# FACTORS ASSOCIATED WITH ECLAMPSIA AMONG WOMEN WHO GAVE BIRTH AT ADAMA HOSPITAL MEDICAL COLLEGE, ETHIOPIA: A CASE CONTROL STUDY

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## ABSTRACT

**BACKGROUND:** Eclampsia is the occurrence of convulsions and/or unexplained coma in women with signs and symptoms of preeclampsia. It is one of the leading obstetric complications associated with increased maternal and perinatal mortality and morbidity. Identification of predictive factors associated with eclampsia helps caregivers with the early identification and prioritization of care for high-risk pregnant women, as well as the development of preventive strategies.

**OBJECTIVE:** The study aimed to identify factors associated with eclampsia among women who gave birth at Adama Hospital Medical College.

**METHODS:** A hospital-based case-control study was conducted from January 2019 to December 2021, and data were collected from a total of 467 patients (94 cases and 373 controls). Multivariable logistic regression analysis was performed to determine the association of predictive variables with the development of eclampsia. The association was estimated using an odds ratio with a 95% confidence interval at a P-value <0.05.

**RESULTS:** During the study period, 94 women with eclampsia were compared with 373 non-eclamptic controls. The likelihood of developing eclampsia was 5.3 times higher among rural residents compared to urban dwellers (AOR = 5.30; 95% CI: 2.98–9.41), 3.7 times higher in primiparous women compared to multiparous (AOR = 3.86; 95% CI: 2.06–7.24), 6.3 times higher in women with no antenatal care (ANC) than those having ANC (AOR = 6.30; 95% CI: 2.75–14.46), 2.3 times higher in anemic pregnant women, and 4.7 times higher in those with a urinary tract infection (UTI) (AOR = 4.70; 95% CI: 2.41–9.16).

**CONCLUSION:** In this study, rural residence, primiparity, lack of antenatal care follow-up, maternal anemia, and urinary tract infections were all independently associated with increased odds of developing eclampsia. These findings highlight the need to strengthen antenatal care services, particularly in rural areas, and to prioritize the early detection and management of anemia and infections during pregnancy. Targeted interventions addressing these modifiable risk factors could play a crucial role in reducing the burden of eclampsia and improving maternal health outcomes.

**KEYWORDS:** Adama, case-control, determinants, eclampsia, Ethiopia

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## INTRODUCTION

Eclampsia is an obstetric emergency characterized by the occurrence of convulsions and/or unexplained coma in patients with preeclampsia[1,2]. The clinical manifestation of eclampsia includes the development of hypertension and proteinuria, followed by premonitory signs and symptoms that lead to the development of convulsion and/or coma[3]. Worldwide, maternal and perinatal mortality and morbidity associated with eclampsia remain high[4]. Globally, each year an estimated 62,000 to 77,000 women die because of hypertensive disorders of pregnancy (HDP)[5]. Of the maternal deaths caused by HDP, eclampsia is responsible for about 49% of the cases[2].

Prevention of eclampsia requires knowledge of its etiology, pathophysiology, and ways to determine which women are at high risk. Socio-demographic factors associated with increased risk of eclampsia include being of Black race[6], rural residence[7], younger maternal age[4, 6, 8, 9], older maternal age (≥35 years)[10, 11], maternal occupation as a housewife[12,13], and lack of formal education[4, 8]. Obesity before pregnancy[14] and conception during the spring and summer months[15] were also significantly associated with an increased risk of eclampsia.

Obstetric factors that increase the risk of eclampsia include primigravida[6, 8, 10, 16, 17], previous history of abortion[7, 18], absence of ANC follow-up[6,7,18–20], unplanned pregnancy[9], longer birth interval[10], multiple pregnancies[16, 21, 22], and previous history of preeclampsia[16]. Chronic hypertension[1, 13], urinary tract infection during pregnancy[6, 23], anemia during pregnancy[23–25], diabetes[6, 7], and cardiac or renal diseases[23, 25, 26] are maternal medical disorders that increase the risk of eclampsia.

Since there are no reliable biological tests to predict which women will develop eclampsia[27], identifying the most important risk factors is crucial for clinical purposes. Most studies conducted to identify determinants of eclampsia were undertaken by combining eclampsia with preeclampsia to achieve a reasonable sample size. This results in an underrepresentation of eclamptic cases because of the relative rarity of the condition. Much of the information was extrapolated from cases of preeclampsia. Reports dealing exclusively with eclampsia are rare, and those available involve only a few cases. Thus, the majority of evidence dealing with determinants of eclampsia is not specific to eclampsia[6]. This case-control study aimed to determine factors associated with eclampsia at a teaching hospital in Eastern Ethiopia.

## 2. METHODS AND MATERIALS

### Study period, design, and setting

A hospital-based unmatched case-control study design was employed to identify factors associated with eclampsia among women who gave birth at Adama Hospital Medical College (AHMC) from January 2019 to December 2021. AHMC is located in Adama town, 100 km southeast of Addis Ababa, the capital of Ethiopia. The total number of deliveries was estimated between 800 and 900 deliveries per month.

### Study participants

The source population for cases and controls included all women who gave birth at AHMC. The study population consisted of all women who gave birth at AHMC during the study period. Those women whose discharge diagnoses were eclampsia and were managed at AHMC during the study period were taken as cases. Controls were women whose discharge diagnoses were not eclampsia and who gave birth at AHMC during the study period.

### Exclusion criteria

**Cases:** All mothers whose convulsions or coma were explained by other causes were excluded. Mothers with eclampsia referred from other hospitals or health centers after delivery and those with incomplete or lost medical records were also excluded.

**Controls:** All women who were referred to AHMC after delivery for other reasons were excluded. In

addition, those women whose medical records were incomplete or lost were also excluded.

**Sample size determination and sampling procedure**

The sample size for the unmatched case-control study design was calculated using Epi Info version 7.2 statistical software, considering the following assumptions: 80% power of the study, 95% confidence level, and a 4:1 control-to-case ratio. To determine the required sample size, obesity was used as a risk factor for eclampsia from the findings of a previous study, which revealed that the percentage of obesity among controls was 10%, and the percentage of cases exposed to obesity was 22%[6]. Accordingly, the estimated sample size was 467 women—94 cases of eclampsia and 373 non-eclamptic women.

The sampling frame was developed based on the client's medical registration numbers recorded in the logbooks over three years. All medical records of women with a discharge diagnosis of eclampsia managed at AHMC during the study period were included consecutively. Controls were selected using a systematic random sampling method. If a selected patient's medical record failed to meet the inclusion criteria, the next eligible woman's record was chosen as a control. During the study period, a total of 120 women had a discharge diagnosis of eclampsia registered in the logbook. Of these, only 100 charts were eligible for the study—12 cases were excluded because of incomplete or lost medical records, 6 cases gave birth at other health facilities, and 2 had other diagnoses (epilepsy and meningitis). Over the three-year period, there were 29,400 total deliveries, from which 373 charts of non-eclamptic women who fulfilled the criteria were selected. Medical records of 94 women with eclampsia were compared with 373 non-eclamptic controls.

**Data collection tools, procedures, and quality control**

Data were collected from logbooks and maternal medical records recorded over three years. The data collection tool, which contained all socio-demographic, obstetric, and maternal medical variables, was designed after reviewing relevant literature. Data were collected by four medical interns after receiving one day of training. Supervision was conducted during data collection.

**Data processing and analysis**

Data were entered into Epi Info version 7.2, and analysis was done using SPSS version 20. Socio-demographic, obstetric, and maternal medical characteristics of cases and controls were described using descriptive statistics, such as frequency and cross-tabulation. A binary logistic regression model was used to identify factors associated with eclampsia, and those variables with a P-value <0.25 were selected for further multivariable logistic regression analysis. The statistical significance of independent variables on eclampsia was declared at a P-value <0.05. The strength of association was estimated using an odds ratio with a 95% confidence interval.

**Ethical approval**

An ethical approval letter was obtained from the Institutional Review Board of AHMC, and the project protocol number was AHMC/MPH/19/11/2013. The names of the study participants were not used on the data collection tool, and the data were coded so that participants could not be identified by any means.

## RESULTS

### 1.1. Socio-demographic characteristics of cases and controls

Analysis of the study revealed that; about 34 (36.2%) of women in the cases and 145 (38.9%) of women among controls were in the age range of 25 -29 years. The distribution of cases and controls across the four seasons of the year was relatively the same (Table 1).

**Table 1: Socio-demographic characteristics of women who gave birth at AHMC from January 2019 to December 2021**

| Characteristics | Cases Number (%) | Controls Number (%) | Total Number (%) |
|---|---|---|---|
| **Maternal Age in Years** | | | |
| ≤ 19 | 10(10.6) | 13(3.5) | 23(4.9) |
| 20-24 | 27(28.7) | 124(33.2) | 151(32.3) |
| 25-29 | 34(36.2) | 145(38.9) | 179(38.3) |
| 30 – 34 | 13(13.8) | 67(18.0) | 80(17.1) |
| ≥ 35 | 10(10.6) | 24(6.4) | 34(7.3) |
| **Place of Residence** | | | |
| Urban | 37(39.4) | 286(76.7) | 323(69.2) |
| Rural | 57(60.6) | 87(23.3) | 144(30.8) |
| **Delivery Season** | | | |
| Autmn (Tseday) | 26(27.7) | 87(23.3) | 113(24.2) |
| Winter (Bega) | 28(29.8) | 107(28.7) | 135(28.9) |
| Spring (Belg) | 22(23.4) | 76(20.4) | 94(20.1) |
| Summer (Kiremt) | 22(23.4) | 103(27.6) | 125(26.8) |

### 1.2. Obstetrics characteristics of cases and controls

According to the finding of this study; majority (77.4%) of eclamptic cases were diagnosed at preterm (gestational age less than 37 weeks), of which 23.1% of them were diagnosed before 34 weeks of gestation. about 55(58.5%) of eclamptic cases occurs during the antepartum period, 20(21.3%) of convulsion occurs intrapartum after the onset of labor, and 19(20.2%) of eclampsia occurs after delivery (postpartum) (Table 2).

**Table 2: Obstetrics characteristics of women who gave birth at AHMC from January 2019 to December 2021**

| Characteristics | Cases Number (%) | Controls Number (%) | Total Number (%) |
|---|---|---|---|
| Parity | | | |
| Primigravida | 42(44.7) | 113(30.3) | 155(33.2) |
| Multigravida | 52(55.3) | 260(69.7) | 312(66.8) |
| Previous History of Abortion | | | |
| Yes | 12(12.8) | 89(23.9) | 101(21.6) |
| No | 82 (87.2) | 284(76.1) | 366(78.4) |
| Previous History of Stillbirth | | | |
| Yes | 7(7.4) | 21(5.6) | 28(6.0) |
| No | 87(92.6) | 352(94.4) | 439(94.0) |
| Planned pregnancy | | | |
| Yes | 60(63.8) | 270(72.4) | 330(70.7) |
| No | 34(36.2) | 103(27.6) | 137(29.3) |
| ANC Follow up | | | |
| Yes | 68(72.3) | 343(92.0) | 411(88.0) |
| No | 26(27.7) | 30(8.0) | 56(12.0) |
| Types of Gestation | | | |
| Singleton | 84(89.4) | 362(97.1) | 446(95.5) |
| Twins | 10(10.6) | 11(2.9) | 21(4.5) |
| Gestational age at Delivery | | | |
| Early Preterm (< 34 weeks) | 20(21.3) | 8(2.1) | 28(6.0) |
| Late Preterm (34-36.6wks) | 51(54.3) | 61(16.4) | 112(24.0) |
| Term (37 -41.6wks) | 22(23.4) | 285(76.4) | 307(65.7) |
| Post-term (≥ 42wks) | 1(1.1) | 19(5.1) | 20(4.3) |
| Maternal Blood Group | | | |
| Group “O” | 40(42.6) | 121(32.4) | 161(34.5) |
| Group “A” | 21(22.3) | 130(34.9) | 151(27.0) |
| Group “B” | 26(27.7) | 100(26.8) | 126(23.1) |
| Group “AB” | 7(7.4) | 22(5.9) | 29(6.2) |
| Previous History of PIH | | | |
| Yes | 6(6.4) | 14(3.8) | 20(4.3) |
| No | 88(93.6) | 359(96.2) | 447(95.7) |
| Previous History of Eclampsia | | | |
| Yes | 2(2.1) | 1(0.3) | 3(0.6) |
| No | 92(97.9) | 372(99.7) | 464(99.4) |
| Family History of PIH | | | |
| Yes | 4(4.3) | 13(3.5) | 17(3.6) |
| No | 90(95.7) | 360(96.5) | 450(96.4) |
| Gender of the Newborn | | | |
| Male | 52(55.3) | 187(50.1) | 239(51.2) |
| Female | 42(44.7) | 186(49.9) | 228(48.8) |

**Medical characteristics of cases and controls**

The study found that; five (5.3%) of the women in the cases and 14(3.8%) of the women among controls had chronic hypertension. Twenty-nine (30.9%) of cases and 43(11.5%) of controls were diagnosed to have urinary tract infections during pregnancy (Table 3).

**Table 3: Maternal Medical characteristics of women who gave birth at AHMC from January 2019 to December 2021**

| Characteristics | Cases Number (%) | Controls Number (%) | Total Number (%) |
|---|---|---|---|
| **Chronic Hypertension** | | | |
| Yes | 5(5.3) | 14(3.8) | 19(4.1) |
| No | 89(94.7) | 359(96.2) | 448(95.9) |
| **History of Cardiac or Renal disease** | | | |
| Yes | 3(3.2) | 7(1.9) | 10(2.1) |
| No | 91(96.8) | 366(98.1) | 457(97.9) |
| **Diabetes Mellitus** | | | |
| Yes | 2(2.1) | 5(1.3) | 7(1.5) |
| No | 92(97.9) | 368(98.7) | 460(98.5) |
| **Anemia During Pregnancy** | | | |
| Yes | 36(38.3) | 77(20.6) | 113(24.2) |
| No | 58(61.7) | 296(79.4) | 354(75.8) |
| **Urinary Tract Infection** | | | |
| Yes | 29(30.9) | 43(11.5) | 72(15.4) |
| No | 65(69.1) | 330(88.5) | 395(84.6) |
| **Edema** | | | |
| Yes | 60(63.8) | 141(37.8) | 201(43.0) |
| No | 34(36.2) | 232(62.2) | 266(57.0) |
| **HIV Sero-status** | | | |
| Reactive | 4(4.3) | 13(3.5) | 17(3.6) |
| Non-Reactive | 83(88.3) | 328(87.9) | 411(88.0) |
| Unknown | 7(7.4) | 32(8.6) | 39(8.4) |

### 1.3. Factors associated with Eclampsia

Data analysis using a bivariate logistic regression model found that; maternal age, place of residency, gravidity, previous history of abortion, planned pregnancy, ANC follow-up, types of gestation, maternal blood group, anemia during pregnancy, and urinary tract infection had a association with eclampsia at a P-value < 0.25. Multiple logistic regression analysis was performed to determine the adjusted effects of selected predictor variables on eclampsia. Accordingly, place of residence, gravidity, ANC follow-up, anemia during pregnancy, and urinary tract infection were variables that had a significant association with eclampsia (P- value <0.05).

The study found that; being a rural resident was associated with 5.3-fold increased odds of having eclampsia. (AOR = 5.30; 95% CI: 2.98, 9.41). The odds of having eclampsia were 3.86 fold higher among primigravid women than multigravida (AOR = 3.86; 95% CI: 2.06, 7.24). As per the finding of the study, those women with no ANC follow-up had

6.3-fold higher odds of having eclampsia compared to those women with at least one ANC follow-up (AOR = 6.30; 95% CI: 2.75, 14.46). The risk of eclampsia among anemic pregnant women was, 2.29 fold higher than among non-anemic pregnant women (AOR = 2.29; 95% CI: 1.25, 4.18). The odds of developing eclampsia were also increased by 4.7 fold in a pregnant woman diagnosed to have a urinary tract infection (AOR = 4.70; 95% CI: 2.41, 9.16) (Table-4)

**Table 4: Factors associated with Eclampsia among women who gave birth at AHMC from January 2019 to December 2021**

| Characteristics | Cases Number (%) | Controls Number (%) | COR[95%CI] | AOR[95%CI] |
|---|---|---|---|---|
| **Place of Residence** | | | | |
| Urban | 37(39.4) | 286(76.7) | 1.00 (Ref.) | 1.00 (Ref.) |
| Rural | 57(60.6) | 87(23.3) | 5.06[3.14, 8.17]* | 5.30[2.98, 9.41]** |
| **Gravidity** | | | | |
| Primigravid | 42(44.7) | 113(30.3) | 1.86[1.17, 2.95]* | 3.86[2.06, 7.24]** |
| Multiparous | 52(55.3) | 260(69.7) | 1.00 (Ref.) | 1.00 (Ref.) |
| **ANC Follow up** | | | | |
| Yes | 68(72.3) | 343(92.0) | 1.00 (Ref.) | 1.00 (Ref.) |
| No | 26(27.7) | 30(8.0) | 4.37[2.43, 7.86]* | 6.30[2.75, 14.46]** |
| **Anemia During Pregnancy** | | | | |
| Yes | 36(38.3) | 77(20.6) | 2.39[1.47, 3.88]* | 2.29[1.25, 4.18]** |
| No | 58(61.7) | 296(79.4) | 1.00 (Ref.) | 1.00 (Ref.) |
| **Urinary Tract Infection** | | | | |
| Yes | 29(30.9) | 43(11.5) | 3.42[1.99, 5.88]* | 4.70[2.41, 9.16]** |
| No | 65(69.1) | 330(88.5) | 1.00 (Ref.) | 1.00 (Ref.) |

* P-value < 0.25; ** P-value < 0.05

## DISCUSSION

The results of this study found that being a woman of rural residence, primigravidity, having no ANC follow-up, having anemia during pregnancy, and having a urinary tract infection during pregnancy were independent determinants of eclampsia. The study found that being a woman of rural residence was associated with a fivefold increased risk of developing eclampsia compared to women of urban residence. This finding is in line with studies done in India[7] and Nigeria[28]. However, the finding of our study does not agree with the study done in Washington, which did not find an association between women's place of residence and the risk of eclampsia[10]. The increased risk of developing eclampsia among rural women could be related to low coverage of healthcare services, poor access to health information, limited infrastructure, and low health-seeking behavior among rural women. There is a marked urban–rural variation in accessing ANC follow-up in LMICs, including Ethiopia[29]. All these factors contribute to an increased risk of developing eclampsia due to delays in recognizing premonitory signs and symptoms before the onset of eclampsia[30]. Primigravidity was one of the factors strongly associated with eclampsia in our study; the odds of having eclampsia were increased in primigravid

women compared to multigravida ones. Similar findings were reported by multicountry surveys done by WHO[8] and systematic reviews in sub-Saharan African (SSA) countries[19]. The finding of this study is also in line with studies conducted in Houston, Texas[31], Japan[17], Egypt[4], and Addis Ababa, Ethiopia[16]. The association between primigravidity and eclampsia can be described as follows: a primigravid woman has a higher risk of immunologic intolerance with the fetus, resulting in defective trophoblast invasion of the spiral arteries, which in turn increases the risk of developing preeclampsia/eclampsia[32].

Regular antenatal care follow-up improves the health of the mother and newborn through risk assessment, health promotion, and disease prevention. Our study revealed that the odds of having eclampsia were increased sixfold in women with no ANC follow-up in the current pregnancy compared to those with at least one ANC visit. This finding agrees with studies done in Houston, Texas[6], India[7], and Morocco[20]. When a woman has no ANC follow-up, routine checkups for blood pressure and/or proteinuria are absent or reduced, which might lead to delays in the diagnosis of preeclampsia and consequently increase the risk of eclampsia.

In this study, anemic pregnant women had more than a twofold higher risk of eclampsia compared with non-anemic pregnant women. Similar findings were reported by studies conducted by WHO[23], in Canada[25], and in Sudan[24]. The increased risk of eclampsia among anemic pregnant women can be explained by the deficiency of micronutrients and antioxidants causing anemia, which creates a condition that increases the risk of preeclampsia/eclampsia[23]. This indicates that screening and treating anemia during ANC visits can reduce the risk of developing eclampsia.

The presence of urinary tract infection or pyelonephritis during pregnancy was also associated with an increased risk of developing eclampsia. Similar findings were reported by studies conducted by WHO[23] and in the United States of America[6]. The exact reason for this association is not known, but several hypotheses involving cardiovascular pathways and inflammatory responses have been mentioned[23]. The finding of this study supports the need for proper screening and treatment of UTI during pregnancy to reduce the risk of developing obstetric complications such as eclampsia.

One of the strengths of this study is that it investigated predictors of eclampsia by comparing a reasonable number of eclamptic women with non-eclamptic controls, allowing for the identification of determinants of eclampsia independent of preeclampsia. The major limitation of the study is that data were retrieved retrospectively from patients' medical records, and information on some important sociodemographic, socioeconomic, and obstetric factors was unavailable or incomplete.

## CONCLUSION

This study identified that rural residence, primiparity, lack of antenatal care follow-up, maternal anemia, and urinary tract infections were all independently associated with increased odds of developing eclampsia. These findings highlight the need to strengthen antenatal care services, particularly in rural areas, and to prioritize the early detection and management of anemia and infections during pregnancy. Targeted interventions addressing these modifiable risk factors could play a crucial role in reducing the burden of eclampsia and improving maternal health outcomes.

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