International Journal of Life Sciences, Biotechnology and Pharma Research Vol. 14, No. 3, March 2025 Online ISSN: 2250-3137
Print ISSN: 2977-0122

DOI: 10.69605/ijlbpr_14.3.2025.50

ORIGINAL RESEARCH

Evaluation of Serum Iron profile in patients of Chronic Kidney disease

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Received: 29 January, 2025 Accepted: 20 February, 2025 Published: 09 March, 2025

Abstract

Introduction: In developing countries, chronic kidney disease (CKD) associated with anaemic condition is the most common public health problems. Gradually the progression of this condition, development of haematological abnormalities including iron related defect. This iron related defect may further increase the morbidity and mortality in these patients. Earlier detection and correction of anaemia may be helpful in preventing the progression of the diseases and its other adverse outcomes. **Aim and Objective:** The aim of the study is to identify the iron status in the Chronic Kidney Disease Patients. **Methods:** The present study was designed to Collect the laboratory data of iron profiles in CKD patients. For this purpose, there were collected 150 adult diagnosed CKD subjects data and consider as cases similarly 150 data were collected and consider as control who were not suffering from CKD. Serum iron, TIBC, serum ferritin level and serum creatinine were estimated by standard laboratory techniques. Statistical data were analyzed by using SPSS 21.**Results:** The mean total serum iron 58.6µg/dl, Total Iron Binding Capacity (TIBC) 238 µg/dl, serum ferritin 438.62 µg/dl, and serum creatinine level 8.35 mg/dl respectively and showed P value significant. When the serum iron profile of individuals was analyzed, majority (54.25%) of the patients were found to have acute phase reaction**.**Only some of the patients showed microcytic anemia in peripheral smear. The primary aetiologies of CKD were Diabetes (42%), Hypertension (24%) and Acute kidney disease (16%). **Conclusions:** Anaemia is one of the commonest and earliest manifestations in CKD patients. All CKD patients had early detection and correction of anemia so that improved renal disease progression and survival rate of the patients.

Keywords: Anaemia, CKD (Chronic kidney disease), Iron deficiency, TIBC (Total Iron binding capacity)

Introductions

Chronic kidney disease is defined as a reduced glomerular filtration rate, increased urinary albumin excretion, or both, and is an increasing public health issue. Prevalence is estimated to be 8-16% worldwide.[1]

Chronic kidney disease (CKD) is a type of long-term kidney disease, in which either there is a gradual loss of kidney function occurs over a period of months to years, or abnormal kidney structure (with normal function).[2 and 3]

Chronic kidney disease is a progressive condition that affects >10% of the general population worldwide, amounting to >800 million individuals. Chronic kidney disease is more prevalent in older individuals, women, racial minorities, and in people experiencing diabetes mellitus and hypertension. [4]

Kidney disease is a significant public health concern in India, with high morbidity and mortality rates. The Million Death Study estimated a 50% increase in deaths due to chronic kidney disease (CKD) between 2001–2003 and 2010–2013.[5] Several surveys have shown a high population prevalence of CKD. As many as one out of every five adults in high-prevalence areas has CKD.[6]

Iron deficiency plays a significant role in anemia in CKD. This may be due to a true paucity of iron stores (absolute iron deficiency) or a relative (functional) deficiency which prevents the use of available iron stores. Several risk factors contribute to absolute and

DOI: 10.69605/ijlbpr_14.3.2025.50

functional iron deficiency in CKD, including blood losses, impaired iron absorption, and chronic inflammation.[7]

Anemia is a common complication of chronic kidney disease (CKD), which is associated with a significantly heightened risk of cardiovascular morbidity and higher mortality rates. Direct health care costs are higher in individuals with CKD and anemia than for those without anemia.[8] Many individuals experience poor health-related quality of life and debilitating symptoms, such as cognitive impairment, shortness of breath, dizziness, headaches, loss of appetite, and depression. The overall prevalence of anemia in CKD was estimated to be 15.4%, with the prevalence of anemia increasing as the disease advances[9].

Anemia can develop in people with chronic kidney disease because the kidneys are not filtering waste and fluid effectively.[1]

The kidneys produce a hormone erythropoietin, that helps the body to make red blood cells. If that hormone is deficient, body under produces red blood cells.People with early stage chronic kidney disease may not be anemic, but if the disease progresses, it becomes a common complication.

Iron deficiency is common in India because of low socio-economic status. In addition, CKD is a major cause of morbidity and co-morbidity in India. Considering the combined effects of both the clinical entities.[10]

Iron deficiency is also accompanied by reductions in serum iron and transferrin saturation (TSAT) and byelevations in red cell distribution width, free erythrocyte

protoporphyrin concentration, total serum iron-bindingcapacity (TIBC), and soluble transferrin receptor(sTfR).[11]

Method

A hospital based case control study was conducted for a period of one year in Department of Clinical Chemistry, GMERS Medical College and Hospital, Sola, Ahmedabad India. None of the patients were involved directly in the study. The lab results and patients information was retrieved from Laboratory information system (150 no. data of chronic kidney disease patients as case and 150 no. without chronic disease patients as control). Estimation of total serum iron, serum ferritin, and TIBC were done by using Transasia Erba 360 fully automated chemistry analyzer instrument.Statistical analysis was done by using SPSS 20 and P-value of <0.05 was considered significant.

Result

In Table 1, explains the Age and Sex distribution in CKD Patients. There were 150 Chronic Kidney Disease patients data included in the study. 42% of the Patients belonged to the age group 41-60 years. Among them 64% of Males and 36% of Females were included in the study projects.

Age and Sex distribution in CKD patients		
Category Age group (years)	**Frequency**	**Percentage**
≤ 20	16	11
21-40	48	32
41-60	64	42
61 and above	22	15
Sex		
Male	95	64
Female	55	36

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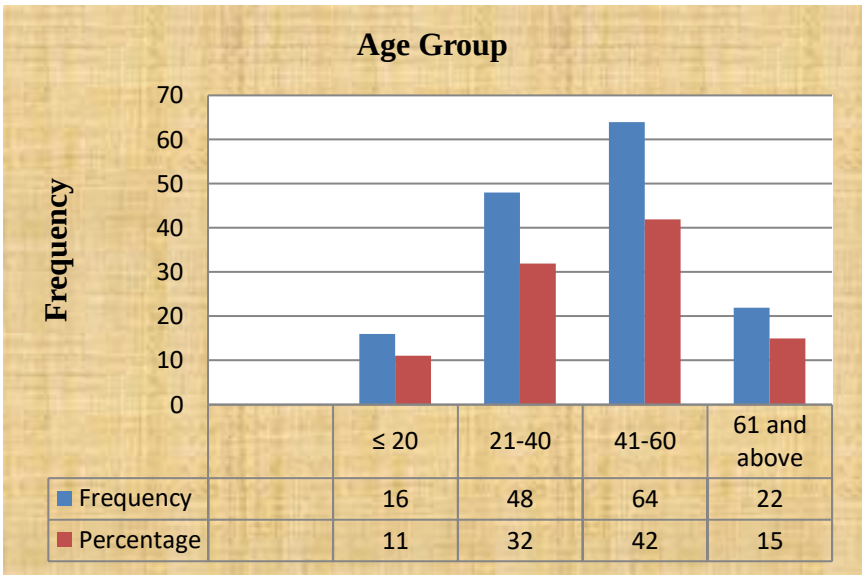
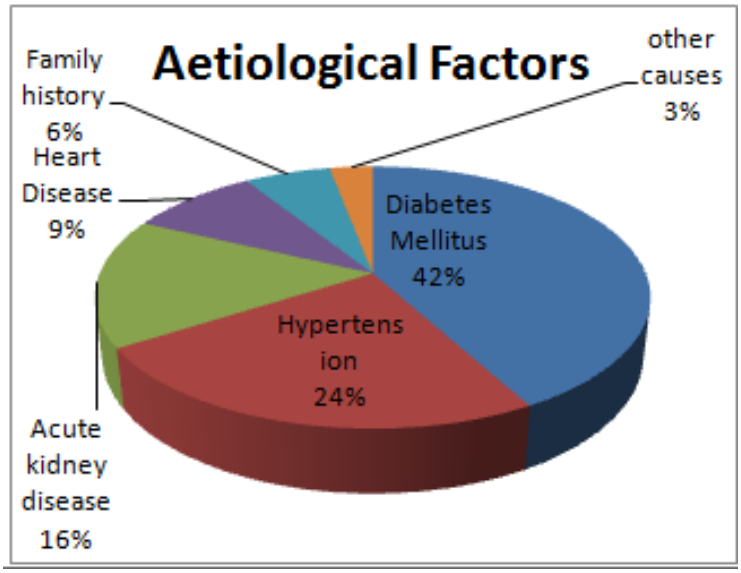


In Table 2, explains the etiological factors in the Chronic Kidney Disease. 42 % of patients were suffering from Diabetes, 24 % of Hypertension, 16 % of acute kidney disease, 9 % of Heart disease, 6% of significant family history and 3% of other causes like obesity, smoking and Autoimmune disease.

NAME OF AETIOLOGICAL FACTORS	PERCENTAGE %
Diabetes Mellitus	42
Hypertension	24
Acute kidney disease	16
Heart Disease	9
Family history	6
other causes	3



In Table 3, revealed the biochemical parameters among Control and CKD patients.
Total serum Iron level range from 65 to 175 ug/dl in male and 50-170 ug/dl in the females. In our study, serum iron level was mean of 58.6 with SDI 39.26. As compared to the controls, Serum iron level was significantly decreased in the CKD patients with significant P value <0.001

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Normal reference range for Total Iron binding capacity (TIBC) were 228-428 ug/dl and in our study mean of CKD patientswere 238 with SDI 114.76. TIBC level were decreased as compared to the control with significant P value <0.05

Estimated Parameters	Cases (N=150)	Control (N=150)	p- value
	Mean ± SDI	Mean ± SDI	
Creatinine	8.35 ± 2.92	1.04 ± 0.60	<0.05
Urea	99.60 ±37.22	40.12 ±2.8	<0.05
Iron	58.6 ± 39.26	128.56 ±32.87	<0.001
TIBC	238 ± 114.76	356.47 ± 39.24	<0.05
Ferritin	438.62 ± 179.09	214.06 ± 74.60	<0.001
Calcium	8.85 ± 1.14	9.2 ± 0.6	<0.001
Phosphorus	5.60 ± 2.23	3.4 ± 1.1	<0.05

Serum ferritin level reference ranges from 20-250ng/ml in male and 10-120 ng/ml in the females. In our study, increased Serum Ferritin level mean 438.62 ± 179.09 were observed as compared to the control with significant P value <0.001.

Mean value of Serum Creatinine and Serum Urea level were 8.35 (SDI 2.92) and 99.60 (SDI 37.22) increased as compared to the control with significant P value<0.05

The Peripheral smear changes was correlated with the serum iron profile. In which most of the patients had normocytic normochromic anaemia and only few patients had microcytic anaemia.

Serum Calcium level ranges from 8.6 to 10.2 mg/dl. In our study, decreased Serum Calcium level with mean of 8.85 (SDI 1.14) as compared to the control with significant P value is <0.001

Serum Phosphorus level ranges from 2.5-4.5 mg/dl. In our study, increased phosphorus level with mean of 5.60 (SDI 2.23) as compared to the controls with significant P value is <0.05.

Discussion

The mean age of CKD in the present study was 47.2 ± 14.23 years and 64% of the male were involved in these study. It was observed similar finding with the Deori R et al[12] study in which mean age group of CKD was 47.6 ± 14.4 and 72% males were involved. In Afshar R et al[13] study showed that 55% were male and 45% were females. Indira shastry et al[14] study, the age distribution of the population were mean of 52 ±14 years.

In the Deori[12] study, it shows that accordingly etiological factors, patients had suffering from44% DM, 36% Hypertension, 18% CGN and 2%CPN. In Ashfar R et al[13] study showed that patients had suffering from 49.1% DM, 28.3% HT, 17.1% Glomerular Disease and 5.6% polycystic kidney disease. In Ashfar et al[13] study, 55% moderate and 45% mild anemia observed. In William Mcclellan et al[15] study showed that patients had suffering from 49.5% DM and 33.0% HT. In our study, 42% DM, 24% HT, 16% acute kidney disease, 9% Heart disease and 6% family history and 3% other causes which are similar results with the above study. So primary etiology of CKD had DM followed by HT. The Kidney disease with Diabetes may progressive and anemia may contribute to progression of Kidney disease

It was in accordance with the study by Talwar et al[16] serum iron level had 55.1 and serum ferritin level had low. In the present study, Total serum iron was mean of 58.6 with SDI 39.26 which is similar to Talwar study and high serum ferritin level. The commonest cause of chronic renal failure in Talwar study group was diabetes mellitus (20%), glomerulonephritis (8%). The majority of the study population in the Talwar study had 65% of microcytic hypochromic anemia due to iron deficiency and 33% parasitic infestation

Study by Singh et al[17] showed higher mean values for serum iron and lower serum ferritin level. In Singh et al study, patients had received erythropoietin therapy and fall in serum Ferritin level due to iron utilization by replicating Erythroid cells. But In our study, lower mean values for serum iron and higher Ferritin level had observed which is opposite to Singh et al study.

In 2010 Jairam et al[18] study revealed that mean serum iron had 153.4± 31.6, serum Ferritin level 331.7 ± 39.56 and TIBC had 476.39± 137.3. It showed that normal serum iron level, increased TIBC and Ferritin level. A normal serum iron level had due to patient taking parenteral or oral iron before presented to the hospital. He also concluded that the use of serum ferritin alone for iron overload is faulty, because 2-3 fold elevations in ferritin levels with inflammatory activation is seen, which is common in CKD patients. In our study, lower mean values for serum iron, Low TIBC and higher Ferritin level had observed. Results of Serum Ferritin level similar to our study.

In the study by Deori et al[12] in 2016, 26% of patients had absolute iron deficiency and it was the most common cause of anemia in which 34% severe, 48% moderate and 18% mild anemia. In Deori study, showed

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the low serum iron level results which are similar to our study. The Deori et al selected the study population which did not receive any parenteral or oral hematinic.
In the study by Indira shastry et al[14], majority of the study population had normocytic normochromic anemia. In this study showed that low serum iron level (61ug/dl), decreased TIBC (216.43 ug/dl) and increased Ferritin level (539.68 ng/dl) which is similar to our study. In this study, high mean serum ferritin values was due to inflammatory state. He selected the study population irrespective of their treatment status with hematinics and erythropoietin.

Conclusion

Most common type of altered serum iron profile found in the study population was acute phase reactions in CKD group, iron metabolism is altered compared to controls. In this study,serum iron levels are low due to inadequate secretion of erythropoietin, erythropoiesis is halted leading to decreased Hb and serum iron. Serum ferritin levels are usually elevated due to chronic inflammatory state and oxidative stress. Over a long time presence of chronic inflammation can cause cytokine mediated inhibition of production of erythropoietin and premature destruction of precursor erythroblasts leading to hypo-proliferative anemia and anemia of chronic disease.All CKD patients had early detection and correction of anemia so that improved renal disease progression and survival rate of the patients.

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