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The Effect Of Maternal Body Mass Index On Duration Of Induced Labor

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Abstract

Background: Induction is the stimulation of uterine contractions to aid childbirth. Meanwhile, the prevalence of obesity is predicted to grow by 33% worldwide by the year 2030. Genetic, environmental, behavioral, and social elements all have a role in the development of obesity. The prevalence of obesity is highly associated with both ancestry and ethnicity. Numerous illnesses and malignancies are only a few of the many that can be exacerbated by obesity. Menstrual irregularities, infertility, and premature birth are just a few of the ways that obesity negatively affects a woman's ability to have healthy, natural children. Longer labors and more cesarean sections are directly related to the rising prevalence of maternal obesity, which also correlates with an increase in the use of labor induction.

The present study aims to evaluate the effect of maternal body mass index on the duration of induction of labor. **Methods:** A prospective cohort study was conducted at Al-Zahraa Teaching Hospital from December 2022 to June 2023. It included 100 pregnant women divided into overweight/obese and non-obese groups. Prim and multi gravida term pregnant women with unfavorable cervix and not in labor were included. The collected data included demographical, menstrual, medical, and surgical history, and assessment of labor duration and success. Labor was induced by using PGE1 and oxytocin. Failed induction was defined as cervical dilatation >4 cm not achieved after 12 ± 3 h of labor or ending with a cesarean section. **Results:** The study examined 100 women undergoing labor induction, finding a success rate of 80% for vaginal delivery and 20% ending in caesarean sections. Notably, failed inductions were associated with larger gestational age and higher Body Mass Index (BMI). In fact, 90% of those who had a failed induction of labor were obese (BMI >30 kg/m²). Despite these findings, there were no significant variations in maternal age, gravidity, parity, and miscarriage rates between the successful and failed induction groups. **Conclusion:** Higher BMI increases the likelihood of failed labor induction but its impact on the duration of induction is not clearly established from the current data which may need further study with increasing sample size.

Key Word : Obesity, BMI, Induced Labor.

INTRODUCTION

Due to its link with obstetrical interventions and difficulties, the rising prevalence of overweight and obesity among pregnant women is a cause for a considerable concern (1, 2). Inducing labor (IOL) is a common necessity for morbidly obese mothers and is associated with an increased risk of post-term pregnancy and pregnancy problems(3, 4). However, there is a need to investigate the correlation between maternal MBI and the length of IOL because of the increased risk of cesarean section (CS) in obese first-time mothers' (BMI) (5).

Numerous health problems, including heart disease, diabetes, joint pain, and even some forms of cancer, have been linked to obesity(6). Sleep apnea, high blood pressure, cardiovascular illness, and psychological issues are all linked to being overweight(7). It also has negative effects on a woman's ability to have children, increasing the likelihood of infertility, miscarriage, and irregular menstrual cycles(8, 9). In addition, hypothalamic-pituitary-gonadal axis abnormalities, which are associated with obesity, can lead to anovulation and infertility(8, 10, 11). Obese women may need more time in labor before a diagnosis of labor arrest can be made, which has significant consequences for the length of induced labor(12).

Obese primiparous women, who may be considerably affected in future pregnancies and delivery, may benefit greatly from a better understanding of the correlation between maternal BMI and the length of induced labor.

Aims: The purpose of this article is to investigate the impact of maternal MBI on the length of induced labor, and thereby to illuminate the causes of labor delay in overweight women and informing clinical practice. It also aims to evaluate the effect of BMI on duration of IOL.

Patients and Methods:

This prospective cohort study was conducted at Al-Zahraa Teaching Hospital, Department of Obstetrics and Gynecology for a period extended from the beginning of December 2022 to the 1st of June 2023. The studied sample will include 100 pregnant women attending to the above-mentioned hospital for IOL.

The sample is divided into two groups; the first is the case group which included women with BMI equal or more than 25 kg/m^2 (overweight and obese women). The second group (the control group) included women with BMI less than 25 kg/m^2 (non-obese).

The inclusion criteria were prim and multi gravida term pregnant ladies (>37 weeks) with a vertex presentation, unfavorable cervix (defined as bishop score less than 6), and not in labor.

The exclusion criteria were previous cesarean delivery or rupture uterus, previous uterine or cervical surgery, suspected macrosomia (ultrasound suspected body weight >4500 gr), fetal congenital abnormality or fetal death, any contraindications to vaginal delivery, abnormal situated placenta, or breach or transvers lie.

All cases were interviewed with predesigned forma that included the demographical data: age, gravidity, parity, abortion, educational level, residency, and menstrual history including the age of menarche, regularity of the cycle, past medical history, and past surgical history. A clinical examination was offered with measuring patient weight and height with estimation of BMI. In addition, an assessment of bishop score and trans vaginal ultrasound examination followed to reach active phase >4cm or successful induction with recording of the duration of the labor and the mode of the delivery and finally report the success of the IOL.

Anthropometric Measurements

The pregnant were determined by using anthropometric measurements which were taken during the study like weight and height. Weight was measured, with the shoes and heavy clothes removed, to the nearest 0.05 kg. with the use of mechanical and electronic scales in kilograms and the height was measured, with shoes removed, to the nearest 0.1cm. by using a tape measure. The BMI calculation is done by dividing the adult weight in kilograms(kg) by their height in square meters (m).

Methods of IOL

When the Bishop score was less than 5, a vaginal tab of prostaglandin E1 (PGE1) - Misoprostol (Vagiprost 25 microgram, Adwia pharmaceuticals, Cairo, Egypt) was inserted into the posterior vaginal fornix to induce labor. After 6-8 hours, if sufficient cervical softening had not occurred, more dosages were administered. When the necessary level of cervical ripening has been reached, defined as a Bishop score >7, 4 pills have been used, or 24 hours have elapsed, the process is repeated.

An hour after PGE1 was administered, the fetal heart rate was monitored, and subsequent checks were made every three hours. In the event of uterine tachysystole, an unsettling fetal heart rate, effective cervical ripening, or after 24 hours of insertion, the vaginal PGE1 tab should be removed. Participants who showed positive responses to the IOL were taken to the delivery room, and oxytocin augmentation of labor was performed if necessary. The uterine contraction patterns informed the decision to inject oxytocin. An infusion of diluted oxytocin was injected intravenously. Starting at 5 mU/min, the infusion rate was doubled every 30 minutes all the way up to a peak of 30 mU/min at the time of delivery.

Failure of IOL was defined as the inability to achieve cervical dilatation >4 cm after 12 ± 3 h of IOL (with a goal 3 contractions/10 min), or those ended with caesarean section.

Ethical considerations

Faculty of Medicine's Scientific and Ethical Committees gave their complete blessing to the study's proposed methodology, and the scientific committee at Al-Zahraa Teaching Hospital also gave their approval. Each participant provided verbal agreement following a thorough explanation of the study's goals and the confidentiality of their data.

Statistical analysis

The information was entered into IBM - SPSS V26 and imported from Microsoft Excel worksheet 16. Data given as rates, frequencies, means, and standard deviations are analyzed using statistical tests such as the Chi-squared test and the Student's t-test, respectively, to determine any significant differences.

Results

The study includes 100 women underwent IOL. The mean maternal age at presentation was 26.92 ±6.87 years, with the mean gestational age being 38.88 ±2.74 weeks. The cause of IOL is shown in

Figure **1**; the most common indication was postdate (54%).

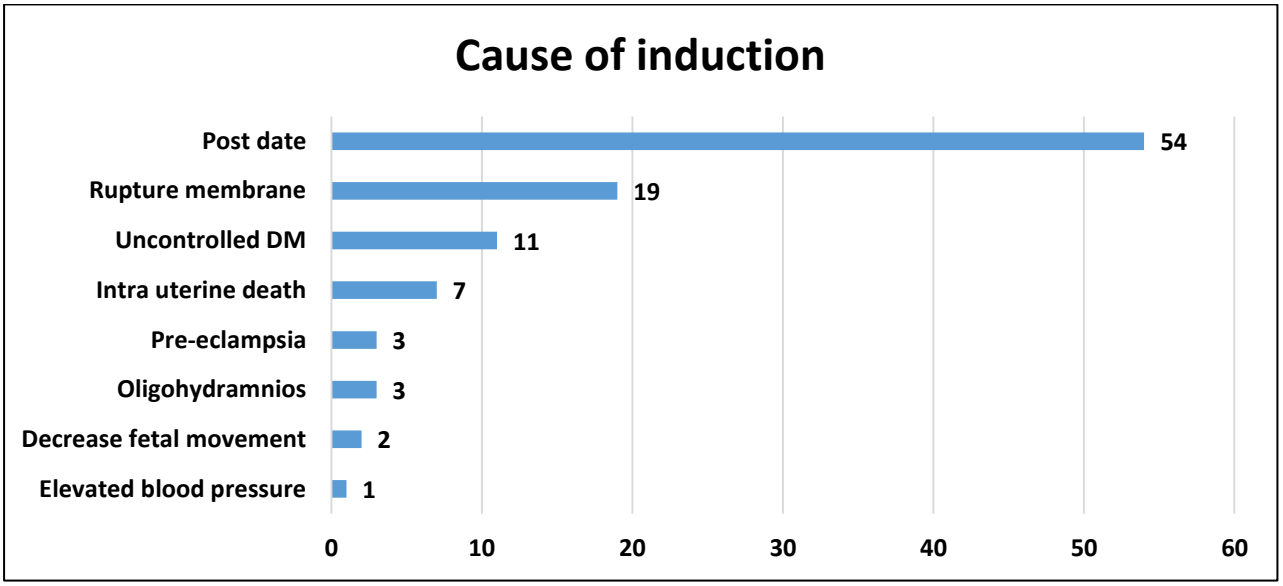

Figure 1: Causes of IOL.

The fate of the IOL was either successful, ending by vaginal delivery, in 80% or failure of IOL, ending by caesarean section, in 20%. According to the outcome of IOL, the data were divided into two groups, Group A with C/S delivery, and Group B with successful vaginal delivery.

The mean maternal age, gravidity, parity, and miscarriage were not different between the two groups while cases of failure of IOL had been associated with larger gestational age and BMI than those with successful vaginal delivery, as shown in Table 1. below:

Table 1: Distribution of Patient Characteristics according to the Groups of the Study.

Variables	Group A (n=20)	Group B (n=80)	P value
	Mean ±SD	Mean ±SD	
Maternal age	26.7 ±7.26	26.98 ±6.82	0.879
Gravidity	2.65 ±2.28	3.16 ±2.02	0.366
Parity	1.2 ±2.04	1.89 ±1.81	0.180
Miscarriage	0.45 ±0.89	0.23 ±0.57	0.292
Gestational age (weeks)	40.35 ±1.35	38.51 ±2.88	<0.0001
BMI	35.51 ±4.55	30.63 ±3.16	<0.0001

Regarding social and past medical histories, no difference was found in the outcome of the IOL; the BMI in was distributed as follow: 90% of those who had failure of IOL were obese (BMI >30 kg/m^2), as shown in Table 2. below.

Table 2: Distribution of Social and Past Medical Histories between the Two Groups

Variables		Group A	Group B	P value
		No. (%)	No. (%)	
Educational level	Illiterate	0 (0)	8 (10)	0.487

	Primary	8 (40)	33 (41.3)	
	Secondary	8 (40)	27 (33.8)	
	University	4 (20)	12 (15)	
Residency	Urban	10 (50)	36 (45)	0.688
	Rural	10 (50)	44 (55)	
DM	Yes	2 (10)	13 (16.3)	0.484
	No	18 (90)	67 (83.8)	
HT	Yes	8 (40)	16 (20)	0.061
	No	12 (60)	64 (80)	
Thyroid disease	Yes	1 (5)	3 (3.8)	0.799
	No	19 (95)	77 (96.3)	

The BMI in was distributed as follow: 90% of those who had failure of IOL were obese (BMI >30 kg/m^2), as shown in Table 1. below:

Table 2: Distribution of BMI according to the Study Groups.

BMI Group	Group A	Group B	P value
	No. (%)	No. (%)	
<25	0 (0)	3 (3.8)	<0.0001
25-30	2 (10)	16 (20)	
30-35	4 (20)	58 (72.5)	
35-40	8 (40)	1 (1.3)	
>40	6 (30)	2 (2.5)	

The cause for IOL and the method used was not different statistically in those who had successfully delivered than those who required C/S, as shown in Table 4. below:

Table 4: Distribution of the Cause and Method of Induction between the Two Groups.

Variables		Group A	Group B	P value
		No. (%)	No. (%)	
Cause of induction	Post date	16 (80)	38 (47.5)	0.231
	Decrease fetal movement	0 (0)	2 (2.5)	
	Elevated blood pressure	0 (0)	1 (1.3)	
	Intra uterine death	0 (0)	7 (8.8)	
	Oligohydramnios	1 (5)	2 (2.5)	
	Pre-eclampsia	0 (0)	3 (3.8)	
	Rupture membrane	1 (5)	18 (22.5)	
	Uncontrolled dm	2 (10)	9 (11.3)	
Type of induction	vageprost	19 (95)	62 (77.5)	0.074
	Pitocen	1 (5)	18 (22.5)	

The duration of labor was not different between the two groups, as shown in Figure 2. below:

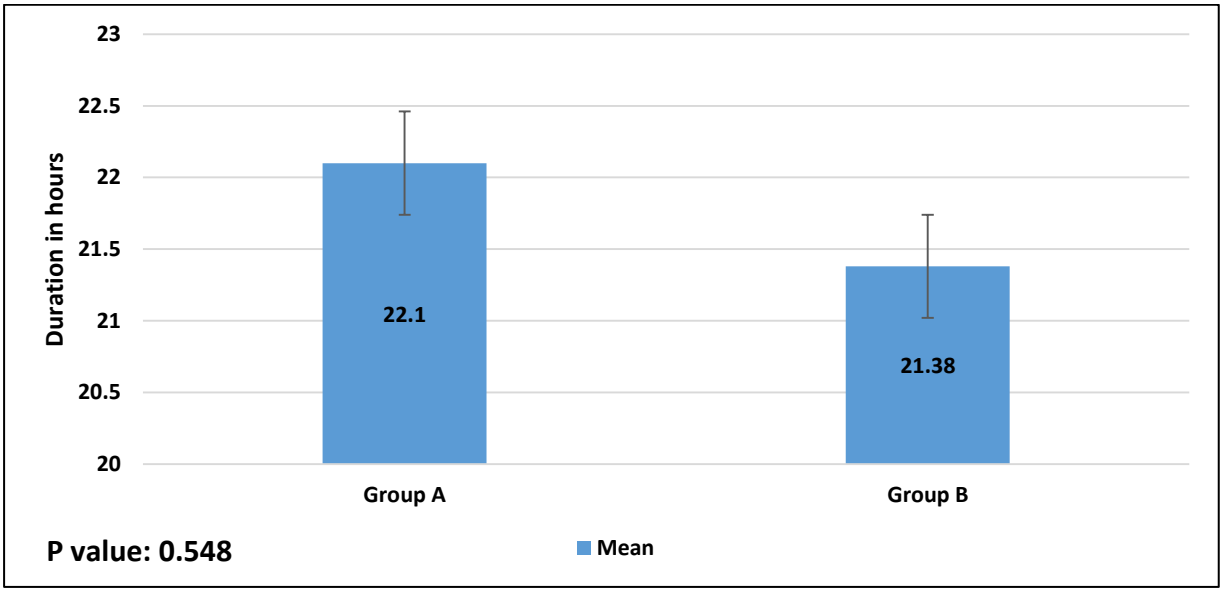

Figure 2: Duration of Labor according to the Study Group.

For the estimation of the predictors of duration of labor we applied regression analysis, which showed that BMI, is the independent variable that predict the duration of labor as shown in Table 3. below:

Table 4: Regression Analysis for Prediction of Duration of Labor.

Variables	Unstandardized Coefficients		Standardized Coefficients	t	P value
	B	Std. Error	Beta		
Maternal age	0.023	0.113	0.034	0.207	0.836
Gravidity	0.002	1.235	0.001	0.002	0.999
Parity	-1.428	1.174	-0.568	-1.217	0.227
Miscarriage	1.285	1.383	0.177	0.929	0.356
Gestational age	-0.306	0.251	-0.178	-1.221	0.226
BMI	0.322	0.144	0.272	2.235	0.028
Educational level	-0.629	0.612	-0.114	-1.028	0.307
Residency	0.438	0.996	0.047	0.44	0.661
Mode of delivery	-1.959	1.394	-0.168	-1.406	0.163
Cause of induction	-0.315	0.368	-0.194	-0.857	0.394
Diabetes	-2.107	2.112	-0.161	-0.998	0.321
Hypertension	-1.068	1.237	-0.098	-0.864	0.39
Thyroid disease	-2.86	2.35	-0.12	-1.217	0.227
Type of induction	0.034	1.967	0.003	0.017	0.986

Neonatal outcome was not different in the term of gender, requirement for NICU admission, and neonatal death, as shown in Table 5. below:

Table 6: Neonatal Outcome according to the Study Groups.

Variables		Group A	Group B	P value
		No. (%)	No. (%)	
Gender	Female	6 (30)	29 (36.3)	0.600

	Male	14 (70)	51 (63.7)	
requirement of NICU	Yes	4 (20)	16 (20)	1.000
	No	16 (80)	64 (80)	
Neonatal death	Yes	0 (0)	7 (8.8)	0.170
	No	20 (100)	73 (91.3)	

Discussion

Having a higher BMI can make it more challenging to induce labor, slow down the progress of labor, raise the risk of complications, and increase the possibility of a cesarean section; all of which can lengthen the overall time of labor(5). The present study's primary aim was to determine if maternal BMI was related to the outcome of IOL.

The study included 100 women with mean age of 26.92 ±6.87 years. The most common indication of IOL was postdate (54%), similarly found by Ramana et al(13). The rate of success of IOL in the current study was 80%, this result was consistent with the findings of previous studies (Tatić-Stupar et al(14) and Lueth et al(15)). The current study included women with a comparable maternal age to eliminate selection bias. Walker et al(16) found that maternal age did not affect the maternal and neonatal outcome in cases of IOL. Besides, the parity had no effect on the success rate of IOL, while Denona et al(17) found in their large cross-sectional study (n=2334) that nulliparous women had four time risk of C/S after IOL than multiparous women. This variability of the result could be attributed to the small sample size used in the current study,

The failure rate of IOL is significantly associated with the gestational age in the current study. Similarly found by Heffner et al(18), the larger gestational age is independent predictor of need of C/S in cases of IOL. As gestational age increases, the need for a C/S in induced labor tends to increase due to several factors. Larger gestational age often means a larger fetal size, which can make vaginal delivery more difficult. Additionally, post-term pregnancy and physiological changes in the mother's body may complicate labor, while induction could be less effective, leading to labor that fails to progress. Lastly, with advancing gestational age, the placenta may become less efficient, potentially causing fetal distress and necessitating a C/S for the safety of mother and baby.

Regarding BMI, the cases that required C/S had higher Mean BMI than those delivered vaginally. All of C/S cases were overweight or obese; furthermore, 40% of C/S cases were obese (BMI 35-40 kg/m^2). Abdo et al(19) found that higher BMI is associated with higher rate of postdate, failure of progression of labor, and failure of IOL. Myers et al(20) found that women with BMI >40 kg/m^2 had significantly increased risk of failure of IOL and requirement of C/S. Maternal BMI has been linked to increased C/S rates due to several factors. High BMI can slow labor progression, possibly due to differences in uterine muscle function as found by O'Brien et al(21) . Labor induction may be more challenging in obese women, while risks of complications such as gestational diabetes (Sugiyama et al(22)) and preeclampsia (Ahmad et al(23)) are higher, potentially necessitating a C/S. Furthermore, high BMI is often associated with larger babies (macrosomia), increasing the risk of delivery complications as stated by Song et al(24). Finally, administering regional anesthesia used in vaginal delivery can be more difficult in overweight and obese women, contributing to a greater likelihood of C/S.

The cause of IOL was not different statistically regarding success of IOL. The better patient selection and reviewing the indication of start

the trial of IOL is paramount to the success of the induction. Furthermore, monitoring maternal and fetal clinical state is essential to determine the possibility of continuation of the IOL. The type of medication used for the IOL did not influence the success rate of IOL and the duration of labor and neonatal outcome was not different between the two group.

Conclusion

A higher BMI increases the likelihood of failed labor induction that required CS, but its impact on the duration of induction is not clearly established from the current study data which may need further study with increasing sample size.

Recommendations

- Counsel High BMI Women: Inform them about the potential labor challenges they may face.
- Implement Weight Management: Include strategies during prenatal care to address risks of high BMI.
- Conduct More Research: Further studies with increasing sample size that focus on the impact of BMI on labor induction duration and how to improve outcomes.
- Provide Personalized Care: Plan care according to each patient's BMI, potentially considering different induction methods for high BMI patients.
- Educate Healthcare Providers: Train them in managing labor induction in high BMI patients.
- Promote Public Health Initiatives: Support efforts to reduce obesity, which can improve pregnancy outcomes.
- Implement Relevant Policies: Ensure BMI is considered in prenatal and perinatal care through effective healthcare system policies.

References:

1. Luis Sanchez ID. induction of labor and termination of the previable pregnancy; James, David K, Steer, Philip J, Weiner, Carl P; High risk pregnancy: management options-expert consult. 4th ed. Amsterdam: Elsevier Health Sciences; 2010. 1145-68 p.
2. Abarca-Gómez L, Abdeen ZA, Hamid ZA, Abu-Rmeileh NM, Acosta-Cazares B, Acuin C, et al. Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128· 9 million children, adolescents, and adults. *The lancet*. 2017;390(10113):2627-42.
3. Stang J, Huffman LG. Position of the Academy of Nutrition and Dietetics: Obesity, Reproduction, and Pregnancy Outcomes. *J Acad Nutr Diet*. 2016;116(4):677-91 DOI: 10.1016/j.jand.2016.01.008.
4. Hermesch AC, Allshouse AA, Heyborne KD. Body Mass Index and the Spontaneous Onset of Parturition. *Obstet Gynecol*. 2016;128(5):1033-8 DOI: 10.1097/aog.0000000000001678.
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 DOI: 10.1111/aogs.13795.
6. MAJEED S, AZHAR R, MUSHTAQ A, JAMAL T, ASHFAQ S. Indicators of Obesity and Cardiovascular Parameters in Obese and Non-Obese Subjects. *Age (year)*.42(3.1):40.22-1.5.
7. Courcoulas AP, Schauer PR. The Surgical Management of Obesity. In: Brunicardi FC, Dana K. Andersen, Timothy R. Billiar, David L. Dunn, John G. Hunter, Lillian S. Kao, et al., editors. Schwartz's Principles of Surgery. 2. 11th ed. New York, USA: McGraw-hill; 2019. p. 1170-2.
8. Kutlu R, Özberk DI, Görkemli H. Incidence of Metabolic Syndrome and Long-Term Chronic Health Problems in Infertile Women. *Istanbul Medical Journal*. 2017;18(4).
9. He Y, Tian J, Oddy WH, Dwyer T, Venn AJ. Association of childhood obesity

with female infertility in adulthood: a 25-year follow-up study. *Fertility and Sterility*. 2018;110(4):596-604. e1.
10. Silvestris E, de Pergola G, Rosania R, Loverro G. Obesity as disruptor of the female fertility. *Reproductive Biology and Endocrinology*. 2018;16(1):1-13.
11. Pickett-Blakely O, Uwakwe L, Rashid F. Obesity in women: The clinical impact on gastrointestinal and reproductive health and disease management. *Gastroenterology Clinics*. 2016;45(2):317-31.
12. Frederiks F, Lee S, Dekker G. Risk factors for failed induction in nulliparous women. *J Matern Fetal Neonatal Med*. 2012;25(12):2479-87 DOI: 10.3109/14767058.2012.703718.
13. Ramana M, Fathima N. A comparative study of single versus multiple instillations of intravaginal PGE2 gel for induction of labour. *Indian J Obstet Gynecol Res*. 2019;6(3):282-7.
14. Tatić-Stupar Ž, Novakov-Mikić A, Bogavac M, Milatović S, Sekulić S. Prediction of labor induction outcome using different clinical parameters. *Srpski arhiv za celokupno lekarstvo*. 2013;141(11-12):770-4.
15. 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 and childbirth*. 2020;20(1):1-10.
16. Walker KF, Dritsaki M, Bugg G, Macpherson M, McCormick C, Grace N, et al. Labour induction near term for women aged 35 or over: an economic evaluation. *BJOG: An International Journal of Obstetrics & Gynaecology*. 2017;124(6):929-34.
17. Denona B, Foley M, Mahony R, Robson M. Discrimination by parity is a prerequisite for assessing induction of labour outcome – cross-sectional study. *BMC Pregnancy and Childbirth*. 2020;20(1) DOI: 10.1186/s12884-020-03334-8.
18. Heffner LJ, Elkin E, Fretts RC. Impact of labor induction, gestational age, and maternal age on cesarean delivery rates. *Obstetrics & Gynecology*. 2003;102(2):287-93 DOI: https://doi.org/10.1016/S0029-7844(03)00531-3.
19. Abdo MM, Kamel HAH, Ibrahim ASM. Maternal Obesity and Its Effect in Late Pregnancy and Labour. *The Egyptian Journal of Hospital Medicine*. 2018;71(4):2982-8.
20. Myers BA, Root EA, Mukherjee A, Gaskins J, Pierson RC, Kline J. Increased Risk of Cesarean Delivery in Severely Obese Patients Who Are Induced Electively or For Obese Status Alone. *Obstetrics & Gynecology*. 2022;139(1):61S-2S.
21. O'Brien M, Carbin S, Morrison JJ, Smith TJ. Decreased myometrial p160 ROCK-1 expression in obese women at term pregnancy. *Reproductive Biology and Endocrinology*. 2013;11(1):1-8.
22. Sugiyama T, Nagao K, Metoki H, Nishigori H, Saito M, Tokunaga H, et al. Pregnancy outcomes of gestational diabetes mellitus according to pre-gestational BMI in a retrospective multi-institutional study in Japan. *Endocrine journal*. 2014;61(4):373-80.
23. Ahmad N. Relationship Between Nutritional Status and Preeclampsia in West Bandung District. *KnE Medicine*. 2022:224–30-–30.
24. Song X, Chen L, Zhang S, Liu Y, Wei J, Sun M, et al. High maternal triglyceride levels mediate the association between pre-pregnancy overweight/obesity and macrosomia among singleton term non-diabetic pregnancies: a prospective cohort study in central China. *Nutrients*. 2022;14(10):2075.