gain 17-19.9kg	8	16.00%	8	11.94%	8	13.11%
Weight gain 20-22.9kg	6	12.00%	12	17.91%	11	18.03%
Weight gain 23-25kg	4	8.00%	1	1.49%	1	1.64%
Weight gain >25kg	3	6.00%	1	1.49%	1	1.64%

Table (3): comparison of complications in relation to BMI categories

Item	Group I No.= 238		Group II No.=222		Group III No.=90		Chi square test
	N	%	N	%	N	%	p-value
Develop complication	50	21.0%	67	30.18%	61	67.7%	<0.0001
Medical complication	19	8.0%	45	20.27%	60	66.67%	<0.0001
DM	4	1.7%	5	2.25%	26	28.89%	<0.0001
Hypertension	1	0.4%	2	0.90%	9	10.00%	0.014
Anemia	15	6.3%	20	9.1%	15	16.67%	<0.0001
Cholycystitis	0	0%	0	0.00%	7	7.78%	<0.0001
Valvovaginitis	18	7.6%	16	7.21%	52	57.78%	<0.0001
UTI	12	5%	35	15.77%	56	62.22%	<0.0001
Obstetric complication	17	7.1%	30	13.51%	59	65.56%	<0.0001
PROM	12	5.0%	25	11.26%	48	53.33%	<0.0001
Malpresentation	5	2.1%	15	6.76%	16	17.78%	<0.0001
Preterm labor	12	5.0%	10	4.50%	41	45.56%	<0.0001
LGA	19	8.0%	30	13.5%	43	47.78%	<0.0001
SGA	13	5.5%	10	4.50%	13	14.44%	0.003
Infant complications	32	13.4%	30	13.51%	56	62.22%	<0.0001

NB: **Some patients develop more than 1 type of complications**

Table (4): comparison of complications in relation to weight changes during pregnancy

Item	Weight loss No.= 74		weight gain ≤13kg No.=278		weight gain >13kg No.=198		Chi square test
	N	%	N	%	N	%	p-value
Develop complication	30	40.54%	55	19.78%	90	45.45%	<0.0001
Medical complication	24	32.43%	40	14.39%	60	30.30%	<0.0001
DM	2	2.70%	4	1.44%	29	14.65%	<0.0001
Hypertension	1	1.35%	2	0.72%	9	4.55%	0.016
Anemia	15	20.27%	10	3.60%	25	12.63%	<0.0001
Cholycystitis	0	0.00%	0	0.00%	7	3.54%	0.002
valvovaginitis	16	21.62%	20	7.19%	50	25.25%	<0.0001
UTI	34	45.95%	29	10.43%	40	20.20%	<0.0001
Obstetric complication	38	51.35%	20	7.19%	50	25.25%	<0.0001
PROM	15	20.27%	20	7.19%	50	25.25%	<0.0001
Malpresentation	10	13.51%	6	2.16%	20	10.10%	<0.0001
Preterm labor	13	17.57%	20	7.19%	30	15.15%	0.005
LGA	0	0.00%	30	10.79%	62	31.31%	<0.0001
SGA	26	35.14%	6	2.16%	4	2.02%	0.001
Infant complications	26	35.14%	36	12.95%	66	33.33%	<0.0001

NB: Some patients develop more than 1 type of complications

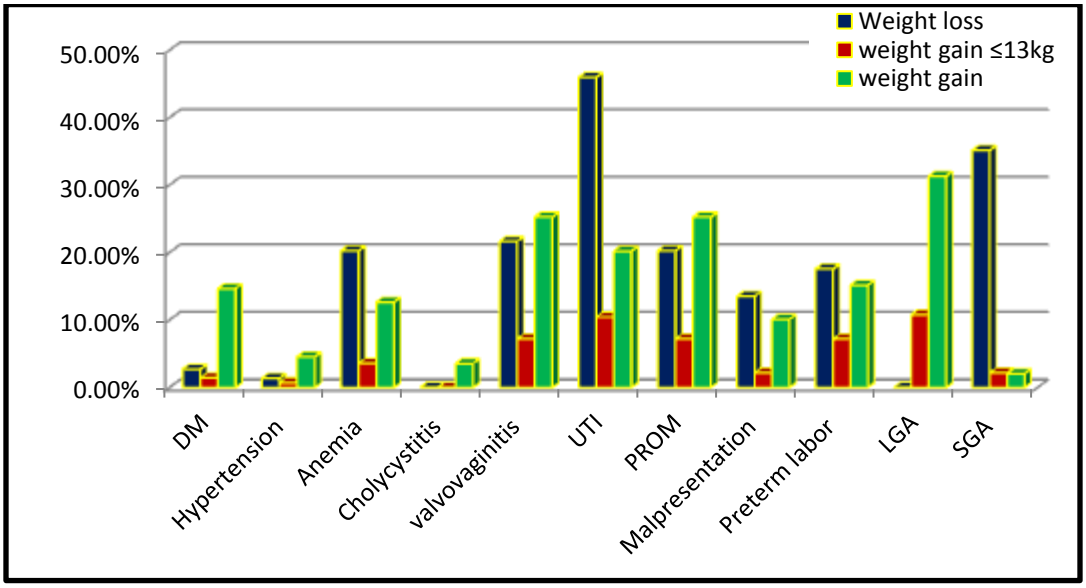

Figure 1: Complications in relation to weight changes during pregnancy

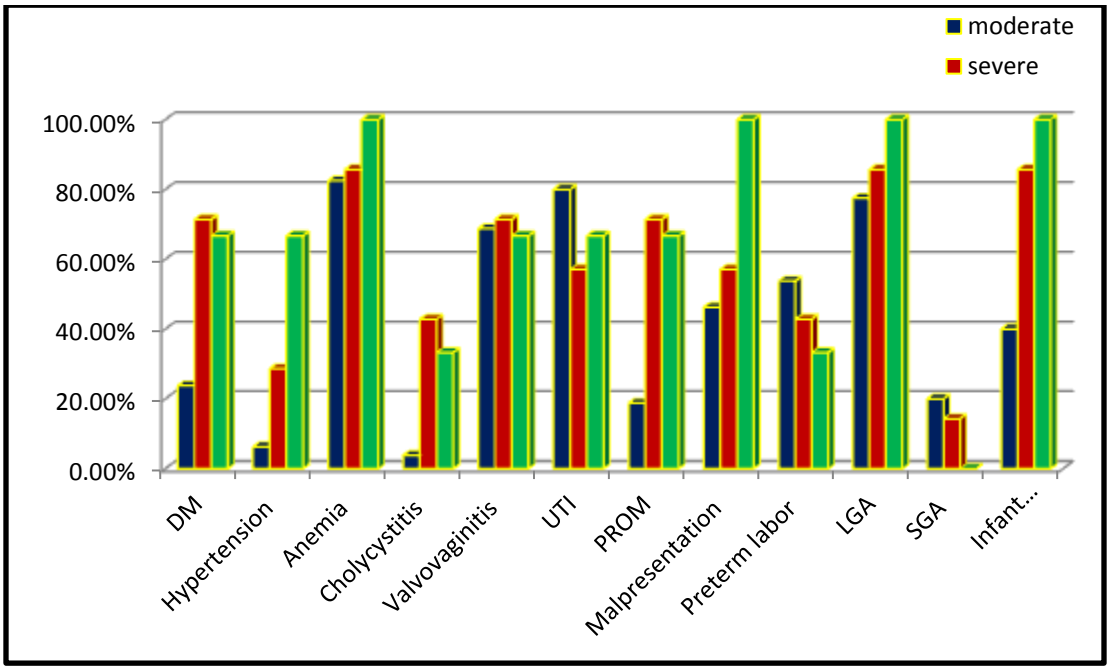

Figure 2: Complications in relation to BMI

Submit your next manuscript to Annals of Neonatology Journal and take full advantage of:

- Convenient online submission
- Thorough and rapid peer review
- No space constraints or color figure charges
- Immediate publication on acceptance
- No limit as regards tables or figures.
- Open Access research freely available for redistribution

Submit your manuscript at:
www.anj.journals.ekb.eg

Citation: Hamdy, M., Taha, R., Mohammed, E., Nour eldien, N. Optimal Gestational Weight Gain According to Pre-pregnancy Body Mass Index That Reduces Fetal and Maternal Complications: A Prospective-Cross Sectional Study. *Annals of Neonatology Journal*, 2023; 5(2): 104-120. doi: 10.21608/anj.2023.287102

Copyright: Hamdy, M. et al., 2023. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC-BY-NC-ND) license (4).