International Journal of Clinical Obstetrics and Gynaecology

ISSN (P): 2522-6614
ISSN (E): 2522-6622

www.gynaecologyjournal.com
2024; 8(5): 89-93
Received: 17-07-2024
Accepted: 22-08-2024

Malika Kareem Jara Allah
Basrah Health Directorate, Basrah, Iraq

Faiz Al Waeely
College of Medicine, University of Basrah, Basrah, Iraq

Corresponding Author:
Malika Kareem Jara Allah
Basrah Health Directorate, Basrah, Iraq

Biochemical parameter changes in pregnant women with preeclampsia

Malika Kareem Jara Allah and Faiz Al Waeely

DOI: https://doi.org/10.33545/gynae.2024.v8.i5b.1512

Abstract
Background: Preeclampsia is diagnosed by elevated blood pressure (≥140/90 mm Hg on two occasions 4 hours apart or ≥160/110 mm Hg) after 20 weeks of gestation. Its etiology is linked to abnormal placentation and risk factors such as nulliparity, advanced maternal age, and comorbidities. Common symptoms include persistent headaches, visual impairments, upper abdominal pain, and hypertension. This study aims to assess the impact of preeclampsia on various biochemical markers in comparison to healthy pregnant women.
Methods: A prospective case-control study was conducted at the Basrah Maternity and Children Hospital from October 1, 2023, to March 31, 2023. It involved 50 preeclamptic women and 50 healthy pregnant women, matched for age and parity. Data collection included interviews, clinical examinations, and blood tests assessing complete blood count (CBC), renal and liver function, uric acid, glucose, and urine protein levels.
Results: indicated no significant difference in age between groups ($p = 0.061$), but 56% of women with preeclampsia had no antenatal care ($p = 0.015$) and exhibited a lower gestational age ($p = 0.009$). Systolic (150.36 vs. 118.2) and diastolic blood pressures (107.48 vs. 79.62) were significantly higher in the preeclamptic group ($p = 0.001$). Additionally, preeclamptic women had a higher BMI (28.6 vs. 25.7, $p = 0.012$), lower platelet count (175.8 vs. 285.91, $p = 0.001$), elevated serum uric acid (8.1 vs. 5.12, $p = 0.036$), and higher liver enzyme levels ($p<0.05$).
Conclusion: preeclampsia is associated with systemic effects, including elevated liver enzymes, reduced platelets, and increased uric acid. Blood pressure, BMI, and antenatal care significantly influence preeclampsia outcomes. Early detection and prenatal care are essential to improving maternal and fetal health.

Keywords: Biochemical, parameter, pregnant, women, preeclampsia

Introduction
Preeclampsia is a hypertensive disorder characterized by the sudden onset of high blood pressure, defined as a systolic blood pressure of 140 mm Hg or higher or a diastolic blood pressure of 90 mm Hg or higher on two occasions at least 4 hours apart. In more severe cases, systolic blood pressure reaches 160 mm Hg or higher, or diastolic blood pressure reaches 110 mm Hg or higher after 20 weeks of gestation [1]. Globally, preeclampsia and eclampsia contribute to approximately 50,000 maternal deaths annually, with a higher incidence among African-American and Hispanic women, where it accounts for about 26% of maternal mortality [2]. The etiology of preeclampsia is not fully understood but is often linked to abnormal placentation, resulting in dysfunctional maternal physiology. Abnormal placentation leads to inadequate spiral artery remodeling, reduced placental blood flow, hypoxia, and oxidative stress [2, 3]. Several risk factors contribute to preeclampsia, including nulliparity, multi-gestational pregnancy, advanced maternal age, assisted reproductive technology, and pre-existing maternal comorbidities such as hypertension, kidney disease, diabetes, obesity, and thrombophilia. Family history, prior history of preeclampsia, and intrauterine growth restriction also increase risk [1, 4]. The clinical presentation of preeclampsia includes a persistent headache unresponsive to treatment, visual disturbances, right upper quadrant or epigastric pain, nausea, vomiting, dyspnea, and worsening edema. These symptoms, combined with elevated blood pressure readings after 20 weeks of gestation, warrant further diagnostic evaluation [5]. Diagnosis is confirmed through laboratory tests assessing liver and renal function, proteinuria, and hematological parameters [6]. Biochemical changes in preeclampsia include elevated liver enzymes, reflecting liver dysfunction, particularly in cases associated with HELLP syndrome,

renal dysfunction indicated by increased serum creatinine and blood urea nitrogen, proteinuria, and thrombocytopenia [7-10]. Inflammatory markers such as C-reactive protein may also be elevated, reflecting underlying endothelial dysfunction, while changes in coagulation parameters indicate a pro-thrombotic state. Treatment of preeclampsia focuses on blood pressure control and seizure prevention. Beta-blockers such as labetalol and calcium-channel blockers like nifedipine are commonly used, along with intravenous magnesium sulfate for seizure prevention in severe cases. Delivery is the definitive treatment for preeclampsia, with management varying based on gestational age and symptom severity [11, 12]. Objectives of the research to investigate the impact of preeclampsia on several biochemical indicators in comparison to healthy pregnant women.

Methods

A prospective case-control study was conducted at the Gynecological and Obstetrical Department of Basrah Maternity and Children Hospital from October 1, 2023, to March 31, 2023. The study aimed to assess the impact of preeclampsia on biochemical markers in pregnant women. The study population included pregnant women admitted to the labor and obstetrical wards. Fifty women with preeclampsia served as the cases, and fifty healthy pregnant women with normal blood pressure served as controls, matched for age and parity.

Inclusion criteria

Included pregnant women aged 20 to 45 years with singleton pregnancies.

Exclusion criteria

Included other causes of hypertension, gestational diabetes mellitus, renal disease, cardiovascular disorders, immunological disorders, polycystic ovary syndrome (PCOS), multiple pregnancies, and women outside the age range of 20 to 45 years.

The study was approved by the University of Basrah and the Basrah Directorate of Health, and informed consent was obtained from all participants. Data collection involved a questionnaire covering socio-demographic characteristics, pregnancy-related variables, and medical history. Clinical examinations included vital signs, blood pressure measurement, and anthropometric data (height, weight, and BMI). After an 8-10-hour fast, 5 ml of blood was collected from each participant for biochemical testing, including complete blood count (CBC), renal and liver function tests, serum uric acid, and fasting plasma glucose. Urine samples were analyzed for protein levels. Statistical analysis was performed using SPSS version 26. The Chi-square test and Fisher's exact test were used for categorical variables, while independent t-tests were used for continuous variables. A p-value of ≤ 0.05 was considered statistically significant.

Results

This research comprised 100 women, 50 with PE and 50 as controls. There is no significant age difference between the ladies in both groups (p-value=0.061). Still, the women in the case group had an average age of 34.12 years, compared to 32.2 years in the control group.

In terms of residency, more than 60% of the women in both groups lived in metropolitan areas, with no significant difference between the groups. In terms of educational level, the majority of women in the case group (40%) had secondary education, whereas 46% of women in the control group had elementary education, but there is no significant statistical difference (p-value >0.05). More over three-quarters of the women in both categories were housewives. The women were questioned about their ANC visits during their current pregnancy; 56% of women with PE had no ANC, whereas 68% of women in the control group had ANC; there is a significant statistical difference (p-value=0.015). Table 1 displayed all of these statistics.

Table 1: Socio-demographic characteristics among participants

Variables		Case group (N=50)	Control group (N=50)	p-value
Age	Mean ±SD	34.12±4.2	32.2± 2.1	0.061
	20-	18 (36.0)	22 (44.0)	
	30-	24 (48.0)	22 (44.0)	
	40-45	8 (16.0)	6 (12.0)	
Residency	Rural	20 (40.0)	18(36.0)	0.680
	Urban	30 (60.0)	32 (64.0)	
Educational level	Illiterate	7 (14.0)	9 (18.0)	0.559
	Primary	21(42.0)	23 (46.0)	
	Secondary	20 (40.0)	14 (28.0)	
	College and higher education	2 (4.0)	4 (8.0)	
Employment status	Housewives	39 (78.0)	41(82.0)	0.617
	Employed	11 (22.0)	9 (18.0)	
ANC	Yes	22 (44.0)	34 (68.0)	0.015
	No	28 (56.0)	16 (32.0)	
Total		50 (100.0)	50 (100.0)	

Table 2 shows the maternal characteristics of case and control groups. There is a significant difference in the gestational age p-value=0.009. The mean gestational age was 37.3 weeks among case group and 39.4 weeks among control group. There is a significant difference in the gestational age p-value=0.031. 42% of women the case group were primigravida. While 54% of women in the control group had 1-2 children. And there is a significant statistical difference between both groups p-value= 0.031.

Table 2: The maternal characteristics among participants

Variables		Case group (N=50)	Control group (N=50)	p-value
Gestational age	**Mean ± SD**	37.3±2.68	39.4±1.81	0.009
Parity	0	21 (42.0)	9 (18.0)	0.031
	1-2	18 (36.0)	27 (54.0)	
	≥ 3	11(22.0)	14 (28.0)	

Table 3 shows the blood pressure and anthropometric measurements among participants. There mean systolic blood pressure show significant higher levels among women with PE in comparison to the control group p-value= 0.001. The mean diastolic blood pressure was 107.48 in PE women and 79.62 in control women and this difference is statically significant p-value=0.001. The weight and height shows no significant statistical difference between women in both groups. While regarding the BMI, women with PE had a higher BMI in comparison to women in the control group and this difference is statistically significant p-value=0.012.

Table 3: The blood pressure and anthropometrics measurements among participants

Patient characteristic	Case group (N=50)	Control group (N=50)	P-value
Systolic blood pressure	150.36±9.90	118.2±7.41	0.001
Diastolic blood pressure	107.48±5.05	79.62±2.65	0.001
Weight	79.8±3.76	72.9±4.0	0.051
Height	161.1±3.12	163.2±4.1	0.062
BMI	28.6±4.1	25.7±3.2	0.012

The biochemical tests result among women in both groups were presented in table 4. The hemoglobin and WBC count level shows nearly similar results among both groups with no significant statistical difference p-value >0.05. The platelet level was lower among women with PE with mean of 175.8 in comparison to 258.91 among healthy women. There is significant statistical difference between both groups p-value=0.001. There is no significant difference in the Blood glucose level, but still women with PE had slightly higher levels. The mean of serum Uric acid in women with PE was 8.1 ± 1.22 and its higher than healthy women 5.12 ± 0.9 and this difference is significant p-value= 0.036. The s. ALT, AST, ALP, all shows a higher level for women with PE than healthy pregnant women and this difference is significant p-value <0.05. The mean of proteinuria was 2.1 among PE patients while its not detected among healthy women.

Table 4: The biochemical tests results among the case and control groups

Variables	Case group (N=50)	Control group (N=50)	P-value
Hb (gm/dl)	11.35±2.9	11.21±3.8	0.436
Platelet count (*10^9)	175.8±20.44	285.9±30.1	0.001
WBC(thousand cells per mm^3)	5.86±1.3	5.21±2.0	0.521
Blood glucose (mg/dl)	89.32±5.1	81.8±4.22	0.06
S.uric acid (mg/dl)	8.1±1.22	5.12±0.9	0.036
AST (IU/l)	39.21±2.3	29.73±3.4	0.001
ALT (IU/l)	45.9±4.11	40.29±3.78	0.03
ALP (IU/l)	129.7±22.2	125.9±5.61	0.05
Proteinuria (mmol/mg)	2.1±0.72	Nill	NA

Discussion

This study aimed to compare the biochemical characteristics of women with preeclampsia (PE) to those of healthy pregnant women, with a focus on identifying factors that could improve diagnosis and treatment. The matching of sociodemographic characteristics such as age, residence, education, and occupation (p> 0.05) between the case and control groups ensured reduced bias and enhanced the reliability of the findings. One significant observation was the lack of antenatal care (ANC) visits in 56% of the PE group, compared to 32% in the control group (p = 0.015), emphasizing the importance of ANC in preventing and managing PE. This finding aligns with the work of Tesfa *et al*. (2023), which also highlights the role of ANC in early detection of hypertension and other risk factors [13]. Gestational age differed significantly between the groups, with PE cases having a lower mean gestational age (37.3 weeks) compared to controls (39.4 weeks, p = 0.009). This reflects the known association between PE and preterm delivery, supported by studies by Davies *et al*. (2016) and An *et al*. (2022) [14, 15]. Parity was another distinguishing factor, as 42% of women in the PE group were primigravida compared to 18% in the control group, confirming previous research by Grum *et al*. (2017) and Hamzah *et al*. (2021) on the elevated risk of PE in first pregnancies [16, 17]. While weight and height did not differ significantly between the groups, the Body Mass Index (BMI) was higher in the PE group (28.6 vs. 25.7, p = 0.012). This finding is consistent with prior research linking elevated BMI to PE due to increased cardiovascular strain and metabolic dysfunction [18-20]. Biochemical analysis showed that while hemoglobin and white blood cell (WBC) counts were similar in both groups, platelet counts were significantly lower in the PE group (175.8 vs. 285.91, p = 0.001). Thrombocytopenia is a recognized complication of PE, indicating severe disease and coagulation abnormalities, as corroborated by Alsheeha *et al*. (2016), Karateke *et al*. (2015), and Siddiqui *et al*. (2015) [21-23]. Han *et al*. (2014) also found that platelet counts decrease as PE progresses (29). Serum uric acid levels were significantly higher in the PE group (8.1 mg/dl) compared to controls (5.12 mg/dl, p = 0.036), suggesting impaired renal function and increased oxidative stress. Elevated uric acid levels are a sensitive marker of PE severity, as noted by Abdelazim *et al*. (2022) and Sameha *et al*. (2023), who both found correlations between uric acid

levels and the severity of hypertensive disorders in pregnancy [25-27]. Kondareddy and Prathap (2016) similarly reported higher serum uric acid levels in PE cases [28]. Although blood glucose levels were not significantly different between groups ($p = 0.06$), the slightly elevated levels in the PE group suggest a possible link between glucose metabolism and PE risk. Prior studies indicate an increased prevalence of PE among women with gestational diabetes mellitus (GDM), though the exact relationship remains unclear [29]. Liver enzymes, including ALT, AST, and ALP, were significantly elevated in the PE group, indicating hepatic involvement and organ dysfunction associated with severe PE. This aligns with findings from Hasen *et al*. (2022), Sarmah *et al*. (2015), and Ekun *et al*. (2018), which attribute liver dysfunction in PE to hypertension-induced vasospasm and endothelial damage [30-34]. Proteinuria, a hallmark of PE, was present in the PE group but absent in the control group. While proteinuria is an established diagnostic criterion for PE, its relationship with pregnancy outcomes remains debated [35]. This study highlights the importance of monitoring biochemical markers for early detection and management of preeclampsia.

Conclusion

Preeclampsia is distinguished by specific biochemical profiles that deviate from those observed in pregnancies without associated complications. These characteristics encompass elevated liver enzyme activities, decreased platelet count, and elevated blood uric acid levels. These results highlight the widespread systemic effects of preeclampsia.\ Specific variables like gestational age, parity, blood pressure levels, and BMI are essential in differentiating women with preeclampsia from those in the control group. This study highlights the need of providing sufficient prenatal care and promptly detecting preeclampsia in order to minimize adverse consequences on both the mother and the fetus.

Conflict of Interest

Not available.

Financial Support

Not available.

References

1. Karrar SA, Hong PL. Preeclampsia. [Updated 2023 Feb 13]. In: StatPearls. Treasure Island (FL): StatPearls Publishing; c2024. Available from: https://www.ncbi.nlm.nih.gov/books/NBK570611/
2. Gestational Hypertension and Preeclampsia: ACOG Practice Bulletin, Number 222. Obstet. Gynecol. 2020;135(6):e237-e260.
3. Jung E, Romero R, Yeo L, Gomez-Lopez N, Chaemsaithong P, Jaovisidha A, *et al*. The etiology of preeclampsia. Am J Obstet. Gynecol. 2022;226(2S):S844-S866.
4. Fox R, Kitt J, Leeson P, Aye CYL, Lewandowski AJ. Preeclampsia: Risk Factors, Diagnosis, Management, and the Cardiovascular Impact on the Offspring. J Clin. Med. 2019;8(10):1625.
5. Portelli M, Baron B. Clinical Presentation of Preeclampsia and the Diagnostic Value of Proteins and Their Methylation Products as Biomarkers in Pregnant Women with Preeclampsia and Their Newborns. J Pregnancy. 2018;2018:2632637.
6. Kattah AG, Garovic VD. The management of hypertension in pregnancy. Adv Chronic Kidney Dis. 2013;20(3):229-239.
7. Walle M, Getu F, Gelaw Y, Getaneh Z. The Diagnostic Value of Hepatic and Renal Biochemical Tests for the Detection of Preeclampsia among Pregnant Women Attending the Antenatal Care Clinic at the University of Gondar Comprehensive Specialized Hospital, Gondar, Northwest Ethiopia. Int. J Gen. Med. 2022;15:7761-7771.
8. Saha A, Gupta AD. Study of changes in biochemical parameters of preeclampsia patients, a prospective five year study. Int. J Reprod. Contracept. Obstet. Gynecol. 2022;11(2):517.
9. Zhang Y, Sheng C, Wang D, Chen X, Jiang Y, Dou Y, *et al*. High-normal liver enzyme levels in early pregnancy predispose the risk of gestational hypertension and preeclampsia: A prospective cohort study. Front Cardiovasc Med. 2022;9:963957.
10. Bhowmik DK, Akhtari R, Kumar SU, Saha M, Adhikary DK. Alteration of liver function in preeclampsia and eclampsia. Chattagram Maa-O-Shishu Hosp Med Coll J. 2013;12(3):9-10.
11. Fordjour F, Dassah ET, Mensah KB, Appiah-Kubi A, Amoateng P, Ohene BK, *et al*. Antihypertensives therapy and monitoring in pre-eclampsia: Role of the pharmacist. J Popl Ther Clin Pharmacol. 2023;30(17):354-367.
12. Chew LC, Verma RP. Fetal Growth Restriction. [Updated 2023 Aug 8]. In: StatPearls. Treasure Island (FL): StatPearls Publishing; c2024. Available from: https://www.ncbi.nlm.nih.gov/books/NBK562268/
13. Tesfa E, Munshea A, Nibret E, Gizaw ST. Determinants of pre-eclampsia among pregnant women attending antenatal care and delivery services at Bahir Dar public hospitals, northwest Ethiopia: A case-control study. Health Sci. Rep. 2023;6(7):e1440.
14. Davies EL, Bell JS, Bhattacharya S. Preeclampsia and preterm delivery: A population-based case-control study. Hypertension in pregnancy. 2016; 35(4):510-519.
15. An H, Jin M, Li Z, *et al* Impact of gestational hypertension and pre-eclampsia on preterm birth in China: A large prospective cohort study BMJ Open. 2022;12:e058068.
16. Grum T, Seifu A, Abay M, *et al*. Determinants of pre-eclampsia/Eclampsia among women attending delivery Services in Selected Public Hospitals of Addis Ababa, Ethiopia: A case control study. BMC Pregnancy Childbirth. 2017;17:307.
17. Hamzah SR, Idris I, Rachmat M. Antenatal care parameters that are the risk factors in the event of preeclampsia in primigravida. Gaceta Sanitaria. 2021 Jan 1;35:S263-267.
18. Young OM, Twedt R, Catov JM. Pre-pregnancy maternal obesity and the risk of preterm preeclampsia in the American primigravida. Obesity. 2016;24(6):1226-1229.
19. Roberts JM, Bodnar LM, Patrick TE, Powers RW. The role of obesity in preeclampsia. Pregnancy Hypertension: An International Journal of Women's Cardiovascular Health. 2011;1(1):06-16.
20. He XJ, Dai RX, Hu CL. Maternal prepregnancy overweight and obesity and the risk of preeclampsia: A meta-analysis of cohort studies. Obesity research & clinical practice. 2020;14(1):27-33.
21. Thalor N, Singh K, Pujani M, Chauhan V, Agarwal C, Ahuja R, *et al*. A correlation between platelet indices and preeclampsia. Hematol. Transfus. Cell Ther. 2019;41(2):129-133.
22. AlSheeha MA, Alaboudi RS, Alghasham MA, Iqbal J,

Adam I. Platelet count and platelet indices in women with preeclampsia. Vasc. Health Risk Manag. 2016;12:477-480.
23. Karateke A, Kurt RK, Baloğlu A. Relation of platelet distribution width (PDW) and platelet crit (PCT) to preeclampsia. Ginekol Pol. 2015; 86(5):372-375.
24. Han L, Liu X, Li H, Zou J, Yang Z, Han J, *et al*. Blood coagulation parameters and platelet indices: Changes in normal and preeclamptic pregnancies and predictive values for preeclampsia. PLoS One. 2014;9(12):e114488.
25. Samaha II, Donayeva A, Abdelazim IA. The relation between serum uric acid and severity of preeclampsia in pregnant women: A cross-sectional study. Prz. Menopauzalny. 2023; 22(3):130-134.
26. Abdelazim IA, Amer OO, Shikanova S, Karimova B. Protein/creatinine ratio versus 24-hours urine protein in preeclampsia. Ginekol Pol. 2022;93(12):975-979.
27. Kumar N, Singh AK. Maternal Serum Uric Acid as a Predictor of Severity of Hypertensive Disorders of Pregnancy: A Prospective Cohort Study. Curr. Hypertens. Rev. 2019;15(2):154-160.
28. Kondareddy T, Prathap T. Uric acid as an important biomarker in hypertensive disorders in pregnancy. Int. J Reprod. Contracept. Obstet. Gynecol. 2016; 5(12):4382-4384.
29. Yang Y, Wu N. Gestational Diabetes Mellitus and Preeclampsia: Correlation and Influencing Factors. Front Cardiovasc Med. 2022;9:831297.
30. Greiner KS, Rincón M, Derrah KL, Burwick RM. Elevated liver enzymes and adverse outcomes among patients with preeclampsia with severe features. J Matern Fetal Neonatal Med. 2023;36(1):2160627.
31. Hammoud GM, Ibdah JA. Preeclampsia-induced Liver Dysfunction, HELLP syndrome, and acute fatty liver of pregnancy. Clin Liver Dis (Hoboken). 2014;4(3):69-73.
32. Hassen FS, Malik T, Dejenie TA. Evaluation of serum uric acid and liver function tests among pregnant women with and without preeclampsia at the University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia. PLoS One. 2022;17(8):e0272165.
33. Sarmah J. Evaluation of serum aspartate aminotransferase (AST), Alanine aminotransferase (ALT), alkaline phosphatase (ALP), lactate dehydrogenase (LDH) and uric acid in preeclampsia. IOSR J. Dent. Med. Sci. Ver. 2015;3(14):2279-861.
34. Ekun OA, Olawumi OM, Makwe CC, Ogidi NO. Biochemical Assessment of Renal and Liver Function among Preeclamptics in Lagos Metropolis. Int J Reprod Med. 2018;2018:1594182.
35. Lei T, Qiu T, Liao W, Li K, Lai X, Huang H, *et al*. Proteinuria may be an indicator of adverse pregnancy outcomes in patients with preeclampsia: A retrospective study. Reprod. Biol. Endocrinol. 2021;19(1):71.

How to Cite This Article
Allah MKJ, Waeely FA. Biochemical parameter changes in pregnant women with preeclampsia. International Journal of Clinical Obstetrics and Gynaecology. 2024;8(5):89-93.