https://doi.org/10.37939/jrmc.v28i3.2545

Uric Acid: A Potential Marker For Predicting Maternal And Fetal Morbidity

Aeman Javed[1], Umber Arooj Tahir[2], Hafsa Tauseef[3], Syeda Luba Hussain[4], Sana Shaukat Siddiqui[5]

Abstract

Objective: To find out serum uric acid levels in normal and preeclamptic pregnant women in the third trimester.
Methods: It was a cross-sectional analytical study conducted from July 2022 to December 2023. All primigravida women aged 20-45 years in the third trimester of singleton pregnancy attending in Obstetrics and Gynecology outpatient department of Ibn-e-Seina Hospital in study duration were included in the study. After obtaining approval from the ethical review committee and informed consent from the participants, relevant data were recorded on a predefined data sheet. Statistical analysis was performed by using SPSS version 14. A chi-square test was performed to find the statistical difference regarding uric acid distribution between groups and the 'p' value <0.05 was considered as significant.
Results: A total of 1264 subjects were included in the study fulfilling the inclusion and exclusion criteria. The mean age of the study participants was 28.5±08.43 years with a mean gestational age of 29.35±3.08 weeks. Out of a total of 1264 women, 85.1% were normal and 14.9% had preeclampsia. In our study out of 189 preeclamptic women, 54.5% had raised serum uric acid levels. The difference between uric acid levels between preeclamptic and non-preeclamptic women was found to be significant (p<0.001).
Conclusion: Serum uric acid level in pregnant women can be used as a useful and inexpensive marker in the prediction of preeclampsia and preventive measures can be taken accordingly.
MeSH Keywords: Uric acid, Preeclampsia, Pregnancy, third trimester.

[1,2,3] Senior Registrar, Multan Medical and Dental College; [4] Senior Lecturer, Watim Medical College; [5] Assistant Professor, Sheikh Zayed Medical College, Rahim Yar Khan.
Correspondence: Dr. Sana Shaukat Siddiqui, Assistant Professor, Sheikh Zayed Medical College, Rahim Yar Khan. **Email:** drssiddiqui7@gmail.com
Cite this Article: Javed A, Tahir UA, Tauseef H, Hussain SL, Siddiqui SS. Uric Acid: A Potential Marker For Predicting Maternal And Fetal Morbidity. JRMC. 2024 Sep. 27;28(3).433-436. https://doi.org/10.37939/jrmc.v28i3.2545.
Received February 13, 2024; accepted July 20, 2024; published online September 26, 2024

1. Introduction

Preeclampsia is a condition during pregnancy that impacts expectant mothers, marked by the emergence of elevated blood pressure and the occurrence of proteinuria after the 20th week of gestation.[1] Globally, it stands as a significant contributor to health issues and fatalities among expectant mothers and their unborn babies, with an estimated impact on around 3-5% of pregnancies.[2] Preeclampsia is linked to numerous complications, such as insufficient placental function, restricted fetal growth, premature birth, and dysfunction of maternal organs.[3] Timely identification and precise diagnosis of preeclampsia are essential for effective treatment and better results. Biomarkers play a critical role in identifying pregnancies at high risk, predicting the advancement of the condition, and guiding clinical decisions. These biomarkers facilitate the prompt implementation of interventions to prevent or manage complications associated with preeclampsia.[4]

Uric acid has emerged as a promising biomarker for preeclampsia due to its potential involvement in the pathophysiology of the condition. Uric acid is the end-product of purine metabolism, and elevated levels have been observed in preeclamptic women compared to normotensive pregnant women.[5] Several studies have reported an association between elevated uric acid levels and the development and severity of preeclampsia. Numerous studies have demonstrated an association between elevated uric acid levels and the occurrence of preeclampsia. Increased uric acid concentrations have been consistently observed in preeclamptic women compared to normotensive pregnant women.[6]

Elevated uric acid levels in preeclampsia have been associated with an increased risk of adverse maternal and fetal outcomes. Several studies have reported significant associations between high uric acid levels and complications such as fetal growth restriction, preterm birth, and maternal organ dysfunction.[7-9] The prognostic value of uric acid in predicting adverse outcomes in preeclampsia elevated that uric acid levels were independently associated with a higher risk of adverse outcomes, including fetal growth restriction and preterm birth. These findings suggest that monitoring uric acid levels in preeclamptic women may aid in identifying those at higher risk of complications, enabling timely interventions and appropriate management strategies.[10,11] Uric acid levels may interact with other biomarkers associated with preeclampsia, such as PlGF and sFlt-1. These biomarkers are involved in the angiogenic imbalance observed in preeclampsia and may influence uric acid

metabolism. Understanding the complex interactions between uric acid and other biomarkers is crucial for accurately interpreting their diagnostic and prognostic value in preeclampsia.[12]

Uric acid as a potential biomarker includes its ease of measurement, low cost, and wide availability in clinical settings. Furthermore, uric acid may reflect underlying processes such as endothelial dysfunction, oxidative stress, and inflammation, which are implicated in the pathogenesis of preeclampsia.[13,14] For a better understanding of the role of uric acid as a biomarker in preeclampsia this study is aimed to find out the serum uric acid level in normal and preeclamptic pregnant women of third trimester visiting outpatient department of obstetrics and gynaecology of Ibn-e-Seina Hospital, Multan.

2. Materials & Methods

The study employed a cross-sectional analytical design. The study took place from July 2022 to December 2023 at the outpatient department of obstetrics and gynaecology in Ibn-e-Seina Hospital, Multan. The study included all primigravida women aged 20-40 years in the third trimester of a singleton pregnancy who attended the Obstetrics and Gynecology outpatient department. Women with a history of chronic hypertension, diabetes mellitus, substance abuse, smoking, alcoholism, liver, cardiac or renal diseases, or any other major illness were excluded from the study. After obtaining ethical approval from the institutional ethical review committee and informed written consent from the participants, relevant data were recorded on a predefined data sheet. Blood samples were collected from all the participants during their antenatal visit in the third trimester, following aseptic precautions, for measuring serum uric acid concentration. The serum uric acid level was determined using a colourimetric assay. Preeclampsia was defined as having a blood pressure (BP) of 140/90 mmHg or above in the third trimester of gestation, measured on at least two occasions at least 6 hours apart, accompanied by proteinuria of 300 mg per 24 hours or above in women who were previously normotensive. A uric acid level higher than 4.5 mg/dl was considered high. Statistical analysis was performed using the computer-based software Statistical Package for Social Science (SPSS) version 27.0 for Windows. The chi-square test was conducted to determine the statistical differences in uric acid distribution between groups, and a p-value <0.05 was considered statistically significant.

3. Results

A total of 1264 subjects were included in the study fulfilling the inclusion and exclusion criteria. The mean age of the study participants was 28.5±08.43 years with a mean gestational age of 29.35±3.08 weeks. The age distribution of the study subjects showed that a major proportion of women 644(50.9%) were in the age group of 26-30 years followed by 291 (23.1%) in 26-30 years, 215 (17.1%) in 31-35 years and 114 (8.9%) in 36-40 years of age group respectively.

Out of a total of 1264 women, 85.1% were normal and 14.9% had preeclampsia as shown in Table II. In our study out of 189 preeclamptic women, 54.5% had raised serum uric acid levels while the uric acid level was normal in 86 (45.5%) preeclamptic women and out of 1075 non-preeclamptic pregnant women uric acid level was raised in only 135 (12.6%) women (Table III). The difference between uric acid levels between preeclamptic and non-preeclamptic women was found to be significant (p<0.001).

Table 1: Age distribution of the Study subjects (n=1124, mean= 28.49, SD= 0.34)

Age (years)	Frequency	Percentage
20-25	291	23.1%
26-30	644	50.9%
31-35	215	17.1%
36-40	114	08.9%
TOTAL	1264	100%

Table 2: Frequency of Preeclampsia

Preeclampsia	Frequency	Percentage
Present	189	14.9%
Not present	1075	85.1%
Total	1264	100%

Table 3: Serum uric acid level in Preeclamptic and normal pregnant women

Uric acid level	preeclamptic		Non-preeclamptic		Total
Raised	103	54.5%	135	12.6%	238
Normal	86	45.5%	940	87.4%	1026
Total	189	100%	1075	100%	1264

χ^2 = 184.98, df =1 P=<0.001

4. Discussion

The mean age of the study participants was 28.5±08.43 years with a mean gestational age of 29.35 and with standard deviation of ±3.08 weeks. The findings of the study revealed that more than half of the study subjects were in between the age group of 26-30 years. Our study results showed that the frequency of preeclampsia was

14.9% which is consistent with the study conducted by Aram S et al. in which it was found to be 16.1%.[16] The frequency of preeclampsia seen in our study was higher than the study conducted by Alavi A. et al. in which preeclampsia was reported in 10% of the primigravidas.[17] These results are also higher than the study conducted by Ghazavi A. et al. in the Iranian population in which the prevalence of preeclampsia in primigravidas was found to be 7-10%.[18] Frequency of preeclampsia may be higher in our study due to the reason that it was a hospital based study and study participants were seeking medical care.

In our study serum uric acid level was found to be significantly higher in preeclamptic women than in non-preeclamptic pregnant women of the third trimester ($p<0.001$). These results are comparable with the study conducted by Eslami B et al. in which uric acid levels were significantly high in preeclamptic women.[19] Our study results also matched with the study conducted by Sultana R et al. in which uric acid level was significantly higher in preeclamptic women than that of controls.[20] Similarly in the study conducted by Ghazavi A et al. serum uric acid level was significantly higher in preeclamptic women than in controls.[18] The results of our study are also consistent with the study conducted by Devi E in which a direct relationship between serum uric acid and preeclampsia was found.[21] Findings from a similar study at CMH Rawalpindi support our results.[22] Continued research on uric acid as a biomarker in preeclampsia is of paramount importance. Further investigations are needed to understand the underlying mechanisms linking uric acid to preeclampsia, including its interactions with other biomarkers and pathways involved in the pathophysiology of the condition. Longitudinal studies are warranted to explore the temporal changes in uric acid levels during pregnancy and their relationship with the onset and severity of preeclampsia. Validation and standardization of uric acid measurement methods in diverse populations are necessary to establish reliable diagnostic and prognostic thresholds. Moreover, interventional trials are needed to evaluate the therapeutic potential of interventions targeting uric acid metabolism or its downstream effects. By addressing these research gaps, we can advance our understanding of the role of uric acid in preeclampsia and its clinical implications. This knowledge can contribute to improved risk stratification, early detection, and personalized management approaches for women at risk of or diagnosed with preeclampsia. Ultimately, continued research on uric acid as a biomarker in preeclampsia may lead to improved maternal and fetal outcomes and better strategies for preventing and managing this serious pregnancy complication.

In summary, the investigation of uric acid as a biomarker in preeclampsia has yielded significant findings and implications. Studies have provided evidence linking uric acid levels to preeclampsia, indicating its potential as a predictive biomarker and its association with the severity of the condition. Uric acid has shown diagnostic and prognostic value in identifying women at risk of adverse maternal and fetal outcomes. However, challenges exist, including variability in measurement methods, the influence of various factors on uric acid levels during pregnancy, and potential interactions with other biomarkers.

This study contains several limitations. First off, sampling bias could be introduced by including only primigravida women in their 20s to 40s who visited a particular outpatient department, which could limit how broadly applicable the results are. Furthermore, the fact that the study was limited to one centre and was carried out in Multan over one year may limit the data's wider relevance by ignoring possible temporal or regional differences. The study's comprehensiveness may potentially be impacted by the use of specific criteria to define preeclampsia, without taking into account additional signs or confounding circumstances. It is noteworthy that these constraints offer opportunities for enhancement in subsequent research endeavours. Here, a more varied and representative sample, broader inclusion criteria, and a multi-centre methodology may augment the resilience and applicability of the results.

5. Conclusion

In this cross-sectional study of primigravid women, a higher serum uric acid level was significantly associated with preeclampsia ($p<0.001$). These findings suggest that uric acid levels may be a useful marker for preeclampsia risk assessment in this population.

INSTITUTIONAL REVIEW BOARD

00291116MMANA Dated 30-11-2016

CONFLICTS OF INTEREST- None

Financial support: None to report.
Potential competing interests: None to report

Contributions:

A.J, H.T, S.L.H, S.S.S - Conception of study
- Experimentation/Study Conduction
A.J, U.A.T, H.T, S.L.H, S.S.S - Analysis/Interpretation/Discussion
A.J, U.A.T, H.T, S.L.H, S.S.S - Manuscript Writing
H.T, S.L.H, S.S.S - Critical Review

All authors approved the final version to be published & agreed to be accountable for all aspects of the work.

References

1. Garovic VD, Dechend R, Easterling T, Karumanchi SA, McMurtry Baird S, Magee LA,et al. Hypertension in pregnancy: diagnosis, blood pressure goals, and pharmacotherapy: a scientific statement from the American Heart Association. Hypertension. 2022 Feb;79(2):e21-41. https://doi.org/10.1161/HYP.0000000000000208
2. Virdi A, Sharma PK, Sharma S, Arun P, Kulkarni AK. Association Of Serum Lipid Profile & Uric Acid Levels In Preeclampsia Patients In Rama Medical College Hospital & Research Center. Int J Acad Med Pharm. 2023;5(5):380-4. DOI: 10.47009/jamp.2023.5.5.75
3. Chuang CJ, Chiou WY, Yang HJ, Lin HY, Hung SK, Lee MS,et al. Impact of preeclampsia/eclampsia on hemorrhagic and ischemic stroke risk: A 17 years follow-up nationwide cohort study. Plos one. 2022 Nov 9;17(11):e0276206. https://doi.org/10.1371/journal.pone.0276206
4. Velegrakis A, Kouvidi E, Fragkiadaki P, Sifakis S. Predictive value of the sFlt 1/PlGF ratio in women with suspected preeclampsia: An update. International Journal of Molecular Medicine. 2023 Oct 1;52(4):1-8. DOI: 10.3892/ijmm.2023.5292
5. Yue C, Ying C, Li X. Association of first trimester serum uric acid with preeclampsia: an observational cohort study with propensity score matching. Hypertension Research. 2023 Feb;46(2):377-85. DOI: 10.1038/s41440-022-01115-8
6. Ambad R, Dhok A. The association of lipid profile and uric acid levels in normotensive, preeclamptic pregnancy–A hospital-based study. Journal of Datta Meghe Institute of Medical Sciences University. 2020 Jan 1;15(1):21-5. DOI: 10.4103/jdmimsu.jdmimsu_19_20
7. Sarkar M. The Prevalence of Fetal Growth Restriction in Pre-Eclampsia Patients Kustia Medical College and Hospital. Sch J App Med Sci. 2021 Nov;11:1680-4. DOI:10.36347/sjams.2021.v09i11.006
8. Verlohren S, Brennecke SP, Galindo A, Karumanchi SA, Mirkovic LB, Schlembach D,et al. Clinical interpretation and implementation of the sFlt-1/PlGF ratio in the prediction, diagnosis and management of preeclampsia. Pregnancy Hypertension. 2022 Mar 1;27:42-50. DOI: 10.1016/j.preghy.2021.12.003
9. Dulaimi AG, Mohsin LA, Aljebori HD, Al-Attar Z. Evaluation of patients with preeclampsia Some Biochemical Parameters and Hormones in Iraqi women. http://doi.org/10.5281/zenodo.7876951
10. Corominas AI, Medina Y, Balconi S, Casale R, Farina M, Martínez N,et al. Assessing the role of uric acid as a predictor of preeclampsia. Frontiers in Physiology. 2022 Jan 13;12:2446. https://doi.org/10.3389/fphys.2021.785219
11. Bellos I, Pergialiotis V, Loutradis D, Daskalakis G. The prognostic role of serum uric acid levels in preeclampsia: A meta-analysis. The Journal of Clinical Hypertension. 2020 May;22(5):826-34. DOI: 10.1111/jch.13865
12. Sudjai D, Satho P. Relationship between maternal serum uric acid level and preeclampsia with or without severe features. Journal of Obstetrics and Gynaecology. 2022 Oct 3;42(7):2704-8. DOI: 10.1016/j.preghy.2021.12.003
13. Varghese B, Jala A, Meka S, Adla D, Jangili S, Talukdar RK,et al. Integrated metabolomics and machine learning approach to predict hypertensive disorders of pregnancy. American Journal of Obstetrics & Gynecology MFM. 2023 Feb 1;5(2):100829. DOI: 10.1016/j.ajogmf.2022.100829
14. Singh U, Solanki V, Mehrotra S, Sharma R. An evaluation of applicability of salivary uric acid measurement in preeclampsia and normal pregnancy and its correlation with serum uric acid. The Journal of Obstetrics and Gynecology of India. 2019 Feb 6;69:62-8. 1. DOI:10.1007/s13224-018-1124-6
15. Kasraeian M, Asadi N, Vafaei H, Zamanpour T, Shahraki HR, Bazrafshan K. Evaluation of serum biomarkers for detection of preeclampsia severity in pregnant women. Pakistan Journal of Medical Sciences. 2018 Jul;34(4):869. DOI: 10.12669/pjms.344.14393
16. Yue C, Ying C, Li X. Association of first trimester serum uric acid with preeclampsia: an observational cohort study with propensity score matching. Hypertension Research. 2023 Feb;46(2):377-85. DOI: 10.1038/s41440-022-01115-8
17. Ardekani AM, Nava ZH, Zaman BA, Vahdat S, Lame-Jouybari AH, Mivefroshan A. The association between lipid profile, oxidized LDL and the components of metabolic syndrome with serum mineral status and kidney function in individuals with obesity. BMC Research Notes. 2023 Sep 5;16(1):196. DOI: 10.1186/s13104-023-06472-2
18. Kaur B, Kumar A, Singh B, Kaur M. Correlation between various biochemical biomarkers and blood pressure in pregnant women. Nepal Journal of Obstetrics and Gynaecology. 2022 Dec 31;17(2):43-9. DOI:10.3126/njog.v17i2.52374
19. Shaheen S, Naseer K, Abid N, Abid F. Frequency of hyperuricemia and fetal outcome in preeclampsia. The Professional Medical Journal. 2023 Mar 31;30(04):472-7. DOI:10.29309/TPMJ/2023.30.04.7440
20. Colmenares-Mejia CC, Quintero-Lesmes DC, Bautista-Niño PK, Guío E, Paez MC, Beltrán M, Williams D, et al. Uric acid and risk of pre-eclampsia: results from a large case–control study and meta-analysis of prospective studies. Scientific Reports. 2023 Feb 21;13(1):3018. DOI: 10.1038/s41598-023-29651-4
21. Bhutani N, Jethani V, Jethani S, Ratwani K. Coagulation profile and platelet parameters in pregnancy induced hypertension cases and normotensive pregnancies: A cross-sectional study. Annals of Medicine and Surgery. 2022 Aug 1;80:104124. DOI: 10.1016/j.amsu.2022.104124
22. Saleem U, Noman M, Yaqub U, Sohail A, Bashir K, Kaiani AS. Correlation of Uric Acid Levels with Feto-Maternal Outcomes in Hypertensive Disorders in Pregnancy. Pakistan Armed Forces Medical Journal. 2023 Feb 28;73(1):243-47. https://doi.org/10.51253/pafmj.v73i1.9140