RESEARCH ARTICLE

EVALUATION OF THE HDP GESTOSIS SCORE FOR PREDICTING PREECLAMPSIA IN THE FIRST TRIMESTER OF PREGNANCY

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Manuscript Info	*Abstract*
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Background and Aims: Hypertensive disorders of pregnancy (HDP), particularly preeclampsia, are a leading cause of maternal and fetal morbidity and mortality worldwide.Despite advancements in screening, predicting preeclampsia remains a challenge, particularly in low-resource settings. The HDP Gestosis Score offers a simple, cost-effective tool to stratify risk by integrating established predictors. This study aimed to evaluate the utility of the HDP Gestosis Score in predicting preeclampsia during the first trimester.

Methods: This prospective study was conducted at BRD Medical College, Gorakhpur, over a one-year period, including 200 pregnant women. Participants were stratified into two groups: those with HDP scores ≥ 3 (high risk) and <3 (low risk). Data on clinical, demographic, and obstetric parameters were collected after obtaining ethical clearance and informed consent. Logistic regression and chi-square tests were used for statistical analysis. Diagnostic accuracy was evaluated using sensitivity, specificity, and area under the curve (AUC).

Results: The study demonstrated a hypertension prevalence of 47.5%, with 85% of hypertensive cases occurring in the high-risk group (HDP ≥ 3).Significant predictors of hypertension included chronic hypertension (OR 18.0), gestational diabetes (OR 11.5), elevated MAP >85 (OR 2.6), and autoimmune disorders (OR 9.0). The HDP Gestosis Score exhibited high sensitivity (90%) and specificity (85%), with an AUC of 0.88, validating its predictive efficacy.

Conclusion: The HDP Gestosis Score is a reliable and cost-effective tool for early identification of preeclampsia risk, enabling timely interventions to reduce adverse outcomes. Its simplicity makes it particularly beneficial in resource-limited settings.

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Introduction:-

Hypertensive disorders of pregnancy (HDP) are a significant global health challenge, contributing to substantial maternal and fetal morbidity and mortality. [1] Among these, preeclampsia stands out as a severe complication, typically presenting as hypertension with or without proteinuria after 20 weeks of gestation. [2] It affects approximately 5–7% of pregnancies worldwide and is a leading cause of maternal mortality, responsible for 14% of deaths related to pregnancy. [3] The condition not only jeopardizes maternal health but also poses significant risks to the fetus, including intrauterine growth restriction, preterm birth, placental abruption, and fetal demise. [4] Beyond the immediate pregnancy-related complications, preeclampsia increases the long-term risk of cardiovascular disease and type 2 diabetes in affected women. [5]

The pathophysiology of preeclampsia involves complex interactions, including endothelial dysfunction and an anti-angiogenic state. Dysregulation of angiogenic factors such as vascular endothelial growth factor (VEGF) and placental growth factor (PlGF) plays a crucial role in its development. [6] While extensive research has identified several risk factors—such as advanced maternal age, first pregnancies, chronic hypertension, and diabetes—the ability to predict and prevent preeclampsia remains a significant clinical challenge. [7] Existing screening modalities, including uterine artery Doppler and biochemical markers, though effective, are often limited by their cost, complexity, and accessibility, particularly in low-resource settings. [8]

The HDP Gestosis Score offers a practical and straightforward approach to address this gap. This scoring system integrates established risk factors, assigning weighted scores based on their contribution to preeclampsia risk. [9] A cumulative score of three or more identifies women as "at risk," enabling early stratification and targeted monitoring. The simplicity and cost-effectiveness of this tool make it particularly valuable in resource-constrained settings, where maternal mortality rates are disproportionately high. [10]

This study aims to evaluate the HDP Gestosis Score's efficacy as a predictive tool for preeclampsia in the first trimester of pregnancy. By examining its sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV), this research seeks to establish its reliability and utility in diverse clinical settings. The findings are intended to provide actionable insights into improving early detection and management of preeclampsia, ultimately reducing maternal and fetal morbidity and mortality. This study underscores the critical importance of timely, accurate screening tools to optimize prenatal care outcomes and achieve global maternal health targets.

Material and Methods.

Study Design and Setting: This was a prospective comparative study conducted in the Department of Obstetrics and Gynecology at BRD Medical College, Gorakhpur, over a one-year period from April 1, 2023, to March 31, 2024.

Study Population:The study included pregnant women attending the antenatal clinic during their early weeks of pregnancy.

Sampling Method:Participants were selected using a simple random sampling method.

Sample Size:The sample size was calculated using the formula

$N=Z^2pq/d^2$

where:

- p = 23%(no of women with exposure),
- q = 1 – p,
- Z = 1.96 (for a 95% confidence level),
- d=6% (absolute error).

  The calculated sample size was 189, and 200 participants were enrolled, with equal allocation to two groups:

- Group A: 100 women with an HDP Gestosis score ≥3 (high risk).
- Group B: 100 women with an HDP Gestosis score <3 (low risk).

Inclusion Criteria

1. Pregnant women in their early weeks of pregnancy attending the antenatal OPD.
2. Women providing informed consent to participate in the study.
3. Women with an HDP Gestosis score ≥3 (Group A).
4. Uncomplicated pregnancies with an HDP Gestosis score <3 (Group B).

Exclusion Criteria

1. Pregnant women with COVID-19 infection.
2. Those with liver disease, cancer, or autoimmune conditions.
3. Women with a history of drug abuse, smoking, or alcohol consumption.
4. Patients refusing consent to participate in the study.

Methodology.
All participants provided informed consent, with the study protocol approved by the Institutional Ethics Committee. Detailed demographic, obstetric, and medical histories were collected. Comprehensive physical and obstetrical examinations were performed, including assessments of blood pressure, urine protein levels, and abdominal and speculum examinations. Laboratory investigations included routine tests such as CBC, LFT, KFT, and additional tests like autoimmune markers where indicated.

The HDP Gestosis scoring system was utilized to stratify participants based on their risk for hypertensive disorders of pregnancy. Risk factors were categorized as follows:

- Low-risk factors (score = 1): Advanced maternal age, obesity, anemia, primigravida status, and chronic vascular disease.
- Moderate-risk factors (score = 2): Hypothyroidism, family history of preeclampsia, and multifetal pregnancy.
- High-risk factors (score = 3): Chronic hypertension, pregestational diabetes, and autoimmune disorders.

Statistical   Analysis
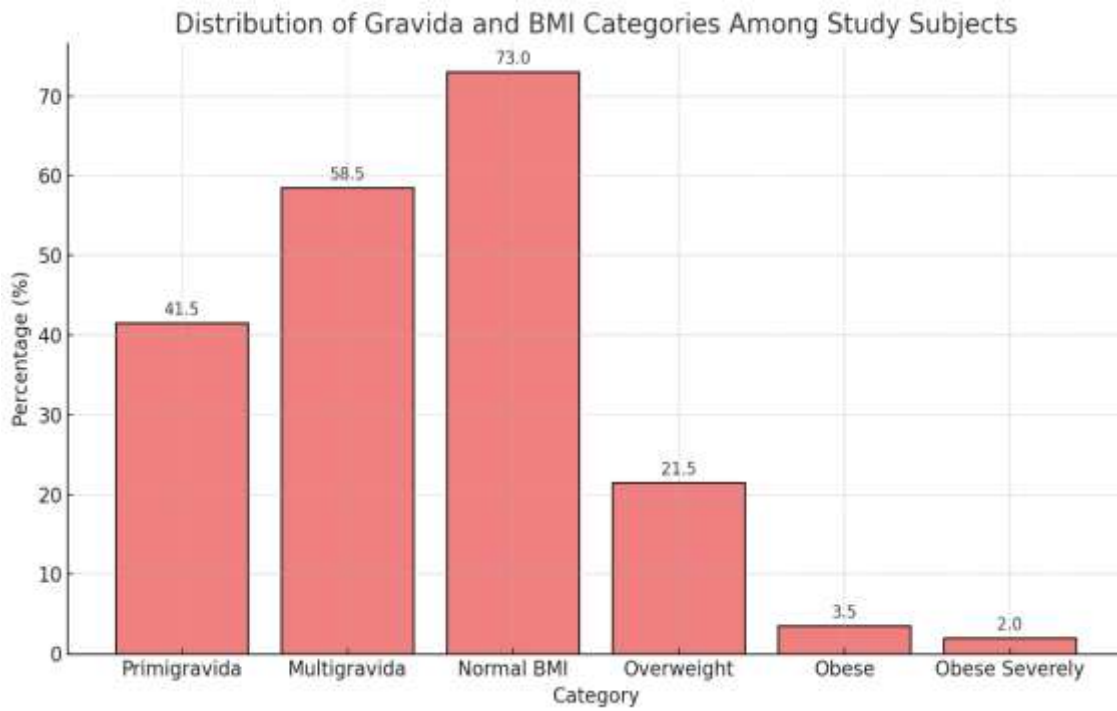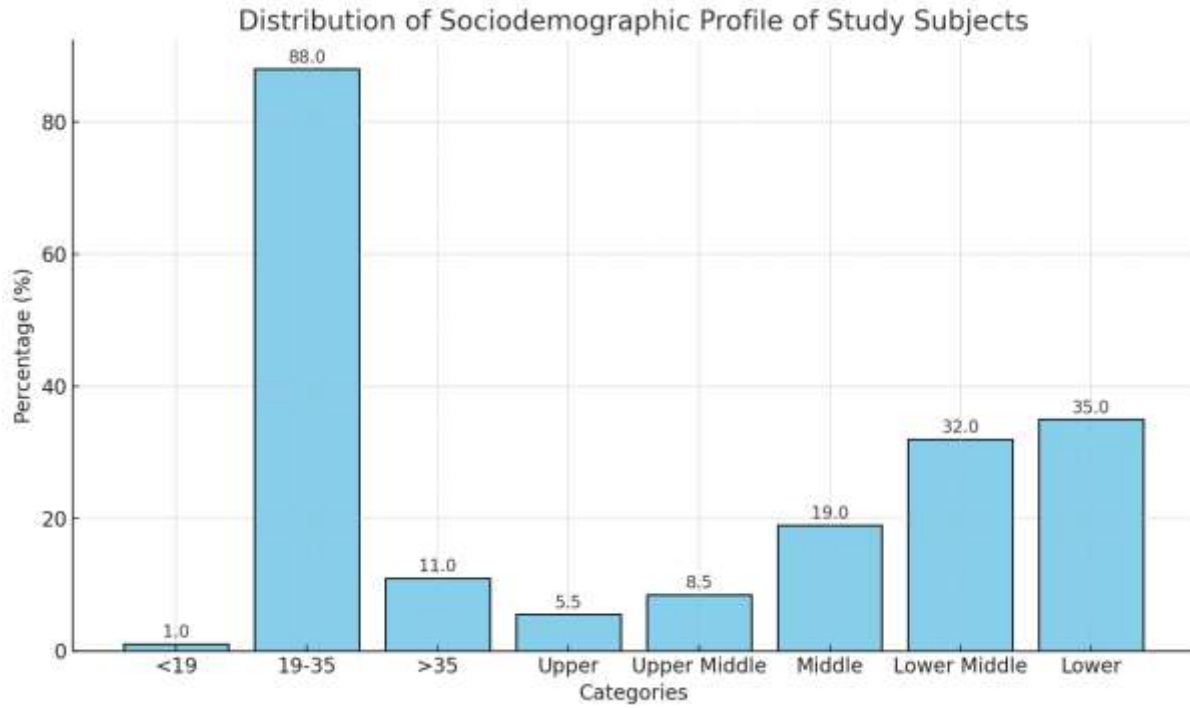Data were recorded in a structured format and analyzed using SPSS version 25. Descriptive statistics were used to summarize demographic and clinical characteristics. Comparative analyses were conducted using Chi-square tests, t-tests, and logistic regression to identify associations. Statistical significance was set at $p<0.05$ $p < 0.05$ $p<0.05$, with $p<0.001$ $p < 0.001$ $p<0.001$ indicating highly significant results. Results were presented through tables, graphs, and charts for clarity and impact.
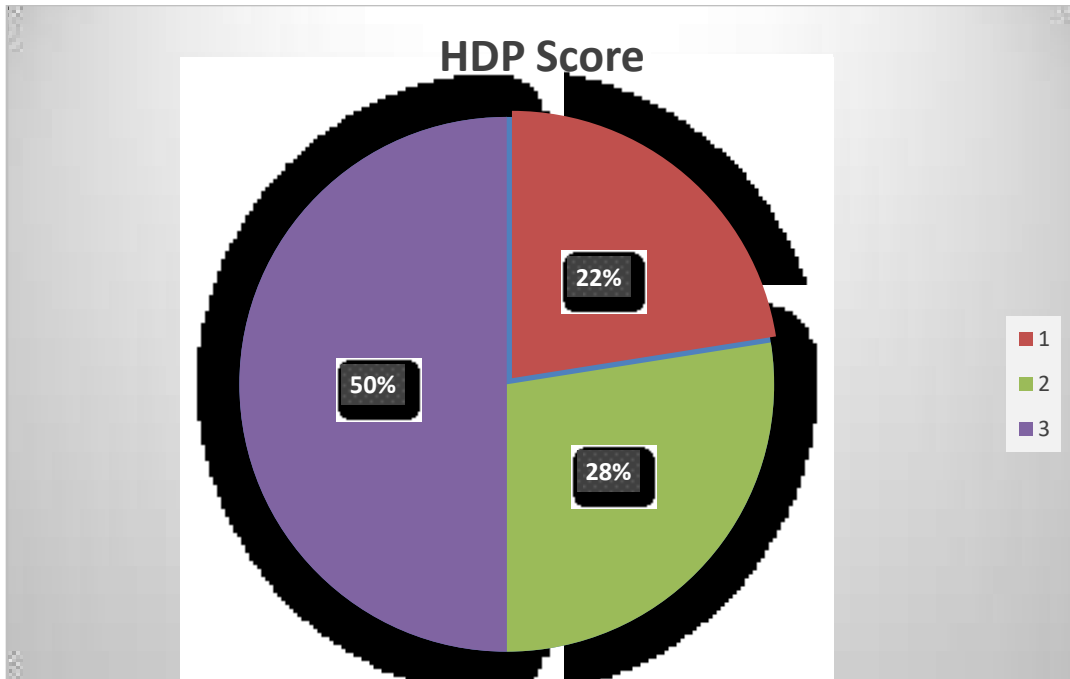
This methodological approach was designed to ensure a robust evaluation of the HDP Gestosis score's utility in predicting hypertensive disorders in pregnancy.

Results.

Table 1 represents the sociodemographic characteristics of the study subjects (N=200). Most participants were aged 19-35 years (88%) with a mean age of 26.85 ± 5.26 years. The majority belonged to lower socioeconomic classes (67%), and 41.5% were primigravida. BMI distribution showed that 73% had a normal BMI, and the mean gestational age was 10.71 ± 2.37 weeks.

Particulars	Frequency/Mean±SD	Percentage
Age (years)		
<19	2	1.0
19-35	176	88.0
>35	22	11.0
Mean Age	26.85 ± 5.26	-
Socioeconomic Status		
Upper	11	5.5
Upper Middle	17	8.5
Middle	38	19.0
Lower Middle	64	32.0
Lower	70	35.0
Gravida		
Primigravida	83	41.5
Multigravida	117	58.5
BMI		
Normal	146	73.0
Overweight	43	21.5
Obese	7	3.5
Obese Severely	4	2.0
Mean BMI	24.12 ± 2.8	-
Mean Gestational Age	10.71 ± 2.37	-

Distribution of Sociodemographic Profile of Study Subjects

Distribution of Gravida and BMI Categories Among Study Subjects

HDP Score

The figure describes the distribution of study subjects according to their HDP scores.

Table 2 highlights the distribution and association of HDP Gestosis scores with hypertensive outcomes among 200 study participants. It demonstrates that a higher HDP score (≥3) is strongly associated with hypertension, with 85% of hypertensive cases occurring in this group (P < 0.001).

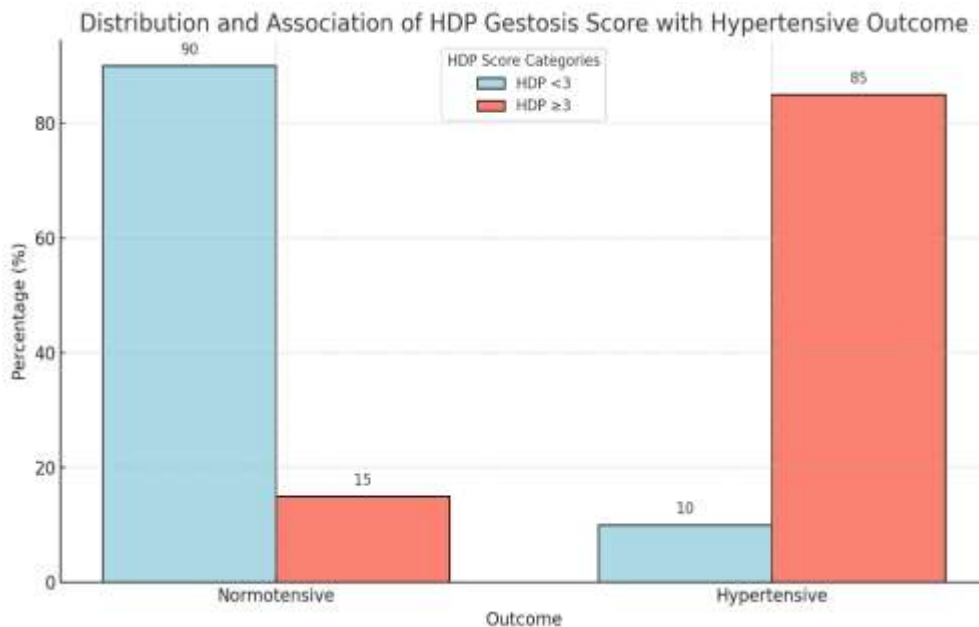| Outcome	HDP <3 (%)	HDP ≥3 (%)
Normotensive	90	15
Hypertensive	10	85

Table 3 represents the distribution of patients with specific HDP score components and their hypertensive outcomes. Notably, combinations such as GDM(2) and Primi(1) + PCOS(1) exhibited high hypertensive rates of 90% and 66%, respectively, emphasizing their predictive value in hypertension risk assessment.

Break up of component	Total no. of patients(n)	number and % Hypertensives
Primi(1)+Pcos(1)	6	4 (66%)
GDM(2)	4	1(90%)
Hypothyroidism(2)	6	0(0%)
Primi(1)+Anemia(1)	1	0(0%)
Hypertension in previous pregnancy(2)	2	1(50%)
Multifetal gestation(2)	3	0(0%)
Primi(1)+Execessive weight gain(1)	1	0(0%)
Long interpregnanacy interval(1)+Pcos(1)	1	0(0%)
Long interpregnancy interval(1)+Anemia(1)	3	0(0%)
BMI>35(2)	1	0(0%)

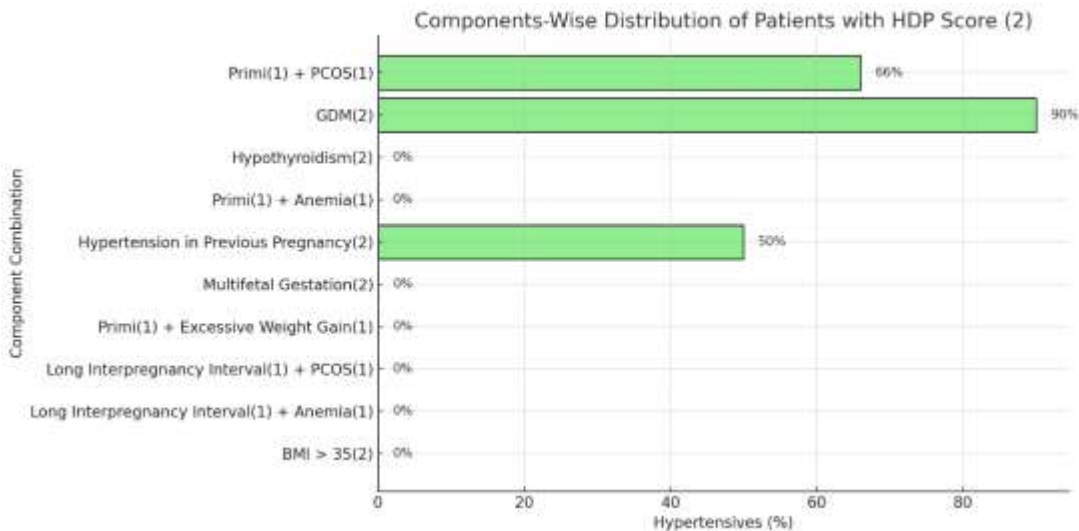Components-Wise Distribution of Patients with HDP Score (2)

Table 4 provides a detailed breakdown of patients with HDP Score (3) based on specific component combinations and their hypertensive outcomes. Notable combinations such as MAP + GDM and Primigravida + PCOS + Age (>35) showed a 100% hypertensive rate, emphasizing their high predictive value for hypertensive disorders.

Break up of component	Total no. of patients(n)	Hypertensives (%)
Primigravida + Hypothyroidism	8	6 (75.0)
Primigravida + Multifetal gestation	4	3 (75.0)
Primigravida + Gestational Diabetes	3	2 (66.6)
Primigravida + PCOS + ART	1	0 (0.0)
Primigravida + PCOS + Age (>35)	1	1 (100.0)
Primigravida + PCOS + Excessive weight Gain	1	1 (100.0)
Diabetes Mellitus	2	1 (50.0)
MAP + GDM	5	5 (100.0)
MAP + Hypertension in previous Pregnancy	3	3 (100.0)
PCOS + Hypertension in Previous Pregnancy	2	2 (!00.0)
Long Pregnancy Interval + Hypertension in previous Pregnancy	2	2 (100.0)1
Excessive Weight Gain + Multifetal Gestation	1	1 (100.0)
ART + Multifetal Gestation	1	1 (100.0)
Hypothyroidism + Anemia	2	2 (100.0)
Hypothyroidism + Age	1	1 (100.0)
Excessive weight gain + Hypertension in previous pregnancy	3	2 (66.6)
BMI (>30) + Anemia + Long interpregnancy interval	1	1 (100.0)
Chronic Hypertension	1	1 (100.0)
GDM + Age	1	1 (100.0)
GDM + Long interpregnancy interval	2	2 (100.0)
Long interpregnancy interval + Age (>35) + Anemia	1	0 (0.0)
Long interpregnancy interval + Age + PCOS	1	0 (0.0)

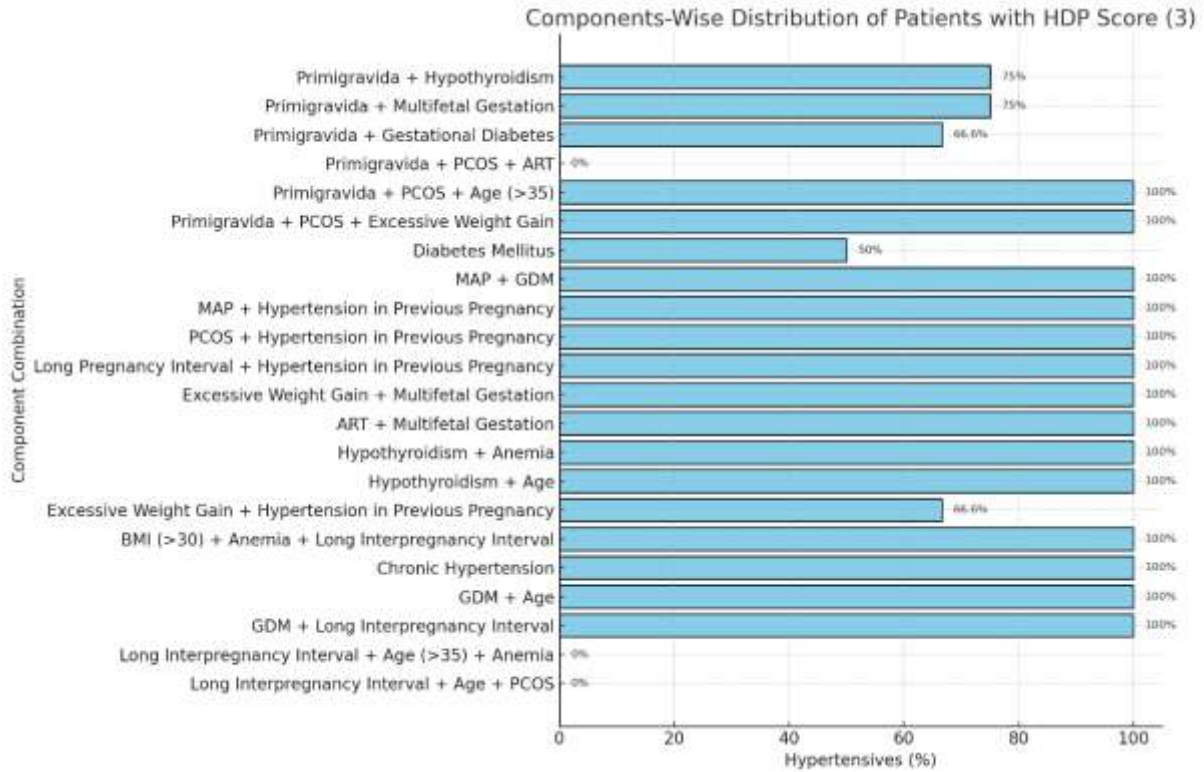Components-Wise Distribution of Patients with HDP Score (3)

Table 5 illustrates the association of various clinical factors with HDP scoring outcomes among study subjects. Key contributors to hypertension included serum TSH >3 (44 cases), previous hypertension (24 cases), and elevated MAP >85 (23 cases). Multigravida women were the largest group with high HDP scores, emphasizing the predictive significance of these factors.

| Clinical Factor	HDP <3 (n)	HDP ≥3 (n)	Total Hypertension Cases
Age <19	0	2	2
Age >35	0	13	13
BMI >30	1	3	4
Primigravida	9	31	40
Multigravida	1	54	55
Excessive Weight Gain	1	8	9
MAP >85	6	17	23
Maternal Anemia	0	6	6
Serum TSH >3	4	40	44
ART	0	2	2
Multifetal Pregnancy	0	9	9
PCOS	4	11	15
Long Pregnancy Interval	1	14	15
Hypertension (Previous)	0	24	24
Chronic Hypertension	0	17	17
Diabetes Mellitus	0	5	5
GDM	0	17	17
Autoimmune Disorder	0	2	2

Association of Clinical Factors with HDP Scores
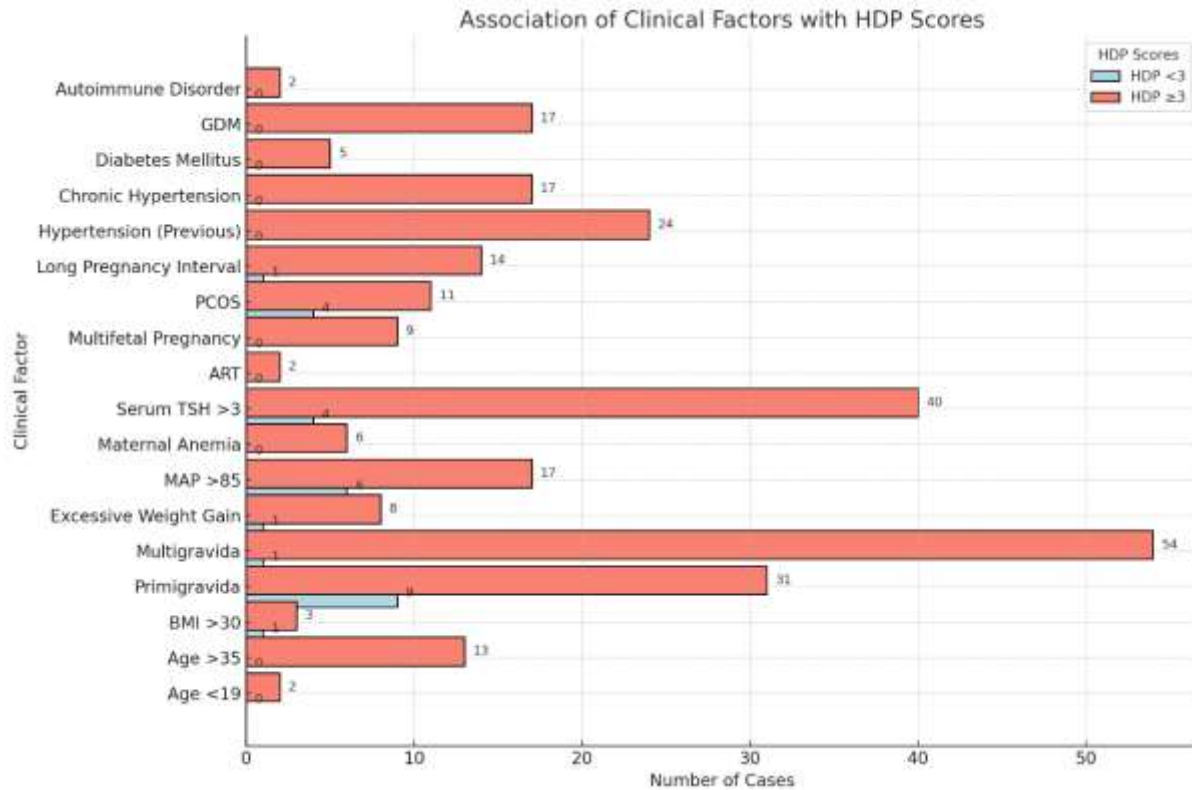
Table 6 demonstrates the association of maternal and fetal outcomes with HDP scores. Key observations include a significantly higher incidence of postpartum hemorrhage (P = 0.010) in the HDP <3 group. While differences in neonatal mortality, NICU admissions, and birth weight were observed, they were not statistically significant

Particulars	HDP <3 (n/%)	HDP ≥3 (n/%)	P Value
Mode of Delivery - NVD	4 (40.0)	26 (30.6)	0.545
Mode of Delivery - Caesarean	6 (60.0)	59 (69.4)	0.545
Postpartum Hemorrhage (PPH) - Yes	2 (20.0)	0 (0.0)	0.010*
Postpartum Hemorrhage (PPH) - No	8 (80.0)	85 (100)	0.010*
Blood Transfusion - Yes	2 (20.0)	9 (10.6)	0.407
Blood Transfusion - No	8 (80.0)	76 (89.4)	0.407
Intubation - Yes	0 (0.0)	15 (17.6)	0.355
Intubation - No	10 (100)	70 (82.4)	0.355
ICU Stay - Yes	0 (0.0)	18 (21.7)	0.20
ICU Stay - No	10 (100)	65 (78.3)	0.20
Birth Weight - LBW (<2500gms)	3 (30.0)	36 (42.4)	0.518
Birth Weight - Normal (>2500gms)	7 (70.0)	49 (57.6)	0.518
Neonatal Mortality - No	8 (80.0)	70 (82.4)	0.103
Neonatal Mortality - NICU	2 (20.0)	14 (16.5)	0.103
Neonatal Mortality - Demise	0 (0.0)	1 (1.2)	0.103
Mean Birth Weight (kg)	2.77 ± 0.71	2.57 ± 0.77	0.06
Mean Apgar Score	7.74 ± 1.19	7.62 ± 1.05	0.452

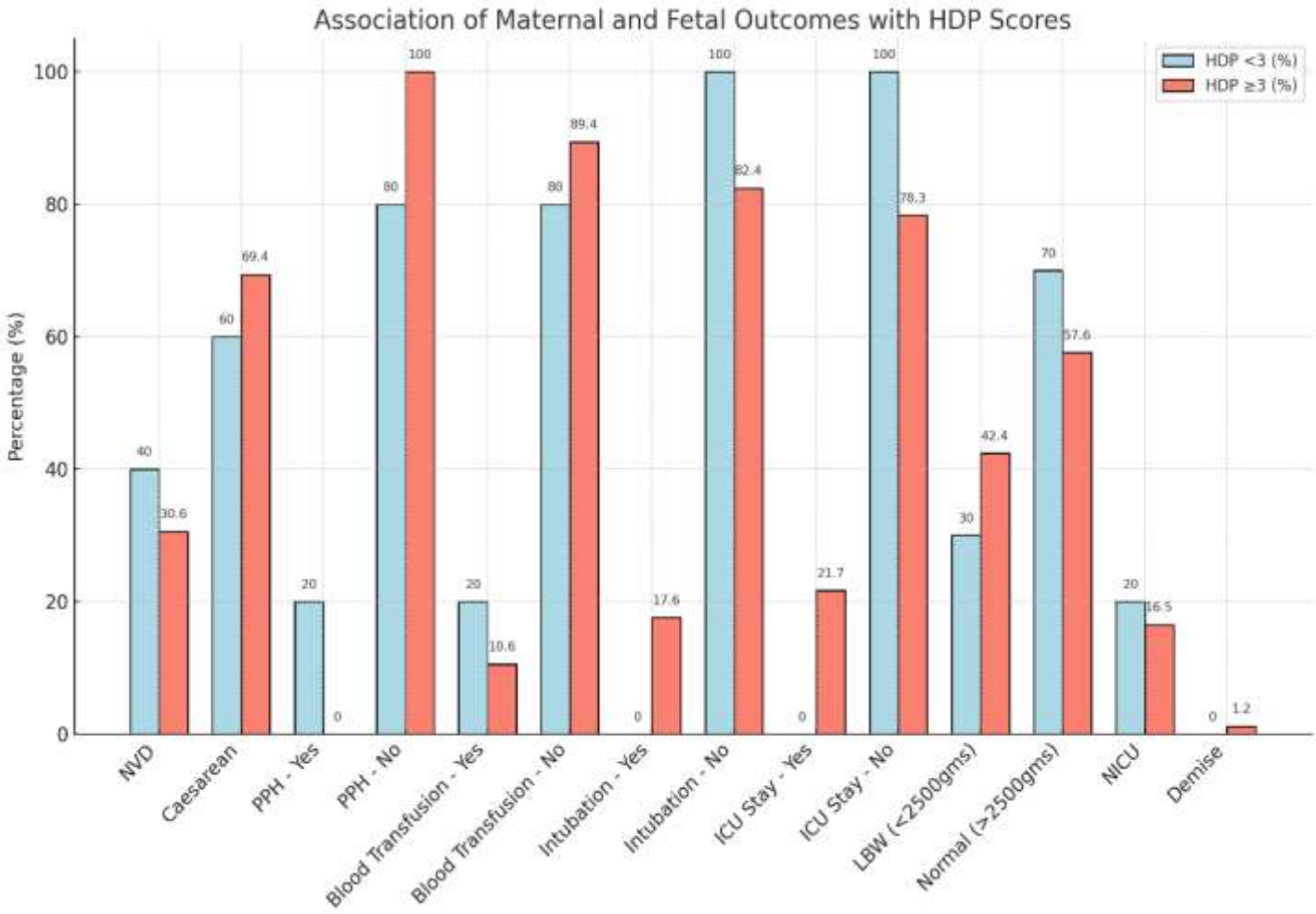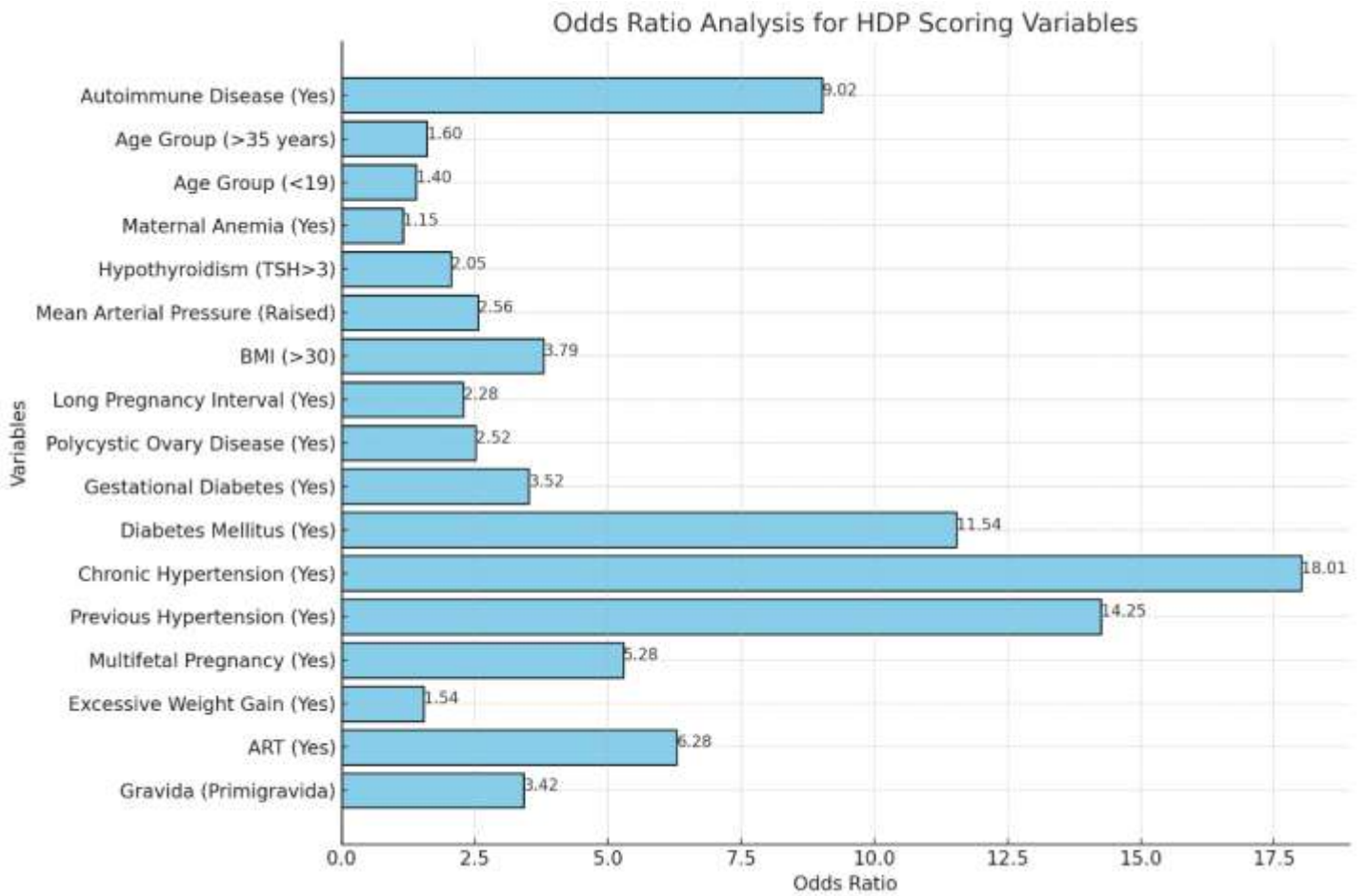Association of Maternal and Fetal Outcomes with HDP Scores

Table 7 presents the logistic regression analysis of various HDP (Hypertensive Disorders of Pregnancy) scoring variables. The analysis includes P-values, Odds Ratios, and 95% Confidence Intervals, highlighting significant predictors such as chronic hypertension, multifetal pregnancy, and autoimmune diseases. Variables with P-values <0.05 are considered statistically significant.

Outcome- Hypertensive		P VALUE	ODDS RATIO	95% C.I	
				Lower	Upper
Gravida	Primigravida	.008	3.419	1.375	8.500
	Multigravida	r			
ART	YES	.999	6.284	.0132	12.067.
	NO	r			
Excessive Weight Gain	YES	.484	1.542	.458	5.195
	NO	r			
Multifetal Pregnancy	YES	.011	5.282	1.476	18.900
	NO	r			
Hypertension (Presvious)	YES	.000	14.254	3.725	54.545
	NO	r			
Chronic Hypertension	YES	.001	18.013	4.187	82.666
	NO	r			
Diabetes Mellitus	YES	.010	11.540	2.112	24.420
	NO	r			
Gestational Diabetes	YES	.010	3.518	1.350	9.171
	NO	r			

Polycystic Ovary Disease	YES	.111	2.520	.809	7.844
	NO	r			
Long Pregnancy Interval	YES	.194	2.281	.658	7.910
	NO	r			
BMI (>30)	YES	.353	3.788	.228	63.086
	NO	r			
Mean Arterial Pressure (Raised)	YES	.038	2.563	1.056	6.222
	NO	r			
Hypothyroidism (TSH>3)	YES	.082	2.054	.912	4.627
	NO	r			
Maternal Anemia	YES	.799	1.152	.386	3.438
	NO	r			
Age Group (<19)	YES	.999	1.396	.000	1.634.
	NO	r			
Age Group (>35 years)	YES	.415	1.605	.515	5.003
	NO	r			
Autoimmune Disease	YES	.002	9.019	4.118	18.555
	NO	r			

Odds Ratio Analysis for HDP Scoring Variables

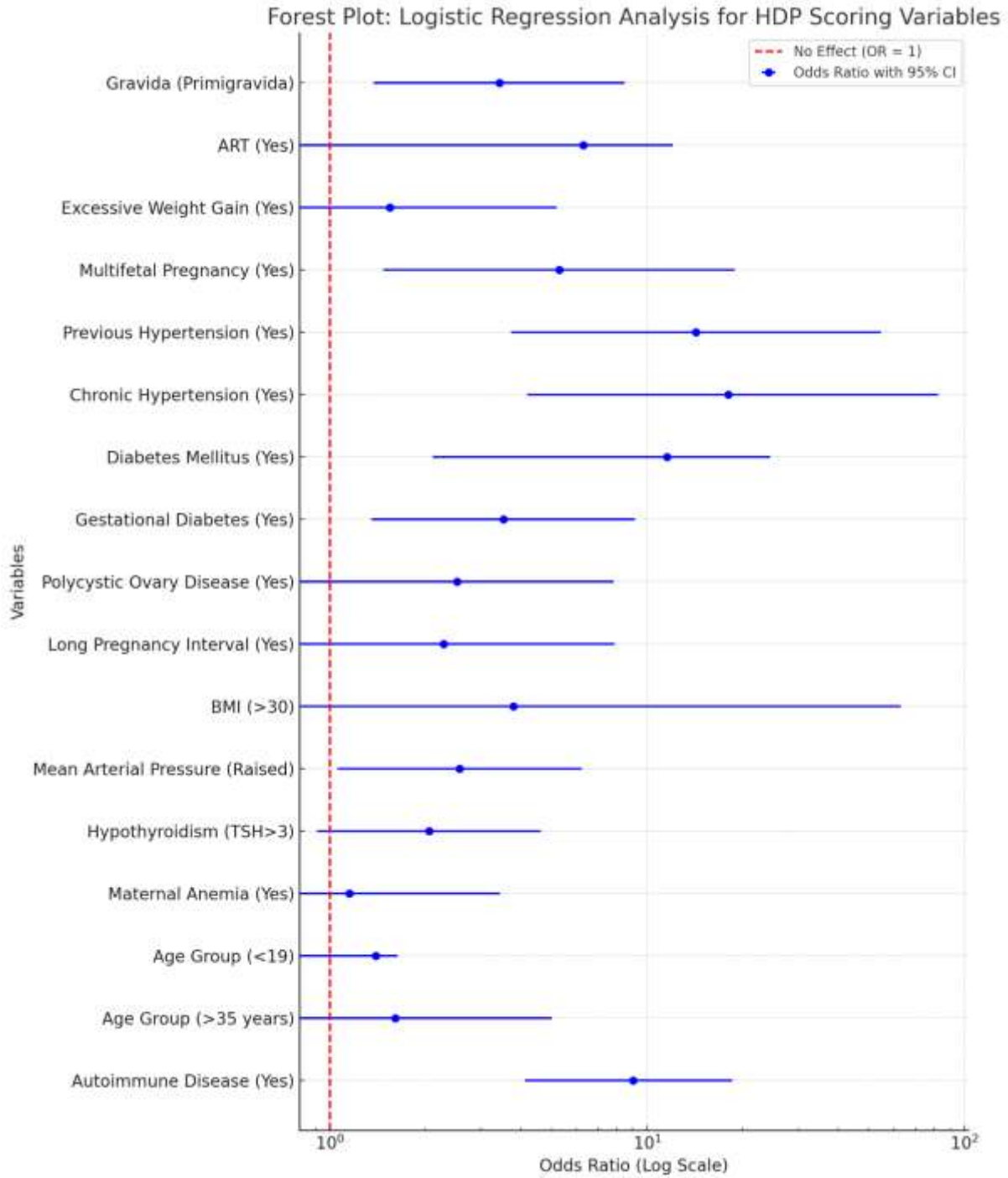Forest Plot: Logistic Regression Analysis for HDP Scoring Variables

Table 8 highlights the diagnostic efficacy of the HDP Gestosis Score. A score of ≥3 demonstrated high sensitivity (90%) and specificity (85%), with a strong area under the curve (AUC) of 0.88, indicating excellent discriminatory power. In contrast, a score of 2 showed limited diagnostic utility.

HDP Score	Sensitivity	Specificity	NPV	PPV	AUC	Positive likelihood ratio	Negative likelihood ratio
≥3	90.0 %	85.0 %	89.5 %	85.7 %	0.88	6	0.17
2	6%	53.3%	38.6%	10.9%	0.28	0.13	1.76
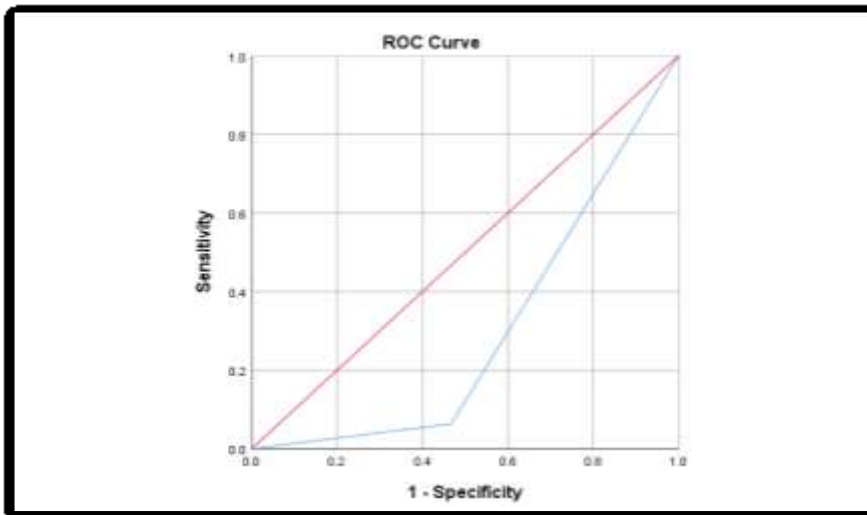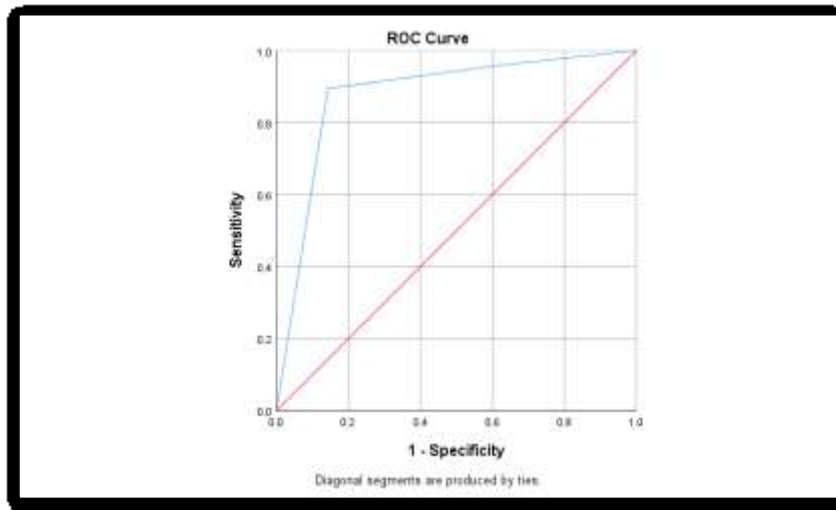
Discussion.

This study, conducted at the Department of Obstetrics and Gynecology, Baba Raghav Das Medical College, Gorakhpur, aimed to evaluate the predictive ability of the HDP Gestosis score for pre-eclampsia in pregnant women. The prospective design, ethical rigor, and detailed assessment of HDP scoring components have offered significant insights into hypertensive disorders of pregnancy (HDP).

The mean age of participants was 26.85 ± 5.26 years, with most (88%) between 19–35 years, while only 1% were under 19 years and 11% over 35 years. Socioeconomic status evaluation using the B.G. Prasad scale revealed that the majority belonged to lower socioeconomic strata, with only 5.5% and 8.5% categorized as upper and upper-middle classes, respectively. The prevalence of hypertension was 47.5%, significantly higher compared to Jain M. [12] (15.1%). This may reflect the referral patterns to this medical college, which primarily serves high-risk populations from the outskirts of the city.

Sravani and Reddy (2022)[10]demonstrated the utility of the HDP Gestosis score in predicting hypertensive disorders, reporting a significant association between higher scores and increased risk of pre-eclampsia. Gupta et al. [11] (2022) validated these findings, establishing the HDP score as a robust predictor of pre-eclampsia. Jain (2022) [12], through a retrospective analysis, corroborated these results by identifying a strong correlation between high gestosis scores and adverse pregnancy outcomes. Manhar et al. (2023) [13] emphasized the importance of early assessment, reinforcing that scores at 12–20 weeks could effectively predict pre-eclampsia.

In our study, 63.15% of women with HDP scores >3 developed severe pre-eclampsia, and 10.5% experienced eclampsia. Jain M. et al. (2022) [12]reported similar findings, with 65.5% developing severe pre-eclampsia and 3.2% eclampsia in women with scores >3. Further analysis highlighted that risk factors like primigravida status, raised MAP (>85 mmHg), and hypothyroidism were prevalent, while chronic hypertension, previous hypertension, and autoimmune disorders were less frequent but strongly predictive of hypertension. Notably, all participants with autoimmune disorders, diabetes mellitus, and multifetal pregnancies had HDP scores >3 and developed hypertension.

The study revealed that 80% of women with HDP scores of 3–4 developed hypertension, while 100% of those with scores >5 developed hypertension. Even among those with scores <3, 10% developed hypertension, primarily associated with primigravida status and PCOS. Sensitivity and specificity of the HDP score were 90% and 85%, respectively, surpassing the sensitivity reported by Manhar et al. (2023) [13] at 50% and Gupta et al. (2022) [11] at 83.1%. However, specificity was slightly lower compared to Manhar et al. [13] (94%) and Gupta et al. [11] (97%).

The positive predictive value (PPV) in this study was 85.7%, higher than Manhar et al. [13] (72.5%) and comparable to Gupta et al. [11] (85.5%). The findings underscore the HDP score's clinical utility, enabling timely interventions to improve maternal and fetal outcomes.

Strengths and Limitations.

The strength of this study lies in validating a scoring system that can be implemented routinely in obstetric practice that is effective and cost efficient in identifying women at risk of developing HDP and thus allowing preventive measures in a timely manner. However due to the limitations of small study population the findings should be viewed with caution .

Conclusion.

The study demonstrated the effectiveness of the HDP Gestosis score in predicting hypertensive outcomes in pregnancy, with higher scores (≥3) significantly associated with adverse maternal and fetal outcomes. Key clinical factors, including primigravida status, elevated MAP (>85 mmHg), previous hypertension, chronic hypertension, and gestational diabetes, were identified as strong predictors of hypertension. The score showed high diagnostic accuracy with a sensitivity of 90%, specificity of 85%, and an AUC of 0.88. These findings validated the HDP score as a cost-effective tool for early risk identification, enabling timely interventions to improve pregnancy outcomes.

Conflict of Interest.

The authors confirm there are no conflicts of interest.
Funding: The study did not receive any financial support.
Consent: Written informed consent was obtained from all participants and securely archived.
Ethical Approval: The study received ethical clearance, adhering to the required institutional protocols.

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