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MEASUREMENT OF PLASMA TOTAL PROTEIN, ALBUMIN AND UREA IN HEALTHY SUDANESE PREGNANT WOMEN

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ABSTRACT

Background: Pregnancy is characterized by extensive maternal physiological adjustments involving a variety of metabolic processes. These characteristic changes are often reflecting in the results of laboratory tests, such that value in healthy pregnant women may fall outside the normal ranges of non-pregnant women. This study aimed to assess the concentration of serum total protein, albumin and blood urea among Sudanese pregnant women during the three trimesters and to compare them with non-pregnant women's. **Methods:** Case control study conducted during the period from January to March 2014 to compare serum levels of total protein, albumin and urea of 80 pregnant women (18 at 1st trimester, 23 at 2nd trimester and 39 at 3rd trimester) with 20 healthy non pregnant women. **Results:** Means of serum levels of total protein in the 1st trimester showed no significance comparing to control group, while serum albumin and urea levels significantly decreased. In second and the third trimesters all total protein, albumin and urea were significantly decreased compared to control group. **Conclusion:** Total protein, serum albumin and blood urea were altered during the pregnancy period compared to non-pregnant women but not to the levels of abnormality.

INTRODUCTION

Physiological changes occur in pregnancy to nurture the developing foetus and prepare the mother for labour and delivery. Some of these changes influence normal biochemical values while others may mimic symptoms of medical disease. It is important to differentiate between normal physiological changes and disease pathology.[1]

During pregnancy, the pregnant mother undergoes significant anatomical and physiological changes in order to nurture and accommodate the developing foetus. These changes begin after conception and affect every organ system in the body.[2] For most women experiencing an uncomplicated pregnancy, these changes resolve after pregnancy with minimal residual effects. It is important to understand the normal physiological changes occurring in pregnancy as this will help differentiate from adaptations that are abnormal. Plasma volume increases progressively throughout normal pregnancy.[3] As a consequence of renal vasodilatation, renal plasma flow and glomerular filtration rate (GFR) both increase, compared to non-pregnant levels, by 40–65 and 50–85%, respectively. In addition, the increase in plasma volume causes decreased oncotic pressure in the glomeruli, with a subsequent rise in GFR.[4] The increase in renal size is associated with an increase in renal vasculature, interstitial volume and urinary dead space. There is also dilation of the ureters, renal pelvis and calyces, leading to physiological hydronephrosis in over 80% of women.[5] Pregnant women require an increased intake of protein during pregnancy. Amino acids are actively transported across the placenta to fulfill the needs of the developing foetus. During pregnancy, protein catabolism is decreased as fat stores are used to provide for energy metabolism.[1]

Arterial under-filling in pregnancy leads to the stimulation of arterial baroreceptors, activating the RAA and the sympathetic nervous systems. This results in a non-osmotic release of AVP from the hypothalamus. These changes lead to sodium and water retention in the kidneys and create a hypervolaemic, hypoosmolar state characteristic of pregnancy.[6] Extracellular volume increases by 30–50% and plasma volume by 30–40%. Maternal blood volume increases by 45% to approximately 1 200 to 1 600 ml above non-pregnant values. By the late third trimester the plasma volume increases by more than 50–60%, with a lower increase in red blood cell mass and therefore plasma osmolality falls by10 mosmol/kg. The increase in plasma volume plays a critical role in maintaining circulating blood volume, blood pressure and uteroplacental perfusion during pregnancy.[7]

Activation of the RAA system leads to increased plasma levels of aldosterone and subsequent salt and water retention in the distal tubule and collecting duct. In addition to the increased renin production by the kidneys, ovaries and uteroplacental unit produce an inactive precursor protein of renin in early pregnancy.[8]

MATERIALS AND METHODS

The study is case control study conducted in Al Saudi maternal hospital in Omdurman city. The study was carried out during the period from January to August 2014. The study included 80 healthy Sudanese pregnant women (18 in 1st trimester, 23 in 2nd trimester and 39 in 3rd trimester) as study group and 20 healthy non pregnant Sudanese women and control group. The study group were interviewed to obtain the clinical data and 2.5 mL of venous blood were collected in heparin containers from all participants (case and control) and centrifuged to obtain plasma. Plasma levels of total protein, albumin and urea were measured using commercial kits from Bio System and Cromatest by using Spectrophotometer 310.

Quality control

Precision and accuracy of all methods used in this study were checked each time. Batch was analyzed by including commercial control sera (normal and pathological).

Data Analysis

Data collected in this study were analyzed using SPSS computer program. The means and the standard deviation of plasma urea, total protein and albumin were calculated and the (t) test was used for comparison (P value of 0.05 is considered to be significant).

RESULTS

Total protein, albumin and urea were monitored in 80 pregnant women at their 1st, 2nd and 3rd trimesters, as well as in control non pregnant women in order to assess the effect of pregnancy on these biological parameters. The results obtained were presented as follow: the albumin and urea were significantly decreased in pregnant women at the 1st trimester compared to control group. At second and third trimesters all parameters were significantly decreased compared to non-pregnant women. Table (1) represents comparison between the levels of biological parameters in pregnant women at 1st and 2nd trimesters. Nearly the parameters were not remarkable attired (p values were 0.068, 0.046 and 0.088 for albumin, urea and total protein respectively). Table (2) represents comparison between the levels of biological parameters during 1st and 3rd trimesters and it showed highly significant

differences between them (p values were 0.000, 0.001 and 0.000 for albumin, urea and total protein). Table (3) illustrates comparison between levels of albumin, urea and total protein in the pregnant women at 2nd and 3rd trimesters and it showed that although urea and total protein were not statistically differed from each other (p values 0.194 and 0.193), albumin showed significant altered (p value 0.000).

Table (1): Comparison between the means and P value of total protein, albumin and urea between 1st and 2nd trimesters.

Parameters	Trimester	No	Mean± SD	p value
Total protein (g/dl)	1st	18	6.9±0.6	0.088
	2nd	23	6.5±0.7	
Albumin (g/dl)	1st	18	3.9±0.4	0.068
	2nd	23	3.7±0.2	
Urea (mg/dl)	1st	18	18±5	0.046
	2nd	23	15±3	

Table (2): Comparison between the means and P value of total protein, albumin and urea between 1st and 3rd trimesters.

Parameters	Trimester	No	Mean± SD	p. value
Total protein (g/dl)	1st	18	6.9±0.5	0.000
	3rd	39	6.3±0.5	
Albumin (g/dl)	1st	18	3.9±0.4	0.000
	3rd	39	3.3±0.3	
Urea (mg/dl)	1st	18	18±5	0.001
	3rd	39	13.6±4	

Table (3): Comparison between the means and P value of total protein, albumin and urea between 2nd and 3rd trimesters.

Parameters	Trimester	No	Mean± SD	p. value
Total protein (g/dl)	2nd	23	6.5±0.7	0.193
	3rd	39	6.3±0.5	
Albumin (g/dl)	2nd	23	3.7±0.2	0.000
	3rd	39	3.3±0.3	
Urea (mg/dl)	2nd	23	15±3	0.194
	3rd	39	13.6±4	

DISCUSSION

In present study, the mean of total protein when compared to the levels of non-pregnant women was insignificant in the 1st trimester and values were within the normal. These results were in agreement with findings reported by Burtis and Ashwood, 1995[9] who claimed that

total protein in pregnant women at their first trimester may be of no remarkable alteration compared with control non pregnant women.

During the 2nd and 3rd trimesters of pregnancy, the plasma total protein may undergo some alterations from control values, significant decrease of protein levels from control was seen during the 2nd and 3rd trimesters, but still values within the normal values of protein, these findings may indicate that during pregnancy in all trimesters total protein undergo significant reduction from control values, but the alteration within the normal. These results agreed with Marnye, 1994[10] who attributed this decrease to the increase plasma volume during pregnancy. Our findings also confirmed by Shalev et al (1999).[11]

On the other hand serum albumin showed the same pattern as protein slight reduction of significantly from control during 1st trimester but the values within the reference range, but during the second and third trimester's highly significant reduction from control occurred but also within the reference value. Decrease in serum albumin during pregnancy was reported by Burtis et al (1995)[9] and Wootton et al (1982)[12], concluded that the reduction of serum albumin during pregnancy maybe due to increased plasma volume and dilution of blood constituents. No significant differences in serum albumin in 2nd and 3rd trimesters.

When measuring the levels of blood urea in pregnant women, urea showed remarkable and significant decrease compare to control value at any trimester, but all these alterations in urea levels were within the normal.

CONCLUSION

Findings of this study suggested that during pregnancy, some alterations in biological parameters namely total protein, serum albumin and blood urea may occur but not to the extent of abnormalities and all changes within the reference values.

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