

## Serum Ferritin and Serum Iron Level in Preeclampsia

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### Abstract

**Background:** Preeclampsia, gestational diabetes, and premature delivery are three obstetric problems related with high iron reserves during pregnancy. Few studies have found an association between preeclampsia and higher serum ferritin levels, however, this finding was not convincing. **Objectives:** The aim of this study was to assess the variation in the levels of serum ferritin and serum iron level in preeclamptic Bangladeshi women compared to healthy pregnant women. **Methods:** This case control study was carried out in the Department of Obstetrics and Gynecology, Bangabandhu Sheikh Mujib Medical University (BSMMU) during October 2018 to September 2020. A total of 94 pregnant women between 18-40 years of age were included in this study in her 32 weeks to 38 gestational weeks. Among them 47 diagnosed case of preeclampsia and rest 47 healthy pregnant women were consider as control. Purposive sampling technique was followed. After taking consent and matching eligibility criteria, data were collected from patients on variables of interest using the predesigned structured questionnaire by interview, observation, clinical examination and hematological investigation of the patients. The serum ferritin and serum iron level were measured in Department of Biochemistry in BSMMU. Statistical analyses of the results were be obtained by using window based Microsoft Excel and Statistical Packages for Social Sciences (SPSS-22), where required. **Results:** Serum ferritin in preeclamptic women was (124.54±32.14 ng/ml), versus (50.83±2.53 ng/ml) in the control group with P-value (0.001). Serum iron in preeclamptic women was (110.19±23.62µg/dl), versus (105.15±26.6 µg/dl) in the control group with P- value (0.334). Almost three fourth (74.5%) patients had serum ferritin >120 (ng/ml) in case and 17(36.2%) in control. The difference was statistically significant (p<0.05) between two groups with OR= 5.15 (95% CI 2.12-12.47). There was a positive significant Pearson's correlation coefficient between serum ferritin and each systolic and diastolic blood pressure (r=0.561, p<0.001 and r=0.556, p<0.001 respectively). Serum ferritin level increases significantly in preeclamptic women. There was no significant difference in serum iron levels between the preeclamptic women and control groups. Increased level of serum ferritin may play a role in pathogenesis of preeclampsia. **Conclusion:** Preeclampsia as one of pregnancy related complications is a notable burden of adverse health. This case-control study demonstrated that preeclampsia is associated with high serum ferritin levels, and that in preeclamptic women, serum ferritin was positively correlated with blood pressure.

**Keywords:** Serum Ferritin, serum Iron, preeclampsia.

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## INTRODUCTION

One of the worrying issues that both doctors and expectant mothers worry about is preeclampsia. Preeclampsia complicates 3% to 5% of pregnancies on average. It is a condition that progresses, and both the way it manifests and how quickly it advances might

vary [1]. A major pregnancy condition is preeclampsia. Although the condition often recovers quickly after delivery, an early delivery raises the baby's chance of problems [2]. A multisystem illness specific to human pregnancy known as preeclampsia is characterized by the start of new hypertension after 20 weeks of

pregnancy and the involvement of one or more other end organ systems as well as the fetus [3] Worldwide, 14% of all maternal deaths are caused by hypertensive diseases of pregnancy. They cause over 26% of maternal mortality in the western world, but they are responsible for 9% of deaths in Asia [4]. For the woman and her child, preeclampsia may have serious complications, including cardiovascular disease in later life [5, 6]. According the Daily Star (2014) the latest maternal mortality rate is 170/100,000 live births estimated by United Nations & World Health Organization on 2014. Among them 20% cause of maternal mortality due to preeclampsia or eclampsia. Preeclampsia is alarmingly common in Bangladesh, where it contributes to roughly 16% of maternal mortality [7]. Ferritin is a ubiquitous intracellular protein that stores iron and releases it in a controlled fashion. The protein is produced by almost all living organisms, including bacteria, algae, higher plants, and animals [8]. Serum ferritin concentration in pregnancy peaks during 12 weeks of gestation and troughs in the third trimester [9]. Although the exact pathophysiology of preeclampsia is not known, but serum ferritin and iron levels are introduced as a probable pathogenesis for preeclampsia. After free radicals produced from cell membrane (because it is rich in polysaturated fatty acids) and circulating lipoproteins start the process of lipid peroxidation causing endothelial injury, the presence of catalytic amounts of transition metal, particularly iron, arising from ischemic placenta by destruction of RBC from thrombotic, necrotic, and hemorrhagic area can generate highly reactive hydroxyl radical by Fenton reaction [10]. Higher ferritin is associated with increased risk for preterm delivery and neonatal asphyxia, while the lower ferritin level is associated decreased risk of preeclampsia, prelabour

rupture of membranes [11]. With this background the aim of this study was to assess the variation in the levels of serum ferritin and serum iron level in preeclamptic Bangladeshi women compared to healthy pregnant women.

## METHODOLOGY

This case control study was carried out in the Department of Obstetrics and Gynecology, Bangabandhu Sheikh Mujib Medical University (BSMMU) during October 2018 to September 2020. A total of 94 pregnant women between 18-40 years of age were included in this study in her 32 weeks to 38 gestational weeks. Among them 47 diagnosed case of preeclampsia and rest 47 healthy pregnant women were consider as control. Pregnant women with Preeclampsia (Case) and Healthy Pregnant women (control) were included and pregnant with Iron deficiency anemia, Haemoglobinopathies, known case of liver disease, chronic hypertension, case of renal disease, gestational diabetes and diabetes mellitus, Past history of preeclampsia, Multiple pregnancy and pregnant women who have not given consent to participate in the study. After taking consent and matching eligibility criteria, data were collected from patients on variables of interest using the predesigned structured questionnaire by interview, observation, clinical examination and hematological investigation of the patients. The serum ferritin and serum iron level were measured in Department of Biochemistry in BSMMU. Statistical analyses of the results were be obtained by using window based Microsoft Excel and Statistical Packages for Social Sciences (SPSS-22), where required.

## RESULT

**Table 1: Categorization of the study subjects by age (n=94)**

Age (in years)	Case (n=47)		Control (n=47)		p value
	N	%	N	%	
<20	1	2.1	3	6.4	0.202 <sup>ns</sup>
20-30	34	72.3	34	72.3	
>30	12	25.6	10	21.3	
Mean±SD	26.74±5.17		25.4±4.95		
Range (min-max)	19-37		18-37		

ns= not significant, p value reached from Unpaired t-test

Table 1 shows study subjects, it was observed that almost three fourth (72.3%) study subjects belonged to age 20-30 years in case and 34(72.3%) in control. The mean age was 26.74±5.17 years in case

and 25.4±4.95 years in control. The difference was statistically not significant (p>0.05) between two groups.

**Table 2: Categorization of the study subjects by parity (n=94)**

Parity	Case (n=47)		Control (n=47)		p value
	N	%	N	%	
Primi	28	59.6	29	61.7	0.832 <sup>ns</sup>
Multi	19	40.4	18	38.3	

ns= not significant, p value reached from Chi-square test

Table 2 shows the study subjects, it was observed that almost two third (59.6%) patients had primi gravida in case and 29(61.7%) in control. The

difference was statistically not significant ( $p>0.05$ ) between two groups.

**Table 3: Categorization of the study subjects by gestational age (n=94)**

Gestational age	Case (n=47)		Control (n=47)		p value
	N	%	N	%	
<37 (Preterm)	42	89.4	38	80.9	0.205 <sup>ns</sup>
≥37 (Term)	5	10.6	9	19.1	
Mean±SD	34.65±1.53		35.08±1.73		
Range(min-max)	32 -37		32 -38		

ns = not significant, p value reached from Unpaired-t test

Table 3 shows the categorization of the study subjects by gestational age. It was observed that majority (89.4%) preeclamptic women had gestational age <37 (Preterm) in case and 30(80.9%) in control.

The mean gestational age 34.65±1.53 weeks in case and 35.08±1.73 weeks in control. The difference was statistically not significant ( $p>0.05$ ) between two groups.

**Table 4: Association between gestational age with serum ferritin (ng/ml) in case-control groups (n=94)**

Serum ferritin (ng/ml)	Preterm (<37 weeks) (n=80)		Term (≥37) weeks (n=14)		p value
	N	%	n	%	
>120 (ng/ml)	45	56.25	7	50.0	0.664 <sup>ns</sup>
≤120 (ng/ml)	35	43.75	7	50.0	

ns=not significant

p value reached from Chi-square test

Table 4 shows the association between gestational ages with serum ferritin (ng/ml) in case-control groups. It was observed that more than half (56.25%) patients belonged to serum ferritin level >120

(ng/ml) in preterm and 7(50.0%) in term. The differences was statistically not significant ( $p>0.05$ ) between gestational ages with serum ferritin.

**Table 5: Difference of the study subjects by hematological parameters (n=94)**

Hematological parameters	Case (n=47)	Control (n=47)	p value
	Mean±SD	Mean±SD	
Serum ferritin (ng/ml)	124.54±32.14	50.83±2.53	0.001 <sup>s</sup>
Range (min-max)	54.6-180.4	17.8-130	
Serum Iron (µg/dl)	110.19±23.62	105.15±26.6	0.334 <sup>ns</sup>
Range (min-max)	68-183	60-160	

s= significant, ns= not significant, p value reached from Unpaired t-test

Table 5 the mean serum ferritin was 124.54±32.14 (ng/ml) in case and 50.83±2.53 (ng/ml) in control. The mean serum iron was 110.19±23.62

(µg/dl) in case and 105.15±26.6 (µg/dl) in control. The difference of serum ferritin was statistically significant ( $p<0.05$ ) between two groups.

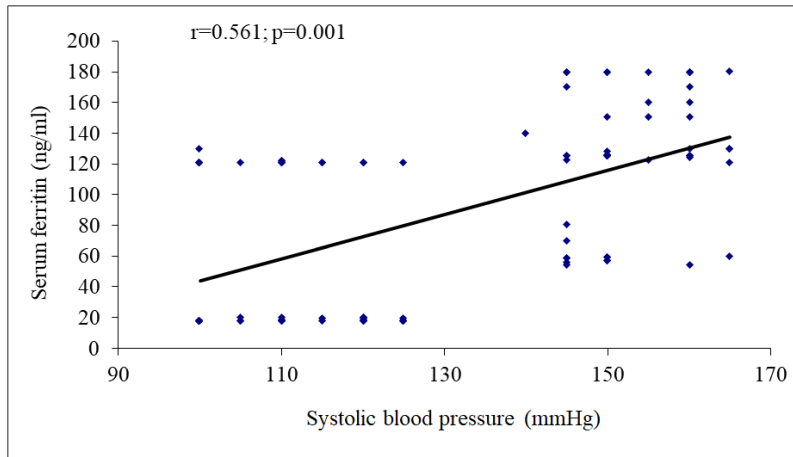
**Table-6: Association between severity of preeclampsia with serum ferritin (ng/ml) in case-control groups (n=94)**

Serum ferritin (ng/ml)	Severe Preeclampsia (n=17)		Mild Preeclampsia (n=30)		Control (n=47)		p value
	n	%	N	%	n	%	
>120 (ng/ml)	16	94.1	19	63.3	17	36.2	0.001 <sup>s</sup>
≤120 (ng/ml)	1	5.9	11	36.7	30	63.8	

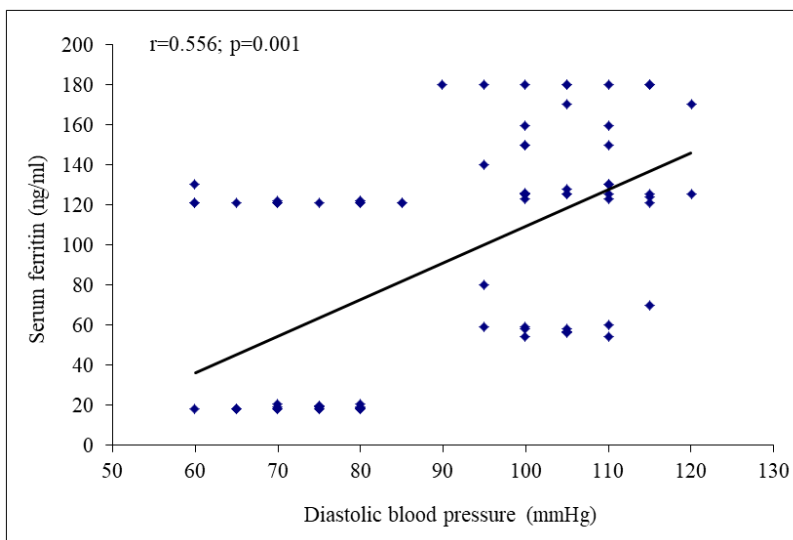
s=significant; p value reached from Chi-square test

Table 6 association between severity of preeclampsia with serum ferritin (ng/ml) in case-control groups. It was observed that majority 16(94.1%) patients belonged to serum ferritin level >120 (ng/ml) in severe preeclampsia, 19(63.3%) in mild preeclampsia

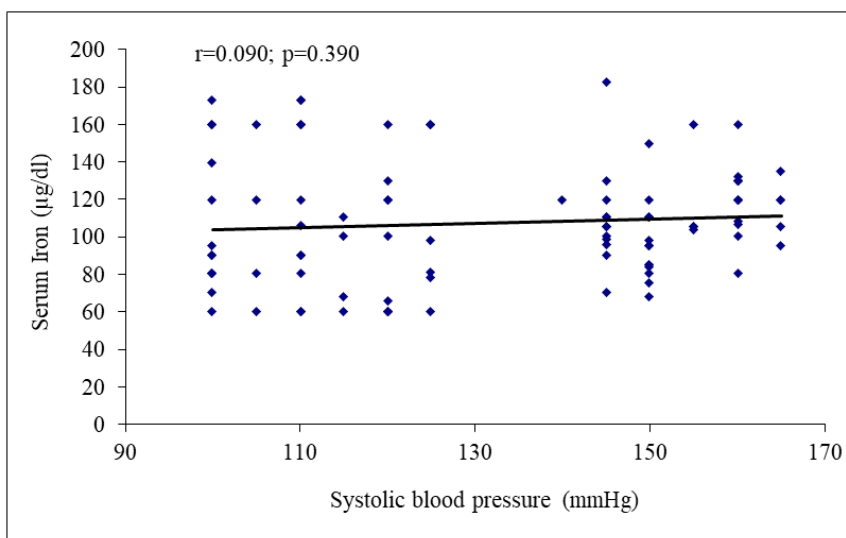
and 17(36.2%) in control. The differences was statistically significant ( $p<0.05$ ) between severity of preeclampsia with serum ferritin.



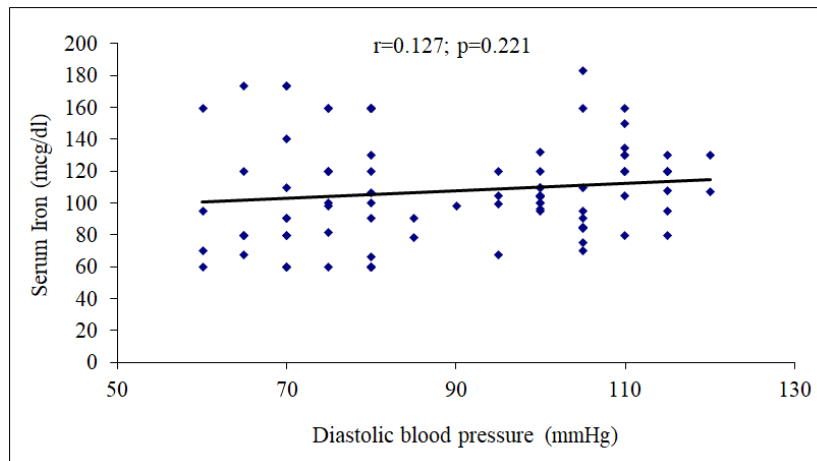
**Figure 1: Scatter diagram showing positive significant Pearson's correlation coefficient ( $r=0.561$ ;  $p=0.001$ ) between systolic blood pressure with serum ferritin (Women with preeclampsia)**



**Figure 2: Scatter diagram showing positive significant Pearson's correlation coefficient ( $r=0.556$ ;  $p=0.001$ ) between diastolic blood pressure with serum ferritin (Women with preeclampsia)**



**Figure 3: Scatter diagram showing negatives not significant Pearson's correlation coefficient ( $r=0.090$ ;  $p=0.390$ ) between systolic blood pressure with serum iron (Women with preeclampsia)**



**Figure 4: Scatter diagram showing negative not significant Pearson's correlation coefficient ( $r=0.127$ ;  $p=0.221$ ) between diastolic blood pressure with serum iron (Women with preeclampsia)**

## DISCUSSION

Preeclampsia is a somewhat common pregnancy disease that develops in the placenta and results in a variety of issues for both the mother and the fetus [12]. A total of 94 singleton pregnant women between 18-40 years of age attending in the Department of Obstetrics and Gynecology, Bangabandhu Sheikh Mujib Medical University (BSMMU) included in this study. Among them 47 diagnosed case of preeclampsia was consider as case and rest 47 healthy pregnant women was consider as control. In this present study, it observed the mean age was  $26.74 \pm 5.17$  years in case and  $25.4 \pm 4.95$  years in control. The difference was statistically not significant ( $p > 0.05$ ) between cases and controls. So, both the cases and controls were well matched. Osman *et al.*, and Fatema *et al.*, found no significant variation in the mean age between the two groups, which are consistent with the current study [13, 14]. In this present study, it observed the mean age was  $26.74 \pm 5.17$  years in case and  $25.4 \pm 4.95$  years in control. The difference was statistically not significant ( $p > 0.05$ ) between cases and controls. So, both the cases and controls were well matched. Similarly Paul *et al.*, Osman *et al.*, Fatema *et al.*, found no significant variation in the mean age between the two groups, which are consistent with the current study [13-15]. In this present study, it was observed that 59.6% had primigravida in case and 61.7% in control. The difference was statistically not significant ( $p > 0.05$ ) between case and control. So, the cases and control group were matched in respect of gravidity. Paul *et al.*, observed 65.0% had primigravida in case and 70.0% in control ( $p > 0.05$ ), which is consistent with the current study [15]. In this current study, it was observed that 89.4% participants had gestational ages  $< 37$  (Preterm) in case and 80.9% in control ( $p > 0.05$ ). Similarly, Paul *et al.*, study found that 95.0% participants had gestational age  $< 37$  (Preterm) in case and 90.0% in control [15]. In this current study, it was observed that the mean serum ferritin was  $124.54 \pm 32.14$  (ng/ml) in case and  $55.73 \pm 2.53$  (ng/ml) in control. The mean

serum ferritin was significantly ( $p < 0.05$ ) higher in preeclampsia. Similar results were seen in study conducted by Zafar and Iqbal [16]. In this present study, it was observed that the mean serum iron was  $110.19 \pm 23.62$  ( $\mu\text{g/dl}$ ) in case and  $105.15 \pm 26.6$  ( $\mu\text{g/dl}$ ) in control. The mean iron level was almost alike between case and control group, no significant ( $p > 0.05$ ) difference was observed between the groups. This study revealed that highly significant correlation between ferritin and each of systolic and diastolic blood pressures ( $r = 0.561$ ,  $p = 0.001$  and  $r = 0.556$ ,  $p = 0.001$  respectively). ElShahat *et al.*, showed there was a highly significant correlation between ferritin and each of systolic and diastolic blood pressures  $r = 0.8$ ,  $p < 0.001$ , and  $r = 0.7$ ,  $p < 0.001$ , respectively, which consistent with this present study [17].

## CONCLUSION

Preeclampsia as one of pregnancy related complications is a notable burden of adverse health. This case-control study demonstrated that preeclampsia is associated with high serum ferritin levels, and that in preeclamptic women, serum ferritin was positively correlated with blood pressure.

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