ADDIS ABABA UNIVERSITY, COLLEGE OF HEALTH SCIENCES, SCHOOL OF MEDICINE, DEPARTMENT OF OBSTETRICS AND GYNECOLOGY POSTGRADUATE PROGRAM

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" **Prevalence and Perinatal outcome of Meconium Stained Amniotic Fluid among Women Come for Labor and Delivery in three Teaching Hospitals, Addis Ababa, Ethiopia, 2023**"

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I, Dr. Legesse Tadege, hereby declare that this is entitled "**Prevalence and perinatal out comes of meconium stained amniotic fluid in women come for labor and delivery in three Teaching Hospitals, Addis Ababa, Ethiopia, 2023**" in line with the requirement of graduate studies has been fully undertaken by me under the guidance of my advisors and that I have, to the best of my knowledge and effort, avoided plagiarism or duplication of materials unless and otherwise cited and/or acknowledged and that it has not been so far submitted for any form of publication or consideration before the final approval.

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Principal investigator _____ Signature _____ Date

We hereby certify that we have read and evaluated this thesis entitled "**Prevalence and perinatal out comes of meconium stained amniotic fluid in women come for labor and delivery in three Teaching Hospitals, Addis Ababa, Ethiopia, 2023**" relating to under our guidance from its inception up to in its current format and that it can be submitted for approval in partial fulfillment to the Degree of Specialty in Obstetrics and Gynecology.

_____ _____ _____

1. Advisor Signature Date

_____ _____ _____

2. Advisor Signature Date

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LIST OF ABBREVIATIONS

AAU	Addis Ababa University
BMV	Bag mask ventilation
CHS	College of Health Science
AFSOL	Active first stage of labor
CPAP	Continuous positive air way pressure
CS	Caesarean section
EONS	Early onset neonatal sepsis
GMH	Gandi Memorial Hospital
IVD	Instrumental vaginal deliveries
LFSOL	Latent first stage of labor
MSAF	Meconium-stained amniotic fluid
MAS	Meconium aspiration syndrome
NRFHRP	Non reassuring fetal heart rate pattern
PNA	Perinatal asphyxia
NICU	Neonatal intensive care unit
NRP	Neonatal resuscitation program
RFHRP	Reassuring fetal heart rate pattern
RDS	Respiratory distress syndrome
SSOL	Second stage of labor
SVD	Spontaneous Vaginal Delivery
TASH	Tikur Anbesa Specialized Hospital
WHO	World Health Organizations
ZMH	Zewditu Memorial Hospital

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Abstract

Introduction: *The occurrence of meconium-stained amniotic fluid (MSAF) during labor has been long considered the predictor of adverse Fetal outcomes such as meconium aspiration syndrome and perinatal asphyxia, which leads to perinatal and neonatal morbidity and mortality.*

Objective: *aim of this study was to determine the prevalence of MSAF and the perinatal outcome of neonates delivered from mothers whose labor were complicated by MSAF at the three teaching hospitals of AAU.*

Methodology: *A hospital based cross sectional descriptive study was carried out on 413 women who delivered at the three teaching hospitals of Addis Ababa University from January 2023 to March 2023. The data were collected by means of structured questionnaires. It was entered, coded and analyzed using Statistical Package for Social Science (SPSS) version 25. Descriptive and logistic regression analyses were conducted. Statistical tests were done using odds ratio with 95% confidence intervals and significance was defined at $p < 0.05$. Variables with P value < 0.25 during the bivariate analysis were included in the multivariate analysis to see the effect of confounding factors.*

Result: *In this study 413 participants were included. Almost thirty-three percent (32.7%)of the participants had meconium stained amniotic fluid at delivery. Participants whose GA at delivery was 42 weeks or more, who delivered a new born weighing 4kg or more and who were workers are significantly higher rate of MSAF with AOR of 3.24 (95% CI, 1.59-6.69), 5.9 (95% CI, 2.00-17.47) and 1.71 (95% CI, 1.01-2.90) respectively. The rate of adverse perinatal outcome in those with MSAF was significantly increased (23% vs 13.3%) as compared to those without MSAF (AOR=2.91, 95% CI; 1.36-6.25). The rate of Caesarean Delivery was significantly higher (55.3 vs 18.5%) with OR of 5.49 (95% CI; 3.50-8.52) as compared to those without MSA.*

Conclusion and Recommendation: *the prevalence of MSAF in the study participants was high and the presence of MSAF was associated with increased risk of adverse perinatal outcome and increased rate of caesarean delivery. In addition, women with post term pregnancies and those with macrosomic fetuses are at higher risk of MSAF. We recommend practitioners to be vigilant in such women and consider early delivery to prevent the complications of MSAF at delivery.*

Key words: *meconium stained amniotic fluid (MSAF), adverse perinatal outcome, and perinatal death.*

1 Introduction

1.1 Background of the study

The occurrence of meconium-stained amniotic fluid (MSAF) during labor has been long considered the predictor of adverse fetal outcomes such as meconium aspiration syndrome and perinatal asphyxia, which leads to perinatal and neonatal morbidity and mortality. [4]

Meconium is a thick, black-green, odourless material first demonstrable in the fetal intestine during the third month of gestation. The characteristics of meconium are key to understanding the pathophysiology of MAS. Meconium results from the accumulation of debris, including desquamated cells from the intestine and skin, gastrointestinal mucin, lanugo hair, fatty material from the vernix caseosa, amniotic fluid, and intestinal secretions, leading to the formation of a viscous, adhesive substance. Meconium also contains blood group-specific glycoproteins and a small amount of lipid and protein that decreases during gestation. The black-green color results from bile pigments. Meconium is sterile, but free fatty acids, bile salts, and pancreatic phospholipases in meconium are responsible for the adverse effect on surfactant function. [10]

Intrauterine fetal distress and fetal asphyxia in utero before birth have been recognized as stimulating and enhancing the intestinal peristalsis of the infant, resulting in relaxation of the anal sphincter and passage of meconium in utero. [18]

When aspirated into the lung, meconium results in decreased pulmonary function and compliance with secondary surfactant inactivation and small airway obstruction with ball-valve or check-valve phenomena leading to atelectasis or air trapping within the alveoli and bronchioles. Progressive hyperinflation ensues, which increases the risk for pneumothorax. Patients with severe disease are at risk for respiratory failure necessitating intubation and mechanical ventilation.

Monthly and annual perinatal reports of three teaching hospitals of Addis Abeba university, shows labor complicated with MSAF is one of the most common cause of poor perinatal outcomes which are MAS,PNA, EONS, increased NICU admission , low 1st and 5th minute APGAR score and neonatal death .It is also one of common indication of operative deliveries, for which increases postoperative complications.

A well-designed study is required, as it is evident that MSAF is associated with poor perinatal outcomes. Still, there is much confusion regarding the management of labor associated with MSAF, thus leading to unnecessary caesarean sections. Farther more

mortality and morbidity of neonates related with MAS is high, due to sub optimal care provided to labouring mothers complicated with MSAF.

MSAF occurs in approximately 15 to 20% of term pregnancies. The incidence of MSAF increases with gestational age and is approximately 23- 52% after 42 weeks of gestation. [3] As most babies with MSAF are 37 weeks or older, it suggests physiological maturation of fetal autonomic nervous system. It may also indicate an acute or chronic hypoxic event, thereby suggesting fetal compromise. [10]

The MSAF is a clinical diagnosis with no practical confirmatory test. However, various methods have been tried to detect the presence of meconium in liquor and to prevent MAS. These methods include amino infusion, oropharyngeal suction, endotracheal intubation, amino scopy, early induction of labour and detection by ultrasonography.

The approach to preventing meconium aspiration syndrome (MAS) in the new born has changed markedly over the last 30 years. In the late 1970s, all infants born through meconium-stained amniotic fluid (MSAF) had upper-airway suctioning before delivery of the shoulders and then had tracheal intubation and suctioning in the delivery room. Now suctioning of the upper airway is no longer recommended, and only “depressed” infants are intubated for tracheal suctioning. MAS is no longer considered to be solely a postnatal disorder that is preventable with routine delivery room suctioning of the trachea; rather, it is considered a complex and multifactorial disorder with antenatal as well as intrapartum factors. The incidence and severity of MAS have been positively affected by a combined obstetrical and neonatal approach to the infant born through MSAF. [16]

Though a lot studies have been conducted on the subject matter globally, very few well-designed comparative studies have been conducted in Ethiopia. The present study aimed to determining prevalence and perinatal outcome in term deliveries associated with MSAF and comparing it with the outcome associated with clear liquor in the three teaching hospitals AAU.

1.2 Statement of the problem

The presence of meconium stained amniotic fluid (MSAF) is a serious sign of foetal compromise, which is associated with an increase in prenatal morbidity [2] clear amniotic fluid on the other hand is considered reassuring.

The foetus passes meconium into the amniotic fluid in 10% of all pregnancies; in 5% of these (i.e. 1:200 of all pregnancies) the meconium is aspirated into the lungs of the foetus or the neonate. This can result in severe respiratory distress, MAS. [2 ,4]

In healthy, well oxygenated foetuses, meconium is cleared from the lungs by normal physiological mechanisms. The presence of the combination of intra-amniotic inflammation with fetal systemic inflammation is however, an important antecedent of MAS. Even with therapy, seriously affected infants frequently die or suffer long-term neurological sequelae. [12].

MSAF is associated with adverse neonatal outcomes, including cord acidosis, the need for resuscitation, low Apgar scores, and neonatal intensive care unit (NICU) admission. Meconium aspiration before or during labor can result in meconium aspiration syndrome (MAS), which is the most dreaded complication of MSAF. MAS complicates about 2-9% of deliveries with MSAF. [11]

Improved antenatal care, intrapartum monitoring and amnio-infusion have resulted in reduced stillbirths and better neonatal outcome in recent years. However, in developing nations, MAS still accounts for about 10% of all cases of respiratory failure with 39% mortality rate [7].

In our country, most maternity centres do not have facilities for continuous FHR monitoring, and facilities for foetal scalp blood sampling are not available even in tertiary care hospitals. Thus, in the absence of these facilities there is an unnecessary increase in instrumental vaginal deliveries (IVDs) and caesarean section (CS) rate with increased maternal morbidity and mortality.

Perinatal morbidity and mortality associated with MAS can be brought down if the high-risk patients are identified in the antenatal period and careful decisions are made about the timing and mode of delivery and vigilant monitoring of the labour. It means that MSAF is associated with a lot of adverse outcomes for the foetus and the mother.

1.3 Significance of the study

Studies conducted around the world showed difference in the proportion of MSAF with different outcome. A majority of the studies conducted were in developed countries and middle-income countries, and very little is known about the situation in Ethiopia. Thus, this study tries to narrow this existing research gap in the area. It will provide information for the hospital to develop its own evidence-based management protocol for labor complicated with MSAF.

2 Literature review

The reported incidence of meconium-stained amniotic fluid (MSAF) varies from 5% in preterm deliveries to 7-22% in term and 23-52% in post-term deliveries. [13] large population-based studies were scarce and suggested a lower incidence of MAS: the national US birth cohort study conducted on the basis of singleton term non- Hispanic white live births (1995–2001) showed that the rate of MAS markedly increased with gestational age (GA), that is, from 0.10% at 37 weeks gestation (WG) to 0.22 and 0.31% at 40 and 41WG, respectively.

There are few studies done in Ethiopia, among this research done in Jimma and Bahirdar Universities the proportion of MSAF was 15.7 % and 24.6% respectively.

The prevalence of MAS could be extrapolated to 0.18% in France population of term infants. In Australia, the rate of MAS requiring mechanical ventilation in level III units ranged between 0.024 to 0.046% at 36–40WG and then increased to 0.080% at 41WG and 0.14% at 42WG. In France, the prevalence of mechanically ventilated MAS was estimated to 0.043% by a retrospective national survey among neonates born in 2000-2001[16].

A retrospective cohort study conducted at Flushing Hospital Medical Canter, New York, from October 2012 to July 2014GC. To determine if the presence of meconium-stained amniotic fluid (MSAF) by itself or in combination with abnormal fetal heart tracing (FHT) (category II and III) is associated with poor neonatal outcomes in full term new born. finding were Abnormal FHT was present in 43.2% of cases compared to 17.6% of controls($p<0.001$). Low Apgar scores (<7) at one and five minutes were more common in the MSAF group ($p=0.03$ and 0.007, respectively). The neonatal intensive care unit (NICU) admission rate was also higher in the MSAF group ($p=0.002$). conclusion was Neonates born with MSAF were more likely to have abnormal FHT and require resuscitation at birth. However, after adjusting for confounding factors, abnormal FHT and one-minute Apgar scores were the only variables predictive of resuscitation needs at birth. [11]

In India a cross sectional study done at governmental medical college from January to December 2016 to determine Maternal risk factors and perinatal outcome in meconium stained amniotic fluid. This study indicates that, MSAF during labor increase the prevalence of abnormal intrapartum CTG, caesarean section, low APGAR score, increased duration of NICU and hospital stay. [3]

The research entitled as Neonatal outcome in meconium stained amniotic fluid-one year experience, A Cross sectional analytical study, conducted in the Shaikh Zyed Federal Postgraduate Medical Institute from April 2006 to March 2007. They conclude that

Meconium stained amniotic fluid (MSAF), is associated with increased neonatal morbidity and mortality. Caesarean sections were performed twice as frequently in women presenting with MSAF. [2]

Other prospective observational, hospital-based study conducted in India , Burla, during January ,2013 through June, 2013.the findings were , The mean gestational age for meconium staining was 40.31±0.48 weeks. Caesarean section was the most common mode of delivery in MSAF group whereas vaginal delivery was most common in control group. Significantly higher number of babies in the study group required NICU admissions. The incidence of MAS and birth asphyxia too was statistically higher among babies born to study group as compared to control group. In Conclusions MSAF has significant adverse effect on the perinatal outcome, as it increases the caesarean section rates, NICU admissions, MAS and birth asphyxia.

The observational study was conducted at Gynae Unit-III of Liaquat University Hospital, Hyderabad, from June to November 2007. To determine the foetal outcome and mode of delivery in patients with meconium stained liquor during labour. which conclude Meconium stained amniotic fluid is a common occurrence during labour and is associated with increased caesarean section rate and foetal morbidity and mortality.

Research done in Jimma University Specialized Hospital from October 1, 2012 to December 31, to determine meconium Stained amniotic fluid and factors affecting maternal and perinatal outcomes conclusion was, the majority of labouring mothers with MSAF had moderate to thick meconium and thickness of meconium was a significant predictor of most of the perinatal outcomes evaluated in this study. The incidence of operative deliveries was higher and those babies delivered with operative deliveries had higher incidence of low fifth minute Apgar sore than those delivered through Spontaneous Vaginal Delivery (SVD). The incidence of MAS was also higher and the rate of low first minute Apgar score is higher despite higher rate of operative deliveries. [8]

Generally it’s recommended that for those new born with depressed Apgar score and thick meconium in the Oropharynx, ONPS better be done under direct vision before stimulating to decrease MAS. [12]

3 Objectives

3.1General objective

To determine perinatal outcome of neonates delivered from mothers whose labor complicated by MSAF at the three teaching hospitals of AAU.

3.2 Specific objectives

Determine the prevalence of meconium stained amniotic fluid.

Determine the effect of meconium stained amniotic fluid on mode of delivery.

Measure the perinatal outcome of delivery complicated with MSAF.

Determine factors associated with MSAF.

4 METHODS AND MATERIAL

4.1 Study area

The study was conducted in the three teaching hospitals of Addis Abeba university: Tikur Anbesa Specialized Hospital, Gandhi Memorial Hospital and Zewditu Memorial Hospitals which are found in Addis Ababa, Ethiopia. There are more than 12 public and more than 25 private hospitals in Addis Ababa city.[14] Of the total 12 public hospitals, 3 of them selected by convenience and included in the study these hospitals serve as central referral teaching hospitals and all obstetric emergencies including high risk pregnancies are referred to these hospitals from Addis Ababa and its vicinity.

4.2 Population

Source Population: Women who come in labor and gave birth in three teaching hospital.

Study population: Women who come in labor and gave birth in three teaching hospital in the study period.

4.3 Study design

A hospital based cross sectional descriptive study was carried out on laboring mothers with both clear and meconium stained amniotic fluid who deliver in the labor ward, at three teaching hospitals of Addis Ababa University.

4.4 Inclusion and Exclusion Criteria

Inclusion criteria

Pregnant women >28 weeks of gestation

singleton pregnancy

Exclusion criteria

multiple pregnancy

breech presentation

fetal congenital malformation

Intrauterine fetal death

Those who are not willing to give consent

4.5 Sample size and sampling technique

4.5.1. Sample size

The sample size determined using single population proportion formula by assuming 95% confidence interval, 5% margin of error and proportion the prevalence of ceasarean delivery among meconium stained amniotic fluid was 43%, which was the largest prevalence of all dependent variables from the previous study, it was taken from a similar study done in Jima, Ethiopia.[8]

$n = \frac{z2 \text{ x } p(1-p)}{d2}$ = 1.96 x1. 96 x0.43 (1-0.43) /0. 03x 0.03 =376

Adding 10% of no respondent participants

376+37= 413

Sampling and Sampling Procedure. A systematic random sampling technique was used to select the required number of participants. To sample our study participants, first, the average numbers of women who gave birth during the study period estimated and obtained based on the number of deliveries over two months prior to data collection by referring to the delivery registration book/record. Totally, 1419 women delivered in two months in the three teaching hospitals. with 416 ,283 and 720 deliveries at ZMH, TAH and GMH respectively. Based on percentage fraction 123 ,70 and 220 laboring mothers was selected from ZMH, TAH and GMH respectively. Secondly, so as to find the sampling fraction, the total number of women who delivered in two months (1419) was divided by the total number of our sample size (413) which will approximately 3. mothers who was admitted in the labor ward for labor and delivery, registered on the delivery registration log book and every 3rd woman was included in the study and the first woman was selected using lottery method. During the sampling procedure, if the selected woman not fulfil the inclusion criteria, the next woman included in the study.

4.6 Study variables

I .The independent variables:

Socio demographic characteristics

- Age
- Marital status
- Occupation
- Address

- Income

Obstetric characteristics

- Parity
- maternal medical and obstetric complications
- GA
- IUGR
- oligohydramnios
- Estimation of fetal weight (US, Clinical)

II. **The dependent variables**:

Primary outcome

MSAF
NRFHRP
Caesarean delivery rate
Operative vaginal delivery rate
APGAR scores
PNA
NICU admission
MAS
EONS
Need for resuscitation
Respiratory support
Early Neonatal death

Secondary outcome

Maternal SSI

Sepsis

Endometritis

4.7 Data Collection Method

Verbal consent taken for data extraction from medical chart and interviewing for missed information. Data taken using Information Sheet during post-partum period after 6 hours of delivery, when patient is stable but before discharge. The data collectors were residents or interns who works in the selected hospitals of the study area. The data collectors received half day training on data collection tool. The data collected using self-prepared, anonymous, semi structured and pre-tested questionnaire. The questionnaire developed in English. Most of the items adapted from existing literatures and the delivery form availed by the department of OBGYN. The English language questionnaire used to collect data after being pre-tested before the study period. Modification of the questioner done based on the pre-test and the pre-test questioners were included in the study. The questionnaire was included questions on

socio-demographic characteristics, reproductive and obstetric history, maternal outcome and neonatal outcome. The wording and sequence of questions designed in such a way that the logical flow of ideas from general to specific, and from easy to difficult questions was maintained. The principal investigator was supervised the data collectors.

Patients history, gestational age, per abdominal examination, per speculum and per vaginal examination, admission tests including intrapartum cardiotocography (CTG) was recorded in a predesigned proforma from patient chart. Both clear liquor or meconium stained liquor detected during artificial rupture of membranes or presenting with leaking per vaginum documented on chart reviewed meticulously for the essence of the study. Both the diagnosis and grading of Meconium staining of amniotic fluid classified as Grade I, II, and III by visual examination, was done by senior resident, who is responsible in the labor ward, after spontaneous or artificial rupture of membranes.

The APGAR score of neonates, neonates who need resuscitation with the type of resuscitation done, birth weight, neonates who have meconium aspiration syndrome, Neonatal Intensive Care Unit (NICU) admission, babies with birth asphyxia recorded. Mode of delivery recorded with all obstetric conditions which were seen at the time of decision.

Women classified into two groups: one group with MSAF, and the other group with clear amniotic fluid. The conditions(outcomes) of neonates, compared between the two groups and tested statistically for significance.

The collected data analysed using SPSS for window version 25 (IBM Corporation). Descriptive statistical measures such as frequencies and percentages generated and presented in tables. Logistic regression analysis conducted to identify statistical association between measures of maternal and fetal outcome (dependent variables) and the explanatory variables. Statistical significance declared when one not included in the 95% CI of the crude and adjusted odd ratios. The study protocol approved by the Ethical Review at AAU. The study participants informed about the objectives and benefits of the study following which informed consent obtained. All of the information accessed during the study used for the purpose of this study alone.

4.8 Operational Definitions

In this research, the following operational definitions used.

Apgar score; - The Apgar score determined by evaluating the new born baby on five simple criteria on a scale from zero to two, then summing up the five values thus obtained.

Liquor status

i. Meconium-stained amniotic fluid (MSAF) was the presence of meconium as assessed by the physician in charge including its grade before and/or at the time of delivery.

ii. blood stained amniotic fluid was the presence blood or red discoloration of the amniotic fluid as reported by the physician in charge at any time before and/or at the time of delivery.

iii. clear amniotic fluid was neither MSAF nor blood stained amniotic fluid as assessed by the physician in charge

iv. MAS: -defined as a respiratory distress that develops shortly after birth, with radiographic evidence of aspiration pneumonitis in the presence of MSAF as assessed by the physician in charge of the neonatal management.

v. NICU admission; - Any new born admitted to the NICU for any reason longer than 24 hours

vi. Low 5^{th} minute APGAR score; -APGAR score < or =6 at 5^{th} minute of neonatal period.

vii. Composite adverse perinatal outcome; -presence of one or more of the following

Low 5^{th} minute APGAR score
Still birth
Early neonatal death
Admit ion to NICU
RDS
PNA

4.9 ETHICAL CLEARANCE

Ethical clearance secured by the Ethical Review Committee of Department of Obstetrics and Gynecology Research and Publication Committee Addis Ababa University and respective hospital were informed. Informed verbal consent obtained for date extraction from medical chart and interviewing for missed information from each participant before the start of data collection. To ensure confidentially of respondents, their names were not indicated on the questionnaire and it assured that their responses kept strictly confidential. The anonymity and confidentiality of the participants kept private. The name of the participants was not included in the data collection format.

5. Result

5.1 Sociodemographic characteristics of the study participants

In our study 413 participants were included making a response rate of 100%. Majority of the study participants (53.3%) were from GMH. The mean age of the study participants was 27.33 ± 4.6 years. The mean age for those with MSAF was 27.1±4.7 years and it was not significantly different (p value of 0.104) from those without MSAF (29.9±4.5 years). Most (89.1%) of the study participants were in the age group of 20-34 years. Almost all (97.1%, n=401) were married and more than two-third (67.1%) were house wives. forty-four percent of the study participants have completed primary level education and 65.4% had a house hold monthly income of 5000-15000 ETB.

Table 1 Socio-demographic Characteristics of the Study Participants Who Gave Birth in the Three Teaching Hospitals of Addis Ababa University.

Variable	Categories	Frequency	Percentage
Place of delivery	TAH	70	16.9
	ZMH	123	29.8
	GMH	220	53.3
Residency	Addis Ababa	410	99.3
	outside Addis Ababa	3	0.7
Age of the study participant	<20	15	3.6
	20-34	368	89.1
	≥35	30	7.3
Marital status	Not married	12	2.9
	Married	401	97.1
Occupation	Housewives	277	67.1
	Working	136	32.9
Partner occupation	Governmentt employee	64	15.5
	Private employee	290	70.2
	Daily labourer	59	14.3
Education status	Illiterate	36	8.7
	read and write	20	4.8
	Primary	185	44.8
	Secondary	96	23.2
	Tertiary	76	18.4
Partner education	Illiterate	14	3.4
	read and write	18	4.4
	Primary	125	30.3
	Secondary	142	34.4
	Tertiary	114	27.6
House hold monthly income	<5000 birr	94	22.8
	5000-15000birr	270	65.4
	>15000 birr	49	11.9

5.2 Obstetric characteristics of the study participants

The mean parity of the study participants was 1.8±1.1. The mean parity among those participants with MSAF was 1.8±1.3 and it was not significantly different (p value of 0.725) from those without MSAF (1.8±1.1). More than half (55.7%, n=230) of the study participants were parous and almost all (99.5%) of the participants had antenatal follow up. The mean GA at delivery for the study participants was 39.4±2.1weeks. The mean GA for those participants with MSAF was 40.1±1.8 weeks and it was significantly different (p value of 0.000) from those without MSAF which was 39.1±2.1 weeks. Most study participants (38%) were delivered with a gestational age of 39-40^{+6} week,11.6 percent of the study participants were delivered at GA of ≥42 weeks. Preterm and post maturity complicates 7.5% and 11.6% of deliveries respectively. In more than three-fourth labour was established spontaneously and in 22% it was induced. The major reason for induction of labour was post term pregnancy (37.4%). Most women with spontaneous labour were admitted at LFSOL (83.5%). Obstetric antepartum risks complicate 26.2% of the participants. From those complications preeclampsia and oligohydramnios each account for 19.8%. Only 20 (4.8%) had medical comorbidities.

Table 2 Obstetric Characteristics of Women Who Deliver in the Three Teaching Hospitals of Addis Ababa University.

Variable	**Categories**	**Frequency**	**Percentage**
Parous	Yes	183	44.3
	No	230	55.7
ANC follow up	Yes	411	99.5
	No	2	0.5
Gestational age	<34	10	2.4
	34-36^{+6}	21	5.1
	37-38^{+6}	88	21.3
	39-40^{+6}	157	38.0
	41-41^{+6}	89	21.5
	≥42	48	11.6
Onset of Labour	Spontaneous	322	78.0
	Induced	91	22.0
Antepartum risk	None	285	69.0
	Obstetric complication	108	26.2
	Medical complication	20	4.8
Indication for induced labour (n=91)	Preeclampsia	18	19.8
	post term	34	37.4
	Oligohydramnios	18	19.8
	PROM	21	23.1
Stage for spontaneous	LFSOL	269	83.5

labour (n=322)	AFSOL	47	14.6
	SSOL	6	1.9
Preterm delivery	Yes	31	7.5
	No	382	92.5
Post maturity	No	365	88.4
	Yes	48	11.6

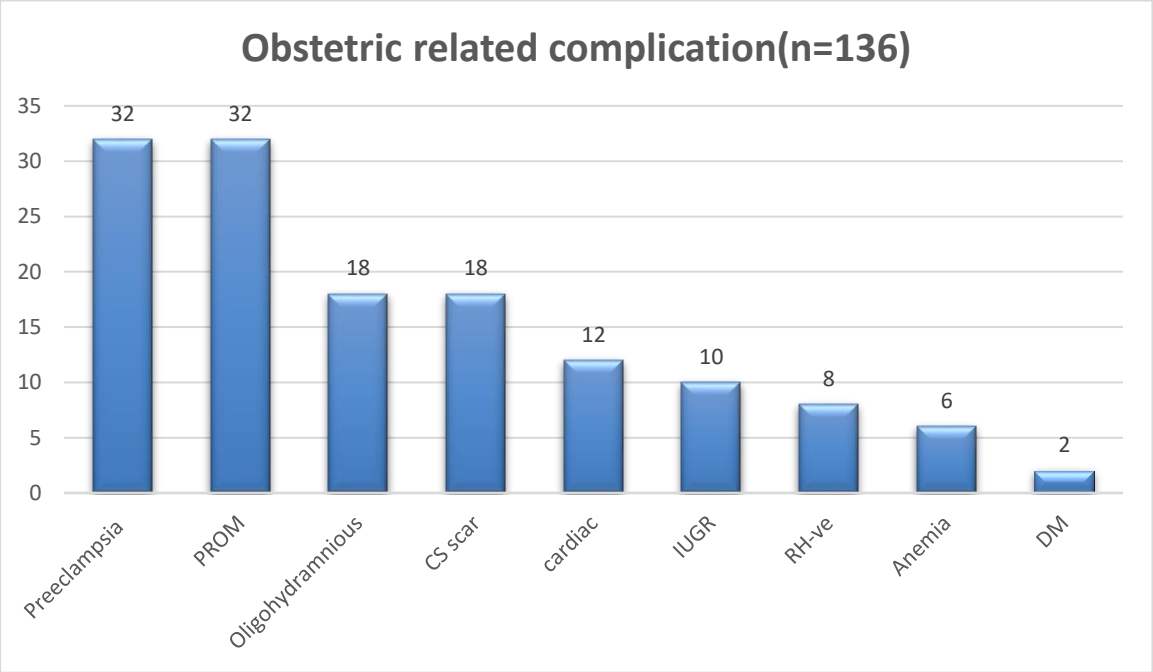

Figure 1. The List of obstetric related complication.

5.3 Labour and Delivery Characteristics of the Study Participants

Nearly two-third (65.4%) of the participants had the membranes ruptured spontaneously during admission. Almost thirty-three percent (32.7%) had meconium stained liquor and among those with meconium staining of the liquor 74.4% had thick meconium. In 21%, the fetal heart rate was non-reassuring intrapartum and from those 65.1% were bradycardia. Almost all (97.1%) participants gave birth within 20 hours of labour. From study participants 38.5% were delivered by caesarean section, from those 52.8% of CSs were done for an indication of thick MSAF in LFSOL or NRFHRP with MSAF (36.4% & 16.3%) respectively. The rate of assisted instrumental deliveries was 5.8%.

Table 3 Labour and Delivery Characteristics of Women Who Deliver in the Three Teaching Hospitals of Addis Ababa University.

Variable	Categories	Frequency	Percentage
Membrane status at admission	Intact	7	1.7
	Spontaneous raptured	270	65.4
	ARM	136	32.9
Liquor status	Clear	268	64.9
	blood-stained AF	10	2.4
	MSAF	135	32.7
Grade meconium status (n=145)	G I MSAF	37	25.5
	GII MSAF	74	51.0
	GIII MSAF	34	23.4
NRFHR pattern	No	327	79.2
	Yes	86	20.8
Types of NRFHRP (n=86)	Tachycardia	24	27.9
	Bradycardia	56	65.1
	abnormal CTG	6	7
Duration labour	<20 hours	401	97.1
	>20 hours	12	2.9
Mode of delivery	SVD	230	55.7
	AID	24	5.8
	CD	159	38.5
Reason for caesarean or instrumental delivery (n=183)	NRFHRP	56	30.6
	MSAF and NRFHRP	26	14.2
	MSAF in LFSOL	58	31.7
	CPD	29	15.8
	CS scar & Labor Abnormality	8	4.4
	failed induction	4	2.2
	Shorten second stage of labor	2	1.1

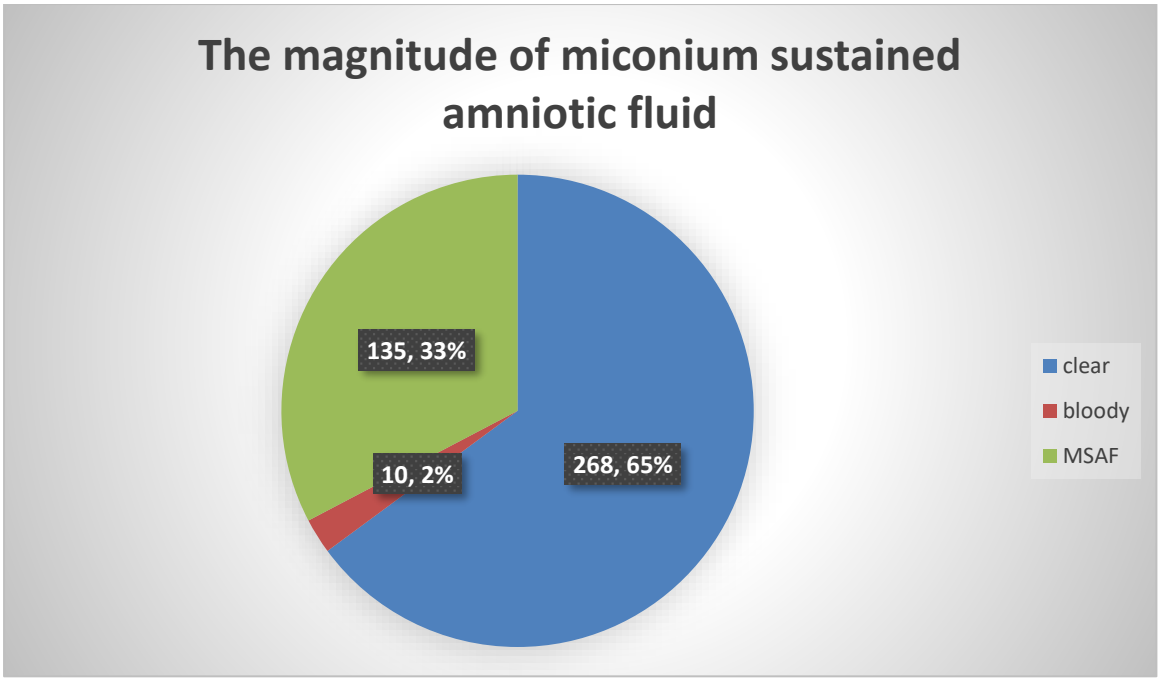

Figure 2. The magnitude of meconium sustained amniotic fluid.

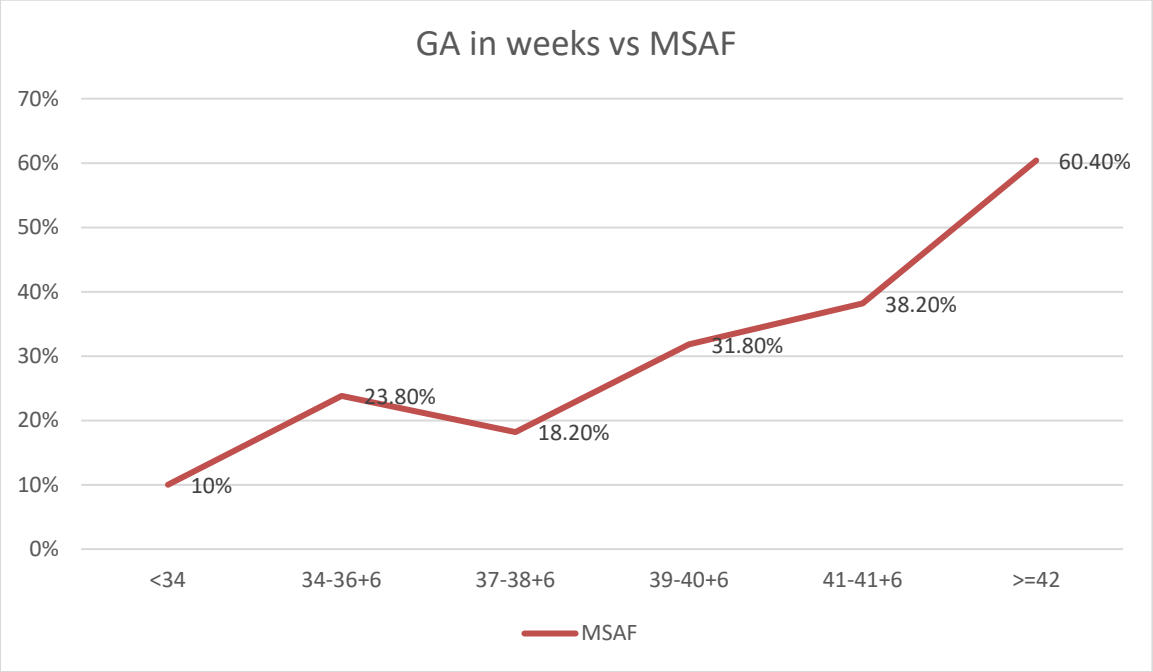

Figure 3. The relation between gestational age and liqueur status.

5.4 Factors associated with meconium sustained amniotic fluid

Participants whose age was <20 and >=35 years had significantly higher rate of MSAF as compared to those who are 20-34 years with an AOR of 6.21 (95%CI, 1.8-21.8) and 3.7 (95% CI, 1.3-10.2) respectively. On the other hand, those participants with GA at delivery between

37 and 39 weeks had significantly lower risk of having MSAF with an AOR of 0.18 (95% CI, 0.05-0.61) of the study participants, parity, gestational age, stage of labour at admission, membrane status at admission and mode of delivery had an association with MSAF by bivariate logistic regression.

The multivariate logistic regression revealed that participant whose age of ≥35 years had 4.42 folds increase association with MSAF compared to participants in the age of 20-34 years AOR=3.67 (95%CI,1.33-10.15). Study participants who were delivered by caesarean delivery had 6.1 folds increased risk to have MSAF compared to those who delivered by SVD.

Table 4 Determinants of MSAF in Women Who Deliver in Three Teaching Hospitals of Addis Ababa University

Variable	Categories	MSAF			P value	OR (95% CI)	**P value**	**AOR (95% CI)**
		No (%)	Yes (%)	Total (%)				
Place of Delivery	TAH	42 (60.0)	28 (40.0)	70 (16.9)	0.114	1	**0.033**	1
	ZMH	91(74.0)	32 (26.0)	123 (29.8)	0.045	0.53 (0.28-0.99)	**0.019**	**0.41 (0.19-0.86)**
	GMH	145 (65.9)	75 (34.1)	220 (53.3)	0.369	0.78 (0.45-1.35)	0.387	0.74 (0.38-1.46)
Residence	Addis Ababa	275 (67.1)	135 (32.9)	410 (99.3)	0.556	1		1
	Outside Addis Ababa	3 (100)	0 (0)	3 (0.7)		-		-
Age of the study participant	20-34	249 (67.7)	119 (32.3)	368 (89.1)	0.073	1	0.222	1
	<20	13 (86.7)	2 (13.3)	15 (3.6)	0.140	0.32 (0.07-1.45)	0.274	0.41 (0.08-2.02)
	≥35	16 (53.3)	14 (46.7)	30 (7.3)	0.114	1.83 (0.87-3.88)	0.197	1.87 (0.72-4.80)
Marital status	Married	272 (67.8)	129 (32.2)	401 (97.1)	0.258	1		1
	Not married	6 (50.0)	6 (50.0)	12 (2.9)		2.11 (0.67-6.67)		-
Occupation	Housewives	194 (70.0)	83 (30.0)	136 (32.9)	0.092	1	**0.046**	1
	Working	84 (61.8)	52 (38.2)	277 (67.1)		1.45 (0.94-		**1.71 (1.01-**

						2.23)		**2.90)**
Education status	Illiterate	20 (55.6)	16 (44.4)	36 (8.7)	0.439	1	0.510	1
	read and write	14 (70.0)	6 (30.0)	20 (4.8)	0.292	0.54 (0.17-1.71)	0.773	0.82 (0.22-3.08)
	Primary	128 (69.2)	57 (30.8)	185 (44.8)	0.115	0.56 (0.27-1.15)	0.339	0.65 (0.27-1.57)
	Secondary	68 (70.8)	28 (29.2)	96 (23.2)	0.100	0.52 (0.23-1.14)	0.110	0.46 (0.18-1.19)
	Tertiary	48 (63.2)	28 (36.8)	76 (18.4)	0.442	0.73 (0.33-1.63)	0.540	0.73 (0.26-2.02)
House hold monthly income	5000-15000birr	191 (70.7)	79 (29.3)	270 (65.4)	0.213	0.70 (0.34-1.40)	0.771	1.14 (0.47-2.75)
	<5000 birr	60 (63.8)	34 (36.2)	94 (22.8)	0.032	0.51 (0.27-0.95)	0.168	0.60 (0.29-1.24)
	>15000 birr	27 (55.1)	22 (44.9)	49 (11.9)	0.071	1	0.059	1
Parous	No	149 (64.8)	81 (35.2)	230 (55.7)	0.219	1	0.090	1
	Yes	129 (70.5)	54 (29.5)	183 (44.3)		0.77 (0.51-1.17)		0.64 (0.38-1.07)
GA at delivery	Term	234 (70.1)	100 (29.9)	334 (80.9)	0.000	1	0.005	1
	Preterm	25 (80.6)	6 (19.4)	31 (7.5)	0.220	0.56 (0.22-1.41)	0.928	1.05 (0.35-3.19)
	Post term	19 (39.6)	29 (60.4)	48 (11.6)	0.000	3.57 (1.91-6.67)	**0.001**	**3.27 (1.59-6.69)**
GA in weeks at delivery	<34	1 (10.0)	9 (90.0	10(2.4)	0.017	0.07(0.01, 0.62)	*	
	34-36^{+6}	5 (23.8)	16 (76.2)	21(5)	0.007	0.21(0.06, 0.65)	0.809	0.8(0.14, 4.73)
	37-38^{+6}	16 (18.2)	72 (81.8)	88(21.3)	0.000	0.15(0.07, 0.32)	0.006	**0.18(0.05, 0.61)**
	39-40^{+6}	50 (31.8)	107 (68.2)	157(38)	0.001	0.31(0.16, 0.59)	0.453	0.67(0.24, 1.90)
	41-41^{+6}	34 (38.2)	55 (61.8)	89(21.5)	0.014	0.41(0.19, 0.83)	0.327	0.57(0.19, 1.75)
	≥42	29 (60.4)	19 (39.6)	48(11.6)	1		1	
Onset of	Spontaneous	213	109	322	0.34	1		1

labour		(66.1)	(33.9)	(78.0)	3			
	Induced	65 (71.4)	26 (28.6)	91 (22.0)		0.78 (0.47-1.30)		
Antepartum risk	None	173 (60.7)	112 (39.3)	285 (69.0)	0.000	1	**0.000**	1
	Obstetric	89 (82.4)	19 (17.6)	108 (26.2)	0.000	0.33 (0.19-0.57)	**0.000**	**0.22 (0.11-0.41)**
	Medical	16 (80.0)	4 (20.0)	20 (4.8)	0.096	0.39 (0.13-1.19)	0.054	0.31 (0.09-1.02)
Birth weight	2500-3900 gm	258 (69.4)	114 (30.6)	372 (90.1)	0.000	1	**0.006**	1
	<2500 gm	12 (80.0)	3 (20.0)	15 (3.6)	0.385	0.57 (0.16-2.04)	0.704	1.36 (0.28-6.63)
	>4000 gm	8 (30.8)	18 (69.2)	26 (6.3)	0.000	5.09 (2.15-12.05)	**0.001**	**5.90 (2.00-17.47)**
Neonatal gender	Female	154 (71.0)	63 (29.0)	217 (52.5)	0.096	1	0.204	1
	Male	124 (63.3)	72 (36.7)	196 (47.5)		1.42 (0.94-2.14)		1.36 (0.85-2.20)
Mode of delivery	SVD	39(9.4)	191(46.2)	230 (55.7)	1			
	AID	8(1.9)	16(3.8)	24 (5.8)	0.055	2.4(0.98, 6.12)	0.086	2.5(0.88, 7.40)
	CD	88(21.3)	71(17.1)	159 (38.5)	0.000	6.1(3.81, 9.67)	0.000	**11.2(5.71, 21.77)**

5.5 The effect of meconium-stained liquor on mode of delivery and perinatal out come

From 265 participants having a clear liqueur status, 71.2%(n=189) were delivered by SVD and 4.5%(n=12) and 25.3%(n=67) were delivered by assisted instrumental delivery and by CS respectively. Ten participants were having bloody stained amniotic fluid, among whom 2/10 were delivered by SVD while 4/10 by AID and the other 4/10 were delivered by CS. One hundred thirty-five of the participants had MSAF and from those 60.2% were delivered by CS, 28.9% by SVD and 5.9% by AID. When compared liquor status& mod of delivery, the presence of MSAF double the rate of CS delivery.

Table 5 The effect of meconium-stained liquor on mode of delivery and perinatal out come

Variable	Category	Frequency (%)	MSAF	
			No	Yes
Mode of Delivery	SVD	230 (55.7)	191 (83.0)	39 (17.0)
	AID	24 (5.8)	16 (66.7)	8 (33.3)
	CD	159 (38.5)	71 (44.7)	88 (55.3)
Caesarean Delivery	No	254 (61.5)	207 (81.5)	47 (18.5)
	Yes	159 (38.5)	71 (44.7)	88 (55.3)
Reason for caesarean and instrumental delivery (n=183)	NRFHRP	56 (30.6)		
	MSAF and NRFHRP	26 (14.2)		
	MSAF in LFSOL	58 (31.7)		
	CPD	29 (15.8)		
	SCAR and Labor Abnormality	8 (4.4)		
	failed induction	4 (2.2)		
	Short second stage	2 (1.1)		
Indication for induced labour (n=91)	Preeclampsia	18 (19.8)		
	post term	34 (37.4)		
	Oligohydramnios	18 (19.8)		
	PROM	21 (23.1)		
Stage for spontaneous labour(n=322)	LFSOL	269 (83.5)		
	AFSOL	47 (14.6)		
	SSOL	6 (1.9)		
Obstetric Complication	No	277 (67.1)		
	Yes	136 (32.9)		
Low 5^{th} min. APGAR	No	404 (97.8)	273 (67.6)	131 (32.4)
	Yes	9 (2.2)	5 (55.6)	4 (44.4)
NICU Admission	No	347 (84.0)	243 70.0)	104 (30.0)
	Yes	66 (16.0)	35 (53.0)	31 (47.0)
Perinatal Death	No	410 (99.3)	277 (67.6)	133 (32.4)
	Yes	3 (0.7)	1 (33.3)	2 (66.7)
ENND	No	410 (99.3)	277 (67.6)	133 (32.4)
	Yes	3 (0.7)	1 (33.3)	2 (66.7)
PNA	No	399 (96.6)	266 (66.7)	133 (33.3)
	Yes	14 (3.4)	12 (85.7)	2 (14.3)
MAS	No	389 (94.2)	276 (71.0)	113 (29.0)
	Yes	24 (5.8)	2 (8.3)	22 (91.7)
Adverse PN Outcome	No	345 (83.5)	241 (69.9)	104 (30.1)
	Yes	68 (16.5)	37 (54.4)	31 (45.6)

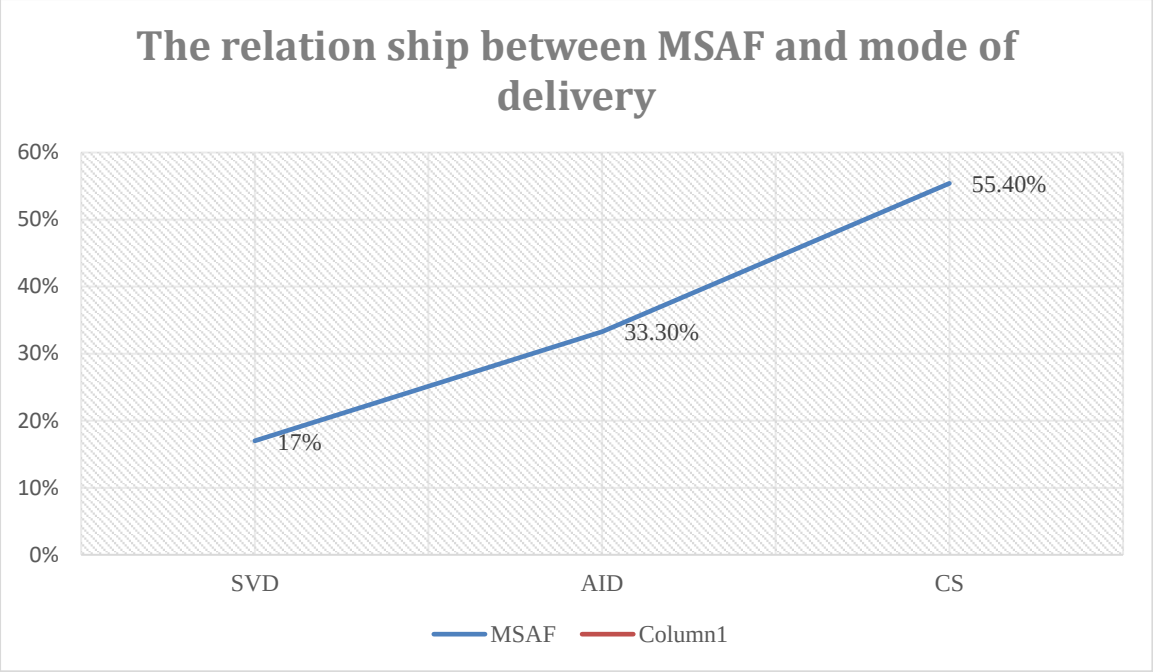

Figure 4. The relationship of liqueur status and mode of delivery.

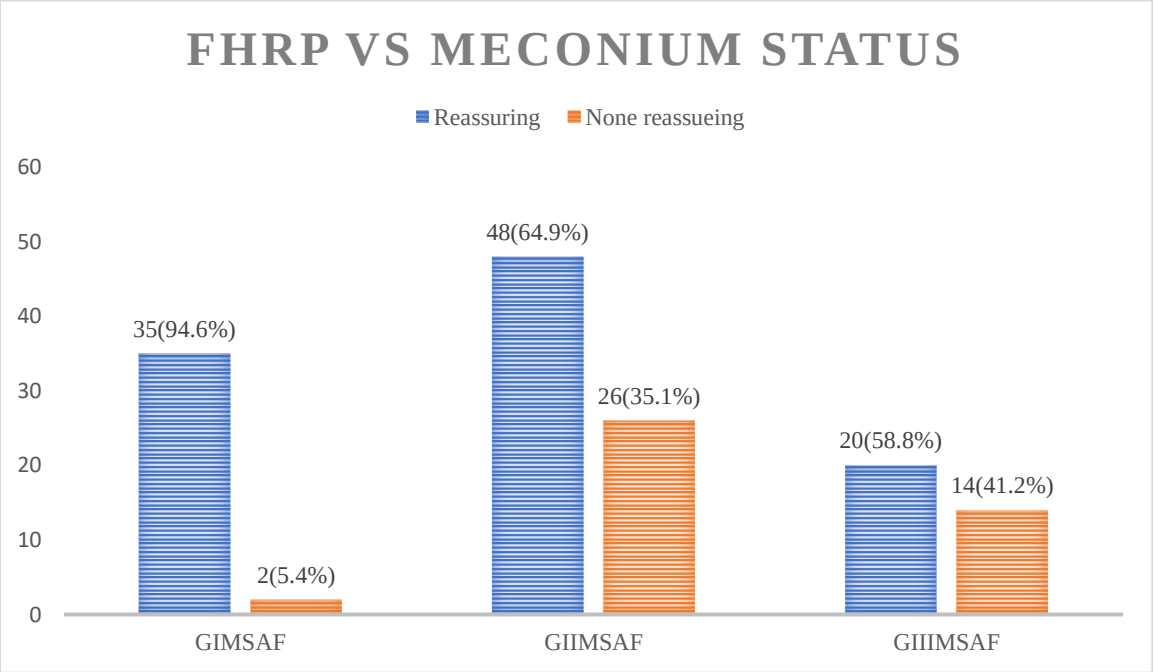

Figure 5. The relation between FHRP and Grading of meconium

5.6 The Perinatal Outcome Characteristics of the Study Participants

The mean birth weight of babies delivered from the study participants was 3126.2 ± 489.8 gm. The mean birth weight in participants with MSAF was 3296.3±470.1 gm which was significantly different (p value of 0.000) from those without MSAF (3043.5±478.5 gm). Ninety percent of the neonates had normal birth weight and 52.5% were female. Almost all

(97.8%) had an APGAR of seven and above at the fifth minute and 93.9% did not need resuscitation immediately after delivery. Sixteen percent (n=66) were admitted in NICU and from those 27.3% were admitted with a diagnosis of MAS and 21.2% were with PNA, from those admitted to NICU 57.6% were supported by intranasal oxygen, however 24.2% did not need any support. Most (95.3%, n=63) survived while 4.7% (n=3) died in the early neonatal death (in the 1st 7 days). Two of them died with a diagnosis of cardiac failure while one was due to septic shock. The composite adverse perinatal outcome was 17% (n=69).

Table 6. The neonatal outcome characteristics of the study participants

Variable	Frequency	Percent
Weight in gram		
<2500	15	3.6
2500-3999	372	90.1
≥4000	26	6.3
Sex of the study participants		
Female	217	52.5
Male	196	47.5
First minute APGAR		
<4	1	.2
4-6	15	3.6
≥7	397	96.1
Fifth minute APGAR		
4-6	9	2.2
>6	404	97.8
Low 5th minute APGAR		
Yes	9	2.2
No	404	97.8
Perinatal death		
Yes	3	0.7
No	410	99.3
ENND		
Yes	3	0.7
No	410	99.3
Variable	Frequency	Percent
MAS		
Yes	389	94.2
No	24	5.8
Types of new born care		
Routine	388	93.9
ONPS	10	2.4
ONPS with BMV	9	2.2
Intubation	6	1.5
Adverse neonatal out come		
Yes	68	16.5
No	345	83.5
Admitted in NICU		
Yes	66	16.0
No	347	84.0

Reason for NICU admission (n=66)		
MAS		
Yes	18	27.3
No	48	76.7
RDS		
Yes	18	27.3
No	48	76.7
PNA		
Yes	14	21.2
No	52	78.8
EONS		
Yes	6	9.1
No	60	90.9
hyper bilirubinaemia		
Yes	4	6.1
No	62	93.9
congenital anomaly		
Yes	4	6.1
No	62	93.9
preterm or LBW		
Yes	2	3.0
No	64	97
Need of support with oxygen (n=66)		
INO2	38	57.6
CPAP	12	18.2
No support	16	24.2
Stage of PNA		
Stage I	5	35.7
Stage II	7	50.0
Stage III	2	14.3
Neonatal outcome from NICU (n=66)		
Survived	63	95.3
Died	3	4.7
Couse of death(n=3)		
Cardiac failure	2	66.7
Septic shock	1	33.3
Length of NICU admission in days		
<1	20	30.3
1-7	28	42.4
>7	18	27.3

5.7 Determinants of Adverse Perinatal Outcome among the Study Participants

Among the study participants, those who delivered at GMH and ZMH had significantly increased composite adverse perinatal outcome with an adjusted OR of 9.92 (95% CI, 2.86-34.39) and 6.35 (95% CI, 1.61-25.03) respectively. Similarly, those participants whose age was <20 and ≥35 were also had significantly increased adverse perinatal outcome with an

adjusted OR of 6.21 (95% CI, 1.77-21.84) and 3.67 (95% CI, 1.33-10.15) respectively. Regarding obstetrical parameters, those participants with MSAF, those with antepartum Obstetrical and medical risk factors and those with birth weight <2500 gram had significantly increased adverse perinatal outcome with an adjusted OR of 2.91 (95% CI, 1.36-6.25), 2.49 (1.06-5.84), 12.22 (95% CI, 3.32-44.97) and 7.25 (95% CI, 1.34-39.11) respectively. On the other hand those participants with monthly household income <5000 ETB were less likely to have adverse perinatal outcome (AOR=0.22; 95% CI, 0.07-0.66).

Table 7 Determinants of Adverse Perinatal Outcome among Women Who Deliver at the Three Teaching Hospitals of Addis Ababa University

Variable	**Categories**	**Adverse Perinatal Outcome**			**P value**	**OR (95% CI)**	**P value**	**AOR (95% CI)**
		No (%)	**Yes (%)**	**Total (%)**				
Place of Delivery	TAH	66 (94.3)	4 (5.7)	70 (16.9)	**0.009**	**1**	**0.001**	1
	ZMH	106 (86.2)	17 (13.8)	123 (29.8)	**0.092**	**2.65 (0.58-8.21)**	**0.008**	**6.35 (1.61-25.03)**
	GMH	173 (78.6)	47 (21.4)	220 (53.3)	**0.006**	**4.48 (1.55-12.93)**	**0.000**	**9.92 (2.86-34.39)**
Residence	Addis Ababa	342 (83.4)	68 (16.6)	410 (99.3)	1.00	1		1
	outside Addis Ababa	3 (100)	0 (0)	3 (0.7)		-		-
Age of the study participant	20-34	318 (86.4)	50 (13.6)	368 (89.1)	**0.000**	1	**0.002**	1
	<20	9 (60.0)	6 (40.0)	15 (3.6)	**0.008**	**4.24 (1.45-12.43)**	**0.004**	**6.21 (1.77-21.84)**
	≥35	18 (60.0)	12 (40.0)	30 (7.3)	**0.000**	**4.24 (1.93-9.33)**	**0.012**	**3.67 (1.33-10.15)**
Marital status	Married	337 (84.0)	64 (16.0)	401 (97.1)	**0.18**	1	0.97	1
	Not married	8 (66.7)	4 (33.3)	12 (2.9)		**2.66 (0.77-9.00)**		0.97 (0.20-4.75)
Occupation	Not working	118 (86.8)	18 (13.2)	136 (32.9)	**0.215**	1	0.30	1
	Working	227 (81.9)	50 (18.1)	277 (67.1)		**0.69 (0.39-1.24)**		0.66 (0.29-1.47)
Partner occupation	government employee	56 (87.5)	8 (12.5)	64 (15.5)	0.65	1	-	1
	private employee	240 (82.5)	50 (17.2)	290 (70.2)	0.36	1.46 (0.66-3.25)	-	-

	daily labourer	49 (83.1)	10 (16.9)	59 (14.3)	0.49	1.43 (0.52-3.91)	-	-
Education status	Illiterate	24 (66.7)	12 (33.3)	36 (8.7)	**0.063**	1	0.479	1
	read and write	16 (80.0)	4 (20.0)	20 (4.8)	**0.295**	0.50 (0.14-1.83)	0.414	0.49 (0.09-2.71)
	Primary	156 (84.3)	29 (15.7)	185 (44.8)	**0.015**	**0.37 (0.17-0.83)**	0.094	0.32 (0.08-1.22)
	Secondary	83 (86.5)	13 (13.5)	96 (23.2)	**0.012**	**0.31 (0.13-0.78)**	0.111	0.29 (0.64-1.33)
	Tertiary	66 (86.8)	10 (13.2)	76 (18.4)	**0.015**	**0.30 (0.12-0.79)**	0.421	0.51 (0.10-2.61)
Partner education	Illiterate	10 (71.4)	4 (28.6)	14 (3.4)	**0.09**	1	0.490	1
	read and write	12 (66.7)	6 (33.3)	18 (4.4)	0.773	1.25 (0.27-5.71)	0.772	1.37 (0.16-11.46)
	Primary	101 (80.8)	24 (19.2)	125 (30.3)	0.411	0.59 (0.17-2.06)	0.773	0.78 (0.14-4.36)
	Secondary	124 (87.3)	18 (12.7)	142 (34.4)	0.363	0.36 (0.10-1.28)	0.457	0.51 (0.08-3.05)
	Tertiary	98 (86.0)	16 (14.0)	114 (27.6)	0.168	0.41 (0.11-1.46)	0.248	0.34 (0.05-2.13)
House hold monthly income	5000-15000birr	226 (83.7)	44 (16.3)	270 (65.4)	**0.027**	1	**0.008**	1
	<5000 birr	84 (89.4)	10 (10.6)	94 (22.8)	0.187	0.61 (0.29-1.27)	**0.007**	**0.22 (0.07-0.66)**
	>15000 birr	35 (71.4)	14 (28.6)	49 (11.9)	**0.043**	**2.06 (1.02-4.13)**	0.123	2.06 (0.82-5.16)
Parous	No	195 (84.8)	35 (15.2)	230 (55.7)	0.44	1	-	1
	Yes	150 (82.0)	33 (18.0)	183 (44.3)		1.23 (0.73-2.06)	-	-
ANC	No	2 (100)	0 (0)	2 (0.5)	1.00	1	-	1
	Yes	343 (83.5)	68 ()	411 (99.5)		-	-	-
GA at delivery	Term	284 (85.0)	50 (15.0)	334 (80.9)	**0.046**	1	0.495	1
	Preterm	21 (67.7)	10 (32.3)	31 (7.5)	**0.016**	**2.71 (1.20-6.09)**	0.370	1.79 (0.5-6.35)
	Postterm	40 (83.3)	8	48 (11.6)	0.760	1.14	0.51	0.69

			(16.7)			(0.50-2.57)	8	(0.22-2.13)
Onset of labour	Spontaneous	275 (85.4)	47 (14.6)	322 (78.0)	**0.054**	1	0.854	1
	Induced	70 (76.9)	21 (23.1)	91 (22.0)		**1.76 (0.99-3.13)**		1.08 (0.48-2.44)
Antepartun risk	None	248 (87.0)	37 (13.0)	285 (69.0)	**0.002**	1	**0.001**	1
	Obstetric	85 (78.8)	23 (21.3)	108 (26.2)	**0.043**	**1.81 (1.02-3.23)**	**0.037**	**2.49 (1.06-5.84)**
	Medical	12 (60.0)	8 (40.0)	20 (4.8)	**0.002**	**4.47 (1.71-11.66)**	**0.000**	**12.22 (3.32-44.97)**
MSAF	No	241 (86.7)	37 (13.3)	278 (67.3)	**0.013**	1	**0.006**	1
	Yes	104 (77.0)	31 (23.0)	135 (32.7)		**1.94 (1.14-3.30)**		**2.91 (1.36-6.25)**
Birth weight	2500-3900 gm	323 (86.8)	49 (13.2)	372 (90.1)	**0.000**	1	0.025	1
	<2500 gm	7 (57.7)	8 (53.3)	15 (3.6)	**0.000**	**7.53 (2.62-21.7)**	**0.021**	**7.25 (1.34-39.11)**
	>4000 gm	15 (57.7)	11 (42.3)	26 (6.3)	**0.000**	**4.83 (2.1-11.13)**	0.095	2.98 (0.83-10.72)
Neonatal gender	Female	180 (82.9)	37 (17.1)	217 (52.5)	0.74	1	-	1
	Male	165 (84.2)	31 (15.8)	196 (47.5)		0.91 (0.54-1.54)		-

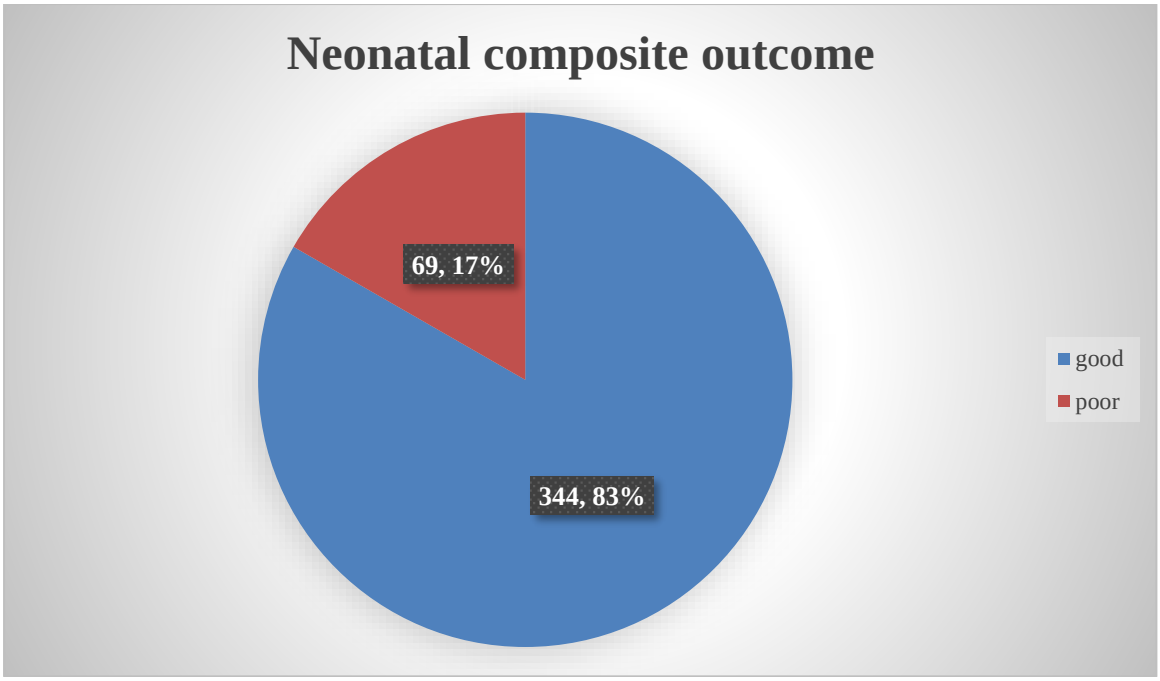

Figure 6. The neonatal composite outcome.

5.8 The relation between fluid status and perinatal outcomes

In this study perinatal mortality in births with clear fluid was 2/1,000 live births and increased to 14/1,000 in the presence of MAF.44.4% of the neonate of APGAR<7 had MSAF, but only 32.4% of APGAR of ≥7 had MSAF. Forty-seven percent of the neonate who were admitted in NICU had MSAF while 30% of the neonate having MSAF were not admitted in NICU.

Table 8. The relation between fluid status and perinatal outcomes

Perinatal outcomes	Total (%)	Fluid status (%)			X^2 test
		Clear	Bloody	MSAF	
Low Fifth minute APGAR					
Yes	9(2.2)	4 (44.4)	1(11.1%)	4(44.4)	0.146
No	404(97.8)	264(65.3)	9(2.2)	131(32.4)	
NICU admission					
Yes	66(16)	35(53)	0	31(47)	0.014
No	347(84)	233(67.1)	10(2.9)	104(30)	
RDS					
Yes	52(78.8)	24(46.2)	0	28(53.8)	0.031
No	14(21.2)	11(78.6)	0	3(21.4)	
MAS					
Yes	23(35.4)	2(8.7)	0	21(91.3)	0.000
No	43(64.6)	32(76.2)	0	11(23.8)	
PNA					
Yes	14(21.2)	12(85.7)	0	2(14.3)	0.001
No	52(78.8)	22(42.3)		30(57.7)	
EONS					
Yes	6(9.1)	4(66.7)	0	2(33.3)	0.045
No	60(90.9)	28(46.7)		32(53.3)	
hyper bilirubinemia					
Yes	4(6.1)	4(100)	0	0	0.214

No	62(93.9)	29(46.8)	1(1.6)	32(51.6)	
congenital anomaly					
Yes	4(6.1)	4(100)	0	0	0.364
No	62(93.9)	39(62.9)	1(1.6)	22(35.5)	
Neonatal outcome from NICU (n=66)					
Survived	63(95.3)	32(53.3		31(46.7)	0.451
Died	3(4.7)	1(33.3)	0	2(66.6)	

5.9 the perinatal outcome of deliveries complicated with meconium sustained amniotic fluid

The overall adverse perinatal outcome in the study participants was 16.5% (n=68). The rate of NICU admission was 16% (n=66) and that of low 5th minute APGAR score was 2.2% (n=9). Perinatal death complicated 0.7% (n=3) of the deliveries. Among the study participants, 23.0% (32/135) of the neonate delivered from MSAF had adverse perinatal outcome as compared to those without MSAF (13.3%). The AOR for adverse perinatal outcome for those with MSAF was 2.91 (95% CI, 1.36-6.25). In other words, the rate MSAF in those participants with adverse perinatal was 45.6% with OR for MSAF of 1.94 (95% CI, 1.14-3.30). The rate of MSAF was also significantly increased in those who were admitted to the NICU (47% vs 30%), and those who deliver by caesarean section (55.3% vs 18.5%) with OR of 2.07 (95% CI, 1.21-3.53) and 5.50 (95% CI, 3.50-8.52) respectively. It was also increased in those with low 5th minute APGAR score (44.4% vs 32.4%) though it did not reach statistical significance.

Table 9 Perinatal Outcome of Deliveries with and without MSAF in Three Teaching Hospitals of Addis Ababa University

Variable	**Category**	**Frequency (%)**	**MSAF**		**P value**	**OR (95% CI)**
			No (%)	**Yes (%)**		
Low 5th min. APGAR	No	404 (97.8)	273 (67.6)	131 (32.4)	0.482	1
	Yes	9 (2.2)	5 (55.6)	4 (44.4)		1.67 (0.44-6.31)
NICU Admission	No	347 (84.0)	243 70.0)	104 (30.0)	**0.007**	1
	Yes	66 (16.0)	35 (53.0)	31 (47.0)		**2.07 (1.21-3.53)**
Perinatal Death	No	410 (99.3)	277 (67.6)	133 (32.4)	0.250	1
	Yes	3 (0.7)	1 (33.3)	2 (66.7)		4.17 (0.37-46.35)
Adverse PN Outcome	No	345 (83.5)	241 (69.9)	104 (30.1)	**0.013**	1
	Yes	68 (16.5)	37 (54.4)	31 (45.6)		**1.94 (1.14-3.30)**
Mode of Delivery	SVD	230 (55.7)	191 (83.0)	39 (17.0)	**0.000**	1
	AID	24 (5.8)	16 (66.7)	8 (33.3)		2.45 (0.98-6.12)
	CD	159 (38.5)	71 (44.7)	88 (55.3)		**6.07 (3.81-9.67)**
Caesarean Delivery	No	254 (61.5)	207 (81.5)	47 (18.5)	**0.000**	1
	Yes	159 (38.5)	71 (44.7)	88 (55.3)		**5.50 (3.50-8.52)**

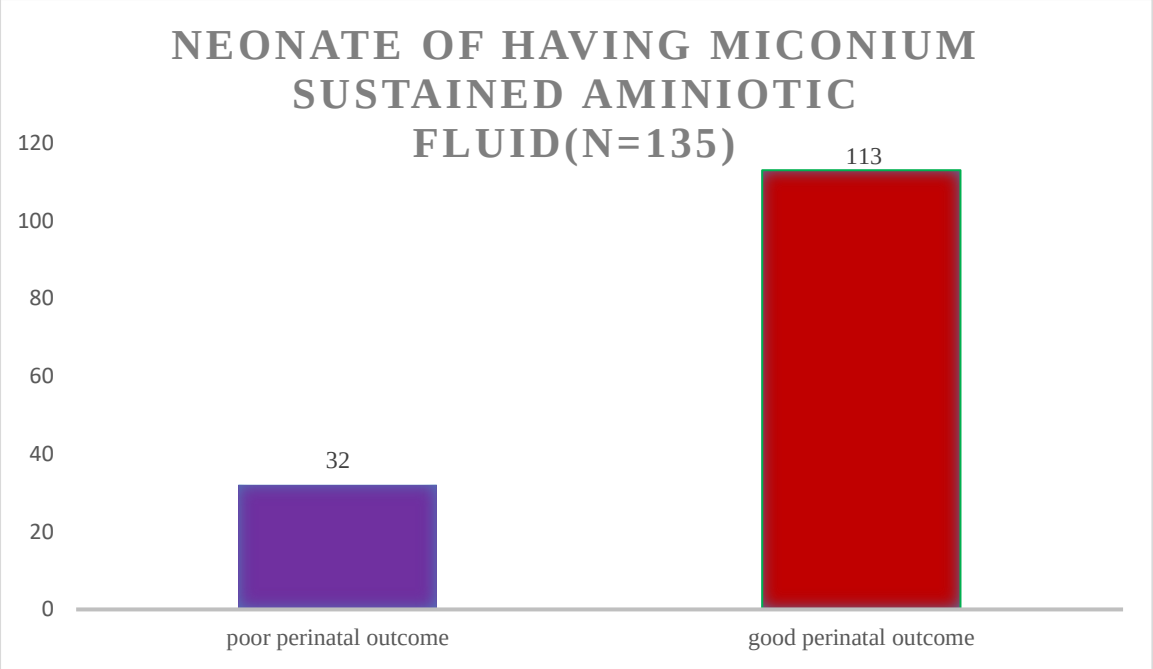

*Figure 7*Figure 8.Neonate of having meconium sustained amniotic fluid

5.10 the association of clear liquor and meconium-stained liquor on neonatal outcome.

In the study setting, liquor status, age of the study participants, education status and parity were associated with composite adverse perinatal outcome by bivariate logistic regression. The multivariate logistic regression revealed that, the study participant who was from GMH were 4.48 folds increase its poor perinatal outcome compared to TASH (AOR=4.48 (1.55-12.93) and study participant whose liqueur was meconium sustained had 1.9 folds increase its poor perinatal outcome compared to clear liqueur (AOR=1.9, 95%CI=1.10, 3.52).

The study participants whose age was >35 years had 4.24fold increased poor perinatal outcome compared to age 20-34 (AOR=4.24 (1.93-9.33) and participants who were illiterate had 2.6 folds increase its poor perinatal outcome compared to education of tertiary and above (AOR=2.6, 95%CI=1.89, 7.47). Participant who were not married had 2.66 folds increased poor perinatal outcome compared to married (AOR=2.66 (0.77-9.00).

Table 4. The association of independent variable with composite perinatal outcome by binary logistic regression.

Categories Place of delivery	Adverse Perinatal Outcome			P value	OR (95% CI)	P value	AOR (95% CI)
	No(%)	Yes(%)	Total(%)				
TAH	66 (94.3)	4 (5.7)	70 (16.9)	**0.009**	**1**	**0.001**	1
ZMH	106(86.2)	17(13.8)	123(29.8)	**0.092**	**2.65 (0.58-8.21)**	**0.008**	**6.35(1.61,25.03)**

GMH	173(78.6)	47(21.4)	220(53.3)	**0.006**	**4.48 (1.55-12.93)**	**0.000**	**9.92 (2.86-34.39)**
Residency							
Addis Ababa	342 (83.4)	68 (16.6)	410 (99.3)	1.00	1		1
outside Addis Ababa	3 (100)	0 (0)	3 (0.7)		-		-
Liquor status							
Clear	231	37	268	1		1	
Meconium stained	113	32	145	0.033	1.8(1.05, 2.99)	0.023	**1.9(1.10, 3.52)**
Age of the study participants in years							
20-34	318(86.4)	50(13.6)	368(89.1)	**0.000**	1	**0.002**	1
<20	9 (60.0)	6 (40.0)	15 (3.6)	**0.008**	**4.24 (1.45-12.43)**	**0.004**	**6.21(1.77,21.84)**
≥35	18 (60.0)	12(40.0)	30 (7.3)	**0.000**	**4.24 (1.93-9.33)**	**0.012**	**3.67 (1.33-10.15)**
Marital status							
Married	337(84.0)	64(16.0)	401(97.1)	**0.18**	1	0.97	1
Not married	8 (66.7)	4 (33.3)	12 (2.9)		**2.66(0.77,9.00)**		0.97 (0.20-4.75)
Occupation							
Not working	118(86.8)	18(13.2)	136(32.9)	**0.215**	1	0.30	1
Working	227(81.9)	50(18.1)	277(67.1)		**0.69 (0.39-1.24)**		0.66 (0.29-1.47)
Partner occupation							
government employee	56 (87.5)	8 (12.5)	64 (15.5)	0.65	1	-	1
private employee	240(82.5)	50(17.2)	290(70.2)	0.36	1.46(0.66-3.25)	-	-
daily labourer	49 (83.1)	10(16.9)	59 (14.3)	0.49	1.43(0.52,3.91)	-	-
Education status							
Illiterate	24(66.7)	12(33)	36 (8.7)	**0.06**	1	0.47	1
read and write	16(80.0)	4(20.0)	20 (4.8)	**0.25**	0.50 (0.141.83)	0.44	0.49 (0.09-2.71)
Primary	156(84)	29(15.7)	185(44)	**0.015**	**0.37 (0.17-0.83)**	0.094	0.32 (0.08-1.22)
Secondary	83 (86.5)	13 (13.5)	96 (23.2)	**0.012**	**0.31 (0.13-0.78)**	0.111	0.29 (0.64-1.33)
Tertiary	66 (86.8)	10 (13.2)	76 (18.4)	**0.015**	**0.30 (0.12-0.79)**	0.421	0.51 (0.10-2.61)
Partner Education							
Illiterate	10 (71.4)	4 (28.6)	14 (3.4)	**0.09**	1	0.490	1
read and write	12 (66.7)	6 (33.3)	18 (4.4)	0.773	1.25 (0.27-5.71)	0.772	1.37 (0.16-11.46)
Primary	101 (80.8)	24 (19.2)	125 (30.3)	0.411	0.59 (0.17-2.06)	0.773	0.78 (0.14-4.36)
Secondary	124 (87.3)	18 (12.7)	142 (34.4)	0.363	0.36 (0.10-1.28)	0.457	0.51 (0.08-3.05)
Tertiary	98 (86.0)	16 (14.0)	114 (27.6)	0.168	0.41 (0.11-1.46)	0.248	0.34 (0.05-2.13)
Parity							
No	195 (84.8)	35 (15.2)	230 (55.7)	0.44	1	-	1

Yes	150 (82.0)	33 (18.0)	183 (44.3)		1.23 (0.73-2.06)	-	-
House hold income							
5000-15000birr	226 (83.7)	44 (16.3)	270 (65.4)	**0.027**	1	**0.008**	1
<5000 birr	84 (89.4)	10 (10.6)	94 (22.8)	0.187	0.61 (0.29-1.27)	**0.007**	**0.22 (0.07-0.66)**
>15000 birr	35 (71.4)	14 (28.6)	49 (11.9)	**0.043**	**2.06 (1.02-4.13)**	0.123	2.06 (0.82-5.16)
para I	34	194		1		1	
para II-IV	23	131		0.995	1.1 (0.56, 1.78)	0.514	1.2(0.67, 2.26)
para >V	12	19		0.002	3.6 (1.60,8.09)	0.046	**2.4(1.84, 2.91)**
Establishment of labor							
Spontaneous	49	273		1		1	
Induced	20	71		0.129	1.6 (0.88, 2.81)	0.161	1.6(0.84, 2.91)

6. Discussion

The finding of this study revealed that the magnitude of MSAF were 32.7% (n=135). This finding was higher than the epidemiologic study done in France (7.9%) [21] it could be due to deference in study design. Our study was a facility-based study at referral centres. In studies done at Bahir Dar and Jimma Referral Hospitals the prevalence of MSAF was 24% and15% respectively. [5],[8] This difference may be due to the effect of a larger proportion of participant having a post term pregnancy in our study were higher (11.6%)from those (60.4%) had meconium-stained amniotic fluid. The finding also revealed that the prevalence of MSAF increased as GA advance, this finding was supported by study done in France [21], Cleary GM, et al [13]. This may be due to that the reduction of amniotic fluid volume as gestation increase, the maturity &development of the GI system increases as gestation advances.

Maternal age ≥ 35, Post term deliveries and presence of maternal medical and obstetric complications were associated with MSAF, these is in line with study done in Bahir Dar. [5]

In our study 65.2% of the study participants who had MSAF were delivered by caesarean section, while majority of the participants who had a clear liqueur were delivered through spontaneous vaginal delivery. This finding was similar with the study done India, and Jimma University Specialized Hospital [3,8]. The higher rate may be due to lack of facilities such as,

foetal scalp PH monitoring and tracings of foetal electronic monitoring. The reason for the increased rate of LSCS and NICU admission in the MSAF group maybe because our institute is a tertiary care referral center with more than 50% of the patients coming to our hospital having some associated high-risk factors.

The other reason why caesarean section increases in with a meconium stained liqueur was increased non-reassuring fetal heart beat status among those with MSAF. Our finding revealed that as grade of meconium increase the level of reassuring reduced. This was evidenced by the research finding of as liqueur status of GIMSAF its reassuring FHRP were 94.6%, but when it became GII and GIIIMSAF the reassuring status reduced to 64.8% and 58.8% respectively, this finding was congruent with the study done in Shaikh Zyed Federal Postgraduate Medical Institute [2].

The finding also revealed that 17% (n=69) of the neonate had poor perinatal composite outcome and from those of poor composite outcome participant having MSAF accounts 46.4% (n=32). This finding was supported by the study done by Shaikh Zyed Federal Postgraduate Medical Institute, USA and Jimma university referral hospital [2, 8,18].

Thirteen percent (n=66) of were admitted in NICU and the Pattern of NICU admission diagnosis were MAS, RDS, PNA and EONS with each account 27.3%, 27.3%, 21.2% and 9.1% respectively. this finding was congruent with the study done in India. [16]

The study participant who was from GMH were 4.48 folds increase its poor perinatal outcome compared to TASH (AOR=4.48, 95%CI=4.6, 95%CI=1.53, 14.06), this may be due to the deference level of care provided during antenatal follow up and NICU.

Participant having liqueur of meconium sustained had 1.9 folds increase its poor perinatal outcome compared to clear liqueur (AOR=1.9, 95%CI=1.10, 3.52). this may be due to as meconium induced inflammation of the lung is complicated by the mechanical effect of particulate meconium causing partial or complete obstruction, this combination results in severe respiratory failure, often with pulmonary hypertension as well as air block syndrome [20] .In this study MAS which is a serious life-threatening disorder of the new born occurs 12% of infants born through MSAF. This is higher than the study done at Baylor university [20]. this may due to sub optimal antepartum and intra partum obstetric management as well as lack of effective postdelivery resuscitation of the neonate delivered through MSAF, in our practice, most infants born through MSAF have upper airway suctioning before delivery of the shoulders and then tracheal intubation and suctioning in the delivery room. Currently

suctioning of upper air way is no longer recommended in vigorous neonates and only depressed infants are intubated for tracheal suctioning [20].

Our study shows 23.0% (32/135) of the neonate delivered from MSAF had adverse perinatal outcome as compared to those without MSAF (13.3%). The AOR for adverse perinatal outcome for those with MSAF was 2.91 (95% CI, 1.36-6.25). this finding was similar with study done in India. [16]

The study participant whose age of ≥35 years had poor perinatal outcome compared to age 20-34 years (AOR=4.24 (1.93-9.33). This finding supported by studies done in India and Northern Ethiopia. [5,16]

7 Conclusion

the prevalence of MSAF in the study participants was high (32.6%) and the presence of MSAF was associated with increased risk of adverse perinatal outcome and increased rate of caesarean delivery. In addition, women with post term pregnancies, maternal age ≥35 presence of maternal medical and obstetric complication and those are at higher risk of MSAF.

60.7% of the study participants those of having MSAF were delivered by caesarean section. The finding also revealed that 17% (n=69) of the neonate had poor perinatal composite outcome and from those of poor composite outcome participant having MSAF accounts 46.4 %. Thirteen percent (n=66) of were admitted in NICU and the Pattern of NICU admission diagnosis were MAS, RDS, PNA and EONS with each account 27.3%, 27.3%, 21.2% and 9.1% respectively.

The determinant factor affecting the perinatal outcome were study setting (AOR=4.6, 95%CI=4.6, 95%CI=1.53, 14.06), liqueur of meconium sustained (AOR=1.9, 95%CI=1.10, 3.52), age of >35 years compared to age 20-34years (AOR=4.24 (1.93-9.33)

8 Recommendation

We recommend practitioners to be vigilant and individualised patient management for those women with extreme age groups and pregnant women with macrosomic fetus, medical or obstetric complications. we also recommend to consider early delivery to decrease post term pregnancies and MSAF and adverse perinatal out come. In this study, the diagnosis of MAS was made by clinical examination only in all of the cases, further studies with Chest X-Ray and follow up of the neonates is needed to settle the actual prevalence of MAS and its outcomes.

Limitation

As a limitation in this study; mothers with uncomplicated labor sent home in the immediate postpartum days with their babies, and therefore postpartum infection couldn't be addressed. And even if in some cases, MAS start to manifest after 24 hours, neonates who were discharged earlier and develop the disease later might be under reported. And this study assessed only the perinatal outcomes of deliveries with MSAF with in a1 week period.

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18. N Beligere and R Rao, Neurodevelopmental outcome of infants with meconium aspiration syndrome: report of a study and literature review

Annex I: English Version Information Sheet

Questionnaire Identification Number _____

My name is _____. I am working as data collector in the research Conducted by Dr Legesse, who is conducting this research for the partial fulfillment of his specialty in Obstetrics and Gynecology in AAU. We are trying to assess Prevalence of Meconium stained amniotic fluid and outcomes of mothers who come in labor and delivery at Three Teaching Hospital Addis Ababa university, Ethiopia.

Purpose: I am hopeful that this research will benefit all who will deliver . I will provide research results to concerned body for intervention.

Procedure: I want your Consent to extract data from your medical chart and interviewing for missed information, to assess the Prevalence Meconium stained amniotic fluid and outcomes of mothers who come in labor and delivery at three Teaching Hospital of Addis Ababa university. If you are willing to participate in this project, you need to understand and say yes‟ on the agreement form.

Risk/ Discomfort: By participating in this research project, you may feel that it has some discomfort especially on Spending time about 30 minutes. We hope you will participate in the study for the sake of the Benefit of the research result. I am Shure there is no risk in participating in this research project.

Benefits there may not be direct benefit to you but your Participation is likely to help us in assessment of Prevalence of Meconium stained amniotic fluid and outcomes of mothers and neonates who come in labor and delivery, which will have importance in improving maternal and child health services at the three institutions.

Confidentiality: The information collect from this research project will be kept confidential and information about you that will be collected by this study will be stored in a file, without your name, but a code number assigned to it. In addition, it will not be revealed to anyone except the principal investigator and will be kept locked with key.

Right to refuse or withdraw: You have full right to refuse from participating in this research. You can choose not to respond to some or all questions if you do not want to give

your response. In case you need more information about the survey, you may contact the PI of the study.

Dr. Legesse Tadege, through the following address:

PI's full name: Legesse Tadege

Cell phone address: +251912275370

Annex II: English Version Consent Form

I understand all conditions stated above. I have understood that Participation in this study is entirely voluntarily. I have been told that my answers to the questions will not be given to anyone else and no reports of this study ever identify me in any way Therefore, I am Ready and willing to participate in this study.

If respondent does not agree to be interviewed thanks them and go to the next respondent

If respondent say YES continue

Checked by:

Supervisor Name _____ signature_____

Date_____/_____/____E.C.

Time Interview Started: Hour: _____ Minute: _____

Questionnaire No_____

Time Interview Ended: Hour: _____ Minute: _____

Date _____/_____/____ ____E.C. signature_____

Part-I: Socio Demographic Characteristics

Date: _____ Hospital_____ serial No_____ Card No_____

1. Address: Addis Ababa ☐ outside Addis Ababa ☐

2. Age (in years) _____

3. Marital Status: Single ☐ Married ☐ Widowed ☐ Divorced☐ Separated☐

4. Occupation: Housewife ☐ Government employee ☐ Private employee ☐

Daily laborer ☐ other _____

5.Partner occupation: Government employee ☐ Private employee ☐

Daily laborer ☐ other _____

6. Educational level: Illiterate ☐ Read and Write☐ Primary education☐ Secondary education☐ Tertiary and above☐

7.Partner education lavel; Illiterate ☐ Read and Write☐ Primary education☐ Secondary education☐ Tertiary and above☐

8.Householed income per mounth:……..EB

Part-II: Reproductive and Obstetric History

9. Gravidity _____

10.Parity_____

11.Abortion_____

12.Other prior pregnancies: _____
13.Gestational Age: Weeks _____ days_____
14.Onset of Labor: Spontaneous ☐ Induced☐

15. If induction, what was the indication: Preeclampsia☐ Post term☐ Oligohydramnios☐ Other……..
16.if spontaneous, Stage of labor at admission: LFSOL ☐ AFSOL ☐ SSOL ☐

17.Antepartum complication: IUGR☐ Preeclampsia☐ Anaemia☐ PPROM☐

Oligohydramnios ☐ other (specify) ……..

18. Status of membrane at admission: intact ☐ raptured ☐

19. If raptured, liquor status: clear ☐ blood stained ☐ MSAF ☐

20. If answer for no19 is MSAF, grade of meconium: grade I ☐ grade II☐ grade III☐

21. Intrapartum FHB status: Reassuring ☐ Non-reassuring☐
22. Type of non-reassuring FHB :Tachycardia☐ Bradi cardia ☐ Abnormal CTG ☐

23. total duration of Labor in (hrs): <20 hrs ☐ ≥20 hrs ☐

24. Mode of delivery: SVD☐ AID ☐ CS☐

25. Indication for operative delivery: MSAF ☐ Non reassuring fetal heart rate pattern☐ MSAF with NRFHRP ☐ MSAF in LFSOL☐ labor abnormality ☐ Other……..

26. labor abnormality diagnosed: PLFSOL ☐ cervical arrest AFSOL ☐ PSSOL ☐ CPD☐ malposition☐ other…….

Part-III: Neonatal outcome

28.Birth weight (in grams) …….

29.Sex: M☐ F☐

30.APG AR score: 1st Minute (<4☐ 4 - 7 ☐ >7 ☐) 5th Minute:(<4☐ 4 - 7 ☐ >7 ☐)
31.Neonate immediately after delivery: vigorous☐ not vigorous ☐

32.Type of neonatal care: routine ☐ ONPS, ☐ ONPS, no BMV ☐ ONPS, with BMV ☐
33.Neonate referred to neonatal ICU: Yes☐ No☐

34.If yes to the above question what was the reason: MAS☐ RDS☐ PNA☐ EONS☐ Others specify……

35.If the reason for referral is PNA ,stage of asphyxia: stage I ☐ stage II ☐ stage III ☐

36.Level of care provider, who resuscitate neonate: junior R ☐ senior R ☐ pedi R☐ midwife ☐

37.Respiratory distress: yes ☐ no ☐

38.Neonate diagnosed with severe MAS: yes ☐ no ☐

39.Type of neonatal respiratory support in the ICU: INO2 ☐ CPAP ☐ INO ☐ surfactant lavage ☐ no support ☐

40.Neonatal death: Yes☐ No☐

41.If yes to question number 40 specify the reason----------

Part-IV: Maternal outcome

42.Maternal infection: SSI☐ deep surgical site infection☐ endometritis ☐sepsis☐

43.Mod of delivery: SVD ☐ CS ☐ IAD ☐

44.Indication for operative delivery: MSAF with NRFHP ☐ GIIMSAF IN LFSOL ☐other☐

45.Hospital admission: Yes☐ No☐

46.Maternal Death: Yes☐ No☐

47. If yes to question number 46 specify the cause of death----------