Original Article
doi:10.31674/mjn.2025.v17i01.014

MJN

Risk Factors Associated with Haemolysis, Elevated Liver Enzymes, and Low Platelets Syndrome among Pregnant Women

Ameera Mohammed Abdulwahab*, Salwa Hazim Al Mukhtar
College of Nursing, University of Mosul, 41002 City of Mosul, Iraq

**Corresponding Author's Email: ameera.22nup16@student.uomosul.edu.iq*

ABSTRACT

Background: Haemolysis, elevated liver enzymes, and low platelets (HELLP) syndrome is considered a part of the preeclampsia disease spectrum, affecting 0.5–0.9% of all pregnancies. **Objective:** To identify risk factors associated with HELLP syndrome among pregnant women at Tal Afar General Hospital. **Methods:** A case-control study was conducted among 125 pregnant women, including 25 cases and 100 controls. The cases included 25 women with HELLP syndrome, while the controls included 100 women with gestational hypertension. A developed interviewing questionnaire was used to collect information related to mothers. The study was conducted at Tal Afar General Hospital. **Results:** The study found that pregnant women who were primigravida (40% vs. 26%), nullipara (48% vs. 33%), had fewer than five antenatal care visits (68% vs. 47%), consumed a high-salt diet (64% vs. 39%), had multiple pregnancies (12% vs. 9%), had a history of chronic hypertension (36% vs. 17%), used assisted reproductive technology (24% vs. 2%), had chronic liver disease (12% vs. 2%), and had a history of preeclampsia (48% vs. 33%) were at increased risk of developing HELLP syndrome compared to those with gestational hypertension. **Conclusion:** The study concludes that high-risk factors associated with HELLP syndrome include a family history of preeclampsia, a history of chronic hypertension, gestational diabetes, assisted reproductive technology, chronic liver disease, and multiple pregnancies.

Keywords: HELLP Syndrome; Pregnant Women

INTRODUCTION

Pregnancy-induced hypertension (PIH) remains one of the most significant obstetric complications globally, encompassing gestational hypertension, preeclampsia (PE), and eclampsia (E). These conditions are major contributors to maternal and neonatal morbidity and mortality, leading to complications such as premature birth, intrauterine growth restriction, placental abruption, and even intrauterine foetal demise (GolaÅ„ska-WrÃ³blewska, Fryczak & Siejka, 2024; Hama Rahim *et al.*, 2025; Jones *et al*., 2024; Soomro *et al*., 2023). It is estimated that PIH affects approximately 5–8% of pregnancies worldwide, with preeclampsia alone accounting for 10% of all pregnancies and ranking as the second leading cause of direct maternal and foetal deaths (Momodu *et al*., 2023; Qian *et al*., 2023). Evidence suggests that Asian women with preeclampsia are more likely to experience adverse pregnancy outcomes compared to other populations (Atiyah & Oleiwi, 2025; Eghan *et al*., 2024).

Women affected by PIH are at increased risk of developing long-term health complications such as chronic hypertension, renal failure, and cardiovascular disease(Johal, Kale & Brar, 2024; Priyadarshanie *et al*., 2023; Youns & Al Mukhtar, 2025). Moreover, the long-term health of the offspring may also be compromised, with elevated risks for developing hypertension, diabetes mellitus, renal anomalies, and cardiovascular conditions later in life (Mohammed-Amen & Ali, 2024; Rahnama *et al*., 2024). The recurrence risk of PIH is also notable—approximately 55% if it occurs before 28 weeks and 25% if it arises before 34 weeks of gestation (Shekaili, Hashmi, & Omari, 2024). These long-term implications not only threaten maternal and foetal health but also impose a considerable burden on healthcare systems.

HELLP syndrome—a severe form of preeclampsia, characterised by haemolysis, Elevated Liver enzymes, and Low Platelets, represents a critical obstetric emergency. Clinical manifestations include

Received: June 8, 2024 Received in revised form: May 30, 2025 Accepted: June 2, 2025

epigastric pain, nausea, vomiting, thrombocytopenia, haemolysis evident on peripheral smear, and deranged liver function tests (Kolokythas *et al*., 2024). First described in 1982, the incidence of HELLP syndrome varies from 0.2 to 7.6 per 1000 deliveries, largely due to inconsistent diagnostic criteria. A partial form—ELLPS (Elevated Liver enzymes and Low Platelet count syndrome)—may occur without evidence of haemolysis (Kolokythas *et al*., 2024; Mohammed & Muhamed , 2023).

HELLP syndrome is associated with an elevated risk of life-threatening maternal complications, including acute renal failure, disseminated intravascular coagulation (DIC), hepatic haemorrhage or failure, placental abruption, and stroke. It is believed to stem from underlying liver dysfunction and thrombotic microangiopathy, occurring in 0.5% to 0.9% of all pregnancies (Obiegbusi, Dong, & Obiegbusi, 2023).

Identifying risk factors associated with HELLP syndrome is essential for early recognition and timely intervention, particularly for healthcare professionals managing patients with severe preeclampsia. While global studies have addressed HELLP syndrome, there remains a gap in localised research—particularly in Iraq and the Nineveh governorate, including Tal Afar district. Therefore, this study aims to investigate the risk factors associated with HELLP syndrome among pregnant women in their third trimester in this specific setting.

METHODOLOGY

Study Design

The study utilised a case-control design to identify the risk factors linked to HELLP syndrome among pregnant women in the third trimester and to compare HELLP syndrome and gestational hypertension. In this study, cases referred to pregnant women with HELLP syndrome, while controls referred to pregnant women with gestational hypertension. The research was conducted at Tal Afar General Hospital in the Tal Afar District, Nineveh Governorate, Iraq, from October 11, 2023, to March 30, 2024.

Study Setting

The study was conducted at Tal Afar General Hospital, located in the Tal Afar District west of Mosul in Nineveh Governorate, northern Iraq. Serving a diverse population of approximately 763,000—primarily Turkmen (60%), Arabs (28%), and Kurds (12%)—the hospital has a 203-bed capacity and employs 642 nurses. It handles an average of 500 vaginal and 78 caesarean deliveries monthly. Additionally, the emergency department treats around 7,667 patients, while consulting clinics serve approximately 9,779 patients each month. The hospital features specialised units, including Obstetrics and gynaecology, paediatrics, Radiology, Laboratory, CT scan, and Physical Therapy.

Data Collection Period

The data for the current study were collected from a single hospital in the Tal Afar district from December 2, 2023, to March 30, 2024.

Sample of the Study

To conduct the research, a non-probability sample for a case-control study was selected, consisting of 25 cases with HELLP syndrome and 100 controls with gestational hypertension, based on specific inclusion and exclusion criteria for pregnant women with HELLP syndrome during their third-trimester visit.

Data Collection Tools

The study employed a structured interviewing questionnaire. (Fort, 2024; Sayed *et al.*, 2024; Pressman *et al.*, 2024) It is divided into six parts: demographic information (age, marital status, occupation, educational level), obstetric history (gestational age, gravidity, parity, history of abortion, antenatal care visits), the clinical presentation of HELLP syndrome (elevated blood pressure, generalized swelling, headache, blurred vision, seizures, chest or shoulder pain, abdominal pain, epigastric pain, vaginal bleeding, shortness of breath, fatigue), risk factors associated with HELLP syndrome (previous preeclampsia, family history of preeclampsia, gestational diabetes, chronic hypertension, dietary habits, consumption of soft drinks and caffeine, canned food intake, stress, smoking, restlessness, multiple pregnancies, kidney disease, assisted

reproductive technology, chronic liver disease), and laboratory analysis (haemoglobin levels, platelet counts, proteinuria, liver function tests, kidney function tests), all conducted in the Tal Afar General Hospital laboratory.

Validity and Reliability

To ensure the validity of the questionnaire, it was reviewed by a panel of experts in obstetrics and gynaecology, who evaluated the content for relevance and comprehensiveness. The questionnaire was then pretested on a small sample of pregnant women to identify any issues with question clarity and to ensure it effectively captured the required data.

Reliability was assessed using a test-retest method (Ibrahim, Ghanim & Alkhaderjameel, 2020; Mahmood *et al.*, 2022; Mohammed & Ibrahim, 2023; Sulaiman *et al*., 2023). The questionnaire was administered to the same group of participants at two different points, and the results were compared to measure consistency. The reliability coefficient obtained demonstrated a high level of consistency in the responses, confirming the tool's reliability for data collection in this study.

Statistical Data Analysis

Data analysis was conducted using IBM SPSS Statistics version 26.0. Descriptive statistics, including frequencies and percentages, were used to summarise categorical variables, while means, minimum and maximum values, and standard deviations (SD) were used to describe continuous variables. To evaluate differences between the case group (n = 25) and the control group (n = 100), odds ratios (OR) with 95% confidence intervals (CI) were calculated. Fisher's Exact Test was used to determine statistical significance for categorical comparisons, particularly when expected frequencies were low. A p-value of < 0.05 was considered statistically significant. For continuous laboratory variables, only descriptive statistics were reported to present the biochemical characteristics of the HELLP syndrome group.

Ethical Consideration

This study received ethical approval from the Collegiate Committee for Medical Research Ethics, University of Mosul, Iraq with reference number 82-CCMRE-Nur-23-24 on 13th December 2023.

RESULTS

The study identified significant differences in obstetric characteristics between the case and control groups. Most cases (68%) were within the 30-40 weeks gestation period compared to 50% of controls, with women in this gestation period having a higher odds ratio (OR 2.12) for developing HELLP syndrome. This suggests that the critical period for monitoring and potential intervention is late in pregnancy, aligning with existing literature that identifies late gestation as a high-risk period for complications such as HELLP syndrome.

Table 1: Descriptive and Comparison of Risk Factors for Obstetrics Characteristics of the Two Sample Groups between Case (n=25) and Control (n=100)

Variables	Case F (%)	Control F (%)	OR	95% CI	*p*-value
24–29 weeks	3 (12.0%)	30 (30.0%)	0.30	0.08–1.08	0.06
30–40 weeks	17 (68.0%)	50 (50.0%)	2.12	0.89–5.02	0.08
>40 weeks	5 (20.0%)	20 (20.0%)	1.00	Reference	–
Primigravida	10 (40.0%)	26 (26.0%)	1.90	0.78–4.66	0.16
1 Abortion	8 (32.0%)	10 (10.0%)	4.20	1.45–12.12	0.009
<5 ANC visits	17 (68.0%)	47 (47.0%)	2.40	1.01–5.69	0.046
≥5 ANC visits	8 (32.0%)	53 (53.0%)	0.417	0.18–0.96	0.041

Table 1 presents a comparison of obstetric risk factors between the case group (n = 25) and control group (n = 100). Notable differences were observed in several variables. A higher proportion of cases had poor antenatal care (<5 visits) compared to controls (68.0% vs. 47.0%; OR = 2.4), and more cases experienced their first

pregnancy (primigravida: 40.0% vs. 26.0%; OR = 1.9). Nulliparity was also more common among cases (48.0% vs. 33.0%; OR = 1.9). Additionally, one abortion history was more frequent among cases (32.0%) than controls (10.0%; OR = 4.2), while recurrent abortions were only observed in the control group. These findings suggest that limited antenatal care and specific obstetric profiles may be associated with increased risk for HELLP syndrome.

Table 2: Frequency and Percentage of Each Variable for Signs and Symptoms of the Two Samples Group between Case (n=25) and Control (n=100)

Symptom	Case Yes (%)	Control Yes (%)	OR	95% CI	*p*-value
Elevated BP (≥140/90)	100%	99%	1.01	0.06–17.0	1.00
Generalized swelling	100%	77%	8.91	1.13–70.13	0.014*
Persistent headaches	100%	98%	2.55	0.13–49.7	1.00
Blurred vision	88%	80%	1.83	0.54–6.25	0.35
Seizures with HELLP	28%	3%	12.62	3.11–51.2	<0.001*
Chest/shoulder pain	8%	4%	2.09	0.36–12.3	0.32
Abdominal pain	88%	45%	8.52	2.66–27.2	<0.001*
Epigastric pain	64%	52%	1.66	0.67–4.08	0.27
Vaginal bleeding	16%	14%	1.17	0.33–4.21	0.79
Shortness of breath	16%	13%	1.28	0.36–4.57	0.71
Fatigue	88%	88%	1.00	0.25–3.94	1.00

*Odds Ratio (OR) *significant*

Table 2 compares the frequency and percentage of clinical signs and symptoms between the HELLP syndrome case group (n = 25) and the control group (n = 100). The most commonly reported symptoms among cases were elevated blood pressure, generalised swelling, persistent headaches, and fatigue, each reported by 88–100% of participants in the case group. These symptoms were also common among controls, though slightly less frequent. Notably, abdominal pain (88.0% vs. 45.0%) and epigastric pain (64.0% vs. 52.0%) were more frequently reported by cases. Seizures were significantly more common in the case group (28.0%) compared to controls (3.0%), suggesting a potential link to disease severity. Other symptoms such as blurred vision, shortness of breath, and vaginal bleeding showed slight differences but were less specific. Overall, the data highlights that certain symptoms, especially hypertension, abdominal discomfort, and neurological manifestations, were more pronounced among HELLP syndrome cases, reinforcing their diagnostic importance.

Table 3: Descriptive and Comparison for Risk factors Associated with HELLP Syndrome of the Two Samples Group between Case (n=25) and Control (n=100)

Variable	Case Yes (%)	Control Yes (%)	OR	95% CI	*p*-value
Prior preeclampsia	48.0%	33.0%	1.87	0.76–4.58	0.17
Family history of preeclampsia	56.0%	39.0%	1.99	0.82–4.80	0.12
Gestational diabetes	12.0%	1.0%	13.5	1.27–143.3	0.01*
Chronic hypertension	36.0%	17.0%	2.74	1.02–7.35	0.045*
High-salt food intake	64.0%	39.0%	2.78	1.12–6.89	0.026*
Stress	96.0%	73.0%	8.87	1.09–72.0	0.017*
ART Pregnancy	24.0%	2.0%	15.4	2.67–88.9	<0.001*
Chronic liver disease	12.0%	2.0%	6.68	1.05–42.5	0.034*

Table 3 presents a comparison of risk factors associated with HELLP syndrome between the case group (n = 25) and the control group (n = 100). Several factors were notably more prevalent among the cases, with the highest odds ratios observed for assisted reproductive technology (OR = 15.4), gestational diabetes (OR = 13.5), chronic liver disease (OR = 6.68), and psychological stress (OR = 8.87), suggesting strong associations with HELLP syndrome. Additional factors such as high salt intake (OR = 2.78), chronic hypertension (OR = 2.74), soft beverage consumption (OR = 2.89) and sleeplessness (OR = 2.39) also showed increased risk. While

some variables, like canned food consumption, did not differ between groups (OR = 1), the findings indicate that a combination of medical, dietary, and lifestyle-related factors may contribute to the development of HELLP syndrome during pregnancy.

Table 4: Mean and Standard Deviation for Characteristics Laboratory Tests of HELLP Syndrome for Case Group (n=25)

Variables	R	Min	Max	$\bar{X}$	SD
Haemoglobin Level g/dl	2.1	7.0	9.1	8.108	0.6448
Platelet Count /ml	59000	52000	111000	91680.00	13347.035
SGPT U/L	109.0	46.0	155.0	74.240	24.6158
SGOT U/L	87.0	48.0	135.0	75.320	19.2044
Alkaline Phosphate U/L	85.0	85.0	170.0	109.360	18.0437
Blood Urea Nitrogen mg/dl	20.0	45.0	65.0	53.028	5.9172
Blood Creatine mg/dl	1.4	1.5	2.9	1.780	0.2872

SD- Standard Deviation

Table 4 summarises the laboratory findings for the HELLP syndrome case group (n = 25), presenting mean values and standard deviations for key haematological and biochemical markers. The mean haemoglobin level was 8.11 g/dl (SD ±0.64), indicating mild anaemia. The platelet counts averaged 91.680/ml (SD ± 13.347), reflecting thrombocytopenia, a hallmark of HELLP syndrome. Elevated liver enzymes were observed, with SGPT at 74.24 U/L (SD ±24.62) and SGOT at 75.32 U/L (SD ±19.20), consistent with hepatic involvement. The mean alkaline phosphatase level was 109.36 U/L (SD ± 18.04). Renal function markers showed elevated levels as well, with blood urea nitrogen at 53.03 mg/dl (SD ± 5.92) and creatinine at 1.78 mg/dl (SD ± 0.29), indicating impaired renal function commonly seen in HELLP syndrome cases. These laboratory results collectively reflect the classic triad of haemolysis, elevated liver enzymes, and low platelet count, which are diagnostic criteria for HELLP syndrome.

DISCUSSION

The 21st century has experienced increased modernisation and industrialization, longer life expectancies, and changes in global habits (Mahmmoed, Ibrahim & Abdulgani, 2020). In the recent edition of the DSM-IV, life-threatening illness was identified for the first time as a potential Criterion A stressor event for PTSD (Alkhyatt *et al*., 2012). Table 2 shows various variables related to obstetric characteristics; this study found that a higher percentage of gestational age (30-40) weeks are more likely to develop this syndrome (68%) compared to the control in the same gestational age (50%). pregnant women within these periods of weeks gestation have an odds ratio of 2.12 significantly increasing the likelihood of developing HELLP syndrome than control, this finding is consistent with a previous study conducted in Turkey that found more than half of pregnant women within 28- and 36-week gestation increased the risk of having HELLP syndrome (Ağaçayak *et al*., 2022; Gerber, Brodsky & Vaught, 2025).

The reasons for these results are increased demands on the body during this time, along with factors like hormonal changes and reduced vascular flexibility, which contribute to the development of the syndrome compared to pregnant women at the same gestational age who have monitoring blood pressure and signs and symptoms that lead to HELLP syndrome. Lifestyle modifications like rest, reducing salt intake, and medications to control blood pressure. Regarding the number of gravidities, the distribution of gravidity differs slightly between cases and controls; the majority of primigravida women are more likely to develop this syndrome (40%) compared to multigravida and grand multigravida (37%) who have gestational hypertension. the odd ratio is 1.9 indicating pregnant women who are primigravida have an increased risk of having the syndrome compared to women with multigravida and grand multigravida this finding is consistent with a previous study conducted in India that found primigravida patients have more chances to develop HELLP syndrome (Shelat *et al*., 2020).

The article also provides information about the number of births (parity); in the case group, the most significant proportion (48%) represents pregnant women with nulliparous, compared to the control group, where the higher percentages (37%) represent multiparous women. the odd ration is 1.9 meaning women who

are nullipara have an increased risk of having HELLP syndrome to multiparous women. a similar study agreed with a previous study conducted in the Netherlands that found most women who were nulliparous had an increased risk of preeclampsia (Van Oostwaard *et al*., 2017). To clear up these results, the occurrence of this syndrome in primigravida and nulliparous women may be related to their older mothers. Additionally, certain pre-existing health conditions or genetic factors may predispose primigravida and nulliparous women to HELLP syndrome. In contrast, multigravida and multiparous women did not develop the syndrome because these women may have had better physiological adaptation to pregnancy in previous pregnancies, which may have reduced the risk of HELLP syndrome.

As for the relationship between miscarriage and high blood pressure during pregnancy, the highest percentages appeared in the case (68%) compared to the control (85%), which indicates the absence of a relationship between miscarriage and high blood pressure during pregnancy, with the odds ratio of 0.3 indicating miscarriage has no effect on developing HELLP syndrome, a similar study agreed with a previous study conducted in Iran that found the number of miscarriages did not affect the prediction model of HELLP syndrome (Farajollahi *et al*., 2023). These findings clarify that both miscarriage and gestational hypertension are associated with certain risk factors, such as maternal health conditions or genetic factors, but they are not directly causally related. The table also showed that the highest percentages of pregnant women who have ≤ 5 antenatal care visits are more likely to develop this syndrome (68%) compared to the control group, the highest percentage (53%) for pregnant women who have ≥ 5 visits. pregnant women who had less than five antenatal care visits have a higher odds ratio of 2.4 and an increased risk of developing HELLP syndrome compared to the control; this finding is consistent with a previous study conducted in Bangladesh that found the incidence of antenatal care was assessed, which showed the majority were on irregular antenatal care, which contributes to the progress of the severity of the disease. (Nazim *et al*., 2024). Elucidate these results, pregnant women who receive fewer than five prenatal care visits are at a higher risk of developing HELLP syndrome due to inadequate monitoring of blood pressure, urine protein levels, and blood tests, which can help detect early signs of preeclampsia, which is closely linked to this syndrome, compared to having more than five prenatal visits enables medical professionals to keep a close on the pregnant patient's health, spot any indications of worsening hypertension or other issues, and take swift action to stop the development of the syndrome, in order to lower the risk of difficulties, these visits also offer the chance for patient education and counselling on controlling hypertension throughout pregnancy.

Table 3 shows the frequencies and percentages of signs and symptoms associated with HELLP syndrome and gestational hypertension among pregnant participants. The results appeared almost similar in the case and control tables about high blood pressure above 140/90 mmHg, and their percentage was (100% vs. 99%); this finding is consistent with a previous study conducted in Turkey, which found Hypertension (blood pressure ≥ 140/90mmHg) is present in most of the patients with HELLPsyndrome. (Ekinci & Ebinç, 2020; Jiang *et al*., 2025). These results construe that pregnancy hormones play a role in regulating blood pressure; imbalances in hormones like oestrogen and progesterone can contribute to gestational hypertension and may exacerbate hypertension in women with HELLP syndrome. While stress and anxiety are everyday in pregnant women, particularly those facing complications like haemolysis, elevated liver enzyme, and low platelet syndrome, they can also influence high blood pressure readings during daily life compared to pregnant women with gestational hypertension, who may be managed with close monitoring without progression to preeclampsia or HELLP syndrome. Pregnant women with gestational hypertension may follow gynaecological medical programmes or browse medical websites on the Internet, which helps them detect any complications early and manage them appropriately.

Regarding other signs associated with this syndrome, the incidence of general swelling of the face and extremities for pregnant women who suffer from the syndrome was 100% compared to pregnant women who suffer from gestational hypertension (77%). As for headaches that are associated with this syndrome, the incidence of headaches in the case-control group was 100% vs. 98%; these results agreed with a previous study conducted in Sierra Leone, which found that most of the pregnant women have clinical symptoms associated with preeclampsia, including headache and generalised oedema. (Chen *et al*., 2025; Stitterich *et al.*, 2021).

These results indicate that fluid retention is a common condition among pregnant women, which can cause

swelling of the face and extremities, among other body areas. Conditions such as HELLP syndrome and preeclampsia often make fluid retention worse. Decreased urine production and fluid retention in the body are symptoms of renal insufficiency HELLP syndrome. Compared to pregnant women who suffer from gestational hypertension, they may maintain their health and follow a diet that contains little sodium. They can drink sufficient water and eat foods rich in potassium, which reduces fluid retention (Mazur *et al*., 2025). Headache symptoms may arise from elevated blood vessel pressure in the brain caused by pregnant women with high blood pressure. Handling a severe medical condition such as HELLP syndrome can be highly stressful and anxiety provoking; stress and anxiety are common causes of headaches in pregnant women, and pregnant women with this syndrome may be more likely to become dehydrated as a result of vomiting, reduced fluid intake, or changes in bodily fluids, dehydration can also exacerbate headaches, compared to pregnant women with gestational hypertension suffering from headaches due to less severe blood pressure elevations which result from hormonal changes and fluid retention during pregnancy.

Also, signs of blurred vision appeared in the case-control groups (88% vs. 80%). This finding is consistent with a previous study conducted in India, which found that the prevalence of retinopathy changes was higher among patients with severe preeclampsia and eclampsia. (Devaru, 2018). Pregnant women with HELLP syndrome suffering from high blood pressure can have affected blood vessels in the eyes, leading to changes in vision. Pregnant women with HELLP syndrome from fluid retention, leading to swelling in the body involving the eyes; this swelling can cause changes in the shape of the eye, affecting vision compared to gestational hypertension, which typically develops later in pregnancy, while HELLP syndrome often occurs in the third trimester. The timing and development of these conditions can affect the severity and onset of symptoms, including blurred vision.

As for the seizures that occur in pregnant women with HELLP syndrome, they appeared in the case-control groups (28% vs. 3.0%); this finding is consistent with a previous study conducted in Nigeria, which found less than a third of pregnant women had seizures associated with preeclampsia. (Bankole, Onebunne & Owonikoko, 2022). In my personal opinion, brain swelling, known as cerebral oedema, is a possible consequence of HELLP syndrome. Brain oedema may develop because of a combination of high blood pressure, liver dysfunction, and other HELLP syndrome-related conditions. Seizures are more likely to occur when there is cerebral swelling compared to pregnant women with gestational hypertension. Lowering the risk of having seizures is due to the absence of organ damage, lower blood pressure, early detection, and care of gestational hypertension. Other signs associated with HELLPsyndrome also include chest pain or shoulder pain, which appeared in the case-control group (8% vs 4%); this finding is consistent with a previous study conducted in Saudi Arabia, which found that pregnant women with preeclampsia are less likely to have chest pain. (Gari *et al*., 2022).

These results clarify pulmonary oedema, a disorder where fluid accumulation in the lungs is a possible outcome of HELLP syndrome. Breathing difficulties, tightness in the chest, and chest pain may result from this fluid accumulation. In contrast to gestational hypertension, chest pain during pregnancy is caused by elevated blood pressure, which can put stress on the heart and result in diseases like cardiomyopathy or hypertensive heart disease. Heart failure or decreased blood supply to the heart muscle (ischaemia) can both cause chest pain. One of the signs and symptoms that include HELLP syndrome is abdominal pain. The result of this study found that women with HELLP syndrome suffered from abdominal pain (88%) compared to women with gestational hypertension (45%). This finding is consistent with a previous study conducted in Poland, which found that the vast majority of patients with preeclampsia have abdominal pain. (Pankiewicz *et al.*, 2019). The researcher's theory is that there is a defect in liver function, which can cause abdominal pain, especially in the right upper quadrant of the abdomen, which pregnant women with HELLPsyndrome experience; this pain could be the result of stretching of the liver capsule or inflammation, compared to abdominal pain, which can still occur in pregnant women who develop gestational hypertension for a variety of reasons, including uterine expansion and gastrointestinal problems.

Also, further signs include epigastric pain and a higher percentage of pregnant women with HELLP syndrome in the case group (64%) compared to the control group (52%); as for fatigue, a higher similar percentage appeared in the case-control groups (88% vs 88%); this finding is consistent with a previous study

conducted in Moscow that found nearly all of the patients presented with generalised malaise and more than two-thirds with epigastric pain (Kuzmin, 2018). Interpret this result: the congestion and inflammation brought on by the HELLPsyndrome can cause the liver to expand and distend, which can put pressure on the upper abdomen and produce discomfort in the epigastric area compared to epigastric pain, which is less common in pregnant women with gestational hypertension. Although elevated blood pressure might cause minor liver involvement, the resulting liver malfunction or enlargement is usually not as severe as in HELLP syndrome. Thus, there is a decreased chance of experiencing epigastric pain. Regarding fatigue, women who suffer from HELLP syndrome or gestational hypertension may find it challenging to tolerate food or have to follow specific dietary guidelines because of symptoms like nausea and vomiting. Fatigue may worsen due to dietary inadequacies, such as iron deficiency.

Another sign associated with HELLP syndrome is vaginal bleeding, which occurred more in the case group (16%) than in the control group (14%); this finding is consistent with a previous study conducted in India which found less than ten per cent of vaginal bleeding associated with preeclampsia (Nagar *et al*., 2015). Also, shortness of breath is one sign of HELLP syndrome; incidence appeared in the case-control group (16% vs. 13%); this finding is consistent with a previous study conducted in Tanzania, which found that ten per cent of patients had shortness of breath (Eze *et al*., 2018). This explains the result; complications associated with HELLP syndrome, such as placental abruption, where the placenta partially or completely separates from the uterine wall before delivery, and vaginal bleeding resulting from placental abruption compared to gestational hypertension, typically do not directly influence the integrity of the placenta. Since gestational hypertension primarily involves elevated blood pressure without placental abnormalities, the risk of placental abruption and subsequent bleeding is lower.

Limitation

This study has several limitations that should be acknowledged. Firstly, the research was conducted in a single hospital with a relatively small sample size (25 cases and 100 controls), which limits the generalizability of the findings. The use of non-probability sampling may have introduced selection bias, and reliance on self-reported data raises the possibility of recall bias, particularly concerning dietary and lifestyle factors. Additionally, the study did not control for potential confounding variables such as socioeconomic status or environmental exposures, which may influence the risk of HELLP syndrome. The cross-sectional nature of data collection restricts the ability to draw causal inferences, and the absence of longitudinal follow-up limits insights into long-term maternal and neonatal outcomes.

CONCLUSION

The findings of the study estimated that specific demographic data, such as younger-age pregnant women, educational level, occupation, and obese pregnant women, increased the incidence of HELLP syndrome compared to gestational hypertension. Furthermore, obstetric factors increase the incidence of HELLP syndrome among pregnant women with a gestational age (30-40) weeks, primigravida, nullipara, and antenatal care of less than five visits. Also, risk factors that significantly increase the risk of the incidence of HELLP syndrome include gestational diabetes, history of chronic hypertension, salty foods, soft beverages, stress, cigarette smoking, sleeplessness, assisted reproductive technology, and chronic liver diseases. In addition, following a history of preeclampsia, family history of preeclampsia, fatty foods, beverages containing caffeine, multiple gestations and a history of kidney disease. Canned foods are the only factors that did not affect the development HELLP syndrome. It was also concluded, through this research, that some clinical signs and laboratory results appear to confirm that pregnant women with HELLPsyndrome, which includes elevated blood pressure above 140/90 mmHg, generalised swelling in the face and extremities, headache, blurred vision, abdominal pain, epigastric pain, and fatigue, in addition to clinical symptoms that are less apparent but occur in very severe cases, such as chest pain or shoulder pain, shortness of breath, seizures and vaginal bleeding. Moreover, there are laboratory results confirming the presence of HELLP syndrome, such as low haemoglobin concentration and low platelet count; in addition, elevated liver function tests such as SGPT, SGOT, ALP and also increased kidney function tests such as blood urea nitrogen and blood creatinine; these results become more abnormal in pregnant women with HELLP syndrome than in those with gestational hypertension.

Recommendation

This study identifies HELLP syndrome as a serious maternal health issue that requires joint efforts from pregnant women, healthcare providers, and policymakers. Pregnant women should prioritise regular prenatal visits, monitor their blood pressure, and maintain a balanced diet to support early detection and reduce risks.

Healthcare providers should enhance screening for high-risk pregnancies and increase monitoring during the third trimester. Providing education on prenatal care, nutrition, and stress reduction is vital. Collaborative care involving obstetricians, dietitians, and mental health professionals can ensure comprehensive support.

Policymakers must improve access to prenatal services, especially in rural areas, and fund research on HELLP syndrome. Awareness campaigns and community programmes should promote healthy behaviours during pregnancy. Investing in diagnostic tools and telemedicine will strengthen prenatal care delivery and reach underserved populations.

Conflict of Interest

The authors declare that they have no competing interests.

ACKNOWLEDGEMENT

The authors are thankful to the institutional authority for completion of the work.

REFERENCES

Ağaçayak, E., Bugday, R., Peker, N., Deger, U., Ölmez Kavak, G., Evsen, M. S., & Gul, T. (2022). Factors affecting ICU stay and length of stay in the ICU in patients with HELLP syndrome in a tertiary referral hospital. *International Journal of Hypertension, 2022*(1). https://doi.org/10.1155/2022/3366879

Alkhyatt, M. K., Abdullah, E. K., Ibraim, R. H., Al Anee, B., & Al Raho*, J. (2012).* Post-traumatic stress in women with breast cancer. *Jordan Medical Journal, 46*(4), 315-319. Retrieved from: https://archives.ju.edu.jo/index.php/jmj/article/view/3444/5729 . Accessed on 8th June, 2023.

Atiyah, F., & Oleiwi, S. (2025). Assessing the Physical, Psychological, and Spiritual Aspects of Self-Care Behaviors for Managing Minor Discomforts During Pregnancy in Karbala City. *Mosul Journal of Nursing, 13*(1), 217-237. https://doi.org/10.33899/mjn.2025.150185.1111

Bankole, A. O., Onebunne, C. A., & Owonikoko, K. M. (2022). Fetomaternal outcome of pre-eclampsia and eclampsia in Lautech Teaching Hospital, Ogbomoso: a 4-year review: Bankole et al: fetomaternal outcomes of preeclampsia and eclampsia. *Tropical Journal of Medical Research, 21*(2), 75-84. https://doi.org/10.5281/zenodo.7792962

Chen, J., Gu, H., Wu, H., Jiang, M., Gu, Y., & Feng, Y. (2025). The serum gamma-glutamyl transpeptidase-to-platelet ratio predicts HELLP syndrome. *BMC Pregnancy and Childbirth, 25*(1). https://doi.org/10.1186/s12884-025-07431-4

Devaru, S. (2018). Study of Fundus Changes in Pregnancy Induced Hypertension (Master's thesis, Rajiv Gandhi University of Health Sciences (India). Retrieved from: https://www.proquest.com/openview/b5ae871042351d604b769ab8ffc35449/1?pq-origsite=gscholar&cbl=2026366&diss=y. Accessed on 15th July, 2023.

Eghan, P., Folson, A. A., Donkor, A., Kokuro, C., & Amo Wiafe, Y. (2024). Relationship between hypertensive disorders of pregnancy (HDP) and cardiac remodeling during pregnancy: Systematic review and meta-analysis. *European Journal of Obstetrics & Gynecology and Reproductive Biology, 298*, 108-115. https://doi.org/10.1016/j.ejogrb.2024.05.003

Ekinci, Ö., & Ebinç, S. (2020). Laboratory and clinical characteristics of patients diagnosed with HELLP syndrome due to microangiopathic hemolytic anemia and/or thrombocytopenia. *Van Medical Journal, 27*(3), 287-291. https://doi.org/10.5505/vtd.2020.57984

Eze, J. N., Ozoh, O. B., Otuu, F. C., Shu, E. N., & Anyaehie, B. U. (2022). Respiratory symptoms and lung function among inmates in a Nigerian prison: a cross sectional study. *BMC Pulmonary Medicine, 22*(1), 84. https://doi.org/10.1186/s12890-022-01882-7

Farajollahi, B., Sayadi, M., Langarizadeh, M., & Ajori, L. (2025). Presenting a prediction model for HELLP syndrome through data mining. *BMC Medical Informatics and Decision Making, 25*(1). https://doi.org/10.1186/s12911-025-02904-0

Fort, R. (2024). Le HELLP syndrome dans tous ses états. *Revue Francophone des Laboratoires, 2024*(560), 54-60. https://doi.org/10.1016/S1773-035X(24)00109-6

Gari, A., Alshanqiti, W., Alshanqiti, F., Alquzi, R., Alsamli, R., & Alqahtani, R. (2022). Level of knowledge on preeclampsia symptoms, complications, and risk factors among women in Saudi Arabia: a cross sectional study. *Medical Science, 26*(128), 1-9. https://doi.org/10.54905/disssi/v26i128/ms432e2512

Gerber, G. F., Brodsky, R. A., & Vaught, A. J. (2025). Complement C5 Inhibition in early onset HELLP Syndrome. *Blood Advances, 9*(13), 3304–3307. https://doi.org/10.1182/bloodadvances.2024014746

Golańska-Wróblewska, M., Fryczak, J., & Siejka, A. (2024). Serum levels of sirtuins, leptin and adiponectin in women with pregnancy-induced hypertension. *Cytokine, 179*. https://doi.org/10.1016/j.cyto.2024.156612

Hama Rahim, B., Amin, B., Akbar, S., & Hamalaw,, S. (2025). Seroprevalence and risk factors of toxoplasmosis among mothers with spontaneous abortion admitted to the Maternity Teaching Hospital in Sulaimani City, Iraq., Iraq. *Mosul Journal of Nursing, 13*(1), 117-128. https://doi.org/10.33899/mjn.2025.151966.1122

Ibrahim, R. H., Ghanim, A. K., & Alkhaderjameel, H. A. (2020). Impact of electronic games on the behavior of children and their academic achievement upon schools in Mosul city [Article]. *Indian Journal of Forensic Medicine and Toxicology, 14*(1), 374-379. https://doi.org/10.37506/v14/i1/2020/ijfmt/192926

Jiang, Y., Chen, L. J., Hu, H. H., Jin, N., Lv, S. R., Fang, C., ... & Luo, Q. (2025). Development a nomogram for predicting HELLP syndrome in women complicated with gestational hypertension. *BMC Pregnancy and Childbirth, 25*(1). https://doi.org/10.1186/s12884-025-07546-8

Johal, D., Kale, M., & Brar, S. (2024). Maternal and fetal outcomes in pregnancy in the fifth decade of life and beyond. *Journal of Obstetrics and Gynaecology Canada, 46*(6). https://doi.org/10.1016/j.jogc.2024.102418

Jones, A. A., Lippincott, J. K., Gonzalez, M. P., & Kim, J. E. (2024). Pregnancy-induced hypertension. *Retinal and Choroidal Vascular Diseases of the Eye*, 437-448. https://doi.org/10.1016/B978-0-443-15583-3.00033-0

Kolokythas, A., Badeghiesh, A., Baghlaf, H., & Dahan, M. H. (2024). A comparison of obstetric and neonatal outcomes in polycystic ovary syndrome and congenital adrenal hyperplasia: a retrospective analysis of a population database. *F&S Science, 5*(3), 293–300. https://doi.org/10.1016/j.xfss.2024.05.001

Kuzmin, V. (2018). Preeclampsia and HELLP syndrome – Obstetric prognosis. *Pregnancy Hypertension, 13*(Suppl 1). https://doi.org/10.1016/j.preghy.2018.08.160

Mahmmoed, H. J., Ibrahim, R. H., & Abdulgani, M. F. (2020). Awareness and dietary adherence of patients with type 2 diabetes mellitus in the city of Mosul: A cross-sectional study. *Biomedical and Pharmacology Journal, 13*(3), 1415-1422. https://doi.org/10.13005/bpj/2012

Mahmood, H. J., Murad, S. H., Abdullah, M. K., & Ibrahim, R. H. (2022). Quality of life in patients with coronary artery disease: a prospective study. *Malaysian Journal of Public Health Medicine, 22*(3), 259-267. https://doi.org/10.37268/MJPHM/VOL.22/NO.2/ART.1618

Mazur, N. K., Fercho, J. M., Kałas, M., Szaruta-Raflesz, K., Grzybowska, M. E., Siemiński, M., & Wydra, D. G. (2025). Intracranial Hemorrhage During Pregnancy: An Interdisciplinary Literature Review and a Rare Case Report of Early-Onset Eclampsia with Intracranial Hemorrhage and HELLP Syndrome. *Journal of Clinical*

Medicine, 14(4). https://doi.org/10.3390/jcm14041361

Mohammed, A., & Muhamed Nury, L. (2023). Effectiveness of educational program on nurses/midwives performance regarding placenta examination at maternity Teaching Hospital in Sulaimani/Iraq. *Mosul Journal of Nursing, 11*(2), 332-341. https://doi.org/10.33899/mjn.2023.180111

Mohammed, D. I., & Ibrahim, R. H. (2023). Exploring the impact of psychological factors on cosmetic surgery acceptance: A cross-sectional study. *Informatics in Medicine Unlocked, 39*. https://doi.org/https://doi.org/10.1016/j.imu.2023.101231

Mohammed-Amen, H., & Ali, S. (2024). Contraceptive method usage among women: A comparative analysis by sociodemographic factors. *Mosul Journal of Nursing, 12*(2), 277-289. https://doi.org/10.33899/mjn.2024.184633

Momodu, O. A., Horner, R. D., Liu, J., Crouch, E. L., & Chen, B. K. (2023). Participation in the CenteringPregnancy Program and Pregnancy-Induced Hypertension. *American Journal of Preventive Medicine, 65*(3), 476-484. https://doi.org/10.1016/j.amepre.2023.04.010

Nagar, T., Sharma, D., Choudhary, M., Khoiwal, S., Nagar, R. P., & Pandita, A. (2015). The role of uterine and umbilical arterial doppler in high-risk pregnancy: a prospective observational study from India. Clinical Medicine Insights: *Reproductive Health, 9*. https://doi.org/10.4137/CMRH.S24048

Nazim, R., Nazim, R., Meherunnesa, S., & Akter, T. (2024). A clinical study on feto-maternal outcome of severe pre-eclamptic patient. *Scholars International Journal of Obstetrics and Gynecology, 7*(3), 138-147. https://doi.org/10.36348/sijog.2024.v07i03.009

Obiegbusi, C. N., Dong, X. J., & Obiegbusi, S. C. (2023). Pregnancy outcomes following antenatal screening for intrahepatic cholestasis of pregnancy (ICP). *Taiwanese Journal of Obstetrics and Gynecology, 62*(6), 809-816. https://doi.org/10.1016/j.tjog.2023.09.001

Pankiewicz, K., Szczerba, E., Maciejewski, T., & Fijałkowska, A. (2019). Non-obstetric complications in preeclampsia. *Menopause Review/Przegląd Menopauzalny, 18*(2), 99-109. https://doi.org/10.5114/pm.2019.85785

Pressman, K., Wellcome, J., Pooran, C., Crousillat, D., Cain, M. A., & Louis, J. M. (2024). Factors associated with early readmission for postpartum hypertension. *AJOG Global Reports, 4*(2). https://doi.org/10.1016/j.xagr.2024.100323

Priyadarshanie, M. N., Waas, D. A., Goonewardena, S., Senaratna, C. V., & Fernando, S. (2023). Association of antenatal anxiety disorders with antenatal comorbidities and adverse pregnancy outcomes among clinic attendees at a tertiary-care hospital in Sri Lanka. *Heliyon, 9*(3). https://doi.org/10.1016/j.heliyon.2023.e13900

Qian, N., Xu, R., Wei, Y., Li, Z., Wang, Z., Guo, C., ... & Qian, Y. (2023). Influence of temperature on the risk of gestational diabetes mellitus and hypertension in different pregnancy trimesters. *Science of The Total Environment, 899*. https://doi.org/10.1016/j.scitotenv.2023.165713

Rahnama, N., Jemâa, N. B., Colson, A., Pasquet, A., de Castro, L. H., Debiève, F., & Pierard, S. (2024). Pregnancy in women with congenital heart disease: New insights into neonatal risk prediction. *American Heart Journal, 273*, 148-158. https://doi.org/10.1016/j.ahj.2024.04.008

Sayed, P. I., López, M. S., Andreo, A. G., Marín, A. Q., Conesa, R. E., Oliver, A. E., ... & Sánchez, F. R. (2024). HELLP syndrome due to gestational trophoblastic disease. *Clinica Chimica Acta, 558 (Supplement 1)*. https://doi.org/10.1016/ j.cca.2024.119309

Shekaili, H. A. A., Hashmi, I. A., & Omari, O. A. (2024). Gestational weight gain and its association with maternal

and neonatal outcomes among pregnant women with normal pre-pregnancy body mass index from a Middle Eastern country. *Midwifery, 130*. https://doi.org/10.1016/j.midw.2024.103929

Shelat, P. M., Vyas, R. C., Shah, S. R., & Nathwani, N. D. (2020). Fetomaternal outcome in pregnancy with HELLP syndrome. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology, 9*(7), 2860-2866. http://dx.doi.org/10.18203/2320-1770.ijrcog20202722

Soomro, M. H., England-Mason, G., Liu, J., Reardon, A. J., MacDonald, A. M., Kinniburgh, D. W., ... & APrON Study Team. (2023). Associations between the chemical exposome and pregnancy induced hypertension. *Environmental Research, 237(1)*. https://doi.org/10.1016/j.envres.2023.116838

Stitterich, N., Shepherd, J., Koroma, M. M., & Theuring, S. (2021). Risk factors for preeclampsia and eclampsia at a main referral maternity hospital in Freetown, Sierra Leone: A case-control study. *BMC Pregnancy and Childbirth, 21*(1). https://doi.org/10.1186/s12884-021-03874-7

Sulaiman, M. H., Jasim, M. S., Abd Ahmed, A., Ahmed, A. A., Ibrahim, R. H., & Al-Mashhadany, O. I. (2023). A winning formula for nursing education: Effective study strategies and techniques. *Teaching and Learning in Nursing, 18*(4). https://doi.org/10.1016/j.teln.2023.05.001

Van Oostwaard, M. F., van Eerden, L., De Laat, M. W., Duvekot, J. J., Erwich, J. J. H. M., Bloemenkamp, K. W. M., ... & Gaugler-Senden, I. P. M. (2017). Maternal and neonatal outcomes in women with severe early onset pre-eclampsia before 26 weeks of gestation, a case series. *BJOG: An International Journal of Obstetrics & Gynaecology, 124*(9), 1440-1447. https://doi.org/10.1111/1471-0528.14512

Youns, I., & Al Mukhtar, S. (2025). Exploring the Association Between Maternal Vitamin D Status, Pregnancy Symptomatology, and Quality of Life: A Cross-Sectional Study in Mosul, Iraq. *Mosul Journal of Nursing, 13*(1), 354-365. https://doi.org/10.33899/mjn.2025.186955