Research Inventy: International Journal of Engineering And Science
Vol.13, Issue 9 (September 2023), PP 30-34
Issn (e): 2278-4721, Issn (p):2319-6483, www.researchinventy.com

Alteration in Urea and Creatinine Concentrations in Third Trimester of Pregnancy in Normotensive and Preeclamptic Pregnant Women

[1]Edebiri, O.E., [2]Uche, O.K., Osazuwa T.I,[5] John C.B[6]. Ohiwerei W.O[3] Ogedegbe, I.S[7] [4]Ehiakhamen, D.O, [1]Ikhajiangbe, H.I. [1]Omogbemhe, S.A, [1]Oyakhire, M.O.

[1]*Department of Physiology, Ambrose Alli University, Ekpoma, Edo State, Nigeria.*
[2]*Department of Physiology, University of Benin, Edo State, Nigeria.*
[3]*Department of research and training, Ohilux Global Research Diagnostic and training centre, Ekpoma Edo State*
[4]*Department of Physiology, University of Ilorin, Ilorin, Kwara State, Nigeria*
[5]*Hospital St-Bartholomew Hospital London*
[6]*Hospital of Watford United Kingdom*
[7]*Narrow Way Clinic, Benin City, Edo state*

Abstract
Measurements of urea and creatinine levels in the blood are a dependable means of evaluating the kidney performance of expectant mothers on a worldwide scale. Nevertheless, there is a lack of comprehensive records regarding the specific changes in renal function during regular pregnancies and in women with preeclampsia in Nigeria overall, as well as in the southwest region specifically. This study investigates the changes in urea and creatinine levels during the third trimester of pregnancy in both normotensive and preeclamptic expectant mothers. A total of thirty pregnant women, comprising fifteen individuals without hypertension and fifteen individuals with preeclampsia from Ondo town, were enrolled as participants for this study. After obtaining consent from the participants, a volume of five milliliters of venous blood was extracted and transferred into sample bottles containing lithium heparin, in preparation for subsequent analysis. Figure 1 displays the findings indicating that normotensive pregnant women exhibited a urea level of 2.00 mmol/l, while pre-eclamptic pregnant women showcased a urea level of 4.00 mmol/l, The obtained results demonstrate a notable and statistically significant elevation in urea concentration among pre-eclamptic women when compared to normotensive pregnant women ($p \leqslant 0.05$). In Figure 2, the results indicate that the creatinine level for normotensive pregnant women was measured at 65.00 µmmol/l, while for preeclamptic pregnant women, it was found to be 78.00 µmmol/l. These findings suggest that there is no statistically significant difference in creatinine concentration between pre-eclamptic women and normotensive pregnant women ($p \leqslant 0.05$). In summary, elevated levels of serum creatinine and serum urea serve as more effective diagnostic and prognostic indicators for preeclampsia, emphasizing the necessity for prompt medical attention in such cases. By utilizing these parameters, the majority of cases can be identified at an early stage during pregnancy, preventing their progression to eclampsia.

Date of Submission: 02-09-2023 Date of Acceptance: 14-09-2023

I. INTRODUCTION

Changes in the serum levels of urea and creatinine serve as dependable indicators for evaluating the renal function of pregnant women worldwide (Patricia *et al*., 2013), Nevertheless, there is limited documentation regarding the biochemical changes in kidney function that occur during regular pregnancies and in women with preeclampsia in both Nigeria as a whole and specifically in the southwest region. Hence, it was crucial to assess the variations in these biochemical parameters during the third trimester of pregnancy in order to understand their effectiveness in evaluating kidney function during gestation.

The process of adapting to pregnancy in humans encompasses not just anatomical and physiological changes, but also includes metabolic modifications in the mother. These alterations are essential for supporting and fulfilling the nutritional and metabolic requirements of both the mother and the developing embryo (Kalhan *et al*., 2000). Nearly every physiological system in the maternal body undergoes adaptations due to pregnancy, yet the renal system experiences the most significant transformation (Clark *et al*., 2014). Numerous alterations

in renal function take place during a typical pregnancy, and without a comprehensive comprehension of these changes, routine clinical examinations can be prone to misinterpretation. (Brown and Whitworth, 1992). These clinical examinations encompass the assessment of serum uric acid, urea, and creatinine levels. To ensure a successful pregnancy, it is essential to regularly monitor these biochemical and hematological parameters throughout all stages of the trimester. This diligent monitoring helps prevent potential complications (Das *et al*.,2016).

Over time, significant attention has been devoted to researching the role of serum urea and creatinine in the development of pregnancy-induced hypertension, including conditions like preeclampsia. This natural process, accompanied by a multitude of biochemical changes (ranging from adjustments in fluid and electrolyte levels to intricate modifications in cortisol and calcium metabolism), plays a crucial role in supporting the growth and viability of the developing embryo (Damudi *et al*., 2015). Urea and creatinine serve as reliable markers for assessing the proper functioning of kidneys, while elevated levels of these substances in the bloodstream indicate kidney dysfunction (Kamal, 2014). Blood urea nitrogen (BUN) and serum creatinine are widely acknowledged as the prevailing and frequently utilized parameters for evaluating kidney function (Kamal, 2014).

A multitude of significant studies exist that, at times confusingly and inconsistently, elucidate the correlation between the levels of these parameters in pre-eclamptic and normotensive groups. There was a notable increase in serum creatinine levels among pregnant women with pre-eclampsia when compared to those without hypertension (Weerasekera and Perris, 2003), However, when it comes to serum urea levels, there were minimal changes observed between pregnant women with pre-eclampsia and those without hypertension (Mohamed *et al*., 2005). Another study reported insignificant changes in serum creatinine levels among both pre-eclamptic and normotensive pregnant women (Salako *et al*., 2003). The perplexing nature of these findings has motivated us to embark on an extensive investigation into these aspects, driven by a desire to unravel the underlying complexities. Nonetheless, the primary objective of this study is to investigate the changes in urea and creatinine levels during the third trimester of pregnancy in both normotensive and preeclamptic expectant mothers.

II. MATERIALS AND METHOD

Sample size: The sample size for this study was determined utilizing the Taro Yamen's formula;

$$n = \frac{n}{1 + N(d)^2}$$

Where:
n= sample size
N=population size
d= level of precision (0.05 at 95% confidence level). For this research, the finite population under consideration consists of 33 mothers residing in Ondo town. Assuming a desired level of precision of 0.05, the sample size will be determined accordingly:

$$n = \frac{33}{1 + 33(0.05)^2}$$

n=30.48
Consequently, the sample selected for this study comprises 30 participants who are pregnant women from Ondo town, consisting of both normotensive and preeclamptic individuals.

Subjects: A total of thirty pregnant individuals who provided their consent were enlisted as participants from the University of Medical Sciences Teaching Hospital, located in Ondo State. The participants in this study were divided into two groups. The first group included 15 pregnant women in their third trimester who were normotensive, with blood pressure measurements below 130/90 mm/Hg and without any signs of proteinuria. The second group consisted of 15 pregnant women in their third trimester who were diagnosed with preeclampsia based on blood pressure measurements above 130/90 mm/Hg and the presence of proteinuria confirmed on two consecutive occasions during their visits to the hospital's antenatal clinic.
Ethical approval and informed consent: The Research Ethics Committee of the University of Medical Science Ondo, Ondo State granted ethical clearance for this study, with the approval number REC Approval No: UNIMEDTH/REC/2020/030. Before commencing the study, written informed consent was acquired from all participants.

Blood sampling: Consenting participants provided a volume of five milliliters (5 ml) of venous blood, which was then collected and stored in sample bottles containing lithium heparin. The blood samples were subjected to centrifugation in a bucket centrifuge at a speed of 2500 RPM (rounds per minute) for a duration of 10 minutes. Following centrifugation, the plasma was carefully collected and stored in plain sample bottles under frozen

conditions. Subsequently, the frozen plasma samples were analyzed to determine the concentration of urea and creatinine.

Experimental protocols: Once the subjects were identified and enrolled in the study, they were escorted to the laboratory where their vital signs were recorded. Subsequently, blood samples were obtained through venipuncture and transported to the chemistry laboratory for analysis.

Study area/population: The research was carried out over a period of three months at the Teaching Hospital of the University of Medical Sciences in Ondo, Ondo State, Nigeria. Department of Obstetricians and Gynecology

Inclusion and Exclusion criteria: This study encompassed pregnant women in their third trimester, both normotensive and pre-eclamptic, aged between 25 and 35 years. The pregnant women included in this study were multiparous, meaning they had previously given birth and were currently experiencing their second pregnancy. Nevertheless, pregnant women with normotension and pre-eclampsia who were taking medications, had a documented history of hyperlipidemia, gestational diabetes, or other comorbidities, and did not meet any of the inclusion criteria were excluded from the study.

Statistical analysis: The data analysis was performed using the GraphPad Prism 8.1 statistical software. The findings were presented as means ± SEM (standard error of the mean) and subjected to statistical analysis using the Student t-test. A significance level of $P < 0.05$ was used to determine statistical significance.

III. RESULTS

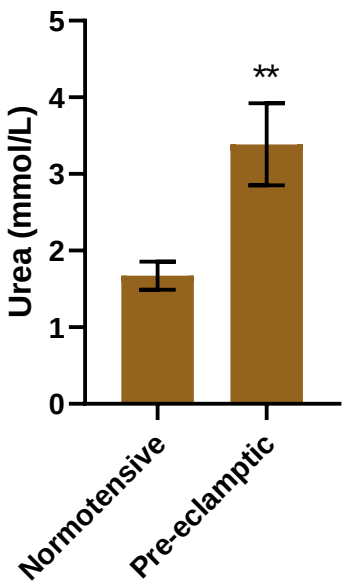

Fig. 1: Urea Concentration in the third trimester of pregnancy of normotensive and preeclamptic pregnant women (N=15;±SEM)

The results displayed in Figure 1 indicate a significant elevation in urea concentration among pre-eclamptic pregnant women when compared to their normotensive counterparts, demonstrating statistical significance with a p-value of less than 0.05.

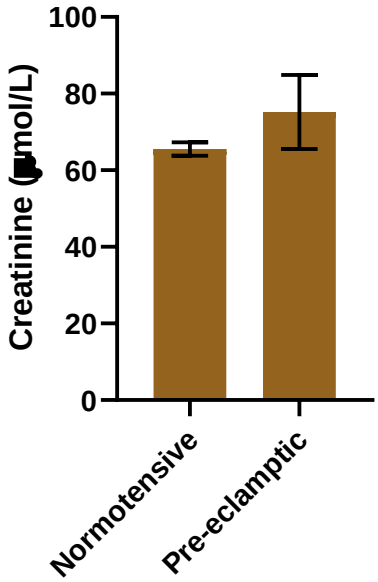

Fig. 2: Creatinine Concentration in the third trimester of pregnancy of normotensive and preeclamptic pregnant women (N=15; ±SEM)

The results depicted in Figure 2 reveal no significant disparity in creatinine concentration between pre-eclamptic pregnant women and normotensive pregnant women, with a p-value greater than 0.05, suggesting the absence of statistical significance.

IV. DISCUSSION AND CONCLUSION

Hypertensive disorders of pregnancy, namely gestational hypertension (GH) and preeclampsia (PE), pose an elevated obstetric risk that includes complications such as placental abruption, preterm labor, eclampsia, and HELLP syndrome. Renal impairment observed in these conditions is attributed to damage to the endothelial cells of the glomeruli, resulting in a decline in glomerular filtration rate (GFR) (Ranjit *et al*.,2019)

The findings depicted in Figure 1 indicate that the urea levels among normotensive pregnant women were measured at 2.00 mmol/l, whereas pre-eclamptic pregnant women exhibited levels of 4.00 mmol/l. These results demonstrate a statistically significant elevation in urea concentration in pre-eclamptic women when compared to their normotensive counterparts ($p \leqslant 0.05$). The outcomes presented in Figure 2 demonstrate that the creatinine levels in normotensive pregnant women were measured at 65.00 µmmol/l, while pre-eclamptic pregnant women exhibited levels of 78.00 µmmol/l. These findings indicate that there is no statistically significant distinction in creatinine concentration between pre-eclamptic women and normotensive pregnant women ($p \leqslant 0.05$). The findings regarding urea in our study contradict the research conducted by Ranjit et al. in 2019 and Magna et al. in 2012. In their studies, they observed a noticeable increase in urea concentration among pre-eclamptic women compared to normotensive pregnant women; however, this increase did not reach statistical significance. This rise in urea concentration could be attributed to a decline in renal function. Interestingly, our study yielded similar results for creatinine levels compared to the aforementioned studies.

V. CONCLUSION

In summary, elevated levels of serum creatinine and serum urea serve as valuable diagnostic and predictive indicators for pre-eclampsia. Prompt medical attention is crucial for managing preeclampsia and its associated risks. By utilizing these parameters, the majority of cases can be identified at an early stage during pregnancy, preventing their progression to eclampsia. Although preeclampsia does not have a definitive cure, healthcare providers commonly prescribe medications to reduce high blood pressure and anticonvulsant medications to prevent seizures.

REFERENCES

[1]. Clark, M., & Tilman, D. (2014). Global diets link environmental sustainability and human health. Nature, 515(7528), 518-522.

[2]. Damudi, H., Bello, B., Yahaya, S. I., Kurawa, M., Musa, S., & Ibrahim, Z. U. (2015). Biochemical assessment of pregnancy-related physiological changes in renal function. American Academic Scientific Research Journal for Engineering, Technology, and Sciences, 14(3), 264-271.

[3]. Das, S., Ngene, P., Norby, P., Vegge, T., De Jongh, P. E., & Blanchard, D. (2016). All-solid-state lithium-sulfur battery based on a nanoconfined LiBH4 electrolyte. Journal of The Electrochemical Society, 163(9), A2029.

[4]. Kalhan, S., & Parimi, P. (2000). Gluconeogenesis in the fetus and neonate. In Seminars in perinatology (Vol. 24, No. 2, pp. 94-106). WB Saunders.

[5]. Mohamed, M. A.,Babiker, I. S., Hiyama, T., & Kato, K. (2005). A GIS-based DRASTIC model for assessing aquifer vulnerability in Kakamigahara Heights, Gifu Prefecture, central Japan. Science of the Total Environment, 345(1-3), 127-140.

[6]. Patricia Farris, M., Jean Krutmann, M., Yuan-Hong Li, M., David McDaniel, M., & Krolj, Y. (2013). Resveratrol: A unique antioxidant offering a multi-mechanistic approach for treating aging skin. J. Drugs Dermatol, 12, 1389-1394.

[7]. Ranjit, Y. S., Azbel, L., Krishnan, A., Altice, F. L., & Meyer, J. P. (2019). Evaluation of HIV risk and outcomes in a nationally representative sample of incarcerated women in Azerbaijan, Kyrgyzstan, and Ukraine. AIDS care, 31(7), 793-797.

[8]. Salako, N., Joseph, B., Ritwik, P., Salonen, J., John, P., & Junaid, T. A. (2003). Comparison of bioactive glass, mineral trioxide aggregate, ferric sulfate, and formocresol as pulpotomy agents in rat molar. Dental traumatology, 19(6), 314-320.