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Serum Uric Acid Levels During Pregnancy: Is There Any Correlation with Gestational Age and Blood Pressure?

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ABSTRACT

Introduction: It is well known that both normal pregnancy and pregnancy-induced hypertension are associated with frequent fluctuations in blood uric acid (UA) levels. The purpose of this study was to measure the serum uric acid levels of healthy pregnant Sudanese women and to correlate these levels with blood pressure and gestational age. **Material and Methods:** this is a cross-sectional hospital-based study enrolled 50 healthy pregnant women from the prenatal care clinic of the Khartoum Police Hospital using a convenient non-probability sampling technique. Standard methods are used to measure serum uric acid and blood pressure. To assess the relation between various variables, ANOVA test and correlation analysis were applied. A P value of less than 0.05 considered statistically significant. **Results**: The participant's age ranged from 19 to 37 years old, with a mean of 27.7±4.3 years. The range of uric acid levels was 1.4 to 7.1 mg/dL, with a mean of 2.6 ± 1 mg/dL. The blood pressure was 110 ± 4 mmHg at the systolic level and 77.6 ± 4.3 mmHg at the diastolic level. The study discovered that there was a significant correlation (p-value <0.0001) between gestational age and serum uric acid level. However, the correlation with the blood pressure was insignificant (p-value= 0.62 and 0.06 for systolic and diastolic blood pressure, respectively). **Conclusion:** the study findings show that serum uric acid levels are useful clinical tool, especially when assessing pregnant ladies beyond 20 weeks of pregnancy.

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1. INTRODUCTION

The final product of purine metabolism is uric acid [1,2]. In women with pre-eclampsia, elevated levels are thought to be a sign of fetal death and an early warning sign of kidney damage. Research is still being done on the contentious hypothesis that uric acid may be involved in the 10-15% maternal and 5.9% fetal mortality that happens in pre-eclamptic people [3].

The uricosuric effects of estrogen and increased renal blood flow cause serum uric acid levels to drop in the early stages of pregnancy, frequently to 3 mg/dl or less. Following that, during the third trimester, uric acid levels increase and peak at 4-5 mg/dl at term [4].

Nonetheless, it is known that people who are at risk of developing pre-eclampsia have somewhat higher blood uric acid

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levels during the first trimester, which is linked to a relatively decreased excretion of urate in the urine [5, 6].

According to previous research, the degree of fetal morbidity, such as small-for-gestational-age babies and fetal death, and the severity of maternal disease are related to the increase in blood uric acid at the time of presentation in pre-eclampsia patients [7]. More and more laboratory testing is being used by modern physicians to manage their patients. Hypertension is a common pregnancy problem that significantly increases the risk of morbidity and death for both moms and newborns [8].

Given that serum uric acid levels fluctuate serially in both pregnancy-induced hypertension and healthy pregnancies, the study of serum uric acid is an intriguing field of research [9, 10]. Ten percent of pregnant women experience pregnancy-induced hypertension, which is a distinct condition that makes up ten percent of all cases of hypertension in women [11].

Elevated blood uric acid is another common clinical finding originally reported more than 80 years ago, in women with clinically evident pre-eclampsia [12].Since then, there has been much discussion about the therapeutic use of elevated serum uric acid [13, 14]. It is possible that the uric acid is elevated in more severe form of pre-eclampsia because it is a marker for tissue damage, oxidative stress, and renal dysfunction. However, high uric acid presents a risk factor for cardiovascular disease because it is also thought to be linked to inflammation and impaired vascular function [15, 16].

Furthermore, research on mice that are not pregnant has demonstrated that increased uric acid particularly lowers blood pressure. Thus, increased uric acid could indicate something different than how severe pre-eclampsia is. If so, elevated uric acid levels ought to be achieved prior to the onset of symptoms [17]. Serum uric acid levels as well as creatinine, sodium, potassium, total protein and albumin, bilirubin, aspartate, and magnesium were found to be normal in both patients and controls in one Sudanese study [18].

The purpose of this study is to measure the levels of uric acid in pregnant Sudanese women in good health, and to correlate the findings with blood pressure and gestational age.

2. MATERIALS AND METHODS

Design, duration and setting

This is a cross-sectional facility based study carried out in antenatal clinics of a police hospital in Khartoum State between November and December 2020.

Study population and eligibility criteria

All age groups of pregnant ladies in any trimester of a healthy/not complicated pregnancy were included. Those who refuse to participate, had a history of hyperuricemia, hypertension, pre-eclampsia, or had a history of chronic illnesses were excluded.

Sample size and technique

Fifty healthy pregnant ladies from antenatal clinics at a police hospital in Khartoum State were selected using convenience sampling technique.

Data collection and procedure

A structured questionnaire covering age, education, pregnancy trimester, and medication history was used to gather data. Standard procedures were use to measure the blood pressure. Trained personnel used a stethoscope and a mercury sphygmomanometer to measure blood pressure. For five minutes, participants were required to sit in a chair. Using cuffs of varying sizes for various body heights, measurements were obtained from the upper arm by covering the left arm at the level of the heart. Three times, at least five minutes apart, the systolic and diastolic blood pressures were taken using a mercury sphygmomanometer with Korotkoff sounds of four rather than five. For analysis, the mean of the three readings was employed.

A spectrophotometer was used to measure the serum uric acid level after five milliliters of blood were drawn from each participant using an entirely aseptic procedure.

Quality control

Before every sample, the machine was calibrated, and any unusual results were verified by experienced staff at the central laboratory in Khartoum Hospital.

Data management and analysis

Version 25.0 of SPSS was used for the statistical analysis. The variables under study were described using means and standard deviations (for the quantitative variable) and the proportions of the groups under study were expressed as percentages. The ANOVA test was used to evaluate the difference in uric acid means between various category variables, such as education, trimester, and medication used, while the Pearson correlation coefficient was utilized to evaluate the correlation between the quantitative variables (such as uric acid level, age, and blood pressure). P values less than 0.05 considered significant.

Ethical consideration

All procedures performed in this study involving human participants conformed to the ethical standards of the institutional and/or national research committee and the 1964 Declaration of Helsinki and its subsequent amendments or comparable ethical standards. The study was approved by the ethical board of The National Ribat University and Ethical Committee of Police Hospital, Khartoum, Sudan. Before being

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enrolled, each volunteer signed a written informed consent form. Every participant had the option to leave the study at any time, and participation was entirely voluntary.

3. RESULTS

Fifty pregnant Sudanese women in good health who resided in Khartoum State were included in this cross-sectional study with the goal of assessing their uric acid levels and correlate them with gestational age and blood pressure.

Table 1. Participant's age and measured variables.

Variable		N	Mean	Standard deviation	Min	Max
Age – years		50	27.7	4.3	19.0	37.0
Blood pressure – mmHg	**Systolic**	50	110.8	4.0	100.0	120.0
	Diastolic	50	77.6	4.3	70.0	80.0
Serum uric acid – mg / dL		50	2.6	1.0	1.4	7.1

Demographic Data

The mean of age was 27.7 ± 4.3 years on average. In addition, 15 (30%) of them were pregnant in the first trimester, 15 (30%) in the second, and 20 (40%) in the third. most of the participants 41 (82%) completed secondary or university education.

Regarding blood pressure, it was found that the mean systolic blood pressure was 110 ± 4 mmHg and the mean diastolic blood pressure was 77.6 ± 4.3 mmHg. The study findings regarding uric acid levels indicated that the range was from 1.4 to 7.1 mg/dL, with a mean of 2.6 ± 1 mg/dL. Table1. Roughly one-third of the participants got multivitamins and calcium, one-third just multivitamins, and one-third folic acid as an extra prescription during their gestation.

Table 2. The relation between gestational age and measured serum uric acid.

Pregnancy trimester	N	Serum uric acid (mg / dL)	
		Mean	Standard deviation
First	15	1.8	0.5
Second	15	2.5	0.3
Third	20	3.3	1.1
P Value	***F statistics = 15.31***		***p value < 0.0001***

Serum uric acid levels and Pregnancy

There was a significant relationship between uric acid levels and gestational age with the third trimester had a significantly higher serum UA levels (p-value < 0.0001) than the other trimesters. Table2. Additionally, there was no statistically significant correlation between measured serum uric acid level and blood pressure. Table3. Furthermore, there was no significant relationships between serum uric acid measured and educational level (p value= 0.71), and additional medications taken during pregnancy (p value= 0.5119).

Table 3. Correlation analysis of measured serum uric acid and study variables.

Factor	R Coefficient	Standard error	t	P value	95% Confidence intervals	
					From	To
Gestational age	-0.01	0.03	-0.15	0.88	-0.07	0.06
Systolic – mmHg	-0.02	0.04	-0.50	0.62	-0.10	0.06
Diastolic – mmHg	0.07	0.03	1.95	0.06	0.00	0.14

4. DISCUSSION

The purpose of the study was to determine whether uric acid levels change during a normal pregnancy's three trimesters and correlate it with the blood pressure.

According to our research, uric acid levels and gestational age have a significant positive relationship. Serum UA levels were significantly higher in the third trimester than in the first and second trimesters. Similarly, Johnson et al. provided an explanation for these findings by pointing out that oestrogen's uricosuric effects and an increase in renal blood flow can cause uric acid levels to drop in the early stages of pregnancy, frequently to 3 mg/dl or less. After then, during the third trimester, uric acid levels increase and by the time of delivery, they are between 4-5 mg/dl [19]. Additionally, Gulati et al. In india documented that, uric acid levels were found to be significantly higher in the third trimester of pregnancy [20]. Furthermore, Corominas et al. demonstrated that up to 20 weeks gestation, the mean uric acid levels in healthy women were either within the normal range or possibly low. After 20 weeks of pregnancy, however, mean uric acid levels were higher in women with normal blood pressure [21]. In Sudan, Aljak et al. also discovered that uric acid level dropped by a third during early pregnancy but rose to non-pregnancy levels in late pregnancy [22].

This study suggests that measuring serum uric acid levels is a useful therapeutic test for pregnant patients with hypertension, particularly those who become primiparous after 20 weeks of pregnancy.

According to our research, there is no significant correlation between serum uric acid and different study variables. Likewise, George et al. claim that hyperuricemia is a common condition

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that can strike individuals of any age [23]. Additionally, Bainbridge et al. reported that elevated blood uric acid levels are linked to poor fetal outcomes in hypertensive pregnancies in the non-pregnant population, hypertension, adverse cardiovascular events, and renal disease [2]. Thus, the absence of hypertensive subjects may account for the lack of statistical significance between uric acid levels and blood pressure measurements in our study.

In our findings, there was no significant correlation observed between serum uric acid and the participant's educational level and/or additional medication they took during pregnancy. Pregnant women's uric acid levels are not expected to be directly correlated with their education level. The impact of low education on the occurrence of issues and complications during pregnancy, such as elevated uric acid, requires further investigation. It is impossible to rule out the possibility of an indirect link between low education and unreliable prenatal care, living in a rural area, or having a low socioeconomic standing. While it is well known that some long-term medications can change blood levels of uric acid, this was not considered in our study. It is advised that this point be covered in future studies because it is possible that taking extra medication during pregnancy will have an impact on a pregnant woman's uric acid levels.

Because of the relatively small sample size and convenience non-probability sampling used, the study findings may not be as general as they could be.

5. CONCLUSION

There is a strong relationship between gestational age and uric acid levels, with higher levels in the third trimester. Nevertheless, there was no significant correlation discovered with blood pressure. Our findings suggest that measuring serum uric acid possibly has diagnostic and /or therapeutic value and should be included in the evaluation process for pregnant ladies, particularly those who present after 20 weeks of pregnancy.

Conflicts of interest: The authors have no financial or non-financial conflict of interest to disclose.

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