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Original Research Article

A Study on Serum Urea, Creatinine and Uric Acid Levels in Normal Pregnancy (First and Third Trimester) in Rohilkhand Region, Uttar Pradesh

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Abstract: The present study has been undertaken to evaluate the changes in serum level of urea, creatinine, and uric acid in normal pregnant women (during 1st and 3rd trimester of pregnancy) and compare it with non-pregnant women. During the study, 76 pregnant women were seen in the 1st trimester but only 48 pregnant women continued the follow up through out to 3rd trimester of pregnancy. 48 non-pregnant healthy women were selected as control group. The estimation of the biochemical parameters were carried out by using Chem 5 plus semi-autoanalyzer. Our study shows that mean ± SD of serum urea, creatinine and uric acid levels significantly decreased during the 1st trimester of pregnany as compared to control group while the non significant decrease level was observed in 3rd trimester of pregnancy as compared to non pregnant healthy women. Comparison between 1st and 3rd trimester of pregnancy and found that the serum urea concentration of 1st and 3rd trimester of pregnancy was not significant while significance difference was found between serum creatinine and uric acid levels. The biochemical parameters serum urea, creatinine and uric acid are affected by pregnancy in the 1st trimester more than the 3rd trimester.
Keywords: Urea, creatinine, uric acid, trimester, pregnancy, semi autoanalyzer

INTRODUCTION

Pregnancy, also known as gravidity or gestation, is the time during which one or more offspring develops inside a woman[1]. A multiple pregnancy involves more than one offspring, such as with twins[2]. It usually lasts around 40 weeks from the last menstrual period (LMP) and ends in childbirth [1, 3]. This is just over nine lunar months, where each month is about 29½ days [1, 3]. When measured from conception it is about 38 weeks. Pregnancy is typically divided into three trimesters. The first trimester is from week one through 12 and includes conception. Conception is when the sperm fertilizes the egg. The fertilized egg then travels down the fallopian tube and attaches to the inside of the uterus, where it begins to form the fetus and placenta [1]. The first trimester carries the highest risk of miscarriage (natural death of embryo or fetus) [4]. The second trimester is from week 13 through 28. Around the middle of the second trimester, movement of the fetus may be felt. At 28 weeks, more than 90% of babies can survive outside of the uterus if provided high-quality medical care. The third trimester is from 29 weeks through 40 weeks [1]. During pregnancy, the woman undergoes profound anatomical, physiological, biochemical and endocrine changes that affect multiple organs and systems. These changes are essential to help the woman to adapt to the pregnant state and to aid fetal growth and survival. However, such anatomical and physiological changes may cause confusion during clinical examination of a pregnant woman. Similarly, changes in blood biochemistry during pregnancy may create difficulties in interpretation of results. Conversely, clinicians also need to recognize pathological deviations in these normal anatomical and physiological changes during pregnancy to institute appropriate action to improve maternal and fetal outcome [5].

Successful outcome of pregnancy requires frequent monitoring of biochemical and hematological

parameters to avoid complications throughout the trimesters of pregnancy. Several authors have been reported disturbances in carbohydrate metabolism [6], lipid profile [7, 8], protein profile, liver function [9] and kidney function [10] during pregnancy. Hematological changes were also documented [11].

Urea is the end metabolic product of protein catabolism in human, and creatinine is an anhydride of creatine. Serum urea and creatinine concentrations depend on the balance between their production and excretion [12]. Measurement of plasma or serum urea concentration is widely regarded as a test of renal function but not a good guide to renal function as it varies with protein intake, liver metabolic capacity and renal perfusion [13]. So, measurement of serum creatinine is a more reliable guide as it is produced from muscle at a constant rate and almost completely filtered at the glomerulus. As very little creatinine is secreted by tubular cells, the creatinine clearance provides a reasonable approximation of the glomerular filtration rate.

Each day, 1-2% of muscle creatine is converted to creatinine. Men tend to have higher levels of creatinine than women because, in general, they have a greater mass of skeletal muscle. Increased dietary intake of creatine or eating a lot of protein (like meat) can increase daily creatinine excretion [14].

Uric acid (2, 6, 8-trihydroxypurine) is the end product of purine metabolism and its elevated level induces endothelial dysfunction and may induce hypertension and vascular disease [15]. An association between elevated serum uric acid levels and preeclampsia was first reported by Slemons and Bogert in 1917. In women who go on to develop preeclampsia, uric acid concentration is elevated as early as 10 weeks of gestation, at a time much earlier than clinical presentation of the disorder [16]. In this context, the present study has been undertaken to evaluate and compare the changes in serum level of urea, creatinine, and uric acid in healthy non-pregnant women and normal pregnant women (during 1st and 3rd trimester of pregnancy) and also to find if there is any significant of serum urea, creatinine, and uric acid levels between 1st and 3rd trimester of pregnancy in Rohilkhand region of Uttar Pradesh.

MATERIALS AND METHODS

Case control study was conducted at the Department of Biochemistry, Rohilkhand Medical College and Hospital (RMCH), Bareilly, Uttar Pradesh after obtaining clearance from institutional ethical committee. Study was done in the year of 2014-15. Total 76 normotensive pregnant women with age's ranges from 21-35 years with low socio-economic status and similar dietary habit receiving antepartum care at the outpatient department of Obstetrics and Gynecology, RMCH, Bareilly after taking their due written consent. 48 healthy non-pregnant women were selected as control group with similar age's and socio-economic status and dietary habit. They were non smokers and non alcohol drinkers. No subject in the study was suffering from acute or chronic illness during the study period nor they had any past history of cardiac, renal, hepatic dysfunction, gout .This is evaluated by taking medical history, surgical history and drug history from each volunteer. Both groups have normal range of renal function test and liver function test. The pregnant women were followed up in the 1st and 3rd trimester. During the study, 76 pregnant women were seen in the 1st trimester (6- 13 weeks) but only (48) pregnant women continued the follow up through out to 3rd trimester (26-38 weeks).

Venous blood samples were collected from antecubital vein after an overnight fasting from all participant's with aseptic precautions. Blood samples were allowed to clot at room temperature and the serum was separated by centrifugation. The estimation of the biochemical parameters were carried out within 4-6 hrs by using Chem 5 plus semi-autoanalyzer. The following tests were done in each sample during the study.

a) Blood urea by Need-dye (initial rate assay) [17]
b) Serum Creatinine by Modified Jaffe's reaction (initial rate assay) [18]
c) Serum uric acid by Uricase-POD method [19]

- Plasma/ Serum Urea: 12.6- 42.6 mg/dL [17, 19]
- Plasma/ Serum Creatinine: 0.6-1.1 mg/dL (Female) [17, 19]
- Serum uric acid :2.4-5.7 mg/dL (Female) [17, 19]

STATISTICAL ANALYSIS

Data were presented as mean ± SD. Comparison of serum levels of the parameters between cases and control was performed by student's t test and $p < 0.05$ was considered as statistically significant.

RESULTS

Table 1; Fig 1 : show a comparison of biochemical parameters (mean ± SD) of serum urea (24.4± 7.20 and 29.8± 7.98), creatinine (0.70±0.10 and 0.79± 0.13) and uric acid levels (4.0 ± 0 .79 and 4.3 ± 0 .88) between cases (pregnancy during the 1st trimester) and control. Serum urea, creatinine and uric acid levels significantly decreased during the 1st trimester of pregnany as compared to control group.

Table 1: Serum urea, creatinine and uric acid levels (mean ± SD) between the cases [Pregnancy (1st trimester)] and control (Non-pregnant healthy women)

Study groups	Parameters Mean ± SD		
	Urea (mg/ dL)	Creatinine (mg/dL)	Uric acid (mg/dL)
Pregnancy (1st trimester)	**24.4± 7.20**	**0.70±0.10**	**4.0 ± 0 .79**
Non-pregnant healthy women	**29.8± 7.98**	**0.79± 0.13**	**4.3 ± 0 .88**
P value	**< 0.05**	**< 0.05**	**< 0.01**

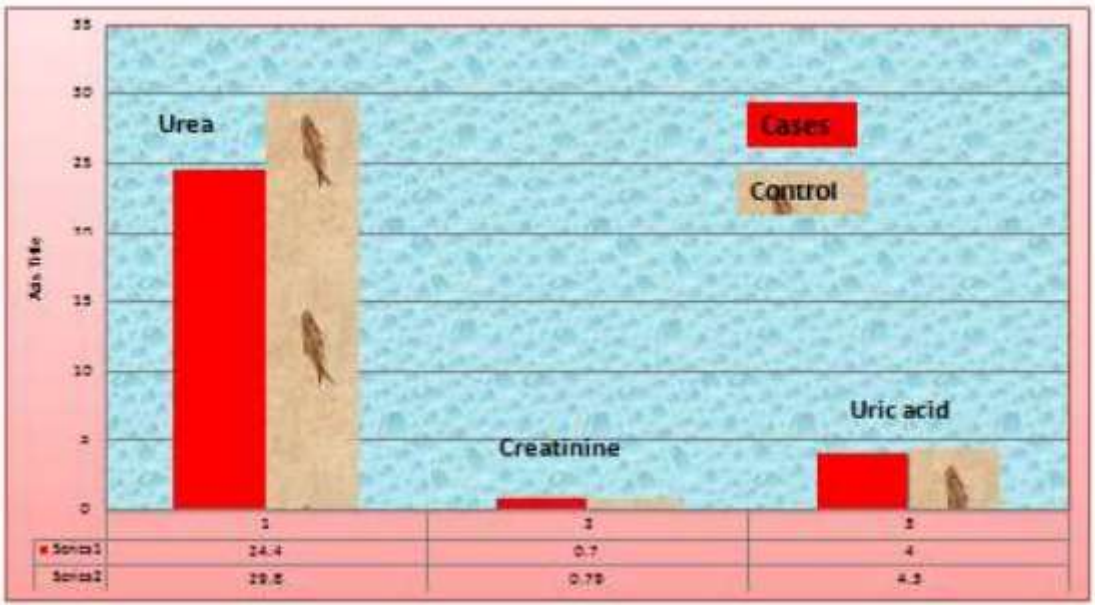

Fig-1: Serum urea, creatinine and uric acid levels (mean ± SD) between the cases [Pregnancy (1st trimester)] and control (Non-pregnant healthy women)

As shown in table-2; Fig 2 the mean ± SD serum urea (26.0± 7.01 and 29.8± 7.98), creatinine (0.74± 0.08 and 0.79± 0.13) and uric acid (4.2± 0.9 and 4.3 ± 0 .88) concentration in 3rd trimester of pregnancy were non significantly decreased as compared to non pregnant healthy women ($p > 0.05$).

Table 2: Serum urea, creatinine levels and uric acid (mean ± SD) between the cases [Pregnancy (3rd trimester)] and control (Non-pregnant healthy women)

Study groups	Parameters Mean ± SD		
	Urea (mg/ dL)	Creatinine (mg/dL)	Uric acid (mg/dL)
Pregnancy (3nd trimester)	**26.0± 7.01**	**0.74± 0.08**	**4.2± 0.9**
Non-pregnant healthy women	**29.8± 7.98**	**0.79± 0.13**	**4.3 ± 0 .88**
P value	>0.05 Not significance	>0.05 Not significance	>0.05 Not significance

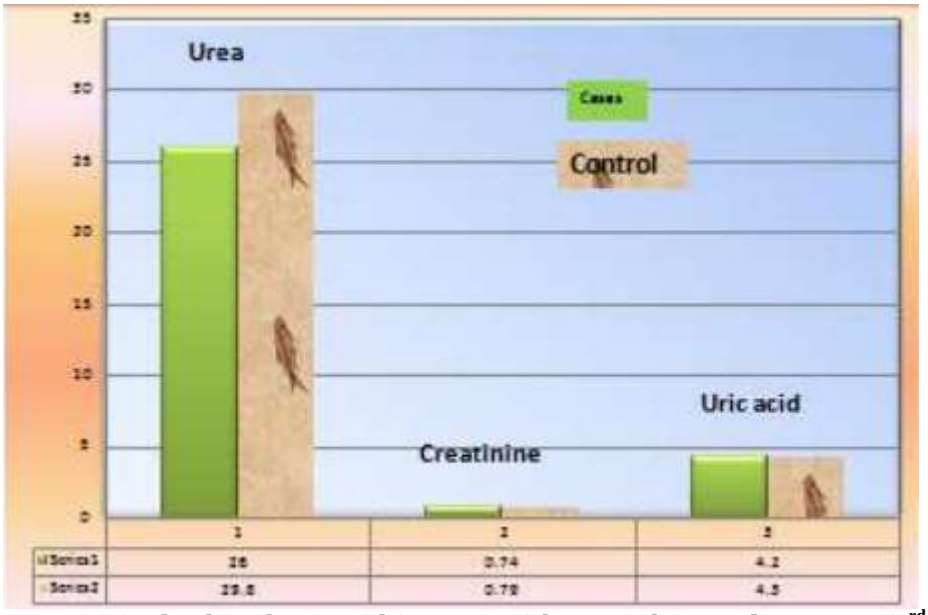

Fig-2: Serum urea, creatinine levels and uric acid (mean ± SD) between the cases [Pregnancy (3rd trimester)] and control (Non-pregnant healthy women)

From table 3; Fig 3: we analyzed the biochemical parameters between 1st trimester and 3rd trimester of pregnancy and found that the mean ± SD of serum urea concentration of 1st and 3rd trimester of pregnancy was not significant (24.4 ± 7 .20 vs 26 ± 7.01; p > 0.05) while significance difference was found between serum creatinine and uric acid levels (0.70±0.10 vs 0.74± 0.08 and 4.0 ± 0 .79 and 4.2± 0.9).

Table 3: Serum urea, creatinine and uric acid levels (mean ± SD) between 1st trimester and 3rd trimester of pregnancy

Study groups	Parameters Mean ± SD		
	Urea (mg/ dL)	Creatinine (mg/dL)	Uric acid (mg/dL)
Pregnancy (1st trimester)	24.4± 7.20	0.70±0.10	4.0 ± 0 .79
Pregnancy (3rd trimester)	26.0± 7.01	0.74± 0.08	4.2± 0.9
P value	> 0.05	< 0.05	< 0.01

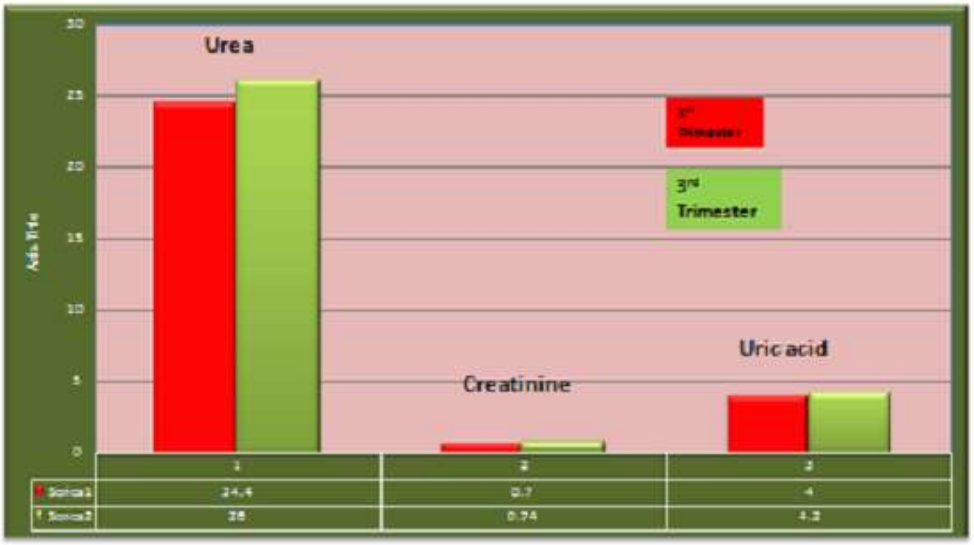

Fig-3: Serum urea, creatinine and uric acid levels (mean ± SD) between 1st trimester and 3rd trimester of pregnancy

DISCUSSION

On analyzing the results of our study (Table-1; Figure 1), we observed that the mean ± SD of serum urea, creatinine and uric acid levels in first trimester of pregnancy were significantly lower than control group. In first trimester of pregnancy plasma volume and GFR increase during the course of pregnancy [20, 21]. These changes in plasma volume and GFR may give a possible explanation for initial increase the clearance of urea, creatinine and uric acid [22, 23] so all three parameters are therefore slightly decrease in serum. The positive protein and purine balance during growth of the fetus, and the increase of GFR, result in lowered maternal plasma urea and urate levels [24]. Our analytical results were in an agreement with other authors namely Dunlop *et al*. [22], Macdonald *et al.* [25] Korda *et al.* [26] From table-2 and figure 2 we found that the mean ± SD of serum urea , creatinine and uric acid levels in 3rd trimester of pregnancy increased but still lower than the control group although the decrease statistically not significant in comparison with control group. Similar finding were observed by other authors [22, 25, 26]. GFR begin to decrease in the 3rd trimester of pregnancy toward non-pregnant values [27], so that serum urea and creatinine concentration rise slightly during the last weeks of pregnancy. During this times, tubular reabsorption of uric acid increase dramatically [27] which increase serum uric acid concentration, also the decrease in plasma volume causing decrease in RPF to the secretary site, which leads to decrease the secretion of uric acid from proximal and more distal parts of tubule. This reflects the increase of serum uric acid in late pregnancy [22].

Serum creatinine and uric acid concentration (mean ± SD) in table –3 and fig-3 found that the statistically significant between the 1st & 3rd trimester while the serum urea concentration was not significant

CONCLUSION

Our study found a significant relation of biochemical parameters like serum urea, creatinine and uric acid concentration between 1st trimester of pregnancy and healthy non pregnant women and non significant relation were observed between 3rd trimester and same control group. We also observed significant relation of serum creatinine and uric acid concentration between 1st trimester and 3rd trimester of pregnancy. It concluded that the serum urea, creatinine and uric acid are affected by pregnancy in the 1st trimester more than the 3rd trimester.

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