

## To Evaluate the Iron Status in Patients with Chronic Kidney Disease: An Institutional Based Study

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### ABSTRACT

**Background:** Anaemia is a common complication of advanced chronic kidney disease. The Chronic Kidney Disease (CKD) considered as a silent epidemic and a major cause of mortality and morbidity. The present study was conducted to evaluate the iron status in patients with Chronic Kidney Disease.

**Materials and Methods:** In the present study the study population consisted of all newly diagnosed patients of Chronic Kidney Disease who were anaemic. The study population consisted of 80 diagnosed patients of CKD and 80 healthy persons served as controls. The collected samples were assayed for haemoglobin concentration, serum creatinine, serum iron, Total iron binding capacity, transferrin saturation and serum ferritin. All data analyses were carried out using the SPSS, version 21. P value of less than 0.05 was taken to be significant.

**Results:** In the present study total cases with CKD were 80 and 80 persons were controls. The CKD cases were maximum in the age group 41-50 years (36.5%). The CKD was more prevalent in males than females. Serum iron, serum ferritin, TSAT and Haemoglobin were significantly lower in CKD group as compared to the control group. TIBC was significantly higher in the CKD group when compared to the control group.

**Conclusion:** This study concluded that the CKD cases were maximum in the age group 41-50 year and more prevalent in males. Serum iron, serum ferritin, TSAT and Haemoglobin were significantly lower in CKD group as compared to the control group. TIBC was significantly higher in the CKD group when compared to the control group.

**Keywords:** Chronic Kidney Disease, Anaemia, Haemoglobin Concentration.

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### INTRODUCTION

Anaemia is an early complication of chronic kidney disease (CKD) and causes increased morbidity and mortality.<sup>1</sup> The burden of Chronic Kidney Disease (CKD) in India has been recognized as a silent epidemic and a major cause of mortality and morbidity affecting large populations worldwide, the approximate prevalence of CKD being 800 per million population.<sup>2</sup> Anaemia develops from intermediate stages of CKD and worsens with progression of CKD. The cause of Anaemia is varied and includes nutritional deficiency, increased pro-inflammatory cytokines, chronic blood loss, and relative erythropoietin (EPO) deficiency. This decrease in EPO matches the decline in kidney function and is the main determinant of Anaemia in CKD stage 4-5.<sup>3</sup> According to national kidney foundation/ kidney disease outcomes quality initiative (NKF/DOQI) guidelines, CKD has been defined as either a level of

glomerular filtration rate (GFR) < 60 ml/min per 1.73 m<sup>2</sup>, which is accompanied in most cases by signs and symptoms of uraemia, or a need for initiation of renal replacement therapy.<sup>4</sup> The effective management of Anaemia in patients with CKD (especially ESRD) requires close monitoring of iron status and adequate replenishment of iron stores especially during treatment with recombinant erythropoietin (rEPO).<sup>5</sup> Assessment of iron stores is routinely done in CKD patients through measurement of various indicators of iron status like haemoglobin, serum iron, percentage transferrin saturation (TSAT), total iron binding capacity (TIBC) and serum ferritin. Haemoglobin is a better quantitative measure for monitoring and managing Anaemia in patients with CKD.<sup>4</sup> The present study was conducted to evaluate the iron status in patients with Chronic Kidney Disease.

## MATERIALS AND METHODS

In the present study the study population consisted of all newly diagnosed patients of Chronic Kidney Disease who were anaemic. Informed consent was obtained from all participants.

The study population consisted of 80 diagnosed patients of CKD between the age of 20 – 60 years. 80 healthy persons served as controls. The patients who have not been started on hematinics, dialysis, or ESA were included in the study. Patients on dialysis, children, those having inflammatory conditions, malignancy, Patients with burns, trauma, known haematological disorders and liver dysfunction or on drugs, haematinics, recombinant human erythropoietin (rHuEPO) and blood transfusion in the last three months that were likely to cause haematological disturbances were excluded from the study. Under aseptic precaution, 5 ml of blood was collected in plain vacutainers from each subject from a large peripheral vein (mostly antecubital vein) with a sterilized

syringe. The serum was separated after centrifugation at 3000rpm for 10min and parameters were analyzed the same day. The collected samples were assayed for haemoglobin concentration, serum creatinine, serum iron, Total iron binding capacity, transferrin saturation and serum ferritin. The estimation of Haemoglobin was done by Cyanmethaemoglobin method<sup>6</sup>, estimation of serum Creatinine by Modified Jaffe's Kinetic method<sup>7</sup>, Estimation of serum Iron by the Ferrozine method<sup>8</sup>, estimation of serum Total Iron Binding Capacity (TIBC) by precipitation with Magnesium Carbonate Method<sup>9</sup>, Estimation of Transferrin Saturation (TSAT)<sup>10</sup>, Estimation of Serum ferritin by quantitative turbidimetric latex assay.<sup>11</sup> All data analyses were carried out using the SPSS, version 21. Results are presented as mean  $\pm$  standard deviation value. Data was analyzed by Student t-test and Karl Pearsons correlation. P value of less than 0.05 was taken to be significant.

**Table 1: Age and gender distribution in CKD patients**

Variable	N (%)
<b>Age group(yrs)</b>	
20-30	10 (12.5%)
31-40	18 (22.5%)
41-50	29 (36.5%)
51-60	23 (28.75%)
<b>Gender</b>	
Males	49 (61.25%)
Females	31 (38.75%)
<b>Total</b>	<b>80 (100%)</b>

**Table 2: Estimated biochemical parameters compared between CKD cases and controls**

Variables	Cases (n=80)	Controls (n=80)	p-value
<b>Serum Iron (<math>\mu\text{g/dL}</math>) (Mean <math>\pm</math> SD)</b>	84.34 $\pm$ 18.65	120.43 $\pm$ 11.23	<0.05
<b>Serum Ferritin (<math>\mu\text{g/L}</math>) (Mean <math>\pm</math> SD)</b>	105.21 $\pm$ 43.23	300.11 $\pm$ 45.56	<0.05
<b>TIBC (<math>\mu\text{g/dL}</math>) (Mean <math>\pm</math> SD)</b>	345.67 $\pm$ 44.64	330.14 $\pm$ 30.34	<0.05
<b>TSAT % (Mean <math>\pm</math> SD)</b>	23.33 $\pm$ 4.45	36.56 $\pm$ 4.33	<0.05
<b>Haemoglobin (g/dL) (Mean <math>\pm</math> SD)</b>	8.42 $\pm$ 1.23	12.41 $\pm$ 0.87	<0.05

## RESULTS

In the present study total cases with CKD were 80 and 80 persons were controls. The CKD cases were maximum in the age group 41-50 years (36.5%). The CKD was more prevalent in males than females. Serum iron, serum ferritin, TSAT and Haemoglobin were significantly lower in CKD group as compared to the control group. TIBC was significantly higher in the CKD group when compared to the control group.

## DISCUSSION

There is a complex interplay of nutritional deficiency, inflammation, chronic blood loss, and renal failure in causation of Anaemia in CKD patients.<sup>12</sup> The NKF-K/DOQI practice guidelines recommend maintaining ferritin >100ng/ml & transferrin saturation (TSAT) >20% to ensure adequate iron supply.<sup>4</sup>

In the present study total cases with CKD were 80 and 80 persons were controls. The CKD cases were maximum in the age group

41-50 years (36.5%). The CKD was more prevalent in males than females. Serum iron, serum ferritin, TSAT and Haemoglobin were significantly lower in CKD group as compared to the control group. TIBC was significantly higher in the CKD group when compared to the control group.

Deori R observed significant correlation between serum iron and TSAT with serum creatinine of CKD patients.<sup>13</sup>

Ashfar R et al found a positive correlation between creatinine clearance and haemoglobin concentration.<sup>14</sup>

Clinical nephrology guidelines recommend use of serum ferritin and TSAT measure to guide iron therapy. Serum ferritin less than 100 µg/L and TSAT less than 20% are taken as a sign of iron deficiency in CKD.<sup>15,16</sup>

Mohammed also reported similar pattern except ferritin that was significantly higher in male CKD patients.<sup>17</sup>

The mean value of serum ferritin was significantly lower in CKD group than non-CKD control which is similar to findings from previous study involving either predialysis CKD patients or those already on RRT.<sup>18</sup>

International guidelines recommend an upper limit of serum ferritin at 500 µg/L to avoid potential complications that are associated with iron therapy.<sup>19</sup>

## CONCLUSION

This study concluded that the CKD cases were maximum in the age group 41-50 year and more prevalent in males. Serum iron, serum ferritin, TSAT and Haemoglobin were significantly lower in CKD group as compared to the control group. TIBC was significantly higher in the CKD group when compared to the control group.

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