

The Obstetric Outcomes of Obese Primigravida with Spontaneous Onset of Labour at Term

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ABSTRACT

INTRODUCTION: Obesity has reached pandemic level with higher prevalence among women. Obese pregnant women have higher risk of comorbidities, maternal and fetal complications. This study aimed to determine the prevalence of vaginal delivery and pregnancy outcomes of obese primigravida presented with spontaneous labour at term.

MATERIALS AND METHOD: This prospective cohort study was conducted in a tertiary hospital in Perak involving 250 obese primigravida (BMI ≥ 27.5 kg/m²) and 250 non-obese primigravida. Data was collected from August 2020 till January 2021 and analyzed using descriptive statistics, independent T-test and Mann-Whitney U test by SPSS version 23.0.

RESULTS: Our study found that there were no significant differences in the proportion of vaginal delivery and caesarean delivery between obese and non-obese primigravida [72.0% vs. 78% (vaginal delivery) and 28% vs. 22% (caesarean delivery)] with spontaneous onset of labour at term. No difference in complications of labour such as PPH and OASIS ($p=0.187$), with high successful delivery without complications. Obese women presented with cervical dilatation of 4cm had longer delivery interval [5.82(2.97) vs. 4.75(2.71), $p=0.013$] but shorter delivery interval at 6cm [2.41(1.58) vs. 3.61(1.78), $p=0.026$] compared to non-obese. They also had higher caesarean rate indicated for abnormal labour progress [28(71.8) vs. 11(28.2), $p=0.019$] and higher comorbidities [149(72.3) vs. 57(27.7), $p<0.001$]. There was no difference in the fetal outcome ($p=0.311$). **CONCLUSION:** After careful selection, both obese and non-obese women with spontaneous labour at term had similar risks of labour augmentation, duration of active labour, emergency caesarean delivery, PPH and OASIS despite higher comorbidities among the obese women.

Keywords

Obstetric outcome, obese primigravida, spontaneous labour

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INTRODUCTION

Obesity has been steadily rising in number and has become one of the major health burdens globally with at least 2.8 million deaths per year.¹ It is a complex, multifactorial disease involving interactions of genetic, hormonal, behavioural, socioeconomic and environmental factors that leads to substantial challenges in preventing the non-communicable disease.¹

During pregnancy, management of obesity is tricky as it brings a huge impact on the mother, such as complicated

antenatal period, labour progress and postpartum period. These include risks of miscarriage, gestational diabetes, pre-eclampsia, venous thromboembolism, induced labour, poor uterine contractility leading to dysfunctional or prolonged labour, Caesarean section, and postpartum hemorrhage (PPH).^{2,3} Obesity also affects placental function and fetal programming that leads to the developmental origin of adult health and diseases (DOHaD).^{4,5} The fetus is also at risk of congenital anomalies, stillbirth, prematurity and macrosomia.⁶

A systematic review and meta-analysis of 11 cohort studies found that the risk of Caesarean delivery in nulliparous singleton pregnancy was increased by 1.5 times in overweight, 2.25 times in obese, and even more in morbidly obese women.⁷ Another recent study published in March 2020 showed that BMI could significantly predict DVT (deep vein thrombosis), longer hospital stay, pyrexia and wound infection.⁸ This made elective caesarean sections in obese women controversial.

Elective Caesarean was found to have had better outcome in some studies but other studies found more complication of DVT/wound infection/shoulder dystocia in the obese women.⁸⁻¹¹ As for vaginal delivery, it was known that obese women are less likely to experience spontaneous labour onset, more likely to have their labour augmented with oxytocin and longer first stage of labour.^{9,12-13} Vaginal delivery also carried the risk of primary postpartum hemorrhage, shoulder dystocia and obstetrics anal sphincter injury.^{3,10}

Available data on the outcomes of spontaneous vaginal delivery in obese women are conflicting with the uncertainty of the safety for both mother and fetus. As obesity and overweight hit almost half of the Malaysian population (probably 54.7% of adult female were overweight or obese with 64.8% female with abdominal obesity), it had come to our interest to look for this gap of information on maternal obesity and spontaneous vaginal delivery.¹⁴ Thus, this study aimed to measure the pregnancy outcomes of obese primigravida presented with spontaneous labour at term. It hoped to be able to produce selective criteria for allowing spontaneous labour among obese primigravida that could ensure a favourable outcome for both mother and fetus.

MATERIALS AND METHODS

This prospective cohort study was conducted in a tertiary hospital in Ipoh, Perak over a six months period. The selection criteria were Malaysian primigravida at 37 weeks of gestation or more with singleton alive fetus and cephalic presentation who presented in spontaneous labour with the cervical os opening of 4cm or more. Women who were contraindicated for vaginal delivery or

had already planned for Caesarean Section, who has a previous uterine scar, with underlying severe comorbidities, with unbooked pregnancy, or who are short statured were excluded. There were no pre-eclampsia cases or other disorders that spontaneous pregnancy was not recommended.

The sample size was calculated using the sample size estimation formula for prevalence calculation. Considering there was no suitable available data that can be used as reference, estimation was made based on the delivery rate in a tertiary center in January 2020 which was documented in the registry book. This number was rounded to 250. Thus, a total of 250 obese primigravidas and 250 non-obese primigravidas who were admitted due to spontaneous signs and symptoms of labour and who fulfilled the selection criteria were recruited in this study using purposive sampling method.

The outcome variables of this study were divided into maternal and fetal. Maternal variables were the outcome of delivery, such as the duration of the first stage of labour where the time was calculated from admission to labour suite until the patient delivered, the delivery method (vaginal delivery or caesarean delivery), delivery complications, and the requirement of labour augmentation. Delivery complications included were PPH, obstetrics anal sphincter injury (OASIS), anaesthetics complications, admission to ICU or HDU, and venous thrombo-embolism. The dependent variables of the fetus were the cardiotocograph, meconium stained amniotic fluid (MSAF), birth weight, NICU admission or neonatal death. The baby's birth weight was measured after birth using a calibrated weighing scale to the nearest 0.1kg. The amniotic fluid was classified into clear, insignificant meconium and significant meconium, whereas, light meconium-stained liquor was categorised into insignificant liquor.¹⁵ On the other hand, the moderate and thick meconium-stained liquor were categorised among the significant meconium group.

The independent variables were maternal age, which was calculated based on the year of birth. Ethnicity was according to the data collection form. The socio-economic status was based on the patient's profession and

the gestational period was calculated based on the patient's last menstrual period or the expected delivery date that had been confirmed by an earlier scan performed at booking. The BMI was given during booking and comorbidity, such as gestational hypertension, gestational diabetes or bronchial asthma can be found from the patient's antenatal book. With reference to the Asian criteria BMI cut-off, obesity is defined as BMI $\geq 27.5\text{kg}/\text{m}^2$.¹⁶ The control group of non-obese primigravidas were those with BMI $<27.5\text{kg}/\text{m}^2$.

Data were obtained from the patient's medical record, antenatal book, delivery registry book, and Hospital Information System (HIS). The delivery progress was observed and any complications aroused from the mothers or babies were documented. The data were analysed using descriptive statistics, Independent T-test, and the Mann-Whitney U test using SPSS version 23.0.

RESULTS

Table 1 showed background characteristics of the respondents. Our study found that the mean age of our respondents was 26 years old with mean gestational age at around 39 weeks. About 72.3% of obese primigravida had comorbidity as compared to only 41.2% in the control group. The characteristics of the respondents were homogenous except the age and comorbidity status.

Table 1 Background Characteristics of the Respondents

Variables	n(%) n=500	Obese n(%) n=250	Non Obese n(%) n=250	p value
Age		26.9(± 4.9)*	26.3(± 4.3)*	0.02**
Ethnicity				0.99
Malay	365(73.0)	183(50.1)	180(49.9)	
Chinese	60(12.0)	29(48.3)	31(51.7)	
India	45(9.0)	23(51.1)	22(48.9)	
Others	30(6.0)	15(50)	15(50)	
Socioeconomic status				0.91
Professional	115(23.0)	58(50.4)	57(49.6)	
Non professional	385(77.0)	192(49.9)	193(50.1)	
Gestation		38.98(± 1.10)*	39.09(± 1.04)*	0.39**
Comorbidity				< 0.001
No	294(58.8)	101(34.4)	193(65.6)	
Yes	206(41.2)	149(72.3)	57(27.7)	

*Mean (SD)

**Independent T-test

Table 2 showed non-obese women had shorter duration of the first stage when presented with cervical dilatation of 4 cm compared to the obese women

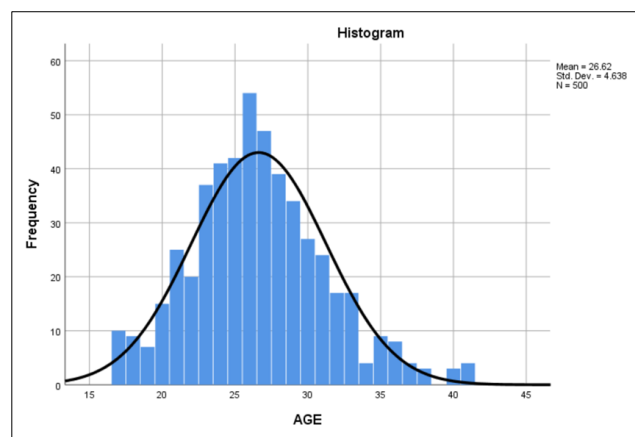


Figure 1 Normal distribution of age among the participants

Table 2 Duration of First Stage of Labour Among the Obese and Non-obese Primigravida According to Cervical Dilatation on Admission.

Cervical Dilatation Upon Admission	Duration of First Stage Of Labour		p value
	Obese Mean(SD) n	Non-obese Mean(SD) n	
4cm	5.82(2.97), n=101	4.75(2.71), n=83	0.013*
5cm	4.76(2.89), n=47	3.78(1.91), n=60	0.112*
6cm	2.41(1.58), n=17	3.61(1.78), n=21	0.026*
7cm	1.90(0.74), n=5	2.25(0.75), n=12	0.935**
8cm	1.61(0.82), n=9	1.83(0.58), n=12	0.429*
9cm	-	1.28(0.49), n=7	

*Mann-Whitney U Test

**Independent T-test

Table 3 showed women in the obese group had a similar ability to deliver vaginally with a similar risk of caesarean delivery and vacuum-assisted delivery as in non-obese women. The risk of fetal distress as an indication for caesarean section was similar for both groups of women. However, indications related to abnormal labour progress for caesarean section (primary dysfunctional labour, secondary arrest and prolonged second stage) was higher in the obese group compared to the non-obese group with a p value of 0.019.

Maternal outcomes of vaginal delivery for obese and non-obese women in both groups were similar. No significant difference in requirement of labour augmentation (48.4% vs 51.6%) and complications such as PPH and OASIS ($p=0.187$). Majority of the neonates of both groups had no increased risk of complications at labour including shoulder dystocia (57.1% vs. 42.9%), meconium stained amniotic fluid ($p=0.169$) or abnormal CTG ($p=0.208$) and had similar risks for admission (58.1% vs. 41.9%).

Table 3 Vaginal Delivery and Caesarean Delivery in Obese and Non-Obese

	Mode Of Delivery n(%)		p value	Type Of Vaginal Delivery n(%)		p value	Indication Of Caesarean Delivery n(%)		p value
	Vaginal Delivery	Caesarean Delivery		Spontaneous	Vacuum Assisted Delivery		Fetal Distress	Abnormal Labour Progress	
			0.121			0.687			0.019
Obese	180(72.0)	70(28.0)		166(92.2)	14(7.77)		42(60.0)	28(40.0)	
Non-obese	195 (78.0)	55(22.0)		182(93.3)	13(6.67)		44(80.0)	11(20.0)	

Table 4 Maternal and Fetal Outcomes Associated with BMI Among Women Delivered Vaginally

	Obese n(%)	Non-obese n(%)	p value
MATERNAL OUTCOME			
Augmentation			0.906
Yes	74(48.4)	79(51.6)	
No	106(47.7)	116(52.3)	
Complications			0.187**
Nil	155(46.4)	179(53.6)	
PPH	24(57.1)	18(42.9)	
OASIS	2(66.7)	1(33.3)	
FETAL OUTCOME			
Birth Weight	3058(388.7)*	2982(369.6)*	0.391**
Liquor			0.169
Clear	136(45.9)	160(54.1)	
Non-significant meconium	36(59.0)	25(41.0)	
Significant meconium	8(44.4)	10(55.6)	
CTG			0.208
Normal	159(48.2)	171(51.8)	
Suspicious	15(40.5)	22(59.5)	
Pathological	6(75.0)	2(25.0)	
Complications			0.311
Nil	151(46.5)	174(53.5)	
NICU/NH DU Admission	25(58.1)	18(41.9)	
Shoulder Dystocia	4(57.1)	3(42.9)	

*Mean(SD)

**Independent T-test

DISCUSSION

Most literatures on obese women in pregnancy included pre labour elective or emergency Caesarean, induction of labour with or without augmentation and those with spontaneous onset of labour. This research only focused on obese women without pre-existing comorbidity with spontaneous onset of labour at term; therefore the result should be interpreted differently.

The Background Characteristics

The mean age of our respondents was 26 years old. The BMI of the obese women in this study ranged from 27.5kg/m² to 45.1kg/m². A study found that women who were obese and of a younger age (less than 30 years old)

was found to have more pronounced longer active first stage of labour and this concluded that maternal age is an effect modifier.¹⁷

The mean gestational age in this study was around 39 weeks. We had 41 (16.4%) obese women presented at postdate while 48 (19.2 %) non-obese women but the difference was not statistically significant. It is known that obese women had higher incidence of prolonged gestation and postdate pregnancy with a lower chance of spontaneous labour onset, indicating induction of labour.^{18, 19}

Among 250 obese primigravidas, 72.3% had underlying comorbidity such as well-controlled gestational hypertension and gestational diabetes, whereas, only 27.7% primigravidas with those comorbid were in the non-obese group. This is expected as obese women in pregnancy have higher risk of developing hypertensive disorders, diabetes mellitus, and even two folds increased risk of pre-eclampsia compared to the normal BMI population.^{18, 20-23}

Progress of Labour

One hundred and eighty nine (189) obese women and 195 non-obese women had successful vaginal delivery. There were 17 (8.9%) obese women and 21 (10.7%) non-obese women were admitted at 6cm dilatation. Surprisingly at cervical dilatation of 6cm, the obese women took shorter duration to deliver with mean(SD) of 2.41(1.58) hours versus 3.61(1.78) hours for the non-obese women with *p*-value of 0.02. Women who were admitted at 4cm dilatation favour the non-obese with shorter progress of labour. The findings of cervical dilatation upon admission

and duration of labour was a surprise and should be explored further.

Currently there are controversies on the start of active phase of labour, either 4cm used in WHO 2006 partograph, or 5cm in the new generation WHO 2021 partograph, or 6cm in the Zhang 2010 partograph.^{24,25} Contemporary labour pattern may have changed with the changing of maternal demographics such as the increasing BMI and older age at first pregnancy.²⁶

Most studies on the duration of labour among obese and overweight women revealed that this population had a significantly longer duration of the first stage of labour compared to normal BMI women.^{18,21,27,28} In a retrospective cohort study, the obese women had slight decrease in duration of labour during the second phase of active labour but not the total duration of the first stage labour compared to normal BMI women.²⁹ In another study, overweight women had prolonged labour mainly at cervical dilatation of four to six centimetres and obese women had a slower labour progression before seven centimetres.³⁰ The later study supported our findings that after 6 cm, the progress of labour was faster in the obese compared to the non-obese women.

Our study revealed a higher prevalence of clear liquor among the non-obese women. In contrast, obese women had a higher prevalence of MSAF, with 36 women with insignificant meconium and 8 women with significant MSAF. In a meta-analysis on maternal obesity and risk of Caesarean Section, the rate of meconium-stained liquor and cord accidents were higher among obese women.³¹⁻³³

The requirement of labour augmentation was the same in both obese and non-obese women as 106 (47.7%) and 116 (52.3%) women started augmentation, respectively. In contrast, many studies found that the requirement of oxytocin was higher among obese women compared to those with normal BMI.^{17,22} They were also more likely to require higher dose of oxytocin infusion rate and longer duration of oxytocin exposure to achieve vaginal delivery.^{34,35} Our study could not find the specific reason for this, it may be due to the fact that all our cases were

spontaneous labour with no cases with induced labour that will usually also need augmentation.

Mode of Delivery

Our study found that there was no significant difference in the prevalence of vaginal delivery and caesarean delivery between obese and non-obese primigravida. Vaginal delivery in this study included spontaneous vertex delivery and instrumental delivery, such as vacuum and forceps assisted delivery. It was revealed that 180 (72%) obese women and 195 (78%) from the control group delivered vaginally. The prevalence of spontaneous vertex delivery was similar in both groups 166 (92.2%) vs. 182 (93.3%). A meta-analysis of 33 studies concluded that the rate of successful vaginal delivery decreases progressively as the maternal BMI increases.³⁶ This could possibly be due to the fact that we have excluded the induction cases.

The prevalence for vacuum-assisted delivery were similar for both groups, 14 (5.6%) and 13 (5.2%) among obese and non-obese women respectively. Instrumental delivery was higher among obese population.^{23,37} However, in another study of 45,557 deliveries, the incidence of instrumental delivery was higher among normal BMI women than the obese group.³⁸ This probably depends on the practice by the individual hospital and our strict selection criteria of our research cohort.

The indication of Caesarean section was divided into fetal distress (abnormal CTG or significant meconium) and abnormal labour progress (primary dysfunctional labour, secondary arrest, or prolonged second stage). 125 women from this study had emergency Caesarean section, where 70(28.0%) were obese and 55(22.0%) from non-obese women. Many studies found that obesity increased the risk of Caesarean delivery.^{3,29,39,40}

A secondary analysis cohort study of nulliparous women had revealed the rate of fetal distress and second stage Caesarean section was higher among obese women.¹³ However, our study revealed that there was equal

number of fetal distress' Caesarean Section in both groups. Interestingly, Caesarean section for abnormal labour progress was significantly higher in the obese group with more than two folds compared to the non-obese.

Upon sub-analyzing, we found that abnormal labour progress was mainly in the obese women who presented at cervical dilatation of < 6 cm and not in those \geq 6 cm. A case-control study found that obese women had a higher incidence of cervical dilatation arrest compared to women with normal BMI (17.6% vs. 5.2%) with a *p*-value of 0.005.⁴¹

Maternal Outcomes

Majority of both obese [155 (86.1%)] and non-obese [179 (91.7%)] women who delivered vaginally had no maternal complication. In contrast, a population-based study in the Netherlands among 6959 mothers revealed that maternal obesity was associated with increased risk of maternal and fetal outcomes.⁴² Again this may be due to our strict selection criteria of our study cohort.

Among the obese women who had vaginal delivery, 24 (13.3%) had postpartum hemorrhage while only 18(9.2%) among the non-obese but this was not statistically significant. The incidence of PPH among the obese population was higher compared to the normal BMI women.^{20, 21, 43, 44} In our research, vacuum assisted delivery was associated with higher incidence of PPH among the obese women compared to non-obese women, 5 (35.7%) and 1 (7.7%) respectively. This is consistent with another study where the incidence of PPH was also higher among obese women with instrumental delivery.²³

OASIS consist either third or fourth-degree tear; we only found 2 (1.1%) obese women that experienced anal sphincter injury and 1 (0.5%) non-obese woman. With regards to OASIS, in a study of 436,482 women on maternal BMI and risk OASIS had found that obese had favourable outcomes compared to normal BMI women in terms of perineal tear damage during labour.⁴⁶

Similarly, another study had also revealed that obese and severely obese women had minor perineal trauma, which included first and second-degree tears. There was no significant association between BMI and OASIS.³⁸

Fetal And Neonatal Complications

A total of 151 (46.5%) babies of obese women were delivered vaginally without any complications. It was almost similar in the non-obese, with 174 (53.5%) babies. A retrospective study with large perinatal database revealed that obesity caused a term pregnancy to be at risk of adverse neonatal outcomes, such as higher level of nursery admission and large for gestational age.⁴⁷

The mean birth weight among these two groups was almost similar, 3058 grams among obese women and 2982 grams in the control group. There were four macrosomic babies with birth weights of more than 4000 grams among obese women. Furthermore, among these four babies, one belonged to an obese mother with underlying gestational diabetes mellitus and another one with gestational hypertension. The other two mothers were healthy with no known comorbid. In addition, among these four babies, two were delivered via uncomplicated Caesarean Section indicated for fetal distress and secondary arrest, one baby was delivered vaginally, which was complicated with primary postpartum hemorrhage secondary to uterine atony. Another baby was delivered vaginally with shoulder dystocia complication. This baby was well and did not require NICU admission.

Fetal with large for gestational age and macrosomia were strongly associated with maternal obesity and it was the single most powerful indicator of shoulder dystocia.⁴⁸⁻⁵⁰ A recent study among obese Polish women found that the adjusted risk of macrosomia was more than three folds.⁵¹ The prevalence of postdate, MSAF and resuscitation requirements among macrosomic babies were also higher.³² A meta-analysis reviewed twenty articles involving 2,153,898 women in evaluating maternal pre-pregnancy obesity and risk of shoulder dystocia revealed a significant risk of shoulder dystocia among the

obese group with a relative risk of 1.63 (1.33-1.99).^{21, 40, 52} In contrast, some studies found that maternal obesity was not a significant independent risk factor of shoulder dystocia but gestational diabetes mellitus.⁵³

Higher number of babies of obese women required NICU/NHCU admission compared to non-obese women, with a total number of 43 babies. The common indications for admission were transient tachypnoeic of newborn or meconium aspiration syndrome, requiring oxygen support or intubation and presumed sepsis. There were two babies admitted to NHCU for subaponeurotic hemorrhage where one baby was delivered via Caesarean Section due to fetal distress and another baby was born via spontaneous vaginal delivery.

The babies of obese mothers were found to be more acidotic, with higher metabolic disturbance and higher risk of NICU admission.^{21, 54} Moreover, diagnosing acute fetal distress during intrapartum is challenging as continuous CTG monitoring has limited evidence and difficult tracing in obese women need internal CTG placement.^{15, 55} Availability of additional facilities, such as fetal scalp sampling may assist in deciding and avoiding unnecessary Caesarean Section.

CONCLUSION

After careful selection, both obese and non-obese women with spontaneous labour at term had similar risks of labour augmentation, vaginal or caesarean delivery, PPH OASIS, and fetal/neonatal outcomes despite higher comorbidities developed during pregnancy among the obese women. Six centimetre or more cervical dilatation at presentation was associated with shorter labour duration and lower caesarean delivery in the obese primigravida compared to the non-obese primigravida.

LIMITATION AND RECOMMENDATION

Our research is specifically for the cohort of primigravida who were obese with no known pre pregnancy comorbidities except for mild and well controlled

gestational hypertension and/or gestational diabetes mellitus that admitted with spontaneous labour symptoms and signs at term. Our cohort was not comparable to other studies, therefore our findings had more favorable maternal and fetal outcomes.

Data on obese women who underwent elective caesarean and who were induced at term were not reviewed. This is an initial data on obese women at term presented with spontaneous onset of labour and further studies are recommended. There is a need to produce selection criteria, defined onset of labour and labour management to allow obese women who go into spontaneous labour to have a safe delivery as the preliminary data showed favourable outcome for both mother and newborn.

CONFLICT OF INTEREST

This study did not involve any pharmaceutical company to sponsor as all expenses for the management of the women involved were under the women's personal or institution expenses and budget.

This study received ethical approval from the Medical Research and Ethics Committee (MREC) and was registered under the National Medical Research Register (NMRR) with the given ID of NMRR-19-4091-52157.

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