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RESEARCH ARTICLE

# Study on Risk Factors for Preeclampsia in Pregnant Women in a Tertiary Care Hospital

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**Abstract:** Preeclampsia remains a significant cause of maternal and fetal morbidity worldwide. This prospective observational study investigated risk factors and clinical outcomes associated with preeclampsia in 36 pregnant women at a tertiary care hospital over six months. The study evaluated the prevalence of comorbidities and their relationship with preeclampsia severity. Hypertension emerged as the most common comorbidity (63.8%), followed by anemia and obesity (11.1% each). Statistical analysis revealed significant associations between maternal obesity and preeclampsia severity (p=0.042). Notably, severe preeclampsia showed a strong correlation with low-birth weight outcomes (p=0.015), with 18 of 22 severe cases resulting in low-birth weight infants. The study found no significant associations between preeclampsia severity and other factors including anemia, hypothyroidism, and mode of delivery. Age distribution analysis showed the highest prevalence in the 31-35 years age group. This research shows the critical importance of early identification and management of high-risk patients, particularly those with obesity and hypertension. Regular antenatal monitoring and targeted interventions for weight management and blood pressure control could potentially reduce preeclampsia-related complications. Limitations of the study including sample size and single-center design suggest the need for larger, multi-center studies to better understand the complex interplay of factors influencing preeclampsia development and progression.

**Keywords:** Preeclampsia; Maternal obesity, Low-birth weight; Hypertension; Pregnancy.

## 1. Introduction

Preeclampsia represents a significant pregnancy complication defined by new-onset hypertension (blood pressure >140/90 mmHg) occurring after 20 weeks of gestation. This multisystem disorder significantly impacts maternal and fetal health, contributing substantially to global maternal mortality and morbidity [1]. The condition particularly affects both primigravida and multigravida women, with improper placentation serving as a primary pathophysiological mechanism [2]. The pathogenesis of preeclampsia involves complex interactions between placental dysfunction and maternal systemic response. A critical component of this process is the imbalance between angiogenic and anti-angiogenic factors. Research has demonstrated significant dysregulation in the expression of soluble fms-like tyrosine kinase-1 (sFlt-1) and placental growth factor (PlGF). This imbalance manifests through elevated circulating sFlt-1 levels relative to PlGF, with corresponding alterations in placental receptor expression patterns [3].

Clinical management of preeclampsia currently focuses on symptomatic treatment and careful monitoring. Standard interventions include antihypertensive medications such as hydralazine and labetalol, combined with magnesium sulfate for seizure prophylaxis. These treatments aim to stabilize maternal condition and extend pregnancy duration when possible, though they do not address the underlying pathology [4]. A particularly concerning aspect of preeclampsia is its association with adverse fetal outcomes, notably low birth weight (LBW). The relationship between preeclampsia and fetal growth restriction stems from compromised placental function and reduced nutrient transfer [5]. Studies consistently demonstrate that LBW infants face increased risks of perinatal mortality and long-term health complications [6, 7, 8].

The role of maternal obesity in preeclampsia development has gained increasing attention. Research indicates that women with elevated body mass index (BMI) face a three to four-fold increased risk of developing preeclampsia compared to those with normal BMI [9, 10]. This association likely reflects the complex interplay between adipose tissue dysfunction, inflammatory processes, and vascular complications.

Several critical complications can arise from preeclampsia. HELLP syndrome (Hemolysis, Elevated Liver enzymes, Low Platelets) represents a severe variant characterized by significant hematological and hepatic dysfunction. Eclampsia, marked by the occurrence

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of seizures in preeclamptic patients, poses an immediate threat to maternal life. Additionally, gestational hypertension, while initially presenting without proteinuria, may progress to full preeclampsia in up to 50% of cases [11].

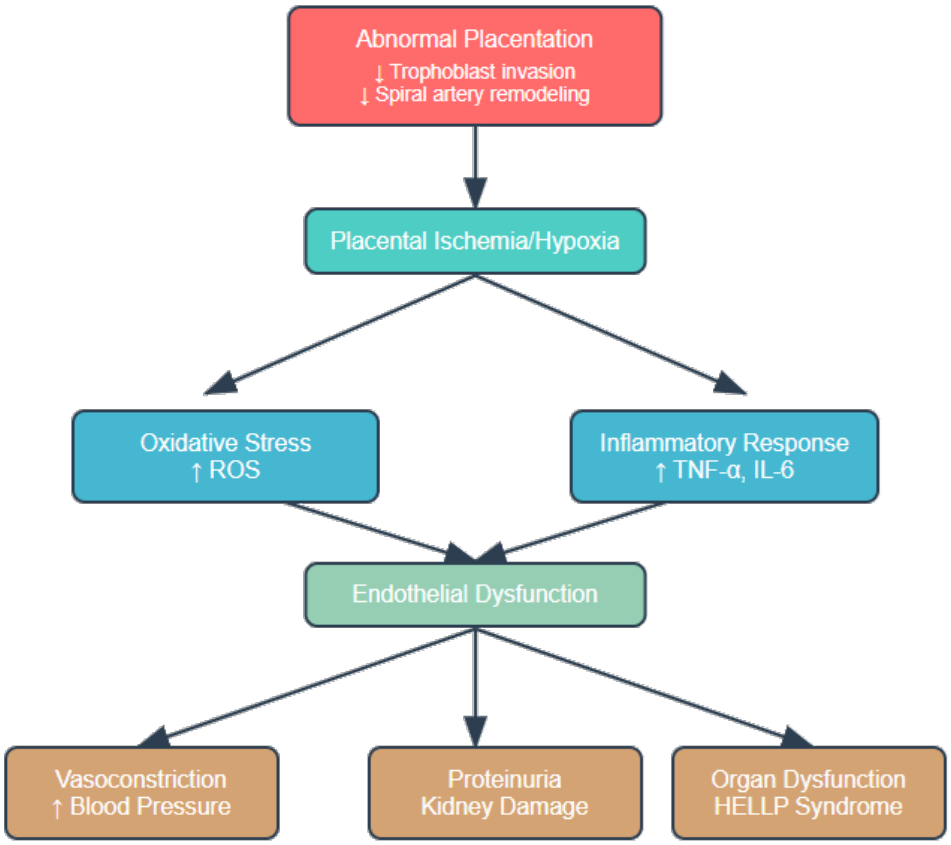


**Figure 1. Pathophysiological mechanism of preeclampsia**

The identification of reliable predictive markers for preeclampsia remains an active area of research. Current evidence suggests that a combination of clinical risk factors, biochemical markers, and biophysical measurements may provide the most accurate risk assessment [12].

## 2. Methodology

### 2.1. Study Design

This prospective observational study was conducted over six months from October 2023 to February 2024 at a tertiary care hospital. The research protocol followed standard ethical guidelines, with institutional review board approval obtained prior to study initiation.

### 2.2. Study Population

The study enrolled pregnant women diagnosed with preeclampsia who met specific inclusion criteria. Eligible participants included women beyond 20 weeks of gestation with a confirmed diagnosis of preeclampsia based on standard clinical criteria. The study also included multiparous women with a previous history of preeclampsia. All participants provided written informed consent before enrollment.

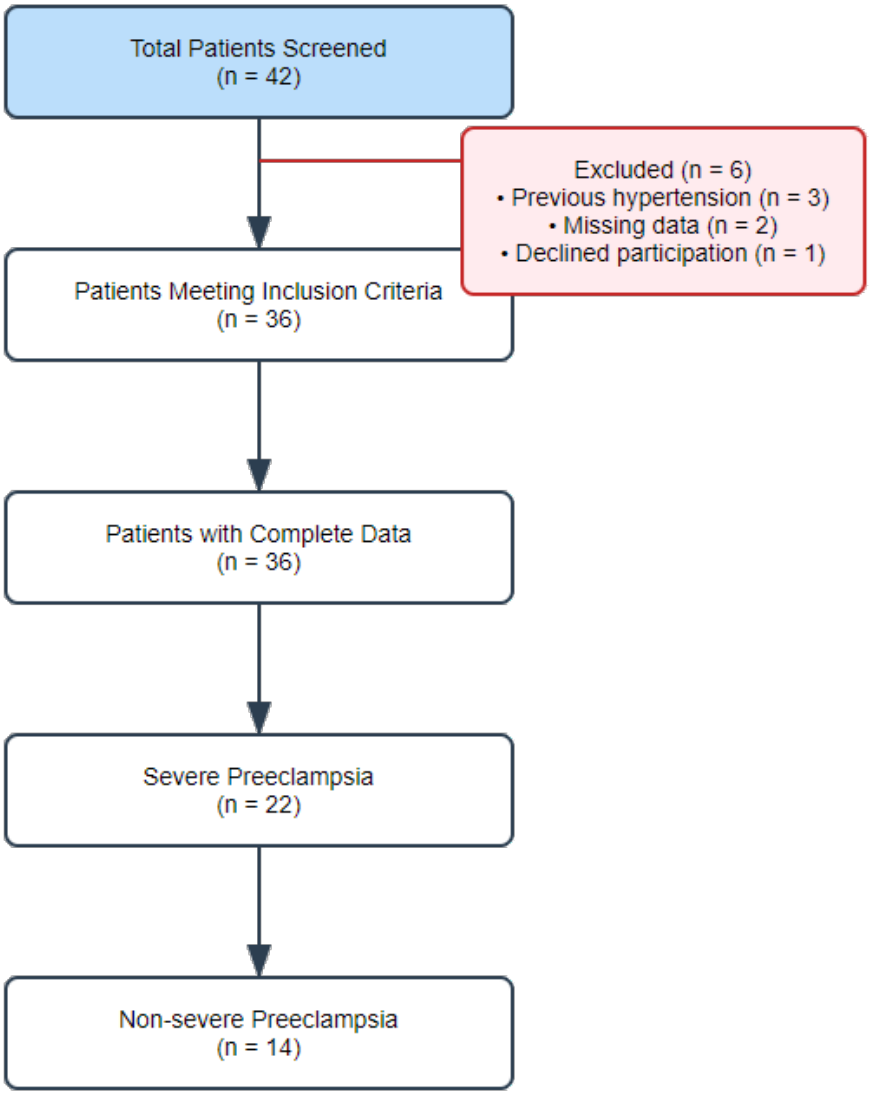


**Figure 2. Study participant flow diagram**

### 2.3. Sample Size and Selection

A total of 36 patients were enrolled during the study period. The sample size was determined based on the hospital's preeclampsia case prevalence and feasibility considerations. Patient recruitment occurred through systematic screening of pregnant women presenting to the gynecology department with symptoms suggestive of preeclampsia.

### 2.4. Data Collection

Clinical data was systematically collected using a standardized data collection form specifically designed for the study. The comprehensive data collection included demographic characteristics, medical history, comorbidities, current pregnancy details, clinical parameters, laboratory findings, and pregnancy outcomes. The research team obtained data through direct patient interviews and medical record review, ensuring completeness and accuracy of information.

### 2.5. Clinical Assessment

Preeclampsia severity was classified according to current international guidelines. Blood pressure measurements were performed using calibrated devices following standardized protocols. Additional clinical parameters, including proteinuria, edema, and systemic symptoms, were documented systematically according to established clinical protocols.

**Table 1.** Clinical parameters used for severity classification

| Parameter | Non-severe Preeclampsia | Severe Preeclampsia |
|---|---|---|
| **Systolic Blood Pressure** | ≥140 to <160 mmHg | ≥160 mmHg |
| **Diastolic Blood Pressure** | ≥90 to <110 mmHg | ≥110 mmHg |
| **Proteinuria** | ≥300 mg/24h or ≥1+ dipstick | ≥5g/24h or ≥3+ dipstick |
| **Headache** | Absent | Persistent, severe |
| **Visual Disturbances** | Absent | Present |
| **Upper Abdominal Pain** | Absent | Present |
| **Serum Creatinine** | Normal | >1.1 mg/dL |
| **Platelet Count** | Normal | <100,000/μL |
| **Liver Enzymes** | Normal | Elevated (2× normal) |
| **Pulmonary Edema** | Absent | Present |

### 2.6. Outcome Measures

The study evaluated several primary outcomes, including preeclampsia severity, mode of delivery, birth weight, maternal complications, and neonatal outcomes. Secondary outcomes focused on examining the association between various risk factors and preeclampsia severity. These measurements provided comprehensive insights into both maternal and fetal outcomes.

### 2.7. Statistical Analysis

Data analysis was performed using appropriate statistical software. The analytical approach incorporated chi-square tests for categorical variables and Fisher's exact test when cell frequencies were low. The significance level was set at $p<0.05$. Descriptive statistics were utilized for demographic data presentation. The analysis focused on identifying associations between risk factors and preeclampsia severity, with particular attention to age distribution patterns, impact of comorbidities, relationship with birth weight, and delivery outcomes.

## 3. Results and discussion

### 3.1. Demographic Characteristics

The study analyzed data from 36 patients monitored between October 2023 and February 2024. Age distribution analysis revealed that the majority of participants are within the 31-35 years age group, representing 36.1% (n=13) of the study population. The 18-25 years age group comprised 33.3% (n=12), while 22.2% (n=8) were between 26-30 years, and 8.3% (n=3) were between 36-40 years.

### 3.2. Prevalence of Risk Factors

Hypertension emerged as the predominant comorbidity, affecting 63.8% (n=23) of the study population. Both anemia and obesity showed equal prevalence at 11.1% (n=4) each. Hypothyroidism was present in 8.33% (n=3) of cases, while diabetes mellitus was observed in 5.55% (n=2) of participants.

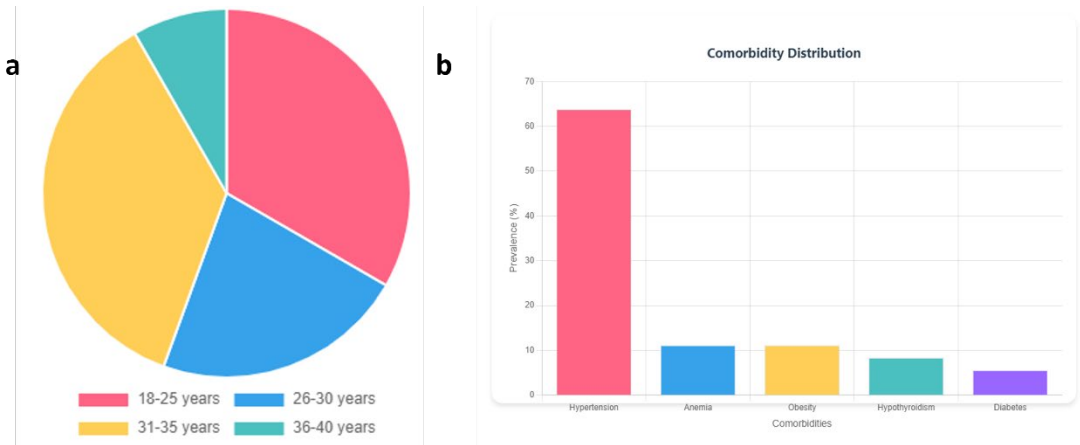


**Figure 3. a. Age Distribution b. Distribution of comorbidities among study participants**

### 3.3. Risk Factor Associations with Age Groups

Statistical analysis of the relationship between risk factors and age groups yielded a p-value of 0.760541, exceeding the 0.05 significance threshold. This finding indicates no significant association between age groups and the distribution of risk factors. The detailed distribution showed varying patterns across age groups, with hypertension being the most prevalent condition across all age categories.

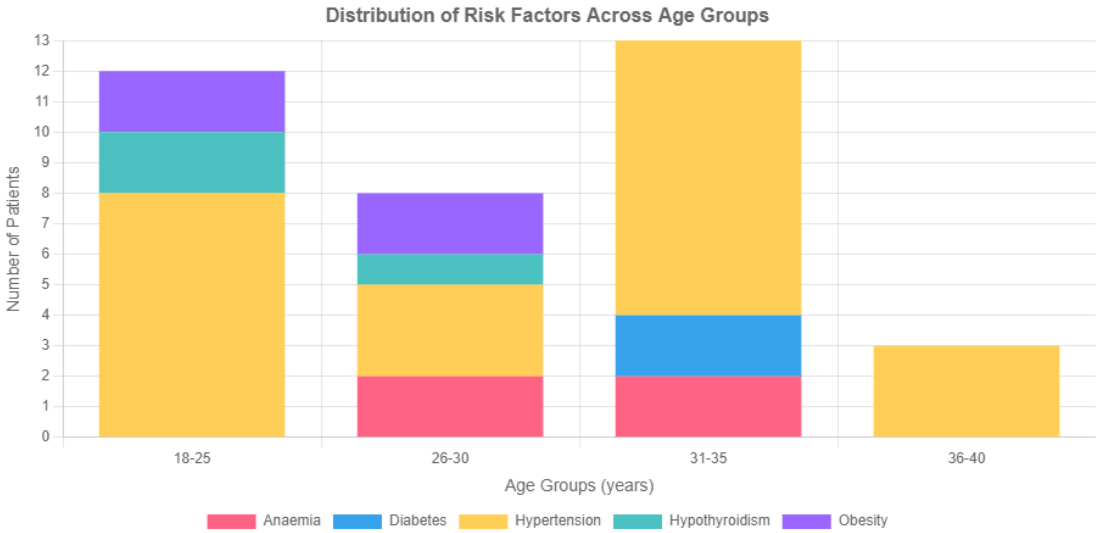


**Figure 4. Risk factor distribution across age groups**

### 3.4. Preeclampsia Severity and Associated Factors

The analysis revealed several significant associations between preeclampsia severity and various clinical parameters. A notable finding was the relationship between obesity and preeclampsia severity (p=0.042145), demonstrating a significant correlation. Among obese patients, the distribution between severe and non-severe preeclampsia showed distinct patterns. The relationship between preeclampsia severity and delivery method was examined, comparing LSCS (Lower Segment Cesarean Section) and NVD (Normal Vaginal Delivery) outcomes. The analysis produced a p-value of 0.360865, indicating no significant association between severity and delivery method.

**Table 2.** Preeclampsia severity and delivery method outcomes

| **Delivery Method** | **Non-severe Preeclampsia (n=14)** | **Severe Preeclampsia (n=22)** | **Total (n=36)** |
|---|---|---|---|
| Vaginal Delivery | 6 (42.9%) | 4 (18.2%) | 10 (27.8%) |
| Emergency Cesarean Section | 5 (35.7%) | 15 (68.2%) | 20 (55.5%) |
| Elective Cesarean Section | 3 (21.4%) | 3 (13.6%) | 6 (16.7%) |
| **Total** | **14 (100%)** | **22 (100%)** | **36 (100%)** |

### 3.5. Birth Weight Outcomes

A significant association emerged between preeclampsia severity and infant birth weight (p=0.015629). Among severe preeclampsia cases, 18 resulted in low birth weight infants, while only 4 produced normal birth weight babies. In non-severe cases, the distribution was more balanced, with 6 low birth weight and 8 normal birth weight infants.

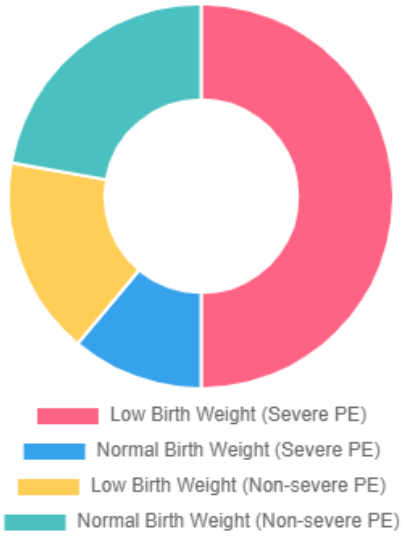


**Figure 5. Birth weight distribution by preeclampsia severity**

### 3.6. Comorbidity Analysis

Analysis of anemia's association with preeclampsia severity yielded a p-value of 0.545599, indicating no significant correlation. Similarly, the relationship between hypothyroidism and preeclampsia severity showed no significant association (p=0.836664).

**Table 6.** Comorbidity associations with preeclampsia severity

| Comorbidity | Non-severe Preeclampsia (n=14) | Severe Preeclampsia (n=22) | Total (n=36) |
|---|---|---|---|
| Anemia | 1 (7.1%) | 3 (13.6%) | 4 (11.1%) |
| Diabetes | 0 (0%) | 2 (9.1%) | 2 (5.6%) |
| Hypertension | 8 (57.1%) | 15 (68.2%) | 23 (63.9%) |
| Hypothyroidism | 2 (14.3%) | 1 (4.5%) | 3 (8.3%) |
| Obesity | 3 (21.4%) | 1 (4.5%) | 4 (11.1%) |
| **Total Comorbidities** | **14 (100%)** | **22 (100%)** | **36 (100%)** |

## 4. Discussion

This prospective observational study shows the predominance of cases in the 31-35 age group aligns with current literature suggesting increased preeclampsia risk with advancing maternal age [13]. The high prevalence of hypertension (63.8%) among study participants shows its role as a primary risk factor. This finding reinforces existing evidence regarding the central role of cardiovascular dysfunction in preeclampsia pathogenesis [14]. The equal prevalence of anemia and obesity (11.1% each) presents an interesting pattern, though their impacts on preeclampsia severity showed divergent trends. A particularly significant finding was the strong association between preeclampsia severity and low birth weight outcomes (p=0.015629). The observation that 18 out of 22 severe preeclampsia cases resulted in low birth weight infants supports existing literature on the impact of preeclampsia on fetal growth restriction [15]. This relationship likely stems from compromised placental perfusion and subsequent fetal nutrition limitations. The significant association between obesity and preeclampsia severity (p=0.042145) aligns with current understanding of adipose tissue's role in inflammatory processes and endothelial dysfunction [16]. However, the lack of significant associations between preeclampsia severity and factors such as anemia (p=0.545599) and hypothyroidism (p=0.836664) suggests these conditions might play a less direct role in disease progression than previously thought. The absence of a significant relationship between delivery method and preeclampsia severity (p=0.360865) indicates that the choice between LSCS and NVD might depend more on individual clinical circumstances than disease severity alone. This finding supports a personalized approach to delivery planning in preeclamptic patients [17]. The study's findings regarding age distribution and risk factor associations, while not statistically significant (p=0.760541), provide valuable insights for clinical practice. These results suggest that preeclampsia risk assessment should consider multiple factors rather than focusing solely on age-related risk [18]. Clinical implications of these findings suggest the need for enhanced monitoring of pregnant women with obesity and pre-existing hypertension. Implementation of early intervention strategies, particularly for weight management and blood pressure control, could potentially reduce adverse outcomes [19].

## 5. Conclusion

In conclusion, this prospective observational study identified hypertension as the predominant comorbidity (63.8%) among 36 preeclamptic patients, with variable frequencies of anemia, obesity, diabetes mellitus, and hypothyroidism. Statistical analysis demonstrated significant correlations between preeclampsia severity and both obesity ($p=0.042145$) and low birth weight outcomes ($p=0.015629$), while other factors such as hypothyroidism showed no significant associations ($p=0.836664$).

## Compliance with ethical standards

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*Conflict of interest statement*

The authors report no conflicts of interest that could have affected this work. No funding was received for this case report.

*Statement of ethical approval*

This case report was conducted in accordance with the ethical standards of our institutional research committee and with the 1964 Helsinki Declaration and its later amendments. No experimental interventions were performed as part of this case report.

*Statement of informed consent*

The patient provided written informed consent for publishing of this case report and any related photos. All patient identifiable information has been removed to ensure anonymity

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