

Prevalence and Contributing Factors of Meconium Stained Amniotic Fluid Among Women Delivered at St Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia

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Abstract

Background: The incidence of meconium-stained amniotic fluid during labor were considered as an indicator of unpleasant condition for the delivery outcomes which leads to mild to severe respiratory problem, which contributed to perinatal and neonatal morbidity and mortality.

Objective: To assess the prevalence of meconium stained amniotic fluid and its contributing factors among mothers who delivered at St. Paul's Hospital Millennium Medical College.

Methods: Hospital based cross-sectional study design was implemented at St. Paul's Hospital Millennium Medical College from June 26 – July 24, 2019. The study respondents were chosen by using systematic random sampling methods. Chart review together with structured interview was implemented to gather the data. Data was entered and analyzed by SPSS versions 20. Both descriptive & analytical statistics were calculated. Statistical significance was measured at $P < 0.05$ and the degree of association were assessed by using adjusted odds ratio.

Result: A total of 248 mothers were enrolled in the study with a response rate of 100%. The prevalence of meconium stained amniotic fluid was found 30 (12.1%) with [95%CI = 8.1-16.5]. Women whose premature rupture of membrane [AOR=7.6, 95%CI=2.525-23.00], preeclampsia [AOR=5.4, 95%CI=1.579-19.145], prolonged premature rupture of membrane [AOR=5.1, 95%CI=1.221-22.122], duration of labor >12hrs [AOR=5.1, 95%CI=1.221-22.122], prolonged labor [AOR = 3.0, 95%CI=1.075-8.857] were associated with meconium stained amniotic fluid in this study.

Conclusion: The finding concludes that meconium stained amniotic fluid was common problem which impose adverse condition to the fetus and newborn. And it is related to maternal factors such as preeclampsia, length of labor, Prolonged Premature Rupture Of Membrane (PPROM), Premature Rupture Of Membrane (PROM) and prolonged labour which increase the incidence of meconium stained amniotic syndrome.

Keywords: Meconium, Meconium stained amniotic fluid, St Paul Hospital Millennium Medical College.

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1. INTRODUCTION

Back ground

Meconium stained liquor (MSL) is the presence of meconium in the uterus during intranatal period.¹ Conditions such as chronic hypoxia, respiratory acidosis and infection are contributors that result stress the fetus which induce the passage of meconium.²

Major Maternal and fetal factors which leads to Meconium stained amniotic fluid (MSAF) include hypertension, gestational diabetes mellitus, maternal chronic respiratory or cardiovascular diseases, post term pregnancy, preeclampsia, eclampsia, oligohydramnios, Intra uterine growth retardation and poor bio physical profile.³

MSAF results long and short-term delivery outcomes, which increased the need of neonatal assistance, due to the adverse outcome such as respiratory distress, lower Apgar score, meconium aspiration syndrome, neonatal sepsis and lung disease.^{2, 4} The effects of MSAF is not only posing a threat to the fetus or the neonate, but also lead to serious maternal complications include amniotic fluid embolism and puerperal endometritis.^{5, 6}

Globally the occurrence of meconium stained liquor is increase as the fetal age gets advanced and about 7 to 22% of full term pregnancy were develop this adverse condition.⁷

Neonate born through MSAF has 100 times more prone to have respiratory problem than those who have

been born with low risk of obstetric complications and clear fluid.⁶ About 5 million neonatal deaths occur globally per year. Out of these, 90% of death results from birth asphyxia and other difficulties associated with breathing. Meconium-stained liquor during labor affects 5% – 25% of all deliveries.⁸ Which subsequently leads to meconium aspiration syndrome (MAS) in about 5-12% infants which holds about 12% of neonatal mortality.^{8,9}

Whenever risk factors are detected timely, labor monitored strictly and prompt decisions are made regarding the timing and way of delivery, in order to reduce morbidity and mortality of neonate due to adverse outcome of MSAF.^{10,11} In order of this it would help stakeholders as an input to design appropriate preventive measures, for further study and may also help policy makers to give emphasis.

Despite the magnitude and associated factors of MSAF were soundly addressed by studies in the industrial countries, at hand small findings shown on the prevalence and contributing factors of MSAF in the developing countries including Ethiopia.

Hence, the purpose of this study was to found out magnitude, contributing factors of meconium stained amniotic fluid and fetal outcome among mothers who delivered at St. Paul's Hospital Millennium Medical College (SPHMMC), Addis Ababa, Ethiopia.

2. METHODS AND MATERIALS

2.1 Study setting and design

Hospital based cross-sectional study design was conducted among mothers delivered, at SPHMMC AA (Addis Ababa), Ethiopia from Jun 26 to July 24/2019 G.C. AA is the capital city of Ethiopia which has 10 sub cities lies on 540 square kilometer surface area and at altitude ranging from 2,100 meter in the southern (Akaki sub city) to 3,000 meter in northern (Entoto) above sea level. Among those sub cities the northern part of the capital city is Gullele sub city in this sub city St. Paul's hospital millennium medical college were found which is the second largest national public general specialized referral hospital located on the way of Piassa to Medhanialem secondary high school straight road way at right side beside to the Ethiopian public health institute.

The hospital was founded in 1961 E.C. by Emperor Hailesilassie with the help of the German Evangelical church by aiming mainly to serve payment free those economically under privileged population. Since 2007 the institution has been starting to train medical, nursing and public health students and named with SPHMMC. Recently it has 350 beds where an average of 300,000 patients per year admitted and treated in its various departments like medical, surgical, emergency, pediatrics, gynecology, obstetrics, NICU (Neonatal Intensive Care Unit). In terms of obstetric care 10,800 labor conducted per year. In the NICU there are around 20 beds where preterm, sick baby and KMC care were delivered. The institution has a more than 5 million catchment population and it is under the supervision of Federal Ministry of Health which holds 1200 clinical and non-clinical staff.

2.2. Sample Size Determination

Sample size was estimated by single population proportion formula. P value by considering previous study on prevalence of MSAF at Felegehiwet hospitals the finding was 17.8% with confidence interval of 95% CI. $Z=1.96$, and marginal error =5% and calculated as below:¹¹

$$n = Z^2 * P (1 - p) / d^2 =$$
$$= (1.96 * 1.96) (0.178) (1 - 0.178) / 0.05 * 0.05$$
$$= 224.8$$

= 225 and add non respondent rate 10%

= 248 were included in the study.

Where

n = is desired sample = 248

z = level of significance at 95% confidence interval = 1.96

p = an estimate of the proportion of MSAF delivery = 17.8%

d = marginal error = 5%

2.3 Sampling Procedure

Addis Ababa is a capital city of Ethiopia with greater than 3 million total population. It has 10 sub cities. The health coverage of AA is around 71% and has 11 federal and regional hospitals. From the 11 hospitals, SPHMMC were randomly selected for the study area. Systematic random sampling was implemented to get respondents from obstetric unit thus the average numbers of mother who gave birth during the data gathering time were 900 and projected based on the previous month HMIS registration book. Then sampling frame was prepared for the maternal record card by ascending order of the numbers. The total number of mothers who gave birth in a month were 900, distributed to the total number of sample size 248 and it nearly 4. The first woman was selected by lottery method then every 4th woman who gave birth was selected for the study.

2.4. Data Collection tools and procedures

Data was collected by questionnaires developed by reviewing different literatures relevant to the study objective. The questionnaire was arranged in such a way it could address independent variables (Socio-demographic characteristics, maternal associated characteristics and fetal related factors) as well as the dependent variable (MSAF). In addition to this check list was developed to guide chart review.

Data was collected by combining structured interview and card review by three BSC nurse and midwives professionals who were trained for purpose of data collection. The data collected from the respondents was on the basis of inclusion criteria in which mothers that had term and cephalic presentation delivery SPHMMC during the data collection period and had medical record with complete information. On the other hand there were excluded mothers who had preterm delivery, breach presentation, in critical condition and not willing to participate in the study.

2.5. Operational Definition

Meconium stained amniotic fluid: - according to this study the term MSAF was taken as one of those reported as having MSAF or ticked by yes and zero of those reported not having MSAF or ticked as no. Additionally the grade was taken as it was defined and record to the mother's card by the obstetricians who conducted the deliveries and graded 1, 2 and 3.

2.6. Data quality management and analysis

For the validation of the tool pretest were conducted in 12 mothers (5% of the sample who delivered at Black lion Hospital). In addition to this the data quality was maintained by data collectors through careful adherence with data collection procedures and daily check up by supervisors for completeness.

The data were checked for its comprehensiveness, reliability and accuracy then entered and analyzed by using SPSS (Statistical Package for Social Science) version 20 software, for which descriptive statistics was summarized by using percentage, ratio, mean, median and frequency. Bivariate analysis was used to check the association between dependent variable (Meconium stained amniotic fluid) with independent variables. Variables which had association with dependent variable at p-value less than 0.2 were entered to multiple logistic regression then significantly associated variables were identified based on p-value less than 0.05 and discussed accordingly.

3. RESULT

3.1. Socio-demographic characteristics

A total of 248 respondents were enrolled in the study with 100% response rate. Most of those mothers (84.3%) were in the age range of 18-35 yrs. Regarding ethnicity (37.1%) of women's were Oromo followed by Amhara (33%). Majority (34.7%) of the respondents were Orthodox Christian followers in Religion. From those respondents, (99.2%) of the laboring mothers were married and 68.5% house wife (Table 1).

Table 1: Socio-demographic characteristics of mothers who delivered at study area during the study period.

Socio-demographic characteristics of the respondents (N=248)		Frequency	Percent
Age	<18	17	6.9
	18-35	209	84.3
	>35	22	8.9
Ethnicity of respondents	Amhara	83	33.5
	Oromo	92	37.1
	Gurage	56	22.6
	Tigray	17	6.9
Residence of respondent	Urban	203	81.9
	Rural	45	18.1
Religion of respondent	Orthodox	86	34.7
	Protestant	82	33.1
	Muslim	47	19.0
	Catholic	31	12.5
	Other	2	.8
Marital status	Married	246	99.2
	Separated	2	.8
Occupation	House wife	170	68.5
	. Government employee	28	11.3
	NGO employee	16	6.5
	. Merchant	24	9.7
	Student	6	2.4
	Daily laborer	4	1.6

3.2 Obstetrics Related Characteristics

Two hundred forty one (97.1%) of mothers had a regular antenatal visit and the remaining 2.8% had less than 4 visit. About 69(27.8%) primipara, 149 (60.1%) Multipara and 30(12.1%) mothers have Grand multiparty. Most of the respondent's GA at delivery was (37-42 wks) and it was 203(81.9%). Most of the mothers 97.6% were RH positive. From the respondents, 32(12.9%) of mothers had prolonged labor and 21 (8.5%) were diagnosed to have pre-eclampsia. The labor was started spontaneously in 223(89.9%) of mothers and the rest 107(43.1%), 94(37.9%) and 47(19.0%) were delivered cesarean section, Spontaneous vaginal delivery (SVD) and instrumental delivery respectively. The fetal distress happened at first and second stage labor was 45(18.1%).

Regarding medical conditions of respondent mothers 23(9.3%), 13(5.2%) and 5(2.0%) had anemia, gestational diabetes mellitus (GDM) and Hepatitis B virus respectively. (Table 2)

Table: 2 Obstetric characteristics of women who delivered at the study time in SPHMMC delivery ward

Variable	Frequency	Percent	
ANC follow up	Yes	246	99.2
	No	2	.8
No of ANC follow up	<4 visit	7	2.8
	>4 visit	241	97.1
Parity*	Primi parity	69	27.8
	Multi Parity	149	60.1
	Grand multiparty	30	12.1
Gestational age	37-42wks	203	81.9
	>42wks	45	18.1
RH factors	Negative	6	2.4
	Positive	242	97.6
Obstructed Labor	Yes	18	7.3
	No	230	92.7
Prolonged Labor	Yes	32	12.9
	No	216	87.1
Intra Uterine Growth Retardation	Yes	12	4.8
	No	236	95.2
Pre-eclapsia	Yes	21	8.5
	No	227	91.5
Oligohydramius	Yes	17	6.9
	No	231	93.1
Onset of labor	Spontaneous	223	89.9
	Induce	25	10.1
Duration of labor**	<12	174	70.2
	> 12	74	29.8
Fetal Distress	Yes	45	18.1
	No	203	81.9
PreRupture of Membrane	Yes	37	14.9
	No	211	85.1
Prolonged PreRupture of membrane	Yes	14	5.6
	No	234	94.4
Meconium stained amniotic fluid	Yes	30	12.1
	No	218	87.9
Grade of MSAF	G I	12	4.8
	G II	10	4.0
	G III	8	3.2

*Prolonged labour defined by the international classification for disease (ICD10) as |progress of slower than one cm per or as irregular or poor uterine contractions or as a labor with regular uterine contractions for more than 12 hours and/or as a cervical dilation of ten cm for more than three hours.¹²

** parity status of women exposure define as number of pregnancy greater than 20 weeks of GA whereby multiparty was defined as a parity of 2 to 4 deliveries while grand multiparty was defined as a parity of 5 or more deliveries.¹³

3.3. Prevalence of meconium stained amniotic fluid

The prevalence of MSAF was found to be 30(12.1%) with [95%CI = 8.1-16.5]. From those 30 delivered mothers with MSAF, 8(26.7%), 10(33.3%) and 12(40.0%) were diagnosis with grade 3, grade 2 and grade 1 MSAF respectively. (Figure: 1) Among the 30 newborns delivered from MSAF, 29 were resuscitated and the rest one received immediate newborn care. From those of resuscitated infant 27 of them were transferred to NICU and three of them stayed with their mother. Most of newborns transferred to NICU 10(37.0%) were diagnosed to have Asphyxia and the rest were diagnosed with respiratory distress and neonatal sepsis.

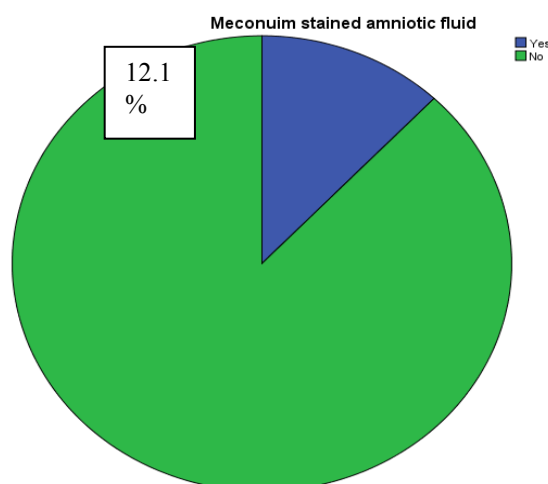


Figure: 1: Prevalence of meconium stained amniotic fluid women who gave birth at study time in SPHMMC delivery ward (n=248)

3.4 Factors Associated with Meconium Stained Amniotic Fluid

The associations between independent and dependent variables were analyzed. In the binary Logistic regression; obstructed labor, prolonged labor, preeclampsia, Intra Uterine Growth Retardation IUGR, Oligohydramius, Duration of labor, onset of labor, PROM, PPRM, Hepatitis B, were associated at p-value less than 0.2 . On the other hand fetal distress, GA, DM were not significant in this study. (Table 3)

Table: 3. Binary logistic analysis cross tab and COR women who gave birth at study time in SPHMMC delivery ward.

Variable		MSAF		Significant	COR(95%CI)
		No	Yes		
Obstructed Labor	Yes	12(4.8%)	6(2.4%)	.007	4.292(1.476-12.478)
	NO	206(83.1%)	24(9.7%)	1	1
Prolonged Labor	Yes	21(8.5%)	11(4.4%)	.000	5.331(2.279-12.478)
	No	197(79.4%)	19 (7.7%)	1	1
Intra Uterine Growth Retardation	Yes	8(3.2%)	4(16%)	.031	4.038(1.476-12.478)
	No	210(84.7%)	26(10.5%)	1	
Pre-eclampsia	Yes	14(5.6%)	7(2.8%)	.004	4.435(1.624-12.109)
	No	204(82.35)	23(9.3%)	1	
Oligohydramius	Yes	10(4.0%)	7(2.8%)	.001	6.330(2.199-18.227)
	No	208(83.9%)	23(9.3%)	1	
Onset of labor	Spontaneous	200(80.6%)	23(9.3%)		
	Induce	18(7.3%)	7(2.8%)	.014	2.299(1.037-5.100)
Duration of labor	<12hr	161(64.9%)	13(5.2)		
	>12hr	57(23.0%)	17(6.9%)	.001	3.694(1.689-8.080)
PROM	Yes	24(9.7%)	13(5.2%)	.000	6.181(2.675-14.282)
	No	194(78.2%)	17(6.9%)	1	
PPROM	Yes	7(2.8%)	7(2.8%)	.000	9.174(2.956-28.473)
	No	211(85.1%)	23(9.3%)		
Hepatitis B	Yes	3(1.2%)	2(0.8%)	.081	5.119(820-31.976)
	No	215(86.7%)	28(11.3%)		

A accordingly multiple logistic regression analysis were done and revealed that, those mothers who had premature rupture of membrane were 7.6 times higher rates of developing MSAF during labor than mothers without PROM [AOR=7.6, 95%CI=2.525-23.00].

Delivered mothers with preeclampsia were 5.4 times more prone to have MSAF as compared to those who didn't have [AOR=5.4, 95%CI=1.579-19.145]. Mothers who had PPRM were 5.1 times higher rates of developing MSAF during labor as compared to those who didn't have [AOR=5.1, 95%CI=1.221-22.122].

Mothers in labor for more than 12 hrs had about 3.2 times more potentially to develop MSAF than those who had less than 12hrs [AOR=5.1, 95%CI=1.221-22.122].

The probability of developing MSAF in prolonged labor was 3 times to have MSAF than without prolonged

labor [AOR =3.0, 95%CI=1.075-8.857]. (Table 4)

Table: 4 Multi logistic regression analysis variables P value < 0.05 women who gave birth at study time in SPHMMC delivery ward (n=248).

Variables	MSAF		Significant	AOR95%CI	
	No	Yes			
PROM	Yes	24(9.7%)	13(5.2%)	.000 ***	7.622(2.525-23.00)
	No	194(78.2%)	17(6.9%)	1	
Pre- eclampisa	Yes	14(5.6%)	7(2.8%)	.007 ***	5.498(1.579-19.145)
	No	204(82.35)	23(9.3%)	1	
PPROM	Yes	7(2.8%)	7(2.8%)	.026 ***	5.1(1.221-22.122)
	No	211(85.1%)	23(9.3%)		
Duration of labor	<12hr	161(64.9%)	13(5.2)		
	>12hr	57(23.0%)	17(6.9%)	.018***	3.268(1.22-8.723)
Prolonged Labor	Yes	12(4.8%)	6(2.4%)	.036 ***	3.085(1.075-8.857)
	No	206(83.1%)	24(9.7%)	1	

*** Variables significantly associated with dependent variable by multiple logistic regression analysis on the basis of p-value less than 0.05

4. DISCUSSIONS

This study assessed the prevalence of MSAF and its contributing factor with mothers delivered at SPHMMC. The result of this study was found to be 12.1%. The finding of this study was harmonious with the study conducted at Jimma University specialized hospital (15.4%).⁹ Furthermore the study was congruent with the finding from Ghana and St.philomenas hospital where (12.42%), (8.96%) respectively^{8,14}.

On the contrary, this result was lower than the study conducted at Bahirdar Felegehiwot hospital and the finding was (17.8).¹¹ Moreover, the finding was lower in prevalence of MSAF in which study conducted in Nigeria University it was (20.4%)¹⁵. The variation might be due to the strategy of the government in reducing NMR.

On the other hand, the prevalence of MSAF in this finding was higher than the study finding in Pakistan (7.7%)¹⁶. Discrepancy between the studies exists because this study was conducted at level of the hospital which covers dense population and where delivering mothers referred after developing complication.

More importantly the study noted that a significant association between variables. Mothers with preeclampsia were almost 5.5 times more likely to develop MSAF. This finding was corresponding with study findings in Felgehiwot comprehensive hospital, [AOR=3.45, 95%CI =1.26–9.37].¹¹ This might be due to the possibility of placental factor in mothers with preeclampsia that results in intrauterine hypoxia.

Prolonged labor showed statistically significant association with MSAF [AOR =3.0, 95%CI=1.075-8.857]. The finding was congruent with findings at India and Felegehiwot hospital [AOR=3.4 95% CI= 1.086-9.354] [25], [AOR=7.1, 95%CI =1.67–29.68] respectively.^{10,11} This reason revealed that when labor duration prolong impose stress to the fetus then the intestine starts to relax and meconium passed.

Furthermore the study shows delivering mothers with PROM were 5.1 times more prone to have MSAF. This study was comparable with the study conducted in Nigeria university teaching hospital.¹⁵ In this finding among MSAF delivery, 90% new born were transferred to NICU immediately after birth, 83 % of these were diagnosed to respiratory problem and neonatal sepsis at NICU. This study share the study conducted at Jimma University specialized hospital the majority of newborn with MSAF had complicated with MAS.⁹

5. Conclusions and recommendation

This study concluded that MSAF was common problem which impose adverse condition to the fetus and newborn. And revealed that Prolonged labor, Preeclampsia and PROM had a significant association for the incidence of MSAF. Therefore, early detection by adhering to partograph and early decision making for intervention is suggested to reduce the incident of prolonged labor and PROM. In addition to this it would be better to stick to protocols or preeclampsia chart for mothers with preeclampsia and strengthen the action of feedback to their catchment health centers. Furthermore finding will be used as an input or a baseline for other/further study.

6. Limitation of the study

This study shares the limitations of cross-sectional studies and hence may not be possible to establish a temporal relationship between MSAF and explanatory variables.

ABBREVIATION

ANC	Antenatal Care
APH	Ante Partum Hemorrhage
C/S	Caesarean Section
DM	Diabetes Mellitus
GA	Gestational Age
HMIS	Health Management Information System
HTN	Hypertension
MSAF	Meconium Stained Amniotic Fluid
MAS	Meconium Asphyxia Syndrome
MSL	Meconium Stained Liquor
NICU	Neonatal Intensive Care Unit
NMR	Neonatal Mortality Rate
PROM	Premature Rupture of Membrane
PPROM	Prolonged premature Rupture of Membrane
PNA	Prenatal Asphyxia
RDS	Respiratory Distress Syndrome
SVD	Spontaneous Vaginal Delivery
SPHMMC	St. Paul's Hospital Millennium Medical College
SPSS	Statistical Package for social Sciences

Ethical consideration

Ethical clearance was obtained from institutional review board St. Paul Hospital Millennium Medical College PM 24/524. Formal letter obtained for cooperation of medical service administrative office of St Paul's hospital millennium medical college. Then the participants were informed about the purpose of the study, the importance of the study, full confidentiality, withdraws at any time and written consent had obtained prior to data collection. Privacy and confidentiality of information given by each respondent were kept properly and number code was used otherwise names were not recorded.

Authors Contribution

All authors made significant contributions in every step of the research. Mainly HAH, FN, EN and BA developed proposal, collecting and analyzing the data and drafted the manuscript. RW performed methodology and quality management. RN and MH contributed in interpretation of data supervising the data collection, reviewed the study design and took drafted the manuscript. All authors were read and revised it critically the final version of the paper and approved for publication.

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