Association of Maternal Obesity and Pregnancy Outcomes

Timoty Krisna Sukoco,[1] Dini Hidayat,[2] Raden Tina Dewi Judistiani[3]

[1]Faculty of Medicine Universitas Padjadjaran, Indonesia, [2]Department of Obstetrics and Gynecology, Faculty of Medicine Universitas Padjadjaran/Dr. Hasan Sadikin General Hospital Bandung, Indonesia, [3]Department of Public Health Faculty of Medicine Universitas Padjadjaran, Indonesia

Abstract

Background: The prevalence of obesity is increasing globally, causing various possible disorders and complications. Maternal and perinatal morbidity and mortality might potentially be affected by maternal obesity. This study aimed to evaluate the association between maternal obesity and pregnancy outcomes.

Methods: This retrospective cohort study was part of a larger cohort study performed from July 2016 to July 2017 in West Java, including 223 pregnant women with normal fetuses, who were obese or non-obese pre-pregnancy. Underweight women were excluded. Data on pregnancy outcomes consisting of Caesarean section, preeclampsia, premature rupture of membrane (PROM), preterm birth, post-term birth, small for gestational age (SGA), and large for gestational age (LGA) were collected. The association with maternal obesity was analyzed using the Fisher's Exact Test to determine the association with a 95% confidence interval, and a p-value <0.05 was considered significant.

Results: There was an association between maternal obesity and Caesarean section, with an increased risk in obese mothers compared to non-obese mothers (RR 2.398 CI 1.328–4.329). There was no significant association between maternal obesity and preeclampsia, PROM, preterm birth, post-term birth, SGA, and LGA.

Conclusion: Maternal obesity is associated with Caesarean section. A more comprehensive approach is essential for obese pregnant women to ensure the health of both the mother and the infant.

Keywords: Obesity, pregnancy, pregnancy outcomes

Introduction

Obesity is excessive body fat accumulation which has been a major global health problem.[1] The World Health Organization (WHO) defines obesity as when a person has a body mass index (BMI) of 30 kg/m^2 or greater, calculated by dividing a person's weight by the square of their height.[2] The prevalence of obesity is escalating worldwide.[3] In Indonesia, 21.8% of adults are considered obese as reported in the Basic Health Research (*Riset Kesehatan Dasar,* Riskesdas) by the Ministry of Health.[4]

Obesity is linked to various disorders and complications.[5] Studies have shown that obesity in pregnant mothers may increase the risk of unfavorable maternal outcomes such as preeclampsia, gestational diabetes, Caesarean section, hemorrhage, and death.[6–8] Offspring of obese mothers may also be at greater risk of perinatal outcomes such as large birth weight, prematurity, low APGAR score, and stillbirth.[6–8]

Obese pregnant women become a global health burden.[9] With a prevalence of 32.2% of obese adult women in West Java, the obstetrical concern might be significant.[4] However, local studies and information about the impact of obesity on maternal and perinatal morbidity and mortality are deficient. The morbidity and mortality are pregnancy outcomes potentially affected by maternal obesity. Therefore, this study was accomplished to evaluate the association between maternal obesity and pregnancy outcomes.

Methods

This retrospective cohort study was part of a

Correspondence: Timoty Krisna Sukoco, Faculty of Medicine Universitas Padjadjaran, Jalan Raya Bandung-Sumedang Km. 21 Jatinangor, Sumedang, Indonesia, E-mail: timoty18002@mail.unpad.ac.id

larger cohort study by Judistiani et al.[10] which was performed from July 2016 to July 2017 in Bandung, Cimahi, Sukabumi, and Waled, West Java, Indonesia. Subjects of the original study were pregnant women with a normal fetus aged 10–14 weeks upon recruitment. BMI was calculated from self-reported pre-pregnancy weight and measured height upon recruitment. Women with obese pre-pregnancy BMI (≥30 kg/m^2) were included in this study while women within the non-obese range were included in the control group. This study excluded women with underweight BMI (<18.5 kg/m^2) and those with inaccessible or incomplete data. The total sampling method was used. The data for this study were acquired following approval from the Research Ethics Committee of Universitas Padjadjaran no. 589/UN6.KEP/EC/2021.

The variables used in this study for maternal outcomes were Caesarean section, preeclampsia, and premature rupture of membrane (PROM), while the variables for perinatal outcomes were preterm delivery, post-term delivery, small for gestational age (SGA), and large for gestational age (LGA). Maternal characteristics including age, parity, and education level were also observed. Statistical analysis was performed using Statistical Package for Social Scientists (SPSS version 25). Fisher's Exact Test was used to determine the association with a 95% confidence interval considering a p-value <0.05 as significant.

Results

From the larger study, this study included 223 eligible subjects consisting of 18 mothers with obese pre-pregnancy BMI (≥30 kg/m^2) and 205 mothers with non-obese pre-pregnancy BMI (18.5–29.9 kg/m^2). The BMI was categorized according to the classification by the WHO. Characteristics of the subjects were presented in Table 1. Subjects were mainly aged under 35 years old with varying parity. Most subjects achieved secondary education. There were no difference in age, parity, and education level proportions between the obese and non-obese groups.

Maternal outcomes in both groups are displayed in Table 2. The risk of Caesarean delivery was significantly increased in obese mothers compared to non-obese mothers (RR 2.398 CI 1.328–4.329) (Table 2).

There was no significant association between maternal obesity and preeclampsia (p=0.239) and PROM (p=1.000). The association of maternal obesity and perinatal outcomes including preterm delivery, post-

Table 1 Characteristics of the Subjects

Characteristic	Obese		Non Obese		p-value
	n	%	n	%	
Age (years)					
<35	14	78	160	78	1.000
≥35	4	22	45	22	
Parity					
0	6	33	74	36	0.081
1	10	56	66	32	
≥2	2	11	65	33	
Level of education					
Primary education	3	17	27	13	0.270
Secondary education	9	50	139	68	
Higher education	6	33	39	19	

Table 2 Maternal Outcomes

Maternal Outcome	Obese	Non Obese	RR [95% CI]	p-value
Caesarean section	8 (44%)	38 (42%)	2.398 [1.328-4.329]	0.015*
Preeclampsia	4 (22%)	22 (11%)	-	0.239
PROM	3 (17%)	36 (18%)	-	1.000

Note: *p-value <0.05 considered as significant, All variables were analyzed using Fisher's Exact Test, PROM= premature rupture of membrane

term delivery, SGA, and LGA was also not significant (data not shown).

Discussion

This study shows an association between maternal obesity and the risk of Caesarean section. This finding corresponds with a study in Iraq[11] and another similar study in Malawi.[12] The latter suggested that women with large body volumes may need extra time to achieve the level of oxytocin needed for labor. The presence of excess intraabdominal fat may also obstruct labor progression and compromise fetoplacental circulation.[12] These factors likely prompt the necessity of Caesarean birth in obese mothers.

Our study found no significant association between maternal obesity and other measured outcomes despite reports of increased risk of preeclampsia in multiple studies.[13,14] The higher risk of preeclampsia involves reduction of placental perfusion, a rise of soluble factor release, and increased sensitivity of maternal vasculature caused by metabolic factors in obese women.[15] Insulin resistance that results from maternal obesity is also related to a reduced cytotrophoblast migration and remodeling of the uterine spiral artery.[16]

A systematic review and meta-analysis found a higher risk of preterm birth in obese women.[17] This was consistent with a large cohort study in Sweden[18] which stated inflammatory up-regulation in obesity might play an important role. Conversely, a study in the United Kingdom[19] found that post-term birth increases with increasing BMI. It is presumed that high lipid profiles correlate with decreased uterine contractility while leptin inhibits oxytocin-induced uterine activity, leading to prolonged pregnancy in obese women.[20]

Research on the relationship between maternal obesity and PROM also have conflicted. Some have found that high pre-pregnancy BMI is linked with an increased risk of PROM.[21,22] Obesity is suspected to induce inflammation and harmful effects on the placenta.[23] Other studies found a lower rate of PROM in obese mothers, pointing to nutritional reasons. This inconsistency may be explained by the heterogeneity of PROM and the ethnic differences in study populations.[23]

Previous studies stated maternal obesity is strongly associated with infant birth weight.[24,25] High birth weight increases with pre-pregnancy obesity.[24] There is also a protective effect of pre-pregnancy obesity against low birth weight.[25] Contrary to these findings, our study has shown no significant association between maternal obesity and offspring birth weight.

This study is subject to several limitations. This study utilized secondary retrospective data with a very small number of subjects, lower than the calculated minimum size of 147. The low sample size was expected due to the time and geographical constraints. Moreover, the variables were not documented in every subject, leading to the exclusion of subjects. This study did not account for potential confounding factors since only basic information was available. Further study with a more appropriate size and method will demonstrate the situation more precisely. Evaluation of other maternal and perinatal outcomes will also be beneficial.

In conclusion, maternal obesity is associated with Caesarean section occurrence. Obese mothers have a greater risk of undergoing Caesarean section delivery compared to non-obese mothers with a relative risk of 2.398. A more comprehensive approach is essential for obese pregnant women to ensure the health of both the mothers and the infants. Strategies need to be implemented to reduce the risks of possible unfavorable pregnancy outcomes in women with obesity.

References

1. Lin X, Li H. Obesity: epidemiology, pathophysiology, and therapeutics. Front Endocrinol (Lausanne). 2021;12:706978.
2. WHO Consultation on Obesity. Obesity: preventing and managing the global epidemic. report of a WHO consultation. World Health Organ Tech Rep Ser. 2000;894:i–xii, 1–253.
3. Orukwowu U. Epidemiology of adult obesity, measurements, global prevalence, and risk factors. IPS Intelligentsia Multidiscip J. 2022;1(1):1–6.
4. Badan Penelitian dan Pengembangan Kesehatan Kementerian Kesehatan RI. Laporan Nasional Riskesdas 2018. Jakarta: Lembaga Penerbit Badan Penelitian dan Pengembangan Kesehatan; 2019.
5. Kinlen D, Cody D, O'Shea D. Complications of obesity. QJM. 2018;111(7):437–43.
6. Sinha K, Pandey S, Das CR. Impact of maternal obesity on pregnancy outcome. J Nepalgunj Med Coll. 2016;14(2):18–22.
7. Stubert J, Reister F, Hartmann S, Janni W. The risks sssociated with obesity in pregnancy. Dtsch Arztebl Int. 2018;115(16):276–83.

8. González-Plaza E, Bellart J, Martínez-Verdú MÁ, Arranz Á, Luján-Barroso L, Seguranyes G. Pre-pregnancy overweight and obesity prevalence and relation to maternal and perinatal outcomes. Enferm Clin. 2021;S1130-8621(21)00081-4.
9. Chen C, Xu X, Yan Y. Estimated global overweight and obesity burden in pregnant women based on panel data model. PLoS One. 2018;13(8):e0202183.
10. Judistiani RTD, Gumilang L, Nirmala SA, Irianti S, Wirhana D, Permana I, et al. Association of colecalciferol, ferritin, and anemia among pregnant women: result from cohort study on Vitamin D status and its impact during pregnancy and childhood in Indonesia. Anemia. 2018;2018:2047981.
11. Al-Kubaisy W, Al-Rubaey M, Al-Naggar RA, Karim B, Mohd Noor NA. Maternal obesity and its relation with the cesarean section: a hospital based cross sectional study in Iraq. BMC Pregnancy Childbirth. 2014;14(1):235.
12. Nkoka O, Ntenda PAM, Senghore T, Bass P. Maternal overweight and obesity and the risk of caesarean birth in Malawi. Reprod Health. 2019;16(1):40.
13. Melchor I, Burgos J, Del Campo A, Aiartzaguena A, Gutiérrez J, Melchor JC. Effect of maternal obesity on pregnancy outcomes in women delivering singleton babies: A historical cohort study. J Perinat Med. 2019;47(6):625–30.
14. Mohammadi M, Maroufizadeh S, Omani-Samani R, Almasi-Hashiani A, Amini P. The effect of prepregnancy body mass index on birth weight, preterm birth, cesarean section, and preeclampsia in pregnant women. J Matern Neonatal Med. 2018;32(22):3818–23.
15. Spradley FT, Palei AC, Granger JP. Increased risk for the development of preeclampsia in obese pregnancies: weighing in on the mechanisms. Am J Physiol Regul Integr Comp Physiol. 2015;309(11):R1326–43.
16. Lopez-Jaramillo P, Barajas J, Rueda-Quijano SM, Lopez-Lopez C, Felix C. Obesity and preeclampsia: Common pathophysiological mechanisms. Front Physiol. 2018;9:1838.
17. McDonald SD, Han Z, Mulla S, Beyene J; Knowledge Synthesis Group. Overweight and obesity in mothers and risk of preterm birth and low birth weight infants: Systematic review and meta-analyses. BMJ. 2010;341:c3428.
18. Cnattingius S, Villamor E, Johansson S, Bonamy A-KE, Persson M, Wikström A-K, et al. Maternal obesity and risk of preterm delivery. JAMA. 2013;309(22):2362–70.
19. Heslehurst N, Vieira R, Hayes L, Crowe L, Jones D, Robalino S, et al. Maternal body mass index and post-term birth: a systematic review and meta-analysis. Obes Rev. 2017;18(3):293–308.
20. Bogaerts A, Witters I, Van den Bergh BRH, Jans G, Devlieger R. Obesity in pregnancy: altered onset and progression of labour. Midwifery. 2013;29(12):1303–13.
21. Tabatabaei M. Gestational weight gain, prepregnancy body mass index related to pregnancy outcomes in Kazerun, Fars, Iran. J Prenat Med. 2011;5(2):35–40.
22. Liu L, Hong Z, Zhang L. Associations of prepregnancy body mass index and gestational weight gain with pregnancy outcomes in nulliparous women delivering single live babies. Sci Rep. 2015;5:12863.
23. Lim J, Han K, Kim SY, Cho YH, Yoon YS, Park HS, et al. Effects of central obesity on maternal complications in Korean women of reproductive age. Obes Res Clin Pract. 2019;13(2):156–63.
24. Yu Z, Han S, Zhu J, Sun X, Ji C, Guo X. Pre-pregnancy body mass index in relation to infant birth weight and offspring overweight/obesity: a systematic review and meta-analysis. PLoS One. 2013;8(4):e61627.
25. Averett SL, Fletcher EK. Prepregnancy obesity and birth outcomes. Matern Child Health J. 2016;20(3):655–64.