นิพนธ์ต้นฉบับ . Original Article

ผลลัพธ์การตั้งครรภ์ในหญิงที่มีโรคอ้วนระดับ 3 ก่อนการตั้งครรภ์: การศึกษาตามรุ่นย้อนหลังแบบสหสถาบัน

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Pregnancy Outcome in Women with Pre-pregnancy Class 3 Obesity: A Multicenter Retrospective Cohort Study

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บทคัดย่อ

หลักการและวัตถุประสงค์: มารดาที่มีโรคอ้วนระดับ 3 (ดัชนีมวลกาย ≥ 40 กก./ตร.ม.) มีความเกี่ยวข้องกับภาวะแทรกซ้อนในการตั้งครรภ์มากมาย ข้อมูลปัจจุบันของภาวะนี้ในประเทศไทยยังมีข้อจำกัด ดังนั้นการศึกษานี้จึงมีวัตถุประสงค์เพื่อศึกษาความชุกของโรคอ้วนระดับ 3 ในหญิงตั้งครรภ์ และศึกษาภาวะแทรกซ้อนของมารดาและทารกแรกเกิดในประเทศไทย

วิธีการศึกษา: ทำการศึกษาแบบเคส-ควบคุมแบบซ้อนกันสหสถาบัน โดยเกณฑ์คัดเข้าศึกษาได้แก่หญิงตั้งครรภ์เดี่ยวที่คลอดในโรงพยาบาลนากลาง กุมภวาปี อุดรธานี หนองหาน บ้านผือ วานรนิวาส บ้านดุง หล่มสักและอ่างทอง ในช่วงเดือนมกราคม 2561 ถึง ธันวาคม 2566 ซึ่งเริ่มฝากครรภ์เมื่ออายุครรภ์น้อยกว่าหรือเท่ากับ 20 สัปดาห์ เกณฑ์คัดออกได้แก่ข้อมูลสำคัญไม่ครบถ้วน เช่นน้ำหนักก่อนตั้งครรภ์หรือภาวะแทรกซ้อน ข้อมูลเก็บจากฐานข้อมูลคอมพิวเตอร์และวิเคราะห์โดยใช้สถิติเชิงพรรณนาและการวิเคราะห์การถดถอยโลจิสติกเชิงพหุ เปรียบเทียบกลุ่มหญิงที่มีโรคอ้วนระดับ 3 ก่อนการตั้งครรภ์เปรียบเทียบกับกลุ่มควบคุมซึ่งเป็นหญิงที่มีค่าดัชนีมวลกายปกติซึ่งสุ่มจากโปรแกรมคอมพิวเตอร์

ผลการศึกษา: ทำการศึกษาเวชระเบียน 44,885 ราย พบมารดาที่มีโรคอ้วนระดับ 3 จำนวน 289 ราย (ร้อยละ 0.64) สุ่มเลือกกลุ่มควบคุมจำนวน 867 ราย (ดัชนีมวลกายปกติ) จากการวิเคราะห์ข้อมูลพบว่ามีอัตราสูงขึ้นอย่างมีนัยสำคัญในโรคเบาหวานขณะตั้งครรภ์ (AOR 7.46, 95% CI3.16-17.66), ภาวะครรภ์เป็นพิษ (AOR 8.20, 95% CI4.08-16.49), ภาวะทารกตัวโต (AOR 10.26, 95% CI1.94-54.29) และทารกแรกเกิดขนาดใหญ่กว่าอายุครรภ์ (AOR 3.41, 95% CI1.81-6.41)

สรุป: พบมารดาร้อยละ 0.64 มีโรคอ้วนระดับ 3 ก่อนการตั้งครรภ์ ภาวะนี้เพิ่มความเสี่ยงของภาวะแทรกซ้อนทั้งของมารดาและทารกแรกเกิดอย่างมีนัยสำคัญ เช่น โรคเบาหวานขณะตั้งครรภ์ ภาวะครรภ์เป็นพิษ ภาวะทารกตัวโตและทารกแรกเกิดขนาดใหญ่กว่าอายุครรภ์ ดังนั้นการควบคุมน้ำหนักก่อนตั้งครรภ์และการดูแลก่อนคลอดที่เหมาะสมจึงมีความสำคัญในกลุ่มนี้เพื่อลดความเสี่ยงของภาวะแทรกซ้อนในการตั้งครรภ์ที่จะเกิดขึ้น

คำสำคัญ: โรคอ้วนทุพพลภาพ, โรคอ้วนระดับ 3, ภาวะทารกตัวโต, โรคเบาหวานขณะตั้งครรภ์, ภาวะครรภ์เป็นพิษ

Abstract

Background and Objective: Maternal class 3 obesity (Body mass index, BMI ≥ 40 kg/m^2) is associated with many pregnancy complications. However, the current data of this condition in Thailand is still limited. This study aimed to study the prevalence of class 3 obesity in pregnant women, maternal complications and neonatal outcomes in Thailand.

Methods: A multicenter nested case-control study was conducted. The inclusion criteria were singleton pregnant women who delivered in Na Klang, Kumphawapi, Udonthani, Nonghan, Ban phue, Wanonniwat, Ban dung, Lomsak, and Ang thong Hospital during January, 2018 to December, 2023 and had their first antenatal care at ≤ 20 weeks gestation. The exclusion criteria were the incompleteness of significant information, such as pre-pregnancy weight or pregnancy complication. Data were collected from the electronic database then analyzed using descriptive statistics and multiple logistic regression. The pre-pregnancy class 3 obesity group was compared with a computer-randomly selected control group with normal BMI.

Results: The medical records of 44,885 cases were included. The class 3 obesity was found in 289 cases (0.64%). The 867 controls (normal BMI) were randomly selected. A significantly higher rate of gestational diabetes mellitus (AOR 7.46, 95% CI 3.16-17.66), preeclampsia (AOR 8.20, 95% CI 4.08-16.49), fetal macrosomia (AOR 10.26, 95% CI 1.94-54.29) and large for gestational age (AOR 3.41, 95% CI 1.81-6.41) was noted in the class 3 obesity group compared to the normal BMI group.

Conclusion: The prevalence of class 3 obesity pregnancy was 0.64%. This condition significantly increased the risk of both maternal and neonatal complications, such as gestational diabetes mellitus, preeclampsia, fetal macrosomia and large for gestational age. Therefore, pre-pregnancy weight control and proper prenatal care are important in this group to decrease risk of pregnancy complications.

Keywords: morbid obesity, class 3 obesity, fetal macrosomia, gestational diabetes, preeclampsia

Introduction

Obesity is defined as abnormal or excessive fat accumulation that presents a risk to health with a body mass index (BMI) ≥ 30 kg/m^2 [1]. For Asian individuals, World Health Organization Asia-Pacific region (WPRO) define obesity as a BMI of ≥ 25 kg/m^2 [2] due to a higher risk of diabetes and cardiovascular diseases. The prevalence of obesity is increasing globally. In 2022, 1 in 8 people in the world were living with obesity. Worldwide adult obesity rate has more than doubled since 1990, and adolescent obesity has quadrupled[1]. In Thailand, the National Health Examination Survey conducted by the Health Systems Research Institute in 2019-2020 reported the prevalence of obesity in Thai women (BMI ≥ 25 kg/m^2) was 46.4%[3]. Obesity is classified to three classes based on the WHO definition, class I obesity is defined as a BMI of 30.0-34.9 kg/m², class II as BMI 35.0-39.9 kg/m², and class III or morbid obesity as a BMI ≥ 40 kg/m^2 [4], In contrast, WRPO standard defines class I obesity as a BMI of 25.0-29.9 kg/m^2 and class II as BMI ≥ 30.0 kg/m^2 but it does not provide a definition for class 3 obesity. According to the National Thai Food Consumption Survey (2018), the prevalence of class 3 obesity (BMI ≥ 40 kg/m^2) among Thai adult was 0.1%[5].

In pregnant woman, maternal obesity is associated with maternal and neonatal complications, such as hypertension, preeclampsia, gestational diabetes mellitus (GDM), increase rate of cesarean section, induction of labour, postpartum hemorrhage, and fetal macrosomia[6-10]. The prevalence of severe maternal morbidity or mortality such as hemorrhage, venous thrombosis, shock increases with the class of obesity[11]. Especially, class 3 obesity had significant increase rate of preterm delivery, antepartum stillbirth, early neonatal death, shoulder dystocia, neonatal intensive care unit (NICU) admission and hospital stay length[9-15]. The prevalence of class 3 obesity and pregnancy outcomes varies between countries due to the socioeconomic status, and data in Thailand is still limited. Therefore, this study aims are to determine the prevalence of class 3 obesity in pregnant women, maternal complications and neonatal outcomes in Thailand.

Materials and methods

The present study is a multicenter retrospective cohort study in Thailand which was approved from the Udonthani Hospital Ethical committee in human subject research (number UDH REC 1074/2563) and was approved by the directors of all participated hospitals. The electronic medical records of women who delivered at a regional tertiary care hospital (Udon Thani), and 8 general hospitals (Na Klang, Kumpawapi, Nong Han, Ban Phue, Wanon Niwat, Ban Dung, Lom Sak and Ang Thong,) in northeast and central Thailand from January 2018 to December 2023, were retrospectively reviewed. The inclusion criteria were pregnant women with singleton pregnancies who delivered a singleton baby in the participated hospitals during the study period, had their information in the electronic database and had their first antenatal care at less than or equal to 20 weeks gestation. The exclusion criteria were the incompleteness of significant information, such as pre-pregnancy weight or pregnancy complication. If a woman had more than one pregnancy during the study period, only the first pregnancy was included in the study.

The electronic medical records were retrospectively reviewed for the maternal characteristics, pregnancy outcomes and neonatal outcomes. The obesity class 3 or morbid obesity was defined as the pre-pregnancy BMI more than or equal to 40 kg/m^2 [16]. According to the literature, individuals with a normal pre-pregnancy BMI (18.5–22.9 kg/m^2)[17] were used as the control group, as they are considered to have a baseline level of risk. The medical databases from all hospitals were extracted and were pooled together, then the all-obesity class 3 cases, whose was compatible with the study criteria, were selected in reverse chronological order until the calculated sample size was reached. The control cases were selected by the computer-generated random number

in the similar period of study. Pair matching between groups was not performed because the study aimed to examine the influence of age and parity with outcomes. The pregnancy complication was defined as at least one of the maternal or fetal complications which resulted from mother with class 3 obesity including gestational diabetes, preeclampsia, preterm birth, primary cesarean delivery, postpartum hemorrhage, fetal macrosomia (birthweight ≥ 4,000 g), large for gestational age, low Apgar score at 1 min (≤7), and neonatal intensive care unit (NICU) admission. Primary cesarean rate was the cesarean deliveries to women who have not had a previous cesarean delivery[18]. The large for gestational age was defined as the birthweight was larger than 90 percentiles of their gestational age[19]. Postpartum hemorrhage was defined as the postpartum blood loss in 24 hours more than or equal to 500 ml in vaginal delivery and 1,000 ml in cesarean delivery.

Statistical analysis

The sample size was calculated by the Stata statistical program version 13 using the formula for a cohort study to estimate the proportion. The estimated proportion of GDM in obesity class 3 group was 3.5% and in the control group was 0.4%[12]. An alpha error was 0.05, beta error was 0.1 and the ratio was 3. The calculated sample size was 289 cases in class 3 obesity group and 867 cases in control group. The medical records from the participated hospital were reviewed and collected until the sample number was reached. The control cases were randomly selected from the same study period using the computer-generated number.

The maternal and neonatal characteristics were described by the descriptive statistical methods such as number, percentage, mean with standard deviation. The prevalence of class 3 obesity in pregnancy was presented in percentage with 95% confidence interval. The comparison between obesity class 3 and normal BMI group were done using unpaired t test, Pearson chi square or Fisher exact test depends on data's characteristics. The possible associated factors of obesity class 3 were analyzed using univariate and multivariate logistic regression analysis. The variables with $p < 0.1$ from univariate analysis and no collinearity were selected to multivariable analysis.

Results

A total of 44,885 medical records of pregnant women were included in this study, comprising 16,573 cases from a regional hospital and 28,312 cases from general hospitals. The obesity class 3 was found in 289 cases (0.64%, 95%CI 0.57-0.72) which composed of BMI between 40-44.99 kg/m^2 in 236 cases (0.53%) and ≥ 45 kg/m^2 in 53 cases (0.12%). The 867 control cases were randomly selected. The comparison of maternal characteristics between obesity class 3 and control groups are shown in table1.

The obesity class 3 group had significantly older age, had higher parity, lower pregnancy weight gain than maternal with normal BMI. The details are shown in Table1.

Table 1 Comparison of maternal characteristics between obesity class 3 and normal body mass index (BMI) groups.

	Obesity class 3 N=289, n(%)	Normal BMI N=867, n(%)	p-value*
Age (years), (mean±SD)	28.25±5.57	26.97±6.45	0.003
<20	13 (4.50)	120 (13.84)	<0.001
≥ 35	45 (15.57)	114 (13.15)	0.301
Gravida, (mean±SD)	2.03±0.95	1.93±1.04	0.141
Primiparity	104 (35.99)	402 (46.37)	0.002
Grand multiparity	4 (1.38)	15 (1.73)	0.689
Occupation			<0.001
Housewife	176 (60.90)	470 (54.21)	
Employee	63 (21.80)	205 (23.66)	
Government officer	5 (1.73)	38 (4.38)	
Farmer	35 (12.11)	108 (12.46)	
Marchant	10 (3.46)	46 (5.31)	
Education			<0.001
Less than Bachelor's degree	269 (93.08)	735 (84.78)	
Bachelor's degree or higher	20 (6.92)	132 (15.22)	
Payment			<0.001
Universal coverage	197 (68.17)	529 (61.01)	
Social insurance	87 (30.10)	260 (29.99)	
Government	4 (1.38)	37 (4.27)	
Self-payment	1 (0.35)	41 (4.73)	
Pre-pregnancy Body mass index (kg/m^2), (mean±SD)	43.22±3.43	20.65±1.26	<0.001
Pregnancy weight gain (kg), (mean±SD)	7.72±6.31	13.28±5.43	<0.001
Normal[a]	86 (29.76)	331 (38.18)	0.001
Under[a]	96 (33.22)	315 (36.33)	
Over[a]	107 (37.02)	221 (25.49)	
Medical complication			
Preexisting DM	8 (2.77)	7 (0.81)	0.011
Chronic hypertension	55 (19.03)	2 (0.23)	<0.001

Abbreviation: SD; standard deviation

*Analyzed by unpaired t test or Pearson's chi square.

[a]According to The Institute of Medicine recommendation (2009)[20]

Pregnancy outcomes are shown in Table 2. Significantly higher rates of GDM (AOR 7.46, 95% CI 3.16-17.66) and preeclampsia (AOR 8.20, 95% CI 4.08-16.49) were note in the obesity class 3 group as compared to the normal BMI group. Mean gestational age at delivery ± standard deviation was 37.58±2.16 weeks in class 3 obesity group and was 37.86±1.96 in normal group (p value = 0.037). Mean birthweight ± standard deviation was 3,142.86±624.92 grams in class 3 obesity group and was 2,984.30±472.45 grams in normal group (p < 0.001). Cesarean delivery was performed in 204 cases (70.59%) in class 3 obesity group and 316 cases (36.45%) in normal group (p = 0.022). The indications for caesarean delivery were as follows: cephalopelvic disproportion in 90 cases (31.14%) of the class 3 obesity group and 142 cases (16.38%) of the normal BMI group; previous caesarean delivery in 99 cases (34.26%) of the class 3 obesity group and 133 cases (15.34%) of the normal group; and other indications in 15 cases (5.19%) of the class 3 obesity group and 41 cases (4.73%) of the normal group. No significant differences delivery outcomes were noted among the groups as gestational age at delivery, preterm delivery, primary cesarean delivery and postpartum hemorrhage. The class 3 obesity group showed a significantly increased risk of fetal macrosomia (AOR 10.26, 95% CI 1.94–54.29) and large for gestational age (AOR 3.41, 95% CI 1.81–6.41). One case of shoulder dystocia occurred in the class 3 obesity group, with no cases reported in the normal BMI group. NICU admission rates were 14.53% in the class 3 obesity group and 7.27% in the normal BMI group, with no statistically significant difference. No maternal mortality was reported in both groups.

Table 2 Comparison of delivery outcomes between obesity class 3 and normal BMI groups.

Delivery outcomes	Obesity class 3 N=289, n (%)	Normal BMI N=867, n (%)	OR (95%CI), p-value*	AOR (95%CI), p-value*
Gestational diabetes	73 (25.26)	54 (6.23)	5.08 (3.47-7.45), <0.001	7.46 (3.16-17.66), <0.001
Preeclampsia	58 (20.07)	51 (5.88)	4.02 (2.68-6.02), <0.001	8.20 (4.08-16.49), <0.001
Preterm delivery	49 (16.96)	137 (15.80)	1.09 (0.76-1.55), 0.644	0.91 (0.46-1.79) 0.792
Primary cesarean delivery	105 (36.33)	183 (21.11)	2.13 (1.60-2.85), <0.001	1.63 (0.89-2.97), 0.114
Postpartum hemorrhage	7 (2.42)	14 (1.61)	1.51 (0.60-3.79), 0.377	0.60 (0.03-14.09), 0.750
Fetal Macrosomia	18 (6.23)	9 (1.04)	6.33 (2.81-14.25), <0.001	10.26 (1.94-54.29), 0.006
Large for gestational age	88 (30.45)	100 (11.53)	3.36 (2.42-4.65), <0.001	3.41 (1.81-6.41), <0.001
Low Apgar score at 1 min	19 (6.57)	44 (5.07)	1.32 (0.76-2.29), 0.332	0.53 (0.18-1.62), 0.267
NICU admission	42 (14.53)	63 (7.27)	2.17 (1.43-3.29), <0.001	1.32 (0.32-5.49), 0.706
Composite complication	222 (76.82)	407 (46.94)	3.75 (2.76-5.08), <0.001	2.63 (1.30-5.30), 0.007

*Abbreviation: SD; standard deviation

Several patients presented with multiple complications.

Composite complication composes of gestational diabetes, preeclampsia, preterm birth, primary cesarean delivery, postpartum hemorrhage, fetal macrosomia, large for gestational age, low Apgar score at 1 min, and NICU admission

*Multiple logistic regression analysis, adjusted for age, primiparity, occupation, education, payment method, gestational weight gain, diabetes and chronic hypertension.

Discussion

The present study found that the prevalence of pregnant women with class3 obesity or morbid obesity was 0.64%. Most cases were BMI between 40-44.9 kg/m^2. There were significantly increased risk of GDM, preeclampsia, fetal macrosomia and large for gestational age in this group.

The prevalence found in this study was comparable to previous reports by Cedergren et al., which estimated the prevalence of class 3 obesity among pregnant women in Sweden at 0.4%[13] and Briese et al., which reported a prevalence of 0.8% in Germany[12]. However, it was lower than the prevalence reported in the United Kingdom (1.9%)[9], Australia (4%)[6], and the United States (6%)[10]. Differences in the prevalence of obesity between countries may be attributed to variations in ethnicity, socioeconomic status, and nutritional conditions specific to each country.

Class 3 obesity increases risk of GDM in this study. The prevalence of GDM in obesity class 3 group in this study was 25.26% compared with 6.23% in the normal BMI group. These finding is consistent with a previous study. Kumari, et al reported the prevalence of GDM was 23.4% in the class 3 obesity group and 1.3% in the normal BMI group[15]. However, this prevalence was higher than other studies. Weiss, et al reported the prevalence of GDM was 9.5% in the class 3 obesity group and 2.3% in normal BMI group[10]. Briese, et al report was 3.5% for class 3 obesity group and 0.4% for normal BMI group[12]. The higher rate of GDM in Thai and Southeast Asian populations may account for this difference[21].

This study found the preeclampsia was increased with the adjusted odds ratio 8.20 times in class 3 obesity group compared to the normal BMI group. Similar to previous studies, Weiss, et al reported odds ratio 3.3 times (95% CI 2.4-4.5) and Cedergren reported odds ratio 4.82 times (95% CI 4.04-5.74) to develop preeclampsia in class 3 obesity group compared to the normal BMI group[10,13].

The increasing of cesarean delivery in class 3 obesity pregnancy was reported in some previous studies. Weiss, et al reported the primary caesarean delivery rate was 47.4% and 20.7% in class 3 obesity group and normal BMI group[10]. Kumari, et al reported the incidence of primary caesarean delivery was 19.1% and 9.3% in class 3 obesity group and normal BMI group[15]. Cedergren MI. reported the incidence of primary caesarean delivery was 24.2% and 10.9% in class 3 obesity group and normal BMI group, respectively[13]. In this study, the incidence of primary caesarean delivery was 36.3% and 21.1% in class 3 obesity group and normal BMI group but did not attain statistically significant. The high incidence of caesarean section in Thailand[22] might be the cause of non-significant difference between both groups.

In class 3 obesity group, previous studies reported an increase risk of postpartum haemorrhage with the odds ratio 1.7 (95% CI 1.45-1.98) and 2.7 (95% CI 2.20-3.40)[9,13]. However, our finding is similar to Dodd, et al who did not find an increasing risk of postpartum haemorrhage[6]. A larger sample size is needed to determine this association due to the limited number of postpartum hemorrhage cases in this study.

The relationship between maternal weight and fetal weight is interesting. An increasing risk of fetal macrosomia and large of gestational age has been observed in class 3 obesity patient[6,9,10,12,13,15]. Our findings confirm this association, this study found that class 3 obesity group have a significant increase risk for fetal macrosomia with the adjusted odds ratio 10.26 (95% CI 1.94-54.29) times and large of gestational age 3.41 (95% CI 1.81-6.41) times compared with normal BMI group.

Previous studies reported increased risk of NICU admission[9,15]. However, our finding is similar to Dodd, et al who reported not significant increase risk of NICU admission in class 3 obesity patient[6]. In this study, the rate of NICU admission in the class 3 obesity higher than normal BMI group, but did not attain statistically significant (AOR 1.32, 95% CI 0.32-5.49).

The main strength of this multicenter study is the adequate sample size, which enhances the robustness of the analysis. However, its retrospective design limits data completeness, with missing information on socioeconomic factors and certain complications, including antepartum stillbirth, early neonatal death, fetal anomalies, infant hypoglycemia, hemorrhage that needs blood transfusion, interventional radiology, or laparotomy, maternal and fetal morbidity and mortality. The follow-up of maternal and neonatal complications did not extend to 42 days postpartum. Additionally, a larger sample size prospective study is needed to analyze these outcomes effectively.

Conclusion

The prevalence of class 3 obesity pregnancy was 0.64%. This condition is significantly increasing risk of both maternal and neonatal complications, such as gestational diabetes mellitus, preeclampsia, fetal macrosomia and large for gestational age. Therefore, pre-pregnancy weight control and proper prenatal care are important in this group to decrease risk of pregnancy complications.

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Disclosure of interest

The authors report no conflicts of interest.

Data availability statement

The data that supports the findings of this study is available on request from the corresponding author within five years after publication.

Author contribution

RC, MS and SS contributed to the study conception and design. Material preparation and data collection was performed by SN, MS, YK, SS, NL, SP, PM and KS. Data analysis was performed by US and MS. The first draft of the manuscript was written and reviewed by RC, MS and SS. All authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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