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Pregnancy Outcomes in Women with Morbid Obesity Presenting at Tertiary Care Hospital

Huma Gul[1], Nuzhat Amin[1], Sadia Mehmood[1], Fatima Safdar[1]

[1]Department of Obstetrics and Gynecology, Mardan Medical Complex, Mardan, Pakistan

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Correspondence to: Huma Gul,
Department of Obstetrics and Gynecology, Mardan Medical Complex, Mardan, Pakistan.
Email: Aitzaz_kpk@yahoo.co.uk

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ABSTRACT

Background: Morbid obesity among pregnant women poses numerous metabolic and endocrine disorders that contribute to the negative impacts on pregnancy. Pregnant women, who have the body mass index of 40kg per square meter or higher, are at higher risk of experiencing pregnancy complications such as preterm delivery, preterm rupture of membranes, and cesarean delivery. Such impacts are of enormous importance to the well-being of the newborns. **Objective**: To determine the pregnancy outcomes in women with morbid obesity presenting at tertiary care hospital. **Study Design**: Descriptive study. **Duration and Place of Study**: This study was conducted from 16th February 2025 to 25th May 2025 in the Department of Obstetrics and Gynecology at Mardan Medical Complex in Mardan. **Methodology**: For the study, a total of 100 pregnant women aged 18 to 40 years with singleton pregnancy, gestational age of 37 weeks and beyond, and morbidly obese with a body mass index of 40 kilogram per meter square and beyond were selected. Follow-up of the subjects till delivery was performed for assessing the pregnancy outcome. Chi square test, Fisher exact test were used for the statistical analysis, with the significance level of p=0.05 and below. **Results**: The mean age of participants was 29.33 years with mean body mass index of 45.79 kilogram per meter square. Preterm birth occurred in 35 women (35%). Premature rupture of membrane was observed in 30 women (30%). Cesarean section deliveries were performed in 35 cases (35%). **Conclusion**: Morbid obesity in pregnancy is associated with high frequency of adverse outcomes including preterm birth, premature rupture of membranes, and cesarean section.

INTRODUCTION

Obesity in pregnancy is now very common problem and it is more serious when the woman is in morbid obesity group, like BMI 40 or more.[1] In this condition the body have lot of extra fat tissue and it change many hormones and metabolic balance, so pregnancy do not run like normal woman.[2] These women have more insulin resistance, high blood pressure and they often develop conditions like gestational diabetes and preeclampsia, so the placenta also get effect and blood flow to fetus may be not ideal.[3] Antenatal checkup become more difficult because it is hard to do proper clinical examination and ultrasound image sometimes not clear due to thick abdominal wall, so some problems are detected late.[4]

In morbidly obese pregnant women the risk of many bad pregnancy outcomes is higher, especially preterm birth and premature rupture of membrane.[5] Because of high inflammation in the body and abnormal hormone level, cervix may become weak earlier and uterus contract before time so preterm labor happen more, sometimes spontaneous and sometimes doctors decide early delivery because mother blood pressure or blood sugar is not controlled or baby is not growing good, so iatrogenic preterm birth also increase.[6] Premature rupture of membrane is also more seen because the membranes are under more stress from large uterus, polyhydramnios, and infections that are more common when woman is obese and less mobile.[7] When the membranes rupture too early, risk of ascending infection, cord prolapse, and fetal distress become high and doctors have to balance between prolonging pregnancy for lung maturity and avoiding sepsis in mother and baby, so hospital stay become long and need of antibiotics, steroid injection and intensive monitoring is more frequent in this group.[8]

Risk of cesarean section is also much higher in women with morbid obesity and it is related to both maternal and fetal factors.[9] Labor induction many time fail because the cervix not favorable and uterine contractions are not strong or regular, so labor become prolonged and doctors worry about fetal distress or uterine rupture and then

decide for emergency C-section.[10] Malpresentation, big baby due to diabetes, and cephalopelvic disproportion are also more common, so vaginal delivery is more difficult and many obstetrician prefer planned cesarean, especially when there is history of previous scar.[11] During C-section, anesthesia is more risky because airway is difficult and there is higher chance of thromboembolism, wound infection and poor wound healing after surgery, so postoperative care need more attention.[12] All these factors together show that morbid obesity in pregnancy is not only simple weight problem but it change pregnancy outcomes like preterm birth, premature rupture of membrane and cesarean section in significant way and increase burden on mother, baby and health system.[13]

A study reported the pregnancy outcomes in morbidly obese women such as Preterm birth in (36.4%), premature rupture of membranes in (28.6%), and C-section in (25%).[14]

There is need to do this study in Mardan because many women here now coming with morbid obesity and doctors do not have enough local data about how it affects pregnancy outcomes. Most research is from other countries and situation in Mardan is different because lifestyle, diet pattern and access to antenatal care not same. By doing this study we can understand better what problems like preterm birth, membrane rupture and C-section happen more in our own population, so hospitals can plan better management. This local evidence will help mothers get safer care and reduce complications because decisions will be based on real data from Mardan women, not only outside studies.

METHODOLOGY

The study was conducted at the Department of Obstetrics and Gynecology at Mardan Medical Complex in Mardan. The study was descriptive in design and conducted from 16th February 2025 to 25th May 2025. The sample size was estimated using the WHO sample size calculator, based on a 95% confidence level, an 8.5% margin of error, and the proportion of C-sections (25%) among morbidly obese pregnant women.[14] The calculated sample size was 100.

Inclusion criteria were pregnant women between 18 and 40 years of age, with a singleton pregnancy and gestational age of ≥37 weeks, who were morbidly obese. Morbid obesity was defined as having a body mass index (BMI) of ≥40 kg/m^2. Exclusion criteria were patients with cardiac diseases, chronic renal or liver diseases, or per vaginal bleeding. Once approval was obtained from the ethical board of the hospital and research department of CPSP Karachi, data collection began. Patients who met the inclusion criteria were enrolled in the study. Informed consent was obtained from all participants after explaining the study's objectives, benefits, and risks. Physical examination and medical assessment were performed on all enrolled patients. All morbidly obese pregnant women with gestational age ≥37 weeks were followed till delivery to evaluate pregnancy outcomes, including preterm birth, premature rupture of membranes, and C-sections. Preterm birth was defined as the birth of a baby before completing 37 weeks of gestation. Premature rupture of membranes was determined by the direct visualization of clear fluid in the posterior fornix of the vagina or the leakage of fluid from the cervical os. C-section was defined as the surgical delivery of a baby through an incision in the mother's abdomen and uterus.

Data analysis was done using SPSS version 23. For numerical data mean ± SD or median (IQR) were used. For categorical data like pregnancy outcomes (preterm birth, premature rupture of membranes, and C-sections), diabetes, hypertension, anemia, socio-economic status, residence area, profession, and education level, frequencies and percentages were calculated. Effect modifiers, including age, BMI, diabetes, hypertension, anemia, socio-economic status, residence area, profession, and education status, were addressed through stratification. Post-stratification chi-square or Fisher's exact test was used, with a p-value ≤ 0.05 considered significant.

RESULTS

The mean age of participants was 29.33±5.92 years, with mean weight of 121.48±14.28 kg, mean height of 1.63±0.07 m, and mean BMI of 45.79±3.71 kg/m^2 (as shown in Table 1). Regarding socioeconomic status, majority of women belongs to poor category with 58 (58.0%), followed by middle class 27 (27.0%) and rich 15 (15.0%). Most participants were uneducated 61 (61.0%) compared to educated 39 (39.0%). Rural residents constituted 69 (69.0%) while urban residents were 31 (31.0%). Comorbidities were also documented where diabetes was present in 23 (23.0%) women, hypertension in 32 (32.0%) women, and anemia in 48 (48.0%) women (as shown in Table 1).

Table 1

Patient Demographics

Demographics		Mean ± SD
Age (years)		29.33±5.92
Weight (kg)		121.48±14.28
Height (m)		1.63±0.07
BMI (kg/m^2)		45.79±3.71
Socioeconomic Status	Poor n (%)	58 (58.0%)
	Middle n (%)	27 (27.0%)
	Rich n (%)	15 (15.0%)
Education Status	Educated n (%)	39 (39.0%)
	Uneducated n (%)	61 (61.0%)
Residence Area	Rural n (%)	69 (69.0%)
	Urban n (%)	31 (31.0%)
Diabetes	Yes n (%)	23 (23.0%)
	No n (%)	77 (77.0%)
Hypertension	Yes n (%)	32 (32.0%)
	No n (%)	68 (68.0%)
Anemia	Yes n (%)	48 (48.0%)
	No n (%)	52 (52.0%)

The frequency of adverse pregnancy outcomes shows that preterm birth occurred in 35 (35.00%) cases while 65 (65.00%) had no preterm birth. Premature rupture of membrane was observed in 30 (30.00%) women whereas 70 (70.00%) did not experience this complication. C-section deliveries were performed in 35 (35.00%) cases while 65 (65.00%) had vaginal deliveries (as shown in Table 2).

Table 2
Frequency of Pregnancy Outcomes in Women with Morbid Obesity

Pregnancy Outcomes		Frequency	% age
Preterm Birth	Yes	35	35.00%
	No	65	65.00%
	Total	100	100%
Premature Rupture of Membrane	Yes	30	30.00%
	No	70	70.00%
	Total	100	100%
C-Section	Yes	35	35.00%
	No	65	65.00%

When analyzing association of preterm birth with demographic factors, age groups ≤30 years had 19 (36.5%) preterm births compared to 16 (33.3%) in >30 years group with p-value of 0.737 showing no significant association. BMI ≤43 kg/m^2 group had 9 (29.0%) preterm births while >43 kg/m^2 group had 26 (37.7%) with p-value 0.402. Socioeconomic status showed poor group with 23 (39.7%), middle class 5 (18.5%), and rich 7 (46.7%) preterm births with p-value 0.104. Education status revealed 13 (33.3%) in educated and 22 (36.1%) in uneducated group with p-value 0.780. Rural residence showed 21 (30.4%) while urban had 14 (45.2%) preterm births with p-value 0.153. Diabetes positive group had 8 (34.8%) compared to 27 (35.1%) in negative group with p-value 0.980. Hypertension positive showed 13 (40.6%) versus 22 (32.4%) in negative group with p-value 0.419. Anemia positive had 13 (27.1%) while negative had 22 (42.3%) preterm births with p-value 0.111. (as shown in Table 3).

Table 3
Association of Preterm Birth with Demographic Factors

Demographic Factors		Preterm Birth		p-value
		Yes n(%)	No n(%)	
Age (years)	≤30	19 (36.5%)	33 (63.5%)	0.737
	>30	16 (33.3%)	32 (66.7%)	
BMI (Kg/m^2)	≤43	9 (29.0%)	22 (71.0%)	0.402
	>43	26 (37.7%)	43 (62.3%)	
Socioeconomic Status	Poor	23 (39.7%)	35 (60.3%)	0.104*
	Middle	5 (18.5%)	22 (81.5%)	
	Rich	7 (46.7%)	8 (53.3%)	
Education Status	Educated	13 (33.3%)	26 (66.7%)	0.780
	Uneducated	22 (36.1%)	39 (63.9%)	
Residence Area	Rural	21 (30.4%)	48 (69.6%)	0.153
	Urban	14 (45.2%)	17 (54.8%)	
Diabetes	Yes	8 (34.8%)	15 (65.2%)	0.980
	No	27 (35.1%)	50 (64.9%)	
Hypertension	Yes	13 (40.6%)	19 (59.4%)	0.419
	No	22 (32.4%)	46 (67.6%)	
Anemia	Yes	13 (27.1%)	35 (72.9%)	0.111
	No	22 (42.3%)	30 (57.7%)	

*Fischer Exact Test

For premature rupture of membrane associations with demographic factors, age ≤30 years group had 18 (34.6%) cases compared to 12 (25.0%) in >30 years with p-value 0.295. BMI ≤43 kg/m^2 showed 8 (25.8%) while >43 kg/m^2 had 22 (31.9%) cases with p-value 0.540. Among socioeconomic groups, poor had 17 (29.3%), middle 9 (33.3%), and rich 4 (26.7%) with p-value 0.909. Education status showed educated group with 16 (41.0%) and uneducated with 14 (23.0%) having p-value 0.054, approaching significance. Rural area had 20 (29.0%) while urban had 10 (32.3%) with p-value 0.741. Diabetes positive showed 8 (34.8%) versus 22 (28.6%) in negative with p-value 0.568. Hypertension positive had 10 (31.3%) compared to 20 (29.4%) in negative with p-value 0.852. Anemia positive showed 15 (31.3%) while negative had 15 (28.8%) with p-value 0.793. (as shown in Table 4).

Table 4
Association of Premature Rupture of Membrane with Demographic Factors

Demographic Factors		Premature Rupture of Membrane		p-value
		Yes n(%)	No n(%)	
Age (years)	≤30	18 (34.6%)	34 (65.4%)	0.295
	>30	12 (25.0%)	36 (75.0%)	
BMI (Kg/m^2)	≤43	8 (25.8%)	23 (74.2%)	0.540
	>43	22 (31.9%)	47 (68.1%)	
Socioeconomic Status	Poor	17 (29.3%)	41 (70.7%)	0.909*
	Middle	9 (33.3%)	18 (66.7%)	
	Rich	4 (26.7%)	11 (73.3%)	
Education Status	Educated	16 (41.0%)	23 (59.0%)	0.054
	Uneducated	14 (23.0%)	47 (77.0%)	
Residence Area	Rural	20 (29.0%)	49 (71.0%)	0.741
	Urban	10 (32.3%)	21 (67.7%)	
Diabetes	Yes	8 (34.8%)	15 (65.2%)	0.568
	No	22 (28.6%)	55 (71.4%)	
Hypertension	Yes	10 (31.3%)	22 (68.8%)	0.852
	No	20 (29.4%)	48 (70.6%)	
Anemia	Yes	15 (31.3%)	33 (68.8%)	0.793
	No	15 (28.8%)	37 (71.2%)	

*Fischer Exact Test

The association of C-section with demographic factors revealed age ≤30 years had 19 (36.5%) while >30 years had 16 (33.3%) C-sections with p-value 0.737. BMI ≤43 kg/m^2 group showed 14 (45.2%) compared to 21 (30.4%) in >43 kg/m^2 group with p-value 0.153. Socioeconomic status demonstrated poor with 20 (34.5%), middle 11 (40.7%), and rich 4 (26.7%) having p-value 0.668. Education status had 13 (33.3%) in educated and 22 (36.1%) in uneducated with p-value 0.780. Rural residence showed 24 (34.8%) while urban had 11 (35.5%) with p-value 0.946. Diabetes positive group had 11 (47.8%) versus 24 (31.2%) in negative group with p-value 0.142. Hypertension positive showed 12 (37.5%) compared to 23 (33.8%) in negative with p-value 0.719. Anemia positive had 14 (29.2%) while negative had 21 (40.4%) with p-value 0.240. (as shown in Table 5).

Table 5
Association of C-Section with Demographic Factors

Demographic Factors		C-Section		p-value
		Yes n(%)	No n(%)	
Age (years)	≤30	19 (36.5%)	33 (63.5%)	0.737
	>30	16 (33.3%)	32 (66.7%)	
BMI (Kg/m^2)	≤43	14 (45.2%)	17 (54.8%)	0.153
	>43	21 (30.4%)	48 (69.6%)	
Socioeconomic Status	Poor	20 (34.5%)	38 (65.5%)	0.668*
	Middle	11 (40.7%)	16 (59.3%)	
	Rich	4 (26.7%)	11 (73.3%)	
Education Status	Educated	13 (33.3%)	26 (66.7%)	0.780
	Uneducated	22 (36.1%)	39 (63.9%)	
Residence Area	Rural	24 (34.8%)	45 (65.2%)	0.946
	Urban	11 (35.5%)	20 (64.5%)	
Diabetes	Yes	11 (47.8%)	12 (52.2%)	0.142
	No	24 (31.2%)	53 (68.8%)	
Hypertension	Yes	12 (37.5%)	20 (62.5%)	0.719
	No	23 (33.8%)	45 (66.2%)	
Anemia	Yes	14 (29.2%)	34 (70.8%)	0.240
	No	21 (40.4%)	31 (59.6%)	

*Fischer Exact Test

DISCUSSION

In the study, the incidence of preterm delivery was recorded at 35 (35.00%) cases, which is a high incidence. This can be attributed to the fact that the condition of obesity causes the body to have a chronic state of inflammation, which stimulates the premature labor process because of the release of inflammation cytokines and prostaglandins. Preterm rupture of the membrane was recorded at 30 (30.00%) cases, which is a high incidence. The mechanism that is responsible for the incidence is the weakness of the membranes, which is stimulated by the high oxidative environment and decreased collagen production by the obese woman. In addition, the mechanical pressure manifested by the excessive adipose tissue components causes the membranes to rupture prior to labor.

C-section rate was 35 (35.00%) in study population, considerably higher than general population rates. This elevated rate occurs because morbid obesity creates multiple complications during labor including cephalopelvic disproportion due to excess pelvic soft tissue, poor uterine contractility from fatty infiltration of myometrium, and difficulty in monitoring fetal status. Also, the risk of failed labor progression and fetal distress increases substantially in obese women necessitating surgical intervention. The prevalence of comorbidities was notable with diabetes in 23 (23.0%), hypertension in 32 (32.0%), and anemia in 48 (48.0%) of participants. These conditions are directly linked to obesity through mechanisms like insulin resistance, increased vascular resistance, and chronic inflammatory state which depletes iron stores and affects erythropoiesis.

The preterm birth rate of 35 (35.00%) in current study is substantially higher compared to global meta-analytic estimate by Langley-Evans SC *et al.* [15] who reported 16% higher preterm birth attributable to maternal obesity. However, this rate aligns more closely with findings from Akyuni Q *et al.* [16] who documented elevated preterm complications in class-III obesity during COVID-19 pandemic. The higher rate in present study may be explained by fact that population consisted entirely of morbidly obese women (mean BMI 45.79±3.71 kg/m^2) which represents more severe category than general obese populations studied by others. Additionally, the high proportion of rural residents 69 (69.0%) and uneducated women 61 (61.0%) in current cohort suggests limited access to prenatal care and health education which further compounds obesity-related risks for preterm delivery.

The C-section rate of 35 (35.00%) observed in present study is considerably lower than rates reported in comparable morbidly obese populations. Joewono HT *et al.* [17] documented 85% CS rate in morbidly obese women with median BMI 45.86 kg/m^2 in Indonesia, while Ibrahim SA & Farag AM [18] found 50% CS rate in Egyptian morbidly obese group. Similarly, Rehman F *et al.* [19] reported 62.2% CS in class-II/III obesity in Pakistani population, and Sakuntala DS *et al.* [20] observed 75% CS rate in Indian obese cohort. The lower operative delivery rate in current study despite similar BMI levels is unexpected and may reflect institutional practice patterns favoring vaginal delivery attempts, or possibly inadequate documentation of emergency CS performed for complications. Alternatively, this could indicate that women delivered at earlier gestational ages with smaller fetal sizes making vaginal delivery more feasible, though this would typically increase neonatal morbidity. The discrepancy warrants further investigation as most literature consistently demonstrates CS rates exceeding 50% in morbidly obese populations due to mechanical factors and increased labor complications.

Premature rupture of membrane occurred in 30 (30.00%) of cases which represents relatively high frequency. While most comparative studies did not specifically report PROM rates as isolated outcome, this finding supports general understanding that obesity compromises membrane integrity through inflammatory pathways. The association approaching significance with education status (p=0.054) where educated women had 16 (41.0%) PROM compared to 14 (23.0%) in uneducated group is paradoxical and contrary to expected patterns. This unexpected finding might reflect small sample size effects or confounding variables not captured in analysis.

The prevalence of diabetes 23 (23.0%) in present cohort is higher than rates reported by Rani S *et al.* [21] who found 14.5% GDM in obese Pakistani women and Choudhry A *et al.* [22] who reported 15% GDM. However, it remains lower than Langley-Evans SC *et al.* [15] meta-analysis showing more than 3-fold increase in GDM risk. The hypertension prevalence of 32 (32.0%) falls within range of Rehman F *et al.* [19] who documented 31.7% gestational hypertension in class-II/III obesity, though lower than Rani S *et al.* [21] who reported 42.1% preeclampsia in obese group. These variations likely reflect differences in diagnostic criteria, timing of assessment, and baseline population characteristics including genetic predisposition and dietary patterns specific to regional populations. Anemia was present in 48 (48.0%) of participants which is considerably high prevalence not extensively reported in comparative studies. This high rate may be attributed to poor socioeconomic status 58 (58.0%) and rural residence 69 (69.0%) in study population where nutritional deficiencies are more common due to limited access to iron-rich foods and inadequate supplementation during pregnancy. The inflammatory state associated with obesity further depletes iron stores making anemic conditions more prevalent in this population.

The study has several limitations which should be acknowledged. Being single center study conducted at one institution limits generalizability of findings to broader populations with different demographic characteristics and healthcare practices. The sample size of 100 participants is relatively small which may have contributed to lack of statistical significance in associations between demographic factors and pregnancy outcomes. The cross-sectional nature of data collection prevents establishment of causal relationships and temporal sequences between obesity and adverse outcomes. Additionally, the study did not account for potential confounding variables such as dietary habits, physical activity levels, adherence to antenatal care visits, and pre-existing medical conditions severity which could influence pregnancy outcomes independently.

CONCLUSION

This study concludes that the incidence of morbid obesity does affect pregnancy outcomes with a high incidence of adverse events like preterm delivery, premature rupture of membrane, and cesarean section delivery. This study population also reveals the prevalence of comorbidities like diabetes, hypertension, and anemia, which complicates pregnancy in the case of morbidly obese women.

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Ethical Approval

The ethical committee approved the study. All of the study followed the rules set by the committee and the Helsinki Declaration.

Patients' Consent

Before joining the study, all patients gave their written consent. They were informed that their data would remain private, and they could quit the study anytime.

REFERENCES

1. Almutairi FS, Alsaykhan AM, Almatrood AA. Obesity prevalence and its impact on maternal and neonatal outcomes in pregnant women: a systematic review. *Cureus*. 2024;16(12):e75262. https://doi.org/10.7759/cureus.75262
2. Fitzsimons KJ, Modder J, Greer IA. Obesity in pregnancy: risks and management. *Obstet Med*. 2009;2(2):52-62. https://doi.org/10.1258/om.2009.090009.
3. Yang Y, Wu N. Gestational diabetes mellitus and preeclampsia: correlation and influencing factors. *Front Cardiovasc Med*. 2022;9:831297. https://doi.org/10.3389/fcvm.2022.831297
4. Prodan NC, Schmidt M, Hoopmann M, Abele H, Kagan KO. Obesity in prenatal medicine: a game changer? *Arch Gynecol Obstet*. 2023;309(3):961-974. https://doi.org/10.1007/s00404-023-07251-x
5. Sobczyk K, Holecki T, Woźniak-Holecka J, Grajek M. Does maternal obesity affect preterm birth? Documentary cohort study of preterm in firstborns—Silesia (Poland). *Children (Basel)*. 2022;9(7):1007. https://doi.org/10.3390/children9071007
6. Chen J, Miao Y, Li Q, Zhang Q, Sun B, Wu Z, *et al*. Maternal obesity phenotype, metabolic dysfunction, and preterm birth: a prospective birth cohort study. *Front Nutr*. 2025;12:1648996. https://doi.org/10.3389/fnut.2025.1648996
7. Sun H, Su X, Mao J, Du Q. Impact of pre-pregnancy weight on the risk of premature rupture of membranes in Chinese women. *Heliyon*. 2023;9(11):e21971. https://doi.org/10.1016/j.heliyon.2023.e21971
8. Robinson L, Reiss K, Seybold D, Younis L, Calhoun B. A comparison of neonatal outcomes between obese and nonobese women with preterm prelabor rupture of membranes. *Cureus*. 2024;16(6):e61754. https://doi.org/10.7759/cureus.61754
9. Gerede A, Danavasi M, Stavros S, Potiris A, Zikopoulos A, Moustakli E. Obesity and pregnancy: impact on childbirth timing, delivery mode, and maternal recovery: an update. *Med Sci (Basel)*. 2025;13(3):182. https://doi.org/10.3390/medsci13030182
10. Krogh LQ, Henriksen TB, Taastrøm KA, Boie S, Kjeldsen ACM, Thornton J, *et al*. Body mass index and failed induction of labor: a cohort study. *Acta Obstet Gynecol Scand*. 2025;104(12):2282-2291. https://doi.org/10.1111/aogs.70081
11. Nikolova Z, Sandeva M, Uchikova E, Kirkova-Bogdanova A, Taneva D, Vladimirova M, *et al*. Impact of maternal overweight and obesity on pregnancy outcomes following cesarean delivery: a retrospective cohort study. *Healthcare (Basel)*. 2025;13(15):1893. https://doi.org/10.3390/healthcare13151893
12. Nivatpumin P, Lertbunnaphong T, Maneewan S, Vittayaprechapon N. Comparison of perioperative outcomes and anesthetic-related complications of morbidly obese and super-obese parturients delivering by cesarean section. *Ann Med*. 2023;55(1):1037-1046. https://doi.org/10.1080/07853890.2023.2187877
13. Gerede A, Danavasi M, Stavros S, Potiris A, Zikopoulos A, Moustakli E, Skentou C, Domali E, Nikolettos N, Eleftheriades M. Obesity and Pregnancy: Impact on Childbirth Timing, Delivery Mode, and Maternal Recovery: An Update. *Med Sci (Basel)*. 2025;13(3):182. https://doi.org/10.3390/medsci13030182
14. Indarti J, Susilo SA, Hyawicaksono P, Berguna JS, Tyagitha GA, Ikhsan M. Maternal and perinatal outcome of maternal obesity at RSCM in 2014–2019. *Obstet Gynecol Int*. 2021;7(1):1-6. https://doi.org/10.1155/2021/6039565
15. Langley-Evans SC, Pearce J, Ellis S. Overweight, obesity and excessive weight gain in pregnancy as risk factors for adverse pregnancy outcomes: a narrative review. *J Hum Nutr Diet*. 2022;35(2):250-264. https://doi.org/10.1111/jhn.12999
16. Akyuni Q, Gumilar KE, Suherman RWP, Akbar MIA, Andini SF, Joewono HT. Obese birthing mothers gave higher adverse pregnancy outcomes in COVID-19 pandemic. *J South Asian Feder Obst Gynae*. 2025;17(1):77-82. https://doi.org/10.5005/jp-journals-10006-2306
17. Joewono HT, Sulistyono A, Kartini N, Aditiawarman. Birth outcomes of maternal morbid obesity. *Int J Psychosoc Rehabil*. 2020;24(9):1796-1805.
18. Ibrahim SA, Farag AM. First trimester body mass index and adverse pregnancy outcomes. *Med J Cairo Univ*. 2022;90(7):1961-1965. https://doi.org/10.21608/mjcu.2022.286858
19. [DUPLICATE OF REFERENCE 13] Rehman F, Asmat S, Mehsud N, Ishtiaq L, Shakeel K, Ali M, *et al*. Effects of obesity on pregnancy and fetomaternal outcome. *Cureus*. 2025;17(10):e94358. https://doi.org/10.7759/cureus.94358
20. Sakuntala DS, Narayanamma L, Akshitha D, Jaggina L. A study on the effect of obesity on pregnancy outcome. *Indian J Obstet Gynecol Res*. 2025;12(4):631-637. https://doi.org/10.18231/j.ijogr.75078.1763444533
21. Rani S, Anjum F, Siddique AA, Khan S, Kazi K, Almas S. Maternal obesity & feto-maternal outcomes. *Pakistan Biomed J*. 2022;5(6):186-190. https://doi.org/10.54393/pbmj.v5i6.588
22. Choudhry A, Choudhry H, Azam N, Jan S. Effects of obesity on pregnancy and its outcome. *Pak Armed Forces Med J*. 2009;59(3):315-319.