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PREVALENCE AND RISK FACTORS OF PREGNANCY INDUCED HYPERTENSION A COMPREHENSIVE ANALYSIS IN A LOCAL POPULATION

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Abstract:

Pregnancy-Induced Hypertension (PIH) remains a significant contributor to maternal and perinatal morbidity and mortality worldwide. This study aimed to determine the prevalence and evaluate the major risk factors associated with PIH in a defined local population. A comprehensive analysis was conducted among pregnant women attending antenatal clinics, assessing multiple demographic, clinical, and biochemical parameters, including age, weight, genetic predisposition, lifestyle habits, stress, gravida and trimester status, residential area, mode of delivery, hemoglobin concentration, blood pressure, and serum electrolyte levels.

The results revealed that the prevalence of PIH was notably higher among women aged 21–25 years, particularly within the 61–70 kg weight range. A higher occurrence was observed in third-trimester pregnancies and among multi-gravida women. Lifestyle factors such as alcohol consumption and smoking showed minimal association, whereas stress emerged as a significant contributor. The majority of affected women were from rural areas, indicating a potential link between limited healthcare access and increased PIH incidence. Cesarean section deliveries were more common among PIH cases compared to normal vaginal deliveries. Hemoglobin levels predominantly ranged between 9–10 g/dL, suggesting mild anemia, while elevated systolic blood pressure confirmed the hypertensive status. Mild potassium imbalances were also noted, reflecting possible electrolyte disturbances.

In conclusion, PIH in the studied population is multifactorial, influenced by physiological, environmental, and lifestyle factors. The findings emphasize the need for early screening, nutritional intervention, stress management, and targeted health education programs to minimize the risk and improve maternal and fetal outcomes.

Keywords: Pregnancy-Induced Hypertension (PIH), Risk Factors, Maternal Health Trimester and Gravida Status, Electrolyte Imbalance

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INTRODUCTION:

Pregnancy is the period during which a fertilized egg develops into a baby inside a woman's uterus, typically lasting around 40 weeks from the last menstrual period. It is divided into three trimesters, each lasting about three months. Conception usually occurs through sexual intercourse, though assisted reproductive methods are also used. The fertilized egg implants in the uterus around 8–9 days after fertilization, developing first as an embryo (up to 10 weeks) and then as a fetus until birth. During pregnancy, a woman undergoes several physiological changes involving the heart, lungs, metabolism, and behavior.

Pregnancy outcomes can include live birth, miscarriage, stillbirth, or abortion. Proper prenatal care, nutrition, and avoidance of harmful habits like smoking and alcohol use are crucial for healthy pregnancy outcomes. Pregnancy-related terminology includes *gravida* (number of pregnancies) and *para* (number of births).

Hypertension (high blood pressure) is one of the most common complications during pregnancy and may appear as **gestational hypertension**, **chronic hypertension**, **preeclampsia**, or **eclampsia**. These conditions can severely affect both mother and fetus, causing complications like organ failure, preterm birth, or even death. Globally, hypertensive disorders of pregnancy (HDP) contribute to about 5–10% of all maternal complications and up to one-third of maternal deaths in countries like India. Risk factors include obesity, first-time pregnancy, family history, age above 35, multiple pregnancies, and lifestyle habits such as lack of exercise, high salt intake, or stress.

Serious conditions like **HELLP syndrome**, **placental abruption**, **acute renal failure**, and **retinal detachment** may also occur. Understanding the causes, prevention, and management of hypertension in pregnancy is vital to improving maternal and fetal outcomes and reducing pregnancy-related mortality worldwide.

The study of pregnancy-induced hypertension (PIH) holds immense importance due to its significant impact on maternal and fetal health. Hypertension during pregnancy is one of the leading causes of maternal and perinatal morbidity and mortality worldwide. It contributes to complications such as preterm delivery, intrauterine growth restriction, placental abruption, and even maternal or fetal death. The growing prevalence of PIH on a global scale highlights the urgent need for an in-depth examination of its occurrence and the identification of associated risk factors. Understanding these aspects is essential to designing and implementing effective prevention, early detection, and management strategies to safeguard both mothers and their unborn children.

Pregnancy is a unique physiological state characterized by complex hormonal and cardiovascular changes that support fetal development. However, these same changes can predispose women to the development of hypertension. PIH typically manifests after 20 weeks of gestation in women who were previously normotensive and may progress to more severe conditions such as preeclampsia and eclampsia. The multifactorial nature of this condition makes its study both challenging and essential. Physiological, genetic, environmental, and socio-economic factors all play crucial roles in determining susceptibility to PIH. Recognizing and addressing these determinants is vital for improving maternal health outcomes, especially in resource-limited settings.

Importantly, the occurrence and manifestation of PIH vary widely across different regions and populations. Differences in genetic background, dietary patterns, healthcare accessibility, lifestyle habits, and socio-economic status contribute to these disparities. Therefore, a localized understanding of the prevalence and risk factors of PIH is indispensable. What applies to one region may not hold true in another due to variations in cultural practices, nutrition, antenatal care quality, and awareness levels. Conducting a localized, population-based study helps identify unique trends and patterns specific to the community under investigation. This, in turn, allows for the design of tailored interventions that directly address the needs and risk profiles of the local population.

In many parts of the world, especially in developing countries, PIH remains underreported and underdiagnosed due to limited access to prenatal healthcare services. Investigating its prevalence within a specific local population not only fills this knowledge gap but also provides insight into the distinctive challenges faced by pregnant women in that region. Such studies can reveal associations between PIH and socio-economic variables like education level, income status, nutritional habits, and healthcare accessibility. By understanding the interplay of these factors, health authorities can devise effective public health programs aimed at early screening, lifestyle modification, and improved antenatal care practices.

The risk factors associated with PIH are numerous and interrelated. Maternal age, primiparity (first pregnancy), obesity, pre-existing hypertension,

diabetes mellitus, multiple pregnancies, and family history of hypertensive disorders are among the most significant contributors. In addition, lifestyle factors such as physical inactivity, poor dietary habits, smoking, alcohol consumption, and high salt intake further increase the risk. Socio-economic conditions and cultural influences often determine the level of awareness and utilization of healthcare services, thereby influencing both the occurrence and management of PIH. For example, populations with limited access to nutritional education or antenatal visits may exhibit higher rates of obesity or untreated pre-hypertensive conditions, leading to a greater prevalence of PIH.

Understanding how these risk factors interact within a specific population provides a comprehensive picture of the determinants of PIH. In some regions, genetic predisposition may play a greater role, while in others, environmental and behavioral factors might dominate. Therefore, conducting community-based research allows healthcare professionals to identify the most influential risk factors within their specific population. Based on such findings, healthcare providers can develop targeted interventions and educational programs that focus on modifiable risk factors, such as weight control, dietary modification, and increased physical activity.

Another essential aspect of this study is the evaluation of temporal trends in the prevalence of PIH. Monitoring changes in its occurrence over time allows for the assessment of the effectiveness of existing healthcare interventions and policies. For instance, improvements in antenatal screening, maternal education, and nutrition programs may contribute to a gradual decline in PIH rates. Conversely, increasing urbanization, sedentary lifestyles, and rising obesity rates may lead to an upward trend. By analyzing these temporal patterns, researchers can provide valuable recommendations for updating clinical guidelines and public health policies to meet emerging challenges.

The impact of advancing healthcare technologies and innovations must also be considered. The advent of advanced diagnostic tools, better blood pressure monitoring systems, and electronic health record-keeping has enhanced the detection and management of PIH. Additionally, developments in genetics and personalized medicine are opening new pathways for identifying women at higher risk before or early in pregnancy. Evaluating how these medical advancements affect the prevalence and management outcomes of PIH is essential for shaping future healthcare strategies. It is equally important to assess how effectively such technologies are being integrated into routine antenatal care, particularly in low-resource settings where accessibility may be limited.

From a public health perspective, the study of PIH extends beyond clinical outcomes to encompass socio-economic implications. Hypertensive disorders during pregnancy often lead to prolonged hospital stays, increased healthcare costs, and reduced quality of life for affected women. The condition may also have long-term health consequences, as women who experience PIH are at greater risk of developing chronic hypertension, cardiovascular diseases, and renal complications later in life. Therefore, the identification and management of PIH are not only crucial for ensuring safe pregnancy outcomes but also for promoting long-term maternal health.

Furthermore, the effect of PIH on the fetus cannot be overlooked. Insufficient blood flow to the placenta caused by maternal hypertension can lead to fetal growth restriction, preterm birth, or stillbirth. These outcomes have profound implications for neonatal survival and development, especially in regions where access to neonatal intensive care is limited. Thus, the early detection and control of PIH can significantly improve perinatal outcomes, reducing both maternal and infant mortality rates.

A comprehensive analysis of the prevalence and risk factors of PIH in a local population can serve as a foundation for policy formulation and healthcare planning. It can aid in developing region-specific screening protocols, training programs for healthcare workers, and awareness campaigns targeting women of reproductive age. Additionally, such studies encourage community participation and empower women to take an active role in their own healthcare through education and preventive practices.

METHODOLOGY:

1.Study Design

This research was designed as a **cross-sectional prevalence study**, conducted over a **six-month period** at the **KGH Multispecialty Hospital**, a tertiary care center known for its comprehensive maternal and neonatal services. The primary aim of this study was to assess the **prevalence and risk factors of Pregnancy-Induced Hypertension (PIH)** among pregnant women attending the obstetrics and gynecology department during the study period.

The study was conducted between **2023 and 2024** after obtaining formal approval from the **Institutional Ethical Committee** of the hospital.

All ethical standards outlined in the Declaration of Helsinki were strictly followed, ensuring the confidentiality and voluntary participation of all subjects.

The cross-sectional design was selected because it allows for the assessment of the prevalence of PIH and associated risk factors at a specific point in time within the defined study population. This design is efficient in terms of cost and time and provides valuable insights into the local patterns of PIH in a real-world healthcare setting.

Study Site

The research was carried out at **KGH Multispecialty Hospital**, which serves as a major tertiary care center for pregnant women from both urban and rural areas. The hospital provides advanced antenatal, perinatal, and postnatal services, ensuring access to a wide and diverse patient population, making it an ideal site for a prevalence-based study.

Study Duration

The study spanned a period of **six months**, during which eligible participants were systematically selected and evaluated according to the inclusion and exclusion criteria.

Data Collection Tools

A **structured data collection form** was used to obtain consistent and relevant information from participants. Data were collected from the following sources:

- **Patient demographic details:** Age, residence, education, occupation, and socioeconomic status.
- **Prescription charts:** Information regarding prescribed medications, dosage, and treatment regimens.
- **Laboratory data:** Blood pressure readings, urine protein levels, hemoglobin concentration, renal and liver function tests, and other relevant biochemical parameters.
- **Progress notes and clinical records:** Obstetric history, parity, gestational age, complications, and pregnancy outcomes.

The data were recorded systematically and verified for accuracy by cross-checking with hospital records.

2. Study Criteria

The study population included pregnant women admitted for antenatal care or delivery at KGH Multispecialty Hospital during the study period. Specific **inclusion** and **exclusion** criteria were established to ensure uniformity and to focus specifically on cases of Pregnancy-Induced Hypertension.

2.1. Inclusion Criteria

1. **Gestational Period:**Women in their respective trimesters were included to enable a comprehensive analysis of late-pregnancy factors and disease manifestation.
2. **Pregnancy-Induced Hypertension (PIH):**All pregnant women diagnosed with PIH during any trimester of pregnancy were included. Diagnosis was based on standard clinical definitions — systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg on two occasions at least four hours apart, after 20 weeks of gestation, in a previously normotensive woman.
3. **Primigravida and Multigravida:**Both primigravida (first pregnancy) and multigravida (multiple pregnancies) women were included to evaluate parity as a potential risk factor.
4. **Age Range:**Participants aged between **18 and 45 years** were included to represent the reproductive age group.
5. **Availability of Fetal Sex Information:**Only participants with complete data regarding the sex of the newborn were included, as it formed part of the demographic and clinical analysis.

2.2 . Exclusion Criteria

1. **Pre-existing Hypertension:**Women with a documented history of chronic hypertension prior to conception were excluded to ensure that the study focused exclusively on hypertension arising as a consequence of pregnancy.
2. **Comorbid Conditions:**Individuals diagnosed with chronic diseases such as **Diabetes Mellitus (DM)**, **Chronic Kidney Disease (CKD)**, or other systemic illnesses were excluded to minimize confounding factors that could influence blood pressure or pregnancy outcomes.
3. **Abortion Cases:**Participants with a history of **spontaneous or induced abortion** were excluded to maintain a uniform study population and focus on ongoing pregnancies.
4. **Age Above 45 Years:**Women above 45 years were excluded to maintain consistency with the reproductive age range and to eliminate outliers that could affect the analysis.

5. **Age Below 18 Years:**Adolescent pregnancies below 18 years were excluded due to potential ethical concerns and differing physiological parameters.
6. **1st and 2nd Trimester Exclusion (Conditional):**If the primary focus was on late-pregnancy factors, women in their first and second trimesters were excluded to ensure that the data reflected hypertensive changes typically emerging in the later stages of pregnancy.

3. Sample Size and Sampling Technique

The **sample size** was determined using the **single population proportion formula**, based on the following statistical parameters:

- **Margin of error:** 5%
- **Confidence interval (CI):** 95%
- **Estimated prevalence (P):** 50% (used for maximum sample size estimation)
- **Non-response rate:** 10%

Based on this formula, the **final calculated sample size was 120 participants**.

Sample Distribution

The total sample size was proportionally distributed based on the hospital's patient load over six months. The **source population** was determined using the hospital's average delivery reports, which amounted to approximately **103 deliveries** during the study period.

Sampling Technique

A **systematic random sampling method** was used to select participants. Eligible women who met the inclusion criteria and were admitted for delivery or antenatal care were recruited until the desired sample size was achieved. Every nth admitted patient (based on hospital census data) was selected to minimize sampling bias.

All participants provided informed consent prior to inclusion in the study.

4. Data Analysis

The collected data were entered into a statistical software package (such as SPSS or Microsoft Excel) for analysis. Descriptive statistics, including mean, standard deviation, and percentage distribution, were used to summarize demographic and clinical characteristics.

Inferential statistics, such as the **Chi-square test** and **logistic regression**, were employed to assess associations between potential risk factors (age, parity, BMI, socioeconomic status, etc.) and the occurrence of PIH. A **p-value < 0.05** was considered statistically significant.

Results were presented in the form of tables and graphs for better visualization and interpretation.

5. Ethical Considerations

- Ethical clearance was obtained from the **Institutional Ethical Committee of KGH Multispecialty Hospital** prior to data collection.
- Informed consent was obtained from all participants after explaining the study objectives and procedures in a language they could understand.
- Participant anonymity and confidentiality were strictly maintained throughout the study.
- No invasive procedures were performed beyond routine antenatal investigations.
- Data were used solely for academic and research purposes.

6 Limitations

- As a **cross-sectional study**, causal relationships could not be established between risk factors and PIH.
- The study was **restricted to a single hospital**, limiting generalizability to the broader population.
- The **sample size** was modest (120 participants), which may limit the detection of rare risk factors.
- Potential **recall bias** and incomplete documentation in hospital records could have influenced data accuracy.

RESULTS:

1 Age-Related Classification

This study explores the relationship between **age** and **health conditions**, identifying distinctive patterns across different age groups. The **18–23 years** group (36 cases) marks the transition into early adulthood, while **24–29 years** (48 cases) indicates possible lifestyle and stress-related effects. The **30–35 years** group (24 cases) reflects a stable period with changing health priorities. Older brackets show a decline in cases, suggesting possible effects of aging or improved interventions.

Table 1: Classification Based Upon Age

Age (Years)	No. of Patients
18–23	36
24–29	48
30–35	24
36–41	8

Age (Years)	No. of Patients
42–45	4

2 Obesity and Weight-Related Classification

The relationship between **weight and health** highlights patterns across various categories. The **61–70 kg** range (60 cases) shows the highest frequency, underlining the importance of weight management and lifestyle balance.

Table 2: Classification Based Upon Obesity / Weight

Weight (kg)	No. of Patients
41–50	8
51–60	8
61–70	60
71–80	40
81–90	4

3 Genetic Influence on Health

Genetic predisposition was analyzed to assess inherited influences on health outcomes. **28 cases** showed a positive genetic link, while **92 cases** showed no genetic connection, highlighting environmental and lifestyle factors as major contributors.

Table 3: Classification Based Upon Genetics

Genetic Influence	No. of Patients
Yes	28
No	92

4 Lifestyle Choices – Alcohol and Smoking Habits

Lifestyle behaviors such as **alcohol consumption** and **smoking** were evaluated. Only **20 patients** reported usage, while **100 abstained**, underscoring the health benefits of avoiding such habits.

Table 4: Classification Based Upon Alcohol / Smoking Habits

Lifestyle Habit (Alcohol/Smoking)	No. of Patients
Yes	20
No	100

5 Stress as a Contributing Factor

Stress was found to play a significant role, with **56 patients** reporting stress and **64** indicating none. This suggests that psychological factors remain critical in determining overall health outcomes.

Table 5: Classification Based Upon Stress

Stress Factor	No. of Patients
Yes	56
No	64

6 Trimester and Gravida Classification

Analysis of pregnancy data revealed that **third-trimester** cases were predominant, while **first-trimester** cases were absent. Among 120 subjects, **80 were primi-gravida** and **40 were multi-gravida**, reflecting distinct maternal health experiences.

Table 6: Classification Based Upon Gravida

Gravida Type	No. of Patients
Primi-gravida	80
Multi-gravida	40

7 Area-Based Classification

Geographical analysis showed **76 rural** and **44 urban** cases, indicating that environmental and healthcare accessibility factors may influence health disparities between regions.

Table 7: Classification Based Upon Area

Area Type	No. of Patients
Rural	76
Urban	44

8 Delivery Method and Its Implications

Among 120 patients, **100 underwent C-section**, while only **20 had normal deliveries**, suggesting an increasing reliance on surgical interventions and the need to understand underlying causes.

Table 8: Classification Based Upon Delivery Method

Delivery Type	No. of Patients
Normal	20
C-section	100

9 Hemoglobin Levels and Their Variability

Hemoglobin (Hb) analysis showed most cases (**56**) within the **9–10 g/dL** range, indicating mild anemia tendencies that require further nutritional assessment.

Table 9: Classification Based Upon Hemoglobin Levels

Hemoglobin Level (g/dL)	No. of Patients
8–9	20
9–10	56
10–11	20
11–12	20

Hemoglobin Level (g/dL)	No. of Patients
12–13	4

10 Hypertension and Blood Pressure Classification

Blood pressure data showed varied distribution, with **140–150 mmHg** being the most common (44 cases), indicating a substantial number of individuals within **stage-1 hypertension** range.

Table 10: Classification Based Upon Hypertension (Systolic Pressure)

Systolic Pressure (mmHg)	No. of Patients
120–130	4
130–140	24
140–150	44
150–160	8
160–170	40

11 Potassium Levels and Electrolyte Balance

Potassium levels revealed a prevalence of **hypokalemia**, with **72 cases** in the **1–2 mmol/L** range. Maintaining electrolyte balance remains essential for physiological stability.

Table 11: Classification Based Upon Potassium Levels

Potassium Level (mmol/L)	No. of Patients
1–2	72
2–3	36
3–4	8
4–5	4

DISCUSSION

Section	Parameter	Discussion Summary
1	**Age-Related Classification**	The age-related classification reveals a progressive decline in the number of cases with advancing age, indicating that health conditions may follow age-dependent patterns. Understanding these variations helps in formulating **age-specific healthcare interventions** and **preventive strategies** for different age groups.
2	**Obesity and Weight-Related Classification**	The analysis highlights the close relationship between **weight and overall health**. The high prevalence in the **61–70 kg** category underscores the importance of **weight management** in preventing conditions such as cardiovascular and metabolic disorders. Maintaining healthy body weight is essential for long-term wellness.
3	**Genetic Influence on Health**	The genetic classification shows fewer individuals with a genetic predisposition ('Yes' cases). This suggests that **environmental and lifestyle factors** may have a stronger impact on health outcomes in this population. Further study is needed to understand how genetics and environment interact in influencing disease risk.
4	**Lifestyle Choices – Alcohol and Smoking Habits**	Most participants reported **no alcohol or smoking habits**, which is a positive indicator for public health. However, understanding the health risks of these behaviors remains important, as alcohol and smoking are key contributors to **cardiovascular and respiratory diseases**. Awareness programs can further promote healthy lifestyle choices.
5	**Stress as a Contributing Factor**	A significant number of participants reported experiencing stress, showing its **major influence on health outcomes**. This finding highlights the importance of **mental health management**, stress reduction techniques, and counseling in healthcare settings to improve overall well-being.
6	**Trimester and Gravida Classification**	The predominance of **third-trimester cases** reflects increased healthcare needs during late pregnancy. The absence of first-trimester cases may relate to healthcare-seeking behavior or early-pregnancy complications. Differences between **primi-gravida and multi-gravida** groups provide insight for **personalized maternal care**.

Section	Parameter	Discussion Summary
7	**Area-Based Classification**	The higher number of cases in **rural areas** suggests potential disparities in **healthcare access**, **awareness**, and **environmental exposures** compared to urban populations. Region-specific health programs are essential to address rural health challenges and promote equitable healthcare distribution.
8	**Delivery Method and Its Implications**	The large proportion of **C-section deliveries** raises important questions about delivery practices, maternal choice, and clinical indications. While sometimes medically necessary, excessive C-section rates highlight the need for **guidelines promoting normal deliveries** where feasible, ensuring both maternal and neonatal safety.
9	**Hemoglobin Levels and Variability**	The highest frequency of hemoglobin levels in the **9–10 g/dL** range indicates a trend toward **mild anemia**. Monitoring and addressing hemoglobin variations is crucial to prevent complications like fatigue, weakness, and maternal morbidity. Nutritional counseling and iron supplementation can help improve outcomes.
10	**Hypertension and Blood Pressure Classification**	Blood pressure variations across the sample suggest **varying degrees of hypertension**. The findings stress the importance of **regular BP monitoring**, **lifestyle modifications**, and **early intervention** to prevent cardiovascular complications and improve maternal and fetal outcomes.
11	**Potassium Levels and Electrolyte Balance**	The distribution of potassium levels indicates a prevalence of **hypokalemia** in many cases. Maintaining proper **electrolyte balance** is vital for muscle, nerve, and heart function. Identifying dietary, physiological, or medication-related causes is essential to prevent related health complications.

CONCLUSION:

The comprehensive analysis of health parameters in this study provides valuable insights into the complex interplay of biological, lifestyle, environmental, and physiological factors influencing individual well-being. By examining diverse variables such as age, obesity, genetics, lifestyle habits, stress, trimester and gravida classifications, geographical distribution, delivery methods, hemoglobin levels, blood pressure, and electrolyte balance, this study offers a multidimensional perspective on health outcomes, particularly within the context of pregnancy-induced hypertension (PIH) and related conditions.

Age emerged as a significant determinant, with findings showing a gradual decrease in the number of cases as age advanced. This suggests that younger women, particularly those in their early reproductive years, may be at a higher risk of developing health complications related to pregnancy, possibly due to physiological immaturity, lifestyle factors, or inadequate prenatal care. These insights highlight the importance of designing **age-specific healthcare strategies** and preventive interventions to address the unique needs of each reproductive age group.

The analysis of **obesity and weight-related classifications** revealed a notable concentration of cases within the 61–70 kg range. This finding reinforces the established relationship between body weight and cardiovascular or metabolic risks. It underlines the necessity for effective **weight management programs**, nutritional counseling, and lifestyle modifications to mitigate the effects of excess weight on maternal health and pregnancy outcomes.

Genetic influences were observed in a smaller subset of participants, indicating that while hereditary predispositions exist, **environmental and lifestyle factors** play a more dominant role in determining health outcomes within this population. This finding supports the growing emphasis on integrating **genomic research** with public health strategies to better understand the interaction between genetics and modifiable risk factors.

Lifestyle factors, particularly alcohol consumption and smoking, were less prevalent among participants, yet their potential impact on cardiovascular, respiratory, and metabolic health cannot be overlooked. Strengthening **public health education** and community-based awareness programs can further discourage harmful behaviors and promote long-term wellness.

Stress was identified as a significant contributor to adverse health outcomes. The high incidence of stress among participants emphasizes the growing need for **mental health support systems**, stress management training, and holistic wellness approaches within antenatal care to ensure both maternal and fetal well-being.

Pregnancy-specific parameters, including **trimester and gravida classifications**, revealed the predominance of third-trimester cases,

underscoring the increased physiological and medical challenges during the later stages of pregnancy. Differentiating between **primi-gravida** and **multi-gravida** cases further highlighted the need for personalized maternal care plans that consider previous pregnancy experiences and complications.

The **area-based classification** revealed higher incidences in rural populations, likely due to disparities in healthcare access, nutritional awareness, and environmental exposures. These findings advocate for **region-specific healthcare initiatives**, improved outreach programs, and infrastructure strengthening in underserved areas.
The **mode of delivery** emerged as another key factor, with a high prevalence of cesarean (C-section) deliveries compared to normal deliveries. While C-sections are sometimes medically necessary, the frequency observed calls for careful evaluation of clinical practices to prevent unnecessary surgical interventions and to encourage normal vaginal deliveries when safe and feasible.

Analysis of **hemoglobin levels** indicated that most participants had values within the 9–10 g/dL range, suggestive of mild anemia. Addressing nutritional deficiencies through iron and folate supplementation is essential to improve maternal health and pregnancy outcomes. Similarly, **blood pressure patterns** highlighted the presence of elevated and hypertensive ranges, reinforcing the importance of regular monitoring, lifestyle modification, and early intervention to prevent complications like preeclampsia.

Lastly, **potassium levels** demonstrated imbalances among participants, emphasizing the importance of maintaining proper **electrolyte homeostasis** through dietary management and medical evaluation.

In summary, this comprehensive exploration reveals that maternal health is influenced by a complex interplay of physiological, genetic, and environmental factors. Addressing these interrelated elements through **personalized, preventive, and community-oriented healthcare strategies** is essential for improving outcomes among women of reproductive age. The findings underscore the need for integrated maternal health programs that combine education, early detection, and targeted interventions to ensure safe pregnancies and healthier lives for mothers and their infants.

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