Research Article

American Journal of Gynecology & Obstetrics

Evaluation of Excessive Gestational Weight Gain on Pregnancy Outcome

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Citation: Samy M and Shinkar DM (2022) Evaluation of Excessive Gestational Weight Gain on Pregnancy Outcome. American J Gyne Obst: AJGO-103.

Received Date: 10 Oct, 2022**; Accepted Date:** 20 Oct, 2022**; Published Date:** 25 Oct, 2022

Abstract

Background: *Excessive gestational weight gain (GWG) is reported to be a contributing factor to this obesity epidemic in women. Furthermore, excessive GWG has been associated with increased rate of pregnancy complications.*
The aim of this study *to investigate the effect of maternal obesity & excessive gestational weight gain on pregnancy complications, delivery outcomes, fetal and neonatal complications.*
Patients and methods: *156 healthy obese nulliparous women were selected, subdivided in two groups according to weight gain during pregnancy; group I has low gestational weight gain (LGWG) and group II has high gestational weight gain (HGWG). the estimated sample was 156 subjects 78 in each group. the study include: Primigravidae seen at routine antenatal care. weight recorded at 14- 16 weeks of gestation. At the end of pregnancy; the woman's total weight gain for the second and third trimesters was calculated as per the institute of Medicine (IOM) (integrated offender management) standards.*
Primary outcome *documentation of pregnancy & delivery complications.*
Result: *Excess of weight gain during pregnancy were associated with greater pregnancy complications Also, the excess of weight gain affected on the delivery complications (increases the rate of cesarean sections). In neonatal complications, the high GWG increases rate of low Apgar scores, admissions to neonatal intensive care unit and increase of macrocosmia.*
Conclusion: *Excess of weight gain during pregnancy were associated with greater pregnancy complications such as preeclampsia and gestational diabetes. Also, the excess of weight gain affected on the delivery complications (increases the rate of cesarean sections). In neonatal complications, increases rate of low Apgar scores, admissions to neonatal intensive care unit and increase of macrocosmic baby.*

Keywords: *excessive gestational weight gain, pregnancy outcome, neonatal mobidity.*

Introduction

World Health Organization (WHO) defined obesity as an abnormal or excessive fat accumulation with negative impact on health, using the body mass index (BMI) of 30 kg/m2 or more as a crude estimate (1).

Excessive GWG has been associated with increased rate of pregnancy complications including large for gestational age (LGA) fetus and increase cesarean delivery. On the contrary, limiting GWG, especially in obese women, has been associated with improved pregnancy outcomes inadequate GWG on other hand, may increase the risk of small for gestational age (SGA) fetuses (2).

Maternal obesity is now the commonest risk factor for maternal mortality in developed countries and is also associated with a wide spectrum of adverse pregnancy outcomes and also associated with increased risks of cardiovascular and metabolic disease for the mother and with increased risks of obesity in the offsprings (3).

Common reported maternal complications include gestational diabetes, hypertension and preclampsia, induction of labor, elective and emergency cesarean section, postpartum hemorrhage, anesthetic complications as well as infections and thromboemblic complications fetal risks include miscarriage, neural-tube defects, heart defects, macrosomia and stillbirth (4).

Labor is often complicated in obese pregnant women. Also, obese women have a higher risk than over weight and lean women to progress beyond term, with a higher incidence of post-term childbirths. Finally, obese women tend to have higher odds for induction of labor and failure to progress with labor (5).

Aim of the study

The aim of this study is to assess the effect of maternal obesity & excessive gestational weight gain on pregnancy complications, delivery outcomes, fetal and neonatal complications.

Patients and methods

A prospective cohort study was carried out at obstetrics and gynecology department, Ain Shams University hospital.

Sample size: the estimated sample was calculated to be 156 by using open Epi at confidence 95% and power 80% 156 pregnant women divided in two groups (78 in each group) according to weight gain during pregnancy; group I has low gestational weight gain (LGWG) and group II has high gestational weight gain (HGWG), group I :Low gestational weight gain mothers (< 0.17 Kg/ wk),group II: High gestational weight gain mothers (> 0.27 Kg/wk).
Inclusion criteria included primigravidae, gestational age 14- 16 weeks, while multigravidae, primigravidae with any medical disorder before pregnancy, Underweight women and those with multiple pregnancy were excluded from study. Primary outcome was documentation of pregnancy & delivery complications. Pregnancy complications include the following: pre-eclampsia and/or eclampsia, aminiotic fluid disorders (oligohydramnios and polyhydramnios) and placental insufficiency, delivery complications included premature rupture of a membrane, abnormal labor. Delivery outcomes include vaginal delivery and/or a cesarean section.

While secondary outcomes were: Fetal and newborn complications, fetal complications: Intrauterine growth retardation, birth and fetal macrosomia (a fetal birth weight above 4,000 grams regardless of gestational age), **newborn complications:** birth injuries, RDS, hyperglycemia, intracranial hemorrhage and ICU admission.

All included women were subjected to the following at recruitment: An informed consent to participation after explaining the clinical study in simple form to the patient, full history was taken including: Personal history (Maternal age, weight, height). Obstetric history. Gravidity, Parity, Any associated complication during pregnancy. Menstrual history (Last menstrual period). Maternal medical history (Hypertension,Diabetes mellitus & Coagulopathies),past surgical history any previous surgeries as myomectomy,drug allergy. Examination: i. General examination: a. Vital signs b. Chest and heart examination ii. Abdominal examination: a. Gestational age b. Fetal weight, amount of liquor, fetal lie and presentation, fetal heart sounds c. Uterine contractions and scar of previous surgeries.
Investigations: CBC, Liver Function, Kidney function, one-hour glucola test screening for gestational diabetes mellitus (GDM),

Woman's weight was recorded at 14 -16 weeks. At the end of pregnancy; the woman's total weight gain for the second and third trimesters was calculated as per the institute of Medicine (IOM) (integrated offender management) standards (6).
We use the 2009 Institute of Medicine guidelines for estimation of the pre-pregnancy body mass index (BMI) and generation of IOM (integrated offender management) pregnancy weight gain categories. Accordingly, 1.25 kg is subtracted from the weight measured at 14–16 weeks of gestation (7).

Pre-pregnancy BMI categories were then calculated using WHO criteria (underweight BMI < 18.5 kg/m2, normal BMI 18.5–24.9 kg/m2, overweight BMI 25.0–29.9 kg/m2 and obese BMI ≥ 30.0 kg/m2). Underweight women will be excluded.

The IOM 2009 guidelines for recommended rates of weight gain for the second and third trimesters for the three pre-pregnancy BMI categories was used to establish weight gain categories (8). Weight gain during pregnancy: reexamining the guidelines.

Table I: guidelines for recommended gestational weight gain based on pre-pregnancy BMI.

	Weight gain (kg/wk)		
	Low	Normal	High
Normal weight (18.5-24.9 kg/ m^2)	< 0.35	0.35-0.50	>0.50
Overweight (0.25-29.9 kg/ m^2)	<0.23	0.23-0.33	>0.33
Obese (≥30.0 kg/ m^2)	<0.17	0.17-0.27	>0.27

A woman's GWG per week in the second and third trimesters adjusted for gestation at delivery is calculated using the following formula: GWG (kg/week) = Total weight gain (kg) (Week at final weight measurement _ Week at first visit measurement)/number of weeks (8).

Ethical consideration:

Objectives of the study were explained to the women before inclusion in the study. An informed consent was obtained prior to inclusion to the study. Consent were obtained from all participants with explanation of management strategy and follow up plan.

Statistical analysis:

Data are coded, entered to SPSS (statistical package for social science), software version 20.

Results

The presented data obtained from 156 healthy nulliparous women selected from all number of cases, subdivided in two groups according to weight gain during pregnancy; group I has low gestational weight gain (LGWG) and group II has high gestational weight gain (HGWG).

The following table contains the demographic data for the two groups including the age, body mass index and the gestational weight gain.

As shown in table (2), the mean age of group I (low gestational weight gain) was 22.6± 5 years old and the range of age was from 17 to38 years old. The mean age of group II (high gestational weight gain) was 21.2 ± 3.88 years old and the range of age was from 15 to 38 years old. P value for age was not significant.

As regard BMI, in group I (low gestational weight gain) the mean of BMI was 33.1± 3.1 kg/m^2 and the range of BMI was from 30 to44 kg/m^2. In group II (high gestational weight gain), the mean of BMI was 32.8 ± 3.3 kg/m^2 and the range of BMI was from 30 to 44 kg/m^2 and the range of BMI was from 30 to45 kg/m^2. The p-value in body mass index was not significant.
As regard gestational weight gain, in group I (low gestational weight gain), the mean of gestational weight gain 0.076 ± 0.06 kg/wk; while in group II (high gestational weight gain) the mean of gestational weight gain was 0.068 ± 0.02 kg/wk. The p-value in the gestational weight gain was significant with group II having higher gestational weight gain compared to group I. Pregnancy complications assented in this study were gestational hypertension, preeclampsia, gestational diabetes, anemia and antepartum haemorrhage. All these complications are listed in table (3) which showed that: gestational hypertension was similar in both groups and represented 3.8% (3 cases) in group I (low gestational weight gain), 3.8% (3 cases) in group II (high gestational weight gain).

As shown in table (4), Weeks of delivary < 37 wk represented 1.30% (one case) in group I (low gestational weight gain); while in group II (high gestational weight gain); represented 2.60 % (2 cases).

Weeks of delivary 37 – 42 wk represented 98.70% (77 cases) in group I (low gestational weight gain); while in group II (high gestational weight gain); represented 97.40 % (76 cases).

As shown in table (5), there was no significant difference as regard premature rupture of membrane in both groups. The values were nearly the same in both groups.

Regarding antipartum haemorrage, there was no significant difference between the two groups. The number of case of was 1 (1.30%) in group I (low gestational weight gain); while in group II (high gestational weight gain) number of cases were 3 (3.80 %).

Regarding failure to progress/dystocia, there was a highly significant difference between the two groups. The number of cases of 10 (12.80%) in group I (low gestational weight gain); while in group II (high gestational weight gain) number of cases were 23 (29.50 %).

Regarding mode of delivery, there was a highly significant difference between the two groups. The number of cases of vaginal delivery were 37 (47.4%) in group I (low gestational weight gain); while in group II (high gestational weight gain) number of cases were 5 (6.4 %). Number of cases of cesarean section was 41 (52.6%). in group I (low gestational weight gain); while in group II (high gestational weight gain) number of cases were 73 (93.6 %).

As shown in table (7), there was a highly significant difference in the method of delivery (spontaneous vaginal, elective cesarean, unplanned cesarean) among two groups and there was no significant difference in the method of delivery (assisted vaginal) among two groups.

Spontaneous vaginal represented 46.20% (36 cases) in group I (low gestational weight gain) while in group II (high gestational weight gain) it was 1.30% (one case).

Assisted vaginal represented 1.30% (one case) in group I (low gestational weight gain) while in group II (high gestational weight gain) it was 5.10% (4 cases).

Elective cesarean represented 5.10% (4 cases) in group I (low gestational weight gain) while in group II (high gestational weight gain) it was 25.60% (20 cases).

Unplanned cesarean represented 47.40% (37 cases) in group I (low gestational weight gain) while in group II (high gestational weight gain) it was 67.90% (53 cases).

There was highly significant difference in the indication for an unplanned cesarean (failure to progress/ dystocia) and there was no significant difference as regard the indication for an unplanned cesarean (placental abruption, fetal distress and failed induction) in both groups. that significant difference as regard to the preeclampsia and no significant difference as regard to the malpresentation and suspected macrosomia in both groups.Malpresentation represented 5.20% (4 cases) in group I (low gestational weight gain); while in group II (high gestational weight gain) represented the same number 3.90% (3 cases).
Suspected macrosomia represented 0% (no case) in group I (low gestational weight gain); while in group II (high gestational weight gain) represented 5.20% (4 cases). Preeclampsia represented 0% (no cases) in group I (low gestational weight gain); while in group II (high gestational weight gain) represented 16.70% (13 cases). there was statistically significant difference in the first stage cesarean and no significant difference in second stage cesarean in both groups. Regarding first stage cesarean, there was 12.80% (10 cases) in group I and 29.50% (23 cases) in group II. Regarding second stage cesarean, there was 1.30% (1 case) in group I and 5.10% (4 cases) in group II. As shown in table (9), there was a highly significant difference in fetal complications (Intrauterine growth retardation and fetal macrosomia) among the two groups as shown in table (10), there was a highly significant difference in both groups for all birth weight.

Regarding birth weight < 2500 gm represented10.25% (8 cases) in group I (low gestational weight gain); while in group II (high gestational weight gain) represented 2.60 % (2 cases).

Regarding birth weight 2500- 4000 gm represented89.75% (70 cases) in group I (low gestational weight gain); while in group II (high gestational weight gain) represented 21.64 % (57 cases).

Regarding birth weight > 4000 gm represented 0% (0 cases) in group I (low gestational weight gain); while in group II (high gestational weight gain) represented 24.30 % (19 cases). there was highly significant difference as regard to apgar score (1 min) 5-7 and 8-10 in both groups and no significant difference as regard to apgar score (1 min) 0-4 in both groups.

Apgar score (1 min) 0-4, represented 1.30% (1 case) in group I (low gestational weight gain); while in group II (high gestational weight gain) represented 3.80% (3 cases). there was significant difference as regard to apgar score (5 min) 8-10 in both groups and no significant difference as regard to Apgar score (5 min) 0-4 and 5-7 in both groups.

Apgar score (5 min) 0-4, represented 1.30% (one case) in group I (low gestational weight gain); while in group II (high gestational weight gain) represented 3.80% (3 cases).

Apgar score (5 min) 5-7, represented 0% (0 case) in group I (low gestational weight gain); while in group II (high gestational weight gain) represented 6.40% (5 cases).

Apgar score (5 min) 8-10, represented 98.70% (77 cases) in group I (low gestational weight gain); while in group II (high gestational weight gain) represented 89.70% (70 cases). there was no significant difference as regard neonatal complications at delivery (birth injury, respiratory distress syndrome, intracranial hemorrhage and hyperglycemia) in both groups.

Table 2: Demographic data.

Demographic data	Group I $\bar{X}$±SD	Group II $\bar{X}$±SD	T	P
Age (y)	22.6 ± 5.0	21.2 ± 3.88	1.94	0.054
Body mass index (kg/m^2)	33.1 ± 3.1	32.8 ± 3.3	0.57	0.56
Gestational weight gain (kg/wk)	0.076 ± 0.06	0.68 ± 0.2	23.8	< 0.001**

Table 3: Pregnancy complications.

Pregnancy complications	Group I	Group II	x^2	P
Gestational hypertension	3 (3.8 %)	3 (3.8 %)	0	0
Preeclampsia	0	13 (16.7 %)	14.18	< 0.001**
Gestational diabetes	0	7 (9 %)	5.38	0.02**
Anemia	9 (11.5 %)	4 (5.1 %)	2.1	0.14
Antepartum haemorrhage	1(1.3%)	3 (3.8 %)	1.36	0.24

Gestational hypertension (Bl/p >140/90 without protenouria), anemia (Hb < 11gm/dl) and Antepartum haemorrhage (placental abruption and placenta previa).

Table 4: Gestational age at delivery (Mean and Range).

Gestational age at delivery	Group I	Group II	T	P
< 37 wk	1 (1.30%)	2 (2.60%)	0.26	0.6
37- 42 wk	77 (98.70%)	76 (97.40%)	0.26	0.6

Table 5: Delivery complications.

Delivery complications	**Group I**	**Group II**	X^2	P
Premature rupture of membrane	3(3.80%)	4(5.12%)	0	1
Antepartum haemorrhage	1(1.30%)	3(3.80%)	1.36	0.24
Failure to progress/dystocia	10(12.80%)	23(29.50%)	6.5	0.01**
post-partum haemorrhage	0.00%	0.00%	0	1

Table 6: Mode of delivery.

Mode of delivery	Group I	Group II	x^2	P
Vaginal delivery	37 (47.4 %)	5 (6.4 %)	33.3	< 0.001**
Cesarean section	41 (52.6 %)	73 (93.6 %)		

Table 7: Method of delivery.

Method of delivery		Group I	Group II	X^2	P
Vaginal	spontaneous	36 (46.20%)	1 (1.30%)	43.4	< 0.001**
	assisted	1 (1.30%)	4 (5.10%)	0.83	0.83
Cesarean	elective	4 (5.10%)	20 (25.60%)	12.61	< 0.001**
	unplanned	37 (47.40%)	53 (67.90%)	6.72	0.009**

Table 8: Indication for an unplanned and elective cesarean and Timing of unplanned cesarean.

Indication for an unplanned cesarean	Group I	Group II	X^2	P
failure to progress/dystocia	10 (12.80%)	23 (29.50%)	6.5	0.01**
Placental abruption	1 (1.3%)	2 (2.6%)	0.13	0.71
fetal distress	2 (2.60%)	3 (3.90%)	0.0	1.0
failed induction	24 (30.80%)	25 (32%)	0.03	0.86
Indication for an elective cesarean	Group I	Group II	X^2	P
Malpresentation	4 (5.20%)	3 (3.90%)	0.0	1.0
suspected macrosomia	0 (0%)	4 (5.20%)	3.3	0.06
preeclampsia	0 (0%)	13 (16.70%)	14.1	<0.001**
Timing of unplanned cesarean	Group I	Group II	X^2	P
first stage cesarean	10 (12.80%)	23 (29.50%)	6.5	0.01**
second stage cesarean	1 (1.30%)	4 (5.10%)	0.001	0.95

Table 9: Fetal complications.

Fetal complications	Group I	Group II	x^2	P
Intrauterine growth retardation	8 (10.25 %)	2 (2.56 %)	3.85	0.049**
Fetal macrosomia	0	19 (24.3 %)	21.64	< 0.001**

Intrauterine growth retardation (weight of baby < 2500 gm) and fetal macrosomia (weight of baby > 4000gm).

Table 10: Birth weight, APGAR scores and neonatal complications.

Birth weight (gm)	Group I	Group II	X^2	P
< 2500 gm	8 (10. 25 %)	2 (2.60%)	3.85	0.04**
2500- 4000 gm	70 (89.75%)	57 (73.00%)	21.64	< 0.001**
> 4000 gm	0	19 (24.30%)	21.64	< 0.001**
Apgar score (1 min)	Group I	Group II	X^2	P
Apgar score (1 min) 0-4	1(1.30%)	3(3.80%)	0.26	0.61
Apgar score (1 min) 5-7	1(1.30%)	9 (11.50%)	68.4	0.008**
Apgar score (1 min) 8-10	76 (97.40%)	66 (84.60%)	7.85	0.005**
Apgar score (5 min)	Group I	Group II	X^2	P
Apgar score (5 min) 0-4	1(1.30%)	3 (3.80%)	0.26	0.61
Apgar score (5 min) 5-7	0(0%)	5 (6.40%)	3.3	0.06
Apgar score (5 min) 8-10	77 (98.70%)	70(89.70%)	4.24	0.03**
Neonatal complications at delivery	Group I	Group II	x^2	P
Birth injury	0	2 (2.65 %)	0.51	0.47
Respiratory distress syndrome	1 (1.3 %)	2 (2.56 %)	0	1
Intracranial haemorrhage	0	0	0	1
Hyperglycemia	0	0	0	1

** significant

Discussion

In our study, there was a significant difference according to weight gain as regard to the rate of pre-eclampsia (0%) in obese nulliparous with low gestational weight gain and (16.7%) in obese nulliparous with high gestational weight gain. This rate in obese nulliparous with high gestational weight gain was 16.7 % which similar to that reported by Aimukhametova et al. (2012) (17.6%) (9). On the other hand, it was higher than that reported by Antonia et al. (2014), (10) where pre-eclampsia rates were 5.5, 5.4, 6.5, 10.5 % respectively.

This difference of pre-eclampsia rate in obese nulliparous with high gestational weight gain can be attributed to inclusion of nulliparous obese and non-obese women and the significantly lower BMI in some women of other studies; we collected data from a relatively smaller sample of women in our study.

Gestational diabetes rate had a significant difference according to the weight gain (0%)in obese nulliparous with low gestational weight gain and (9%) in obese nulliparous with high gestational weight gain.

This rate was nearly similar to that reported by Slavin et al. (2013) (11.2%) and Jared et al. (2019) (6%) (11,12). On the other hand, it was lower than that reported Vaswani and Balachandram (2018) (28.7%). The great difference between our data and the data reported by other studies may be due to the difference in sample size, BMI, parity and also the difference of gestational weight gain (13).

The mean of gestational age at delivery in obese nulliparous with low gestational weight gain was higher (40 ± 1.6wks) than obese nulliparous with high gestational weight gain (39.5 ± 1.8wks). Regarding gestational age at delivery in obese nulliparous (low gestational weight gain), it was similar to that reported by Vahratian et al. (2015) (39.6 wks) and Chung et al. (2013) (39.8wks). Also, the gestational age at delivery in obese nulliparous (high gestational weight gain), it was similar to that reported by Chung et al. (2013) (39.9wks) (8,14).

Failure to progress and dystocia in obese nulliparous with high gestational weight gain (29.50 %) was significantly higher than that in obese nulliparous with low gestational weight gain (12.80%). It was similar to that reported by Vahratian et al. (2015) (13.7%) in obese nulliparous with low gestational weight gain. The difference in obese nulliparous with high gestational weight gain can be attributed to the significantly lower BMI in some women in the other study and also the inclusions of the difference gestational weight gain in our study (14).

Vaginal delivery percentage in obese nulliparous with low gestational weight gain was (47.4%) and (6.4%)in obese nulliparous with high gestational weight gain. In our study, the vaginal delivery in obese nulliparous with high gestational weight gain was much lower than that reported by Antonia et al. (2014) (69%) (10).

This difference can be attributed to higher rate of postdate, failure to progress, failed induction and macrosomia in this

study and the difference in BMI in other study in addition to difference in sample size.

The present value of vaginal delivery in obese nulliparous with low gestational weight gain was nearly similar to that reported by Gulzhan Aimukhametova et al. (2012) (41.2%) and Slavin et al. (2013) (51.6%), (9,11)

Our study had several limitations as a small sample of women, the difference in BMI and the gestational weight gain, in addition to other studies were done on healthy non obese and obese pregnant females.

The cesarean sections percentage in obese nulliparous with low gestational weight gain was (52.6%) and (93.6%) in obese nulliparous with high gestational weight gain. Several authors have speculated that association between cesarean section and obesity may be due to the added soft-tissue deposits in the pelvis of obese women, which coupled with larger fetus necessitating more time and stronger contraction to progress through labor (Vahratian et al., 2015). Recent studies reported cesarean sections rate between 38-50 % for women with BMI > 40 (Slavin et al., 2013)(13,15).

In the present work, the rate of cesarean section in obese nulliparous with low gestational weight gain was similar to that reported by Gulzhan Aimukhametova et al. (2012) (58.8%) (9).

The high rate of cesarean section can be attributed to high rate of postdate, failure to progress, failed induction and cephalopelvic disproportion (due to macrosomic babies), excessive fat deposition in the soft tissues of the pelvis or because of abnormal uterine action.

In the current study, the rate of elective cesarean was significantly higher in obese nulliparous with high gestational weight gain (25.60 %) than the reported rate in low gestational weight gain (5.10 %).

The rate of elective cesarean in obese nulliparous with high gestational weight gain was similar to that reported by Vaswani and Balachandram (2013) (31%). on the other hand, it was higher than that reported by Vahratian et al. (2005) (6.1 %). This difference could be attributed to high rate of cesarean sections and the excess in gestational weight gain. While, the rate of elective cesarean in obese nulliparous with low gestational weight gain was similar to the value that reported by Vahratian et al. (2005) (6.1 %) (13,14).

The timing of unplanned cesarean was significantly higher in obese nulliparous with high gestational weight gain (29.50 % during first stage) than the low gestational weight gain (12.80 % during first stage). Regarding timing of unplanned cesarean obese nulliparous with high gestational weight gain, it was nearly similar to that reported by Vahratian et al. (2005) (20% during first stage) (14).

The mean of birth weight in obese nulliparous with low gestational weight gain was significantly lower (2.9±0.3 kg) than the mean of obese nulliparous with high gestational weight gain (4 ± 0.5 kg). This value of mean in obese nulliparous with low gestational weight gain was nearly similar to that reported by Vahratian et al. (2005) (3.5 kg) and Chung et al. (2013) (3.3 kg). However, the value of birth weight in obese nulliparous with high gestational weight gain was higher than that reported by Chung et al. (2013) (3.5 kg) (8,14).

Birth weight (<2500 gm) was significantly higher in obese nulliparous with low gestational weight gain (10.25 %) than the high gestational weight gain (2.60 %).

This rate in obese nulliparous with low gestational weight gain was nearly similar to that reported by Gulzhan Aimukhametova et al. (2012) (5.1%) while it was lower than that reported by Chung et al. (2013) (21%) (8,9).

This difference of birth weight in obese nulliparous with low gestational weight gain may be due to inclusion of nulliparous obese and non-obese women in the other studies.

On the other hand, the rate of birth weight (<2500 gm) in obese nulliparous with high gestational weight gain (2.60 %)was similar to that reported by Jared et al.(2019)(4.8%) but it was lower than that reported by Chung et al. (2013) (9.3%) this difference of birth weight in obese nulliparous with high gestational weight gain may be due to inclusion of nulliparous obese and non-obese women in the other studies.(8,15).

The percent value of birth weight (2500 - 4000 gm) was significantly higher in obese nulliparous with low gestational weight gain (89.75 %) than the high gestational weight gain (73 %). It was nearly similar to that reported by Gulzhan Aimukhametova et al. (2012) (83.4%) (9).

Birth weight (> 4000 gm) was significantly higher in obese nulliparous with high gestational weight gain (24.30 %) and no cases (0%) reported in obese nulliparous with low gestational weight gain.

Macrosomia has been reported to be high in obese women and higher in morbidly obese women. The combination of increased energy influx to the fetus along with fetal hyperinsulinemia associated with obesity may explain the increased frequency of macrosomic babies (Vaswani and Balachandram, 2013) (14).

Apgar score (1min) 5-7 value was significantly higher in obese nulliparous with high gestational weight gain (11.50 %) than the low gestational weight gain (1.30 %). This value was less than that reported by Vahratian et al. (2015) (24.50%). This difference of Apgar score(1min) 5-7 in obese nulliparous with high gestational weight gain may be due to our study had several limitations. We collected data from a small sample of women and there is difference in gestational weight gain. (14).

On the other hand, the Apgar score (5 min) 8-10 was significantly higher in obese nulliparous with low gestational weight gain (98.70 %) than in the obese nulliparous with high gestational weight gain (89.70 %). Comparison the Apgar score (5min) 8-10 value in obese nulliparous with low gestational weight gain with other

studies, it was similar to that reported by Vahratian et al. (2015) (97.9%). While, the value Apgar score (5min) 8-10 in obese nulliparous with high gestational weight gain was lower than this ratio may be due to failure to progress during the first stage of labor, higher rates of failed trial of labor, maternal diabetes, and fetal macrosomia this lead to prolonged labor and fetal distress (14).

Excess of weight gain during pregnancy were associated with greater pregnancy complications such as preeclampsia and gestational diabetes. Also, the excess of weight gain affected on the delivery complications (increases the rate of cesarean sections) (16). For neonatal complications, the high GWG increases rate of low Apgar scores, admissions to neonatal intensive care unit and increase of macrocosmic baby. On the other hand, the low GWG decreased the rates of preeclampsia, gestational diabetes, cesarean delivery, low Apgar score, admissions to neonatal intensive care unit and macrocosmic baby (17).

Our study had several strength points as: Involving only nulliparity,not including women with medical disorder before pregnancy ,estimation of pre-pregnancy weight, BMI, GWG.

While limitations for this study small sample size, wide variations in BMI, furthermore, actual weight gain every week wasn't accurately measured as weight was measured two times only in study, this may have impact on outcome.

Conclusion

In this work, there are many problems produced from the excess of GWG for the nulliparous obese pregnant women's. Excess of weight gain during pregnancy were associated with greater pregnancy complications such as preeclampsia and gestational diabetes. Also, the excess of weight gain affected on the delivery complications (increases the rate of cesarean sections). In neonatal complications, the high GWG increases rate of low Apgar scores, admissions to neonatal intensive care unit and increase of macrocosmic baby. On the other hand, the low GWG decreased the rates of preeclampsia, gestational diabetes, cesarean delivery, low Apgar scores, admissions to neonatal intensive care unit and macrocosmia.

Acknowledgements

Special thanks go to the patients and their families for the great support of our work. Also, the authors appreciate ultrasound unit &neonatology unit of Ain Shams University Maternity Hospital for the outstanding support during the entire study.

Compliance with ethical standards:

Disclosure statement: No potential conflict of interest was reported by the authors.
Informed consent: Informed consent was obtained from all individual participants included in the study.
Ethical approval: All procedures performed in studies involving human participants were in accordance with ethical standards of the Ethical committee of the department of obstetrics and gynecology faculty of medicine, Ain Shams University.

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