LITERATURE REVIEW

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The Relationship Between Risk Factor Obesity in Pregnancy with the Incidence of Caesarean Delivery: Literature Review

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ABSTRACT

The obesity rate in Indonesia has increased from 14.8% to 21.8% from 2013 to 2018. Especially obesity in pregnancy is a problem that can threaten pregnancy until delivery and become one of the risk factors associated with caesarean delivery. The results of research in America state that almost 50% of cesarean deliveries are women who are overweight or obese before pregnancy. This type of research uses literature review. This literature review seeks to establish the correlation between the risk factors associated with obesity during pregnancy and the occurrence of cesarean delivery.. The method of searching articles or journals using boolean operators and keywords (OR NOT, AND or AND NOT). The selection criteria employed encompassed articles that were available in their entirety via national and international database searches, spanning the period of the past decade (2010-2020). The results based on a literature review of 8 journals found that 6 of the 8 articles stated that there was an association between the risk factors of obesity in pregnancy with the incidence of cesarean delivery, Contrary to the previous two papers, our findings indicate that there is no connection between the likelihood of cesarean delivery and obesity in women. The literature study concludes that there is a correlation between obesity during pregnancy and the occurrence of cesarean birth. Although it is necessary to conduct more primary research related to this topic.

INTRODUCTION

Obesity is one of the problems that is currently increasing in the world, even in Indonesia. According to data in the United States, since 2017-2018, obesity has increased by 42.4%(1). The research by Dewi et al.(2) showed Australia at 30% be the highest of gestational diabetes mellitus (GMD) with one of the average risk is BMI or Body Mass Index > 25 kg/m^2. In Indonesia, the obesity rate has also increased from 14.8% to 21.8% from 2013 to 2018. In Indonesia, 23.1% of adults are affected by obesity, while 28% have central obesity. These conditions put individuals at a higher risk

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of developing diabetes and hypertension. The incidence of obesity is higher in women than men[3]. In pregnant women, obesity is a problem that can threaten pregnancy until childbirth, where there is an accumulation of fat and adipose tissue in the body as a producer of cytokines, Tumor Necrosis Factor α, especially Interleukin-6 (IL-6), and MCP 1 or abbreviation of Monocytes Chemoattractant Protein 1 which have a role in the inflammatory process[4]. Based on the results of research[5], that obesity in pregnancy can be one of the factors causing preeclampsia (PE), gestational diabetes mellitus (GDM), sectio caesarea (SC) and gestational hypertension (GH). The same research by Wardhana et al.[6] showed that caesarean delivery occurred more frequently in the case group of preeclampsia in pregnancy compared to te control group (40,3% vs 59,7%, p=0,025). It can also increase the likelihood of macrosomia, fetal death in utero (FMD), low birth weight (LBW), and NICU care[5].

Caesarean delivery (CD) is one method of delivery using surgical techniques to remove the fetus by making a cut in the uterine wall and abdominal wall on medical indications that can threaten the life of the mother and fetus so as to prevent maternal and newborn deaths[7]. The average standard of caesarean delivery in a country is about 5 until 15% / 1000 births in the world. This standard has been set by the WHO or abbreviation of World Health Organization. Data from the Survey conducted by the World Health Organization on the health of mothers and newborns 2011 showed that 46.15% of all deliveries were caesarean deliveries[8]. Throughout Asia, the number of CD has increased, namely 110,000 per birth since 2007-2008 (Sihombing et al., 2017). Likewise, in Indonesia it is also increasing. Utilizing information derived from the IDHS or abbreviation of Indonesian Demographic and Health Survey in 2017, the incidence of caesarean delivery reached 17% of total births[9]. The caesarean delivery rate increased by 17.6% based on RISKESDAS data in 2018[10].

One of the risk factors associated with caesarean delivery is obesity, although there is still some controversy in determining the level of nutritional status categories of pregnant women calculated based on BMI. According to a study conducted by Rogers et al[11], out of the approximately 4 million births in the US in 2014, 32.3% were delivered by cesarean section, and nearly 50% of the prior to becoming pregnant, a significant proportion of women were classified as either overweight (25.6%) or obese (24.8%).. In this study also mentioned that women Obese women who have a history of caesarean delivery experience worse postpartum conditions, including the risk of thromboembolism, infection, blood transfusion, and maternal mortality in comparison to women of normal weight who have had a cesarean delivery or women who are obese and have had a vaginal delivery.

Chu et al.[12] conducted a meta-analysis of the literature and found that obese and extremely obese women have a 2 to 3 times greater risk of cesarean birth compared to pregnant women of normal weight. According to this study, obesity is linked to an enlargement of the soft tissue in the mother's pelvic area, which can make the birth canal narrower. It also affects how pregnant women respond to oxytocin, increases the likelihood of complications like meconium staining or cord accidents during labor, and raises the risk of needing a cesarean delivery. Nevertheless, this analysis examined articles that were published prior to 2005. Further investigation is required to explore the correlation between maternal obesity during pregnancy and the prevalence of cesarean section.

Based on the above description, it is important for researchers to connect two phenomena related to obesity with the incidence of caesarean delivery. So that it can provide benefits to increase knowledge and insight related to care services, especially in women of childbearing age with pregnant programs and mothers who are pregnant, especially related to body mass index so as to reduce the incidence of obesity in pregnancy where the hope in the future can reduce caesarean delivery.

The aim of this study was to establish the correlation between the risk factor of obesity during pregnancy and the occurrence of cesarean birth.

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METHOD

This research methodology involves conducting a literature review, which is a rigorous examination or evaluation of the knowledge, ideas, or findings presented in academic literature. The method used is using a journal search strategy both nationally and internationally, the data source used is from articles, scientific journals searched via the internet from Scoppus, Pubmed, and Google Scholar. The keywords used are "obesity, pregnancy, caesarean delivery, body mass index" and used the boolean operator is "AND". The inclusion criteria used were journals that could be accessed in full text through international and national database searches, that published articles within the last 10 years (2010-2020), that use Indonesian and English, is also an original research article not a literature or systematic literature review that using theme of the relationship between risk factor obesity in pregnancy with the incidence of caesarean delivery. Online journal database searches can be seen through the Preferred Reposrting Items for Systematic Reviews and Meta-Analyses abbreviated ie PRISMA scheme.

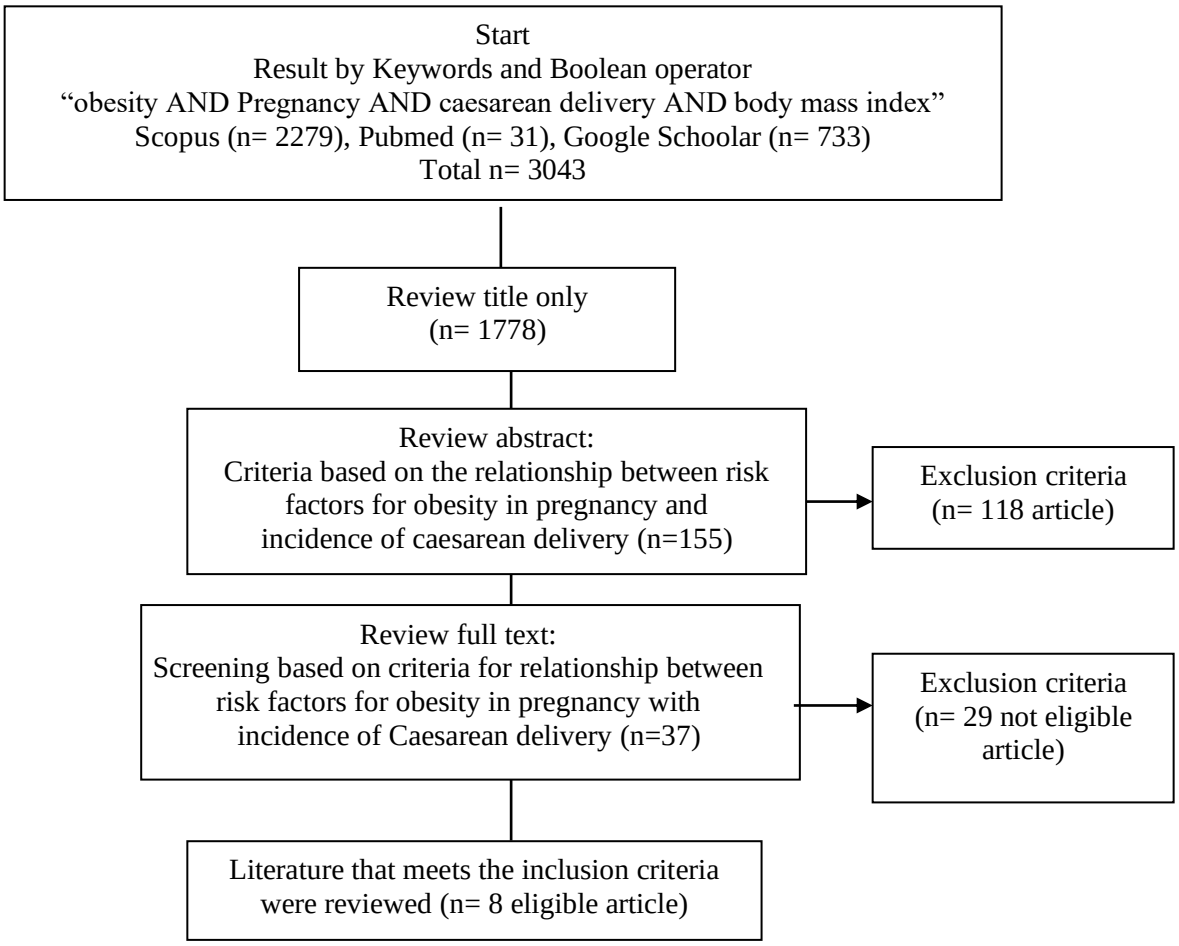

Figure 1. PRISMA Diagram

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RESULT AND DISCUSSION

Result

The results of data collection of literature review studies from 3 databases, namely Scoppus, Pubmed, and Google Scholar, obtained 8 articles that match the author's needs. Furthermore, data charting was carried out to find out the results of the data from the article in detail and classify into several points such as the place of research, research objectives, methods used, and research results found. Based on the 8 selected articles, there are several characteristics of the place of research, characteristics of research methods and characteristics of research design. Table 1 displays a concise overview of the search results.

Table 1.
Summary of Contents of Selected Journal Articles

Author (Year)	Ethnic group/ Country	Participant/setting	Study design,Sample size	Intervention	Outcome measure (s)	Result
Frolova et al., 2020 (13)	American	Nulliparous, laboring women at term who had a pressure chamber in their uterus. Exclusion criteria for this study were women who had several pregnancies and underwent a cesarean section before reaching a cervical dilatation of less than 4 centimeters.	Secondary analysis of a prospective cohort, n=480	Data on contractions were obtained throughout the final hour of the initial stage of labor.	The main results focused on two basic measures: the quantity of Montevideo units (MVU) and the level of compaction they exhibited (MVU≥200). Additional results encompassed the mean contractions per 10 minutes, as well as the occurrence rates of tachysystole and cesarean birth.Comparison was made between women with a BMI less than 30 (non-obesity) and those with a BMI equal to or greater than 30 (obese).	The prevalence of primary cesarean sections in obese women was significantly higher compared to women with normal weight (40.3% vs 19.5%, p<0.001). Obese women had a significantly greater risk of cesarean section compared to women with acceptable contractility (6.1% vs 16.7%, p<0.05). However, after accounting for confounding factors, this difference was no longer statistically significant (adjusted relative risk 2.83, 95% confidence interval 0.86-6.21).
Chen et al. 2021 (14)	Chinese	The CLIMB research is a triple randomized controlled trial that focuses on complex milk fat supplementation during pregnancy. It was originally conducted in Chongqing starting from September 2015 and included pregnant women who were registered for the study.	A cohort study was conducted, involving a total of 1273 women, to analyze the outcomes of pregnancy and neonates. In addition, the analysis of child neurological development comprised 1017 children at the 1-year follow-up, with 256 children lost to follow-up.	The recruitment of women took place at the initial stage of their pregnancy at the First Chongqing Women and Children's Health Center (CHCWC) and Affiliated Hospital of Chongqing Medical University in China. The recruitment process was finalized in June 2017. The eligible gravida were between the ages of 20 and 40 and had a pregnancy with only one fetus. Exclusion criteria for this study were women who had experienced preterm labor before 32 weeks' gestation, had a known allergy or aversion to milk, or had lactose intolerance. In addition, 1017 children were	Pregnancy outcomes included: GDM, PROM or abbreviation of premature rupture of membrane, SGA, C-section, PTB or abbreviation of preterm birth, macrosomia, LBW or abbreviation of low birth weight, LGA.	According to the Chinese and Asian criteria set by the World Health Organization (WHO), women who are overweight or obese have a higher likelihood of undergoing a cesarean delivery. However, this increased risk is not observed when using the European criteria set by the WHO (Chinese BMI category: odds ratio [OR] = 1.49, 95% CI or abbreviation of confidence interval: 1.07 to 2.06; WHO Asian BMI category). The odds ratio (OR) is 1.40 with a 95% CI ranging from 1.05 to 1.86, according to the WHO. The European BMI category has an odds ratio (OR) of 1.26, with a

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Author (Year)	Ethnic group/ Country	Participant/setting	Study design,Sample size	Intervention	Outcome measure (s)	Result
				included in the analysis of child neurodevelopment at the 1-year follow-up.		95% CI ranging from 0.86 to 1.85.
Zhao et al., 2017 (15)	Chinese	A healthy woman who has never given birth before and is currently pregnant with one baby in the head-down position. She is in the latter stages of pregnancy and is experiencing labor at the Beijing Obstetrics and Gynecology Hospital.	Cohort study, n=6908. The participants were categorized into two distinct groups: the vaginal delivery group, including 92.88% (6,416 out of 6,908), and the emergency cesarean section group, comprising 7.12% (492 out of 6,908).	The 6908 women were categorized into three groups based on their BMI. The first group consisted of underweight women with a BMI less than 18.5 kg/m(2), accounting for 17.39% (1,201 out of 6,908) of the total. The second group included women with a normal weight, with a BMI ranging from 18.5 to 24.9 kg/m(2), making up 73.00% (5,043 out of 6,908) of the total. The third group comprised overweight and obese women, with a BMI equal to or greater than 25.0 kg/m(2), representing 9.61% (664 out of 6,908) of the total.	ORs or abbreviation of Non-adjusted and adjusted odds ratios CIs or abbreviation of and confidence intervals of the risk of emergency caesarean section were computed by bivariate logistic regression.	The study found that being overweight or obese increased the likelihood of nulliparous women needing an emergency cesarean section. T The unadjusted odds ratio was 1.98 with a 95% confidence interval of 1.54-2.54, whereas the adjusted odds ratio was 1.66 with a 95% confidence interval of 1.27-2.16. Women who were overweight or obese who gained either insufficient or excessive gestational weight had a greater probability of requiring an emergency cesarean section. The odds ratios were adjusted to 2.33 (with a 95% confidence interval of 1.06-5.14) and 1.62 (with a 95% confidence interval of 1.44-2.28), respectively. There was no statistically significant disparity in the likelihood of emergency caesarean section between overweight and obese women and normal weight women in the same GWG group. The odds ratio (OR) was 1.54 with a 95% confidence interval (CI) ranging from 0.94 to 2.54. The group of individuals who were underweight had a lower probability of needing an emergency caesarean section. The odds ratio (OR) was 0.55 with a 95% confidence interval (CI) of 0.40-0.74. After adjusting for other factors, the adjusted odds ratio (aOR) was 0.66 with a 95% CI of 0.48-0.90.
Minsart et al., 2014 (16)	Djibouti City (East Africa)	Women who experienced childbirth, resulting in either a live or stillborn baby, after completing 22 weeks of	Observational cohort study, n=497	During pregnancy, a woman's body mass index (BMI) was determined. A BMI of 30.0 or more was deemed obese for women. BMI is computed as weight in kilograms divided by height in meters squared..	100 (24.8%) of 404 participants were obese before 14 weeks' gestation, as were 112 (25.2%) of 445 participants before 22 weeks' gestation, and 200 (43.2%) of 463	Obesity before to 22 weeks of pregnancy was linked to a 127% increased likelihood of having a cesarean birth. The adjusted odds ratio was 2.27, with a 95% confidence interval of 1.07-4.82, and a p-value of

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Author (Year)	Ethnic group/ Country	Participant/setting	Study design,Sample size	Intervention	Outcome measure (s)	Result
		pregnancy throughout the time frame of October 1, 2012 to November 30, 2013.			participants at the time of labor.	0.032.
Gu et al., 2023 (17)	South China	The study comprised pregnant women who had created consistent prenatal records and planned to give birth at Guangdong Women and Children Hospital (Guangzhou, China) from January 2020 to December 2021.	Retrospective cohort study, n=5614	Respondents' blood was sampled using vacuum tubes which containing potassium salts of ethylenediaminetetraaceti c acid and stored at 4°C.	Methylenetetrahydro folate reductase gene polymorphisms	Pregnant women who are obese have a 2.11 times higher risk of developing gestational diabetes mellitus (GDM) compared to non-obese women. Additionally, pregnant women who are overweight and have the MTHFR A1298C AA genotype have a 1.64 times higher risk of developing celiac disease (CD) compared to non-overweight women. Furthermore, pregnant women who are obese and have the MTHFR CT+TT genotype have a 2.40 times higher risk of developing GDM compared to non-obese women, and a 1.98 times higher risk of developing CD compared to non-overweight women.
Subramaniam et al., 2014 (18)	New Orlean, LA	All women with a body mass index of 40 kg/m2 or higher who gave birth to a single infant at our hospital between January 2007 and February 2013, either through planned cesarean section or induction of labor, regardless of the specific method of delivery, between 37 and 41 weeks of pregnancy.	Retrospective cohort study, n=661	Recognized every woman with a BMI ≥40 kg/m^2	The primary result is the maternal morbidity rate including mortality as well as surgical, infectious and thromboembolic complications. The secondary result was the rates of illness or injury in newborns. Other results covered specific elements of comparative outcomes.	The induction and cesarean delivery groups showed no statistically significant difference in the maternal morbidity composite, with an adjusted hazard ratio of 0.98 (95% confidence range, 0.55-1.77).
Kawakita et al., 2017 (19)	United States	Women with a single, head-first pregnancy, without a history of prior cesarean section, and	Retrospective cohort study, n=661	The data were allocated to pre-established codes at the data coordination center. Information extracted from important factors was compared with medical records.	Assessed maternal outcomes such as cesarean delivery, surgical delivery, severe lacerations (third or fourth degree), excessive	Among women who have never given birth, there is no evidence to suggest that inducing labor for non-medical reasons increases the likelihood of having a cesarean delivery. In fact,

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Author (Year)	Ethnic group/ Country	Participant/setting	Study design,Sample size	Intervention	Outcome measure (s)	Result
		with chronic hypertension, gestational diabetes, or pregestational diabetes, between 37 weeks and 41 weeks and 6 days of pregnancy.			bleeding after childbirth (postpartum hemorrhage), and a combined measure of maternal outcomes (including transfusion, hospitalization to the critical care unit, and venous thromboembolism).	it is associated with a reduced risk of having a baby with macrosomia (2.2% vs 11.0%; adjusted odds ratio = 0.24; 95% confidence interval = 0.05-0.70) in the early stages of pregnancy. In women who have given birth several times, inducing labor for reasons other than medical need was found to decrease the likelihood of having a baby with macrosomia in the early stages of pregnancy (4.2% vs 14.3%; OR = 0.30; 95% CI = 0.13-0.60), as well as diminish the likelihood of having a cesarean delivery at full term (5.4% vs 7.9%; OR = 0.64; 95% CI = 0.41-0.98).
Lodi et al., 2023 (20)	French	Pregnant women who were both class III obese and nulliparous and who tried vaginal birth were studied at two university hospitals in France.	Multicentric retrospective cohort study, n=410	The cesarean risk for obese nulliparous women was assessed using data from two cohorts.	Maternal characteristics (smoking, age, initial and final weight, height, diabetes mellitus/gestational, gestational weight gain, and high blood pressure) and delivery characteristics (labor onset, epidural analgesia, mode of delivery gestational age at delivery)	The logistic regression model revealed that only the starting body weight and inducement of labor had a significant impact on predicting unscheduled cesarean section. The probability forest model accurately estimated the likelihood of a cesarean section by using only two pre-delivery factors: the baseline body weight of the mother and whether labor was induced. The findings were obtained using a risk cut-off point of 49.5%. The estimated values, together with their 95% confidence intervals, are as follows: area under the curve 0.70 (0.62, 0.78), specificity 0.87 (0.77, 0.93), accuracy 0.66 (0.58, 0.73), and sensitivity 0.44 (0.32, 0.55).

Discussion

Several studies mentioned that overweight and obesity can increase various health problems which are generally regarded as important risk factors for causing negative pregnancy outcomes such as gestasional diabetes mellitus (GDM), preeclampsia, and caesarean delivery (CD) [21] [22] [23]. The impacts of oxidative stress, proinflammatory state, energy homeostasis, angiogenesis, and insulin insensitivity in overweight and obese moms are responsible for this phenomenon [24]. According to the research conducted by Gu et al.[17], pregnant women with a higher BMI are more likely to be at risk of CD (Celiac Disease) compared to pregnant women with a normal weight. The research study

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examines the correlation between pre-BMI and Methylenetetrahydrofolate Reductase (MTHFR) genotypes in relation to the likelihood of experiencing negative pregnancy outcomes. These findings are consistent with earlier research done in Western and Chinese populations, which indicate that women who are obese before pregnancy are more prone to developing hypertension compared to those with a normal BMI. OR for this association is 5.53, with a 95% confidence interval (CI) of 4.28-7.13[25].

A recent research conducted in the United States focused on the impact of cesarean delivery on the body mass index (BMI) of different groups of women. The study found that nulliparous women (women who have never given birth), multiparas without prior caesarean delivery, and multiparous women with previous caesarean delivery saw an increase in BMI. The chances of caesarean delivery leading to increased BMI were found to be 5% for nulliparous women, 5% for multiparas without previous caesarean delivery, and 2% for multiparous women with previous caesarean delivery. Each group saw a 1 kg/m2 rise in BMI. However, these studies differ in their capacity to evaluate information on cesarean birth, such as whether they involve voluntary participants or a sequence of medical courses markers, including lack of progress or the non-reassuring surveillance of fetal heart rate[11].

The association between obesity and an elevated risk of cesarean delivery (CD) is intricate. As stated in this article, it might be challenging to separate the impact of obesity as a factor that contributes to the risk of CD and as a factor that modifies the risk of CD. In order to reduce uncertainty in testing specific theories, several studies effectively establish a cohort of pregnant women who have a low likelihood of conception by eliminating obese women with chronic medical issues, obstetric difficulties, or prior uterine scarring [26]. Additional research indicates that maternal underweight and overweight/obesity detected during the early stages of pregnancy are linked to a higher likelihood of experiencing different pregnancy problems. However, there is no evidence to suggest a connection between these conditions and poor neurocognitive development in infants. Our findings suggest that healthcare practitioners should encourage women to begin pregnancy with a healthy body mass index (BMI). The elevated incidence of obesity among pregnant women in Djibouti City is linked to the likelihood of cesarean birth, even after accounting for other medical and socioeconomic factors[16]. According to the research conducted by Lodi et al. [20], it has been found that inducing labor greatly raises the chances of having a cesarean section in nulliparous patients with a BMI of 40 kg/m2 or more. This finding aligns with the outcomes of several earlier studies [(13),(27–29)]. The study found a clear negative relationship between initial body weight and the likelihood of developing CD. This association was observed in both logistic and random predictive models.

Indeed, women with a BMI of 40 kg/m2 or above who had an exceptionally high BMI were more likely to have a planned or unexpected cesarean delivery before the labor trial. As a result, they were removed from the study. Furthermore, the prediction model enabled us to precisely measure the probability of unscheduled cesarean delivery using just prenatal data, a novel accomplishment in our field. However, a factor that might restrict the practical use of the model is the occurrence of false positives, which refers to women who are projected to have a high likelihood of unscheduled cesarean birth but should have really had a vaginal delivery. The metric is denoted by specificity, where high specificity corresponds to a low false positive rate. Women who receive false-negative findings will often be required to go through a trial of labor as part of conventional clinical practice. However, women who receive false-positive results may end up with a needless scheduled cesarean delivery, which can be iatrogenic. According to current scientific research, it has been demonstrated that women who are classified as class III obesity have an increased likelihood of having cardiovascular disease (CD).

Obese women have a reduced likelihood of experiencing enough contractions and are at an increased risk of undergoing a caesarean section during the initial stage of labor. Nevertheless, if

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obese women attain sufficient contractility, the likelihood of undergoing a first-stage caesarean delivery is comparable to that of non-obese women. The results indicate that a decrease in uterine contractility might be the underlying cause for the elevated frequency of caesarean section in this particular group[13]. Pregnancy induces a moderate inflammatory condition in the mother's body, while the placenta also releases several hormones and cytokines that regulate the immune system [27]. Maternal systemic and placental inflammation have been seen in pregnancies affected by obesity in humans[28]. Maternal obesity in humans leads to placental inflammation and the release of higher levels of cytokines, interleukin 1β, including interleukin 6, and tumor necrosis factor-α (TNF-α) [30]. Additionally, it results in an increase in the number of invading monocytes and activated macrophages[31]. Evidence demonstrates a correlation between maternal inflammatory mediators during pregnancy and fetal adiposity as well as neonatal fat mass [32].

Contrary to the findings of Subramaniam et al. [18], their investigation revealed no notable distinction in terms of maternal and newborn morbidity between cesarean delivery and induction of labor in mothers with class III obesity. The varying outcomes of this study can be attributed to the inclusion of only obese women as participants, who were separated into two groups: those undergoing scheduled cesarean birth and those undergoing induction of labor. Kawakita et al. [19] found no correlation between the induction of labor for non-medical reasons and a heightened likelihood of cesarean birth in obese women.

Subsequent studies should assess the accuracy and reliability of this literature evaluation and aim to comprehend the comparative impact of each conceivable route connecting obesity and cesarean birth. This may enable the formulation of recommendations based on research to decrease the occurrence of unnecessary caesarean sections in obese women. These recommendations would focus on factors that can be modified and factors that influence the relationship between obesity and the heightened risk of caesarean section [11].

CONCLUSION

The increasing occurrence of maternal obesity presents a substantial challenge to obstetric practice. Maternal obesity can result in negative outcomes for both the mother and the unborn child. Based on the description of the research result of 8 article of literature above, 6 article prove that there is a relationship between obesity risk factors and the incidence of caesarean delivery. Midwives have an obligation as the front guard in carry out maximum supervision when providing pregnancy program services and antenatal care in preventing obesity, especially obesity during pregnancy.

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