ASSOCIATION BETWEEN BODY MASS INDEX AND INDUCTION OF LABOR

Dr. Farwa Ashfaq[*1], Dr. Bushra Kant[2], Dr. Afnan Rizwan[3], Dr. Maria Tariq[4], Dr. Gull Amber Benish Bhutta[5], Dr. Samra Manzoor[6]

[*1] *Post Graduate Trainee (FCPS Obstetrics & Gynecology), Dr. Akbar Niazi Teaching Hospital, Islamabad.*
[2] *Professor / HOD, Obstetrics & Gynecology, Dr. Akbar Niazi Teaching Hospital, Islamabad.*
[3] *Associate Professor, Obstetrics & Gynecology, Dr. Akbar Niazi Teaching Hospital, Islamabad.*
[4,5] *Assistant Professor, Obstetrics & Gynecology, Dr. Akbar Niazi Teaching Hospital, Islamabad.*
[6] *Post Graduate Trainee, Obstetrics & Gynecology, Dr. Akbar Niazi Teaching Hospital, Islamabad.*

[*1]farwa.ashfaq22@gmail.com

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Corresponding Author: *
Dr. Farwa Ashfaq

Abstract

Background: *Obesity in pregnancy is linked to adverse outcomes, including prolonged labor, higher cesarean rates, and increased maternal complications. Conflicting evidence exists on its effect on induction of labor (IOL); this study was planned to assess the association between BMI and IOL.*

Objectives: *To compare frequency of induction of labor based on BMI at a tertiary care hospital.*

Duration: *Six months w.e.f 01-10-2024 to 31-03-2025*

Methodology: *After ethical approval, 182 pregnant women meeting inclusion criteria at Dr. Akbar Niazi Teaching Hospital, Islamabad, were enrolled, and written informed consent obtained. Labor was induced per hospital protocol when indicated, while others had spontaneous labor. All procedures were supervised by a senior gynecologist, and data were recorded and analyzed using SPSS 26.*

Results: *A total of 182 participants were included, with a mean age of 28.30 ± 5.54 years and mean BMI of 28.85 ± 4.17 kg/m²; half were classified as obese. Obese women had significantly higher rates of induction of labor (35.2% vs. 12.1%), increased cesarean deliveries (59.3% vs. 40.7%), and longer labor duration (12.14 ± 3.81 vs. 11.00 ± 3.29 hours), while fetal weight differences were not statistically significant. Higher induction rates were observed across all subgroups of obese women.*

Conclusion: *In this study, obesity was significantly associated with higher rates of labor induction and cesarean delivery, as well as longer labor duration. Obese women had nearly four times higher odds of induction compared to non-obese women, highlighting BMI as an important factor influencing obstetric outcomes.*

INTRODUCTION

Induction of labor (IOL) is the medical initiation of uterine contractions before spontaneous labor, with or without rupture of membranes. Its prevalence varies globally, being higher in developed countries compared to developing nations.[1,2] IOL is performed to achieve vaginal delivery when the benefits outweigh the risks of continuing pregnancy. In developed countries, up to 25% of term deliveries involve IOL,[3] whereas in Pakistan, the rate has been reported as 17.5%.[4] Maternal obesity at booking increases the risk of pregnancy and childbirth complications for both mother and baby. Obese women are at higher risk of gestational diabetes, miscarriage, preeclampsia, thromboembolism, and postpartum hemorrhage.[5,6] Evidence suggests that maternal obesity independently raises the likelihood of instrumental and cesarean deliveries and adverse neonatal outcomes, including macrosomia, shoulder dystocia, and stillbirth.[7] Adipose tissue releases peptide hormones, such as leptin and steroid hormones, and adipokines, including cytokines, adipsin, acylation-stimulating protein, adiponectin, and resistin, which dysregulate tissue function and impair myometrial contractility.[8] This leads to increased risk of postdates pregnancy, altered labor quality, cesarean section, and postpartum hemorrhage.[7] A Nigerian study reported maternal obesity prevalence at 42.3%, highlighting its growing global concern.[9]

Qazi et al. conducted a study at Lady Reading Hospital, Peshawar, Pakistan, and found that induction of labor (IOL) occurred more frequently in obese women than in non-obese women (39.3% vs. 7.8%; $p < 0.001$).[10] This suggested that maternal body mass index (BMI) could influence the need for labor induction, and healthcare providers should consider BMI when managing deliveries in obese women to prevent complications for both mother and baby. In Pakistan, a low-resource country, managing induced labor requires extra resources, so it was important to evaluate whether IOL was necessary before advocating it routinely.

On the other hand, Angeliki et al. in Greece reported a lower rate of IOL in obese women compared to non-obese women (11.0% vs. 16.0%; $p > 0.05$), but the difference was not statistically significant.[11] Previous studies show conflicting results regarding the association between maternal BMI and induction of labor (IOL), and available data remain limited.[10,11] This study aims to re-examine this relationship to provide clearer evidence. If induction of labor occurs more frequently in obese women, clinicians can identify high-risk patients and plan management proactively. Conversely, if no significant difference is observed, it helps prevent unnecessary interventions, conserves healthcare resources, and supports evidence-based obstetric practice. By clarifying this association, the study aims to guide better clinical decision-making and improve outcomes for both mothers and newborns.

METHODOLOGY

The study was a descriptive cross-sectional study conducted in the Department of Obstetrics & Gynaecology at Dr. Akbar Niazi Teaching Hospital, Islamabad, over a period of six months following approval of the synopsis. The sample size of 182 participants was calculated using the WHO calculator with a 95% confidence interval, population proportion of 7.8%, and absolute precision of 3.9%.[10] Non-probability consecutive sampling was employed to enroll the participants. Obesity was defined as a BMI of $\geq 30\ kg/m^2$, while participants with lower BMI were classified as non-obese. Indications for induction of labor were met if any three of the following conditions occurred: premature rupture of membranes without spontaneous labor, preeclampsia with systolic blood pressure $\geq 140/90$ mmHg and urinary protein ≥ 300 mg in 24 hours and reduced amniotic fluid (oligohydramnios) <5 cm. Labor induction was performed using 5 IU oxytocin in 0.9% NaCl 50 ml, with a starting dose of 1.67 mU/min, maximum dose of 10 mU/min, and escalation of 1.67 mU/min every 10-15 minutes. Inclusion criteria included pregnant women of any parity aged 18–40 years with gestational age between 37 and 41 weeks, while exclusion criteria included women with stillbirth, emergency treatment needs, smoking or alcohol use, multiple pregnancies, and prior history of cesarean section or uterine surgery. After approval from the hospital's ethical review committee, 182 eligible women presenting for delivery were enrolled after obtaining written informed consent. Participants were observed during labor, and those requiring induction were managed according to the hospital's standard protocol, while others underwent spontaneous labor. All procedures were conducted by the same staff, and decisions regarding induction were made by a senior gynecologist to minimize bias, with all findings recorded by the resident. Confounding variables were controlled through the exclusion criteria. Data were analyzed using SPSS version 26, with mean and standard deviation computed for numerical variables such as maternal age, BMI, gestational age at admission and delivery, labor duration, and fetal weight. Frequencies and percentages were calculated for categorical variables including maternal parity, induction of labor, and mode of delivery. Furthermore, the frequency of labor induction between obese and non-obese women was stratified by maternal age, gestational age, parity, and mode of delivery, and a p-value ≤0.05 was considered statistically significant.

RESULTS

A total of 182 participants were included in the study. The mean age of the participants was 28.30 ± 5.54 years, with the majority (59.9%) aged between 18 and 30 years, and the remaining 40.1% aged between 31 and 40 years. The mean Body Mass Index (BMI) was 28.85 ± 4.17 kg/m². Half of the participants (50.0%) were classified as obese, while the other half were non-obese. The mean parity was 1.96 ± 0.81, with 69.8% having one to two previous deliveries and 30.2% having more than two. The mean gestational age at delivery was 39.02 ± 1.41 weeks. Most deliveries (59.9%) occurred between 37 and 39 weeks of gestation, while 40.1% occurred at 40 weeks or later. Data is given in Table 1.0. There were no statistically significant differences between obese and non-obese groups in terms of age, parity, or gestational age at delivery ($p > 0.05$) as shown in Table 2.0.

As shown in Table 3.0, induction of labor was significantly more common among obese participants compared to non-obese participants (35.2% vs. 12.1%; $p = 0.000$), with the odds of induction being nearly four times higher in the obese group (OR: 3.945; 95% CI: 1.839–8.461). Cesarean delivery was also significantly more frequent among obese women (59.3% vs. 40.7%; $p = 0.012$). The mean duration of labor was longer in the obese group (12.14 ± 3.81 hours) compared to the non-obese group (11.00 ± 3.29 hours), with a statistically significant difference ($p = 0.031$). Although the mean fetal weight was slightly higher in the obese group (3.25 ± 0.47 kg vs. 3.14 ± 0.39 kg), this difference was not statistically significant ($p = 0.088$).

Table 4.0 shows higher induction rates in obese women across all subgroups, with significant differences in younger age, gestational age, cesarean delivery, and low parity groups ($p < 0.05$). Non-obese women had consistently lower induction rates, though some differences lacked significance, likely due to small sample sizes.

Table 1.0: Demographic Characteristics of Patients Included in the Study

Characteristics	Total (182)
Age (years)	28.30±5.54
• 18-30 years	109 (59.9%)
• 31-40 years	73 (40.1%)
BMI (kg/m^2)	28.85±4.17
• Non-Obese	91 (50.0%)
• Obese	91 (50.0%)
Parity	1.96±0.81
• 1-2	127 (69.8%)
• >2	55 (30.2%)
Gestational Age at Delivery (weeks)	39.02±1.41
• 37-39 weeks	109 (59.9%)
• ≥40 weeks	73 (40.1%)

Table 2.0: Comparison of Baseline Characteristics between the Study Groups

Characteristics	Group A /Obese (n=91)	Group B / Non-Obese (n=91)	p-value
Age (years)	28.41±5.64	28.20±5.47	0.800
• 18-30 years	55 (60.4%)	54 (59.3%)	0.880
• 31-40 years	36 (39.6%)	37 (40.7%)	
Parity	1.93±0.79	1.98±0.83	0.714
• 1-2	66 (72.7%)	61 (67.0%)	0.420
• >2	25 (27.5%)	30 (33.0%)	
Gestational Age at Delivery (weeks)	38.90±1.44	39.14±1.37	0.247
• 37-39 weeks	57 (62.6%)	52 (57.1%)	0.420
• ≥40 weeks	34 (37.4%)	39 (42.9%)	

Chi Square test/ Independent sample t test, taking p-value≤0.05 as significant.

Table 3.0: Comparison of Induction of Labor between the Groups

Characteristics	Obese (n=91)	Non-Obese (n=91)	p-value
Induction of Labor			
• Yes	32 (35.2%)	11 (12.1%)	0.000
• No	59 (64.8%)	80 (87.9%)	
Odds Ratio (95% CI): 3.945 (1.839-8.461)			
Mode of Delivery			
• Vaginal Delivery	37 (40.7%)	54 (59.3%)	0.012
• Cesarean Delivery	54 (59.3%)	34 (40.7%)	
Duration of Labor (hrs)	12.14±3.81	11.00±3.29	0.031
Fetal Weight (kg)	3.25±0.47	3.14±0.39	0.088

Chi Square test/ Independent sample t test, taking p-valuee≤0.05 as significant.
OR >1 was considered as significant

Table 4.0: Frequency of IOL Stratified for Sub Groups

Group	Sub Group	Obese (n=91)	Non-Obese (n=91)	p-value
Maternal Age	18-30 years	21/55 (38.2%)	5/54 (9.3%)	0.000
	31-40 years	11/36 (30.6%)	6/37 (16.2%)	0.147
Gestational Age	37-39 weeks	17/57 (29.8%)	5/52 (9.6%)	0.009
	≥40 weeks	15/34 (44.1%)	6/39 (15.4%)	0.007
MOD	Vaginal Delivery	7/37 (18.9%)	5/54 (9.3%)	0.181
	Cesarean Delivery	25/54 (46.3%)	6/37 (16.0%)	0.003
Parity	1-2	24/66(36.4%)	5/61 (8.2%)	0.000
	>2	8/25 (32.0%)	6/30 (20.6%)	0.309

Chi Square test/ Fisher's Exact test, taking p-value≤0.05 as significant.

DISCUSSION

Obesity in pregnancy is a growing concern worldwide and is associated with adverse maternal and neonatal outcomes, including increased risk of labor complications, prolonged labor, and higher rates of cesarean delivery.[12,13] Existing studies have reported conflicting results regarding the impact of maternal Body Mass

Index (BMI) on the likelihood of labor induction, with some suggesting a strong association while others finding minimal effect.[10,11] Due to these inconsistencies, there is a need for further investigation to clarify the relationship. This study was therefore planned to evaluate the association between maternal BMI and induction of labor, aiming to provide clearer evidence on its impact on obstetric outcomes.

The findings of the present study align with several international and national studies demonstrating the influence of pre-pregnancy body mass index (BMI) on pregnancy outcomes. In Pakistan, Qazi et al. reported a statistically significant association between elevated pre-pregnancy BMI and postdates pregnancy (OR: 4.93; 95% CI: 1.98–12.26; $p = 0.001$). In contrast, the association between high BMI and induction of labor (IOL) was not statistically significant (OR: 0.56; 95% CI: 0.21–1.48; $p < 0.001$). Additionally, higher BMI was linked with increased rates of instrumental deliveries ($p = 0.0005$) and cesarean sections (CS) ($p = 0.0001$). These results suggest that women with elevated BMI are more likely to experience prolonged pregnancies, contributing to a higher likelihood of operative interventions.[10]

Similarly, Angeliki et al., in a Greek cohort, demonstrated that rising BMI independently increased the odds of cesarean delivery, with overweight and obese women having 1.58 and 2.75 times higher likelihood of CS, respectively. The CS rate increased progressively from 10.2% in normal BMI women to 15.8% in overweight and 24.9% in obese women ($p < 0.001$). Interestingly, unlike the Pakistani study, instrumental delivery rates were not significantly affected by BMI in this cohort. However, Apgar scores at one and five minutes were lower in overweight and obese women, emphasizing the neonatal impact of maternal obesity. The study highlighted the crucial role of midwives in preconception weight management to reduce adverse maternal and neonatal outcomes.[11]

The relationship between maternal BMI and labor dynamics was further elucidated by Carlhäll et al., who observed that the duration of active labor was influenced by maternal BMI, particularly in underweight women and those with BMI ≥40 kg/m². While women with extreme obesity who reached active labor had similar chances of spontaneous vaginal delivery (SVD) as normal-weight women, both labor duration and CS rates were elevated. These findings indicate that maternal obesity may prolong the latent and active phases of labor, increasing the probability of surgical interventions.[14]

Dammer et al. reported that higher BMI negatively impacts labor induction at term, with nulliparous women being particularly affected. This aligns with the present study, which showed prolonged labor and increased operative interventions in obese women.[15] Taoudi et al. further reinforced these observations by reporting that women over 25 years with overweight or obesity exhibited a fourfold higher CS rate compared to normal-weight women (53.8% vs. 12.8%; $p = 0.018$). Additionally, post-term pregnancy was significantly higher in obese women (33.8% vs. 20.2%; $p = 0.013$), and elevated gestational BMI correlated positively with neonatal birth weight ($r = 0.29$; $p < 0.001$), leading to a higher prevalence of macrosomia. Obesity was also associated with increased maternal complications, including gestational diabetes, anemia, and preeclampsia, highlighting the burden of maternal obesity on both health systems and families.[16]

In a cohort of 955 women, Teal et al. observed that BMI ≥35 was associated with decreased odds of vaginal delivery (OR 0.5; 95% CI 0.3–0.9) and longer IOL duration, with a median labor time of 37.9 hours in the highest BMI group ($p < 0.0001$). However, after adjusting for confounders, BMI was not linked with maternal or neonatal morbidity, suggesting that higher BMI primarily affects labor progression and mode of delivery rather than perinatal complications directly.[17]

Collectively, the literature emphasizes that higher pre-pregnancy BMI is associated with increased risk of postdates pregnancy, prolonged labor, higher rates of cesarean and instrumental deliveries, and certain neonatal risks such as lower Apgar scores and macrosomia. These findings underscore the importance of preconception counseling and weight management interventions to optimize maternal and neonatal outcomes.

CONCLUSION

In this study, obesity was significantly associated with higher rates of labor induction and cesarean delivery, as well as longer labor duration. Obese women had nearly four times higher odds of induction compared to non-obese women, highlighting BMI as an important factor influencing obstetric outcomes.

LIMITATIONS & RECOMMENDATIONS

This study's strengths include a well-defined cohort, equal representation of obese and non-obese participants, and comprehensive analysis of labor outcomes, allowing meaningful comparison with existing literature. Limitations include its single-center design, modest sample size, and lack of long-term neonatal follow-up, which may affect generalizability. Future research should involve multicenter, larger-scale studies, explore the impact of maternal BMI on postpartum and neonatal outcomes, and evaluate targeted interventions for weight management before and during pregnancy.

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Authors Contribution

Author 1

Substantial contributions to study design, acquisition of data
Analysis & Interpretation of Data, Manuscript writing
Has given final approval of the version to be published
Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Author 2-4

Substantial contributions to concept, study design, Data Analysis,
Manuscript writing, Critical Review
Has given final approval of the version to be published
Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Author 5,6

Substantial contributions to Concept, Data Analysis & Interpretation,
Manuscript writing, Critical Review
Has given final approval of the version to be published
Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

REFERENCES

Lueth GD, Kebede A, Medhanyie AA. Prevalence, outcomes and associated factors of labor induction among women delivered at public hospitals of MEKELLE town- (a hospital based cross sectional study). BMC Pregnancy Childbirth. 2020;20(1):1-9.

Yosef T, Getachew D. Proportion and outcome of induction of labor among mothers who delivered in teaching hospital, Southwest Ethiopia. Front Public Health. 2021;9(1):686682.

Carlson N, Ellis J, Page K, Dunn Amore A, Phillippi J. Review of evidence-based methods for successful labor induction. J Midwifery Womens Health. 2021;66(4):459-69.

Assemie MA, Mihiret GT, Mekonnen C, Petrucka P, Getaneh T, Ashebir W. Outcomes and associated factors of induction of labor in East Gojjam Zone, Northwest Ethiopia: a multicenter cross-sectional study. Obstet Gynecol Int. 2023;2023;1-7.

Soomro SB, Mahar F, Akhtar T. Elective induction of labor and postpartum hemorrhage in females presenting for normal vaginal delivery at term. Pak J Med Health Sci. 2022;16(08):303-5.

Wheeler V, Hoffman A, Bybel M. Cervical ripening and induction of labor. Am Fam Physician. 2022 Feb;105(2):177-86.

Eberle A, Czuzoj-Shulman N, Azoulay L, Abenhaim HA. Induction of labor at 39 weeks and risk of cesarean delivery among obese women: a retrospective propensity score matched study. J Perinat Med. 2021;49(7):791-6.

Sanchez-Ramos L, Levine LD, Sciscione AC, Mozurkewich EL, Ramsey PS, Adair CD, et al. Methods for the induction of labor: efficacy and safety. Am J Obstet Gynecol. 2024;230(3):S669-95.

Agwara EO, Tendongfor N, Jaja PT, Choy AM, Egbe TO. Prevalence and pregnant women's knowledge of maternal obesity and excessive gestational weight gain among women attending antenatal care in Fako Division, Cameroon. Pan Afr Med J. 2023;44(4):2-13.

Qazi Q, Liaqat N, Hussain SS, Syed W. Association of high body mass index and postdates pregnancy. Pak J Med Sci. 2022;38(5):1371-5.

Angeliki A, Dimitrios P, Chara T. Maternal obesity and its association with the mode of delivery and the neonatal outcome in induced labour: implications for midwifery practice. Eur J Midwifery. 2018;2(1):11-8.

Ashraf R, Maxwell C, D'Souza R. Induction of labour in pregnant individuals with obesity. Best Pract Res Clin Obstet Gynaecol. 2022;79:70-80.

Kammies JD, De Waard L, Muller CJ, Hall DR. Delivery outcomes in women with morbid obesity, where induction of labour was planned to prevent post-term complications. J Obstet Gynaecol. 2022;42(8):3450-5.

Carlhäll S, Källén K, Blomberg M. The effect of maternal body mass index on duration of induced labor. Acta Obstet Gynecol Scand. 2020;99(5):669-78.

Dammer U, Bogner R, Weiss C, Faschingbauer F, Pretscher J, Beckmann MW, et al. Influence of body mass index on induction of labor: a historical cohort study. J Obstet Gynaecol Res. 2018;44(4):697-707.

Taoudi F, Laamiri FZ, Barich F, Hasswane N, Aguenaou H, Barkat A. Study of the prevalence of obesity and its association with maternal and neonatal characteristics and morbidity profile in a population of Moroccan pregnant women. J Nutr Metab. 2021;2021:6188847.

Teal EN, Lewkowitz A, Koser S, Tran C, Gaw S. Relationship between maternal BMI and labor induction outcomes. Obstet Gynecol. 2019;133:216.