MEKELLE UNIVERSITY

COLLEGE OF HEALTH SCIENCEs

INSTITUTE OF BIOMEDICAL SCIENCES

DEPARTMENT OF HUMAN ANATOMY

MAGNITUDE AND ASSOCIATED FACTORS OF OLIGOHYDRAMNIOS AMONG THIRD TRIMESTER PREGNANT WOMEN AT MEKELLE PUBLIC HOSPITALS, TIGRAY, ETHIOPIA, 2024/2025: CROSS SECTIONAL STUDY

BY

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A THESIS SUBMITTED TO DEPARTMENT OF HUMAN ANATOMY, INSTITUTE OF BIOMEDICAL SCIENCES, COLLLEGE OF HEALTH SCIENCES, MEKELLE UNIVERSITY IN PARTIAL FULLFIIMENT OF THE REQUIREMENTS FOR THE MASTER'S DEGREE IN HUMAN ANATOMY

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Examiners' Approval Sheet

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I hereby certify that all the corrections and recommendations suggested by the Board of Examiners are incorporated into the final thesis entitled "Magnitude and Associated Factors of Oligohydramnios among Third Trimester Pregnant Women Attending at Public Hospitals in Mekelle city, Tigray, Ethiopia, 2024/2025, Cross-Sectional Study", By Shushay Tekulu Aregay

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LIST OF ABBREVIATIONS AND ACRONYMS

ACSH	Ayder Comprehensive Specialized Hospital
AF	Amniotic Fluid
AFI	Amniotic Fluid Index
AFV	Amniotic Fluid Volume
ANC	Antenatal care
AOR	Adjusted Odds Ratio
APGAR	Appearance, Pulse, Grimace, Activity, Respiration
CI	Confidence interval
COD	Crude Odds Ratio
CS	Cesarean Section
DM	Diabetes Miletus
EFW	Estimated Fetal Weight
GA	Gestational Age
GYN/OBS	Gynecology and Obstetrics
HIV/AIDS	Human Immune Virus/ Acquired Immune Deficiency Syndrome
IUFD	Intrauterine Fetal Death
IUGR	Intrauterine Growth Restriction
LBW	Low Birth Weight
LMIC	Low-and middle-income countries
MAM	Moderate Acute Malnutrition
MICHU	Maternal Infant Child Health Unit
MGH	Mekelle General Hospital
MSAF	Meconium Stained Amniotic Fluid
MUAC	Middle Upper Arm circumference
OPD	Out Patient Department
OR	Odds Ratios
PIH	Pregnancy Induced Hypertension
PKD	Polycystic kidney Diseases
PROM	Premature Rapture of Membrane
QGH	Quiha General Hospital
SAM	Severe Acute Malnutrition
SDP	Single Deepest Pockets
US	Ultrasound
UTI	Urinary Tract Infection
VIF	Variance Inflation Factor

ABSTRACT

Background: Oligohydramnios is a condition where amniotic fluid volume is lower than expected for gestational age. It is the most common amniotic fluid disorder and the leading cause of severe fetal and maternal adverse outcomes. Despite the severity of the problem, studies regarding the magnitude and associated factors of oligohydramnios in third-trimester pregnancy were limited in Ethiopia, mainly in the study area.

Objective: To assess magnitude and associated factors of oligohydramnios among women in the third trimester of pregnancy at Mekelle public hospitals, Tigray, Ethiopia, 2024/2025.

Methods: A cross-sectional study was conducted from December/1/2024 to May/30/2025 in Mekelle city. We included pregnant women using consecutive sampling technique using predefined inclusion criteria. Interview using structured questionnaire was employed to collect socioeconomic and demographic, lifestyle, medical and obstetric related data. The data were analyzed using SPSS version 27. Descriptive statistics were utilized to summarize data. Binary logistic regression analysis was employed to identify factors associated with oligohydramnios in third-trimester of pregnancy. Variables with P<0.05 in multi-variable analysis were declared statistically significant & interpreted using AOR with 95% CI. Hosmer-Lemeshow test was used to assess model fitness & it was insignificant (P=0.956), indicating a good-fitted model for the data. The maximum VIF was 1.12, telling that no Multicolinearity issue among covariates.

Results: The mean age of the study participant, 356 with a 100% response rate, was a 28.2±5.06 years. The magnitude of oligohydramnios in third trimester of pregnancy was 7.9% (95% CI: 5.3-11.2%). Women with a history of diabetes mellitus [AOR=4.12 (95% CI: 1.26-13.53)], hypertension [AOR=6.12 (95% CI: 1.82-20.59)], anemia [AOR=4.63 (95% CI: 1.61-13.37)], hyperemesis gravid arum [AOR=4.76 (95% CI: 1.82-12.48)], post-term pregnancy [AOR=7.22 (95% CI: 1.41-36.98)] and fetal factors, including congenital anomalies [AOR=7.60 (95% CI: 1.81-31.94)] and intrauterine growth restriction [AOR=5.87 (95% CI: 1.42-24.32)], were significantly associated with an increased odds of oligohydramnios.

Conclusion & Recommendations: 7.9% of pregnant women had sustained oligohydramnios. Maternal diabetes, hypertension, anemia, hyperemesis gravid arum, post-term pregnancy, fetal congenital anomalies and intrauterine growth restriction were identified as significant risk factors for oligohydramnios. We recommend increased surveillance for oligohydramnios focusing on the identified risks, maternal life style modifications & regular antenatal checkups in pregnancy.

Key words: *Oligohydramnios, Magnitude, Associated factors, Third Trimester, Pregnant Women, Mekelle, Tigray, Ethiopia*

1 INTRODUCTION

1.1 Background

Oligohydramnios is defined as a decrease in amniotic fluid volume below what is expected for given gestational age (1). According to specific ultrasound (US) criteria, oligohydramnios is also defined as; an amniotic fluid index (AFI) less than 5^{th} percentile for gestation, an AFI of 5 cm or less, or a single deepest pocket (SDP) of less than 2 cm, regardless of estimated gestational age (GA) for singleton pregnancy (1–3). No presence of Amniotic fluid (AF) is called anhydramnios (1). Normal amniotic fluid volume (AFV) ranges from 5-24 cm of AFI and from 2-8 cm of SDP. An AFI ≥25 cm or a SDP > 8 cm is called polyhydramnios (2,4,5).

Oligohydramnios is recognized as the most common amniotic fluid disorder (6). Amniotic fluid is a clear, watery substance found within amniotic sac (5). The semi-quantitative AFV evaluation approaches (AFI and SDP) are crucial for monitoring fetal well-being, particularly in pregnancies at higher risk of oligohydramnios problems during the second and third trimesters. The estimated or subjective method requires the clinician's experience. Oligohydramnios can be identified during routine check-ups or may be diagnosed accidentally in inpatients who do not attend regular antenatal care (ANC) (4,7–11).

Mechanism of AF production, reabsorption, composition & volume depends on GA. **Composition of Amniotic Fluid**: it primary consists of water and also various solid substances: 0.5gr of protein, 24 mg of non-protein nitrogen, 4.5mg of uric acid, 19 mg of sugar, 5.5 mg of calcium & 3.1 mg of phosphorus per 100 ml. Additionally it contains different types of cells; epithelial & fibroblastic cells which support fetal growth (4,12).

Production and reabsorption of amniotic fluid: AF is renewed continuously throughout pregnancy. The process continues actively until labor begins to ensure optimal fluid environment remains supportive and protective for the developing fetus. This renewal process occurs through production and reabsorption of AF (maternal and placental source, fetal kidney urine production and reabsorption of membrane and skin). In first trimester, AF is produced from both fetal & maternal sources, primary the amniotic membrane. In second and third trimester, fetal urine is the main source of AF, produced by the fetal kidneys starting before the end of first trimester (5,12).

Amniotic Fluid Volume: it normally changes with GA and increases as fetus grow and reach peak around 28 weeks of gestation and then after decreases progressively towards the end of pregnancy. It is predictable from first half of pregnancy. It starts as 50-60 ml at 12 weeks, 175-200 mL at 16 weeks, 400 ml at mid pregnancy, reaching 1000 mL at 28 weeks and then after followed by a steady decline until 42 weeks. At 36 weeks become 900 mL and after 38 weeks decreases by 125 ml per week, reaching 800 ml at 40 weeks of term pregnancy and so on. In the final weeks of pregnancy and postdate period, AFV declines significantly with a 93% decrease each week. After 41 weeks there is a 25% decrease in the AFI per week, dropping to 250 ml of AFV by 43 weeks. The lower AFV indicates a poorer prognosis for the pregnancy (12–15).

Role of Amniotic Fluid in Embryo and Fetal Development: amniotic fluid plays several crucial roles in the development of embryos and fetus. It is essential for lung and even musculoskeletal developments. Swallowing of AF supports growth of gastrointestinal tracts and provides essential nutrients to the fetus. AF also creates a protective environment that is sterile and thermally controlled, cushioning the fetus & umbilical cord (avert compression) from trauma. Additionally, AF has bacteriostatic properties that help reduce infection and lessen impact of uterine contractions on the fetus (9,11,12,15,16).

1.2 Statement of the Problem

Oligohydramnios is the significant cause of complications (maternal and perinatal morbidity and mortality) during pregnancy, and it may reach up to 56.5% (17,18). Globally, its magnitude varies by region, affecting about 1–5% of all pregnancies, but increase beyond 12–14% after 41 weeks and 30% in post-term pregnancies (5,6,19). The worldwide magnitude of isolated oligohydramnios at term (GA ≥37 weeks) pregnancy is 6.7% (20). In regions with good access to US the magnitude of oligohydramnios range from 0.5% to 8% and in low and middle income country (LMIC), due to limited use of US in routine ANC, the occurrence & effects of oligohydramnios are largely unknown (21). In LMIC, the magnitude in third trimester pregnancy is 0.7% and it varies among study sites; from the lowest of 0.2% in Zambia and Democratic Republic of Congo to the highest of 1.5% in Pakistan (22).

In India, the magnitude of oligohydramnios is around 2.3% across all pregnancies and 1–5% at term (23,24). In Africa, magnitude rate range from 4% to 23% of all pregnancy (25) and a study

report in Uganda reveals a 9.4% rate at term pregnancies (19). Study in Ethiopia revealed a 2.3% magnitude across all gestations (26). Studies in Amhara region revealed a magnitude of 2.36% at third trimester (16) and 36.46% at term pregnancy (14). A study in teaching hospitals of Mekelle University, Tigray region reported a 2.6% magnitude rate at term pregnancy (9).

The cause of oligohydramnios is dynamic & multi-factorial. It may be unknown cause (account up to 56%) or various maternal, placental and fetal factors (5,19,27). Depending on the time of pregnancy when it is diagnosed, its causes may be fetal structural defects, utero-placental insufficiency, intrauterine growth restriction, premature rupture of membranes (PROM), prolonged pregnancy & drugs (3,17,28). In post-term pregnancies, the majority (93%) of oligohydramnios cases are of unidentifiable cause and about 7% of the cases have placental insufficiency (19).

The maternal factors include post-term pregnancy (GA>42 weeks), severe maternal illness like hypertension, preeclampsia, anemia, Diabetes Miletus (DM), malnutrition, multiple pregnancies, prim gravidity, drug adverse effect, leaky and dehydration (due to few water intake or high environmental temperature) (6,8,11,13).

The fetal factors include congenital abnormalities like urinary tract anomalies such as bilateral renal agenesis and polycystic kidney lead to reduced fetal urine production, pulmonary hypoplasia which can lead to poor fetal outcomes like intra uterine growth restriction (IUGR) and structural deformities and low fetal weight. Placental abnormalities like Abruptio placenta, twin-twin transfusion complications and IUGR (12,20,24–26).

The complexity of oligohydramnios causes highlights the importance of thorough clinical evaluation and surveillance in addressing oligohydramnios (3). Additionally, understanding the interplay of these factors can aid in developing tailored interventions to improve maternal and fetal outcomes. However, there are very few studies that link these interacting factors to oligohydramnios in Ethiopia, particularly in the Tigray region. Therefore, this study aims to contribute the lack of data linking maternal, fetal, and placental factors to oligohydramnios in the study area.

Consequence of oligohydramnios; it can lead to several serious complications for the fetus and the mother. For the fetus, include IUGR, pulmonary hypoplasia (a reduction in the number of alveoli), Potter's syndrome, fetal deformities (hip dislocation, club foot and hand), and umbilical cord compressions in severe instances can lead to fetal death (7,22,26,31,32). In the third trimester, the incidence of adverse perinatal outcomes vary significantly from 29.7% to 46.6% and it may be due to umbilical cord compression, utero-placental insufficiency, meconium aspiration and other causes (33,34).

Oligohydramnios at term is linked with an increased incidence of intra-partum complications and short-term neonatal morbidities such as high rate of preterm delivery, IUGR, labor induction, caesarean deliveries, Apgar score<7 at 1 and 5 minutes and admission to the neonatal intensive care unit (20,35).

Oligohydramnios is also associated with higher maternal health risks, including increased rates of infection, induction and operative deliveries. Globally, cesarean section (CS) rate range from 42.0% to 83.6% in oligohydramnios cases. Oligohydramnios also doubles the risk of CS for fetal distress and risk of Apgar score <7 at 5 minutes (16,20,21). The most indication for CS is fetal distress in 42.9% in oligohydramnios cases (5).

In Ethiopia and Tigray the rate of CS was increased from 2% in 2016 to 5% in 2019 and from 2% in 2016 (36) to 6.9% in 2019 (37) respectively. A study in teaching hospitals of Mekelle University among term-pregnant women had revealed 89.4% of participants with composite adverse maternal outcomes (labor induction, operative vaginal delivery, or CS). The CS complication alone accounted 69.2% and oligohydramnios was the commonest indication for this in 22% (9). Nearly 30% of participants had composite adverse perinatal outcomes, and IUGR was detected as the most significant common reason for having a CS (34). Low AFV can also severely affect the accuracy of US imaging (14).

The detection of oligohydramnios affects how pregnancy is managed and may lead to early delivery based on GA (15). Early detection and managing of oligohydramnios can potentially reduce fetal perinatal complications and maternal risk of CS (24,31). Causative factors can be corrected at early antepartum period to reduce incidence of oligohydramnios (18). Only a few studies have been conducted in the world. Studies in African countries are also very few in

numbers including Ethiopia. Most of the few studies done elsewhere included pregnancy that are term or post term and its outcome (9,19). A study in Amhara region of Ethiopia at term pregnancy revealed about 1/4th (25.01%) of pregnancies complicated by abnormal AFV (both oligohydramnios & polyhydramnios) (14). The author had suggested, following researchers to conduct a separate study on polyhydramnios & oligohydramnios.

A study in India (38) reveals treatment trial of oligohydramnios that can be achieved by infusing saline solution into the amniotic cavity through trans-abdominally, known as amnioinfusion. The study had found a significant difference in mean of AFI, pre (3.3 cm) and post (8.8 cm) in amnioinfusion (P-value<0.001). It raises the AF especially in preterm (28-34 weeks) and help to reduce complications resulting from decreased intra-amniotic volume which prevent cord compression, prolong duration of pregnancy, increasing birth weight, preventing fetal distress and reducing operative intervention. From this we can observe that the trial does not cure the case, only minimize its severity of complications.

Oligohydramnios remains a significant concern in obstetric practice and it is recognized as the most common amniotic fluid disorder, which leads to serious complications (6). Despite the severity of the problem, the risk factors associated with oligohydramnios have been poorly understood in Ethiopia, mainly in the study area. In the selected study set-ups, there is an observed increased burden of oligohydramnios leading to complications such as maternal adverse outcomes like risk of increased demand for CS and bad perinatal outcomes due to this case, despite using some advanced diagnostic modalities (US) and clinical practices. The underlying risk factors in the area are less understood because no prior study has focused on this issue. Thus, detecting oligohydramnios and identifying its risk factors in third-trimester pregnancy is very crucial to applying proper intervention measures such as prevention, early detection and management for health outcomes of mothers and babies to fulfill the gaps by conducting a detailed institution-based cross-sectional study.

1.3 Significance of the Study

The expected findings of this study will provide valuable insights for healthcare professionals, researchers, individual women and the community, contributing to a better understanding of oligohydramnios and its associated factors in feto-maternal health and helping to improve outcomes for both mothers and their babies.

The findings of this study will help to inform & strengthen clinical practice of healthcare providers and the institutions about the specific factors affecting oligohydramnios to enhance early detection and management, ultimately improving outcomes for mothers and their babies. Additionally, the study will clarify the burden of oligohydramnios, which give clue to health programmers.

Furthermore, the study will contribute to enhancing counseling and prevention strategies during the preconception and pregnancy periods at both individual and community levels. It will help in raising awareness among women about the identified risk factors of oligohydramnios and the importance of monitoring optimal amniotic fluid levels in pregnancy that affect feto-maternal health. Moreover, it will improve understanding of how abnormal amniotic fluid volume impacts fetal growth, potentially leading to fetal growth restrictions and developmental abnormalities such as congenital anomalies (birth defect). Likewise, it will serve as aid in teaching anatomy to health professionals to aware them about the effect of oligohydramnios. Finally, it will serve as baseline information to guide future research on oligohydramnios.

2 LITERATURE REVIEW

2.1 Literatures on Magnitude and Associated Factors of Oligohydramnios

2.1.1 Magnitude of oligohydramnios

A cross-sectional study conducted in Nepal among 477,486 women giving birth, regardless of GA screened out, identified oligohydramnios in 86 cases, revealing a 1.2% magnitude rate (39). Another similar study done in Pakistan among 5,406 second and third-trimester pregnant women attending inpatient & outpatient services found oligohydramnios in 173 women, making a magnitude rate of 3.2% overall gestation & 2.6% at term (40), which is inconsistent with the study in Nepal.

A similar study done in India, out of 12000 third trimester pregnant women screened, oligohydramnios was found in 150 women, giving a 1.25% magnitude rate (23). In line with this, a study done on GA≥28 weeks pregnancy in Yemen among 6637 deliveries screened out had found 100 women, resulting in a 1.5% magnitude rate (5). Another study in Pakistan, out of 15,579 total deliveries examined, found 592 women, giving a 3.8% magnitude rate (31), which is slightly higher compared to studies in India and Yemen. A study done in the Amhara region of Ethiopia on third trimester of pregnancy found oligohydramnios in 51 women out of 153 samples, making a 33.3% magnitude rate (41), which is inconsistent with the above studies, showing a discrepancy in rate (higher).

Another cross-sectional study carried out at term pregnancy in Uganda, among 426 women screened out, oligohydramnios was found in 40 women, resulting in a magnitude of 9.4%(19). In a study in Amhara region of Ethiopia, out of 384 women screened, 140 women were found, giving a magnitude of 36.46% (14), which is inconsistent (higher rate) with the study result in Uganda. On the other hand, a similar study done in academic hospitals of Mekelle university in Tigray region of Ethiopia, out of 10,451 pregnant women giving birth screened out, 273 women found with oligohydramnios, making a magnitude of 3.2% across all gestations & 2.6% at term pregnancy (9), which is inconsistent with the study results in Amhara region and Uganda, showing a great discrepancy.

2.1.2 Socioeconomic and demographic factors

Increasing age was significantly associated with oligohydramnios in a case-control study done in Nepal on 148 pregnant women during third-trimester pregnancy (P=0.035)(18). Additionally, low socioeconomic status was significantly associated with oligohydramnios in a retrospective study done in India on 90 pregnant women during third trimester pregnancy (P=0.017) (24). Furthermore, living in a rural area was also significantly associated with oligohydramnios in a term cross-sectional study involving 384 pregnant women during third-trimester of pregnancy in Amhara region of Ethiopia [AOR=3.21(1.19-5.37)] (14).

2.1.3 Maternal clinical and life style factors

Anemia was significantly associated with oligohydramnios in a cohort study done in Pakistan among 551 pregnant women in their term pregnancy (P=0.001) (42). Another cross-sectional study done in Pakistan had identified a significant association between urinary tract infection (UTI) and oligohydramnios among 173 pregnant women in their second and third trimesters (P=0.047)(43). Additionally, diabetes mellitus was significantly associated with oligohydramnios in a cohort study done in Saudi Arabia among 497 third-trimester pregnant women (P=0.005) (4) and in a cross-sectional study done in Amhara region of Ethiopia among 384 women at term pregnancy [AOR=2.16 (1.32-4.75)] (14).

Hypertension, including pregnancy induced was significantly associated with oligohydramnios in a cross-sectional study done in Pakistan among 185 pregnant women in their second and third trimester pregnancy (P=0.000) (43) and in a cross-sectional study done in Amhara region of Ethiopia among 334 pregnant women at term pregnancy [AOR=3.22(1.24-8.36)] (16).

Lack of taking nutritionally diversified diets (not taking extra diets like meat, fish, eggs (P < 0.008) & vegetables (P<0.016) was significantly associated with oligohydramnios among 296 pregnant women in their third trimester in a case-control study done in Nepal (18).

2.1.4 Maternal obstetric related variables

Increasing GA was significantly associated with oligohydramnios in a case-control study done in Nepal on 148 oligohydramnios cases of pregnant women in their third trimester (P<0.001) (18) and in a cross-sectional study done in Yemen among 6637 pregnant women in their third trimester (P=0.04) (5). In term cross-sectional studies done on 426 pregnant women in Uganda

[P=0.022, AOR=2.5(1.1-5.6)2.5] in GA 40-41 weeks and [P<0.001, AOR=6.0(2.3-16)] in GA>41 weeks(19) and on 334 pregnant women in Amhara region of Ethiopia [AOR=1.58(1.16-2.17)] in GA>40 weeks (16), similar significant association. Prolonged (post-dated) pregnancy was significantly associated with oligohydramnios among 148 oligohydramnios cases of pregnant women in their third trimester in a case-control study in Nepal [P < 0.05, OR = 5.520 (2.666-11.427)] (18).

Primigravidity was significantly associated with oligohydramnios among 384 pregnant women at term pregnancy in Uganda [P=0.002, AOR=3.7(16-6.7)] (19). History of abortion was significantly associated with oligohydramnios among 185 pregnant women in their third trimester in a cross-sectional study in Pakistan (P=0.004) (43) and on 334 pregnant women at term in Amhara region of Ethiopia [AOR=3.42(1.26-9.23)] and among 334 pregnant women at term in the Amhara region of Ethiopia [AOR=3.42(1.26-9.23)] (16).

Short inter-pregnancy interval (<2 years) [AOR=3.03(2.18-6.28)] and hyperemesis gravid arum [AOR=1.19(1.02-4.41)] were found to be significantly associated with oligohydramnios among 384 term pregnancies in a cross-sectional study done in the Amhara region of Ethiopia (14). A study done in academic hospitals of Mekelle university in Tigray on 273 term pregnant women had found primigravida [P=0.003, AOR=2.3(13-4.0)] and post-term pregnancies [P=0.024 (AOR=2.4(1.1-5.1)] to be statistically significant determinants of adverse neonatal outcome in oligohydramnios and IUGR and had also found them to be statistically associated and the most common reasons for having CS [AOR=18.0 (13.1-24.2)] (34).

2.1.5 Feto-placental related variables

In a study done in Pakistan among 149 cases during the second trimester, US-detectable fetal abnormalities (different renal anomalies, polycystic kidney disease (PKD), and hydronephrosis) were significantly associated with oligohydramnios (P=0.045) (44). In a case-control study done in Sudan among 247 pregnant women in their third trimester, congenital anomalies were significantly associated with oligohydramnios (OR=37.1034) (45). IUGR was significantly associated with oligohydramnios among 100 pregnant women in their third trimester in a cross-sectional study done in India (P<0.01) (46).

CONCEPTUAL FRAME WORK MODEL

The conceptual framework is developed and adapted from reviewed literatures (11, 14, 30, 32–35, 37), mainly to illustrate the association between the risk factors and oligohydramnios.

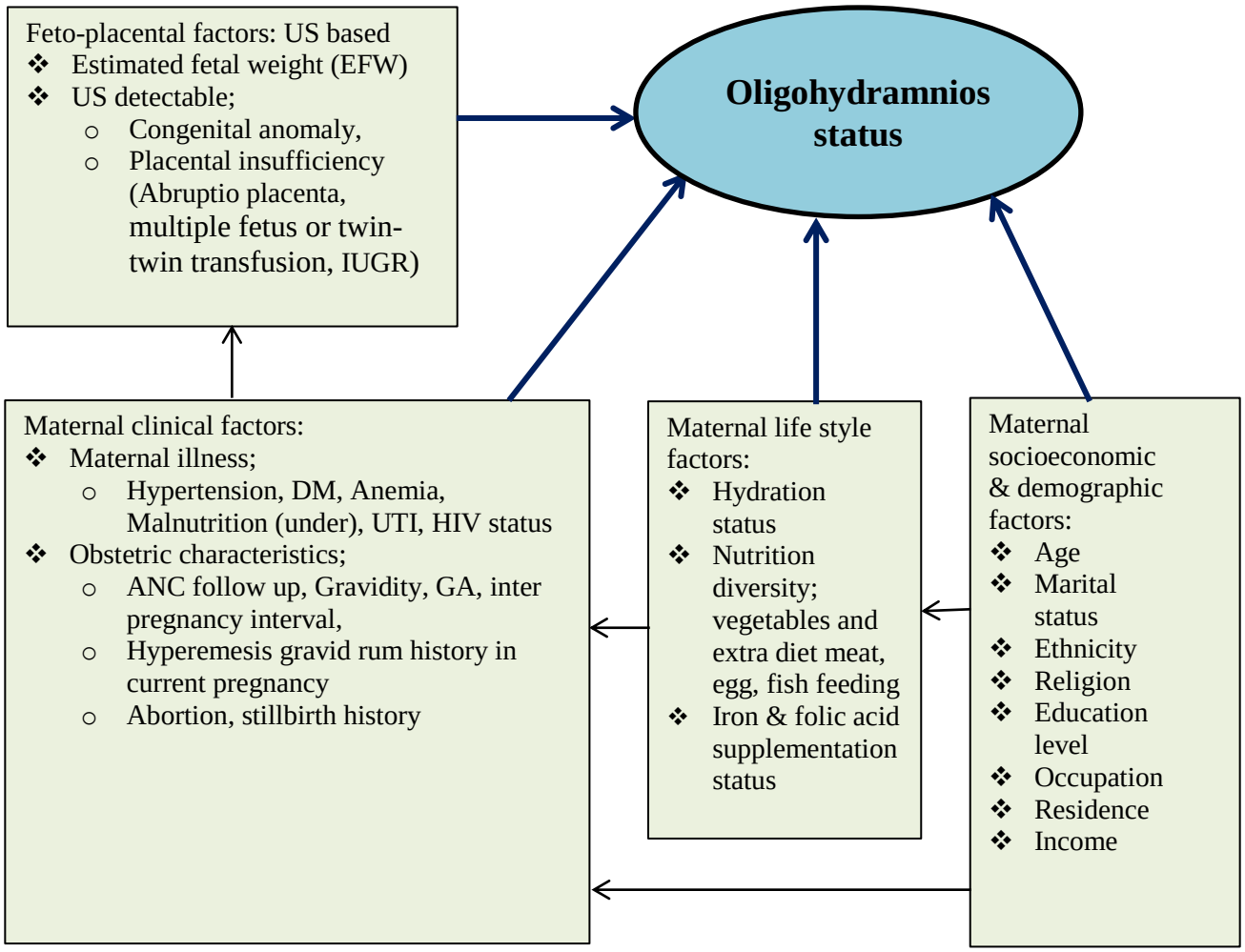


Figure 1: Conceptual framework illustrating the relationship between risk factors and oligohydramnios.
NB: thick arrow indicates the association between the independent variables and the outcome variable that included in this study; thin arrow indicates that there may be an association but not studied in this study.

3 OBJECTIVES OF THE STUDY

3.1 General Objective

To determine magnitude and associated factors of oligohydramnios among third trimester pregnant women attending at Mekelle public hospitals, Tigray, Ethiopia, 2024/2025.

3.2 Specific Objectives

1. To assess magnitude of oligohydramnios among third trimester pregnant women attending at Mekelle public hospitals.
2. To identify factors associated with oligohydramnios among third trimester pregnant women attending at Mekelle public hospitals.

4 METHODS AND MATERIALS

4.1 Study Setting and Period

4.1.1 Study setting

The study was conducted at Ayder Comprehensive Specialized Hospital (ACSH), Mekelle general hospital (MGH) and Quiha general hospital (QGH) located in Mekelle city, Tigray, Ethiopia. Mekelle is situated 783 kilometers from Addis Ababa, the capital city of Ethiopia and had an estimated population of 215,546, with 110,788 females according to the 2007 census by the Ethiopian Central Statistical Agency (47).

Ayder Comprehensive Specialized Hospital (ACSH) is one of the largest public hospitals in Ethiopia, providing referral and non-referral services since 2008 to over 8 million people in the Tigray, Afar, and northern Amhara regions. It also serves as teaching hospital affiliated with Mekelle University and functions as a tertiary hospital offering a wide range of comprehensive medical care. Obstetrics and gynecology care service provision is one of the main services. It have two separate outpatient department (OPD); one offering services for low risk women in Maternal Infant Child Health Unit (MICHU) clinic and the other for high risk women in Gynecology and Obstetrics (Gyn-Obs) OPD. MGH and QGH are other governmental general hospitals in the city that offer both inpatient and outpatient care, including obstetrics & gynecology services.

Currently, in ACSH 15 senior Obstetrician and Gynecologists, 39 residents and 113 midwives and in MGH 4 Obs-Gyn specialists, 12 residents and 40 midwives are providing the care. QGH has 1 Obs-Gyn specialist, 1 emergency surgeon and 30 midwives are providing the care. The annual ANC service delivery of ACSH, MGH and QGH were 3288, 2220 and 1988 clients respectively (from the annual reports of the institutions, 2023/2024 fiscal year).

4.1.2 Study period

The study was conducted from December/1/2024 to May/30/2025, covering the period from the development of the research proposal to the final thesis report summation and presentation.

4.2 Study Design

Institution-based cross sectional study design was utilized to investigate the magnitude and associated factors of oligohydramnios among third trimester pregnant women at public hospitals in Mekelle city.

4.3 Population

4.3.1 Source or Target population

All pregnant women ≥28 weeks of gestation attended at public hospitals in Mekelle city.

4.3.2 Study population

All pregnant women ≥28 weeks of gestation attended at selected hospitals during the data collection period (from January to February 2025) and fulfill the inclusion criteria.

4.3.3 Study unit/Subject

Individual pregnant woman in her third trimester was recruited for this study.

4.4 Eligibility Criteria

4.4.1 Inclusion criteria

All pregnant women ≥28 weeks of gestation who visited ANC clinics, emergency unit, Gyn-Obs OPD and admitted in labor ward having ultrasound record information during the data collection period.

4.4.2 Exclusion criteria

Pregnant women in their third trimester with PROM, those in active stage of labor and those without ultrasound records and non-available medical charts during data collection time, were excluded from this study.

4.5 Sample Size Determination and Sampling Procedure

The required sample size was estimated by using the assumption of single population proportion formula with confidence level (CL) 95%, margin of error (E) 5% and taking the proportion of oligohydramnios from cross sectional study finding in Amhara region of Ethiopia in 2023, which was 36.46%(14).

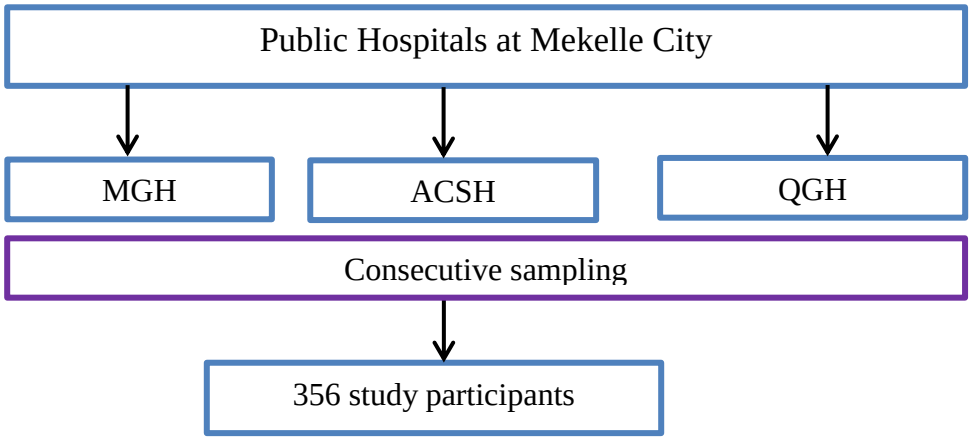
$$n = \frac{\left(\frac{Z\alpha}{2}\right)^2 P(1-P)}{(E)^2} \ldots\ldots\ldots\ldots\ldots\ldots (48,49)$$

Where: n=sample size, E =margin of error = 0.05, P =Proportion= 0.3646, q=1-P = 0.6354, Zα/2 of 95% CL = 1.96, by substituting these values in the formula:

$$= \frac{(1.96)^2 0.3646(0.6354)}{(0.05)^2} = 356 \text{ study participants}$$

Then, the desired sample size for the study became 356 pregnant women in third trimester of pregnancy with 100% response rate that attended various service at the 3 public hospitals were enrolled in this study.

A consecutive sampling method was employed to enroll study participants. The three public hospitals of Mekelle city were purposely selected, because all have the capacity to assess the case among the pregnant women using ultrasound, deliveries special services related the case and have high caseloads (34).



Legends: MGH: Mekelle General Hospital, ACSH: Ayder Comprehensive Specialized Hospital, QGH: Quiha General Hospital.
Figure 2: Diagram showing sampling procedure at Mekelle city public hospitals, Tigray, Ethiopia, 2025.

4.6 Data Collection Methods

Data was collected through structured questionnaire based interviews (one-on-one) and medical records review using Kobo Toolbox platform. The questionnaire was adapted from reviewed previous studies (11,14,30, 32–35, 37) to collect data on maternal socioeconomic, demographic, life style, medical and obstetric characteristics. Data lacked to get from participants, such as ultrasound result of feto-placental and maternal obstetric conditions were extracted from medical

records retrieving or directly observing ultrasound information using data extraction checklist which developed in the platform.

4.7 Study Variable

4.7.1 Dependent variable

Oligohydramnios status; dichotomous categorical (Yes/No)

4.7.2 Independent variables

Maternal demographic & socio-economic characteristics: Age, Marital Status, Ethnicity, Education level, Religion, Occupation, Residence, Income.

Maternal life style: Hydration status, Nutrition diversity; vegetables and extra diet meat, egg, fish food intake habits, Iron and folic acid supplementation.

Maternal illness: DM, Hypertension, Anemia, UTI, Malnutrition (under), HIV/AIDS status

Obstetric maternal conditions: ANC follow up, Gravidity, GA, Inter pregnancy interval, history of Abortion, Still birth and Hyperemesis gravid rum.

Obstetric Feto-placental conditions from current US result: EFW, US detectable congenital anomalies, Placental abnormality (Abruptio placenta, multiple fetuses or twin-twin transfusion problem) and IUGR.

4.8 Operational Definitions and Measurements

Oligohydramnios: low amniotic fluid volume, Amniotic Fluid Index ≤ 5 cm or a Single Deepest Pocket of amniotic fluid < 2 cm (1).

Well-nourished: if mid upper arm circumference (MAUC) of pregnant women is ≥ 23 cm (50).

Malnutrition (under): if the MUAC of the pregnant women is < 23 cm (50).

Moderate acute malnutrition (MAM): if the MUAC of the pregnant women is 21-22.9 cm (51).

Severe acute malnutrition (SAM): if the MUAC of the pregnant women is <21 cm (51).

Definition & measurement of variables in this study was based on standard national and international guidelines. Some test result like glucose level, hemoglobin, urine analysis, HIV status were taken from mother chart most recent laboratory results.

4.9 Data Processing and Analysis

The collected data using questionnaire were carefully checked for completeness and consistency. The data was exported from Kobo Toolbox to SPSS version 27.0 statistical packages, and then

cleaned, recoded and categorized before proceeding to analysis. Outlier detection process using frequency and logistic regression assumption fulfillment test were also done before proceeding to analysis. Hosmer-Lemeshow test was done to check the overall model fitness and it was insignificant (P=0.96), indicating that a good-fitted model for the data. Multicolinearity among independent variables was checked using variance inflation factor (maximum VIF=1.12), which indicating that there was no Multicolinearity issue and also the maximum Pearson correlation(r) was 0.24, telling that there was no interactions among covariates, as cited in the annex part.

Descriptive statistics were utilized to summarize the collected data. For continuous normally distributed variables summarization was done using mean with standard deviations, for continuous not-normally distributed using median with interquartile range and for the categorical variables frequency with percentage. Proportion was calculated to determine the magnitude of oligohydramnios. The results were presented in text, numbers, tables and figures.

Logistic regression analysis was employed to identify factors associated with oligohydramnios in third-trimester of pregnancy. A bi-variable logistic regression analysis was conducted to determine the crude association between each independent variable & outcome variable. Variables with P-value ≤0.25, derived from Wald test were entered to multi-variable logistic regression analysis for adjustment which helps to control confounders. Variables with P-value<0.05 in the multi-variable model were declared statistically significant and interpreted using adjusted odds ratio with 95% confidence interval, including P-value. The model was developed using default enter method regression.

4.10 Data Quality Assurance

To ensure data quality, a structured questionnaire and data extraction sheet adapted from reviewed literatures was used. The tool was prepared initially in English language and then translated into local language (Tigrigna) for the purpose of data collection. It was retranslated back to English language again for consistency and accuracy. Qualified data collectors, 5 BSc degree holder midwives who work in the specific wards were recruited due to financial issue and a one day intensive training was given on Kobo Toolbox, regarding how to use and how to collect, by the principal investigator to reduce technical errors and biases.

Pre-test was carried out on 18 samples (5%) of the total sample size of the study in Lekatit 11 primary hospital to check for clarity and appropriateness of the questionnaire and accordingly necessary modification on the tool was done based on the available data before implementing to the actual data collection time. To improve data completeness and consistency a close and ongoing supervision was done by the supervisor and principal investigator during the data collection process & problems identified during data collection was discussed and handled timely.

4.11 Ethical Consideration

This study was ethically reviewed and approved by the Institutional Review Board (IRB) of College of health sciences of Mekelle University and an ethical clearance was obtained (Ref.: MU-IRB 2440/2017 E.C). An official letter of support (Ref.: BMD-142/2017 E.C) was written by the Institute of Biomedical Science to Tigray Health Bureau to obtain permission. The permission letter (Ref.:3207/7767/17 E.C) was delivered to the relevant authorities of the public institutions and had briefed on the purpose of the study as well. Then data collection was started after formal permissions were obtained from the authorities of each study hospital.

Informed and written consent was obtained from each participant after clarifying the study purpose prior to the data collection. Codes were used to avoid the disclosing of participant's names and information without their willingness. Confidentiality of data was maintained throughout the study process. No potential harm was issued for the study subjects and hospital in utilizing the data for the purpose of the study. Therefore, neither the medical data record numbers nor the collected data were used for any other purposes.

4.12 Dissemination of results

The final results of the study will be submitted to MU, CHS, Institute of Biomedical Science, and Department of Human Anatomy to ensure that the study was conducted formally. After approval, the summarized findings will be communicated to the three participating institutions. The findings will also be disseminated to Tigray Health Bureau and other responsible stakeholders like NGOs working on maternity to be used by health workers for intervention. Eventually, the study final work will be disseminated through seminars and published in high impacting international journals in order to access by others to share knowledge.

5 RESULT

Socioeconomic and demographic characteristics of the study participants

A total of 356 participants (GA ≥28 weeks) were included in this study. The mean age of the participants was 28.2(±5.06 S.D) years & the minimum age was 17 years. Majority of participants 142(39.9%) were in the age group of 25-29 years, 338(95%) were orthodox follower, urban residence 292(82.0%), no formal education 25(7%), housewife occupation 189(53.1%) and monthly household income ≤5000 ETB 193(54.2%) (Table1).

Table 1: Socioeconomic & demographic characteristics of participants in their third trimester pregnancy at public hospitals in Mekelle city (N=356).

Variables	Category	Oligohydramnios status		Total	
		YES (%)	NO (%)	No	%
Age	15-19 years	0(0)	8(100)	8	2.2
	20-24 years	9(11.7)	68(88.3)	77	21.6
	25-29 years	8(5.6)	134(94.4)	142	39.9
	30-34 years	7(10)	63(90)	70	19.7
	≥ 35 years	4(6.8)	55(93.2)	59	16.6
Marital status	Married	28(8)	324(92)	352	98.8
	Single	0(0)	2(100)	2	0.6
	Divorced (Separated)	0(0)	2(100)	2	0.6
Religions	Orthodox	28(8.3)	310(91.7)	338	95
	Muslim	0(0)	11(100)	11	3.1
	Catholic	0(0)	4(100)	4	1.1
	Protestant	0(0)	3(100)	3	0.8
Ethnicity	Tigrian	28(7.9)	325(92.1)	353	99.1
	Afar	0(0)	1(100)	1	0.3
	Amhara	0(0)	2(100)	2	0.6
Residence	Rural	4(6.3)	60(93.7)	64	18
	Urban	24(8.2)	268(91.8)	292	82
Educational level	No formal education	3(12)	22(88)	25	7
	Primary education (1-8)	5(5)	95(95)	100	28.1
	Secondary & above (9-12)	16(12)	117(88)	133	37.4
	Tertiary (college & above)	4(4)	94(96)	98	27.5
Occupation	House wife	17(10)	172(90)	189	53.1
	Merchant or self-employed	6(9.8)	55(90.2)	61	17.1
	Governmental employed	3(4.3)	66(95.7)	69	19.4
	Farmer	1(7.1)	13(92.9)	14	3.9
	Daily labor + Other	1(4.3)	22(95.7)	23	6.5
Monthly household income in Ethiopian birr (ETB)	≤ 5000 Birr	19(9.8)	174(90.2)	193	54.2
	5000-10000 Birr	7(5.6)	117(94.4)	124	34.8
	10000-15000 Birr	0(0)	22(100)	22	6.2
	≥ 15000 birr	2(11.8)	15(88.2)	17	4.8

Classifications were based on literatures, EDHS and nature of the variables. Example, income based on study done in Gondar (33).

Medical and life style characteristics of the study participants

Among the total study participants, 36(10.1%) had Diabetes Miletus and hypertensive disorders, 50(14.0%) suffered from anemia, 35(9.8%) had UTI, from the tested participants (n=331) for HIV/AIDS, 6(1.7%) were sero positive, 64(18%) experienced moderate acute mal nutrition (MAM) and 20(5.6%) had severe acute malnutrition (SAM). Additionally, 334(93.8%) of participants drinks less than 2 liters of water daily, 246(69.1%) ate vegetables in their daily diet, and 237(66.6%) ate extra diet like meat, egg, fish etc. at least once a week in their current pregnancy. Most of the participants 342(96.1%) had not taken folate supplement before conception at least for 3 months, while 315(88.5%) received iron folic acid supplement during their current pregnancy (Table 2).

Table 2: Clinical and life style characteristics of participants women in their third trimester pregnancy at public hospitals in Mekelle city (N=356)

Variables	Category	Oligohydramnios status		Total	
		YES (%)	NO (%)	No	%
Diabetes Miletus	Yes	6(16.7)	30(83.3)	36	10.1
	No	22(6.9)	298(93.1)	320	89.9
Hypertensive disorders	Yes	6(16.7)	30(83.3)	36	10.1
	No	22(6.9)	298(93.1)	320	89.9
Anemia in current pregnancy	Yes	11(22)	39(78)	50	14
	No	17(5.6)	289(94.4)	306	86
UTI in current pregnancy	Yes	3(8.6)	32(91.4)	35	9.8
	No	25(7.8)	296(92.2)	321	90.2
Nutritional status, from MUAC in cm	<21 cm (SAM)	3(15)	17(85)	20	5.6
	21-22.9 cm (MAM)	6(9.4)	58(90.6)	64	18
	≥23 cm (Well-nourished)	19(7)	253(93)	272	76.4
HIV test in current pregnancy	Yes	26(7.9)	305(92.1)	331	93
	No	2(8)	23(92)	25	7
Water intake daily in litters	<2 liters (Suboptimal)	26(7.8)	308(92.2)	334	93.8
	≥2 liters (Optimal)	2(9.1)	20(90.9)	22	6.2
Vegetable feeding habit	No	7(6.4)	103(93.6)	110	30.9
	Yes	21(8.5)	225(91.5)	246	69.1
Extra diet (meat, egg, fish etc.) feeding at least once per week	No	8(6.7)	111(93.3)	119	33.4
	Yes	20(8.4)	217(91.6)	237	66.6
Folate intake before conception at least for 3 months	No	27(7.9)	315(92.1)	342	96.1
	Yes	1(7.1)	13(92.9)	14	3.9
Iron folic acid supplementation	No	4(9.8)	37(90.2)	41	11.5
	Yes	24(7.6)	291(92.4)	315	88.5

Legend: MUAC: Middle upper arm circumference, MAM: Moderate acute malnutrition, SAM: Severe acute malnutrition, UTI: Urinary tract infection

Obstetric and clinical characteristic of the study participants

Majority of participants 334(93.8%) attended ANC, with 5(1.5%) having once, 19(5.7%) having twice, 70(21%) having trice or 102 (71.8%) having ≥ 4 visits. The median GA at the time of current visit was 37 weeks with 6 weeks interquartile range. Among the total study participants, 222(62.4%) were multigravida with 273(76.7%) having less than 24 months inter pregnancy interval. More than half of the participants, 184(51.7%) were term, 150(42.1%) were preterm & 22(6.2%) were post term in gestational age. Some participants reported obstetric related problems, including a history of abortion 63(17.7%), still birth 10(2.8%) and hyperemesis gravid rum during the current pregnancy 78(21.9%) (Table3).

Table (3&4) shows participant women with ultrasound-detected fetal abnormalities and their magnitude, including macrosomia 10(2.8%), congenital anomalies including CNS and renal both 7(1.96%), cardiac 1(0.28%), and multiple congenital anomalies 1(0.28%), IUGR 28(7.8%) with severe asymmetric IUGR 1(0.28%) and severe symmetric IUGR 1(0.28). Feto-placental insufficiency like abruption placenta 4(1.12%) and twin fetuses 6(1.68%). Other detected problems include erythroblastosis fetalis, hydrocele, IUFD, fistula, placenta previa, and meconium stained amniotic fluid (MSAF), each at 1(0.28%).

Table 3: Obstetric and clinical characteristic of participants women in their third trimester pregnancy at public hospitals in Mekelle city (N=356).

Variables	Category	Oligohydramnios status		Total	
		YES (%)	NO (%)	No	%
ANC service	No	2(9.1)	20(90.9)	22	6.2
	Yes	26(7.8)	308(92.2)	334	93.8
Gravidity	Primigravida	13(9.7)	121(90.3)	134	37.6
	Multigravida	15(6.8)	207(92.2)	222	62.4
Gestational age in weeks	Preterm	8(5.3)	142(94.7)	150	42.1
	Term	15(8.2)	169(91.8)	184	51.7
	Post term	5(22.7)	17(77.3)	22	6.2
Previous history of abortion	Yes	9(14.3)	54(85.7)	63	17.7
	No	19(6.5)	274(93.5)	293	82.3
Previous history of stillbirth	Yes	1(10)	9(90)	10	2.8
	No	27(7.8)	319(92.2)	346	97.2
Hyperemesis gravid rum history in current pregnancy	Yes	15(19.2)	63(80.8)	78	21.9
	No	13(4.7)	265(95.3)	278	78.1
EFW in grams	<4000	27(7.8)	319(92.2)	346	97.2
	≥4000	1(10)	9(90)	10	2.8

Fetal congenital anomalies	Yes	6(27.3)	16(72.7)	22	6.2
	No	22(6.6)	312(63.4)	334	93.8
Placental insufficiency (abnormality)	Yes	1(10)	9(90)	10	2.8
	No	27(7.8)	319(92.2)	346	97.2
IUGR	Yes	4(14.3)	24(85.7)	28	7.8
	No	24(7.3)	304(92.7)	328	92.2
Other fetal or maternal problems else detected	Yes	3(12.5)	21(87.5)	24	6.7
	No	25(7.5)	307(92.5)	332	93.3

Legend: ANC; Antenatal care, EFW: Estimated fetal weight, IUGR: Intrauterine growth restriction

Table 4: Summarization of fetal and maternal abnormalities detected in third trimester pregnant women at public hospitals in Mekelle city.

Abnormalities	Specific name	Oligohydramnios		Total Patient (%)
		YES	NO	
CNS anomalies =7(1.96%)	Anencephaly	-	3	3(0.84)
	Ventriculomegaly	-	2	2(0.56)
	Ventriculomegaly (right) + Thoraco-lumbar defect (Meningocele)	-	1	1(0.28)
Renal anomalies =7(1.96%)	Bilateral kidney & bladder distention	2	-	2(0.56)
	Bilateral kidney & bladder stenosis	1	-	1(0.28)
	Bilateral hydronephrosis	1	-	1(0.28)
	Unilateral polycystic kidney (right)	-	1	1(0.28)
Cardiac anomaly	(Ventricular septal defect)	-	1	1(0.28)
Multiple congenital anomalies		-	1	1(0.28)
Feto-placental insufficiency	Abruption placenta	1	3	4(1.12)
	Multiple fetus (Twin)	-	6	6(1.68)
IUGR	Severe symmetrical IUGR	1	-	1(0.28)
	Severe asymmetric IUGR	1	-	1(0.28)
Other fetal & maternal problems else detected	Erythroblastosis fetalis	-	1	1(0.28)
	Hydrocele	-	1	1(0.28)
	IUFD	-	1	1(0.28)
	MSAF (turbidity)	-	1	1(0.28)
	Placenta previa	-	1	1(0.28)
	Fistula	-	1	1(0.28)
	Recurrent Vaginal Hemorrhage history	-	2	2(0.56)
	Bad Obstetric history	-	1	1(0.28)

Legend: CNS: Central nervous system, IUFD: Intra uterine fetal death, MSAF: Meconium stained amniotic fluid

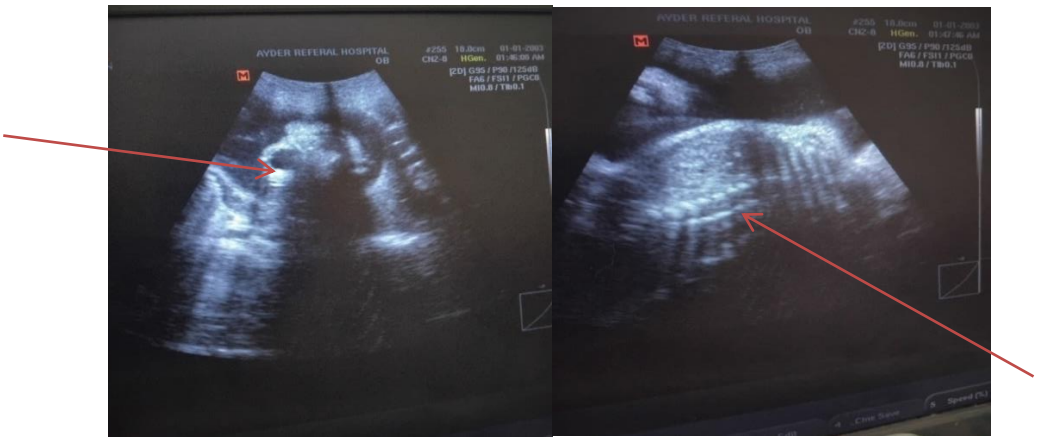


Figure 3: Ultrasonographicaly detected Anencephaly with normal spine scan of fetus in 35 years old primigravida pregnant woman at 32 weeks of gestation in ACSH, 2025.

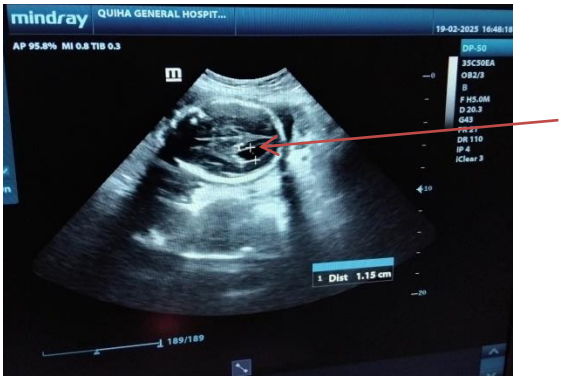


Figure 4: Ultrasonographicaly detected ventricular defects of fetus in 30 years old multi gravida pregnant woman at 29 weeks of gestation in Quiha general hospital, 2025.

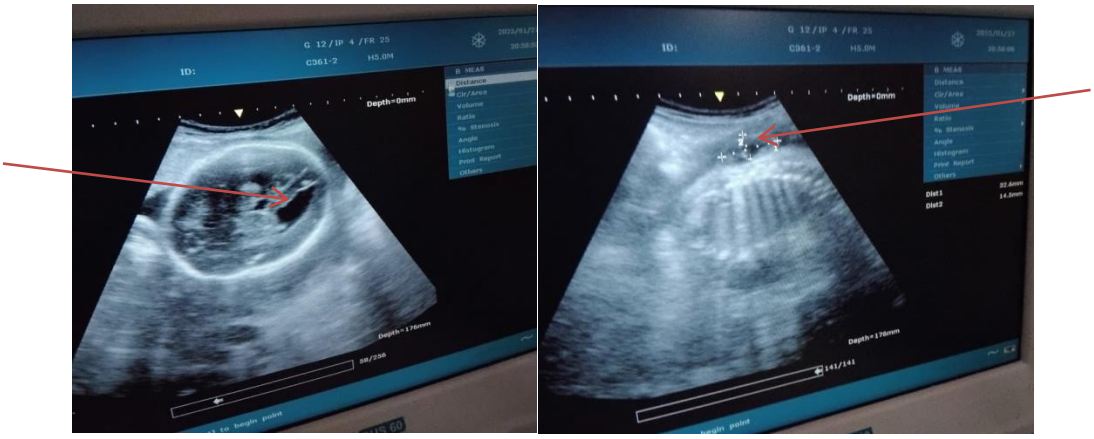


Figure 5: Ultrasonographicaly detected ventricular and spinal defects of fetus in 25 years old multigravida pregnant woman at 31 weeks of gestation in Mekelle general hospital, 2025.

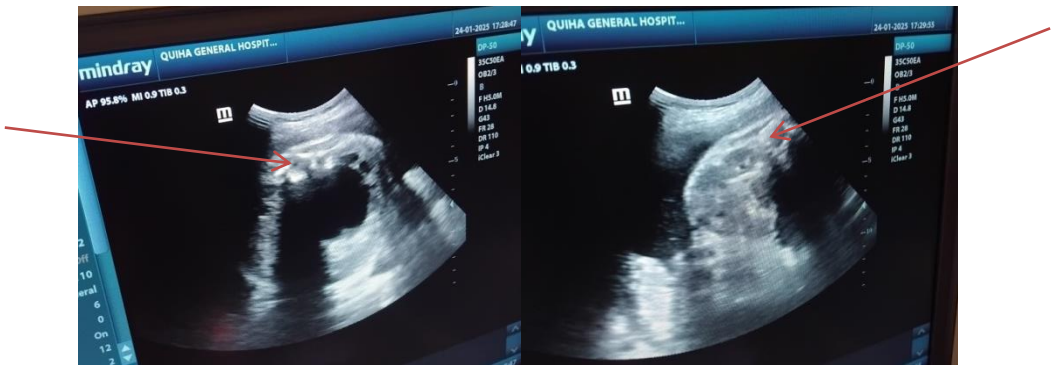


Figure 6: Ultrasonographicaly detected unilateral polycystic kidney disease (right) of fetus in 22 years old multigravida pregnant woman at 40 weeks of gestation in Quiha general hospital, 2025.

In this study most of the congenital anomalies were related with younger age and multigravida, it could be due to lack of taking folate supplementation before conception, but needs further study.

Magnitude of oligohydramnios

Among the total 356 participants underwent ultrasound assessment for AFV, 28 women had a SDVP of less than 2 cm and subjectively observed to have an inadequate amount of amniotic fluid in all four uterine quadrants, resulting in a magnitude of oligohydramnios of 7.9% (95% CI: 5.3-11.2%) (Figure7).

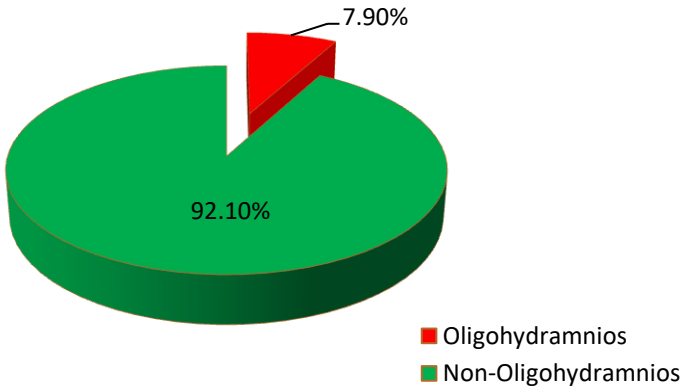


Figure 7: Magnitude of oligohydramnios in third trimester pregnant women at public hospitals in Mekelle city, 2025.

Binary logistic regression analysis and its interpretation

Bi-variable logistic regression analysis was done for each variable.

The analysis results (Table 5) indicated that educational level, history of Diabetes Miletus, hypertension, anemia, abortion, hyperemesis gravid arum, MUAC, gestational age, fetal

congenital anomalies and IUGR were associated with oligohydramnios (P≤ 0.25) and hence were modeled into the multivariable logistic regression analysis.

Table 5: Bi-variable logistic regression analysis of factors associated with oligohydramnios in third trimester of pregnancy at public hospitals in Mekelle city (N=356.

Variables	Category	COR	95% C.I for COR		P-value
Age in complete years		1.003	.391	2.574	.996
Residence	Rural	.744	.249	2.225	.597
	Urban			1	
Educational level	No formal education	2.591	.575	11.665	.215*
	Primary education	.997	.268	3.712	.997
	Secondary & above	3.205	.669	15.361	.145
	College & above			1	
Occupation	House wife	.906	.340	2.412	.843
	Merchant or self-employed	1.285	.158	10.431	.815
	Farmer	2.174	.276	17.147	.461
	Daily labor +others	2.174	.617	7.664	.267
	Governmental employed			1	
Monthly household income in Ethiopian birr		1.337	.769	2.324	.304
Diabetes Miletus	Yes	2.709	1.019	7.201	.046*
	No			1	
Hypertensive disorders	Yes	2.709	1.019	7.201	.046*
	No			1	
Anemia in current pregnancy	Yes	4.795	2.093	10.983	.000**
	No			1	
UTI in current pregnancy	Yes	1.110	.317	3.882	.870
	No			1	
Nutritional status (MUAC in cm)	<21 cm (SAM)	2.350	.632	8.735	.202*
	21-22.9 cm (MAM)	1.706	.385	7.551	.482
	≥23cm (Well-nourished)			1	
Daily water intake habits	Suboptimal	.844	.187	3.812	.826
	Optimal			1	
Vegetable feeding habits	No	.728	.300	1.767	.483
	Yes			1	
Extra diet (meat, egg, fish etc.) feeding at least once a week	No	.782	.334	1.832	.571
	Yes			1	
Folic acid supplementation	No	1.114	.140	8.844	.918
	Yes			1	
Iron folic acid supplementation	No	1.311	.431	3.987	.633
	Yes			1	
ANC service	No	1.185	.262	5.350	826
	Yes			1	
Gravidity	Primigravida	1.483	.682	3.221	.320
	Multigravida			1	

Gestational age in weeks	Preterm			1	
	Term	1.575	1.072	10.241	.037*
	Post term	5.221	1.533	17.778	.008**
Previous history of abortion	Yes	2.404	1.032	5.596	.042*
	No			1	
Previous history of stillbirth	Yes	1.313	.160	10.752	.800
	No			1	
Hyperemesis gravid rum	Yes	4.853	2.199	10.714	.000**
	No			1	
Fetal congenital anomalies	Yes	3.977	1.346	11.750	.013*
	No		1		
Placental insufficiency	Yes	1.313	.160	10.752	.800
	No		1		
IUGR	Yes	2.883	1.003	8.287	.049*
	No		1		
Other fetal or maternal problem else detected	Yes	1.754	.489	6.288	.388
	No		1		

**for P<1%; mean the variable is highly significant, *for P<5%; mean the variable is significant at 95% confidence level.

Multi-variable logistic regression analysis

This analysis was performed to assess whether the independent variables increase or decrease the likelihood of developing oligohydramnios. The multi-variable logistic regression analysis results (Table 6) indicated that history of Diabetes Miletus, hypertension, anemia, post-term pregnancy, hyperemesis gravid arum, fetal congenital anomalies and IUGR were significantly associated with oligohydramnios (P<0.05).

Table 6: Multi-variable logistic regression analysis of factors associated with oligohydramnios in third trimester pregnant women at public hospitals in Mekelle city (N=356).

Variables	Category	B	SE	Wald	AOR	95% C.I for AOR		P-value
Educational level	No formal education	.845	1.028	.676	2.328	.310	17.460	.411
	Primary education	.079	.944	.007	1.082	.170	6.883	.934
	Secondary & above	1.438	1.083	1.763	4.213	.504	35.209	.184
	College & above					1		
Diabetes Miletus history	Yes	1.416	.607	5.448	4.119	1.255	13.524	.020*
	No					1		
Hypertension history	Yes	1.812	.619	8.569	6.122	1.820	20.592	.003**
	No					1		
Anemia history	Yes	1.533	.541	8.040	4.633	1.605	13.371	.005**
	No					1		
Nutritional status	<21 cm (SAM)	.013	1.027	.000	1.013	.135	7.588	.990

(MUAC)	21-22.9 cm (MAM)	-.349	1.110	.099	.705	.080	6.211	.753
	≥23cm (Well-nourished)					1		
Gestational age	Preterm					1		
	Term	1.072	.732	2.144	2.923	.696	12.279	.143
	Post-term	1.976	.834	5.622	7.217	1.409	36.977	.018*
History of abortion	Yes	.776	.545	2.031	2.173	.747	6.318	.154
	No					1		
Hyperemesis gravid rum history	Yes	1.560	.492	10.066	4.759	1.815	12.475	.002**
	No					1		
Fetal congenital anomalies	Yes	2.028	.732	7.668	7.601	1.809	31.941	.006**
	No					1		
IUGR	Yes	1.769	.726	5.946	5.867	1.415	24.322	.015*
	No					1		
	Constant	-8.183	2.002	16.709	.000			.000

Hosmer-Lemeshow test (P=0.956), maximum VIF=1.121, maximum (r)= 0.236. NB: **for P<1%; mean the variable is highly significant, *for P<5%; mean the variable is significant at 95% confidence level.

Interpretation of multivariable logistic regression final model

The model explained 35.8% (Nagelkerke Pseudo R-Square) of the variance in the oligohydramnios and correctly classified 94.1% of the cases, as cited in the annex part. In this final model, significant variables were interpreted using AOR with 95% confidence interval, including P-value.

History of diabetes mellitus had a statistically significant association with oligohydramnios (AOR=4.12 (95% CI:1.26-13.52), P=0.020), indicating that individuals with a history of diabetes mellitus have 4.12 times higher odds of experiencing oligohydramnios compared to those without such a history while controlling other constants.

History of hypertension had a statistically significant association with oligohydramnios, AOR=6.12% CI:1.82-20.59), P=0.003, indicating that individuals with a history of hypertension have 6.12 times higher odds of experiencing oligohydramnios compared to those without such a history, while keeping other factors constant.

History of anemia was significantly associated with oligohydramnios (AOR=4.63 (95% CI: 1.61-13.37), P=0.005). This indicates participants with a history of anemia in their current pregnancy had odds of developing oligohydramnios that were 4.63 times higher compared to their counterparts while controlling other constants.

Post-term pregnancy (≥42 weeks of gestation) had a significant association with oligohydramnios, AOR=7.22 (95% CI: 1.41-36.98), P=0.018. This means that the odds of experiencing oligohydramnios were 7.22 times higher among participants who were at ≥42 weeks of gestation compared to participants who were at 28-36 weeks of gestation (pre-term), while keeping other factors constant.

History of hyperemesis gravid arum in current pregnancy had a statistically significant relationship with oligohydramnios (AOR=4.76 (95% CI: 1.82-12.48), P=0.002). This means that the odds of experiencing oligohydramnios were 4.76 times higher among participants with a history of hyperemesis gravid arum as compared to those without such a history, while controlling other constants.

Fetal congenital anomalies were significantly associated with oligohydramnios with an AOR=7.60(95%CI: 1.81-31.94), P=0.006. This means that fetuses with congenital anomalies have 7.60 times higher odds of developing oligohydramnios compared to normally developing fetuses, while keeping other factors constant.

Intrauterine growth restriction (IUGR) had a statistically significant relationship with oligohydramnios (AOR=5.87 (95% CI: 1.42-24.32)), P=0.015. This indicates that fetuses with IUGR have 5.87 times higher odds of developing oligohydramnios compared to normally growing fetuses while keeping other factors constant.

6 DISCUSSION

Oligohydramnios is the most common disorder related to amniotic fluid and the leading cause of pregnancy complications (6,18). The mean age of the study participant, 356 with a 100% response rate, was a 28.2±5.06 years. Majority of participants, 142(39.9%) were in the age group of 25-29 years.

According different literatures, the global magnitude of oligohydramnios varies by region, affecting approximately 1–5% of all pregnancies. However, the rate increases to 12–14% after 41 weeks and rises to 30% in post-term pregnancies (5,6,19). In Africa, the magnitude ranges from 4% to 23% of all pregnancies (25). A study in Uganda revealed a 9.4% magnitude rate at term pregnancies (19). In Ethiopia the reported magnitude is 2.3% across all gestational periods (26). Studies conducted in Amhara region found significantly higher magnitude of 36.46% in term pregnancies and 33.3% in third-trimester of pregnancies (14,41).

The magnitude of oligohydramnios in third-trimester of pregnancies in our study was 7.9% (95% CI: 5.3-11.2%). This finding is higher than those reported in cross sectional studies conducted in India (1.25%) (23), Yemen (1.5%) (5) and Pakistan (3.8%) (31). However, in contrast to the study done in the Amhara region of Ethiopia, which reported a magnitude of 33.3% in third-trimester (41), our finding indicated a lower magnitude of oligohydramnios in the same trimester. These difference may be explained due to variations in study populations, diagnostic criteria and methodological factors such as sample size, study period, eligibility criteria or study design, all of which may influence the reported rate of oligohydramnios (19,43).

For instance, the study conducted in India lasted six months and included 12,000 patients attending at outpatient clinics, antenatal wards and labor wards, encompassing both low and high-risk pregnancies, with AFI<5 cm used as a diagnostic criteria and excluded multiple gestations (23). In contrast, the study in Yemen lasted one year, focused on single, live fetuses in vertex presentation, involved 6,637 high-risk women admitted to the labor ward and used a diagnostic criterion of AFI≤5 cm (5). Similarly, according to a study done in Pakistan (25), which lasted one year and included 15,579 high-risk patients admitted through outpatient departments, antenatal clinics, and labor wards, oligohydramnios was diagnosed using an AFI<5

cm. The study excluded women with certain health conditions, like cardiac disease and a history of caesarian section.

In contrast, the study conducted in Amhara region of Ethiopia a cross-sectional comparative design over six months, using secondary data from 153 participants, applied a diagnostic criterion of AFI<5cm and excluded cases of multiple gestations, congenital anomalies and polyhydramnios (41). Our study, however, is also cross-sectional but was carried out over 2 months and included both low and high-risk women. We used a diagnostic criterion of SDVP<2cm, collected both primary and secondary data and including both singleton and multiple gestations, without excluding cases of congenital anomalies or polyhydramnios.

Study reports have indicated that, the causes of oligohydramnios are dynamic and multi-factorial, may often resulting from a combinations of maternal, placental and fetal factors, though the exact cause may sometimes remain unknown (5,19,27). This complexity of oligohydramnios cause highlights the importance of thorough clinical evaluation and surveillance in addressing oligohydramnios. Additionally, understanding the interplay of these factors can aid in developing tailored identifications and interventions to improve maternal and fetal outcomes. In this study, significant factors associated with oligohydramnios included a history of DM, hypertensive disorders, anemia during current pregnancy, hyperemesis gravid arum during current pregnancy, post-term pregnancy, fetal congenital anomalies and IUGR.

History of Diabetes Miletus (DM) had significantly associated with oligohydramnios, with an AOR=4.12(95% CI: 1.26-13.52), indicates that individuals with DM have 4.12 times higher odds of experiencing oligohydramnios compared to those without such history. This finding is consistent with studies done in Saudi Arabia (P=0.005) (4) and Amhara region of Ethiopia (AOR=2.16(1.32-4.75) (14). This association may be explained due to the fact that uncontrolled DM can impair placental perfusion, reducing blood flow and leading to utero-placental insufficiency that can cause oligohydramnios by hypoxemia, which redistributes blood flow to territory organs (brain, heart), with decreased renal perfusion and a decreased amount of urine demand (17). On the other hand, poorly controlled DM in pregnancy (hyperglycemic state of the fetus) could lead to increased fetal urine output that can be contribute to increased AFV.

Consistent with previous findings in Pakistan (P=0.000) (43) and Amhara region of Ethiopia [AOR=3.22(1.24-8.36)] (16), we identified a significant association between a history of hypertensive disorders and oligohydramnios, with an AOR of 6.12(95%CI: 1.82-20.59). This result implies that, individuals with hypertension have 6.12 times higher odds of developing oligohydramnios compared to those without hypertension. This association may be explained by the fact that high blood pressure has a direct or indirect physiological effect on feto-placental perfusion and oxygenation. It can affect placental perfusion, resulting in reduced blood flow and utero-placental insufficiency that affects the delivery of nutrient and oxygen. Hypoxemia, can cause oligohydramnios by redistributing blood flow to vital areas (heart, brain), while renal perfusion is reduced and less urine is produced (17).

On the other hand, a history anemia during the current pregnancy was significantly associated with oligohydramnios, with an AOR of 4.63(95% CI: 1.61-13.37). This result indicates that, as hemoglobin level decrease, the odds of oligohydramnios increase by 4.63 times and this finding is consistent with an observational study done in Pakistan (P=0.001) (42). The possible explanation for this association is due to anemia have both direct and indirect physiological effect on feto-placental perfusion and oxygenation, potentially leading to inadequate nutrient and fluid supply (hypoxemia), with decreased renal perfusion that can reduce fetal urine production (19). In case of placental insufficiency and chronic hypoxia, the fetus adapts to the new situation by redirecting blood flow to vital organs to preserve them. This mechanism causes decreased urine output and secretion of lung fluids, which eventually leads to oligohydramnios (52).

History of hyperemesis gravid arum during the current pregnancy was significantly associated with oligohydramnios, with an AOR of 4.76(95%CI: 1.82-12.48). This means that women with a history of hyperemesis gravid arum have 4.76 times higher odds of developing oligohydramnios as compared to those without such a history. This finding is consistent with a study conducted in the Amhara region of Ethiopia, which reported a similar association of AOR=1.19(95% CI: 1.02-4.41) (29). The possible explanation for this association may be due to the implication of severe vomiting on maternal nutrition, electrolyte imbalance and fetal growth, which may impair maternal-fetal and placental perfusion, ultimately leading to diminished AFV.

Post-term pregnancy (≥42 weeks of gestation) had a significant association with oligohydramnios, with an AOR=7.22(95%CI: 1.41-36.98). This means the odds of experiencing oligohydramnios were 7.22 times higher among participants who were at ≥42 weeks of gestation as compared to participants who were at 28-36 weeks of gestation, in other words as gestational age increase in weeks the odds of experiencing oligohydramnios also increase. This finding is supported by studies done in Nepal [P<0.05, OR=5.520(2.666-11.427)] (18) and in Uganda [P<0.001, AOR=6.0(2.3-16)] (19). This association could be due to physiological or pathological causes of reduced placental perfusion in prolonged pregnancy (43). In post-term pregnancy, alterations in the expression of aquaporin (aquaporin-1 and aquaporin-3) on the amnion, placenta and chorion are thought to be responsible for the reduction in amniotic fluid (53). Alternatively, accelerated apoptosis or increased renal tubular reabsorption as a result of a more mature tubular system has also been hypothesized as a possible underlying mechanism in the pathogenesis of oligohydramnios in post pregnancies (54).

Fetal congenital anomalies were significantly associated with oligohydramnios, with an AOR of 7.60(95% CI: 1.81-31.94). This means that fetuses with congenital anomalies had 7.60 times higher odds of developing oligohydramnios compared to normally developing fetuses. This finding is comparable with the studies done in Pakistan (P=0.045) (44) and Sudan (OR=37.1034) (45). This correlation may be attributed to fetal anomalies such as renal anomalies (renal agenesis or polycystic kidney disease), which impair the fetus's ability to produce and excrete urine (blockage) (17). Reduced renal perfusion in utero-placental insufficiency can leads to decreased urine output, contributing to oligohydramnios (24). Central nervous system anomalies may also affect AFV by disrupting cerebrospinal fluid production and reabsorption processes (17). The other possible justification for this correlation may be tendency of many women in the study population to seek ANC late in pregnancy or attend health centers without access to ultrasound services and potentially delaying the detection of congenital anomalies, further leading to low AFV.

Likewise, intrauterine growth restriction (IUGR) was significantly associated with oligohydramnios, with an AOR of 5.87 (95%CI: 1.42-24.32). This indicates that fetuses with IUGR have 5.87 times higher odds of developing oligohydramnios compared to normally growing fetuses. This finding is in line with a study conducted in India (P<0.01) (46) and the

association may be explained by placental insufficiency in which poor placental function can impact the transfer of nutrients, fluid and waste products, affecting AFV. In IUGR cases can reduce fetal renal perfusion and urine output, leading to decreased AFV (17). Oligohydramnios is a common finding in growth restricted fetus and it is an important diagnostic and prognostic parameter.

In the current study, 334 participants (93.8%) reported that they were drinking less than 2 liters of water daily during pregnancy. Among those participants, 26(7.8%) were diagnosed with oligohydramnios. This indicates that 26 out of the 28 total cases of oligohydramnios identified were linked with suboptimal water intake. While low water consumption may contribute to maternal dehydration, potentially leading to oligohydramnios, we found no significant correlation between the two. Additionally, our literature search did not reveal any previously published studies supporting this link.

Three hundred forty two participants (96.1%) had not taken folic acid supplement for at least three months before conception. Among those, 27(7.89%) were diagnosed with oligohydramnios. This indicates that 27 out of the 28 total cases of oligohydramnios identified were linked with lack of folic acid supplementation. This may suggests that the lack of folic acid supplementation may contribute to congenital anomalies, particularly those affecting the central nervous system (CNS). Moreover, CNS anomalies may also contribute to oligohydramnios, as this was significantly correlated in our study. However, no significant correlation was found between folic acid intake and oligohydramnios. Furthermore, we could not find any previous studies either supporting or contradicting this relationship.

7 STRENGTH AND LIMITATION OF THE STUDY

The main strength of our study lies in its comprehensive data collection, utilizing both primary and secondary data through the Kobo Tool box platform. This approach effectively captures categorical and continuous variables to explain appropriately the outcome variable. The high response rate of the primary data collection achieved likely enhances the accuracy and reliability of our findings. Additionally, this study generated valuable epidemiological data that can serve as an initial estimate of the burden and correlates of oligohydramnios in the region, but specific determinants may vary across regions due to differences in lifestyle and environmental factors.

The study also has some limitations. The cross-sectional nature of our study restricts us to establish a cause-and-effect relationship from the observed association between the risk factors and oligohydramnios. Furthermore, due to the lack of longitudinal outcome data, we were unable to assess the prognostic implications of oligohydramnios in our study population. The multi-centered nature of this study may be prone to variations in ultrasound measurement of AFV between different clinicians. Some variables were reliance on self-reported data. The study was done in general and referral hospitals which scored a relatively higher rate of oligohydramnios. Finally, since the study was hospital-based and included only pregnant women attending various services, the generalizability of the findings to the broader population may be limited. So we suggest taking a great caution in applying the findings of the study to non-hospital population.

8 CONCLUSSION

The magnitude of oligohydramnios in the third trimester of pregnancy at the public hospitals in Mekelle city was detected 7.9%. The higher magnitude is due to the study was done in general and referral hospitals. History of maternal Diabetic Mellitus, hypertensive disorders, anemia in current pregnancy, hyperemesis gravid arum in current pregnancy, post-dated pregnancy and fetal factors, including fetal congenital anomalies and intrauterine growth restriction, were identified as significant risk factors for oligohydramnios.

9 RECOMMENDATION

We recommend that health professionals increased surveillance for oligohydramnios in third-trimester of pregnancies, particularly in women with a history of diabetes mellitus, hypertensive disorders, anemia in current pregnancy, hyperemesis gravid arum in current pregnancy, post-dated pregnancy, fetal congenital anomalies and IUGR, in order to promptly identify and institute timely intervention to improve maternal and fetal outcomes. Additionally, health care professionals should also offer targeted counseling and prevention strategies during preconception & pregnancy periods to raise awareness on individual women regarding on the identified risks of oligohydramnios.

To reduce the risk of oligohydramnios, we recommend maternal lifestyle modifications, including adequate hydration, balanced diet rich in vegetables and protein source such as meat, eggs, or fish, using of folate supplements before conception and iron-folate supplements during pregnancy. Regular antenatal checkups are also essential to monitor maternal and fetal health.

Local governments (Institutions & Regional health bureau), should design targeted interventions based on the identified determinants. Health institutions should also ensure continuous access to essential diagnostic tools, like ultrasound, to facilitate early detection of oligohydramnios and timely targeted intervention. The health bureau must allocate sufficient resources to equip healthcare facilities with necessary tools and considered to integrate the identified risk factors into maternal health improvement programs. Furthermore, health policymakers should consider these findings to guide policy and promote ongoing awareness campaigns, emphasizing the importance of natural folate intake from locally available foods during pregnancy & enhanced supplementation before conception.

Finally, we suggest future researchers to conduct longitudinal studies with larger sample sizes and extended follow-up periods to better assess the clinical outcomes and long-term effects of oligohydramnios, to provide deeper insights into its association with the identified risk factors within this context.

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12 ANNEXES

12.1 Logistic Regression Assumption Fulfillment Tests and Interpretation

The binary logistic regression model normality assumption was tested using the following statistics. The Hosmer-Lemeshow goodness-of-fit test was run to check the overall model fitness, in which a P-value >0.05 indicates a well-fitted model for the data set. The selected model was a good-fit model for the data set, since the Hosmer-Lemeshow goodness-of-fit P-value was insignificant (0.956), which is greater than 0.05. The presence of multicollinearity among covariates was tested using linear regression of variance inflation factor (maximum VIF =1.121) that was less than 10, which indicates that no multicollinearity issue. Additionally, correlation among covariates was tested using Pearsonn correlation (r) (maximum (r) = 0.236, between educational level and MUAC) that was less than 0.75, which indicates no interaction issue. Nagelkerke Pseudo R-square statistics were tested to see the model prediction value and it was 0.358. This means that the model explained 35.8% (Nagelkerke Pseudo R-Square) of the variance in the oligohydramnios. The model also correctly classified 94.1% of the cases.

Overall model fitness test: is checked using **Hosmer-Lemeshow goodness-of-fit test;** P-value >0.05(non significant) indicates a well-fitted model for the data set.

Analysis→Regression→Binary logistic→Hosmer and lemeshow→Ok

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	2.626	8	.956

Pseudo R-Square (Chi-Square): used to test model explaination value.

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	137.565[a]	.152	.358

a. Estimation terminated at iteration number 7 because parameter estimates changed by less than .001.

Classification Table[a]

Observed			Predicted: Oligohydramnios status: Oligohydramnios	Predicted: Oligohydramnios status: Non-Oligohydramnios	Percentage Correct
Step 1	Oligohydramnios status	Oligohydramnios	8	20	28.6
		Non-Oligohydramnios	1	327	99.7
	Overall Percentage				94.1

a. The cut value is .500

A classification table indicates the percentage of probability of participants or cases to occur (1) or not occur oligohydramnios (0) correctly classify. The above model show 94.1% of the participants/cases correctly classified.

Multicolinearity test

Analysis→Regression→ Linear regression→Colinearity diagnosis→Ok

VIF value>10 considered presence of Multicolinearity among covariates and VIF <10 value considered no Multicolinearity.

Coefficients[a]

Model		Unstandardized Coefficients: B	Unstandardized Coefficients: Std. Error	Standardized Coefficients: Beta	t	Sig.	95.0% Confidence Interval for B: Lower Bound	95.0% Confidence Interval for B: Upper Bound	Collinearity Statistics: Tolerance	Collinearity Statistics: VIF
1	(Constant)	.385	.221		1.746	.082	-.049	.819		
	Educational level	.014	.015	.047	.912	.362	-.016	.045	.892	1.121
	Diabetes Miletus history (including GDM)	.095	.044	.106	2.136	.033	.007	.182	.976	1.025
	Hypertension history (including PIH)	.119	.044	.133	2.676	.008	.032	.207	.968	1.033
	Anemia history in current pregnancy	.133	.039	.172	3.395	<.001	.056	.210	.937	1.067
	Middle upper arm circumference in cm	.026	.024	.055	1.077	.282	-.022	.074	.920	1.086
	Gestational age in complete weeks	-.060	.023	-.133	-2.640	.009	-.105	-.015	.949	1.054
	History of abortion	.067	.035	.096	1.922	.055	-.002	.136	.973	1.028
	Hyperemesis gravidrum history in current pregnancy	.126	.033	.193	3.796	<.001	.061	.191	.929	1.077
	US detectable fetal conigonital anomalies	.154	.056	.137	2.728	.007	.043	.264	.946	1.057
	Intrauterine growth restriction	.117	.051	.117	2.317	.021	.018	.217	.938	1.066

a. Dependent Variable: Oligohydramnios status

Correlation test

Analysis→ Correlation→ Bivariate correlation→ Pearson correlation(r) → Ok

Pearson correlation(r) value >0.75 indicates correlation among covariates and value <0.75 no correlation.

Correlations

		Oligohydramnios status	Educational level	Diabetes Miletus history (including GDM)	Hypertension history (including PIH)	Anemia history in current pregnancy	Middle upper arm circumference in cm	Gestational age in complete weeks	History of abortion	Hyperemesis gravidrum history in current pregnancy	US detectable fetal conigonital anomalies	Intrauterine growth restriction
Pearson Correlation	Oligohydramnios status	1.000	.034	.110	.110	.212	.071	-.124	.111	.224	.142	.108
	Educational level	.034	1.000	-.106	-.126	.087	.236	-.045	-.010	-.138	.010	.057
	Diabetes Miletus history (including GDM)	.110	-.106	1.000	.104	-.002	-.042	.064	.015	.025	-.009	.006
	Hypertension history (including PIH)	.110	-.126	.104	1.000	-.028	-.042	.032	-.033	-.043	-.047	.006
	Anemia history in current pregnancy	.212	.087	-.002	-.028	1.000	.091	-.095	-.018	.157	.031	-.088
	Middle upper arm circumference in cm	.071	.236	-.042	-.042	.091	1.000	.097	-.005	-.033	.074	.071
	Gestational age in complete weeks	-.124	-.045	.064	.032	-.095	.097	1.000	-.045	-.069	.119	.104
	History of abortion	.111	-.010	.015	-.033	-.018	-.005	-.045	1.000	.128	.003	-.081
	Hyperemesis gravidrum history in current pregnancy	.224	-.138	.025	-.043	.157	-.033	-.069	.128	1.000	-.023	-.029
	US detectable fetal conigonital anomalies	.142	.010	-.009	-.047	.031	.074	.119	.003	-.023	1.000	.185
	Intrauterine growth restriction	.108	.057	.006	.006	-.088	.071	.104	-.081	-.029	.185	1.000

12.2 Participant Information Sheet

Title of the research project: Magnitude and associated factors of oligohydramnios among third trimester pregnant women attending at Mekelle public hospitals, Tigray, Ethiopia, 2024/2025 G.C.

Investigator: Shushay Tekulu

Email: shushaytekulu.44@gmail.com

Phone: 09448442338

Main Advisor: Kidanemariam Gaim (Assistant Prof.)

Introduction: Hello, I am Shushay Tekulu from Mekelle University, College of Health Sciences. I am here today to collect data on magnitude and associated factors of oligohydramnios in third trimester pregnancy at ACSH, MGH and QGH in Mekelle city, Tigray, Ethiopia. The

objective of this study is to determine magnitude and associated factors of oligohydramnios among third trimester pregnant women attending at Mekelle public hospitals, Tigray, Ethiopia from December/1/ 2024 to May/30/2025. I am kindly request that you take part in this study. Your cooperation and willingness are greatly helpful in identifying information related to oligohydramnios. It needs about 10 minutes for the interview. There is no direct benefit or possible risk associated with participating in this study except for the time spent responding to the interview. The information you provide will be kept strictly confidential. Your participation is voluntary & you are not obliged to answer any question that you do not want to answer. If you feel uncomfortable with the question, it is your right to drop it at any time you want.

Purpose: The overall purpose of this study is to determine magnitude and associated factors of oligohydramnios among third trimester pregnant women attending at Mekelle public hospitals, Tigray, Ethiopia from December/1/ 2024 to May/30/2025. I want to find out the magnitude of oligohydramnios and to identify the associated risk factor in third trimester's pregnancy at ACSH, MGH and QGH, Tigray, Ethiopia. With this information, I will be able to give information to health care providers and responsible bodies and share it with the rest of the world to raise awareness about the magnitude and associated factors of oligohydramnios at ACSH, MGH and QGH, Tigray, Ethiopia.

Procedure and participation: You will receive the Tigrigna version of this information sheet and consent form to read until you completely understand it. If you cannot read, that will not be a problem because I will also provide you with an oral briefing so that maximum understanding and clarity will be created. Then, subjects with an interest in participating in my study will be asked to sign the consent form, and the investigator/data collector will record their personal information. After providing your consent, I will ask you about demographic, social and economic information and other relevant clinical data.

Confidentiality: I strongly assure you that your name and other identifiers will not be disclosed to anyone outside of the study.

Rights, Risk and Benefits of the Study: Your participation in the study will not have any risk, it is only an interview.

The interview will be carried out by experienced health professionals in the hospital. You will not receive a direct benefit from participating in this research. However, you will be assisted and briefed by experienced health professionals to gain an improved understanding and awareness about the associated risk factors of oligohydramnios and its effects. The information you provide is confidential and will only be used for the objective mentioned above. Information about your health information collected from the study will be stored in code numbers. No personal identification will be mentioned in the results of the study, which may be published for scientific purposes. Therefore, I want to assure you that your participation in this study will not involve any risks to you.

Inducement, incentive and compensation: There will not be any monetary payment linked with your participation in this study. The benefit you will gain are mentioned in the above under the section ‘‘Benefit’’.

Freedom to withdraw: Your participation in this study is completely voluntary. No penalty or loss of benefit is involved if you change your idea that you do not want to participate at any time.

Person to contact: In case you have any questions, unclear ideas and doubt about the study please feel free to contact the following individuals through their addresses:

- Principal investigator: Shushay Tekulu (BSc. in Public Health)
  Email: shushaytekulu.44@gmail.com, Cell phone: 0948442338
- Principal Advisor: Kidanemariam Gaim (Asst. prof)
  Email: kidegaim2@gmail.com

Informed Consent

I understand that the purpose of the study is to collect information regarding the magnitude and associated factors of oligohydramnios among third trimester’s pregnant women attending at ACSH, MGH and QGH in Mekelle city, Tigray, Ethiopia. I have read the above information or it has been read to me. I have had the opportunity to ask questions and any questions that I have asked have been answered to my satisfaction. I consent voluntarily to participate in this study and understand that I have the right to withdraw at any time without affecting my social life or medical care in any way.

1. Yes, of course ☐
2. No. ☐

12.3 Questionnaire & Data Extraction Sheet: Developed & Adapted from Reviewed Literatures (English Version)

Questionnaire & data extraction sheet to collect data about magnitude and associated risk factors of Oligohydramnios in third trimester pregnant women who visits for different service at public hospitals in Mekelle city, Tigray, Ethiopia, 2024/2025.

(Please indicate the response by circle the levels number or write on the blank space given)

Part i: Data collector and hospital related information	
Code of Questionnaire & Data extraction sheet	
Name of data collector	
Mobile number	
Date of data collection	
Hospital Name	1. ACSH 2. MGH 3. QGH
Ward (Unit) name	1. ANC 2. GYN-OBS OPD 3. Emergency unit 4. Labor ward (waiting area)
Part ii: Socio-economic and demographic characteristics of women	
What is your current age in complete years?	
What is your marital status?	1. Married
	2. Single (never married)
	3. Widowed
	4. Divorced (separated)
What is your religion?	1. Orthodox
	2. Muslim
	3. Protestant
	4. Catholic
	5. Other, specify
What is your ethnicity?	1. Tigrain
	2. Afar
	3. Amhara
	4. Other, specify
Where is your place of residence?	1. Rural
	2. Urban
What is the highest level of schooling you have completed?	1. Unable to write & read (no education)
	2. Primary education (1-8)
	3. Secondary and above (9-12)
	4. Tertiary (college and above)
What is your occupation?	1. House wife
	2. Merchant or self-employed
	3. Governmental employed
	4. Farmer
	5. Daily labor
	6. Other, specify
What is your house hold monthly income in Ethiopian birr?	
Part iii: Maternal clinical related variables	
Do you have history of Diabetes Miletus? (or from mother chart)	1. Yes
	2. No
Do you have history of hypertension? (or from mother chart)	1. Yes

	2. No
Do you have history of anemia during this pregnancy? (or from mother chart most recent laboratory result)	1. Yes
	2. No
Do you have history of urinary tract infection during this pregnancy? (or from mother chart most recent lab. result)	1. Yes
	2. No
Does you tested for HIV serostatus during this pregnancy? (or see it from mother chart)	1. Yes
	2. No
If yes what was the result (or see it from mother chart)	1. Positive
	2. Negative
Middle upper arm circumference (MUAC) in cm? (or from mother chart)	
Part iv: Maternal life style related variables	
How much water do you drink per day (24 hr) during this pregnancy? (approximate the amount in liter from the house hold drinking material use)	
Do you feed on vegetables during this pregnancy on your daily meal?	1. Yes
	2. No
If yes, how many times per day do you feed on vegetables?	
Do you feed on extra diet meat, milk, egg or fish during this pregnancy weekly?	1. Yes
	2. No
If yes, how many days per week do you feed on it?	
Did you had taken folic acid (Iron folic acid) before conception at least for 3 months	1. Yes
	2. No
Does you have taken Iron folic acid during this pregnancy (from different sources)	1. Yes
	2. No
If yes, for how many months do you taken?	
Part v: Maternal Obstetric related variables	
What is the gestational age (GA) of your current pregnancy? (Calculate from the mother last normal menstrual period in weeks or from US estimation result)	
How many pregnancies have you had to date? (gravidity)	
(If she is multigravida) How much is your inter pregnancy interval/space in months? (space between the current pregnancy and the previous one)	
Do you have history of abortion?(or see from mother chart)	1. Yes
	2. No
Do you have history of stillbirth? (or see from mother chart)	1. Yes
	2. No
Do you have Antenatal care (ANC) follow up or visits?	1. Yes
	2. No
If Yes, how many times do you attend?	
Do you have history of severe vomiting during this pregnancy?	1. Yes
	2. No
If yes or look, specify the symptoms or sign observed?	
Part vi: Obstetric conditions of fetus and placenta to be extracted from chart of US results recent one	
Medical record number of mother chart	
Date of ultrasound (US) scanned	
Single deepest vertical pocket (SDP) in cm (semi-	

quantitative assessment)	
Or Amniotic fluid index (AFI) in cm (semi-quantitative assessment)	
Amniotic fluid volume (qualitative or subjective assessment)	1. Adequate
	2. Inadequate (low)
Estimated fetal weight (EFW) in grams	
US detected fetal congenital anomalies (like renal tract obstruction (renal agenesis or PCK), gastrointestinal (hernia), musculoskeletal, CNS (spinal bifida), & multiple congenital anomalies etc.)	1. Yes
	2. No
If yes, select from the list or options (you can select more than one)	1. Urinary tract obstruction like renal agenesis or poly cystic kidney disease
	2. Neural tube defect (CNS) like spinal bifida
	3. Gastrointestinal like umbilical hernia anomalies
	4. Musculoskeletal anomalies
	5. Cardiac anomaly
	6. Multiple congenital anomalies
	7. Other, specify
Placental insufficiency (like Abruptio placenta, twin-twin transfusion or multiple pregnancy abnormality)	1. Yes
	2. No
If yes, select from the list or options (you can select more than one)	1. Abruptio placenta abnormality
	2. twin-twin transfusion abnormality
	3. Multiple pregnancy
	4. Other, specify
Intrauterine growth restriction detected	1. Yes
	2. No
Other associated obstetric problem else detected	1. Yes
	2. No
If yes, specify	

Thank you for your participation!!

ልጋብ-1: <u>ንተሳተፍቲ ብዛዕባ ዘካይዶ መጽናዕቲ ሓበሬታ ወሃቢ ጽሑፍ</u>

ርእሲ እዚ መጽናዕቲ: ኣብ ኮምፕሬሄንሲቭ ስፔሻላይዝድ ሆስፒታል ዓይደር፣መቀለ ሓፈሻዊ ሆስፒታል፣ ኹሓ ሆስፒታልን ዘለዋ መጠን ዋሕዲ መሐመሲ ዕሸል ፈሳሲ ኣብ ልዕሊ 28 ሰሙን ጥንሲ ዘለወን ኣዴታትን ተተሓሓዝቲ መንቅሊታቱን ዳህሳስ”

<u>ተማራማሪ</u>: ሹሻይ ተኩሉ

መማከርቲ: ኪዳነማሪያም ጋይም (ሓጋዚ ፕሮፌሰር) ፣ ኣፈወርቂ በቀለ (ሓጋዚ ፕሮፌሰር) ፣ዶ/ር ይትባረክ ታደሰ (ላዕለዋይ ወይ ፍሉይ ባዓል ማያ ጥንስን ሕርስን)

መእተዊ እዚ ሓበሬታ ወሃቢ ጽሑፍ ሓፈሻዊ ዕላምኡ ኣብዚ ዘካይዶ መጽናዕቲ ተሳተፍቲ ንኽትኮና ፍቓድክን ንምሕታት ኮይኑ ብዛዕባ እዚ ዘካይዶ መጽናዕቲ ሙሉእ ሓበሬታ ክዋህበክን እዩ። ብተወሳኺ እውን ካብ ተሳተፍቲ እንደልዮ ሓገዝ ብዝርዝር ዝተገለጸ ኮይኑ ኣብዚ ከይዲ ድሕንነት፣ ክብርን መሰልን ተሳተፍቲ ብዘረጋገጸ መንገዲ ንኽኸውን እንወስዶም ጥንቃቐታት እውን ኣቐሚጥና ኣለና። ስለዝኾነ ኣብዚ መጽናዕቲ ተሳታፊ ንምኳን ንኽውስና እዚ ሓበሬታ ብዕምቐት ምርዳእ ጠቃሚ ይኸውን። ዝኾነ ዓይነት ሕቶ ወይ ከዓ ግልጺ ዘይኮነ ነገር እንተጋጢምወን ብዘይዝኾነ ስኽፍታ ክንዲዝደለይኦ ግዜ ንኽሓታና ይላቦ። ኣብዚ መጽናዕቲ ተሳታፊ ንምኳን እንተወሲነን እሞ እዚ ውሳነኣን እቲ መጽናዕቲ ይኹን ንሰን ዝግበረለን ሓገዝን ካልኦት ዝተጠቐሱ ዛዕባታት ሙሉእ ብምሉእ ተረዲእወን ብሰናይ ድሌየተን ፈቂደን ምኻነን ኣብቲ ዝተዳለወ ናይ ስምምዕ ቅጥዒ ብምፍራም ከራጋግፃልና እየን። ንዝገብክናልና ምትሕብባርን ሓገዝን ብቕድምያ ምስጋናይ የቕርብ። ዓላማ ናይዚ መጽናዕትን ናተን ተሳትፎን

ሓፈሻዊ ዕላማ እዚ መፅናዕቲ ኣብ ኮምፕሬሄንሲቭ ስፔሻላይዝድ ሆስፒታል ዓይደር ፣መቀለ ሓፈሻዊ ሆስፒታል፣ኹሓ ሓፈሻዊ ሆስፒታልን ዘለዋ " መጠን ዋሕዲ መሐመሲ ዕሸል ፈሳሲ ኣብ ልዕሊ 28 ሰሙን ጥንሲ ዘለወን ኣዴታትን ተተሓሓዝቲ መንቅሊታቱን ዳህሳስ" ብዝብል ርእሲ ንምፅናዕ እዩ። ማለት እውን ኣብ ልዕሊ 28 ሰሙን ጥንሲ ዘለወን እዴታት ዋሕዲ መሐመሲ ዕሸል ፈሳሲን መንቀሊታቱን ንምፅናዕን ካብዚ መፅናዕቲ እዚ ብዝርከብ መረዳእታ ድማ ብቐንዱ ንነደፍቲ ፖሊሲን ንባዓል ሞያ ጥዕና ሓበሬታ ብምሃብ ዝክኣል ግንዛበ ንኽፍጠር ክግበር እዩ።

ተሳተፍቲ እዚ መጽናዕቲ ብኸመይ ይሕረያ?

ዒላማዊ መረፃ ተሳተፍቲ ምስኣካየድና እቲ ሓበሬታ ወሃቢ ወረቐት ክተንብብኦ ክወሃበክን እዩ። ድሕሪ እዚ ተወሳኺ መብራህርሂ ክዋሃበክን እዩ። ዝተወሰነ ሕቶታት ብምሕታት ሕድሕድ ነጥቢ ከምዝተረደኣክን ምስ ኣረጋገጽኩ ኣብዚ መጽናዕቲ ንምስታፍ ድሌት ዘለዎን ልዕሊ 28 ሰሙን ጥንሲ ዘለወን ብድሌተንን ፈቃደንን ኣብቲ ናይ ስምምዕ ቅጥዒ ብምፍራም የረጋግፃ። ብድሌተን ምስገለፅክናልና ነዚ መፅናዕቲ እዚ ዝተዳለዉ ሕቶታት ብቐደም ሰዓብ ብምሕታትን ዝከኣል መልሲ ክንረክብ ኢና። ኣብዚ መጽናዕቲ ብምስታፍክን እንታይ ጥቅሚ ይረኽባ? ምስ እዚ መጽናዕቲ ዝተተሓሓዘ ንተሳተፍቲ ዝኽፈል ቀጥታ ክፍሊት ከምዘይህሉ ክንገልጽ ንፈቱ። ኮይኑ ግና ካብዚ መፅናዕቲ እዚ ብዝርከብ ሓበሬታ መሰረት ዋሕዲ መሐመሲ ዕሸል ፈሳሲ ኣብ ኣዴታትን ህጽንን ዘምጽኦ ሳዕቤንን ተፅዕኖን ኣብ ግንዛበን ኣብ ምምራፅ ዝሓሸ መከላከሊ መንገዲ ንምንዳይ ከም ውልቀ ሰብ ኮነ ከም ዓዲ ተረባሒት እየን ኢለ የኣምን።

ኣብዚ መጽናዕቲ ብምስታፈይ እንታይ ጉድኣት ክበጽሐኒ ይኽእል? እዚ መጽናዕቲ ናይ ተሳተፍቲ ድሕንነት፣ ክብርን መሰልን ብዝለዓለ ደረጃ ብዘረጋገፀ ከይዲ ንኽፍፀም ዓብዪ ጥንቃቐ ክገብር ኢየ።ንተሳተፍቲ ጉድኣት ዘብጽሕ ወይ ከዓ ናብ ሓደጋ ዘጋልጽ ተግባር የለን። ነዚ ቃለ መሕትት 10 ደቂቃ ግዜኦም/ኣን ክህቡ/ባና እዮም። እቲ መጽናዕቲ

ከቋርፃ ይኽእል ‘ዶ? ቅድም ኢሉ ከምዝተገለፀ ኣብዚ መፅናዕቲ ምስታፍ ሙሉእ ንሙሉእ ኣብ ሰናይ ድሌት ተሳተፍቲ ዝተመርኮሰ እዩ። ኣብ ከይዲ ካብቲ መጽናዕቲ ምቁራጽ ይከኣል እዩ። ስለዘቋረፃ ዝበጽሐን ዝኾነ ዓይነት ክፍሊት ይኹን ቅጽዓት ኣይህሉን። ካብ ተሳተፍቲ እንወስዶ ሓበሬታ ምስጢራውነት ብዝምልከት ካብ ተሳተፍቲ እንወስዶ ሓበረታ ናይመን ምኻኑ ብዘየፍልጥ መንገዲ ብኮድ እዩ ክፍፀም። ስለዚ ነዚ ፅነዓት ኢሎን ዝሃቦኦ ሓበሬታ ምስጢሩ ዝተሓለወ እዩ። ምዝርጋሕ ውፅኢት ናይዚ መፅናዕቲ ዝምልከት ውፅኢት ናይዚ መፅናዕቲ ብመልክዕ ሕታም ወይ ከዓ ኣብ ኮንፈረንስታት ብምቕራብ ክሰራጮ/ክዝርጋሕ እዩ። ከከም ኣድላይነቱ ካልኦት ሜላታት እናተጠቀምካ እውን እቲ ውፅኢት ናይ ምዝርጋሕ ስራሕቲ ክስራሕ ይኽእል እዩ።

ንመን ክረኽባ ይደልዩ/ያ? ኣብቲ ፅንዓት ዝልዓል ሕቶ እንተሃልይዎም/ን ዋና ተመራማሪ በዚ ዝስዕብ አድራሻ ምርካብ ይክእላ፡ ሹሻይ ተኩሉ ስልኪ ቁፅሪ:0948442338 ኢ-ሜይል: shushaytekulu.44@gmail.com ወይ ዋና መማከሪ ኪዳነማርያም ጋይም ስልኪ ቁፅሪ: 0920173828 ኢ-ሜይል: kidegaim2@gmail.com,

ልጋብ 2: <u>ኣብ ኣፍልጦ ዝተመስረተ ናይ ተሳታፋይነት ስምምዕነት</u>

ዓላማ ናይዚ መፅናዕቲ ብዛዕባ ኣብ ኮምፕሬሄንሲቭ ስፔሻላይዝድ ሆስፒታል ዓይደር ፣መቀለ ሓፈሻዊ ሆስፒታልንኹሓ ሓፈሻዊ ሆስፒታልን ዘለዋ ”መጠን ዋሕዲ መሐመሲ ዕሸል ፈሳሲ ኣብ ልዕሊ 28 ሰሙን ጥንሲ ዘለወን ኣዴታትን ተተሓሓዝቲ መንቅሊታቱን ዳህሳስ”ብዝብል ርእሲ መረዳእታ ንምእካብ ምኺኑ ብዝግባእ ተረዲአ ኣለኹ። ዝርዝር ብዛዕባ ንተሳተፍቲ ዝዋሃብ ሓበሬታ ወሃቢ ጽሑፍ እውን ኣንበበን ተነቢቡለይን ኣሎ። ዘይበረሀለይ ሕቶ ናይ ምሕታት እኹል ዕድል ዝረኸብኩ እንትከውን ዝግባእ እኹል መልሲ እውን ተዋሂቡኒ እዩ። ብተወሳኺ ብሰናይ ድለየተይ ኣብዚ መፅናዕቲ እዚ እናተሳተፍኩ እንትኾን ኣብ ዝደለኽዎ ግዜ ብዘይዝኾነ ምቅዋስ/ሃሰያ ማሕበራዊ ሂወት ወይካዓ ጥዕናዊ ኣገልግሎት ካብዚ መፅናዕቲ ምስታፍ ዓርሰይ ከግልል ዝኽእል ምኺነይ ተረዲአ ኣለኹ።

1. እወ፣ ብዝግባእ ☐
2. ኣይፋልን ☐

12.4 ልጋብ 3: መሕትት (ስርሒት ትግርኛ)

ክፋል 1፡- ኣከብቲ ሓበሬታን ሆስፒታልን ምስኡ ዚተሓሓዝ ሓበሬታ ዝምልከት	
መሕትት ኮድ	
ስም ኣከቢ ሓበሬታ	
ቁፅሪ ሞባይል	
ሓበሬታ ዝተኣከበሉ ዕለት	
ስም ሆስፒታል	1. ዓይደር ኮምረሀንሲብ ስፐሻሊዝድ ሆስፒታል 2. መቀለ ሓፈሻዊ ሆስፒታል 3. ኩሓ ሓፈሻዊ ሆስፒታል
ስም ዋርድ ወይ ኣገልግሎት ክፍሊ	1. ክፍሊ ቅድሚ ወሊድ ክትትል ግልጋሎት (ANC unit)

	2. ክፍሊ ጋይን ኦቢስ ኦፒዲ (GYN-OBS OPD) 3. ክፍሊ ሃደቤታዊ ሕክምና 4. ክፍሊ ወሊድ ግልጋሎት (መፀበይ ቦታ)
ክፋል 2፡- ማሕበራውን ቍጠባውን ስነ ህዝባዊን ባህርያት ኣዴታት ዝምልከት	
ዕድሜኪ ብዓመት ክንደይ እዩ?	
ባዓልቲ ሓዳር(ተዋሲብኪ) ዲኪ?	1. ተመርዕወት
	2. ንጽል (ዘይተመርዓወት)
	3 ሰብኣያ ዝሞታ
	4 ዝተፋተሐት (ዝተፈላለየት)
ሃይማኖትኪ እንታይ እዩ?	1. ኦርቶዶክስ
	2. ሙስሊም
	3. ፕሮተስታንት
	4. ካቶሊክ
	5. ካልእ ይገለፅ
ቤሄርኪ እንታይ እዩ?	1. ትግራወይቲ
	2. ዓፋር
	3. ኣምሓራ
	4. ካልእ ብንጹር ይገለፅ
ኣበይ ትነብሪ?	1. ገጠር
	5. ከተማ
እቲ ዝዛዘምካዮ ዝለዓለ ደረጃ ትምህርቲ ክንደይ እዩ ?	1. ክጽሕፍን ከንብብን ኣይክእልን (ኣይተማህርኩን)
	2. መባእታዊ ትምህርቲ (1-8)
	3. ካልኣይ ብርኪን ልዕሊኡን (9-12)
	4. ኮሌጅን ልዕሊኡን
ስራሕኪ እንታይ እዩ ?	1. ሓብሓቢት ገዛ
	2. ነጋዲት ወይ ናይ ግሊ(ባዕላ) ስራሕ ዘለዋ
	3. ሰራሕተኛ መንግስቲ
	4. ሓረስታይ
	5. መዓልታዊ ሸቃሊት
	6. ካልእ ብንጹር ይገለፅ
ናይ ስድራኩም ወርሓዊ ኣታዊ ብናይ ኢትዮጵያ ቅርሺ ክንደይ እዩ?	
ክፋል 3፡- ምስ ጥዕና ኣዶ ዝተተሓሓዙ ሓበሬታታት	
ሕማም ሽኮርያ ኣለኪ ድዩ?(ወይ ካብ ካርዲ ኣደ ረኣይ)	1. እወ
	2. ኣይፋልን
ሕማም ልዑል ጸቕጢ ደም ኣለኪ ድዩ?(ወይ ካብ ካርዲ ኣደ ረኣይ)	1. እወ
	2. ኣይፋልን
ኣብዚ ናይ ሕዚ ጥንሲ ዋሕዲ ደም ኣለኪ ዳኦ ተባሂልኪ ኢኪ?(ወይ ካብ ናይ ቀረባ እዋን ውጽኢት ላብራቶሪ ዝተረኽበ ካብ ካርዲ ኣዶ)	1. እወ
	2. ኣይፋልን
ኣብዚ ናይ ሕዚ ጥንሲ ናይ ስርዓተ ሽንቲ ረክሲ ኣለኪ ዳኦ ተባሂልኪ ኢኪ?(ወይ ካብ ናይ ቀረባ እዋን ውጽኢት ላብራቶሪ ዝተረኽበ ካብ ካርዲ ኣዶ)	1. እወ
	2. ኣይፋልን
ኣብዚ ናይ ሕዚ ጥንሲ ኤች. ኣይ. ቪ. ተመርሚርኪ ዶ?(ወይ ካብ ናይ ኣዶ ካርዲ ረኣይ)	1. እወ
	2. ኣይፋልን
እወ እንተኾይኑ መልስኪ ውጽኢቱ እንታይ ነይሩ?(ወይ ካብ ናይ ኣዶ ካርዲ ረኣይ)	1. ኣለኒ
	2. ነፃ

ዓቀን ላዕለዋይ ቅልፅም ኢድ ወይ ሙዋክ (MUAC) ቢ ሴንት ሜትር (ወይ ካብ ካርዲ ኣዶ ረኣይ)	
ክፋል 4 ፡- ናይ ኣነባብራ ስታይል ባህርያት ኣዶ ዝምልከት	
ኣብዚ ናይ ሕዚ ጥንሲ እዚ ኣብ መዓልቲ ኽንደይ ዚኣክል ማይ ኢኪ ትሰቲዩ ኣብ ምሽጢ 24 ሰዓት? (ብገምጋም መጠን እቲ ኣብ ገዛ ዝርከብ መስተዩ ማይ ዝጥቀምሉ ኣቃሓ ብሊትሮ)	
ኣብዚ ናይ ሕዚ ጥንሲ ኣሕምልቲ ትምገቢ ዶ ኣብ መዓልታዊ ምግቢኪ?	1. እወ 2. ኣይፋልን
እወ እንተኮይኑ መልስኪ ኣብ መዓልቲ ኽንደይ ሳዕ ኢኪ ኣሕምልቲ ትምገቢ?	
ኣብዚ ናይ ሕዚ ጥንሲ ተወሳኺ ምግቢ ከም ስጋ; እንቋቕሑ;ፀባ ወይ ዓሳ ትምገቢ ዶ ኣብ ሰሙናዊ ምግቢኪ?	1. እወ 2. ኣይፋልን
እወ እንተኮይኑ መልስኪ ኣብ ሰሙን ክንደይ መዓልትታት ኢኻ ትምገቢ?	
ቅድሚ ምጥናስኪ ፎሊክ ኣሲድ ዝባሃል መድሓኒት እንተናኣሰ ን 3 ወረሒ ወሲድኪ ዶ ነይርኪ?	1. እወ 2. ኣይፋልን
ኣብዚ እዋን እዚ ሓጺን(ኣይሮን) ፎሊክ ኣሲድ ትወስዲ ዶ?	1. እወ 2. ኣይፋልን
እወ እንተኮይኑ መልስኪ ንክንደይ ሰሙናት ኢኻ ወሲድኪ ወይ ዊሒጥኪ?	
ክፋል 5፡- ኮነታት ሕረሲን ጥንስን ኣዶ ዝምልከት ሓበሬታ	
ዕድመ ጥንሲኪ ክንደይ ገይሩ ብሰሙናት?(ካብታ ኣደ ናይ መወዳእታ ንቡር ወርሓዊ ፅግያት ብሰሙናት ወይ ካብ ናይ ኣልትራ ሳውንድ ገምጋም ውፅኢት)	
ክንደይ ግዜ ጠኒስኪ ክሳብ ሕዚ (ኮለይ ናይ ሕዚ ሓዊሱ)? (ግራቪዲቲ ወይ በዝሒ ጥንሲ)	
(ን2 ግዜን ልዕልኡን ዝጠነሰት ጥራሕ) ኣብ ውሽጢ ክንደይ ዚኣክል ግዜ ኢኻ ጠኒስኪ ብኣዋርሕ?(ኣብ መንጎ እዚ ሕጂ ዘሎ ጥንሲን እቲ ኣቐዲሙ ዝነበረ ጥንስን ዘሎዎም ኣፈላላይ ወይ ርሕቀት)	
ምንፃል ጥንሲ ኣጋጢሙኪ ይፈልጥ ድዩ?(ወይ ካብ ናይ ኣዶ ካርዲ ርኣ)	1. እወ 2. ኣይፋልን
ምዉት ዕሸል ወሊድኪ ትፈልጢ ድኪ?(ወይ ካብ ናይ ኣዶ ካርዲ ርኣ)	1. እወ 2. ኣይፋልን
ቅድሚ ወሊድ ክትትልን ክንክን ሕክምና ወይ ምብጻሕ ትገብሪ ዶ ነይርኪ?	1. እወ 2. ኣይፋልን
እወ እንተኮይኑ መልስኪ ክንደይ ግዜ ተካታቲልኪ?	
ኣብዚ ጥንሲ እዚ ኽቢድ ዝባሃል ተምላስ ነይርኪ ድዩ?(ነታ ኣደ ሓያል ማይ ፃምእ ሰብነት ከስዕበላ ዝኽእል ተደጋጋሚ ተምላስ ወይ ቮሚት)	1. እወ 2. ኣይፋልን
እወ እንተኮይኑ መልሳ ወይ ዝርአ ባዕልካ ዝተዓዘብካዮ እንተሃልይዋ ነቲ ምልክት መርሚርካ ይገለፅ?	
ክፋል 6፡- ዕሸልን መድሓንትን ወይ ፌቶ-ፕላሰንታ ዝምልከት ሓበሬታ (ካብ ናይ ኣዶ ካርዲ ውጽኢት ኣልትራሳውንድ ዚገልፅ ሓበሬታ ኣብ ቀረባ እዋን ካብ ዝተላዓለቶ ተረኽበ ወይ ሽዑ ዝተላዓለቶ ውፅኢት ተጠቀም)	
ናይ ኣደ ሕክምና መፍለይ ካርዲ ቁፅሪ	
ኣልትራሳውንድ ዝተላዓለትሉ ዕለት (መዓልቲ/ወርሒ/ዓመት)	
ፈሳሲ መሐመሲ ህፃን (ቀሽት) ዓቀን (AFV) (ኣምኖቲክ ፍሉድ ቮሌም) (qualitative or subjective assessment)	1. እኩል 2. እኩል ዘይኮነ (ውሕድ)

ፈሳሲ መሐመሲ ህፃን ዓቀን (መሐበሪ ፈሳሲ ኣምኖቲክ ፍሉድ ኢንደክስ ቢ ሴንቲ ሜትር) (ብመሰረት ሓኪም ዝተጠቀመሉ ዓይነት መለክዒ ቅስት ወይ ፈሳሲ መሐመሲ ህፃን) (Semi-quantitative assessment)	AFI in cm =
ወይ ንፅል ንትኩል ጁባ ዝልካዕ, ሲንግል ዲፐስት ፖኬት ቢ ሴንቲ ሜትር (ብመሰረት ሓኪም ዝተጠቀመሉ ዓይነት መለክዒ ቅስት ወይ ፈሳሲ መሐመሲ ህፃን)(Semi-quantitative assessment)	or SDP in cm =
ኣልትራሳውንድ ገምጋማዊ ክብደት ዕሸል (ብ ግራም)	
ብኣልትራሳውንድ ምርመራ ጥንሲ ዘይንቡር ኣፈጣጥራ ዕሸል ምኽኑ ዝተፈለጠ ከም ናይ መትኒ ቱቦ ጉድለት (ዓንዲ ሕቜ ክፍተት ወይ ቢፊዳ) ናይ ስርዓተ ሽንቲ ትቦን ኮላሊትን መዕፀውቲ ወይ ኣጀነሲስ ከምኡ እውን ሄርንያ ወዘተ	1. እወ 2. ኣይፋልን
እወ እንተኮይኑ ካብቲ ዝርዝር ይመረፅ እቲ ዝተረከበ (ካብ 1 ንላዕሊ ምምራፅ ይካኣል እዩ)	1. መዕፀውቲ ስርዓተ ሽንቲ ትቦን ኮሊትን ወይ ኣፈጣጥራ ጉድለት ከም ሬናል ኣጀኔስስ 2. ናይ መትኒ ቱቦ ጉድለት ኣፈጣጥራ ከም ክፍተት ዓንዲ ሕቜ ወይ ቢፊዳ ዝኣመሳሰሉ 3. ናይ መዓናጥ ጉድለት ኣፈጣጥራ ከም ዕትብቲ ምፍዳእ ወይ ኣምብላይካል ሄርንያ 4. ናይ ጭዋዳታትን ኣዕፅምትን ጉድለት ኣፈጣጥራ 5. ናይ ልቢ ኣፈጣጥራ ፀገም 6. ዝተፈላለዩ ዘይንቡር ኣፈጣጥራ ጉድለታት 7. ካልእ ይገለፅ
ድክመት መደሓንቲ ዘስዕቡ ፀገማት: ከም ምንፃል መደሓንቲ ካብ ግድግዳ ማህፀን ወይ ኣባሩፕቲዮ ፕላሰንታ; ዘይንቡር ምምሕላላፍ ማንታ ፀገም ወይ ብዙሕ ጥንሲ ምኽኑ ዝተፈለጠ ጥንሲ (ድክመት መደሓንቲ ዘስዕብ)	1. እወ 2. ኣይፋልን
እወ እንተኮይኑ ካብቲ ዝርዝር ይመረፅ እቲ ዝተረከበ (ካብ 1 ንላዕሊ ምምራፅ ይካኣል እዩ)	1. ምንፃል መደሓንቲ ካብ ግድግዳ መህፀን ወይ ኣብራፕትዮ ፕላሴንታ 2. ምምሕላላፍ ፀገም ማናቱ 3. ብዙሕ ጥንሲ ምህላው 4. ካልእ ይገለፅ
ኣብ ውሽጢ ማህፀን ዘሎ ዕሸል ዕቤት ውስንነት ወይ ቀይድታት ምህላዉ ዝተፈለጠ (IUGR) ወይ ዕድመ ጥንስን እቲ ዕሸልን ዘይመጣጠኑ ወይ ንእሽቶ ዕሸል(SGA)	1. እወ 2. ኣይፋልን
ካልእ ዝተተሓሓዘ ፀገም ወይ ጉድለት ኣፈጣጥራ ዝተረከበ ናይ ዕሸል ወይ ኣዶ	1. እወ 2. ኣይፋልን
እወ እንተኮይኑ ይገለፅ	

ንተሳትፎኺ የቕንየለይ!!