

Measurement of Serum Uric Acid, Urea and Creatinine in Pregnant Women

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Abstract

Serum uric acid ,urea and creatinine were assessed in normal pregnant women in order to identify the association between these biochemical parameters and gestational periods (first and third trimester) compared to those of normal non- pregnant women as a control group. The study has been done on (53) normal pregnant women, but only (38) continued the follow up through out to third trimester, and a comparison was done with (37) normal non-pregnant women as a control group. The mean of serum uric acid, urea and creatinine showed a significant lower values in pregnant group during the 1st trimester of pregnancy than the control group. While the mean values of serum uric acid, urea and creatinine show a non significant decrease through out the 3rd trimester compared to the control group. There was a significant difference in serum uric acid and creatinine between the 1st and 3rd trimester which were higher in the 3rd trimester than the 1st trimester of pregnancy, but no significant difference in serum urea between the 1st and 3rd trimester.

Introduction

Pregnancy is a normal physiological condition which show many changes in the maternal environment ⁽¹⁾. Adaptation to pregnancy in humans involves anatomic, physiologic and metabolic changes in the mother to support and provide her with nutritional and metabolic needs and those of growing conceptus ⁽²⁾. Almost all maternal physiological system under go adjustment as a result of pregnancy, but perhaps the greatest upheaval is caused to the renal system ⁽³⁾. Many changes in renal function occur in normal pregnancy, without a proper understanding of these changes, routine clinical investigations may be easily misinterpreted ⁽⁴⁾ such as serum uric acid, urea and creatinine. Renal function is affected by the changes in other systems particularly by those that occur in hemodynamic control ⁽⁵⁾. The systemic hemodynamic profile of pregnancy is characterized by an increase in intravascular volume ,cardiac output and heart rate with marked fall in vascular resistance and tendency toward a decrease in a mean blood pressure in association with an increase in renal plasma flow (RPF) and glomerular filtration rate (GFR) ^{(6), (7)}. The increase in GFR has important clinical implications ,such as serum level of uric acid, urea and creatinine during

pregnancy ⁽¹⁾. In human, uric acid is the major product of catabolism of the purine, nucleosides, adenosine and guanosine ⁽⁸⁾. The reference intervals using an enzymatic method is 155 – 357 $\mu\text{mol/l}$ (2.6 – 6 mg/dl) for females ⁽⁹⁾. Plasma urea and creatinine concentrations depend on the balance between their production and excretion ⁽¹⁰⁾. Urea is the major nitrogen-containing metabolic product of protein catabolism in human, the reference intervals using an enzymatic about 2.5 – 7.5 mmol/l (15 – 45 mg/dl) ⁽⁹⁾. The 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 ⁽¹¹⁾ 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. If muscle mass remains constant, changes in creatinine concentration reflect changes in GFR ^{(9), (11)}. Plasma creatinine is mostly derived from endogenous source by tissue creatine breakdown .The reference intervals for serum or plasma creatinine, measured by jaffe methods is

53 – 97 $\mu\text{mol/l}$ (0.6 – 1.1mg/dl) in women⁽⁹⁾. The present study was designed to investigate the effect of pregnancy on serum uric acid, urea and creatinine during the 1st & 3rd trimester of gestation.

Materials And Methods

The subjects involved in this study included (53) healthy pregnant women from alkansa hospital their ages were between (20-39) years with a mean of (28) years. The control group was (37) healthy non-pregnant women their ages were between (23-40) years with a mean of (30) years. A complete history of every pregnant woman was obtained including name, age, weight, occupation, gravity, parity ,history of previous pregnancies ,family history and any drug intake all subjects had no renal disease or any other disease. The pregnant women were followed up in the 1st and 3rd trimester. During the study, (53) pregnant women were seen in the 1st trimester (6-13 weeks) but only (38) pregnant women continued the follow up through out to 3rd trimester (26-38 weeks). Approximately (5) ml of the venous blood was placed in a plain tube ,then the blood samples were left on the bench at room temperature for 30 minutes to allow the blood to clot, serum samples were obtained by centrifugation at 3000 rpm for 10 minutes. The serum was collected into other clean plain tube for the following tests: serum uric acid, urea and creatinine .Serum uric acid was determined by an enzymatic method (Uricase) using kit (biomerieux / France)⁽¹²⁾. Serum urea was estimated by an enzymatic method (Urease-modified Berthelot reaction) using kit (biomerieux /

France)⁽¹³⁾. Determination of serum creatinine was based upon the colorimetric method with deproteinisation using kit (Syrbio / France)⁽¹⁴⁾.

Statistical Analysis

Data were analyzed using unpaired t-test .The results were expressed as mean \pm standard deviation & $p < 0.05$, $p < 0.01$ was considered as statistically significant⁽¹⁵⁾.

Results

Table (1): Show a comparison of biochemical parameters (serum uric acid ,urea and creatinine) between the control & pregnant group during the 1st trimester. Serum uric acid decreased significantly ($p < 0.05$) as compared to control group ,while serum urea and creatinine show high significant decrease in their level ($p < 0.01$)during the 1st trimester as compared to control group.

Table(2): Show a comparison of the biochemical parameters (serum uric acid, urea and creatinine) between the control & pregnant group during the 3rd trimester .Serum uric acid, urea and creatinine show a non significant decrease during the 3rd trimester compared with control group.

Table(3): Show a comparison of biochemical parameters (serum uric acid, urea and creatinine) between the 1st & 3rd trimester of pregnancy. Serum uric acid and creatinine increased significant ($p < 0.05$) during the 3rd trimester of gestation as compared to 1st trimester of pregnancy while there was no significant difference in serum urea.

Table (1): A comparison of the biochemical parameters (mean \pm SD) between the control & pregnant group in the 1st trimester.

Parameters	Mean \pm SD		T- value	P- value
	Control Group (n=37)	1st Trimester (n=53)		
Serum Uric Acid ($\mu\text{mol/l}$)	275.2 \pm 53.7	249.7 \pm 47.9	2.37	<0.05
Serum Urea (mmol/l)	4.99 \pm 1.36	4.24 \pm 1.23	2.76	<0.01
Serum Creatinine ($\mu\text{mol/l}$)	70.4 \pm 12.5	63.85 \pm 8.40	3.00	<0.01

$P < 0.05$ =Significant Difference, $p < 0.01$ =High Significant Difference.

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Table (2): A comparison of the biochemical parameters (mean \pm SD) between the control & pregnant group in the 3rd trimester.

Parameters	Mean \pm SD		T - value	P - value
	Control Group (n=37)	3rd Trimester (n=38)		
Serum Uric Acid ($\mu\text{mol/l}$)	275.2 \pm 53.7	275.0 \pm 56.9	0.01	NS
Serum Urea (mmol/l)	4.99 \pm 1.36	4.49 \pm 1.31	1.63	NS
Serum Creatinine ($\mu\text{mol/l}$)	70.4 \pm 12.5	67.26 \pm 6.83	1.37	NS

NS =No significant difference.

Table (3): A comparison of the biochemical parameters (mean \pm SD) between the 1st & 3rd trimester of pregnancy.

Parameters	Mean \pm SD		T - value	P - value
	1st trimester (n=53)	3rd trimester (n=38)		
Serum Uric Acid ($\mu\text{mol/l}$)	249.7 \pm 47.9	275.0 \pm 56.9	- 2.30	<0.05
Serum Urea (mmol/l)	4.24 \pm 1.23	4.49 \pm 1.31	- 0.96	NS
Serum Creatinine ($\mu\text{mol/l}$)	63.85 \pm 8.40	67.26 \pm 6.83	- 2.06	<0.05

P<0.05 =Significant difference, NS =No significant difference.

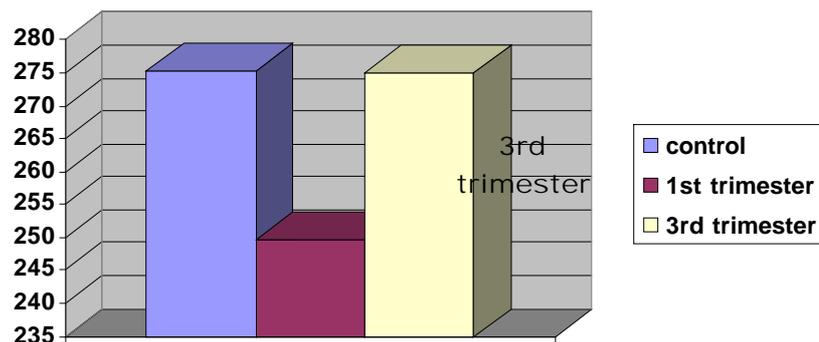


Fig (1): Serum uric acid concentration in control and pregnant groups.

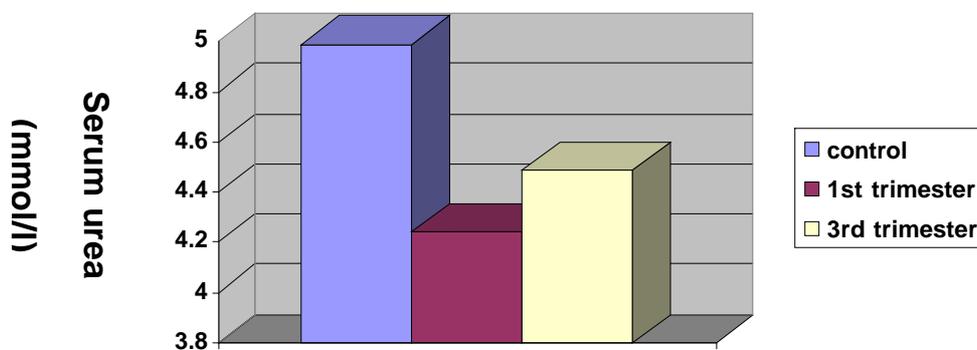


Fig (2): Serum urea concentration in control and pregnant groups.

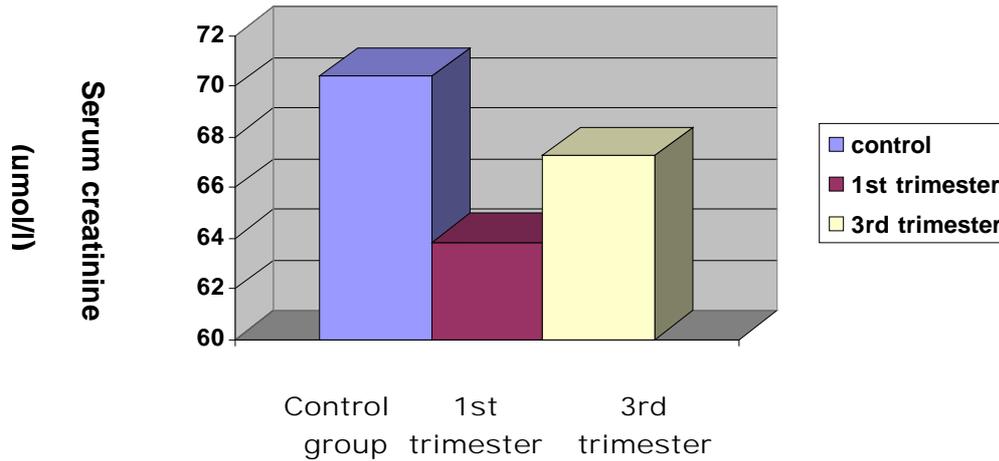


Fig (3): Serum creatinine concentration in control and pregnant groups.

Discussion

The present results showed that the serum uric acid, urea and creatinine in the 1st trimester of pregnancy were significantly lower in pregnant group than control group; Figure (1). From the results shown in table (2), it appears that the results of serum uric acid, urea and creatinine during the 3rd trimester are found to be increased but still lower than the control group although the decrease statistically not significant in comparison with control group; Figure (2). The results were in an agreement with Dunlop and Davison (16), Macdonald and Good (17), Korda and Horvath (18). Plasma volume increase during the course of pregnancy, also GFR increase in early pregnancy (19), (20). These changes in plasma volume and GFR may give a possible explanation for initial increase the clearance of uric acid, urea and creatinine (16), (21), so all three parameters are therefore slightly decrease in serum for much of the pregnancy. 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 (10). In the 3rd trimester the GFR begin to decrease toward non-pregnant values (9), 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 (9) 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 (16). This reflects the increase of serum uric acid in late pregnancy. The differences between the trimester in serum uric acid and creatinine were statistically significant between the 1st & 3rd trimester. While the difference between the 1st & 3rd trimester in serum urea was not significant; Figure (3). It concluded that the serum uric acid, urea and creatinine are affected by pregnancy in the 1st trimester more than the 3rd trimester.

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