Section: Community Medicine

Original Research Article

A STUDY ON DETERMINANTS OF PRE – ECLAMPSIA AND ITS CORRELATION WITH OUTCOME AMONG PREGNANT FEMALES ATTENDING ANC CLINIC IN RURAL AREA OF DISTRICT JALAUN

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ABSTRACT

Background: Pre-eclampsia is a multisystem hypertensive disorder that typically develops after 20 weeks of gestation, characterized by elevated blood pressure and proteinuria. It is a leading cause of maternal and perinatal morbidity and mortality, particularly in low-resource and rural settings. This study was undertaken to assess the key determinants of pre-eclampsia and examine their correlation with pregnancy outcomes among antenatal women attending healthcare services in rural areas of District Jalaun, Uttar Pradesh, India. **Aim and Objective:** The aim was to assess the sociodemographic, clinical, and obstetric risk factors contributing to pre-eclampsia and to evaluate their impact on maternal and fetal outcomes.

Materials and Methods: A cross-sectional follow-up study was conducted over 18 months among 400 pregnant women beyond 20 weeks gestation, selected through simple random sampling. Data collection included interviews, clinical assessment, and laboratory investigations. Statistical analyses were performed to determine associations between variables.

Results: Pre-eclampsia was found in 9% of participants. Significant associations were observed with primigravidity, anemia ($p<0.001$), obesity ($p<0.001$), and fewer than three ANC visits ($p=0.00012$). Age, religion, and socioeconomic status did not show statistically significant associations. Pregnancy outcomes were significantly poorer in the pre-eclamptic group, including higher incidences of low birth weight, IUGR, preterm births, and cesarean sections ($p<0.0004$ for outcomes; $p=0.008$ for delivery mode).

Conclusion: Pre-eclampsia continues to be a significant public health concern in rural India, where preventable factors like anemia, insufficient antenatal care, and obesity elevate the risk. Implementing early screening, improving healthcare infrastructure, and conducting focused community education are vital steps to minimize complications and enhance maternal and neonatal health outcomes in these underserved regions.

Keywords: Pre-eclampsia; antenatal care; anemia; obesity; rural health

INTRODUCTION

Pre-eclampsia is a hypertensive disorder unique to pregnancy, characterized by the onset of hypertension and proteinuria after 20 weeks of gestation. It remains one of the leading causes of maternal and perinatal morbidity and mortality worldwide. As a multisystem condition, it can compromise vital organs such as the kidneys, liver, brain, and cardiovascular system, and if left unchecked, may progress to life-threatening complications. The International Society for the Study of Hypertension in Pregnancy defines pre-eclampsia as new-onset gestational hypertension with proteinuria, although it may also present without proteinuria in cases involving end-organ

dysfunction. Severe forms can progress into eclampsia, marked by convulsions, or into HELLP syndrome (hemolysis, elevated liver enzymes, and low platelet count), which further complicates clinical management. Despite improvements in maternal healthcare globally, the burden of pre-eclampsia remains high, particularly in low- and middle-income countries (LMICs), where access to quality obstetric care is limited.[1] The World Health Organization reports a global prevalence of 2.8% in low-income countries versus 0.4% in high-income regions, underlining inequities driven by disparities in healthcare access, nutrition, and socio-economic conditions. Pre-eclampsia is implicated in approximately 10–15% of maternal deaths and is associated with increased fetal risks, including intrauterine growth restriction, preterm delivery, stillbirth, and neonatal mortality due to placental insufficiency and compromised fetal oxygenation and nutrition.[2]

The pathogenesis of pre-eclampsia involves abnormal placentation early in pregnancy. Normally, extravillous trophoblasts invade and remodel maternal spiral arteries to increase uteroplacental perfusion. In pre-eclampsia, this remodeling is incomplete, resulting in high-resistance, low-capacity blood vessels that cause placental ischemia. The resultant hypoxic environment prompts the release of anti-angiogenic factors such as soluble fms-like tyrosine kinase-1 (sFlt-1) and inflammatory cytokines into the maternal circulation, leading to widespread endothelial dysfunction. This endothelial disruption contributes to the hallmark clinical features of hypertension, proteinuria, and multi-organ involvement. Risk factors for pre-eclampsia are both intrinsic and extrinsic. Non-modifiable risks include advanced maternal age, primiparity, a personal or family history of pre-eclampsia, and ethnicity, while modifiable risks involve chronic hypertension, diabetes, obesity, poor nutritional status, and inadequate antenatal care. In rural settings, these risks are exacerbated by poverty, lack of education, and minimal healthcare infrastructure, which delay diagnosis and compromise timely intervention.[3]

Clinically, pre-eclampsia ranges from mild to severe forms. Diagnostic criteria set by the WHO include a blood pressure ≥140/90 mmHg and proteinuria ≥300 mg/24 hours after 20 weeks of gestation. Severe disease is diagnosed when blood pressure exceeds 160/110 mmHg or when signs of end-organ damage appear, such as thrombocytopenia, elevated liver enzymes, renal dysfunction, pulmonary edema, or central nervous system disturbances like headaches and visual changes. In some patients, especially those with HELLP syndrome, proteinuria may be absent, which can obscure diagnosis and necessitate comprehensive laboratory evaluation. The maternal consequences of severe pre-eclampsia are grave, encompassing eclampsia, cerebral hemorrhage, renal failure, liver rupture, and disseminated intravascular coagulation. Fetal complications stem from reduced placental perfusion, resulting in conditions like oligohydramnios, growth restriction, and intrauterine fetal demise. In high-risk cases, prompt delivery may be the only solution, despite the potential risks of prematurity.[4]

Management of pre-eclampsia revolves around stabilizing maternal condition, monitoring fetal wellbeing, and determining the optimal timing for delivery. Antihypertensives such as labetalol and nifedipine are used to control blood pressure, while magnesium sulfate remains the drug of choice for seizure prophylaxis and treatment. Decisions regarding delivery depend on gestational age, disease severity, and fetal status. While delivery is the definitive cure, premature birth introduces complications that require well-equipped neonatal care, often lacking in LMICs. In these settings, resource limitations—including shortages of trained personnel, medications, and diagnostic capabilities—make effective management challenging and increase the likelihood of adverse outcomes.[5]

Pre-eclampsia remains a major public health concern in rural districts like Jalaun, Uttar Pradesh, due to maternal undernutrition, anemia, poor antenatal care, and inadequate emergency services, often leading to late diagnosis and complications. This study evaluates maternal and fetal outcomes by analyzing sociodemographic factors, comorbidities, nutrition, and ANC practices to identify key risk factors. Findings aim to guide region-specific strategies, including community screening, improved ANC, nutrition and hypertension education, and strengthened rural health infrastructure, ultimately reducing the pre-eclampsia burden and improving outcomes for mothers and newborns in underserved communities through timely, evidence-based interventions.[6]

This study aims to assess the determinants of pre-eclampsia and their correlation with pregnancy outcomes among antenatal women in district Jalaun. Objectives include evaluating the sociodemographic profile, identifying key risk factors contributing to pre-eclampsia, analyzing the association between these determinants and pregnancy outcomes, and formulating evidence-based recommendations to improve maternal health based on the study findings.

MATERIALS AND METHODS

This cross-sectional follow-up study was conducted over 18 months (June 2023 to November 2024) in rural areas of District Jalaun, Uttar Pradesh, to evaluate the determinants of pre-eclampsia and their correlation with pregnancy outcomes among ANC clinic attendees. Pregnant women aged 18–45 years with gestational age ≥ 20 weeks were selected using simple random sampling. Exclusion criteria included fetal anomalies, unrelated chronic illnesses, corticosteroid use, and refusal to consent. Ethical

approval was obtained, informed consent was taken, and confidentiality ensured. The study included tool design, data collection, follow-up, analysis, and manuscript preparation.

RESULTS

In the study, PIH was most prevalent in the 18–27 years age group (7.75%), with significantly fewer cases in the 28–34 years (0.75%) and >34 years (0.5%) groups. Most normotensive women were aged 28–34 years (41.25%), followed by 18–27 years (35.25%). A significant association was found between age group and PIH (Chi-Square = 30.13, p < 0.001).

The distribution of PIH across socioeconomic classes shows the highest prevalence in the lower middle class (4.25%), followed by the lower class (2.75%) and middle class (1.75%), with no cases in the upper class. Most normotensive women belonged to the lower and lower middle classes. The association between class and PIH was not statistically significant ($\chi^2 = 2.41$, $p = 0.65$). [Table 1]

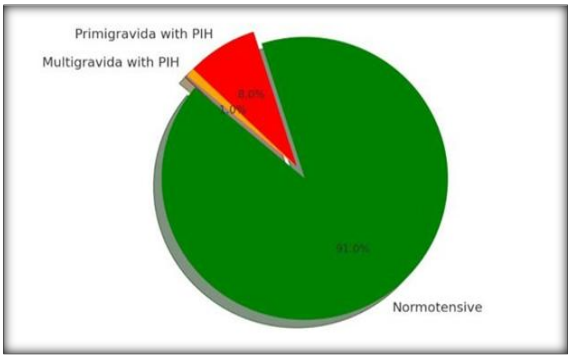

Figure 1: Obstetric History of the Participants

The highest prevalence of PIH (8%) was found among primigravida women, while multigravida and multigravida with abortion groups showed significantly lower PIH rates (1% and 0%, respectively). Most normotensive women were multigravida (66.5%). A strong and statistically significant association between gravidity and PIH was observed ($\chi^2 = 86.19$, $p = 0.001$), indicating increased PIH risk in primigravida. [Figure 1]

The table shows a significantly higher prevalence of PIH (4%) among women with fewer than three ANC visits compared to those with three or more visits (5%). Most normotensive women had ≥3 ANC visits (75%). The association between ANC visits and PIH was highly significant ($\chi^2 = 14.77$, $p = 0.00012$), indicating better ANC reduces PIH risk. [Table 2]

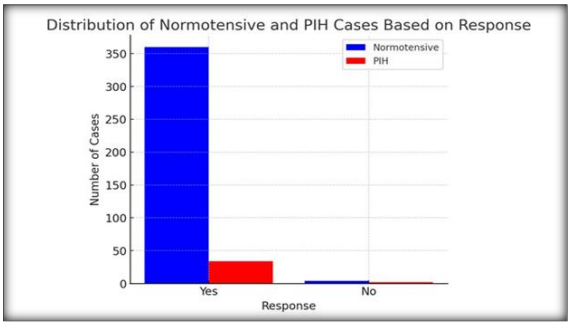

Figure 2: Graphical Representation of Calcium Intake of the Participants

The PIH was more prevalent among women who received care (8.5%) compared to those who did not (0.5%), though the latter group was very small (1.5% of total). Most normotensive cases were among those receiving care (90%). The association between care and PIH was statistically significant ($\chi^2 = 4.40$, $p = 0.035$), suggesting care access influences outcomes. [Figure 2]

The prevalence of PIH was significantly higher among anemic women (6.25%) compared to non-anemic women (2.75%). Most normotensive cases occurred in the non-anemic group (62%). A strong association was observed between anemia and PIH, with statistical significance ($\chi^2 = 18.65$, $p < 0.001$), indicating that anemia may be a notable risk factor for developing PIH in pregnancy. [Table 3]

The table shows that PIH was more prevalent among non-obese women (7.75%) than obese women (1.25%), despite obesity being traditionally linked to hypertension. Most normotensive participants were non-obese (84.5%). A statistically significant association was found between obesity and PIH ($\chi^2 = 38.77$, $p < 0.001$), suggesting other confounding factors may influence this unexpected distribution in the study population. [Table 4]

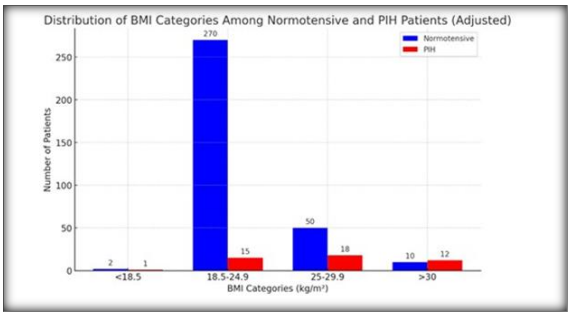

Figure 3: BMI Distribution among the Participants

The graph shows most normotensive women had a BMI of 18.5–24.9 (270 cases), while PIH was more common in higher BMI categories—especially 25–29.9 (18 cases) and >30 (12 cases). Very few cases were seen in the underweight group. This suggests an increasing trend of PIH with higher BMI, indicating a potential link between elevated BMI and hypertension in pregnancy. [Figure 3]

The table shows that PIH was more common among women aged 18–34 years (8.5%) compared to those

at age extremes (<18 or >34 years, 0.5%). Most normotensive women also fell within the 18–34 age group. However, the association between age category and PIH was not statistically significant ($\chi^2 = 2.13$, $p = 0.14$), suggesting limited age influence in this dataset. [Table 5]

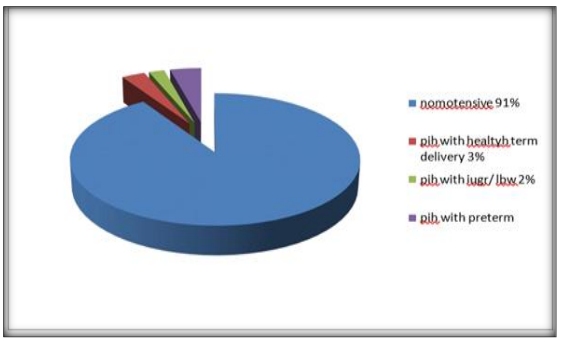

Figure 4: Outcome Variable among the Participants

The pie chart illustrates that 91% of pregnancies were normotensive, while only 9% involved PIH cases. Among PIH outcomes, 3% resulted in healthy term deliveries, 2% in intrauterine growth restriction or low birth weight, and another 4% in preterm births. This highlights that PIH, though less prevalent, is associated with notable adverse perinatal outcomes. [Figure 4]

The table shows that most normotensive women (79.25%) had normal vaginal deliveries (NVD), while a higher proportion of PIH cases (17 out of 36) required cesarean sections. The association between mode of delivery and hypertensive status was statistically significant ($\chi^2 = 28.69$, $p = 0.008$), indicating that PIH significantly increases the likelihood of cesarean delivery. [Table 6]

Table 1: Socioeconomic Status of Participants

CLASS	NORMOTENSIVE	PIH	TOTAL	χ2	DOF	p-value
Lower		11				
	133 (33.25%)		144 (36%)			
Class		(2.75%)				
Lower						
		17	145			
Middle	128 (32%)					
		(4.25%)	(36.25%)			
Class						
Middle		7	94			
	87 (21.75%)					
Class		(1.75%)	(23.5%)			
Upper						
	5 (1.25%)	0	5 (1.25%)			
Class				2.41	4	0.65
Upper						
		1				
Middle	11 (2.75%)		12 (3%)			
		(0.25%)				
Class						
			400			
TOTAL	364 (91%)	36 (9%)				
			(100%)			

Table 2: ANC Visit

VARIABLES	NORMOTENSIVE	PIH	TOTAL	χ2	DOF	p-value
ANC VISIT >=3 visit	300(75%)	20(5%)	320(80%)	14.77	1	0.00012
<3 visit	64(16%)	16(4%)	80(20%)			
Total	364(91%)	36 (9%)	400 (100%)			

Table 3: Anemia Distribution among Participants

VARIABLE	NORMOTENSIVE	PIH	TOTAL	χ2	DOF	p-value
ANEMIA	116 (29%)	25 (6.25%)	141(35.25%	18.65	1	<0.001
NON — ANEMIC	248(62%)	11(2.75%)	259(64.75%)			
TOTAL	364(91%)	36(9%)	400(100%)			

Table 4: Obesity Distribution among Participants

VARIABLE	NORMOTENSIVE	PIH	TOTAL	χ2	DOF	p-value
OBESITY	26 (6.5%)	5(1.25%)	31(7.75%)	38.77	1	<0.001
NON—OBESE	338(84.5%)	31(7.75%)	369(92.25%)			
TOTAL	364(91%)	36(9%)	400(100%)			

Table 5: Age at the Time of Conception among Participants

VARIABLE	NORMOTENSIVE	PIH	TOTAL	χ2	DOF	p-value
EXTREME OF AGE <18yrs or >34yrs	52(13%)	2(0.5%)	54 (13.5%)	2.13	1	0.14
BETWEEN 18-34YRS	312(78%)	34(8.5%)	346(86.5%)			
TOTAL	364(91%)	36(9%)	400(100%)			

Table 6: Mode of Delivery

MODE	NORMOTENSIVE	PIH	TOTAL	χ2	DOF	p-value
NVD	317(79.25%)	19 (4.75%)	336(84%)	28.69	1	0.008
C-SECTION	47(11.75%)	17(4.25%)	64(16%)			
TOTAL	364 (91%)	36(9%)	400 (100%)			

DISCUSSION

Pre-eclampsia, a pregnancy-specific hypertensive disorder with proteinuria occurring after 20 weeks of gestation, poses significant maternal and fetal risks, particularly in low-resource settings. It disrupts multiple organs due to placental insufficiency and endothelial dysfunction triggered by poor trophoblastic invasion and the release of anti-angiogenic factors. Despite global advances, the condition remains a major cause of morbidity and mortality, necessitating improved diagnostic, therapeutic, and preventive strategies, especially in socioeconomically disadvantaged regions.[7]

In our study, most normotensive women were in the 18–27 (35.25%) and 28–34 (41.25%) year age groups, while PIH was less frequent with 7.75% and 0.75% respectively, indicating lower PIH incidence among younger women. This supports Baumwell S et al., who found higher pre-eclampsia risk with advancing age. . Education showed no significant PIH correlation (p = 0.46), consistent with Jianjun Z et al. and Ephraim RK et al.[8-12]

In our study, most women belonged to joint families (72.25%) and fewer to nuclear families (27.75%), with PIH observed in 5.75% and 3.25% of these groups, respectively. The chi-square test (p = 0.24) showed no significant association, supporting Barden A et al. and Fikadu K et al., who reported family structure had minimal impact on pre-eclampsia. Similarly, most participants were from lower (36%) and lower-middle (36.25%) socioeconomic classes, with PIH in 2.75% and 4.25%, and no significant correlation (p = 0.65), consistent with Essa RM et al. and Abuya et al., highlighting that pre-eclampsia risk is influenced more by genetic, environmental, and healthcare access factors than by SES or family type.[13-16]

In our study, 91% of participants were normotensive and 9% had PIH, consistent with Manandhar BL et al. and Tola PA. PIH was more common in primigravidas (80%), supporting findings by Igbokwe U et al. and Kinuthia CG. Only 5% of PIH cases had three or more ANC visits, compared to 75% in normotensives, aligning with studies by Fondjo LA et al. and Tesfa E et al., highlighting inadequate ANC as a significant PIH risk factor.[17-22]

In our study, 98.5% of participants reported calcium intake, with a significant association between calcium consumption and reduced PIH (p = 0.035), contrasting studies by Getaneh Y et al. and Kassa BG et al., who found no conclusive protective effect. High-risk pregnancies (60.75%) were more common in normotensives, but not significantly linked to PIH (p = 0.086), consistent with Wagnew M et al. and Tlaye KG et al. Anemia showed a strong association with PIH (p < 0.001), aligning with Seif SA et al. and Shegaze M et al.[23-28]

In our study, obesity showed a significant association with PIH (p < 0.001), with findings consistent with Nathan HL et al. and Billah et al., who linked obesity to insulin resistance and endothelial dysfunction in preeclampsia. In contrast, no significant association was found between extreme maternal age (<18 or >34 years) and PIH (p = 0.14), differing from Ogboye A et al. and Rashid SA et al., who observed higher PIH risk in such age groups. Similarly, short stature showed no significant association (p = 0.68), contrasting findings by Aggarwal S et al. and Nandhini CC.[29-34]

In our study, pregnancy outcomes showed marked disparities between normotensive and PIH participants. While 70.7% of normotensive women delivered healthy babies, only 3% of PIH cases had similar outcomes. IUGR or LBW occurred more frequently in PIH (2%) compared to 6% in normotensives, and preterm births were 4% in PIH versus 14.2% in normotensive pregnancies, with a significant p-value <0.0004, aligning with Ahmed EM et al. Mode of delivery also differed significantly ($p < 0.008$); only 4.75% of PIH cases had NVD compared to 79.25% normotensives. Nahrel R et al. and Mohammed E et al. similarly reported higher C-section rates in PIH pregnancies due to fetal distress and hypertension.[35-37]

CONCLUSION

The study emphasizes that pre-eclampsia is a multifactorial condition influenced by sociodemographic, obstetric, and clinical factors. Key determinants identified include primigravidity, limited antenatal care visits, obesity, anemia, and insufficient calcium intake. These factors were significantly associated with adverse pregnancy outcomes such as preterm births, low birth weight, intrauterine growth restriction (IUGR), and increased cesarean deliveries. The findings underscore the importance of early detection, routine monitoring, and preventive strategies in maternal healthcare to mitigate the risks associated with pre-eclampsia and improve both maternal and neonatal outcomes, particularly in high-risk pregnancies and resource-limited settings.

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