Al-Azhar Med. J. (Surgery). *Vol. 50(3), July, 2021, 1749-1760*
DOI: 10.21608/amj.2021.178266
https://amj.journals.ekb.eg/article_178266.html

EFFECT OF MATERNAL BODY MASS INDEX ON PROGRESS AND OUTCOME OF LABOR IN NULLIPAROUS PREGNANT WOMEN

By

Mohamed Ahmed Ragheb Mansour, Hossam Al-Din Hussien Kamel Salem and Mohamed Mahmoud Mohamed

Obstetrics & Gynecology Department, Faculty of Medicine, Al-Azhar University

E-mail: dr_m2017@yahoo.com

ABSTRACT

Background: Obesity is a widely spread health problem the complications of which are too many whether general or obstetric complications.

Objective: The aim of this observational study is to evaluate the impact of increased BMI of nulliparous women on progress of labor, incidence of peri-partum complications (1ry outcome) and neonatal outcome of these women (secondary outcome).

Patients and Methods: In this prospective observational study, 150 primigravidas in labor were recruited in Mit Ghamr General Hospital between November 1st, 2019 and April 30th, 2020 and categorized into 5 groups according to WHO BMI classification; Group A contained 50 patients with BMI 18.9-24.9, group B 50 patients with BMI 25-29.9, group C1 20 patients with BMI 30-34.9, group C2 20 patients with BMI 35-39.9 and group C3 10 patients with BMI at least 40. Recruited patients were monitored for their progress of labor (in terms of time of cervical dilation from 4 cm to 10 cm, the accordingly calculated rate of cervical dilation and duration of head descent) and their development of peri-partum complications (cervical dystocia, shoulder dystocia, arrest of head descent, the subsequent potential need for CS, 3rd and 4th degree perineal tears, 1ry post-partum hemorrhage, retained placenta). Neonatal outcome was observed by measuring fetal birth weight, APGAR score at 1 minute and 5 minutes, subsequent potential need for NICU admission and occurance of neonatal jaundice.

Results: A statistically significant difference was found regarding progress of labor and neonatal outcome with women in obese groups (C1, C2, C3) having slower progress and worse neonatal outcome, while no statistically significant difference was found regarding mode of delivery and peri-partum complications.

Conclusion: Obese women in labor considered high-risk cases that required special measures whether on short-term or long-term basis.

Keywords: Obesity, BMI, Primigravida, labor, Partogram, Peri-partum, Neonatal.

INTRODUCTION

The worldwide prevalence of obesity has increased substantially over the past few decades. Economic, technologic, and lifestyle changes have created an abundance of cheap, high-calorie food coupled with decreased required physical activity. We are eating more and moving less. Obesity is a significant public health concern and is likely to remain so for the foreseeable future *(Lampard et al., 2014)*.

The most commonly used measurement for defining obesity is Body Mass Index (BMI), which refers to an individual's weight in kilograms divided by the square of his or her height in meters. Individuals are deemed overweight when they have a BMI between 25 and 30 kg/m2; obesity is defined as a BMI greater than or equal to 30 kg/m2, and extreme obesity is defined as a BMI greater or equal to 40 kg/m2 *(Tchernof et al., 2013)*.

For example, weight lifters and professional athletes tend to have high BMI because they have a high muscle mass, not excess fat. These individuals are not at risk for metabolic health problems because the health consequences of obesity come from excess adipose tissue, not the size of one’s body. Despite this limitation, BMI continues to be used today because it is easily calculated and is the best tool available from a broad-based health policy perspective *(Tchernof and Després, 2013)*.

Both increased and decreased BMI have been demonstrated to be associated with an increased rate of adverse events *(Denison et al., 2014)*.

Some studies have investigated the impact of maternal BMI on the progress of labor and the length of labor; patients with increased BMI have been shown to experience slower labor progress, labor dysfunction, and a higher cesarean delivery rate *(Vinturache et al., 2014)*.

Obesity is associated with increased rates of pregnancy-induced hypertension (PIH), gestational diabetes mellitus (GDM), venous thromboembolism (VTE), and postpartum hemorrhage risk during pregnancy and the intrapartum period *(John et al., 2014)*.

Active management of the third stage should be recommended to reduce the risk of postpartum haemorrhage (PPH) *(Denison et al., 2018)*.

Additionally, emergency and elective cesarean rates, labor induction rates, risk of preterm birth, shoulder dystocia, macrosomia, newborn intensive care unit (NICU) requirement, fetal and neonatal death, and the risk of low APGAR scores increase in obese pregnant females. Antenatal medical care expenses also increase significantly in obese and overweight females *(Minsart et al., 2013)*.

Because obese women are more likely to have excessive gestational weight gain (GWG), this further increases the risk of developing the metabolic syndrome in later life. The offspring have an increased risk of obstetric morbidity and mortality *(Stubert et al., 2018)*.

The aim of this observational study was to evaluate the impact of increased BMI of nulliparous women on progress of labor, incidence of peri-partum complications (1ry outcome) and neonatal outcome of these women (secondary outcome).

PATIENTS AND METHODS

This randomized prospective study population included nulliparous patients attending the labor ward of Mit Ghamr General Hospital, Egypt, during active phase of labor between November 1st, 2019 and April 30th, 2020.

Inclusion criteria:

Nulliparous women, age 20-40 years, BMI ≥18.9, full-term singleton pregnancy [37-42 weeks gestation calculated by Last Menstrual Period (LMP) and confirmed by 1st trimester ultrasonography], cephalic [vertex] presentation, occipito-anterior position and in active phase of labor [dilation of cervix at least 4 cm].

Exclusion criteria:

Multiparous women, age below 20 or over 40, BMI less than 18.9, multifetal pregnancy, major fetal anomalies, malposition, premature rupture of membranes, maternal pregestational, gestational medical disorders other than obesity and labor induction (by stripping, amniotomy, prostaglandins or oxytocin infusion).

Patients included in this study were subjected to informed consents, full history taking and clinical examination: (vital signs, height, weight, head and neck, breast, limb) and abdominal examination

- **Inspection:** to detect size of the abdomen, striae gravidarum and pigmentations as linea nigra.
- **Obstetric palpation (Maneuvers of Leopold):** Fundal level, fundal grip, umbilical grip, first pelvic grip, second pelvic grip.

Laboratory Investigations:

CBC, kidney and liver function, coagulation profile, FBS, PPBS, HBA1C and urine analysis.

Ultrasound:

Ultrasound examination was done, to assess Bio Physical Profile (BPP), number of fetuses (Exclusion of multiple pregnancies), position of the placenta, biometry, gestational age, presentation (at term), estimated fetal weight, umbilical artery Doppler flowmetry.

Monitoring progress and complications (Primary outcome):

Patients were weighed and had their height measured. This study depends on the pre-labor weight rather than pre-pregnancy weight. Patients were divided into groups using their BMI based on WHO criteria: Group A included 50 women with normal BMI of [18.9-24.9], group B included 50 overweight women with BMI of [25-29.9], group C included 50 obese women with BMI of at least 30 which subdivided into 3 sub-groups corresponding to the 3 classes of obesity according to WHO criteria: Sub-group C1 included 20 women with BMI of 30-34.9, Sub-group C2 included 20 women with BMI of 35-39.9, Sub-group C3 included 10 women with BMI of at least 40. Friedman curve was used to monitor progress of labor in terms of cervical dilation and head descent vs. time.

Neonatal assessment (secondary outcome):

The neonatal birth weight, follow up the neonate for Apgar score at 1 & at 5 minutes by trained pediatrician, neonatal admission to NICU, occurrence of neonatal jaundice.

Statistical analysis:

Data were collected, revised, coded and entered to the Statistical Package for Social Science (IBM SPSS) version 23. The quantitative data were presented as mean, standard deviations and ranges when parametric and median, inter-quartile range (IQR) when data found non-parametric. Also qualitative variables were presented as number and percentages. The Comparison between groups with qualitative data were done by using Chi-square test. The comparison between more than two groups with quantitative data and parametric distribution were done by using One Way ANOVA test; while data with non - parametric distribution were done by using Kruskall Wallis test. The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant when P < 0.05: Significant.

RESULTS

Regarding the age, time, rate of cervical dilation per hour and duration of head descent, there was statistically significant difference between groups and within the groups **(Table 1)**.

Table (1): Baseline characters and progress of labor among studied groups

Parameters \ Groups		Group A No. = 50	Group B No. = 50	Group C1 No. = 20	GroupC2 No. = 20	Group C3 No. = 10	P-value
Age	Mean±SD	24.32 ± 3.94	25.11± 5.31	25.48±4.27	26.64 ± 4.48	28.87 ± 4.62	0.043
Weight	Mean±SD	59.3±6.85	71.9±7.32	86.82±7.21	95.64±8.34	112.36±9.88	0.001
Height	Mean±SD	161.84±6.64	163.55±12.87	165.89±11.81	164.34±8.67	163.64±6.87	0.628
Cervical dilation per hour	Median (IQR)	1.38 (1.2 – 1.6)	1.31 (1.28 - 1.42)	1.2 (0.98 - 1.3)	0.92 (0.8 - 1)	0.83 (0.78 - 0.98)	<0.001
Time of cervical dilation from 4 cm to 10cm	Median (IQR)	4.3 (4 - 4.9)	4.6 (4.2 - 5.1)	5.3 (5.0 - 5.9)	6.6 (5.8 - 7.6)	6.9 (6 - 8.1)	<0.001
Duration of head descent from station 0 to +3	Median (IQR)	2.1 (1.4 – 2.6)	2.5 (1.75 – 3.2)	3.1 (2.6 – 3.4)	3.6 (2.8 – 4.5)	3.71 (3.2 – 4.8)	<0.001

•: One Way ANOVA test; ‡: Kruskal Wallis test

Regarding fetal weight, APGAR score at 1 minute, APGAR score at 5 minutes, neonatal need for NICU admission and occurance of neonatal jaundice there was highly statistically significant difference between the groups and within all groups **(Table 2)**.

Table (1): Neonatal outcome among different study groups

Parameters \ Groups		Group A No. = 50	Group B No. = 50	Group C1 No. = 20	GroupC2 No. = 20	Group C3 No. = 10	P-value
Fetal birth weight	**Median (IQR)**	2.8 (2.6 – 3.2)	3.2 (2.8 – 3.5)	3.5 (3.1 – 3.7)	3.8 (3.4 – 4.1)	4.1 (3.7 – 4.2)	<0.001
APGAR score	1min	8 (7– 9)	8 (7 – 8)	8 (7 – 8)	7 (7 – 8)	7 (6 – 8)	<0.001
APGAR score	5min	9 (8– 9)	9 (8 – 9)	8 (8 – 9)	8 (8 – 9)	8 (7 – 8)	<0.001
NICU admission	Yes	3 (6.0%)	3 (6.0%)	2 (10.0%)	4 (20.0%)	4 (40.0%)	0.010
	No	47 (94.0%)	47 (94.0%)	18 (90.0%)	16 (80.0%)	6 (60.0%)	
	Total	50 (100.0%)	50 (100.0%)	20 (100.0%)	20 (100.0%)	10 (100.0%)	
Neonatal jaundice	Yes	1 (2.0%)	2 (4.0%)	2 (10.0%)	3 (15.0%)	4 (40.0%)	0.001
	No	49 (98.0%)	48 (96.0%)	18 (90.0%)	17 (85.0%)	6 (60.0%)	
	Total	50 (100.0%)	50 (100.0%)	20 (100.0%)	20 (100.0%)	10 (100.0%)	

*: Chi-square test; ‡: Kru

DISCUSSION

Obesity has become an epidemic throughout the world. Worldwide, obesity rates have doubled in the last 30 years, with rates also increasing among pregnant women *(Yu et al., 2013)*. Maternal obesity has significant health implications, contributing to increased morbidity and mortality for mother and baby, a higher proportion of women who die in pregnancy/postpartum are obese *(Ono et al., 2010)*.

We compared our five groups of BMI regarding maternal (in terms of progress of labor and incidence of peripartum complications) and neonatal outocome (as a secondary outcome in terms of fetal birth weight, APGAR scores at 1 and 5 minutes, neonatal need for NICU admission and occurance of neonatal jaundice).

Regarding progress of labor, we evaluated it in each of our recruited patients by tracing the time elapsed from 4-10 cm cervical dilation and consequently the rate of cervical dilation in addition to time elapsed by head descent. Regarding time and rate of cervical dilation and duration of head descent, there was a statistically significant difference between groups and within the groups with longer durations in obese groups. On the other hand, A majority of previous studies show an association between maternal obesity and total duration of active labor. The higher the BMI goes the more prolonged the first stage of labor seems to be, leading to a more prolonged duration of labor as a whole *(Norman et al., 2012*; and *Carlhall et al., 2013)*.

Regarding other studies, a strong association between increasing BMI and labor progress was found, labor progression is significantly slower in obese women *(Arrowsmith et al., 2011)*. Similarly another study found active phase of labor (defined as 4-10cm cervical dilation) was significantly longer in overweight and obese women, after adjusting for birth weight *(Arrowsmith et al., 2011)*. This current study supports previous studies; the rate of cervical dilation had a median of 1.38 cm/hour in Group A, while it was 1.31 cm/hour in Group B and 1.2 cm/hour in Group C1, 0.92 cm/hour in group C2, and 0.83 cm/hour in group C3.

Regarding mode of delivery, there was increasing percentage of cesarean section in obese groups, yet it was statistically insignificant difference. This is in contrary to the findings of several larger studies *(Davies et al., 2010* and *Scott-Pillai et al., 2013)*.

In this current study, the rates of performed cesarean sections in obese women were high, yet these results failed to show statistically significant difference. This study agreed with a previous study *Wispelwey et al. (2013)* that found increased BMI increases the risk of cesarean section, about two folds increase in obese than overweight and normal weight group *(Catalano and Shankar, 2017)*.

Regarding peri-partum complications, all of the traced complications (including those with increased incidence in the obese groups) failed to achieve a statistically significant difference among the studied groups. Regarding cervical dystocia there was increasing percentage yet statistically insignificant difference among study groups. On the other hand, a study targeting impact of obesity and other risk factors on labor dystocia in term primiparas women concluded that BMI was higher in the dystocia group, and rising maternal pre-pregnancy BMI had a strong association with dystocia risk. If BMI increased by 1 kg/m2, the risk of CS elevated by 10% *(Hautakangas et al., 2018)*.

Regarding arrest of head descent and shoulder dystocia, there was no statistically significant difference among study groups. A similar study came to the conclusion that maternal obesity was not significant as an independent risk factor for arrest of head descent and shoulder dystocia which is on the same side of this current study. It stated that fetal macrosomia was the single most powerful predictor *(Adams et al., 2012)*.

Regarding 3rd and 4th degree perineal tears, there was no statistically significant difference among different study groups. Furthermore, a study targeting the association of maternal obesity and risk of obstetric anal sphincter injury came up with the conclusion that maternal obesity in all three obesity classes tend to decrease the risk for all three degrees of anal sphincter injuries after adjustment for instrumental delivery, birth weight and late fetal head position. The strongest risk factor for anal sphincter laceration was high birth weight but, given equal size of the infant, the risk of anal sphincter injury decreased slightly with increasing maternal BMI. So based on these data, maternal obesity seems to be associated with less serious pelvic floor damages *(Blomberg, 2014)*.

Regarding primary post-partum hemorrhage, there was increasing incidence but not enough to achieve a statistically significant difference among different study groups. Unlike these current results regarding 1ry PPH, another study conducted on nulliparous obese women have found a two fold increase in risk of major PPH compared to women with normal BMI regardless of mode of delivery. Higher rates of PPH among obese women are not attributable to their higher rates of caesarean delivery. It came to the conclusion that obesity is an important high risk factor for PPH, and the risk following vaginal delivery is emphasized. This study recommended in addition to standard practice of active management of third stage of labor, there should be increased alertness and preparation for PPH management in obese women *(Elaine et al., 2012)*.

Fetal weight showed statistically significant difference between and within the groups with women in obese groups tending to have increased fetal birth weight. Unlike these current results another study conducted in 2017 concluded that regardless of gestational diabetes, maternal obesity is not associated with increased birth weight but is associated with increased neonatal adiposity in girls only *(Delphine et al., 2017)*.

Regarding APGAR score at 1 minute and APGAR score at 5 minutes, there was statistically significant difference between the groups and within all groups. Going hand in hand with this current study the results of a systematic review and meta-analysis of 11 cohort studies with a total of 2,586,265 participants showed that infants whose mothers had a BMI≥25kg/m2 during pregnancy had an increased risk of low Apgar scores at 1 and 5minutes and that the 5 minutes APGAR score is more predictive of neonatal survival than the 1 minute APGAR score *(Tingting et al., 2015)*.

Regarding neonatal need for NICU admission there was a statistically significant difference between the groups and within all groups. In agreement with these current observations, the neonatal admission for intensive care unit was significantly increased in obese mothers in a meta-analysis including studies, and a higher rate of admission to NICU in obese women has been previously observed in Europe, USA, Canada, and Australia even in term births *(Marchi et al., 2015)*.

Regarding occurrence of neonatal jaundice, there was a statistically significant difference between the groups and within all groups. In agreement with this current observation, a large amount of pregnancy weight gain was also associated with an increased risk of neonatal hyperbilirubinemia. No appreciable alterations in risk of neonatal hyperbilirubinemia were observed in infants of mothers with a relatively small amount of pregnancy weight gain. The effects of pregnancy weight gain on neonatal jaundice have not been well studied. However, a high maternal prepregnancy BMI has been associated with increased neonatal hyperbilirubinemia *(McDonald et al., 2010)*.

CONCLUSION

The primary objective in the management of obesity during pregnancy is prevention. Having obese women lose weight with lifestyle changes and achieves a normal BMI before conception would be the ideal goal, but realistically it is quite difficult to achieve.

Further studies are needed to determine the association between maternal obesity and disorders of early gestation like risk of spontaneous abortion, congenital anomalies and disorders of late gestation like gestational hypertension and gestational diabetes. At parturition, which was the subject of this current study, the increased risk of slower progress of labor and subsequently increased incidence of peri-partum complications drives us into the necessity to consider obese women that are in labor, high-risk cases not only during labor but also regarding short-term and long-term post-partum complications.

REFERENCES

1. **Adams TD, Davidson LE, Litwin SE, Kolotkin RL, LaMonte MJ, Pendleton RC, Strong MB, Vinik R, Wanner NA, Hopkins PN and Gress RE (2012):** Health benefits of gastric bypass surgery after 6 years. JAMA, 308(11):1122-31.
2. **Arrowsmith S, Wray S and Quenby S (2011):** Maternal obesity and labor complications following induction of labor in prolonged pregnancy. BJOG: An International Journal of Obstetrics & Gynaecology; 118(5):578-88.
3. **Blomberg M (2014):** Maternal Body Mass Index and Risk of Obstetric Anal Sphincter Injury. BioMed Research International; 1–8.
4. **Carlhall S, Kallen K and Blomberg M (2013):** Maternal body mass index and duration of labor. Eur J Obstet Gynecol Reprod Biol.; 171:49–53.

5. **Catalano PM and Shankar K (2017):** Obesity and pregnancy: mechanisms of short term and long term adverse consequences for mother and child. BMJ; 356:j1.

6. **Davies G A, Maxwell C, McLeod L, Gagnon, R, Basso M Bos H and Mundle W (2010):** Obesity in pregnancy. Journal of Obstetrics and Gynaecology Canada, 32(2): 165-173.

7. **Delphine M, Jacqueminet S, Nizard J, Tanguy ML and Ciangura C (2017):** Effect of maternal obesity on birthweight and neonatal fat mass: a prospective clinical trial, PloS one 12(7): e0181307.

8. **Denison FC, Aedla NR, Keag O, Hor K, Reynolds RM, Milne A and Diamond A (2018):** On behalf of the Royal College of Obstetricians and Gynaecologists. Care of Women with Obesity in Pregnancy. Green-top Guideline No. 72. BJOG.

9. **Denison FC, Norwood P, Bhattacharya S, Duffy A, Mahmood T, Morris C, Raja EA, Norman JE, Lee AJ and Scotland G (2014):** Association between maternal body mass index during pregnancy, short-term morbidity, and increased health service costs: a population-based study. BJOG; 121: 72-82.

10. **Elaine MF, John T, Ngaire HA, Katie MG and Lesley MM (2012):** BMC Pregnancy Childbirth; 12: 112.

11. **Hautakangas T, Palomäki O, Eidstø K, Huhtala H and Uotila J (2018):** Impact of obesity and other risk factors on labor dystocia in term primiparous women: a case control study. BMC Pregnancy and Childbirth; 18(1).

12. **John E, Cassidy DM, Playle R, Jewell K, Cohen D and Duncan D (2014):** Healthy eating and lifestyle in pregnancy (HELP): A protocol for a cluster randomised trial to evaluate the effectiveness of a weight management intervention in pregnancy. BMC Public Health; 14:439.

13. **Lampard AM, MacLehose RF, Eisenberg ME, Neumark-Sztainer D and Davison KK (2014):** Weight-related teasing in the school environment: Associations with psychosocial health and weight control practices among adolescent boys and girls. Journal of youth and adolescence; 43(10):1770-80.

14. **Marchi J, Berg M, Dencker A, Olander EK and Begley C (2015):** Risks associated with obesity in pregnancy, for the mother and baby: a systematic review of reviews. Obesity Reviews; 16(8):621-38.

15. **McDonald SD, Han Z, Mulla S and Beyene J (2010):** Overweight and obesity in mothers and risk of preterm birth and low birth weight infants: systematic review and meta-analyses. BMJ; 341.

16. **Minsart AF, Buekens P, De Spiegelaere M and Englert Y (2013):** Neonatal outcomes in obese mothers: a population-based analysis. BMC Pregnancy Childbirth; 13:36.

17. **Norman SM, Tuuli MG, Odibo AO, Caughey AB, Roehl KA and Cahill AG (2012):** The effects of obesity on the first stage of labor. Obstet Gynecol.; 120:130–135.

18. **Ono T, Guthold R and Strong K (2011):** WHO Global Comparable Estimates, 2010. WHO Global Infobase. [http://apps.who. int/infobase/]. Accessed 15 June.

19. **Scott-Pillai RA, Spence D, Cardwell CR, Hunter A and Holmes VA (2013):** The impact of body mass index on maternal and neonatal outcomes: a retrospective study in a UK obstetric population, 2004–2011. BJOG: An International Journal of Obstetrics & Gynaecology; 120(8):932-9.

20. **Stubert J, Reister F, Hartmann S and Janni W (2018):** The Risks Associated With Obesity in Pregnancy. Dtsch Arztebl Int.; 115(16):276–283.

21. **Tchernof A and Després JP (2013):** Pathophysiology of human visceral obesity: an update. Physiological reviews, 2013.

22. **Tingting Z, Jun T, Fengyan Z and Yi Q (2015):** Association between maternal obesity and offspring Apgar score or cord pH: a systematic review and meta-analysis. Scientific Reports; 5: 18386.

23. **Vinturache A, Moledina N, McDonald S, Slater D and Tough S (2014):** Pre-pregnancy body mass index and delivery outcomes in a Canadian population. BMC Pregnancy and Childbirth; 14: 422.

24. **Wispelwey BP and Sheiner E (2013):** Cesarean delivery in obese women: a comprehensive review. J Matern Fetal Neonatal Med.; 26(6):547–551.

25. **Yu Z, Han S, Zhu J, Sun X, Ji C and Guo X (2013):** Pre-pregnancy body mass index in relation to infant birth weight and offspring overweight/obesity: a systematic review and meta-analysis. PloS one; 8(4):e61627.

تأثير معامل الكتلة الجسدية للأم على تقدم ونتاج الولادة للسيدات الحوامل اللائى لم يسبق لهن الولادة من قبل

محمد أحمد راغب منصور، حسام الدين حسين كامل سالم، محمد محمود محمد

قسم أمراض النساء والتوليد، كلية الطب، جامعة الازهر

E-mail: dr_m2017@yahoo.com

خلفية البحث: تعد المشاكل المتعلقة بالبدانة مع الحمل كثيرة سواء على المدى القريب او البعيد وسواء كانت للام او الجنين. وهذه المشاكل المتعلقة بالحمل والولادة تكون بسبب البدانة السابقة لحدوث الحمل اكثر منها بسبب زيادة الوزن المصاحب للحمل والتي قد تشارك فى تحويل سيدة من كونها غير بدينة الى بدينة.

الهدف من البحث: دراسة تأثير معامل الكتلة الجسدية للأم علي تقدم ونتاج الولادة للسيدات الحوامل اللائي لم يسبق لهن الولادة من قبل.

المريضات وطرق البحث: فى هذه الدراسة تم تجميع 150 امرأة حامل وتم تقسيمهن الى 5 مجموعات طبقا للفئة المنتمى اليها معامل الكتلة الجسدية لهم والتى اقرتها منظمة الصحة العالمية كما يلى: **المجموعة (أ):** تضمنت 50 سيدة اصحاب معامل الكتلة الجسدية 18.9 -24.9، **المجموعة (ب):** تضمنت 50 سيدة اصحاب معامل الكتلة الجسدية 25 -29.9، **المجموعة (ج1):** تضمنت 20 سيدة اصحاب معامل الكتلة الجسدية 30 -34.9، **المجموعة (ج2):** تضمنت 20 سيدة اصحاب معامل الكتلة الجسدية 35 -39.9، **المجموعة (ج3):** تضمنت 10 سيدات اصحاب معامل الكتلة الجسدية 40 فما اكثر. تم تقييم الولادة عن طريق حساب الوقت المستغرق و كذلك معدل إتساع عنق الرحم بالاضافة الى الوقت المستغرق لنزول رأس الجنين واحتمالية إحتياج الأم الى الخضوع لولادة قيصرية. مضاعفات الولادة و مابعدها التى تم ملاحظتها فى هذه الدراسة تضم فشل إتساع عنق الرحم, فشل تقدم كتفي الجنين, وتمزقات العجان من الدرجة الثالثة والرابعة, وتوقف تقدم الرأس, واحتباس المشيمة, والنزيف الاولى مابعد الولادة.

نتـــائج البحـــث: لـــوحظ ان النســـاء المنتمـــين لمجموعـــات (ج) كانـــت لهـــن معـــدلات تقـــدم ولادة ابطـــأ مـــن أقـــرانهن ســـواء فيمـــا يخـــص معـــدل إتســـاع عنـــق الـــرحم او الوقـــت المنقضـــى لنـــزول رأس الجنـــين. إلا أن كـــل مضـــاعفات الـــولادة ومابعـــدها التـــى تمـــت دراســـتها (بمـــا فيهـــا المضـــاعفات ذات النســـب المتزايـــدة) لـــم تســـتطع تحقيـــق فـــارق ذو أهمية إحصائية بين مجموعات الدراسة المختلفة.

الاســـتنتاج: يحقـــق فقـــدان الـــوزن وتعـــديل نمـــط الحيـــاة معامـــل كتلـــة جســـدية أقـــرب للمعدلات العادية قبل حدوث الحمل.

الكلمـــات الدالـــة: الســـمنة، معامـــل الكتلـــة الجســـدية، ســـيدة لـــم يســـبق لهـــا الـــولادة، المخاض، مخطط الحمل، الفترة المحيطة بالوضع، حديثي الولادة.