Failed induction of labour and associated factors among women delivered in Jigjiga University Sheik Hassan Yabare Referral Hospital: a cross-sectional study

Andualem Mebratu (andualemmeberatu@yahoo.com)
Jigjiga University
Dawit Getachew Assefa
Dilla University
Eden Dagnachew Zeleke
Bule Hora University
Wondwosen Molla
Dilla University
Nebiyu Mengistu
Dilla University
Tigist Tekle Woldesenbet
Pharma College
Amdehiwot Aynalem
Hawassa University
Ahmedin Sefa
Dilla University
Dawit Mellesse
Dire Dawa University

Research Article

Keywords: Magnitude, Associated factors, Failed induction of labour

Posted Date: December 13th, 2021

DOI: https://doi.org/10.21203/rs.3.rs-1146427/v1

Abstract

Introduction: Induction of labour is one component of comprehensive obstetrics care services that is increasing employed in modern day obstetrics to decrease the risk of maternal and neonatal morbidity and mortality. However, it has been strongly associated with poor maternal and perinatal outcomes. Therefore, his study was aimed to assess the magnitude of failed induction of labour and associated factors among mothers delivered at Jigjiga University Sheik Hassan Yabare referral Hospital, Eastern Ethiopia from June 1 to June 30, 2021.

Methods: An institutional based cross-sectional study was carried out among 364 women's delivered at Jigjiga University Sheik Hassan Yabare Referral Hospital from 2018 to 2021. A checklist was used to collect the data from the women's chart. To isolate independent predictors related to failed induction of labour, multivariate logistic regression analyses were performed.

Result: Our study participants were 364 women's. The magnitude of failed induction of labour was 36.8% (95% CI: 31.8, 42.0). Age of the mother (<30 years) (AOR= 3.2; CI: 1.78, 5.75), rural residency (AOR=2.28; CI:1.29, 4.01), being primi-para (AOR= 2.76; CI: 1.55, 4.91), gestational age less than 37 or greater than 42 year (AOR= 2.65; CI: 1.44, 4.89) , multiple ton of pregnancy (AOR= 2.36; CI: 1.01, 5.55), premature rapture of membrane (AOR= 4.88; CI: 2.33, 10.21), pregnancy induced hypertension (AOR= 5.11; CI: 2.67, 9.79), and bishop score less than six (AOR= 1.95; CI: 1.15, 3.32) were significantly associated with failed induction of labour.

Conclusion: The magnitude of failed induction of labour among mothers undergoing labor induction was relatively high in the study settings compared with previous studies in the country. Failed induction of labour was significantly associated with age of the mother (<30 years), rural residency, being primi-para, gestational age less than 37 or greater than 42 years, multiple ton of pregnancy, premature rapture of membrane, pregnancy induced hypertension, and bishop score less than six.

Introduction

Labour induction is a common obstetric intervention used to bring an end to pregnancies when the benefits of giving birth and prevent risks related to such problems and helps to improve the maternal and neonatal outcome [1, 2]. It is stimulation of uterine contraction artificially after the fetus has reached viability (after the 28th week of gestation) and before the spontaneous onset of labor for accomplishing vaginal delivery. The procedure primarily employed when the benefits of delivery outweigh the risks of continuing the pregnancy [3, 4]. Elective induction of labor takes place when a mother wishes to deliver at a particular time usually after term [5–8]. However, it is recommended that induction of labour be done for medical and obstetric reasons only due to risks associated with the procedure [9, 10]. This obstetrics care service has decreased the risk of maternal and neonatal morbidity and mortality by ending the pregnancy in presence of many obstetrics and medical conditions (prolonged pregnancy, hypertensive disorders, and etc.) that threaten the continuing of pregnancy [6–8, 11].

Perhaps, this procedure may sometimes fail to generate regular contractions and cervical change after artificial rupture of membrane and at least 24 hour of oxytocin use [4, 10, 12–15]. According to previous studies conducted in Ethiopia and elsewhere in Africa, the magnitude of failure of induction of labour (IOL) was significantly higher [16, 17]. Also, a study done in Woldia Hospital, Ethiopia reported 37.1% of pregnant whose pregnancy was induced goes to caesarean section while 62.9 delivered vaginally [18] and 31.4% in Amhara Regional State, Ethiopia referral hospital's [19]. Failure of IOL is a clinical and public health concern as it results in increased cesarian section rate which is a classic example of the mismatch between evidence and practice in obstetrics. Poor IOL outcomes are rising making it a priority area in maternal health [4].

Failure is a concern for all health care professional and accurate of failure is still a difficult for the health care professionals. Despite these obstacles, Ethiopians, like many other Sub-Saharan countries, have not adequately studied the national magnitude of failed induction of labor and associated factors. Therefore, his study was aimed to assess the magnitude of failed induction of labour and associated factors among mothers delivered at Jigjiga University Sheik Hassan Yabare referral Hospital Eastern Ethiopia, to improve the understanding the reason behind the failure of induction of labor among those women whose labor is induced, and inform professionals and patients about the possible increment of caesarean section and other risks and complications that follow this procedure.

Methods

Study setting and population

An institutional based cross-sectional study was carried out among 364 women's delivered at Jigjiga University Sheik Hassan Yabare Referral Hospital, Somali Regional States, Eastern Ethiopia from 2018 to 2021. Jigjiga is the capital town of Somali Regional State located in the eastern part of Ethiopia. The region has estimated total population of 4.4 million [20], the rural population is 86% while 14% is urban population. 85% of total population led pastoral- nomadic lifestyle. The population is mainly of Somali extraction and most residents are Muslim.

The study populations were all medical records of women admitted for induction of labor delivery ward from April 01 2018 to April 01 2021 in Jigjiga University Sheik Hassan Yabarre Referral Hospital.

Sample size determination

The sample size was determined using the formula for single population proportion; Where: n = sample size, Z = standard normal distribution corresponding to significance level at $\alpha = 0.05$, p =population proportion. The magnitude of failed induction, study done in Amhara region shows that the prevalence of failed IOL in the study settings was 31.4% [19].

$$n = \frac{Z^2 a^2/2\ p(1-p)}{d^2}$$

Based on this sample size become 331. For the second objective the required sample size of this study was determined by comparing the sample size determination of second specific objective (330,190,290) with sample size determination of first specific objective (331), and then the greatest sample size was selected as a final sample of the study. So, the sample size of this study was by adding 10% of incomplete rate, the final sample was being: 364.

Eligibility criteria

Inclusion criteria

Women who gave birth after induction of labor from April 2018 to April 2021 and induction performed at gestational age (GA) of 28 weeks or more including all parity was included.

Exclusion criteria

Those who are lost card, incomplete registry and delivery before 28 weeks of gestation was excluded from the study.

Study variables

Dependent variable

Failed induction of labor (Yes/No).

Independent variables

women socio-demographic factors (age and residential address).

Obstetric characteristics (ANC follow up, parity, gestational age, bishop score, weight and sex of the newborn).

Indications of induction (post-term pregnancy, PIH, PROM and other).

Methods of induction (oxytocin only, oxytocin with prior cervical ripping, misoprostol only and artificial rupture of membrane).

Data collection methods and Analysis

From the induction registry and medical record archives, data on demographics, obstetrics history and characteristics, and descriptions of induction of labor (indication, process, mode of childbirth, maternal, and neonatal conditions) was compiled and entered into a predesigned checklist. Data were collected by

three midwifes who working in the other unit during investigation of the study. They were collected the data from women's record by using the predesigned checklist those were supervised by the principal investigator. Data was entered into Epi data 4.2 and then exported to SPSS version 20/0 for further analysis. First percentage, frequency and mean were calculated. Then, bivariate analysis was used to evaluate the relationship between various possible factors (demographic and obstetrical traits, induction indication and method) and failed induction of labor, with a p-value of less than or equal to 0.25 being used as a cut-off point for selecting candidate variables for the final multivariate logistic regression models.

Results

Socio demographic characteristics

A total of 364 mothers who gave birth after induction of labor were included. The mean (±SD) age of respondents was 25.91 (4.35) years. From all samples 266(73.1%) of them were below 30 years of age and 258 (70.9%) were urban resident respectively (Table 1**).**

Obstetric factors

From the total participant 261 (71.7%) of the women were multi-Para and 244 (66.8%) were in gestational age group of 37-42 weeks based on their last number of menstrual periods **(**Table 2**).**

Table 1
Socio demographic characteristics women who gave birth in Jigjiga University Sheik Hassan Yabarre Referral Hospital, Somali Region, Ethiopia, 2018- 2021(n=364).

Variable	Frequency	Percent
Age		
above 30	98	26.9
below 30	266	73.1
Marital status		
with partner	309	84.9
without partner	55	15.1
Residence		
urban	258	70.9
rural	106	29.1

Table 2
Obstetrics characteristics of women who gave birth in Jigjiga University Sheik Hassan Yabarre Referral Hospital, Somali region, Ethiopia, 2018- 2021 (n=364).

Variable		Frequency	Percentage (%)
Number of previous births	primi para	103	28.3
	multi para	261	71.7
Gestational age	<37wks	65	17.85
	37-40wks	243	66.75
	>42wks	56	15.4
ANC follow up	yes	306	84.1
	no	58	15.9
Ton of pregnancy	single	328	90.1
	multiple	36	9.9
Diastolic blood pressure(mmHg)	less than 60	48	13.2
	between 60-80	200	54.9
	above 80	116	31.9
sex of neonate	male	177	48.6
	female	187	51.4
Weight of newborn(gm)	<2500	69	19
	>2500	295	81

Obstetric conditions before and after induction started

The study found that at time of induction 210 (57.7%) of the women had bishop score of less than or equal to six, membrane was ruptured in 150 (41.2%) and liquor smelling in 71 (46.4%) of the women. Furthermore, 279 (76.6%) fetuses that had regular fetal heartbeat pattern before induction and 97 (34.8%) of them have developed none reassuring fetal heart beat pattern. Besides, out of the neonates who had positive fetal heartbeat at the start of induction, 54 (16.3%) of them develop adverse newborn outcome.

Indication and method of induction of labour

The predominant indications for induction of labor in the study area were pregnancy induced hypertension (23%) and the most commonly used methods were oxytocin infusion and oxytocin with cervical ripening 208 (57.1%) and 112 (30.1%) respectively, Fig. 1.

Labour outcome of induction of labour

Since the main goal of induction was to succeed vaginal delivery so that in this study all women delivered by caesarean section were considered as failed induction that makes its magnitude 36.8% (95% CI:31.8, 42.0).

Factor associated with failed induction of labour

In bivariate analysis age of the mother (<30 years), place of residence, gestational age, ANC follow-up, ton of pregnancy, weight of the newborn, rupture of membrane, premature rapture of membrane, pregnancy induced hypertension, method of induction, and bishop score before induction have showed an association.

After controlling the effect of other variables (confounders), the likelihood of failure in induction of labour in women under the age of 30 was three times higher than those women's whose age was greater than 30 years (AOR=3.20; CI:1.78, 5.75). Consistently, in women's who lives in rural area (AOR=2.28; CI: 1.3, 4.01), are primi-para (AOR=2.76; CI: 1.55, 4.91)), gestational age <37 and >42, (AOR=2.654; CI: 1.440,4.892), had multiple ton of pregnancy (AOR=2.36; CI: 1.01, 5.55), bishop score less than six (AOR=1.95; CI: 1.15, 3.32), the likelihood of failure in induction of labour was two times higher than those who lives in urban area, are multi-para, gestational age between 37-42, single ton of pregnancy, and bishop score greater than six. Furthermore, in women who had premature rapture of membrane (PROM), the likelihood of failure in induction of labour was four times higher than those didn't have PROM (4.88; CI: 2.33, 10.21), and pregnancy induced hypertension (PIH) has also increased the likelihood of induction of labour by five times as compared to those women's who didn't have PIH (AOR=5.11; CI: 2.667, 9.786) and has shown significant association with failed induction of labour (Table 3).

Table 3
Multivariate analysis of associated factors for labour outcome of induction of labour among women delivered in Jigjiga University Sheik Hassan Yabarre Referral Hospital, Somali region, Ethiopia, 2018-2021 (n=364).

Variable	Labour outcome of induction		COR (95%CI)	AOR (95%CI)	p-value
	Success (n=230)	Failed (n=134)			
Age					
<30	183(68.8%)	83(31.2%)	2.39(1.49, 3.845) **	3.202(1.784,5.75) **	**0.001**
>30	47(48%)	51(52%)	1	1	
Residence					
Urban	178(69%)	80(31%)	1	1	**0.004**
Rural	52(49.1%)	54(50.9%)	2.311(1.454,3.67) **	2.281(1.298,4.008) *	
Parity					
Multi	178(66.3%)	83(33.7%)	1	1	**0.001**
Primi	52(56.8%)	51(43.2%)	2.10(1.32,3.35) *	2.760(1.55,4.9) **	
Gestational age					
37-42wks	162(66.7%)	81(33.3%)	1	1	0.002
<37and>42	68(56.2%)	53(43.8%)	1.56(0.99,2.44) *	2.65(1.44,4.89) *	
ANC follow up					
Yes	199(65%)	107(35%)	1	1	0.191
N0	31(53.4%)	27(46.6%)	1.62(0.92,2.86)	1.6(0.79,3.23)	
Ton of pregnancy					
Single	214(65.2%)	114(34.8%)	1	1	**0.049**
Multi	16(44.4%)	20(56.6%)	2.35(1.17,4.70)	2.36(1.01,5.55)	
Weight of the newborn(gm)					
>2500	194(65.8%)	101(34.2%)	1.76 (1.04,2.99) *	0.66(0.32,1.35)	**0.250**
<2500	36(52.2%)	33(47.8%)	1	1	

(For AOR) * = statistically significant at p<0.05 **=statistically significant at p<0.001 1= reference.

Variable		Labour outcome of induction		COR (95%CI)	AOR (95%CI)	p-value
Rupture of membrane Before induction						
Yes		87(58.0%)	63(42%)	1.46(0.95,2.25)	1.38(0.74,2.58)	**0.309**
No		143(66.8%)	71(33.2%)	1	1	
Indication of induction						
PROM	YES	38(46.3%)	44(53.7%)	2.47(1.49,4.08) **	4.88(2.33,10.21) **	**0.001**
PIH	NO	192(68.1%)	90(31.9%)	1	1	
	YES	40(46%)	47(54%)	2.57 (1.57,4.19) **	5.11(2.67,9.79) **	**0.001**
	NO	190(68.6%)	87(31.4%)	1	1	
Method of induction						
Oxytocin only	YES	138(66.3%)	70(33.7%)	0.73(0.48,1.12)	0.611(0.27,1.38)	**0.234**
	NO	92(59%)	64(41%)	1	1	
Oxytocin with ripening	YES	64(57.1%)	48(42.9%)	1.448(0.92,2.28)	1.420(0.6, 3.37)	**0.426**
	NO	166(65.9%)	86(34.1%)	1	1	
Bishop score						
<6		120(57.1%)	90(42.9%)	1.875(1.20,2.92) *	1.95(1.15,3.32)	**0.014**
>6		110(71.4%)	44(28.6%)	1	1	
(For AOR) * = statistically significant at p<0.05 **=statistically significant at p<0.001 1= reference.						

Discussion

Induction of labour is one of the fastest-growing procedures in current obstetric practice. This study tried to show the magnitude of failed induction of labour and its associated factor among women delivered in Jigjiga university Sheik Hassan Yabarre referral hospital. This study has shown that the magnitude of failed induction of labour was 36.8% (95% CI:31.8, 42.0) and it exhibited by age, residence of the mother, gestational age, primi parity, ton of pregnancy, premature rupture of membrane, pregnancy induced hypertension and unfavorable pre induction bishop score. Its magnitude was higher than a WHO report in eight Latin American countries -30% [21], Kathmandu Medical College of Nepal (34.6%), Jimma University of Ethiopia (34.2%), and Amhara region multi center referral hospital 31.4% [19, 22, 23]. However, the magnitude of failed IOL found in this study was lower than the study done in woldia general hospital-37.1% [18]. But it may also be due to variation in commonly used methods of induction of labor, in which oxytocin infusion was the predominantly used method in the study area [24–26] while in the other cases

misoprostol with other safe methods like Balloon catheter was used as a common practice and also due to high number of nulliparous women came to delivery [24, 27–31]. This difference might be due to the variances in the selection criteria in which the previous studies defined failed induction only if mothers failed to achieve active first stage of labor after 6 to 8 h. In this study, any labour that led to caesarean section (C/S) after initiation of labor induction was considered a failed induction regardless of the time.

The main reason for indication of C/S in this study was failed induction of labour 82 (61.2%) followed by fetal distress 25(18.66%) and prolonged labour 20(15.67%), while cephalopelvic disproportion was 6(4.48%). However, in the University clinics of Kinshasa, the Democratic Republic of Congo, the indications of cesarean section, the leading cause was fetal distress 11.3% followed by failure of induction 7.8% and CPD 5.2% [32].

The common indications for induction of labor in the study area were pregnancy induced hypertension followed by premature rapture of membrane. Consistent result also reported from Amhara Region, Ethiopia (35.5%) followed by PROM (34.5%), post term (16.3%) and others (13.6%) [18]. Relatively to the study area study done Woldia hospital different indications for induction of labour are available from this PROM takes the largest account (36.0%) followed by hypertensive disorder of pregnancy (27.0%) [18]. Post term was the first indication for induction study done on Kathmandu medical college teaching hospital of Nepal [23]. In agreement with previous studies failed induction of labour shows significant association with age of the mother less than 30 which is three times more of going to Cesarean section delivery. This is due to as the age increase the higher chance of developing obstetrical complications and geographic location, study unit, time variations the study period, study design, logistic parameters and maternal health service quality [33, 34].

Failed induction of labour shows significant association with residence of the mother two times more in women resident in rural than urban. Consistently, a study done Dessie referral hospital also showed that women live in a rural area failed induction of labour four times more likely to develop failed induction of labour than those who lives in urban areas [35]. This is due in adequate access to reach them with available transportation to reach them to health institution and other problems due to that there may be early or late initiation of labour. Also, it was two times more in women with gestational age <37 and >42 and it was consistent with a research done in Aga Khan University [36]. This may be explained by the practice of inducing labour just after 40 weeks rather than following expectant management till 42 weeks when majority of women may present in spontaneous labour.

The odds of failed induction of labour were two times more in multiple pregnancy than in single pregnancy. This result was supported by a study done in Israel [37]. This is due to twins' pregnancy is related to premature rupture of membrane and preeclampsia those case was highly related to induction of labour. Furthermore, the odds of failed induction were two times more in women with primi parous and a study done in Woldia General Hospital and Hawassa health facility, also reported that primipara women have 3-4 times more of undergoing caesarean section due to unable deliver virginally following induction respectively [9, 18]. This would be for the reason that multiparous women have experienced pelvis when it

comes to vaginal deliveries decreasing the chance of failure of the procedure. This shows that probably contracted pelvis could have the higher incidence of failed induction in the case of nulliparous women. This is consistent with the theory that the primiparous cervix is immature, and an immature cervix requires more time to stimulate through induction.

The odds of failed induction were five times more among mothers who had induction of labor for the indication of PROM. This result was in line with other literature in Ethiopia [9]. This was due to the fact that mother with premature rupture of membrane had higher chance developing chorioamnionitis and which would compromise to fetal distress. Besides, the odd of failed induction of labour was five times more among mothers who had induction of labor for the indication of pregnancy induced hypertension. This result was supported by some studies done in Amhara Region, Ethiopia multi center referral hospital which was two times higher among mothers who had induction of labor for the indication of pregnancy induced hypertension [19]. This might be due to that pregnancy induced hypertension predisposes fetal compromise as a result of utero-placental insufficiency. In addition, it may necessitate preterm labor induction before maturation of the fetus which may easily lead to a non-reassuring fetal heart beat pattern when uterotonic agents are administered.

Moreover, the odds of failed induction was also having two times more in women who have unfavorable bishop score than those who have a favorable cervix. This association is supported by study done in Woldia hospital three times more in women who have bishop score of less than six than favorable bishop score [18]. The statistically significant association of failed induction of labour and unfavorable bishop score is plausible as an unfavorable bishop score is a sign of non-effaced cervix that may result in failure to achieve first stage of labor.

Limitation

There are significant drawbacks to the study, such as the fact that measures like bishop score are subjective, with inter and intra observer differences that might lead to bias. There might be additional variables that were not taken into consideration but could have an impact on the study's findings.

Conclusion

The magnitude of failed induction of labour among mothers undergoing labor induction was relatively high in the study settings compared with previous studies in the country. Failed induction of labour was significantly associated with higher age, residence of the mother, unfavorable bishop score, primi parity, gestational age, pregnancy induced hypertension, and PROM delivery

Abbreviations

ANC
Antenatal Care
AOR

Adjusted Odd Ratio

CI

Confidence Interval

COR

Crude Odd Ratio

C/S

Caesarean Section

GA

Gestational Age

IOL

Induction of Labour

PIH

Pregnancy Induced Hypertension

PROM

Premature Rupture of the Membranes

SD

Standard Deviation

SPSS

Statistical Package for Social Science

Declarations

Acknowledgment

First and foremost, we would like to greatly thank the almighty God, the foundation of knowledge and wisdom for enabling us to achieve this task. The authors express their gratitude to Jigjiga University Sheik Hassan Yabarre Hospital, Gynecology and Obstetrics Department, Medical Director and other stuffs for their relevant technical support.

Authors' contributions

AM, DGA, EDZ, WM, NM, TTW, AS, AA, and DM design and conceived the study, developed the tool, coordinated data collection, and carried out the statistical analysis, and drafted the manuscript. All authors read and approved the final manuscript.

Funding

This study received funding from Jigjiga university.

Availability of data and materials

Data will be available upon request from the corresponding authors.

Ethics approval and consent to participate

Ethical clearance was obtained from Jigjiga University, College of Medicine and Health Science research review committee and permission to perform the study in Jigjiga Referral Hospital from the hospital ethical review board. All participants were provided with Amharic language written consent and obtained their signature prior to participate in the study.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

References

1. Caughey AB, Sundaram V, Kaimal AJ, Cheng YW, Gienger A, Little SE, et al: **Maternal and neonatal outcomes of elective induction of labor.** *Evidence report/technology assessment* 2009**:**1.

2. Coates D, Homer C, Wilson A, Deady L, Mason E, Foureur M, et al: **Induction of labour indications and timing: A systematic analysis of clinical guidelines.** *Women Birth* 2020, **33:**219-230.

3. Nwachukwu D, Abiodun M: **Short Report Pattern of cervical dilatation among parturients in.** *An African Med* 2009, **8:**181-184.

4. Cunningham F, Leveno K, Bloom S, Spong CY, Dashe J: *Williams obstetrics, 24e.* Mcgraw-hill; 2014.

5. Dodd JM, Crowther CA, Grivell RM, Deussen AR: **Elective repeat caesarean section versus induction of labour for women with a previous caesarean birth.** *Cochrane Database Syst Rev* 2017, **7:**Cd004906.

6. Dögl M, Romundstad P: **Elective induction of labor: A prospective observational study.** 2018, **13:**e0208098.

7. Grobman WA, Caughey AB: **Elective induction of labor at 39 weeks compared with expectant management: a meta-analysis of cohort studies.** *Am J Obstet Gynecol* 2019, **221:**304-310.

8. Little SE: **Elective Induction of Labor: What is the Impact?** *Obstet Gynecol Clin North Am* 2017, **44:**601-614.

9. Geta M, Belachew T, Fekecha B: **Failed induction of labor and associated factors among women delivered in Hawassa Public health facilities, SNNPR, Ethiopia.** 2015.

10. Triebwasser JE, VanArtsdalen J, Kobernik EK, Seiler K, Langen ES: **Assessing Maternal and Fetal Risks Associated with Prolonged Induction of Labor.** *Am J Perinatol* 2019, **36:**455-459.

11. Saccone G, Berghella V: **Induction of labor at full term in uncomplicated singleton gestations: a systematic review and metaanalysis of randomized controlled trials.** *American journal of obstetrics and gynecology* 2015, **213:**629-636.

12. Kamel RA, Negm SM, Youssef A, Bianchini L, Brunelli E, Pilu G, et al: **Predicting cesarean delivery for failure to progress as an outcome of labor induction in term singleton pregnancy.** *Am J Obstet Gynecol* 2021, **224:**609.e601-609.e611.

13. Ashwal E, Hadar E, Chen R, Aviram A, Hiersch L, Gabbay-Benziv R: **Effect of fetal gender on induction of labor failure rates.** *J Matern Fetal Neonatal Med* 2017, **30:**3009-3013.

14. Batinelli L, Serafini A, Nante N, Petraglia F, Severi FM, Messina G: **Induction of labour: clinical predictive factors for success and failure.** *J Obstet Gynaecol* 2018, **38:**352-358.

15. Brik M, Mateos S, Fernandez-Buhigas I, Garbayo P, Costa G, Santacruz B: **Sonographical predictive markers of failure of induction of labour in term pregnancy.** *J Obstet Gynaecol* 2017, **37:**179-184.

16. !!! INVALID CITATION !!!

17. Abraha TH, Kasahun WW, Fisseha GK: **Failure of labor induction in Tigray region, Ethiopia: a retrospective record review study.** 2020.

18. WODAJE M: **"PREVALENCE AND FAILURE RATE OF INDUCTION OF LABOUR WITH THEIR ASSOCIATED FACTOR AMONG WOMEN DELIVERED IN WOLDIA GENERAL HOSPITAL, NORTHERN ETHIOPIA, 2018".** *adissabeba university repository* 2018.

19. Debele TZ, Cherkos EA, Badi MB, Anteneh KT, Demssie FW, Abdo AA, et al: **Factors and outcomes associated with the induction of labor in referral hospitals of Amhara regional state, Ethiopia: a multicenter study.** *BMC Pregnancy and Childbirth* 2021, **21:**1-8.

20. Csa I: **Central statistical agency (CSA)[Ethiopia] and ICF.** *Ethiopia demographic and health survey, Addis Ababa, Ethiopia and Calverton, Maryland, USA* 2016.

21. Guerra G, Cecatti J, Souza J, Faúndes A, Morais S, Gülmezoglu A, et al: **Factors and outcomes associated with the induction of labour in Latin America-BJOG: An International Journal of Obstetrics and Gynaecology-Vol. 116, 13-p. 1762-1772.** 2017.

22. Girma W, Tseadu F, Wolde M: **Outcome of induction and associated factors among term and post-term mothers managed at Jimma University specialized hospital: a two years' retrospective analysis.** *Ethiopian journal of health sciences* 2016, **26:**123-132.

23. Rayamajhi R KC, Shrestha N, Padhye S.: **Indications for labour induction and predictors for failed induction at KMCTH.** *Orig Artic* 2011**:**7(1):21–25.

24. Acharya T, Devkota R, Bhattarai B, Acharya R: **Outcome of misoprostol and oxytocin in induction of labour.** *SAGE Open Med* 2017, **5:**2050312117700809.

25. Berghella V, Bellussi F, Schoen CN: **Evidence-based labor management: induction of labor (part 2).** *Am J Obstet Gynecol MFM* 2020, **2:**100136.

26. Bostancı E, Kilicci C, Ozkaya E, Abide Yayla C: **Continuous oxytocin versus intermittent oxytocin for induction of labor: a randomized study.** 2020, **33:**651-656.

27. Duro Gómez J, Garrido Oyarzún MF, Rodríguez Marín AB, de la Torre González AJ, Arjona Berral JE, Castelo-Branco C: **Vaginal misoprostol and cervical ripening balloon for induction of labor in late-term pregnancies.** *J Obstet Gynaecol Res* 2017, **43:**87-91.

28. Familiari A, Khalil A, Rizzo G, Odibo A, Vergani P, Buca D, et al: **Adverse intrapartum outcome in pregnancies complicated by small for gestational age and late fetal growth restriction undergoing induction of labor with Dinoprostone, Misoprostol or mechanical methods: A systematic review and meta-analysis.** *Eur J Obstet Gynecol Reprod Biol* 2020, **252:**455-467.

29. Gommers JSM, Diederen M, Wilkinson C, Turnbull D, Mol BWJ: **Risk of maternal, fetal and neonatal complications associated with the use of the transcervical balloon catheter in induction of labour: A systematic review.** *Eur J Obstet Gynecol Reprod Biol* 2017, **218:**73-84.

30. Kehl S, Born T, Weiss C, Faschingbauer F, Pretscher J, Beckmann MW, et al: **Induction of labour with sequential double-balloon catheter and oral misoprostol versus oral misoprostol alone in obese women.** *Eur J Obstet Gynecol Reprod Biol X* 2019, **3:**100034.

31. Orr L, Reisinger-Kindle K, Roy A, Levine L, Connolly K, Visintainer P, et al: **Combination of Foley and prostaglandins versus Foley and oxytocin for cervical ripening: a network meta-analysis.** *Am J Obstet Gynecol* 2020, **223:**743.e741-743.e717.

32. Barthélémy T. RLaMM: **Maternal and perinatal outcomes of induction of labor at term in the university clinics of Kinshasa.** *DR Congo Open Journal of Obstetrics and Gynecology* 2013**:**3, 154-157.

33. El-Sayed YY, Rice MM, Grobman WA, Reddy UM, Tita ATN, Silver RM, et al: **Elective Labor Induction at 39 Weeks of Gestation Compared With Expectant Management: Factors Associated With Adverse Outcomes in Low-Risk Nulliparous Women.** *Obstet Gynecol* 2020, **136:**692-697.

34. Wang C, Geng H, Liu W, Zhang G: **Prenatal, perinatal, and postnatal factors associated with autism: A meta-analysis.** *Medicine (Baltimore)* 2017, **96:**e6696.

35. Dilnessa T, Temesgen K, Workie A: **The proportion of failed induction of labour and associated factors among women undergoing induction of labour in Dessie referral hospital: northeast Ethiopia a cross-sectional study.** *Asian Journal of Pregnancy and Childbirth* 2019**:**1-13.

36. Khan NB, Ahmed I, Malik A, Sheikh L: **Factors associated with failed induction of labour in a secondary care hospital.** *Journal of the Pakistan Medical Association: JPMA* 2012, **62:**6.

37. Okby R, Shoham-Vardi I, Ruslan S, Sheiner E: **Is induction of labor risky for twins compare to singleton pregnancies?** *J Matern Fetal Neonatal Med* 2013, **26:**1804-1806.

Figures

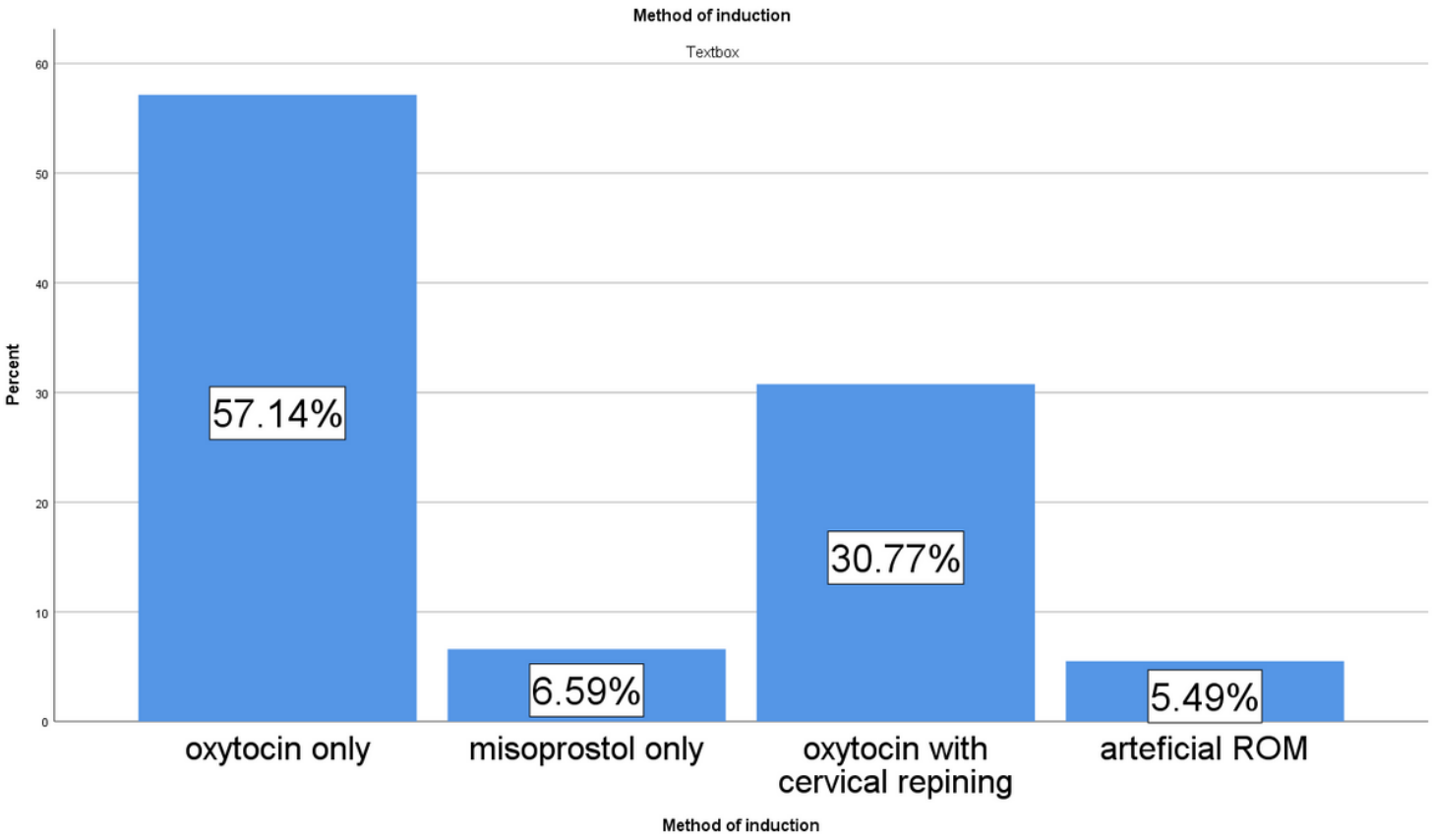

Figure 1

Methods for induction of labour in mothers undergo induction of labour in Jigjiga University Sheik Hassan Yabarre Referral Hospital, Somali region, Ethiopia, 2018- 2021.