THE EFFECTS OF OBESITY ON THE ACTIVE PHASE OF THE FIRST STAGE OF LABOR

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ABSTRACT

Background

Obesity is carrying many pregnant women now a day and has many risks for complications. There is an association between body mass index and the progression of the active phase of first-stage labor.

Objectives

To estimate and detect obesity's effect on the duration and progression of the active phase of labor and the outcomes of the deliveries, either by vaginal delivery or cesarean section.

Patients and Methods

A prospective observational cross-sectional study was designed and conducted at Sulaimani maternity teaching hospital in Sulaimani City. From 1st February 2020 to 1st February 2021, about labor study included the progression of 184 multiparous women (para1-4) with a single vertex presentation from (37+1 to 41+6) weeks of complete gestation. Either by spontaneous or induction labor (misoprostol or oxytocin). Between four groups, defined by body mass index according to the world health organization. Normal (n=88), over weight (n=3), obesity class 1(n=43), obesity class 2(n=50)

Results

A total of 184 patients were collected in this study. The mean ± SD (standard deviation) age/year of participants was (27, 49 ±5.54 SD) minimum age was 17 years, and the maximum age was 44 years. A high percentage of them (51.6%) were living in urban. About (27.2%) were classified as obesity class 2, which carries a high percentage of cases that ends by cesarean section C/S (n=9) 81.8%, with prolonged duration of active phase by mean (4.988) and standard deviation (1.9302) in comparison with other classes.

Conclusion

The duration of the active phase of labor, cesarean section rate, and the time for induction until the active phase of labor were increased by increasing body mass index.

Keywords: *Maternal obesity; Active phase of first stage labor; Cesarean section; vaginal delivery.*

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INTRODUCTION

Obesity is defined as a condition of abnormal excessive fat accumulation in adipose tissue, leading to adverse health effects [1], and it is the fifth leading cause of death worldwide [2].

According to the world health organization (WHO), humans can be classified into five groups concerning their body mass index (BMI) [3]

Table 1. WHO classification of BMI.

BMI (kg/m2)	Classification
<18.5 kg/m2	Underweight
18.5-24.9 kg/m2	Normal
25-29.9 kg/m2	Overweight
30-34.9 kg/m2	Obesity class 1
35-39.9 kg/m2	Obesity class 2
≥40 kg/m2	Obesity class 3

Furthermore, body mass index (BMI) equals a person's weight in kilograms divided by the square of height in meters.

The increasing global prevalence of overweight and obesity makes it more likely that many women with high body mass index (BMI) are becoming pregnant.

Obesity in pregnancy is usually defined as a Body Mass Index (BMI) of 30 kg/m^2 or more at the first antenatal consultation [4].

In recent years, obesity has been a global health problem, one of the most common risks for maternal mortality in developed countries. In addition, it is associated with a wide spectrum of adverse pregnancy outcomes [5].

Obese women are more likely to undergo labor induction (IOL) than normal-weight women, partly explained by the positive association between maternal obesity and post-term pregnancy [6].

As a result of the increasing worldwide number of women undergoing IOL-related resources and space burden at the delivery units, outpatient inductions have been adopted in some countries as the phase of cervical ripening is relevant for outpatient and inpatient management.

The rate of labor induction is reported to be doubled for obese pregnant women compared to non-obese women.

It is well established that obese women have a higher risk of several Maternal and neonatal complications, such as labor induction, gestational diabetes mellitus, pregnancy-induced hypertension, preeclampsia, failure of labor induction, instrumental vaginal delivery, cesarean delivery, macrosomia, shoulder dystocia and admission to neonatal intensive care unit [7- 9].

Post-partum complications also appear to get a significant number among this group, including infection, thromboembolism, prolonged hospital stay, and hospital readmission [10].

Maternal obesity can have a direct influence on the mode of delivery, and it is duration.

On the other hand, delay in the active first stage of labor is significantly more common, and it has been shown that a more significant number of first-stage arrests occur in women with a big BMI than in normal-weight controls [11,12]. That is why there is an increased risk of the cesarean section between 2 to more than three-fold, even after augmentation with oxytocin and misoprostol.

Besides that, cesarean section itself also carries additional risks for obese women and has a considerable impact on postnatal morbidity; when they are undergoing CS, they are at risk of DVT, pyrexia, wound infection, and endometritis. Besides, they had a longer hospital stay and higher birth weight for their neonates compared with non-obese women [13].

Also, the analysis showed an incidence of fetal macrosomia (>4000 grams) in babies born to obese mothers. Intrapartum complications like shoulder dystocia, Erb's palsy, clavicular fractures, low APGAR scores, and birth asphyxia all increase among women with fetal macrosomia.

Perhaps this increase can be explained by various irregularities in a biochemical and metabolic state that

neonates born to obese mothers may be more at risk [14].

The main aim of the study is to detect the association between maternal BMI and its effect on the duration of the active phase of labor, more specifically, their outcomes.

PATIENTS AND METHODS

A prospective observational cross-sectional study was designed and was conducted from 1st February 2020 to 1st February 2021 at Sulaimani maternity teaching hospital (delivery ward), which is the main maternity hospital in Sulaimani city where most of the patients come to there.

A total of 184 pregnant women were collected randomly. by interviewing method , exclusion criteria in this study include multiple pregnancies, fetal compromise, intrauterine death (IUD), intrauterine growth restriction (IUGR), premature, maternal comorbidities like hypertension, diabetes mellitus, ischemic heart disease, history of previous cs, and refusal of participation.

Then the following information was obtained from every patient, gravida, parity, history of miscarriage, and fetal death, and calculation of their gestational age by weeks; each patient was asked about the history of previous cesarean section, any complication from a previous pregnancy and their outcomes, and history of diabetes mellitus DM, Ischemic heart disease (IHD), hypertension (HTN) or at present.

After obtaining their informed consent and agreement, their weights in kilograms and high meters were recorded and re-checked in the labor ward. The Body Mass index (BMI) of every patient was measured by using the following equation:

BMI=Weight/ (Height) 2 (Kg/M2). With the evaluation of their risk factors.

Then according to BMI, were divided into:

1- Group I: Normal BMI (18.5-24.9 kg/m^2)

2- Group II: Overweight BMI (25-29.9 kg/m^2)

3- Group III: Obese class 1 BMI (30-34.9 kg/m^2)

4- Group IIV: Obese class 2 BMI (35-39.9 kg/m^2)

To assess the antenatal care visits regularly, they were asked whether they lived in rural, suburban, or urban areas.

Two methods were used for data analysis:

Descriptive approach; for finding frequencies, percentages, and mean standard deviation.

Analytical approach; for finding associations between variables by using special statistical tests like (chi-square test and T-test+ANOVA test), and finding p-value; a p-value ≤ 0.05 is regarded as statistically significant.

Ethical approval from the Kurdistan Higher Council of Medical Specialties approved the study proposal. In addition, a formal acceptance letter from the directorates of Sulaimani health & Sulaimani maternity teaching hospital, with informed consent from the participants (patients) to roll in this study.

RESULTS

During the study period, a total of (184) patients were included in the final analysis. There were no missed cases.

The mean ± SD age/ year of participants was (27.49 ± 5.54 SD) (ranging from 17 to 44) years. The BMI of the participants was divided into four different groups, which were collected randomly. Near half of them were of normal weight (n=88) 47.8%, and after that, Obesity class 2 by (n=50) 27.2%.

Regarding delivery method, most of them were delivered by VD (n=173)94%, while only (n=11)6% of the outcomes were by emergency C/S.

For maternal outcomes, only (n=8)4.3% of them developed post-partum hemorrhage, and the others (n=176)95.7% did not get any complications. Table (2)

In Table3, shows that those groups who had normal & overweight categories delivered by VD,by (n=88)47.2% for normal & (n=3) 1.6% for overweight. However, (n=2)18.2% delivered by emergency C/S which regards as Obesity class 1, and Obesity class 2 carries a high percentage of cases delivered by emergency C/S (n=9) % 81.8.

The Table shows that by increasing maternal weight, the period of labor will be prolonged. By mean of (4.988) for Obesity class 2, (3.931) for Obesity class 1, and (1.333) for Overweight and normal weight, the mean is (2.290).

Moreover, the p-value is <0.001, which regards as significant. Also, fetal weight increased by increasing BMI. Besides that, the study shows that most people increase their weight by aging.

Table (5) shows that there is also an association between BMI and gestational age with the Apgar score of fetuses after delivery. Obesity is one risk factor that will lead the pregnancy to be prolonged and increase the induction rate.

Regarding Obesity class 2 Mean is (38.90) for gestational age and (9.24) for Apgar score with a p-value of <0.001.

This Table shows the fetal outcome; only (n=16)8.7% were admitted to NICU, and related to those women categorized as Obesity class 2.

This figure shows the residency of participants of the study; the majority were from the urban area by (n=95) 51.63%.

Table 2. Shows the study participants' distribution according to some variables.

	Variables	Frequency	Percentage %
BMI	Normal weight	88	47.8
	Overweight	3	1.6
	Obesity class 1	43	23.4
	Obesity class 2	50	27.2
Delivery Method VD		173	94.0
	Emergency **C/S**	11	6.0
Maternal outcome	Without complication	176	95.7
	Post-partum hemorrhage	8	4.3
Total		**184**	**100**

Table 3. Shows the association of BMI with modes of delivery.

BMI groups	Delivery Methods (no. & %)		Total	P- Value
	VD	Emergency C/S		
Normal weight	88 (50.9)	0 (0.0)	88 (47.2)	<0.001
Overweight	3 (1.7)	0 (0.0)	3 (1.6)	
Obesity class 1	41 (23.7)	2 (18.2)	43 (23.4)	
Obesity class 2	41 (23.7)	9 (81.8)	50 (27.2)	
Total	**173 (100.0)**	**11 (100.0)**	**184 (100.0)**	

Table 4. Shows an association between the duration of labor with BMI.

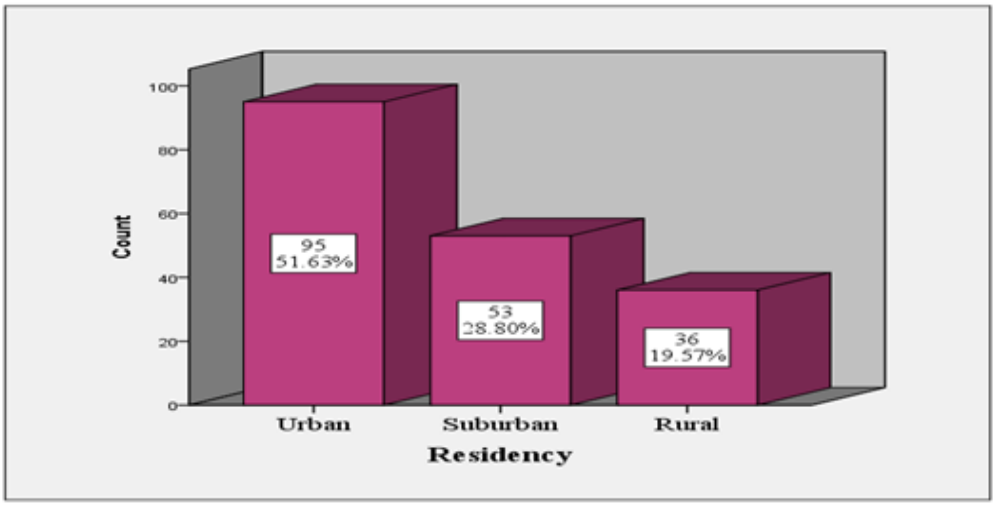
BMI Groups		Duration of labor	Fetal weight	Age/yr.
Normal weight	Mean	2.290	3.675	26.28
	Std. Deviation	0.7795	0.4276	4.720
Overweight	Mean	1.333	3.067	29.00
	Std. Deviation	0.5774	0.0577	1.732
Obesity class 1	Mean	3.931	3.505	27.49
	Std. Deviation	1.4166	0.5576	5.910
Obesity class 2	Mean	4.988	3.742	29.52
	Std. Deviation	1.9302	0.3818	6.182
Total	Mean	3.391	3.643	27.49
	Std. Deviation	1.7801	0.4587	5.544
P-Values		**<0.001**	**0.009**	**0.01**

Table 5. Shows the association between APGAR score & gestational age with BMI.

BMI Groups		Gestational age/week	APGAR score
Normal weight	Mean	39.51	9.36
	Std. Deviation	1.006	0.860
Overweight	Mean	37.33	9.33
	Std. Deviation	0.577	0.577
Obesity class 1	Mean	39.00	9.35
	Std. Deviation	1.175	0.897
Obesity class 2	Mean	38.90	9.24
	Std. Deviation	1.182	1.098
Total	Mean	39.19	9.33
	Std. Deviation	1.146	0.930
P- Values		**<0.001**	**0.89**

Table 6. Shows fetal outcomes.

Fetal outcome	Frequency	Percent
Admitted to NICU	16	8.7
Not admitted to NICU	168	91.3
Total	**184**	**100.0**



Finger 1. Shows residency of participants.

DISCUSSION

Our study found that, even in the context of a standardized labor induction protocol, women with obesity are at higher risk of cesarean delivery. In particular, at increased risk of cesarean for failed induction [15]. In addition, one study found this difference increases with increasing obesity class. Moreover, with an increasing number of cesarean deliveries and morbidity for obese women undergoing cesarean delivery, it is prudent that we re-evaluate the standard definition of labor arrest [16].

Although there were no differences between normal and overweight women's time in active labor, all had the same chance for spontaneous vaginal delivery.

Another study under the name of the Inhibitory effect of leptin on human uterine contractility in vitro. Audrey T Moynihan and Mark P Hehir compare myometrium contractility by maternal BMI. Demonstrated a significant reduction in the amplitude and frequency of contractions among women with obesity when differentiated from women with normal BMI [17]. This decrease in contractility is more likely to be secondary to hormonal differences. For example, women with high cholesterol are closely related [18]. Studies have shown that cholesterol and low-density lipoprotein (LDL) inhibit spontaneous contractions. Increased BMI may lead to variation in the expression and function of the oxytocin receptor of the human myometrium [19].

In Sulaimani Maternity Teaching Hospital, different methods of induction are used and its chosen based on the bishop score.

In general, prostaglandins or balloon catheter is chosen if the bishop score is (0-4), and amniotomy with oxytocin infusion if the bishop > 5. However, some women require all three methods for induction.

Obese women have more medical indications for labor induction, like gestational diabetes mellitus, pregnancy-induced hypertension, and preeclampsia; obese women are induced at lower gestational age than normal women.

On the other hand, we detect that the first stage of labor among maternal obese is longer in duration and slower progression than non-obese women by an average of 2-4 hrs.

In a prospective cohort study performed with 612 women, Vahratian et al. found that compared with normal-weight women, obese women have a longer duration of labor [20].

Most recently, Koimniarek et al. used a similar interval-censored regression analysis to investigate the effect of BMI on labor progression. In this study, 118,978 nulliparous and multiparous women were included. The study concluded that increasing BMI is associated with slower labor advancement in primiparous and multiparous women [21].

Our results show that maternal BMI significantly impacts the time of labor progression, which increases successively with increasing maternal BMI. The clinical implications of the study finding are that the active phase of labor in women with obesity class 2 after that of obesity class 1 when induced labor is prolonged compared with women in other BMI classes. In the future, it might be reasonable that partographs are stratified for maternal BMI and to adapt the upper limit of the normal duration of active labor according to maternal BMI.

Many studies found an increased duration of the first stage of labor among obese women compared to non-obese subjects [22]. A study by Carlhäll et al. included 63,829 women and found a significantly slower progression of labor in obese women compared with women with normal BMI [23], as obese women may have a higher risk for unfavorable cervical status and, thereby, increased risk for a longer induction phase [6].

In conclusion, the study demonstrated that the cesarean section C/S rate concerning increasing maternal BMI increased. With the increasing number of cesarean sections, C/S increased their morbidity, either intrapartum or post-partum.

Obese women spent a long time in the delivery room, especially during the active phase of labor, compared with those with normal BMI, either spontaneous or by induction labor. Also, obese patients have poor fetal outcomes and low Apgar score most of the time.

Recommendations

First, antenatal advice for preventing more weight gain during pregnancy; is done by eating healthy food and exercising properly.

Second, we recommend conducting this study with a larger sample size.

Third, doing this research for a longer period (long study duration).

Fourth, Obstetricians should be acutely alert that maternal obesity forms a high-risk population with an incidence of cesarean section, post-partum hemorrhage, and perineal trauma.

Fifth, obstetricians and pediatricians must be present at the time of birth for obese women because they are at risk for intrapartum and perinatal complications.

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