

## A STUDY ON HDP GESTOSIS SCORE AS A PREDICTOR OF PRE ECLAMPSIA

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### ABSTRACT

**Background:** Preeclampsia is a major cause of maternal and perinatal morbidity and mortality worldwide. Early identification of women at risk is essential, particularly in resource-limited settings. This study evaluated the association of HDP Gestosis Score risk factors with preeclampsia and assessed its usefulness as a clinical risk assessment tool. **Materials and Methods:** This hospital-based unmatched case-control study was conducted in the Department of Obstetrics and Gynaecology, Government Vellore Medical College, Tamil Nadu, from July 2021 to June 2022. A total of 200 pregnant women were included, comprising 100 women with preeclampsia/eclampsia and 100 controls without preeclampsia. Clinical history, antenatal records, and HDP Gestosis Score risk factors were evaluated. Logistic regression analysis was performed to identify significant predictors of preeclampsia. **Result:** Age <19 years (14% vs 3%), primigravidity (61% vs 38%), MAP >85 mmHg (84% vs 0%), excessive gestational weight gain (10% vs 1%), multiple pregnancy (7% vs 2%), previous HDP (6% vs 1%), pregestational diabetes mellitus (2% vs 1%), and chronic hypertension (9% vs 0%) were more common among cases. Socioeconomic class II (AOR: 2.255; p=0.032) and class III (AOR: 2.0; p=0.043) showed significant association with preeclampsia. Significant independent predictors included teenage pregnancy (AOR: 61.832; p=0.005), obesity (AOR: 10.442; p=0.022), primigravidity (AOR: 17.593; p=0.005), pregestational diabetes mellitus (p=0.004), and chronic hypertension (p=0.002). **Conclusion:** Low socioeconomic status, teenage pregnancy, primigravidity, obesity, pregestational diabetes mellitus, and chronic hypertension were important predictors of preeclampsia. The HDP Gestosis Score is a simple, practical, and cost-effective tool for identifying high-risk women during antenatal care.

## INTRODUCTION

Hypertensive disorders in pregnancy (HDP) comprise a spectrum of conditions ranging from chronic hypertension to severe multisystem disorders such as preeclampsia. These disorders complicate approximately 5–10% of pregnancies worldwide and remain a major cause of maternal and perinatal morbidity and mortality. The incidence of gestational hypertension is around 2%, chronic hypertension 1%, preeclampsia 2–4%, and HELLP syndrome approximately 0.5%.<sup>[1,2]</sup>

According to the World Health Organization (WHO), hypertensive disorders of pregnancy are among the leading causes of maternal mortality worldwide and contribute significantly to adverse maternal and neonatal outcomes.<sup>[3]</sup> Globally, 76,000 women and 500,000 babies die each year due to complications

related to hypertensive disorders and preeclampsia.<sup>[3]</sup> Intracranial hemorrhage remains one of the most common causes of maternal death associated with preeclampsia.<sup>[2]</sup>

Preeclampsia is a pregnancy-specific multisystem disorder affecting approximately 3–8% of pregnancies worldwide and is an important cause of maternal complications, fetal growth restriction, iatrogenic preterm birth, and perinatal mortality.<sup>[1,2]</sup> The incidence is higher among nulliparous women, ranging from 3–10%. Development of preeclampsia following gestational hypertension usually occurs within an average duration of five weeks, particularly when hypertension develops before 34 weeks of gestation.<sup>[4]</sup>

In addition to immediate maternal and fetal complications, preeclampsia is associated with increased long-term cardiovascular morbidity among

affected women.<sup>[5-7]</sup> Women with a history of preeclampsia are at higher risk of developing chronic hypertension, ischemic heart disease, stroke, and other cardiovascular disorders later in life.<sup>[5,6]</sup>

In low- and middle-income countries, factors such as poor socioeconomic status, limited access to antenatal care, delayed referral, transport difficulties, and lack of high-dependency care units contribute significantly to adverse maternal outcomes. Early identification of women at risk for preeclampsia is therefore essential to reduce maternal and perinatal complications.<sup>[8,9]</sup>

Various screening methods have been recommended by organizations such as FIGO, NICE, and ACOG for early detection of preeclampsia. However, in many resource-limited settings, advanced biomarker testing and universal screening facilities are not always feasible. Under such circumstances, simple clinical risk assessment models based on maternal history and antenatal records are more practical and cost-effective.<sup>[8,9]</sup>

The HDP Gestosis Score, developed by FOGSI-GESTOSIS-ICOG, is a simplified clinical risk assessment tool designed to identify women at increased risk for developing preeclampsia using easily obtainable clinical parameters.<sup>[8-10]</sup> This study aimed to evaluate the association of HDP Gestosis Score risk factors with preeclampsia and to assess its usefulness in identifying women at risk for developing the disease.

## MATERIALS AND METHODS

This hospital-based unmatched case-control study was conducted in the Department of Obstetrics and Gynaecology, Government Vellore Medical College, Tamil Nadu, India, over a period of one year from July 2021 to June 2022. Institutional Ethical Committee approval was obtained prior to the commencement of the study. Written informed consent was obtained from all participants before enrolment.

**Study Population and Sampling:** A total of 200 pregnant women were included in the study and divided into two groups. The case group comprised 100 women diagnosed with preeclampsia/eclampsia who received treatment and delivered in the labour room of the study hospital during the study period. The control group included 100 pregnant women attending antenatal clinics and labour room services during the same period who did not develop preeclampsia/eclampsia.

## Inclusion and Exclusion Criteria

Women diagnosed with preeclampsia/eclampsia during pregnancy were included as cases. Pregnant women without preeclampsia/eclampsia were included as controls. Women with incomplete medical records or unwillingness to participate in the study were excluded.

**Methods:** A convenient sampling technique was used for participant recruitment. This was a non-randomised study. Detailed history taking and clinical assessment were performed for all participants. Baseline demographic and obstetric details including maternal age, gravidity, interpregnancy interval, conception by assisted reproductive techniques (ART), family history of preeclampsia or cardiovascular disease, and birth weight of the mother herself were recorded.

Antenatal care records and previous medical records were reviewed to identify risk factors included in the HDP Gestosis Score. Variables assessed included haemoglobin level, body mass index (BMI), serum lipid profile, thyroid status, pregestational and gestational diabetes mellitus, chronic hypertension, chronic kidney disease, mental illness, polycystic ovarian syndrome (PCOS), thrombophilia, autoimmune disorders such as systemic lupus erythematosus (SLE) and antiphospholipid antibody syndrome (APLA), history of hypertensive disorders in previous pregnancy, and mean arterial pressure (MAP) at the first antenatal visit.

**Statistical Analysis:** Continuous variables were expressed as mean  $\pm$  standard deviation, while categorical variables were expressed as frequency and percentage. Logistic regression analysis was performed to evaluate the association between HDP Gestosis Score risk factors and preeclampsia. Adjusted odds ratios (AOR) with 95% confidence intervals (CI) were calculated. A p-value of  $<0.05$  was considered statistically significant.

## RESULTS

The mean age was  $25 \pm 6$  years among cases and  $26 \pm 4$  years among controls. Mean weight was  $61 \pm 11$  kg in cases and  $60 \pm 11$  kg in controls. Mean BMI was  $26.1 \pm 4.8$  kg/m<sup>2</sup> among cases and  $25.8 \pm 4.7$  kg/m<sup>2</sup> among controls. Socioeconomic class IV was more common among cases (42%) compared to controls (26%) [Table 1].

**Table 1: Baseline demographic and socioeconomic characteristics**

Variable	Cases	Controls	p-value
	Mean $\pm$ SD/ n (%)		
Age (years)	25 $\pm$ 6	26 $\pm$ 4	0.153
Weight (kg)	61 $\pm$ 11	60 $\pm$ 11	0.702
BMI (kg/m <sup>2</sup> )	26.1 $\pm$ 4.8	25.8 $\pm$ 4.7	0.759
Socioeconomic Class II	23 (23%)	30 (30%)	0.032
Socioeconomic Class III	35 (35%)	44 (44%)	0.043
Socioeconomic Class IV	42 (42%)	26 (26%)	0.054

Age <19 years (14% vs 3%), primigravidity (61% vs 38%), MAP >85 mmHg (84% vs 0), and excessive weight gain during pregnancy (10% vs 1%) were more common among cases. Other Score 1 risk

factors showed no difference between groups [Table 2].

**Table 2: Distribution of HDP Gestosis Score 1 Risk Factors**

Risk Factor	Cases n (%)	Controls n (%)
Age >35 years	8 (8%)	6 (6%)
Age <19 years	14 (14%)	3 (3%)
Maternal anemia	23 (23%)	18 (18%)
Obesity (BMI >30)	16 (16%)	15 (15%)
Primigravida	61 (61%)	38 (38%)
Woman born as SGA	5 (5%)	6 (6%)
Family history of cardiovascular disease	7 (7%)	3 (3%)
PCOS	12 (12%)	9 (9%)
Interpregnancy interval >5 years	4 (4%)	7 (7%)
Conceived with ART (IVF/ICSI)	1 (1%)	1 (1%)
MAP >85 mmHg	84 (84%)	0
Chronic vascular disease (Dyslipidemia)	2 (2%)	0
Excessive weight gain during pregnancy	10 (10%)	1 (1%)

Maternal hypothyroidism (9% vs 9%), GDM (15% vs 15%), multiple pregnancy (7% vs 2%), and HDP in previous pregnancy (6% vs 1%) were observed more

frequently among cases compared to controls. [Table 3].

**Table 3: Distribution of HDP Gestosis Score 2 Risk Factors**

Risk Factor	Cases n (%)	Controls n (%)
Maternal hypothyroidism	9 (9%)	9 (9%)
Family history of preeclampsia	1 (1%)	0
GDM	15 (15%)	15 (15%)
Obesity BMI >35 kg/m <sup>2</sup>	5 (5%)	5 (5%)
Multiple pregnancy	7 (7%)	2 (2%)
HDP in previous pregnancy	6 (6%)	1 (1%)

Pre-GDM (2% vs 1%) and chronic hypertension (9% vs 0) were more frequent among cases. Mental disorder was observed in 2% of cases and 1% of

controls but was not significant in multivariate analysis [Table 4].

**Table 4: Distribution of HDP Gestosis Score 3 Risk Factors**

Risk Factor	Cases n (%)	Controls n (%)
Pre-GDM	2 (2%)	1 (1%)
Chronic hypertension	9 (9%)	0
Mental disorder	2 (2%)	1 (1%)
Autoimmune diseases (SLE/RA/APLA)	0	1 (1%)
Inherited/acquired thrombophilia	0	0
Maternal CKD	0	0
Pregnancy with ART (OD/Surrogacy)	0	0

Socioeconomic class II (AOR: 2.255; p=0.032) and class III (AOR: 2.0; p=0.043) showed significant

association with preeclampsia. Age, weight, height, and BMI were not significant [Table 5].

**Table 5: Multivariate Logistic Regression Analysis of Demographic Variables**

Variable	Adjusted Odds Ratio	95% Confidence Interval	p-value
Age	1.043	0.984–1.106	0.153
Socioeconomic Class II	2.255	1.072–4.740	0.032
Socioeconomic Class III	2	1.023–3.907	0.043
Height	1.015	0.767–1.345	0.915
Weight	0.933	0.654–1.332	0.702
BMI	1.14	0.494–2.631	0.759

Age <19 years (AOR: 61.832; p=0.005), primigravidity (AOR: 17.593; p=0.005), obesity (AOR: 10.442; p=0.022), pre-GDM (p=0.004), and

chronic hypertension (p=0.002) were significant predictors of preeclampsia [Table 6].

**Table 6: Multivariate Logistic Regression Analysis of Significant HDP Gestosis Risk Factors**

Risk Factor	Adjusted Odds Ratio	95% Confidence Interval	p-value
Age <19 years	61.832	3.369–1134.840	0.005
Obesity (BMI >30)	10.442	1.397–78.043	0.022
Primigravida	17.593	2.424–127.672	0.005
Pre-GDM	1.091	0.067–17.705	0.004
Chronic hypertension	2	0.000–10.9	0.002

## DISCUSSION

Hypertensive disorders of pregnancy are a major cause of maternal and perinatal morbidity worldwide. This study aimed to evaluate the association of HDP Gestosis Score risk factors with preeclampsia and assess its role in identifying women at risk. The study found that low socioeconomic status, teenage pregnancy, primigravidity, obesity, pregestational diabetes mellitus, and chronic hypertension were significant predictors of preeclampsia, supporting the usefulness of HDP Gestosis Score as a simple clinical risk assessment tool.

In the present study, demographic variables such as age, weight, and BMI were comparable between cases and controls. Lower socioeconomic status was observed more frequently among women with preeclampsia. Mattsson et al., found that women who developed preeclampsia were more likely to be primiparous, obese, and from lower socioeconomic backgrounds, with low household disposable income and lower educational level significantly increasing preeclampsia risk after adjusting for maternal region of birth, age, BMI, parity, and smoking.<sup>[11]</sup> Similarly, Nakimuli et al., reported younger maternal age and lower socioeconomic status as independent risk factors for progression from preeclampsia to eclampsia, underscoring the vulnerability of socioeconomically disadvantaged populations.<sup>[12]</sup> Furthermore, Padhan et al. identified family history of hypertension and chronic hypertension as significant risk factors for preeclampsia, supporting the role of maternal risk profiling in early identification of women at risk.<sup>[13]</sup> These findings collectively suggest that lower socioeconomic status may be associated with increased risk of preeclampsia, possibly due to differences in nutrition, antenatal care access, and psychosocial stress.

In our study, teenage pregnancy, primigravidity, MAP >85 mmHg, and excessive weight gain during pregnancy were more commonly seen among cases with preeclampsia. Other HDP Gestosis Score 1 risk factors were comparable between the groups. Mattsson et al. reported that primiparity was among the independent predictors of preeclampsia.<sup>[11]</sup> Kharodia et al., reported that in women aged <19 years, the odds ratio for preeclampsia was 4.09 (95% CI: 2.05–8.18), and obesity was also a significant predictor with an OR of 5.21, which broadly corroborates our findings of teenage pregnancy and obesity as important risk factors within Score 1.10. Similarly, Gong et al., reported that prepregnancy overweight/obesity and higher gestational weight gain velocity significantly increased the risk of

preeclampsia.<sup>[14]</sup> These findings indicate that obesity, excessive weight gain, and primigravidity may represent important modifiable contributors to preeclampsia.

The current study showed that multiple pregnancy, history of hypertensive disorder in previous pregnancy, pregestational diabetes mellitus, and chronic hypertension were more common among cases. Mental disorder was more frequent among cases but was not significant in multivariate analysis. Maternal hypothyroidism and gestational diabetes mellitus were similarly distributed in both groups. Chantanahom and Phupong, reported 11.6% developed preeclampsia, identified nulliparity (AOR: 1.57) and chronic hypertension (AOR: 6.22) as the only independent clinical risk factors for preeclampsia in twin pregnancies.<sup>[15]</sup> Gazis et al., found that pregnancies complicated by pregestational diabetes mellitus had a significantly increased risk of preeclampsia (OR: 4.46; 95% CI: 3.94–5.05) compared to controls.<sup>[16]</sup> Similarly, Shimizu et al., identified prior preeclampsia as a major risk factor for recurrence in subsequent pregnancies, consistent with our observation of increased prior HDP among cases.<sup>[17]</sup> These findings suggest that Score 2 and Score 3 risk factors, particularly chronic hypertension, pre-existing diabetes, and multiple pregnancy, may identify women requiring closer antenatal surveillance.

Our analysis demonstrated that lower socioeconomic status had significant association with preeclampsia, whereas age, height, weight, and BMI did not show significant association. This finding is supported by Mattsson et al., who demonstrated that lower household income and educational level were associated with higher preeclampsia risk after multivariate adjustment.<sup>[11]</sup> Nakimuli et al. validated across two geographically distinct populations & reported that socioeconomic disadvantage was independently associated with progression from preeclampsia to eclampsia.<sup>[12]</sup> These findings collectively suggest that socioeconomic status exerts an independent effect on preeclampsia risk, possibly through pathways involving nutritional status, healthcare access, and psychosocial stress, while anthropometric variables alone are insufficient predictors in multivariate models.

The present study identified teenage pregnancy, primigravidity, obesity, pregestational diabetes mellitus, and chronic hypertension as significant predictors of preeclampsia. Kharodia et al. identified age <19 years (OR: 4.09; 95% CI: 2.05–8.18) and obesity (OR: 5.21; 95% CI: 2.75–9.85) as significant predictors.<sup>[10]</sup> Gong et al. reported that prepregnancy

obesity was independently associated with a significantly increased risk of preeclampsia, with obese women showing nearly five times higher risk compared to women with normal BMI.<sup>[14]</sup> Chantanahom and Phupong reported that chronic hypertension carried an AOR of 6.22 (95% CI: 1.98–19.57) for preeclampsia even within the specific subgroup of twin pregnancies.<sup>[15]</sup> These findings support the biological plausibility of the HDP Gestosis Score risk stratification and suggest that teenage pregnancy, nulliparity, metabolic comorbidities, and chronic hypertension contribute to increased risk of preeclampsia.

In this study, low socioeconomic status, teenage pregnancy, primigravidity, obesity, pregestational diabetes mellitus, and chronic hypertension emerged as important predictors associated with preeclampsia. Reddy et al. reported a sensitivity of 83.1%, specificity of 97.51%, positive predictive value (PPV) of 85.51%, and diagnostic accuracy of 95.35% for the gestosis score in predicting preeclampsia.<sup>[18]</sup> Furthermore, Gazis et al. reported that PGDM carried the highest independent risk for preeclampsia (OR: 4.46; 95% CI: 3.94–5.05), and Chantanahom and Phupong et al. confirmed chronic hypertension as the clinical predictor of preeclampsia in their multivariate model (AOR: 6.22).<sup>[16,15]</sup> These findings support the HDP Gestosis Score as a simple, low-cost, and clinically useful tool for identifying women at risk of preeclampsia, especially in resource-limited antenatal care settings where advanced screening methods may not be available.

Overall, the findings of the present study highlight the importance of HDP Gestosis Score risk factors in identifying women at increased risk of preeclampsia. Low socioeconomic status, teenage pregnancy, primigravidity, obesity, pregestational diabetes mellitus, and chronic hypertension were important predictors, supporting the usefulness of HDP Gestosis Score as a simple and practical risk assessment tool in routine antenatal care.

### Limitations

This study was limited by its single-center hospital-based design, relatively small sample size, convenient sampling method, and non-randomized approach, which may affect generalizability of the findings. Biochemical markers and Doppler studies were not included, and long-term maternal and fetal outcomes were not assessed.

## CONCLUSION

The present study identified low socioeconomic status, teenage pregnancy, primigravidity, obesity, pregestational diabetes mellitus, and chronic hypertension as important predictors of preeclampsia. The findings support the usefulness of the HDP Gestosis Score as a simple, low-cost, and practical clinical risk assessment tool for early identification of high-risk women, particularly in resource-limited antenatal care settings.

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