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# Maternal Outcome and Associated Factor of Severe Preeclampsia among Women Admitted at Asella Referral and Teaching Hospital, Oromia, Ethiopia, 2024

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## ABSTRACT

**Background:** Preeclampsia is a significant pregnancy complication characterized by high blood pressure and proteinuria. Severe preeclampsia is a more advanced stage of the condition and is associated with heightened risks for both the mother and the fetus. Understanding maternal outcomes and the factors associated with severe preeclampsia is crucial for effective management and improving overall outcomes.

**Objective:** To assess maternal outcomes and factors associated with severe preeclampsia among patients admitted to Asella Referral and Teaching Hospital from August 1, 2024, to December 30, 2024.

**Methods:** A hospital-based cross-sectional study was conducted to evaluate maternal outcomes and associated factors of severe preeclampsia at Asella Referral and Teaching Hospital in 2024. All cases of preeclampsia with severe features (PEWSF) after 28 weeks of gestation were prospectively registered. Data were collected using a structured, pre-tested questionnaire via face-to-face interviews and clinical chart reviews. Data were entered into EpiData V.4.6 and analyzed using SPSS V.25.0 statistical software. Binary logistic regression analysis was used to assess the association between independent and dependent variables, presenting both crude and adjusted odds ratios. Variables with p-values <0.05 at a 95% confidence interval were considered potential determinants of adverse maternal outcomes.

**Results:** A total of 362 respondents participated in the study, yielding a 95.26% response rate. The mean age of the participants was 27.26 ± 4.94 years. The prevalence of unfavorable maternal outcomes was 34.8% (95% CI: 34.59–35.01). The most common unfavorable outcomes were abruptio placenta (28.6%), HEELP syndrome (26.2%), and postpartum hemorrhage (PPH) (10.2%). Factors significantly associated with unfavorable maternal outcomes included maternal age (35–44 years) (AOR 1.41 [95% CI: 1.01–4.19]), nulliparity (AOR 1.51 [95% CI: 1.04–5.16]), high BMI (≥30) (AOR 1.63 [95% CI: 1.12–6.20]), severe hypertension at admission (AOR 1.46 [95% CI: 1.02–3.67]), a history of preeclampsia (AOR 2.07 [95% CI: 1.09–4.84]), and the presence of headaches at admission (AOR 1.79 [95% CI: 1.01–4.72]).

**Conclusion:** The prevalence of unfavorable maternal outcomes among women with severe preeclampsia in Asella Referral and Teaching Hospital is high. The most common unfavorable outcomes were abruptio placenta, HEELP syndrome, and PPH. Maternal age, nulliparity, high BMI, severe hypertension at admission, a history of preeclampsia, and the presence of headaches at admission were significantly associated with adverse maternal outcomes. Therefore, promoting socioeconomic development and ensuring early recognition of the severe signs and symptoms of preeclampsia are essential steps to reducing these adverse outcomes.

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## Introduction

### Background of the Study

Hypertension in pregnancy is defined as a systolic blood pressure (BP) ≥ 140 mmHg or diastolic blood pressure ≥ 90 mmHg on two separate occasions at least six hours apart. According to the International Society for the Study of Hypertension in Pregnancy (ISSHP), these disorders are classified into five categories: gestational hypertension, chronic hypertension, preeclampsia, eclampsia, and superimposed hypertension. These conditions complicate 10% of all pregnancies and remain a leading cause of fetal morbidity and mortality worldwide [1-3].

Preeclampsia is characterized by the new onset of hypertension and proteinuria after 20 weeks of gestation in a previously normotensive woman. Severe preeclampsia is a more serious

clinical manifestation, defined by at least one of the following: persistent increase in blood pressure (≥ 160/110 mmHg), hepatic or renal failure, platelet count < 100,000/mm³, hemolysis, elevated liver enzymes, and low platelet count (HELLP) syndrome, cerebral or visual disturbances, persistent severe epigastric pain, or pulmonary edema [4,5].

Preeclampsia accounts for the majority of referrals in tertiary care centers and stands as one of the major causes of maternal and perinatal morbidity and mortality. Hypertension in pregnancy is the most common medical complication, occurring in 12-22% of all pregnancies, with preeclampsia remaining the leading cause, complicating 10% of pregnancies. Seizures most commonly occur in the postnatal period in 44% of cases, antenatally in 38%, and during the intrapartum period in 18% [6].

Depending on the location of the study, the prevalence of these disorders can range from 5% to 10% of all pregnancies. These disorders not only pose risks to the health and well-being of the mother but also have significant consequences for the fetus [7-9].

In one study, maternal morbidity was primarily due to eclampsia, which accounted for 40.8% of cases. The study recorded 21 maternal deaths, resulting in a maternal lethality rate of 5.1%. Among fetal morbidities, prematurity was the most prevalent, affecting 36.4% of cases. These findings underscore the significant impact of preeclampsia with severe features on the health of both mothers and infants, highlighting the need for improved management and preventive measures [10].

In another study, complications were observed in 57% of patients. The most prevalent complication was HELLP syndrome, affecting 21% of patients, followed by placental abruption (16%), eclampsia (11%), coagulopathy (4%), and acute renal failure (3%). A separate study reported similar rates of eclamptic seizures (6.3%) and HELLP syndrome (0.3%). Although less frequent, placental abruption occurred in 7.7% of cases. Unfortunately, two deaths were recorded, accounting for 2% of patients, with one death linked to acute renal failure and the other to HELLP syndrome [11].

In Ethiopia, the prevalence of preeclampsia ranges from 4% to 12%, making it a significant contributor to maternal mortality, accounting for approximately 15% of deaths. A retrospective study showed a perinatal mortality rate of 290 deaths per 1,000 births associated with preeclampsia [2].

Among 211 women with hypertensive disorders of pregnancy (HDP), approximately 37.9% (80 women) experienced complications related to hypertension, with HELLP syndrome being the most prevalent, affecting 19.9% [12].

The underlying causes of preeclampsia and eclampsia remain largely unknown, and effective primary prevention measures are not well-established [7].

There is limited research on maternal outcomes and associated factors of preeclampsia with severe features in patients admitted to Asella Referral and Teaching Hospital (ARTH). Therefore, conducting research in this area is essential to provide background data for further studies and to explore maternal and perinatal outcomes, as well as the associated factors of preeclampsia with severe features. The findings will inform relevant recommendations for improving care.

## Methods and Materials

### Study Area

The study was conducted at Asella Teaching and Referral Hospital, located in Asella town, approximately 175 km southeast of Addis Ababa, the capital city of Ethiopia. Established on October 15, 2014, Arsi University is a third-generation public university, and the hospital serves as a referral center for the Arsi Zone, catering to a catchment area of approximately 3.5 million people.

Asella Teaching and Referral Hospital is equipped with around 310 beds and includes four major inpatient departments: internal medicine, surgery, gynecology/obstetrics, and pediatrics. The hospital also features an adult Intensive Care Unit (ICU) and a general emergency Outpatient Department (OPD). In addition, it offers various services such as multiple outpatient departments (OPDs), a Maternal and Child Health (MCH) unit, Voluntary Counseling and Testing (VCT), Antiretroviral Therapy (ART) services, major operation rooms, and a minor operation room.

The hospital provides 24-hour delivery and abortion services. It is staffed by 10 General Practitioners (GPs), 15 consultants in gynecology and obstetrics, and 39 residents from various batches in the obstetrics and gynecology department.

### Study Period

The study was conducted from August to December 30, 2024.

### Study Design

Institutional based cross sectional study design was used.

### Source Populations

All pregnant mothers admitted to Asella referral and teaching hospital from August to December 30, 2024.

### Study Populations

All pregnant mothers admitted to Asella referral & teaching hospital with diagnosis of preeclampsia with severity features from August 1 to December 30, 2024.

### Inclusion and Exclusion Criteria

- **Inclusion Criteria:** All patients with confirmed severe preeclampsia and either symptomatic manifestation of the condition or deranged biochemical/hematological blood indices. Patients who are willing to participate in the study.
- **Exclusion Criteria:** Patients who had incomplete medical records or missing data necessary for the study analysis were excluded. Patients with previous history of a seizure disorder such as epilepsy were excluded.

### Sample Size Determination

The sample size was calculated by using single population proportion formula. The estimated sample size was n, degree of precision of 5 %( d) , confidence interval of 95% (Z= 1.96) and based on hospital-based cross-sectional study done to determine the prevalence and factors associated with unfavorable maternal outcomes among pregnant women with pre-eclampsia with severity features at Abebech Gobena Maternal and Children's Health and St. Peter's Hospital, Addis Ababa, Ethiopia, 2023, the overall prevalence of unfavorable maternal outcomes was 33.9% [13].

$n = (Z\ \alpha/2)^2 * p\ (1-p)/\ d^2$

Where n= desired sample size

$$n = \frac{(Z_{\alpha/2})^2 * p(1-p)}{d^2} = \frac{(1.96)^2 * 0.339(1-0.339)}{(0.05)^2} = 345$$

The calculated sample size was 345 and adding 10 % of non-respondent rate, n=380 The sample size for the second objective was calculated by taking more frequently observed associated factors for associates of unfavorable maternal outcomes using epi info StatCalc function.

| Factors | AOR | P1= % of case exposed | P2= % control exposed | Sample size |
|---|---|---|---|---|
| Age above 35 years | 2.7 | 15.4 | 84.6 | 196 |
| Rural residence | 1.94 | 34.9 | 65.1 | 271 |
| Unemployment | 0.35 | 44.1 | 55.9 | 301 |
| severe BP on admission | 2.32 | 21.5 | 78.5 | 247 |
| complain of severe headache | 1.91 | 40.2 | 59.8 | 307 |

I took the higher sample size and by considering 10% non-responsive rate, the final sample size was 362.

**Sampling Techniques**

All mothers diagnosed with preeclampsia with severe features who gave birth during the study period were included to determine the maternal outcomes and associated factors of severe preeclampsia. A total of 362 cases of preeclampsia with severe features, meeting the inclusion criteria, were included in the study using a census sampling method.

**Data Collection Procedures**

Data were collected through a structured questionnaire and clinical chart reviews, which were adapted from previously published studies and tailored to the study setting. The questionnaire included inquiries about the mothers' socio-demographic information, obstetric history, and pre-existing medical conditions. To facilitate timely data collection, all interns, residents, midwives, and clinical nurses were instructed to inform the principal investigator upon a mother's admission for delivery.

Trained junior residents, assigned to various wards (labor, prenatal, postnatal, and post-operative), were responsible for collecting the data. They gathered relevant information from the mothers during their hospital stay.

An exit interview was also conducted in person with mothers who delivered either vaginally or by cesarean section. These interviews were carried out by the data collectors, who then submitted the gathered information to the principal investigator. After delivery, the data collectors reviewed the delivery summaries, charts, and logbooks to ensure the accuracy of the outcome investigation.

**Data Quality Assurance**

To ensure data quality, a two-day training session was provided to the data collectors prior to the commencement of data collection. The validity of the questionnaire was pre-tested at Kersa Hospital with 5% of the study sample. Feedback from the pre-test led to revisions of the questionnaire, including the removal of repetitive questions, elimination of irrelevant items, and clarification of unclear questions.

The data collectors were closely supervised by the principal investigator on a daily basis throughout the data collection process. The collected data was reviewed and cleaned by the investigator each day.

The questionnaire was initially drafted in English, then translated into the local languages (Amharic and Oromiffa) for the data collection. It was subsequently re-translated into English to ensure consistency and accuracy.

**Data Processing and Analysis**

Data cleaning and analysis were conducted using the Statistical Package for Social Sciences (SPSS) version 25.0, after the data were exported from Epi-Data software version 4.6. The study's findings were presented using descriptive statistics. The association between independent variables and maternal outcomes was evaluated using binary logistic regression analysis with a 95% Confidence Interval (CI). Both bivariable analysis (crude odds ratio, COR) and multivariable analysis (adjusted odds ratio, AOR) were used for data analysis. Variables with p-values less than 0.25 in the bivariable analysis were included in the multivariable analysis. In the multivariable analysis, variables were considered significant predictors of maternal outcomes at a 95% CI if the p-value was less than 0.05.

To check for multicollinearity among the independent variables, the standard error for each variable was examined, with a threshold value between -2 and +2. No multicollinearity was detected. Additionally, the Hosmer-Lemeshow test was applied to assess the model's fit, and a p-value of 0.894 indicated that the model was suitable for further statistical analysis.

**Ethical Considerations**

The research proposal was submitted to the Department of Public Health and the Department of Gynecology and Obstetrics for review and approval by the Institutional Research Review Board (IRB). A permission letter was obtained from the Department of Gynecology and Obstetrics to conduct the study at Asella Referral and Teaching Hospital. Ethical clearance was granted by the IRB of Arsi University, College of Health Sciences. Informed consent was obtained from each participant, ensuring their understanding and voluntary participation. To maintain confidentiality, data were anonymized using codes.

**Results**

**Socio-Demographic Characteristics of the Respondents**

A total of 362 respondents participated in this study, yielding a 95.26% response rate. The mean age of the respondents was 27.26 ± 4.94 years. Two hundred eighteen (60.2%) of the respondents were in the 25–34 age group. Most of the respondents, 356 (98.3%), were married. The majority were Muslim (179, 49.4%), followed by Orthodox Christians (158, 43.6%). In terms of ethnicity, more than three-fourths of the respondents were Oromo (315, 87%), followed by Amhara (44, 12.2%). Over half of the respondents (197, 54.4%) came from rural areas. Nearly one-third (117, 32.3%) had completed their primary and secondary education. Regarding occupation, most mothers were housewives (60.2%), followed by merchants (68, 18.8%). The majority of respondents had a monthly income below 10,000 currency units (85.6%). (Table 1).

**Table 1: Sociodemographic Characteristics of the Respondents Admitted with PEWSF at ARTH, Assela, Ethiopia. 2024**

| Variables | Category | Frequency | Percentage |
|---|---|---|---|
| Mothers Age (n=362) | 15-24 | 99 | 27.3 |
| | 25-34 | 218 | 60.2 |
| | 35-44 | 45 | 12.4 |
| Marital Status (n=362) | Married | 356 | 98.3 |
| | Single | 4 | 1.1 |
| | Divorced | 2 | 0.6 |
| Religion (n=362) | Muslim | 179 | 49.4 |
| | Orthodox | 158 | 43.6 |
| | Protestant | 25 | 6.9 |
| Ethnicity (n=362) | Amhara | 44 | 12.2 |
| | Gurage | 3 | 0.8 |
| | Oromo | 315 | 87 |
| Place of Residence (n=362) | Urban | 165 | 45.6 |
| | Rural | 197 | 54.4 |
| Mothers Education (n=362) | Unable to read and write | 16 | 4.4 |
| | Able to read and write | 42 | 11.6 |
| | Primary school | 117 | 32.3 |
| | Secondary school | 117 | 32.3 |
| | College and above | 70 | 19.3 |
| Mothers Occupation (n=362) | Housewives | 218 | 60.2 |
| | Farmer | 40 | 11 |
| | Students | 3 | 0.8 |
| | Government employee | 29 | 8 |
| | Daily laborer | 4 | 1.1 |
| | Merchant | 68 | 18.8 |
| Mode of Admission (n=362) | Self | 73 | 20.2 |
| | Referral | 289 | 79.8 |
| Monthly Income (n=362) | <10000 | 310 | 85.6 |
| | ≥10000 | 52 | 14.4 |

**Obstetric History of the Respondents Admitted with PEWSF**

Among the participants, 40.9% had a history of preeclampsia during a previous delivery, while 59.1% did not. Only 5% reported a history of stillbirth, with the vast majority (95%) having no such history. A history of abortion was reported by 6.4% of participants, while 93.6% had no such history. Additionally, 42% reported a family history of preeclampsia, whereas 58% did not. About one-quarter of participants (25.4%) had a history of medical illness, while 74.6% reported no such history. Among those with medical conditions, chronic hypertension was the most common (35.9%), followed by diabetes mellitus (27.2%), cardiac disease (21.7%), asthma (7.6%), and HIV (7.6%). (Table 2).

**Table 2: Obstetric History of the Respondents Admitted with PEWSF at ARTH, Assela, Ethiopia. 2024**

| Variables | Category | Frequency | Percentage |
|---|---|---|---|
| History of Preeclampsia during Previous Delivery (n=362) | Yes | 148 | 40.9 |
| | No | 214 | 59.1 |
| History of Still Birth (n=362) | Yes | 18 | 5 |
| | No | 344 | 95 |
| History of Early Neonatal Loss (n=362) | Yes | 41 | 11.3 |
| | No | 321 | 88.7 |
| Family History of Preeclampsia (n=362) | Yes | 152 | 42 |
| | No | 210 | 58 |
| History of Abortion (n=362) | Yes | 23 | 6.4 |
| | No | 339 | 93.6 |
| Spouse Change | Yes | 104 | 28.7 |
| | No | 258 | 71.3 |
| History of Medical Illness (n=362) | Yes | 92 | 25.4 |
| | No | 270 | 74.6 |
| Types of Medical Illness (n=92) | Chronic hypertension | 33 | 35.9 |
| | DM | 25 | 27.2 |
| | Cardiac disease | 20 | 21.7 |
| | Asthma | 7 | 7.6 |
| | HIV | 7 | 7.6 |

**Current Medical and Obstetrics Profile of the Respondents**

Among the 362 participants, 63% were multigravida, while 37% were primigravida. Nulliparous women made up 40% of the group, and the majority (56.4%) had 1–4 previous live births. Nearly half (48.1%) were admitted before 37 weeks of gestation, while 51.9% were admitted at term (≥37 weeks). Most participants (56.7%) had a birth-to-pregnancy interval of ≥2 years, while 43.3% had intervals of less than 2 years. Additionally, 74.9% had singleton pregnancies, and 25.1% had twin or multiple gestations.

A high proportion (99.2%) attended antenatal care (ANC), with 60.8% having 1–3 visits, 34.8% having 4–6 visits, and only 3.6% attending 7–8 visits. Spontaneous labor occurred in 48.9% of cases, while labor was induced in 51.1%. The majority of deliveries were vaginal (56.9%), with 36.2% resulting in cesarean sections and 6.9% in instrumental deliveries. The leading reasons for cesarean delivery were non-reassuring fetal heart rate (NRFHR) at 51.1%, followed by failed induction at 25.2%, GIIMSAF at 10.7%, severe placental abruption at 9.9%, and preeclampsia with a previous C-section scar at 3.1%. (Table 3).

**Table 3: Current Medical and Obstetrics Profile of the Respondents Admitted with PEWSF at ARTH, Assela, Ethiopia. 2024**

| Variables | Category | Frequency | Percentage |
|---|---|---|---|
| Gravidity (n=362) | Primigravida | 134 | 37 |
| | Multigravida | 228 | 63 |
| Parity (n=362) | Nulliparous | 147 | 40.6 |
| | 1-4 | 204 | 56.4 |
| | Grand-multiparity | 11 | 3 |
| Gestational Age at Admission (n=362) | < 37 weeks | 174 | 48.1 |
| | ≥ 37weeks | 188 | 51.9 |
| Birth to Pregnancy Interval (n=362) | < 2 years | 106 | 43.3 |
| | ≥ 2 years | 139 | 56.7 |
| Number of Fetus (n=362) | Singleton | 271 | 74.9 |
| | Twin/multiple | 91 | 25.1 |
| ANC Follow Up (n=362) | Yes | 359 | 99.2 |
| | No | 3 | 0.8 |
| Number of ANC Visit (n=359) | 1-3 visit | 220 | 60.8 |
| | 4-6 visit | 126 | 34.8 |
| | 7-8 visit | 13 | 3.6 |
| On Set of Labor (n=362) | Spontaneous | 177 | 48.9 |
| | Induced | 185 | 51.1 |
| Mode of Delivery (n=362) | SVD | 206 | 56.9 |
| | Cesarean section | 131 | 36.2 |
| | Instrumental delivery | 25 | 6.9 |
| Indication for C/S (n=131) | NRFHR | 67 | 51.1 |
| | Failed induction | 33 | 25.2 |
| | GIIMSAF | 14 | 10.7 |
| | Severe abruption | 13 | 9.9 |
| | C/S plus pre-eclampsia | 4 | 3.1 |
| Sex of Neonate (n=362) | Male | 218 | 60.2 |
| | Female | 144 | 39.8 |
| Maternal Outcome (n=362) | Unfavorable | 126 | 34.8 |
| | Favorable | 236 | 65.2 |

## Maternal Outcome

Overall, 34.8% (n=126) of mothers (95% CI: 34.59–35.01) experienced unfavorable maternal outcomes (Table 3). The most common complications among mothers diagnosed with PEWSF were abruptio placenta (28.6%), HELLP syndrome (26.2%), postpartum hemorrhage (12.7%), and acute kidney injury (10.3%) (Figure 2).

## Clinical Features and Investigations of Participants during Admission

Nearly half (46.4%) of the participants reported experiencing headaches, while 43.4% reported epigastric pain. Only 15.5% of participants reported visual disturbances, with 84.5% not experiencing this symptom. Nausea or vomiting was present in 13.8% of respondents, and 86.2% did not report these symptoms. Convulsions were reported in 8.56% of cases, with 91.44% not experiencing them.

The majority of participants (83.1%) had severe-range blood pressure, while 16.9% had blood pressure in the mild range. In terms of body mass index (BMI), 59.4% of participants had a BMI between 18.5-24.9 kg/m², while 9.7% had a BMI of 30 kg/m² or greater. Most participants (82%) had a hematocrit level of ≥33, while 18% had lower levels. Liver function was normal in 81.5% of participants, while 18.5% showed abnormal results. Similarly, creatinine levels were normal in 79.8% of participants, with 20.2% having deranged results.

Proteinuria was observed in varying degrees: 42.5% had no protein, 34% had +1 protein, 13.8% had +2 protein, and 9.7% had +3 protein. A history of spouse change was reported by 28.7% of participants, while 71.3% had no such history. About half (48.9%) of the participants had a hospital stay of 3 days or less, while 51.1% stayed for more than 3 days (Table 4). The most common outcomes among pregnant women admitted with PEWSF were abruptio placenta (28.6%), HELLP syndrome (26.2%), and postpartum hemorrhage (12.7%) (Figure 2).

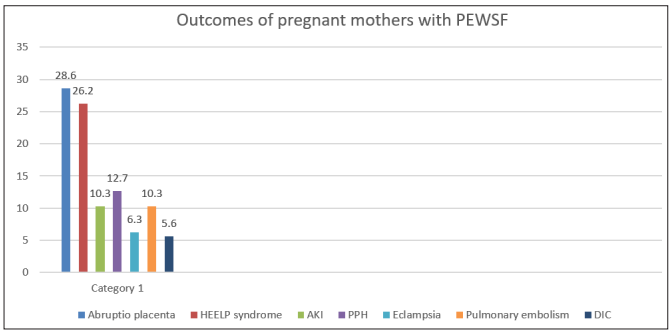


**Figure 2:** Outcomes of Pregnant Women Admitted with Pre-Eclampsia with Severe Features at ARTH, Assela, Ethiopia. 2024

**Table 4: Clinical Features of Participants Admitted with PEWSF at ARTH, Assela, Ethiopia, 2024**

| Variables | Category | Frequency | Percentage |
|---|---|---|---|
| Headache (n=362) | Yes | 168 | 46.4 |
| | No | 194 | 53.6 |
| Epigastric pain (n=362) | Yes | 157 | 43.4 |
| | No | 205 | 56.6 |
| Visual disturbance (n=362) | Yes | 56 | 15.5 |
| | No | 306 | 84.5 |
| Nausea/vomiting (n=362) | Yes | 50 | 13.8 |
| | No | 312 | 86.2 |
| Convulsion (n=362) | Yes | 31 | 8.56 |
| | No | 331 | 91.44 |
| Edema (n=362) | Yes | 90 | 24.9 |
| | No | 272 | 75.1 |
| Blood pressure at admission (n=362) | Severe | 301 | 83.1 |
| | Mild | 61 | 16.9 |
| BMI in kg/m² (n=362) | <18.5 kg/m² | 13 | 3.6 |
| | 18.5-24.9 kg/m2 | 215 | 59.4 |
| | 25-29.9 kg/m² | 99 | 27.3 |

| | | | |
|---|---|---|---|
| | ≥ 30 kg/m$^2$ | 35 | 9.7 |
| Hematocrit (n=362) | ≥ 33 | 297 | 82 |
| | < 33 | 65 | 18 |
| Liver function (n=362) | Normal | 295 | 81.5 |
| | Deranged | 67 | 18.5 |
| Creatinine (n=362) | Normal | 289 | 79.8 |
| | Deranged | 73 | 20.2 |
| Urine protein (n=362) | Negative | 154 | 42.5 |
| | +1 | 123 | 34 |
| | +2 | 50 | 13.8 |
| | +3 | 35 | 9.7 |
| Duration of hospital stay (n=362) | ≤ 3 days | 177 | 48.9 |
| | >3days | 185 | 51.1 |

### Factors Associated with Maternal Outcome

Bivariate logistic regression analysis was conducted to identify factors associated with maternal outcomes. The following variables were found to be associated in the bivariate analysis: age, residence, parity, birth interval, BMI, BP at admission, family history of preeclampsia, previous history of preeclampsia, spouse change, number of fetuses, presence of headache, and creatinine levels at admission. However, only six of these variables remained significantly associated in the multivariate analysis (Table 5).

**Table 5: Bivariate Analysis of Factors Associated with Maternal Outcome among PEWSF at ARTH, Assela, Ethiopia, 2024**

| Variables | Category | Maternal outcome | | COR (95% CI) | P value |
|---|---|---|---|---|---|
| | | Unfavorable (%) | Favorable (%) | | |
| Age | 15-24 | 31(8.6) | 68(18.8) | 1 | |
| | 25-34 | 72(19.9) | 146(40.3) | 0.92 (0.55-1.54) | 0.76 |
| | 35-44 | 23(6.4) | 22(6.1) | 0.44 (0.21-0.9) | 0.02 |
| Religion | Muslim | 60(16.6) | 119(32.9) | 0.93 (0.38-2.28) | 0.88 |
| | Orthodox | 58(16) | 100(27.6) | 0.81 (0.33-2) | 0.65 |
| | Protestant | 8(2.2) | 17(4.7) | 1 | |
| Residence | Urban | 64(17.7) | 101(27.9) | 1 | |
| | Rural | 62(17.1) | 135(37.3) | 1.38 (0.9-2.13) | 0.15 |
| Mothers education | Unable to read and write | 7(1.9%) | 9(2.5%) | 1 | |
| | Able to read and write | 17(4.7) | 25(6.9) | 1.39 (0.63-3.1) | 0.42 |
| | Primary school | 38(10.5) | 79(21.8) | 1.41 (0.68-2.93) | 0.35 |
| | Secondary school | 41(11. 3) | 76(21) | 1.26 (0.61-2.6) | 0.53 |
| | College and above | 23(6.4) | 47(13) | 0.87 (0.27-2.8) | 0.82 |
| Mode of admission | Self | 25(6.9) | 48(13.3) | 1 | |
| | Referral | 101(27.9) | 188(51.9) | 0.97 (0.57-1.66) | 0.91 |
| Gravidity | Primi-gravida | 48(13.3) | 86(23.8) | 1.07 (0.69-1.68) | 0.76 |
| | Multigravida | 78(21.5) | 150(41.4) | 1 | |
| Parity | Nulliparous | 66(18.2) | 81(22.4) | 0.7(0.2-2.5) | 0.23 |
| | 1-4 | 56(15.5) | 148(40.9) | 1.51 (0.43-5.4) | 0.34 |
| | Grand multiparity | 4(1.1) | 7(1.9) | 1 | |
| Birth interval | < 2 years | 45(18.4) | 61(24.9) | 1.89 (1.01-3.23) | 0.019 |
| | ≥ 2 years | 39(15.9) | 100(40.8) | 1 | |
| BMI | <18.5 | 1(0.3) | 12(3.3.) | 1 | |
| | 18.5-24.9 | 74(20.4) | 141(39) | 0.16 (0.02-1.25) | 0.08 |
| | 25-29.9 | 34(9.4) | 65(18) | 0.16 (0.02-1.27) | 0.084 |
| | ≥ 30 | 17(4.7) | 18(5) | 0.09 (0.01-0.75) | 0.027 |
| BP at admission | Severe | 113(31.2) | 188(51.9) | 2.22 (1.15-4.3) | 0.017 |
| | Mild | 13(3.6) | 48(13.3) | 1 | |
| History of abortion | Yes | 11(3%) | 12(3.3%) | 1.79 (0.76-4.17) | 0.28 |
| | No | 115(31.8) | 224(61.9) | 1 | |
| Family history of preeclampsia | Yes | 67(18.5) | 85(23.5) | 2.02 (1.3-3.13) | 0.002 |
| | No | 59(16.3) | 151(41.7) | 1 | |
| History of preeclampsia | Yes | 64(17.7) | 84(23.2) | 1.87 (1.2-2.9) | 0.005 |
| | No | 62(17.1) | 152(42) | 1 | |
| Spouse change | Yes | 56(15.5) | 51(14.1) | 2.9 (1.82-4.64) | 0.001 |
| | No | 70(19.3) | 185(51.1) | 1 | |
| Number of fetus | Singleton | 77(21.3) | 194(53.6) | 1 | |
| | Multiple | 49(13.5) | 42(11.6) | 0.34 (0.21-0.56) | 0.001 |
| Mode of delivery | SVD | 67(18.5) | 139(38.4) | | |
| | OVD | 8(2.2) | 17(4.7) | 1.02 (0.42-2.5) | 0.96 |
| | C/S | 51(14.7) | 80(22.1) | 0.76 (0.48-1.2) | 0.28 |
| Sex of neonate | Male | 82(22.7) | 136(37.6) | 1.37 (0.86-2.15) | 0.37 |
| | Female | 44(12.2) | 100(27.6) | 1 | |
| Headache | Yes | 74(20.4) | 94(26) | 2.15 (1.38-3.34) | 0.001 |
| | No | 52(14.4) | 142(39.2) | 1 | |
| Convulsion | Yes | 14(3.8) | 17(4.7) | 0.69 (0.02-2.23) | 0.42 |
| | No | 120(33.2) | 211(58.3) | 1 | |
| Creatinine | Normal | 108(29.8) | 181(50) | 1 | |
| | Deranged | 18(5) | 55(15.2) | 1.82 (1.02-3.27) | 0.04 |
| Hematocrit | ≥ 33 | 110(30.4) | 187(51.7) | 1 | |
| | < 33 | 16(4.4) | 49(13.5) | 1.8(0.98-3.32) | 0.59 |

Women aged 35–44 years had significantly higher odds of unfavorable maternal outcomes compared to those aged 15–24 years (AOR: 1.41; 95% CI: 1.01–4.19; p=0.04). Nulliparous women also had significantly higher odds of unfavorable maternal outcomes compared to women with grand multiparity (AOR: 1.51;

95% CI: 1.04–5.16; p=0.03). Women with a BMI ≥30 were more likely to experience unfavorable maternal outcomes compared to those with a BMI <18.5 (AOR: 1.63; 95% CI: 1.12–6.2; p=0.031). Severe-range blood pressure (BP) records at admission were significantly associated with higher odds of unfavorable maternal outcomes compared to mild-range BP records (AOR: 1.46; 95% CI: 1.02–3.67; p=0.018). A prior history of preeclampsia was significantly associated with unfavorable maternal outcomes (AOR: 2.07; 95% CI: 1.09–4.84; p=0.028). Additionally, the presence of a headache was significantly associated with unfavorable maternal outcomes (AOR: 1.79; 95% CI: 1.01–4.72; p=0.04). (Table 6).

**Table 6: Multivariate Analysis of Factors Associated with Maternal Outcome among PEWSF at ARTH, Assela, Ethiopia, 2024**

| Variables | Category | Maternal outcome | | COR (95% CI) | AOR (95% CI) | P value |
|---|---|---|---|---|---|---|
| | | Unfavorable (%) | Favorable (%) | | | |
| Age | 15-24 | 31(8.6) | 68(18.8) | 1 | 1 | |
| | 25-34 | 72(19.9) | 146(40.3) | 0.92(0.55-1.54) | 0.86(0.39-1.91) | 0.72 |
| | 35-44 | 23(6.4) | 22(6.1) | 0.44(0.21-0.9) | 1.41(1.01-4.19) | 0.04 |
| Residence | Urban | 64(17.7) | 101(27.9) | 1 | 1 | |
| | Rural | 62(17.1) | 135(37.3) | 1.38(0.9-2.13) | 1.41(0.76-2.62) | 0.28 |
| Parity | Nulliparous | 64(17.7) | 69(19.1) | 0.7(0.2-2.5) | 1.51(1.04-5.16) | 0.03 |
| | 1-4 | 52(14.4) | 143(39.5) | 1.51(0.43-5.4) | 0.72(0.16-3.3) | 0.67 |
| | Grand multiparity | 10(2.8) | 24(6.6) | 1 | 1 | |
| Birth interval | < 2 years | 45(18.4) | 61(24.9) | 1.89(1.01-3.23) | 0.7(0.38-1.29) | 0.25 |
| | ≥ 2 years | 39(15.9) | 100(40.8) | 1 | 1 | |
| BMI | <18.5 | 1(0.3) | 12(3.3.) | 1 | 1 | |
| | 18.5-24.9 | 74(20.4) | 141(39) | 0.16(0.02-1.25) | 1.94(0.56-4.51) | 0.514 |
| | 25-29.9 | 34(9.4) | 65(18) | 0.16(0.02-1.27) | 0.75(0.09-3.23) | 0.167 |
| | ≥ 30 | 11(30.7) | 47(13) | 0.09(0.01-0.75) | 1.63(1.12-6.2) | 0.031 |
| BP at admission | Severe | 113(31.2) | 188(51.9) | 2.22(1.15-4.3) | 1.46(1.02-3.67) | 0.018 |
| | Mild | 13(3.6) | 48(13.3) | 1 | 1 | |
| Family history of preeclampsia | Yes | 67(18.5) | 85(23.5) | 2.02(1.3-3.13) | 0.56(0.69-3.35) | 0.46 |
| | No | 59(16.3) | 151(41.7) | 1 | 1 | |
| History of preeclampsia | Yes | 64(17.7) | 84(23.2) | 1.87(1.2-2.9) | 2.07(1.09-4.84) | 0.028 |
| | No | 62(17.1) | 152(42) | 1 | 1 | |
| Spouse change | Yes | 56(15.5) | 51(14.1) | 2.9(1.82-4.64) | 0.36(0.07-1.23) | 0.46 |
| | No | 70(19.3) | 185(51.1) | 1 | 1 | |
| Number of fetus | Singleton | 77(21.3) | 194(53.6) | 1 | 1 | |
| | Multiple | 49(13.5) | 42(11.6) | 0.34(0.21-0.56) | 0.87(0.61-2.03) | 0.62 |
| Headache | Yes | 74(20.4) | 94(26) | 2.15(1.38-3.34) | 1.79(1.01-4.72) | 0.04 |
| | No | 52(14.4) | 142(39.2) | 1 | 1 | |
| Creatinine | Normal | 108(29.8) | 181(50) | 1 | 1 | |
| | Deranged | 18(5) | 55(15.2) | 1.82(1.02-3.27) | 0.87(0.18-2.77) | 0.39 |

## Discussion

An institutional-based cross-sectional study was conducted among mothers with preeclampsia with severe features at Asella Teaching and Referral Hospital (ARTH), Assela, Ethiopia, from August to December 2024. The study aimed to assess maternal outcomes and associated factors in women admitted with this condition. The findings revealed a prevalence of unfavorable maternal outcomes at 34.8% (95% CI: 34.59–35.01). Significant factors associated with these unfavorable outcomes included advanced maternal age (35–44 years), nulliparity, high BMI (≥30), severe hypertension at admission, a history of preeclampsia, and the presence of headaches upon admission. The findings of the present study revealed that the magnitude of unfavorable maternal outcomes among mothers with preeclampsia with severe features (PEWSF) was 34.8% (95% CI: 34.59–35.01). This result is comparable with studies conducted at Abebech Gobena Mothers and Children Health and Saint Peter's Specialized Hospital, as well as an Amhara region referral hospital and Saint Paulos Hospital, where 33.9%, 37.7%, and 31.7% of mothers with PEWSF experienced unfavorable outcomes, respectively [14-16]. This finding is higher than a study conducted in Zanzibar (26.3%), the USA (10%), and Thailand (9.5%) [17-19]. This discrepancy could be due to variations in the study population and the likelihood of better healthcare systems. However, our finding is lower than a study conducted in Mekelle (53.7%) and Sidama (43%) [20,21]. This discrepancy may be attributed to differences in study design and healthcare delivery systems across various regions of Ethiopia. The current study also indicated that the most common unfavorable outcomes among mothers with PEWSF were abruptio placenta (28.6%), HELLP syndrome (26.2%), and postpartum hemorrhage (PPH) (10.2%). Similarly, studies conducted at Abebech Gobena Mothers and Children Health and Saint Peter's Specialized Hospital, Sidama

region, and Thailand also revealed that placental abruption, PPH, APH, acute kidney injury (AKI), and heart failure were the most commonly detected unfavorable outcomes among mothers with PEWSF [15,19,21]. In this study, women aged 35–44 years had significantly higher odds of unfavorable maternal outcomes (AOR=1.41, P=0.04). Several studies have shown that older maternal age is a risk factor for adverse pregnancy outcomes. A study by Gilboa et al. reported that women aged ≥35 years are at higher risk for preeclampsia and related complications, such as maternal organ dysfunction [22]. Similarly, a study in Ethiopia by Mengistu and Kuma (2020) found that older age was a significant factor in unfavorable maternal outcomes in women with hypertensive disorders in pregnancy [23]. The association between advanced maternal age and poor maternal outcomes is well-documented, as older women are more likely to have comorbidities such as diabetes, hypertension, and obesity, all of which increase the risk of preeclampsia and other complications. Nulliparous women had significantly higher odds of unfavorable maternal outcomes (AOR=1.51, P=0.03) compared to multiparous mothers. Parity is a well-known factor influencing pregnancy outcomes. Nisly et al. identified higher risks for nulliparous women, attributing these risks to first-time exposure to pregnancy-induced physiological changes and potential gaps in care due to unfamiliarity with the process [24]. Moreover, a study by Nie et al. (2024) indicated that the risk of severe preeclampsia and maternal complications decreases with increasing parity, which is consistent with the findings of this study [25]. Women with a BMI ≥30 had significantly higher odds of unfavorable outcomes (AOR=1.63, P=0.031). High BMI is a well-established risk factor for preeclampsia and adverse maternal outcomes. A study by Mrema et al. showed that obese women (BMI ≥30) are at an increased risk for preeclampsia, gestational diabetes, and cardiovascular complications during pregnancy [26]. Furthermore, Abraham and Romani found that obesity significantly raised the likelihood of preeclampsia, with severe outcomes being more common in obese women [27]. Obesity exacerbates the risk of hypertension, insulin resistance, and systemic inflammation, which are known to contribute to the development of preeclampsia. The findings from this study emphasize the critical need for weight management and monitoring in pregnant women, particularly in populations at higher risk. Severe hypertension at admission was associated with a higher likelihood of unfavorable maternal outcomes (AOR=1.46, P=0.018). Numerous studies confirm that severe hypertension at admission is a major predictor of poor maternal outcomes. For instance, Tadesse et al. demonstrated that women with severe hypertension upon admission were more likely to develop complications such as eclampsia, stroke, and organ failure [15]. In another study in Tanzania, Manyami et al. found that severe hypertension was associated with increased maternal mortality and morbidity [28]. This finding underscores the importance of early detection and aggressive management of hypertension in pregnant women, particularly those with preeclampsia, to reduce the risk of adverse outcomes. A history of preeclampsia was significantly associated with unfavorable maternal outcomes (AOR=2.07, P=0.028). A history of preeclampsia is a well-known risk factor for recurrence in subsequent pregnancies. Khedagi and Belo found that women with a history of preeclampsia have a significantly higher risk of developing it in subsequent pregnancies, which is linked to increased maternal morbidity and mortality [29]. Barton and Sibia et al. also reported that women with a history of preeclampsia are at a higher risk for severe complications in future pregnancies [30]. The higher risk of unfavorable outcomes in women with a history of preeclampsia can be attributed to the persistence of underlying risk factors such as endothelial dysfunction and vascular abnormalities, which predispose them to complications in subsequent pregnancies. Headache was associated with higher odds of unfavorable outcomes (AOR=1.79, P=0.04). Headache is a common symptom of preeclampsia, and its presence is often correlated with severe disease. A study by Wood et al. found that severe headache in pregnant women is frequently linked to an increased risk of maternal complications, including stroke and eclampsia [31]. Similarly, Miller and Volibracht et al. noted that headache, especially when associated with other symptoms like visual disturbances, could be indicative of worsening preeclampsia [32]. The presence of headache in women with preeclampsia is an important clinical sign, and its association with unfavorable outcomes emphasizes the need for close monitoring and management to prevent escalation to more severe complications.

**Declarations**

Ethics Approval and Consent to Participate: Arsi University ethical review board approved the study. Issues of rights, privacy, and confidentiality ensured during data collection period. Participants had the right to participate or not and to withdraw at any time when they feel discomfort.

**Availability of Data and Materials:** The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

**Competing Interests:** The authors declare that they have no competing interests.

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**Authors' Contributions**

EB=Original draft preparation, Conceptualization, Methodology, Investigation, data curation,
MTA= Conceptualization, Methodology, Analysis, data curation,
LT= Original draft preparation, Conceptualization, Methodology, Review and editing HK=Analysis, Methodology, Review and editing
AW= Methodology, Review and editing

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