Macrosomia and Associated Factors among Newborns Delivered at Asella Teaching and Referral Hospital, Southeast Ethiopia, 2025

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Abstract

Background: Fetal macrosomia defined as birth weight of 4000 g and above regardless of gestational age. Globally, macrosomia affects 8 to 12% of normal pregnancy. Fetal macrosomia increases maternal risks like postpartum hemorrhage, prolonged labor, perineal tears, and cesarean delivery, while newborns face risks such as perinatal asphyxia, meconium aspiration, and birth injuries like clavicular fractures. In resource-limited settings, these complications are heightened due to limited obstetric and neonatal care, especially in developing countries.

Objectives: This study aims to Asses Prevalence and Factors Associated with Macrosomia Among Newborns Delivered in AR at Arsi University Referral and Teaching Hospital in 2025.

Methodology: A Facility based Cross-Sectional design was employed from August-October 2025. Data were collected through direct interviews, along with measuring the newborn weight, and supported by a review of medical records. The collected data were exported from Kobo toolbox to SPSS for thorough analysis. Descriptive statistics were used to summarize sociodemographic, obstetric, and clinical characteristics of the study participants. Bivariate analysis was initially conducted and Variables with a p-value <0.25 in the bivariate analysis was included in the multivariable logistic regression model to control for potential confounders. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) was used to measure the strength of association, and statistical significance was declared at p-value <0.05.

Results: The prevalence of macrosomia was 12.9% (95% CI: 10.0%–15.9%).. In multivariable analysis, maternal age ≥35 years (AOR = 2.1; 95% CI: 1.36–7.45), urban residency (AOR = 1.26; 95% CI: 1.07–5.94), college-level or higher education (AOR = 4.4; 95% CI: 1.44–43.38), pre-pregnancy overweight (AOR = 6.2; 95% CI: 1.59–23.71), and obesity (AOR = 13.1; 95% CI: 2.28–74.23) were significant predictors of macrosomia.

Conclusion: The study found a relatively high prevalence of macrosomia, with advanced maternal age, urban residence, higher maternal education, and pre-pregnancy overweight and obesity significantly increasing the risk. Interventions focusing on maternal weight management and lifestyle modification, especially among older and urban women, are critical to reduce macrosomia-related complication

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First and foremost, I am deeply grateful to Almighty God. I also extend my heartfelt appreciation to Arsi University, College of Health Sciences, Department of Obstetrics and Gynecology, for providing the opportunity to engage in this research, which has significantly contributed to my growth as an academic. I am especially thankful to my advisors Dr Adem Jambo and Dr Gebi Hussein, whose invaluable insights and guidance have been instrumental in shaping this proposal. Additionally, . I am also deeply thankful to the study participants who willingly took part in this study and generously shared their time and information. Their cooperation was essential for the successful completion of this research.My heartfelt appreciation goes to the data collectors for their dedication, patience, and careful data collection process. Their honest effort and adherence to ethical principles greatly contributed to the quality of the data.

Acronyms/abbreviation

ACOG…… American College of Obstetricians and Gynecologists

AOR……..Adjusted Odds Ratio

ANC……Antenatal Care

APH……..Antepartum Hemorrahage

ARTH……Arsi University Referral Teaching Hospital

BMI……..Body Mass Index

C/D……..Cesarean Delivery

CHTN……Chronic Hypertension

CI……Confidence Interval

DM……Diabetes Mellitus

GDM……Gestational Diabetes Mellitus

GWG……Gestational Weight Gain

IRB……Institutional Review Board

LGA……Large for Gestational Age

LBW……Low Birth Weight

LNMP ……The last normal menstrual period

MAS……Meconium Aspiration Syndrome

MICS…….The Multiple Indicator Cluster Survey

OVD……...Operative Vaginal Delivery

NICU …….Neonatal Intensive Care Unit

PIH……Pregnancy Induced Hypertension

PNA……Perinatal Asphyxia

PROM……Premature Rupture of Membrane

RBS…….Random Blood Sugar

RDS……..Respiratory Distress Syndrome

SSA……Sub Saharan Africa

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1. INTRODUCTION

1.1. Background

Fetal macrosomia defined as birth weight of 4000 g and above regardless of gestational age. Large for gestational age (LGA) is defined as birth weight greater than the 90th percentile at a given gestational age. For infants, the recommended grading system for decision making regarding operative delivery is grade I, which is 4000–4499 g, grade II, which is 4500– 4999 g, and grade III, which is over 5000 g (1,2).

Globally, the incidences of macrosomia have increased dramatically including sub-Saharan African (SSA) countries. There has been an increased incidence of macrosomia newborns in the world and most of the macrocosmic newborns are born from non-GDM pregnant women. Globally, macrosomia affects 8 to 12% of normal pregnancy and 15%-45% of mothers with gestational diabetes. The increased risk of macrosomia in GDM is mainly due to the increased insulin resistance of the mother. In GDM, a higher amount of blood glucose passes through the placenta into the fetal circulation. As a result, extra glucose in the fetus is stored as body fat causing macrosomia, which is also called ‘large for gestational age (2-4).

While the incidence of fetal macrosomia varies among racial and ethnic groups, 6–10% of babies are affected by it. Globally, macrosomia occurs in 3–15% of pregnancies, with the largest numbers (5–20%) reported in high-income countries. Fetal macrosomia prevalence can vary greatly between locations and even within communities, exhibiting temporal variations driven by a range of variables including diet, maternal health, and socioeconomic position. Numerous research have looked into these variances, and the results show that lifestyle, genetic, and environmental variables all have a role in the varying prevalence of macrosomia in various groups.

1.2. Statement of the Problem

The incidence of Macrocosmic deliveries increased during the 20th century. At the beginning of the 20th century, the incidence of birth weight > 5000 g was 1 to 2 per10, 000 births (1). This compares with, 6.4 percent of all newborns weighed 4000 to 4499 g; 0.9 percent weighed 4500 to 4999 g; and 0.1 percent were born weighing ≥5000 g In the United States in 2019 (48).Globally, macrosomia affects 8 to 12% of normal pregnancy and 15%-45% of mothers with gestational diabetes.(39)

Fetal macrosomia is associated with various maternal and perinatal complications, including infection, postpartum hemorrhage, prolonged labor, severe perineal tears, cesarean delivery, anesthetic accidents, and thromboembolic events. According to the American College of Obstetricians and Gynecologists (ACOG) practice bulletin, macrocosmic fetuses face a greater risk of perinatal asphyxia, meconium aspiration, clavicular fracture, brachial plexus injury, and shoulder dystocia.(7) Similarly, a long term health effects contributed by macrosomia includes type 2 diabetes mellitus, hypertension, and obesity in adulthood [27] .For mothers, the risks associated with macrosomia include cesarean delivery, postpartum hemorrhage, and vaginal lacerations(6–11).

There are many risk factors associated with fetal macrosomia factors, advanced age (≥ 36), pre-pregnancy overweight/obesity (≥ 25 kg/m2), pre-pregnancy diabetes mellitus, gestational hypertension, gestational diabetes , and infant male sex were important risk factors for macrosomia.(14). Several interventions have been proposed to interdict suspected or “impending” fetal overgrowth. Exercise in pregnancy is beneficial to the mother, does not increase the risk for growth impairment, and decreases macrosomia risk. One meta-analysis of 28 studies involving 5322 women concluded that exercise reduces the risk of an LGA newborn or birthweight >4000 g without raising the risk of an SGA neonate or birthweight <2500 g (36). Similarly, others have concluded that aerobic exercise increases the likelihood of a normal weight neonate (37).

Macrosomia can pose a greater obstetric risk for women in Ethiopia, where childhood under nutrition may hinder the full development of the pelvis. When pregnancy occurs before the pelvis has fully matured, delivering a large baby can be distressing for the mother, the baby, and the medical team, potentially leading to unfavorable outcomes throughout pregnancy, delivery, and the

postpartum period. In such cases, complications can be more severe due to the combination of underdeveloped maternal anatomy and fetal overgrowth.

Some studies conducted in Ethiopia have identified key predictor variables for macrosomia, including gestational age, gestational diabetes mellitus (GDM), fetal sex, weight gain during pregnancy, pre-pregnancy overweight or obesity, maternal age, and parity. These factors contribute to the risk of delivering a macrosomia baby, further complicating obstetric care in resource-limited setting. (5, 8, 27)

1.3. Significant of the Study

Fetal macrosomia is a growing public health concern, especially in developing countries, due to its association with increased maternal and neonatal morbidity and mortality. Compared with developed countries, researches on macrosomia in developing world such as Ethiopia, particularly in the study settings are insufficient.

The real burden of fetal macrosomia in ARTH is not known and also the burden of fetal macrosomia in Ethiopia is not clearly known. Factors associated with fetal macrosomia were not known in ARTH. Researching factor associated with fetal macrosomia helps to pinpoint specific factors that contribute to its development, such as maternal obesity, gestational diabetes, previous macrosomic births, and certain lifestyle factors.

By understanding these risk factors, healthcare providers and Policy Makers can implement targeted interventions like preconception counseling, gestational diabetes management, and encouraging healthy lifestyle choices to prevent or mitigate the occurrence of macrosomia.

2. LITERATURE REVIEW

2.1 Magnitude of Fetal Macrosomia

Macrosomia is nightmare of obstetricians because it increases the morbidity and mortality of Fetus, neonate and also increases the risk obesity, diabetic mellitus, metabolic syndrome, and asthma, during childhood and adult. Worldwide, macrosomia affects 3–15% of all pregnancies. (33) In developed countries, the prevalence of macrosomia ranges from 5% to 20% at all births, although there has been a rise of 15–25% in the last two decades. (3,4)

Koyanagi and colleagues (2013), using the WHO's Global Survey on Maternal and Perinatal Health, examined the prevalence, risk factors and delivery outcomes of macrosomia across three continents: Asia, Africa, and Latin America. They reported a prevalence ranging from 0.5% in India, 7.5% in Nigeria, 8.4% in Uganda and 14.9% in Algeria (47)

Research done at the Specialized Hospital of Gynecology and Obstetrics of Sidi Bel Abbes ,West Of Algeria,shows The frequency of macrosomia studied was 10.19%.(49)

Research in 23 developing countries across Asia, Africa, and Latin America found that the prevalence of macrosomia varied widely from 0.5% in India to 14.9% in Algeria(.39)
Based on the findings of two studies, the macrosomia rate in Chad was reported as 7.6%10 and 11.8% in Iran. (40)

In Saudi Arabia, the prevalence of macrosomia ≥4000 g is 3.4%; however, it is much higher among women with gestational diabetes (GDM) and pre-gestational diabetes (pre-GDM), as recent reports showed a prevalence range from 10 to 19.8% (45,46)

A 2024 study used multilevel multinomial logistic regression analysis to explore factors associated with birth weight in sub-Saharan Africa (SSA), focusing on low birth weight (LBW) and macrosomia. The study found prevalence rates of 10.44% for LBW and 8.33% for macrosomia. (24). Similarly, a 2015 prospective study in a Nigerian tertiary hospital reported a 5.5% incidence of macrosomia (23).

A study conducted in Iringa municipality, Tanzania, from September to December 2017 found that the incidence of fetal macrosomia was 3.26%. Similarly, a retrospective study at Balikesir State Hospital,Turkiye showed an 8.6% prevalence of fetal macrosomia in non-diabetic women..

In Eikwe, Ghana, a cross-sectional survey from January to May 2017 found a 6.5% prevalence of fetal macrosomia (33).

A cross-sectional study at Labe Regional Hospital,Guinea in 2024 found a neonatal macrosomia frequency of 2.54% (9).

A cross-sectional study at the University of Gondar Comprehensive Specialized Hospital, conducted from February to April 2020, reported a macrosomia prevalence of 7.54 %(29).

A similar cross-sectional study in 2017 in Hawassa city public health institutions found a macrosomia prevalence of 11.86 %,(30).

A 2017 institution-based cross-sectional study conducted in private clinics of Mekelle city, Tigray region, Ethiopia, revealed a macrosomia prevalence of 19.1%(8).

2.2 Factors associated with Fetal Macrosomia

A multicenter cross-sectional study in China, conducted between 2015 and 2016, explored the combined effects of risk factors on macrosomia, reporting a weighted prevalence of 5.8%.(15). It identified Several factors were significantly associated with an increased risk for macrosomia .

Among these risk factors, advanced age (≥ 36) [adjusted OR (aOR) 1.85; 95% confidence interval (CI) 1.83–1.87], pre-pregnancy overweight/obesity (≥ 25 kg/m2) (aOR 2.15; 95% CI 2.14–2.17), pre-pregnancy diabetes mellitus (aOR 2.73; 95% CI 2.66–2.79), gestational hypertension (aOR 2.10; 95% CI 2.05–2.14), gestational diabetes (aOR 1.44; 95% CI 1.42–1.45), and infant male sex (aOR 1.56; 95% CI 1.55–1.57) were important risk factors for macrosomia.

In India, a 2019–2021 study revealed a fetal macrosomia was more Common among male neonates than female (AOR: 0.730; 95% CI: 0.687-0.775). Regarding maternal characteristics, overweight (AOR: 1.468; 95% CI: 2.042-2.559) and obese (AOR: 2.764; 95% CI: 2.394-3.192) mothers with GDM (AOR: 1.731, 95% CI: 1.385-2.164) and hypertension (AOR: 1.288, 95% CI: 1.116-1.488)

were more likely to have macrosomic babies. Multiparous mothers (AOR: 1.207, 95% CI: 1.128-1.293) and women who did not undergo ANC follow up had also greater risk of developing fetal macrosomia. Muslim women (AOR: 1.223, 95% CI: 1.119-1.338) were significantly associated with the risk of having newborn ≥4000 g. (6,16–18).The Multiple Indicator Cluster Survey (MICS) in Bangladesh linked fetal macrosomia to higher maternal age, secondary education, , hypertension, rural residence, and found female infants had 18% lower odds of macrosomia than males (AOR = 0.82, 95% CI = 0.72-0.93).

A retrospective study at the Royal Brisbane and Women's Hospital (2002–2004) found that macrosomia was more likely in women with a BMI over 30 kg/m², male infants, and pregnancies beyond 40 weeks, while maternal smoking reduced the risk. Macrosomia was more than 2 times likely in women with BMI of > 30 kg/m(2) (OR) 2.41, 95% CI) 1.26-4.61) and in male infant sex (OR 2.05, 95% CI 1.35-3.12), and 4 times more likely in gestation of > 40 weeks (OR 3.93, 95% CI 1.99-7.74). Maternal smoking reduced the risk of fetal macrosomia (OR 0.27, 95% CI 0.14-0.51). (22).

In a separate unmatched case-control study conducted between February and May 2020 in referral hospitals in the northwest Amhara region, researchers identified key factors contributing to macrosomia among 279 mothers and their newborns. The study found that excessive weight gain during pregnancy, regular antenatal follow-up, physical activity, and the neonate's sex were significant determinants of macrosomia. Another study conducted in 2014 at Debre Markos Referral Hospital found that multiparty and post-maturity were predictors of macrosomia. Neonates born from multiparous women were 1.44 times more likely to have macrosomia as compared to neonates born from primiparus women with 95%CI of AOR (1.05, 1.98). Neonates born post term were 3.67 time more likely to have macrosomia as compared to preterm deliveries with 95% CI of AOR (1.01, 13.32). Maternal complications were significantly as Neonates born from multiparous women were 1.44 times more likely to have macrosomia as compared to neonates born from primiparous women with 95%CI of AOR (1.05, 1.98). The study also noted that maternal complications were more common in macrosomic births, and emphasized the importance of managing multiparty and post-maturity to reduce the risk of macrosomia(28).

At the community level, place of residence and the specific SSA region were significantly associated with both LBW and macrosomia. macrosomia was more likely in cases involving higher parity, marital status, and desired pregnancy. The study emphasized that maternal age, parity, number of pregnancies, marital status, wanted pregnancy, residence, and SSA region were significantly associated with macrosomia. Maternal level of education has a significant association with macrosomia; mothers who attained primary education, secondary education, and higher education were 1.25 [aRRR = 1.25, 95% CI 1.20, 1.31], 1.11 times [aRRR = 1.11, 95% CI 1.06, 1.17] and 1.15 times [aRRR = 1.15, 95% CI 1.04, 1.26] times higher risk of having a macrosomic baby than those who didn't attain formal education, respectively.(24)

A matched case-control study conducted in Wolaita Sodo, Southern Ethiopia, from June to July 2021, investigated the determinants of fetal macrosomia. The study revealed that Male neonates were four times more likely to be macrosomia than female neonates MAOR = 4.0 [95%CI; 2.25–7.11, $p < 0.001$]. Neonates born at gestational age ≥ 40 weeks were 4.33 times more likely to be macrosomia with MAOR = 4.33 [95%CI; 2.37–7.91, $p < 0.001$]. Neonates born from physically inactive mothers were 7.76 times more likely to be macrosomia with MAOR = 7.76 [95CI; 3.33–18.08, $p < 0.001$]. Neonates born from mothers who consumed fruits and dairy products in their diet frequently were 2 and 4.9 times more likely to be macrosomia MAOR = 2.03 [95%CI; 1.11–3.69, $p = 0.021$] and AOR = 4.91[95%CI; 2.36–10.23, $p < 0.001$] respective (34).

Additionally, this study identified gestational age over 40 weeks, maternal diabetes, previous history of macrosomia, and male sex as significant predictors of macrosomia. with male neonates, gestational age over 37 weeks, and a history of macrosomia being the most significant factors. The study identified several significant factors associated with macrosomia, including weight gain during pregnancy (≥16 kg), pre-pregnancy overweight and obesity, maternal age, and a history of delivering a macrosomic baby.

2.1. Conceptual Framework

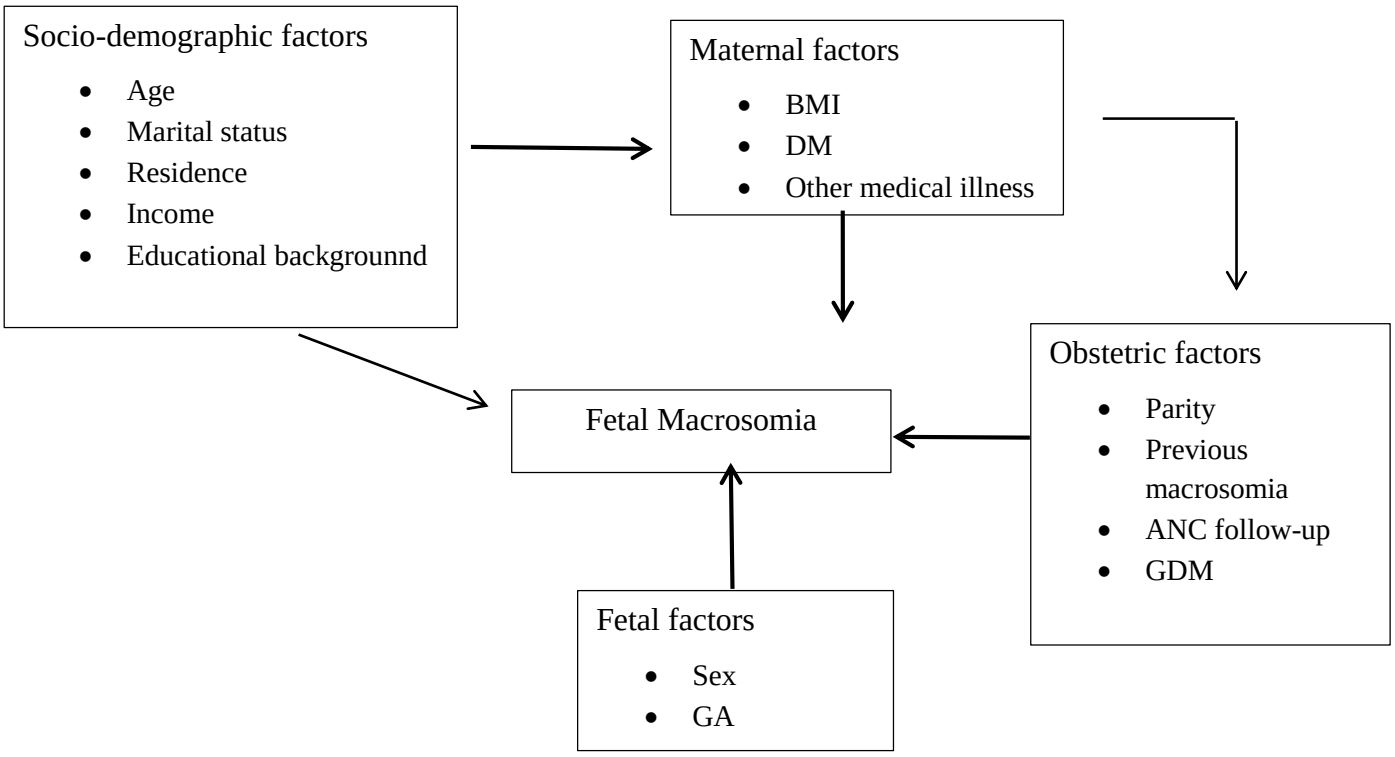

Figure 1- Conceptual frame-work for Macrosomia factors associated with fetal macrosomia among newborns in ARTH (3,9,19)

3. OBJECTIVES OF THE STUDY

3.1. General Objective

To Asses Macrosomia and Factors Associated with Macrosomia among Newborns Delivered in ARTH, Southeast Ethiopia, 2025

3.2. Specific Objectives

- To determine the Magnitude of fetal macrosomia among Newborns Delivered at ARTH , Ethiopia September 2025 –November 2025
- To Asses Factors Associated With macrosomia Among Newborns Delivered at ARTH , Ethiopia September 2025-November 2025

4. METHODS AND MATERIALS

4.1 Study area and period

4.1.1. Study area

This study was conducted in Arsi University Asella teaching and referral Hospital. Arsi University is one of the third-generation public universities, established on 15 October 2014 and located in Asella town which is 159 km in the south east of Addis Ababa, capital city of Ethiopia. The Asella teaching and referral Hospital is the only referral hospital in Arsi zone with catchment area of 3.5 million people. The hospital has around 310 beds distributed in four major inpatient departments (internal medicine, surgery, gyn/obs and pediatrics). It has also adult ICU and general emergency OPD.

There are different OPD, MCH unit, VCT AND ART services, major operation rooms and minor operation room.

The hospital provides 24 hours delivery and abortion service. It has 14 consultants and 38 residents of different batch in department of Obstetrics and Gynecology. The hospital provide an average of 550 (520-615) deliveries monthly and the cesarean rate is ranging from 21%-27%.

4.1.2. Study Period

The study was take place from September to November, 2025.

4.2. Study design

Institution based cross sectional study.

4.3. Population

4.3.1. Source Population:

All Pregnant women and their neonates delivered at ARTH during the study Period.

4.3.2. Study Population:

All randomly selected mother and their neonates' pairs during the study period.

4.4. Eligibility Criteria

4.4.1. Inclusion Criteria:

- All mothers who delivered live newborns at ARTH during the study period.

4.4.2. Exclusion Criteria:

- Mothers who are critically ill to respond.

4.5. Sample Size and Sampling Procedure

4.5.1. Sample size determination

The sample size will be determined using single population proportion formula

$$n = \frac{Z_{\frac{\alpha}{2}}^{2} P (1 - P)}{d^{2}}$$

Where **n** is the sample size, d is the desired level of precision (the margin of error), p- is the, and q =1-p, Z-value is found in Z-table. The sample size was calculated using a single population proportion formula by considering confidence level (95%), a margin of error = 3%, a margin and 11.86% of prevalence taken

from the previous study done in Hawassa, Ethiopia. This gives us the sample size of 446. Taking the probability of non-respondent of 10%, the sample size will be 488. So, a sample 488 study participants in our target population was enough to give us the confidence levels we need.

4.5.2. Sampling procedure

The client registration book of two months before the data collection time was reviewed and then the total numbers of deliveries during a data collection time were estimated 1367deliveries per three months. To determine the sampling interval (K), the total expected number of all births during the study period 1367 was divided by the sample size 488 to give 3.

To select the first participant, the lottery method was used. Then every 3rd record was selected to form the sample.

4.6. Study variables

4.6.1 Dependent variable

Fetal macrosomia

4.6.2 Independent Variables:

Socio-demographic characteristics considered as independent variables in this study Includes; Maternal age, educational attainment, marital status, Place of residence, employment status, household income and ethnicity. Independent variable related to obstetrics history, maternal life style and anthropometric status were included based on prior literature indicating their potential influence on fetal macrosomia growth. Obstetrics variable included parity, GA at delivery, history of macrosomia and iron and folic acid supplementation. lifestyle factors assed were maternal dietary habit, physical activity before and during pregnancy.

Anthropometric measure such as pre-pregnancy BMI is included independent variables. In addition, selected newborn related factors were assessed as independent variables, including sex of new born and gestational age at birth.

4.7. Operational Definition

- Inter-Pregnancy interval: is the time interval between live birth and conception of current pregnancy recommended as at least 24 month

- Birth weight: Newborn's first weight measured within one hour of birth
- Gestational age: is the period between the first day of the last normal menstrual period to the date of delivery , measured in completed weeks of pregnancy.
- Live birth: live birth is the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of the pregnancy, which, after such separation, breathes or shows any other evidence of life
- Macrosomia-Birth weight of 4000 gram or more measured immediately after delivery using calibrated digital scale, irrespective of gestational age.

- Physically active: pregnant mothers who walk for more than 30 minutes a day or at least 150 minutes of moderate-intensity physical activity a week, such as, 5 days a week.

- Physically inactive: are those pregnant mothers who walk for less than thirty minutes per day or doing < 150 minutes of moderate-intensity physical activity a week, such as, < 5 days a week.

4.8. Data Collection Procedures and Quality Assurance

4.8.1. Data Collection Tools and Techniques

Structured questionnaire were adapted from relevant articles and literature. Data were collected through direct interviews, along with measuring weight of the newborn, and was supported by a review of medical records using Kobo Toolbox. An interviewer administered questionnaires were used to collect data on the wealth index, maternal age, religion, marital status, occupation, educational level, and place of residence.

Data on parity, antenatal follow-up, first-trimester weight, third-trimester weight, and a history of macrosomia was extracted from antenatal follow-up records using an extraction checklist. When certain information cannot be confirmed, ultrasound evidence from the first or second trimester was used, and respondents were classified into preterm, term, or post-term categories.

4.8.2. Data quality control

To ensure the quality of data in the study, a carefully designed data collection tool was prepared. A two-day training session was provided to all data collectors to establish a common understanding of the study's objectives and methodologies. The questionnaire was pre-tested at Adama Hospital before actual data collection, and based on the pre-test results, necessary modifications were made to enhance clarity and relevance. To ensure accessibility for participants, the questionnaire was translated into Afaan Oromo, and then back-translated into English to confirm the consistency and accuracy of the translation. During the data collection process, supervisor was periodically checking the data for accuracy and completeness, allowing for the identification and resolution of any discrepancies as they arise. After data collection, the principal investigator cross-checked and cleaned the data before and after data entry to identify and correct any errors or inconsistencies that may occur.

4.8.3. Data processing and analysis

All collected questionnaires were rechecked for completeness. Then Data was exported to SPSS version 23 , and coded for analysis. Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to summarize socio-demographic, obstetric, and clinical characteristics of the study participants.

Bivariate analysis was initially conduct to identify candidate variables associated with fetal macrosomia . Variables with a p-value <0.25 in the bivariate analysis was included in the multivariable logistic regression model to control for potential confounders. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were used to measure the strength of association, and statistical significance was declared at p-value <0.05. Model fitness was assessed using the Hosmer-Lemeshow goodness-of-fit test..

4.9. Ethical Considerations

The research proposal was presented to department of public health and department of gynecology and obstetrics.

Ethical clearance was obtained from the institutional Research Ethics Review Board of Arsi University CoHS. Support letter were secured from the Department and directors of selected health units were informed about the purpose of the study to obtain their agreement and cooperation.

.Informed verbal consent for participation was taken from client; whenever clarification is needed the response was given by principal investigator

4.10. Plan for Dissemination of Results

Upon completion, the research paper will be submitted to the Department of Obstetrics and Gynecology of ACSH in partial fulfillment of the requirements for an Obstetrics and Gynecology specialty certificate. The findings will be submitted to recognized medical publishers for consideration and was presented at national and international academic forums to reach a wider audience. Furthermore, the paper was published in a peer-reviewed journal, ensuring broad dissemination within the academic and medical communities. The findings will also made available through a web-based platform, allowing others to access and reference the study for future research and practice.

5. Result

5.1 The socio-demographic characteristics of the study participants

The study participants had a mean age of 26.38 years, and the majority were aged 20–29 years (63.3%). Most respondents were rural residents (55.9%) and married (90.8%). Muslims (65.4%) were the predominant religious group. Regarding education, primary level (50.6%) was the most common. The majority of mothers were housewives (73.4%), and most had a monthly income of 5,000–10,000 ETB (61.3%).

Table 1. The socio-demographic characteristics of the study participants who gave birth at Asella Teaching and Referral Hospital

Variable	Frequency	Percent
Age in years		
<20	46	9.4
20-29	309	63.3
30-34	90	18.4
≥35	43	8.8
Place of residency		
Urban	215	44.1
Rural	273	55.9
Marital Status		
Single	30	6.1
Married	443	90.8
Divorced	10	2.0
Widowed	5	1.0
Religion		
Muslim	319	65.4
Orthodox	128	26.2
Protestant	41	8.4
Educational status of the mother		
Not able to read and write	96	19.7
Primary	247	50.6
Secondary	44	9.0
Collage and above	101	20.7
Occupation of the mother		
Housewife	358	73.4
Employed	97	19.9
Student	33	6.8
Monthly income		
<5000	146	29.9
5000-10000	299	61.3
>10000	43	8.8

5.2 Obstetrics related characteristics of the study participants

About 95.7% of the study participants had ANC follow-up, and among those, 71.7% attended four or more ANC visits. Public hospitals accounted for 44.5% of ANC bookings. Parity one constituted 48.6% of the participants. Unplanned pregnancies were reported by 67.8%, and 60.8% had an inter-pregnancy interval of less than two years. Regarding gestational age, 60.0% of the deliveries were term. About 88.3% had no previous history of stillbirth, while 70.1% experienced antepartum complications, with PROM accounting for 32.7% of the complications.

Table 2. Obstetrics related characteristics of the study participants

Variable	Frequency	Percent
ANC		
Yes	467	95.7
No	21	4.3
Number of ANC (n=467)		
<4	132	28.3
≥4	335	71.7
Place of ANC booking		
HC	191	40.6
Private hospital	41	8.7
Public hospital	209	44.5
private and public	29	6.2
Parity		
0	144	29.5
1	237	48.6
2-4	39	8.0
≥5	68	13.9
Pregnancy planned		
Yes	157	32.2
No	331	67.8
Inter-pregnancy interval in years		
<2	222	60.8
≥2	143	39.2
Gestational age		
Preterm	44	9.0
Term	293	60.0
Post-term	21	4.3
Unknown	130	26.6
Previous History of Macrosomia Delivery		
Yes	37	10.7

No	87	25.1
Uknown	222	64.2
Previous History of Still birth		
Yes	42	11.7
No	317	88.3
Antepartum complication		
Yes	342	70.1
No	146	29.9
Types of antepartum complication (n=324)		
APH	80	23.4
DM	11	3.3
GDM	9	2.7
PIH	100	29.2
PROM	112	32.7
CHTN	13	3.8

5.3 Nutritional health activity related characteristics of the study participants

About 51.8% of the participants did not receive dietary counselling during the current pregnancy. All participants (100.0%) reported consuming three or more meals per day and none smoked cigarettes during pregnancy. Alcohol use was reported by 7.2%, while 92.8% did not use alcohol. Approximately 61.7% engaged in less than 30 minutes of physical activity per day before pregnancy, whereas 57.4% reported 30 minutes or more per day during pregnancy. Normal pre-pregnancy BMI accounted for 71.3% of the participants. Appropriate gestational weight gain was observed in 71.0%. Dairy product consumption was reported by 96.5%, fruit intake by 83.2%, and iron and folic acid supplementation by 93.9% of the study participants.

Table 3. Nutritional health activity related characteristics of the study participants

Variable	Frequency	Percent
Dietary counselling during this pregnancy		
Yes	235	48.2
No	253	51.8
How many meals per day you were using in this pregnancy		
3 and more per day	488	100.0
Smoke Cigarette in this pregnancy		
No	488	100.0
use any kind of Alcoholic drink in this pregnancy		
Yes	35	7.2

No	453	92.8
Pre-pregnancy physical activity in a day		
<30min/day	301	61.7
≥30min/day	187	38.3
Physical activity during pregnancy in a day		
<30min/day	208	42.6
≥30min/day	280	57.4
Pre-pregnancy body mass index		
Normal	171	71.3
Underweight	26	10.8
Overweight	24	10.0
Obese	19	7.9
Gestational Weight Gain		
Appropriate	171	71.0
Inadequate	29	12.0
Excessive	41	17.0
Dairy products		
Yes	471	96.5
No	17	3.5
Fruit		
Yes	406	83.2
No	82	16.8
Iron and folic acid supplementation (IFA)		
Yes	458	93.9
No	30	6.1

5.4 Labor and delivery related characteristics of the study participants

About 59.2% of the participants delivered by spontaneous vaginal delivery, while 31.4% underwent cesarean section. Live births accounted for 97.3% of the deliveries. Normal birth weight (2500–3999 g) was observed in 74.6% of the neonates. Female neonates constituted 50.4% of births. An APGAR score ≥7 was recorded in 91.6% of newborns. Nearly 19.6% of neonates were referred to the NICU, and among those admitted, meconium aspiration syndrome (33.3%) was the most common diagnosis.

Table 4. Labor and delivery related characteristics of the study participants

Variable	Frequency	Percent
Mode of delivery in this pregnancy		
SVD	289	59.2
OVD	46	9.4
CS	153	31.4

Neonatal condition at birth		
Alive	475	97.3
Stillbirth	13	2.7
Neonatal Birth weight in gram		
<2500	61	12.5
2500-3999	364	74.6
4000-4500	50	10.2
4500-4999	8	1.6
≥5000	5	1.0
Neonatal Sex		
Female	246	50.4
Male	242	49.6
APGAR Score		
<7	40	8.4
≥7	435	91.6
Neonatal referred to NICU		
Yes	93	19.6
No	382	80.4
Diagnosis of neonatal at NICU(n=93)		
MAS	31	33.3
PNA	27	29
RDS	25	26.9
Hypoglycemia	8	8.6
Other	8	8.6

5.5 The magnitude of macrosomia among women who gave birth at ARTH

The prevalence of fetal macrosomia was 12.9% (95% CI: 10.0%–15.9%). as shown in the figure below.

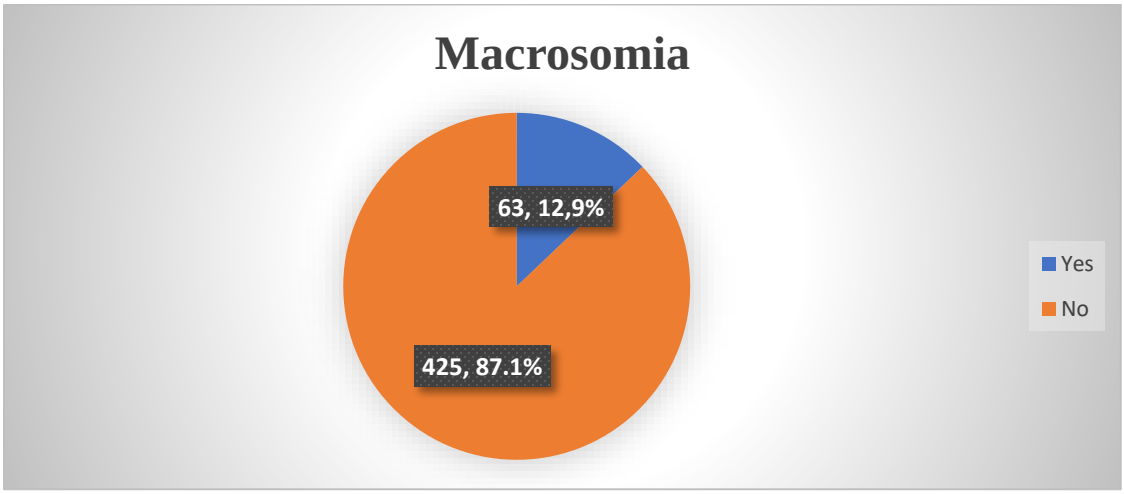

Figure 1. The magnitude of macrosomia among women gave birth at Asella Teaching and Referral Hospital

5.6 The determinants of macrosomia among women who gave birth Asella Teaching and Referral Hospital

Prior to bivariate analysis, the distribution of the data was assessed for normality and outliers, and model fitness was evaluated using the Hosmer–Lemeshow goodness-of-fit test. Correlations among independent variables were checked to avoid multicollinearity, and potential confounders and interactions were considered to ensure valid estimates of associations. Following this, bivariate analysis was performed to examine the relationship between each independent variable and fetal macrosomia. Variables with a p-value <0.25 in the bivariate analysis were included in the multivariable logistic regression model to identify independent determinants of fetal macrosomia.
In the bivariate logistic regression analysis, maternal age ≥35 years showed a statistically significant association with macrosomia (COR = 5.5, 95% CI: 1.44–21.33). Secondary education (COR = 7.0, 95% CI: 2.47–19.84) and college and above education (COR = 4.7, 95% CI: 1.82–12.03) were significantly associated with macrosomia compared to mothers who could not read and write. Monthly income >10,000 ETB was also significantly associated with macrosomia (COR = 8.8, 95% CI: 3.73–20.94). Regarding nutritional status, overweight (COR = 9.5, 95% CI: 3.72–24.06) and obese mothers (COR = 4.7, 95% CI: 1.64–13.29) had higher odds of delivering macrocosmic neonates compared to mothers with normal BMI. Additionally, an inter-pregnancy interval of ≥2 years was significantly associated with macrosomia (COR = 3.1, 95% CI: 1.65–5.53). Other variables did not show statistically significant associations in the bivariate analysis.

In the multivariable logistic regression analysis Mothers aged ≥35 years had 2.1 times higher odds of delivering a macrosomic newborn compared to mothers aged <20 years
(AOR = 2.1, 95% CI: 1.36–7.45).,. Mothers residing in urban areas had 1.26 times higher odds of delivering a macrosomic newborn compared to rural residents (AOR = 1.26, 95% CI: 1.07–5.94).
. Mothers who had attained college-level education or above had 4.4 times higher odds of delivering a macrosomic newborn compared to mothers who could not read and write(AOR = 4.4, 95% CI: 1.44–43.38)..Mothers who were overweight before pregnancy had 6.2 times higher odds of delivering a macrosomic newborn compared to mothers with normal BMI(AOR = 6.2, 95% CI:

1.59–23.71). Mothers who were obese before pregnancy had 13.1 times higher odds of delivering a macrosomic newborn compared to mothers with normal BMI(AOR = 13.1, 95% CI: 2.28–74.23). . Other variables, including monthly income, pregnancy planning status, history of stillbirth, physical activity during pregnancy, and inter-pregnancy interval, were not statistically significant after adjustment for confounders.

Table 5.The bivariate and multivariate logistic regression of association between macrosomia and independent variable among women who gave birth at Assela referral hospital

Variable	Macrosomia		p-value	COR with 95%CI	p-value	AOR with 95%CI
	yes	No				
Maternal age						
<20	3	43	1		1	
20-29	31	278	0.454	1.6(0.47, 5.46)	0.473	1.6(0.46, 5.35)
30-34	17	73	0.066	3.3(0.92, 12.05)	0.104	3.4(0.78, 14.79)
≥35	12	31	0.013	5.5(1.44, 21.33)	0.04	**2.1(1.36, 7.45)**
Residency						
Urban	31	184	0.178	1.3(0.75, 2.16)	0.039	**1.26(1.07, 5.94**)
Rural	32	241	1		1	
Education status						
Not able to read and write	6	90	1		1	
Primary	19	228	0645	1.3(0.48, 3.23)	0.428	0.39(0.04, 3.87)
Secondary	14	30	0.000	7(2.47, 19.84)	0.234	4.3(0.39, 47.52)
Collage and above	24	77	0.001	4.7(1.82, 12.03)	0.029	**4.4(1.44, 43.38)**
Monthly income						
<5000	11	135	1		1	
5000-10000	34	265	0.211	1.6(0.77, 3.21)	0.280	3.6(0.35, 37.16)
>10000	18	25	0.000	8.8(3.73, 20.94)	0.084	8.5(0.75, 95.9
Pregnancy planned						
Yes	26	131	0.100	1.6(0.92, 2.71)	0.896	0.92(0.26, 3.22)
No	37	294	1		1	
Previous history of still birth						
Yes	9	33	0.199	1.7(0.76, 3.78)	0.960	0.94(0.09, 9.26)
No	44	273	1		1	
Physical activity during pregnancy in a day						
<30min/day	32	176	0.162	1.5(0.86, 2.48)	0.493	1.4(0.50, 4.22)
≥30min/day	31	249	1		1	

Pre-pregnancy body mass index						
Normal	19	152	1		1	
Underweight	2	24	0.601	0.67, 3.05)	0.649	1.7(0.17, 17.91)
Overweight	13	11	0.000	9.5(3.72, 24.06)	0.008	**6.2(1.59, 23.71)**
Obese	7	12	0.004	4.7(1.64, 13.29)	0.004	**13.1(2.28, 74.23)**
intern-pregnancy interval						
<2years	20	202	1		1	
≥2 years	33	110	0.000	3.1(1.65, 5.53)	0.893	0.91(0.23, 3.61)

6. Discussion

In the present study, the prevalence of macrosomia was 12.9% (95% CI: 10.0%–15.9%) which falls within the upper range of the global prevalence of macrosomia (3–15%) (33). This finding is comparable with reports from several developing Studies, including, Hawassa, Ethiopia (11.86%) (95% CI 7.8,-15.2)) (29), Iran (11.8%) (95% CI 9-14.6%)(39), private clinics in Mekelle (19.1%)(95% CI = 14.9-23%) (7). and Sidi Bel Abbes (West Of Algeria)(47) 10.19 %(95% CI 8.5-12.2%)

However, it is higher than reports from Tanzania (3.26%) (11), Guinea (2.54%) (8), Ghana (6.5%) (32), Nigeria (5.5%) (22), and Gondar (7.54%) (95% CI 1.7-9.7)) (28). The observed variation across studies may be explained by differences in maternal nutritional status, socioeconomic conditions, urbanization, study settings, and the burden of metabolic disorders. The relatively higher prevalence in the current study may reflect changing lifestyles, increased urban residence, and rising rates of maternal overweight and obesity, which have been reported to contribute to the global rise in macrosomia over the past two decades (3, 4).

Pre-pregnancy overweight and obesity were among the strongest predictors of fetal macrosomia in the present study. Mothers who were overweight before pregnancy had more than six times higher odds of delivering a macrosomic neonate (AOR = 6.2, 95% CI: 1.59–23.71), while obese mothers had an even greater risk, with over thirteen times higher odds of macrosomia compared with mothers of normal body mass index (AOR = 13.1, 95% CI: 2.28–74.23). These findings indicate a

strong dose–response relationship between increasing maternal body mass index and excessive fetal growth.

The results of this study are consistent with evidence from Mekelle, Tigray, Ethiopia, where mothers who were overweight before pregnancy had five times higher odds of delivering a macrosomic newborn compared with normal-weight mothers (AOR = 5.0, 95% CI: 2.0–13.0), and obese mothers had approximately fifteen times higher odds of macrosomia (AOR = 15.0, 95% CI: 5.0–50.0).(40) This close similarity in effect size strengthens the validity of the current findings in an Ethiopian context.

Comparable associations have also been reported in international studies. A large study from China demonstrated that pre-pregnancy overweight and obesity were significantly associated with an increased risk of fetal macrosomia (AOR = 2.15, 95% CI: 2.14–2.17).(14) Similarly, studies conducted in India reported higher odds of macrosomia among overweight and obese pregnant women, with adjusted odds ratios of 2.76 (95% CI: 2.39–3.19) for overweight and 2.04 (95% CI: 1.47–2.56) for obesity, respectively(42). Although the magnitude of association varies across settings, the direction and statistical significance of the findings are consistent with the present study.

Furthermore, evidence from a 2024 Sub-Saharan Africa multinomial logistic regression analysis supports these findings, showing that maternal overweight and obesity were significantly associated with macrosomia compared to normal birth weight. In that study, overweight mothers had an adjusted relative risk ratio of 1.45 (95% CI: 1.28–1.65), while obese mothers had an even higher risk (aRRR = 1.89, 95% CI: 1.52–2.35), after controlling for maternal age, parity, education, household wealth, and place of residence.(23)

Biologically, excess maternal adiposity is associated with insulin resistance and altered glucose and lipid metabolism, which increases the transfer of nutrients to the fetus and promotes accelerated fetal growth. The strong and consistent association observed across multiple studies underscores the growing public health concern of maternal overnutrition, particularly in low- and middle-income countries undergoing rapid nutritional and lifestyle transitions.

In the present study, maternal age of ≥35 years was independently associated with fetal macrosomia. Mothers in this age group had 2.1 times higher odds of delivering a macrosomic neonate compared with younger mothers (AOR = 2.1, 95% CI: 1.36–7.45), indicating a statistically significant association.

This finding is consistent with evidence from China, where advanced maternal age (≥36 years) was significantly associated with an increased risk of macrosomia (AOR = 1.85, 95% CI: 1.83–1.87).(14) Similarly, a study conducted in Bangladesh reported higher odds of macrosomia among mothers aged greater than 34 years (AOR = 1.35, 95% CI: 0.98–1.86).

Comparable results have also been reported from Sub-Saharan Africa, where women of advanced maternal age were found to have increased odds of delivering macrosomic newborns (AOR = 1.07, 95% CI: 0.92–1.25).(23) While the magnitude of association varies across studies, the consistent trend suggests that increasing maternal age contributes to a higher likelihood of fetal overgrowth.

Biologically, advanced maternal age is often associated with metabolic changes, increased insulin resistance, higher prevalence of gestational diabetes mellitus, and cumulative weight gain over successive pregnancies, all of which may promote excessive fetal growth. The findings of the present study, together with existing evidence, support the conclusion that advanced maternal age remains an important risk factor for fetal macrosomia.

In this study Urban residency was also independently associated with macrosomia (AOR = 1.26, 95% CI: 1.07–5.94) . This finding aligns with evidence from multicountry studies in sub-Saharan Africa where urban residency was significantly associated with macrosomia aRRR 1.16(95%CI 1.03-1.31)(23) and Bangladesh, where the study found Urban residency significantly associated with Higher odds of macrosomia reporting an AOR of 1.25 (95% CI 1.15-1.49) (41).
Urban women may have greater access to energy-dense foods, lower physical activity levels, and higher rates of overweight and obesity, which can increase the risk of fetal overgrowth. Urbanization-related lifestyle changes may therefore play a key role in the rising burden of macrosomia.

Higher maternal educational status, particularly college level and above, was identified as an independent predictor of fetal macrosomia in the present study. Mothers with college education or higher had 4.4 times higher odds of delivering a macrosomic neonate compared with those with no formal education (AOR = 4.4, 95% CI: 1.44–43.38). ,suggesting a meaningful relationship between maternal education and excessive fetal growth.

Similarly, a study conducted in Bangladesh reported that mothers who had completed secondary school or higher education had significantly increased odds of delivering macrosomic newborns compared with mothers with no formal education (AOR = 1.78, 95% CI: 1.26–2.51).(41)

Comparable results were also observed in a multilevel multinomial study from Sub-Saharan African countries, which showed that women who completed higher levels of education had increased odds of delivering macrosomic neonates (aRRR = 1.25, 95% CI: 1.20–1.31), even after adjusting for maternal age, parity, wealth status, and place of residence.(23)

Higher educational attainment is often linked with improved socioeconomic status, better food security, and increased caloric intake, which may contribute to excessive gestational weight gain and fetal growth. While education generally improves maternal and child health outcomes, it may also be associated with lifestyle patterns that increase the risk of macrosomia.

7.Strength and Limitations of the Study

This study has certain limitation that should be adressed. The institution-based cross-sectional design limits the ability to establish temporal or causal relationships between predictors and fetal macrosomia. The findings may not be fully generalizable to all pregnant women in the community, as the study was conducted in a referral hospital setting. Some variables relied on recorded or self-reported information, which may be subject to measurement error or misclassification. Additionally, certain potential confounders, such as detailed dietary intake or physical activity levels, were not assessed and may have influenced the observed associations.

This study has notable strengths. First, it is the first study in the region as well to the institution to investigate magnitude and determinants of fetal macrosomia, providing valuable baseline local data for maternal and child health programs. Second, it included a relatively large sample size, which increases the statistical power and reliability of the findings. Third, the study utilized validated measurement tools and standardized procedures, ensuring accuracy and consistency in data collection

8. Conclusion

The prevalence of macrosomia among mothers delivering at Asella Teaching and Referral Hospital was 12.9%,(95% CI:10.0%–15.9%) indicating a significant public health concern. Maternal factors such as advanced age (≥35 years), urban residence, higher educational status, and pre-pregnancy overweight and obesity were independently associated with an increased risk of macrosomia births.

9. Recommendations

- Implement interventions to promote healthy pre-pregnancy BMI and prevent excessive weight gain during pregnancy.
- Provide focused education and monitoring for older, urban, and highly educated women who are at higher risk of macrosomia.

- Nutrition and lifestyle interventions avoidance of over-nutrition before and during pregnancy.
- Integrate macrosomia risk assessment into routine ANC visits to identify high-risk pregnancies early.
- Promote public health strategies that raise awareness about macrosomia and its complications, particularly in urban settings.

10.Future Research Directions

Future studies are recommended to explore the causal pathways linking maternal age, nutritional status, and fetal macrosomia using longitudinal or cohort study designs. Further research could also assess the effectiveness of targeted interventions, such as nutritional counseling or weight management programs, in reducing the incidence of fetal macrosomia. Additionally, studies conducted in community-based settings or different regions would enhance the generalizability of findings.

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10. ANNEXES

Annex 1: Information Sheet and Consent Form

Investigator: Dr. Yosef Mesfin (MD, Obstetrics and Gynecology Resident)

Institution: Arsi University, College of Health Sciences

Dear Participant, I am Dr. Yosef Mesfin, College of Health Sciences. We are conducting a study to Asses Macrosomia and factors associated with among Newborns delivered at ARTH. We kindly request your participation in this study to provide the required information.

If you choose to participate, you will be asked to sign a consent form, and your personal information will be recorded. Your privacy will be respected throughout the study. . All information will be anonymized, meaning it will not be tied back to you in any way. The findings of the research will be published or presented without revealing your identity. Your participation in this study is entirely voluntary, and you are free to withdraw at any time without any penalties or loss of benefits. Participation in this study does not involve any additional medical risk beyond the standard care you would receive. There will be no monetary compensation for participating in the study. The results of this research will be shared through publications and presentations, and other communication methods may be used if necessary. If you have any further questions, feel free to contact me, Dr. Yosef Mesfin or by email at yosefmwsfin1k@gmail.com.

Thank you for considering participating in this study.

Annex 2: Questionnaire

Questions	Answers	Remark
Part I. Socio demographic characteristics		
1.Name of data collector		Mention your name here
2.Site		
3.MRN		
4.Cell phone		Her own/husbands
5.Age in years		
6. Residency	1.Urban 2.Rural	

7.Marital status	1.Married 2.Divorced 3.Single 4.Widowed	
8. Religion	1.Orthodox 2.Muslim 3.Protestant 4.Others Specify _____	

9.Educational Status of the mother	1.unable to read and write 2.able to read and write 3.Completed Primary School 4.Completed Primary School 5.College and Above		
10.Occupation of the mother	1.Housewife 2.Student 3.Government Employee 4.Private Business		
11,Average monthly family income in Ethiopian Birr			
12.Reproductive History			
	Parity	1.nulliparous 2.1 3.2-4 4.5 and Above	

14.ANC	1.Booked	
13. Gestational age	1.Pre- term 2.Term 3.Post term 4.Uknown	Mention the parameter it is calculated from (from reliable LNM,P, Early Ultrasound)
	2.Unbooked	
15.Frequency of ANC Contact, if booked	1.<4 2.>4	
16.Previous History of Macrosomia Delivery	1 –Yes 2-No 3-Uknown	
17.Previous History of Still birth	1-Yes 2-No	
18.Was there any Dietary counselling during this pregnancy?	1-Yes 2-No	
19.How many meals per day you were using in this pregnancy?	1.< 3 meals per day 2.3 and more per day	

20.Place of ANC booking	1.Public Hospital 2.Private hospital,Clinic 3.Public Health center	
21.Antepartum Obstetric complication in current pregnancy	1. PIH 2. APH 3. PROM 4. CHTN 5. GDM 6. DM 7. Other 8. None	

22.Pre-pregnancy physical activity in a day	1.<30 min/day 2..>30 min/day	
23.Physical activity during pregnancy in a day	1.<30 min/day 2.>30 min/day	

24.Pre-pregnancy body mass index(if known or documented)	1.Underweight 2.Normal weight 3.Overweight and obese 4.Unkown	

25.Pregnancy interval (years)	1.<2 years 2.>years	
26.Dairy products	1.Yes 2.no	
27.Fruit	1.Yes 2.No	
28-Did you smoke cigarrate in this pregnancy?	1-yes 2-No	

29-Did you use any kind of Alcoholic drink in this pregnancy?	1-yes 2-No	
30-Pre-Pregnancy Physical activity in most of the day	1-<30 minutes 2- 30 or more Minutes	
31-Physical Activity in this pregnancy in most of the day	1-<30 minutes 2- 30 or more Minutes	
32-Pre-Pregnancy BMI(If known or documented)	1-Underweight 2-Normal Weight 3-Obese 4-Uknown	
33-Gestational weight Gain Based on BMI	1- Excessive 2-Appropriate 3-Inadequate 4-Unkown	

34.Iron and folic acid supplementation (IFA)	1.Yes 2.no	
35-Mode of delivery in this pregnancy	1-SVD 2-C/D 3-OVD	
36-Neonatal Condition at Birth	1- Alive 2-Stillborn	
37-Neonatal Birth weight	1-<2.5 KG 2-2.5-3.9 KG 3-4-4.5 KG 4-5 KG and above	
38-Neonatal sex	1-Male 2-Female	
39-APGAR Score	1-<7 2-7 and above	
40-Was The neonate Refereed to NICU	1-yes 2-No	
41-If yes what was the diagnosis ?	1-MAS 2-PNA 3-RDS 4-HYPOGLYCEMIA	

	5-BIRTH INJURIES 6-CONGENITAL ANOMALY	

DECLARATION

Assurance of principal investigator

I agree to accept responsibility for the scientific, ethical and technical conduct of the research proposal project & provision of the required progress report as per terms and condition of the College of Health Sciences in effect at the time of grant is forwarded as the result of this application.

Name of Investigator Signature Date

Dr. Yosef Mesfin

Approval of the advisors

This Research Thesis has been submitted with my approval as university advisors

Dr. Signature Date

Dr. Signature Date