Research Article **CODEN: AJPAD7** **ISSN: 2321 - 0923**

Asian Journal of Pharmaceutical Analysis and Medicinal Chemistry

Journal home page: www.ajpamc.com

BIOCHEMICAL AND HEMATOLOGICAL EVALUATIONS IN SUDANESE WOMEN WITH PREECLAMPSIA

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ABSTRACT

Objectives of the study: The aim of this study was to evaluate the biochemical and hematological changes which occur in the serum of pregnant women with pre-eclampsia. **Materials and methods:** The study included 120 pregnant women with pre-eclampsia, beside 75 normotensive women at third trimester of pregnancy, served as control group. Serum uric acid, creatinine, urea, total protein, albumin, alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP) were measured using automated chemical analyzer. Serum sodium and potassium were measured using ion selective electrode. Complete blood count (CBC) was done using full automated hematology analyzer. Data were analyzed using IBM SPSS Statistics version 20. **Results:** The study revealed that the mean age of the women with pre-eclampsia was (28.11±6.45years), versus (29.18±6.35 years). The diastolic blood pressure was (152.29±17.67mmHg) versus (106.48±11.54mmHg) with P.value (0.000). The systolic blood was (122.80±5.57mmHg) versus (78.94±3.25mmHg) with P.value (0.000). Serum creatinine was (0.68±0.36mg/dl) versus (0.43±0.25mg/dl) with P.value (0.000). Uric acid was (6.96±2.07 mg/dl) versus (4.98±1.42mg/dl) with P value (0.000). The mean ALP was (130.70±46.12U/L) versus (83.85±17.67U/L) with P. value (0.000). The AST was (63.88±112.23 U/L) versus (29.60±12.07 U/L) with P.value (0.01). The ALT was (32.10±49.91 U/L) versus (18.18±8.55 U/L) with P.value (0.003). The mean of white blood cells (WBCs) was (9.44±4.18x10^9/l) versus (8.22±2.77x10^9/l) with P.value (0.015). The mean of platelets (PLTs) was (211.19±93.06x10^9/l) versus (245.36±65.97x10^9/l) with P.value (0.003). **Conclusion:** In Sudanese women with preclampsia; serum creatinine, uric acid, alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase and white blood cell count significantly increase, while platelets count significantly decrease.

KEY WORDS

Preeclampsia, Biochemical, Hematological evaluation, Sudan.

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INTRODUCTION

Pre-eclampsia (PE) is a multisystem disease unique to human pregnancy characterized by hypertension after 20 weeks of gestation[1], including proteinuria and edema[2,3]. Precise etiology and definition of (PE) has changed several times[4,5]. Pre-eclampsia is a major cause of maternal and perinatal morbidity and mortality worldwide[6,7]. Its incidence is 2-10% worldwide depending on the population studied[4]. In

developing countries it rank second only to anaemia, with approximately 7-10% of all pregnancies being complicated[6]. The incidence of (PE) reached 16% in some countries like Bangladesh[8]. Ideally; the diagnosis of (PE) should involve the use of biomarkers that reflect the underlying pathophysiology of the disease process[5]. Preeclampsia is characterized by elevated liver enzymes and low platelets[9,1]. Serum creatinine level decreases during normal pregnancy mainly because of the combination of blood volume expansion; hyper filtration and oncotic pressure decrease[10]; but in (PE) serum creatinine levels varies widely from mild increase to dialysis requirement[10].

Serum uric acid concentrations fall in early pregnancy due to an elevation in renal clearance secondary to increased glomerular filtration rate[11]. Later in pregnancy the serum uric acid levels increase, possibly due to raised fetal production and a decline in uric acid clearance until the end of pregnancy[12]. In (PE); hypoxia and ischemia of the placenta induce the expression of xanthine oxidase and therefore, increase the production of uric acid[11]. When serum uric acid increased, birth weight significantly decreased[13]. Xanthine oxidoreductase is the enzyme that catalyzes the chemical reactions of purine catabolism to xanthine and then xanthine to uric acid, this enzyme is found mainly in the liver[14]. All markers of liver function are generally reduced or low during pregnancy due to the expansion of extracellular fluid. Hence; serum albumin, (AST), ALT) and total bilirubin are low compared with the non-pregnant state[15,16]. In (PE) hyper vascularization and vasoconstriction of liver leads to liver cell injury and alteration of cell membrane permeability and damage to the cells which allows intracellular enzyme to leak into the blood ,leads to elevated liver enzymes[17]. The only exception is (ALP) which is elevated due to ALP of placental origin[16]. In the liver function the most sensitive change seen in (AST), but there is also a rise in (ALT)[18]. Almost all of patients with (PE) and abnormally elevated liver function tests had hyperuricaemia. Thus there seems to be a strong association between liver dysfunction and hyperuricaemia in (PE)[15]. A rise in liver enzyme levels is always significant and needs to be followed carefully, severe liver impairment can be associated with liver swelling, which causes the epigastric pain and can lead to liver rupture[18].

In (PE) hematological profile shows no significant change in haematocrit, but platelet count is significantly lower and neutrophil count is significantly higher[19]. When the platelet count is less than 50,000 per mm^3 (50×10^9 per L) active bleeding may occur[3].

Early screening for (PE) may allow vigilant antenatal surveillance and appropriate timing of fetal delivery in order to avoid serious sequelae[6].

MATERIALS AND METHODS

This case control study was done during the period from September 2013 to July 2015; in Maternity Hospital and Ribat University Hospital in Khartoum- Sudan. Random blood samples were collected from 120 pregnant women with pre-eclampsia, and from 75 normotensive women at third trimester of pregnancy served as control group. Ten ml of blood were drawn from each subject by disposable plastic syringes then divided into 5ml in a plain container without anticoagulant; and another 5ml in EDTA tube for complete blood count (CBC) using full automated hematology analyzer (Sysmex). Serum preparation was done by the centrifugation at 3000 rpm for 10 minutes, and then stored at -20^{o}C till the time of analysis. The serum sample was used for the measurement of urea, creatinine, uric acid, total protein, albumin, aspartate aminotransferase (AST), alanine aminotransferase (ALT) and alkaline phosphatase (ALP); using automated chemical analyzer (Mindary BS -210), while serum sodium and potassium were measured using (iron selective electron). Data were analyzed using IBM SPSS Statistics version 20. The mean and standard deviation was obtained, t test was used for the comparison studies, P value < 0.05 was considered significant. The ethical approval was obtained from Federal Ministry of Health and from National Ribat

University ethical committee. Informed and verbal consent was taken from individuals under study.

RESULTS

This study revealed that the mean age of the women with pre-eclampsia was (28.11 ±6.45years), while in the women with normal pregnancy was (29.18±6.35 years). The mean weight in the preeclampsic women was (79.34±8.97Kg), while in the control group was (77.42±5.81Kg). The mean of diastolic blood pressure in the preeclampsic women was (152.29±17.67 mmHg); while in the control group was (122.80±5.57 mmHg); with P.value (0.000). The mean of systolic blood pressure in the preeclampsic women was (106.48±11.54 mmHg); while in the control group was (78.94±3.25 mmHg); with P.value (0.000). The mean of urea in the women with pre-eclampsia was (26.26±13.84 mg/dl) versus (24.0400±9.76 mg/dl) in the women with normal pregnancy with no significant difference. Serum creatinine in the women with pre-eclampsia was (0.68±0.36mg/dl) versus (0.43±0.25mg/dl) in the women with normal pregnancy with P.value (0.000). The mean of sodium in the women with pre-eclampsia was (135.87±6.19908m.mol/l) versus (136.42±5.55 mmol/l) in the control group with no significant difference. The mean of potassium in the women with pre-eclampsia was (3.93±0.75 mmol/l) versus (4.20±0.88 mmol/l) in the control group with no significant difference. The mean serum uric acid in the women with pre-eclampsia was (6.96±2.07 mg/dl) versus (4.98±1.42mg/dl) in the women with normal pregnancy; with P.value (0.000). The mean of total protein in the women with pre-eclampsia was (6.14±0.78g/dl) versus (6.78±0.59g/dl) in the women with normal pregnancy with no significant difference. The mean of albumin in the women with pre-eclampsia was (2.82±0.62g/dl) versus (3.48±0.53g/dl) in the women with normal pregnancy with no significant difference. The mean of ALP in the women with pre-eclampsia was (130.70±46.12 U/L) versus (83.85±17.67U/L) in the women with normal pregnancy with P.value (0.000). The mean of AST in the women with pre-eclampsia was (63.88±112.23 U/L) versus (29.60±12.07 U/L) in the women with normal pregnancy; with P.value (0.01). The mean of ALT in the women with pre-eclampsia was (32.10±49.91 U/L) versus (18.18±8.55 U/L) in the women with normal pregnancy; with P.value (0.003) (Table No.1). The mean of Hb in the women with pre-eclampsia was (11.35±1.61) versus (11.78±1.44) in the control group there was no significant change. The mean of PCV in the women with pre-eclampsia was (34.71±4.92) versus (35.36±4.84) in the women with normal pregnancy; there is no significant difference. The mean of MCV in the women with pre-eclampsia was (82.91±6.11) versus (83.99±4.16) in the women with normal pregnancy; there was no significant difference. The mean of MCH in the women with pre-eclampsia was (28.02±3.97) versus (28.55±2.44) in the women with normal pregnancy there was no significant difference. The mean of MCHC in the women with pre-eclampsia was (32.92±2.97) versus (32.89±1.99) in the women with normal pregnancy; there was no significant difference. The mean of RBC in the women with pre-eclampsia was ($3.9442\pm0.77x10^{12}$/l) versus ($4.00\pm0.71x10^{12}$/l) in the women with normal pregnancy; there was no significant difference. The mean of WBC in the women with pre-eclampsia was ($9.44\pm4.18x10^{9}$/l) versus ($8.22\pm2.77x10^{9}$/l) in the women with normal pregnancy; with P.value (0.015). The mean of PLTs in the women with pre-eclampsia was ($211.19\pm93.06x10^{9}$/l) versus ($245.36\pm65.97x10^{9}$/l) in the women with normal pregnancy; with P.value (0.003), (Table No.2).

DISCUSSION

Preeclampsia and its associated morbidity and mortality for both mother and fetus remain significant clinical problem; one of these complications is gestational hypertension, in the present study; both diastolic and systolic blood pressure significantly increase, which are in agreement with that reported by many authors like Akter *et al* (2014)[13], Lowe *et al* (2014)[20], Redman *et al* (1976)[21], Varma (1982)[22] and Mustaphi *et al*

(1996)[23]. During normal pregnancy blood pressure falls in first trimester and rises towards pre-conception by term as written by Lowe et al (2014)[20]. Perinatal mortality rises with diastolic blood pressures above 90 mmHg as also reported by Lowe *et al* (2014)[20]; the mean diastolic pressure in Sudanese women with preeclampsia is (152.29±17.67 mmHg). Women with pregnancy induced hypertension are at high risk of developing cardiovascular related diseases as found by Raijmakers *et al* (2003)[24]. As uric acid is partly a surrogate marker of tissue involvement in pre-eclampsia as reported by James (2000)[18]. The data of the present work shows significantly increase in serum uric acid which is consistent with that reported by Akter *et al*; (2014)[13], Lowe *et al* (2014)[20], Razia *et al* (2013)[8], Rizwana *et al* (2015)[25], James (2000)[18], Paneri *et al* (2011)[27]. Rising level of serum urate is indication of preeclampsia progress and a good predictor for increased fetal risk as described by Redman *et al* (1976)[21]. On the other hand hyperuricaemia is quantitatively related to the outcome of the pregnancy for both the infant and the mother as written by Roger (2008)[15].

The present study reveals significant increase in serum creatinine levels in the preeclampsic women; this finding is also reported by Paneri *et al* (2011)[26], Rizwana *et al* (2015)[25], Basima *et al* (2014)[27]. In preeclampsia renal blood flow and glomerular filtration rate decrease; leading to endothelial damage; hence appear elevated creatinine and decreased creatinine clearance; proteinuria, hyperuricaemia, oliguria; causing renal tubular necrosis and renal failure as mentioned by guidelines of RCOG (2010)[28].

In this study all liver enzymes (AST, ALT and ALP); significantly increase in the Sudanese women with preeclampsia, this finding are consistent with that found by (Paneri *et al*; 2011)[26], but Basima *et al* (2014) [27] found no significant difference in the level of ALP in the preeclampsic which is in disagreement with this study.

The elevation of liver enzymes especially AST and ALT was also reported by Remero *et al* (1988)[29] and Leela *et al* (2015)[30]. This happen because in pre eclampsia hyper vascularization and vasoconstriction of liver leads to liver cell injury and alteration of cell membrane permeability and damage to the cells which allows intracellular enzyme to leak in to the blood, leads to elevated liver enzymes as suggested by Madazila *et al* (1999)[17].

The hematological profile shows that hematocrit, MCV, MCH, MCHC and RBC are not different between the preeclampsia group and their control, but platelet count is significantly lower and neutrophil count is significantly higher in the pre-eclamptic group; these finding also reported Anne *et al* (1996)[19]. Low platelets are also described by James (2000)[18], Rizwana *et al* (2015)[25].

Table No.1: Biochemical parameters (urea, creatinine, sodium, potassium, uric acid, alkaline phosphatase (ALP), aspartate aminotransferase (AST) and alanine aminotransferase (ALT) in preeclampsic women (N =120) and their control (N=75)

S.No	Study groups (variable)		Mean	Std. Deviation	P value
1	Urea (mg/dl)	Pre-eclampsic group	26.2667	13.84836	
		control group	24.0400	9.76956	0.190
2	Creatinine (mg/dl)	Pre-eclampsic group	0.6842	0.36553	
		control group	0.4387	0.25779	0.000
3	Sodium (m.mol/l)	Pre-eclampsic group	135.8750	6.19908	
		control group	136.4286	5.55690	0.744
4	Potassium (m.mol/l)	Pre-eclampsic group	3.9393	0.75150	
		control group	4.2000	0.88129	0.336
5	Uric acid (mg/dl)	Pre-eclampsic group	6.9650	2.07480	
		control group	4.9893	1.42502	0.000
6	T. protein (mg/dl)	Pre-eclampsic group	6.142	0.7810	
		control group	6.780	0.5991	0.264
7	Albumin (g/dl)	Pre-eclampsic group	2.828	0.6218	
		control group	3.485	0.5373	0.261
8	ALP (u/l)	Pre-eclampsic group	130.7041	46.12225	
		control group	83.8533	17.67017	0.000
9	AST (u/l)	Pre-eclampsic group	63.8833	112.23701	
		control group	29.6000	12.07186	0.01
10	ALT (u/l)	Pre-eclampsic group	32.1083	49.91536	
		control group	18.1867	8.55300	0.003

Table No.2: Hematological parameters (Hb, PCV, MCV, MCH, MCHC, RBC, WBC and PLTs) in preeclampsic women (N =120) and their control (N=75)

S.No	Study groups		Mean	Std. Deviation	P value
1	Hb (g/dl)	Pre-eclampsic group	11.3567	1.61691	
		control group	11.7800	1.44886	0.059
2	PCV (%)	Pre-eclampsic group	34.7152	4.92316	
		control group	35.3640	4.84156	0.376
3	MCV (FI)	Pre-eclampsic group	82.9108	6.11255	
		control group	83.9920	4.16182	0.144
4	MCH (pg)	Pre-eclampsic group	28.0200	3.97660	
		control group	28.5533	2.44851	0.248
5	MCHC (g/dl)	Pre-eclampsic group	32.9275	2.97420	
		control group	32.8933	1.99671	0.924
6	RBC (10^{12}/l)	Pre-eclampsic group	3.9442	0.77609	
		control group	4.0067	0.71402	0.566
7	WBC (10^{9}/l)	Pre-eclampsic group	9.4467	4.18356	
		control group	8.2280	2.77701	0.015
8	PLTs (10^{9}/l)	Pre-eclampsic group	211.1917	93.06475	
		control group	245.3600	65.97105	0.003

CONCLUSION

In Sudanese women with preeclampsia both systolic and diastolic blood pressures significantly increase; beside serum uric acid, creatinine, alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase and neutrophils also significantly increase, while platelets count significantly decrease. Early screening by using the simple biochemical and hematological profile seems to be useful to predict maternal complications in the management of women with preeclampsia.

ACKNOWLEDGEMENT

The authors are grateful to all the staff of the hospitals where the study was done, for providing facilities to perform this work.

CONFLICT OF INTEREST

We declare that we have no conflict of interest.

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Please cite this article in press as: Eltayeb Mohamed Ahmed Tayrab and Sohinda Saladdin. Biochemical and hematological evaluations in sudanese women with preeclampsia, *Asian Journal of Pharmaceutical Analysis and Medicinal Chemistry,* 4(1), 2016, 1-7.