



Research Article

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## Estimation of serum ferritin level in type 2 diabetes mellitus with chronic kidney disease

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### ABSTRACT

Ferritin the storage form of iron was found to be elevated in type 2 diabetes mellitus as evidenced by various studies. Diabetes mellitus is a metabolic disease due to insulin resistance or insulin deficiency leading to a number of complications. Since Chronic Kidney Disease is one of the most important complications due to diabetes mellitus, this study was designed to observe the serum ferritin level in type 2 diabetes mellitus associated with Chronic Kidney Disease. The aim of this study is to assess the serum ferritin concentration in type 2 diabetic patients with chronic kidney disease. 50 participants were included in the study and were divided into two groups of 25 each, 1<sup>st</sup> group consisting of type 2 diabetic patients with Chronic Kidney Disease and group 2 of healthy controls. Blood Sugar, urea, creatinine and ferritin were estimated for all the participants. The average serum ferritin level in the type 2 diabetes mellitus patients with Chronic Kidney Disease was 327.68ng/ml while amongst the controls it was 41.88ng/ml. The results were found to be statistically significant ( $p$  value <0001). Serum ferritin is found to be elevated in type 2 diabetes mellitus progressing to chronic kidney disease thus predicting an iron overload or an inflammation. Ferritin estimation can be routinely analyzed in diabetic patients to check its progression to Chronic Kidney Disease at an earlier stage.

**Key words:** ferritin, diabetes, CKD, iron

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### INTRODUCTION

Diabetes mellitus is a metabolic disease with high blood glucose due to inadequate insulin release or insulin resistance leading to cardiovascular and renal complications. It is major health concern throughout the world.

Chronic kidney disease (CKD), also known as chronic renal disease, is a progressive loss in renal function over a period of months or year. The most commonly recognized cause of CKD is diabetes mellitus.

Ferritin is a ubiquitous intracellular protein that stores iron and which is by various studies found to be elevated in diabetes. Many studies have shown positive correlation between serum ferritin and type 2 diabetes mellitus [1].

In the recent years iron overload has gained great importance [2]. Excess iron deposition is found to cause secondary form of diabetes which has led to speculation that higher concentrations of iron may increase the risk of

developing diabetes. Significant iron accumulation can affect the vital organs like the liver, heart etc.[3]. Also it was proved in a Finnish cohort that men with high iron stores had a 2.4 fold increased risk of incident diabetes as compared with those in the lowest quartile [4].

In this study the serum ferritin concentration is estimated in type 2DM with Chronic Kidney Disease. Diabetes along with hypertension is a major cause of Chronic Kidney Disease.

### EXPERIMENTAL SECTION

The study was designed as a case controlled study. 50 participants from the nephrology OPD of Sree Balaji Medical College and Hospital were included in the study. They were in the age group of 35-75 years. All of them had a diabetic duration of more than 5 years. A detailed Performa was filled regarding the age, sex, any other past history along with treatment history, age of onset and duration of diabetes were recorded. They were divided into two groups of 25 each, 1<sup>st</sup> group consisting of type 2 diabetic patients with CKD and the 2<sup>nd</sup> group of healthy controls. After obtaining informed consent from the subjects, 4 ml of venous blood was collected under aseptic precaution. Blood Sugar, urea, creatinine and serum ferritin were estimated. Serum ferritin was analyzed using the Semi-Automated analyzer. The ferritin test is based upon the reactions between ferritin in the sample and latex covalently bound antibodies against human ferritin. Ferritin values are determined turbidimetrically using fixed-time measurement with sample blank correction. The relationship between absorbance and concentration permits a multiple point calibration. The measuring temperature is 37°C. The turbidimetric analyzer automatically calculates the ferritin concentration of each sample.

### RESULTS AND DISCUSSION

Among the 25 cases and 25 controls 52% were males and 48% were females. The serum ferritin was found to be higher among the patients who were diabetic with Chronic Kidney Disease. The average serum ferritin level was 327.68ng/ml amongst the cases while in the controls it was 41.88ng/ml. The average serum ferritin was 310.08ng/ml in females while in males it was 343.92ng/ml. As expected the urea and creatinine levels were higher amongst the cases while in the controls they were in the normal ranges. All the controls were normoglycemic while the cases had a fasting blood glucose of more than 120 mg/dl. The statistical analysis was done using the student T test and the results were found to be significant (<0.0001). The analysis was performed using the SSPS software. There was no direct correlation observed between serum ferritin and the duration of diabetes mellitus and Chronic Kidney Disease.

	Mean Serum ferritin (ng/ml)	P-value
cases	327.68	0.0001
controls	41.88	

Table 1: comparison of the mean serum ferritin levels in the cases and the controls

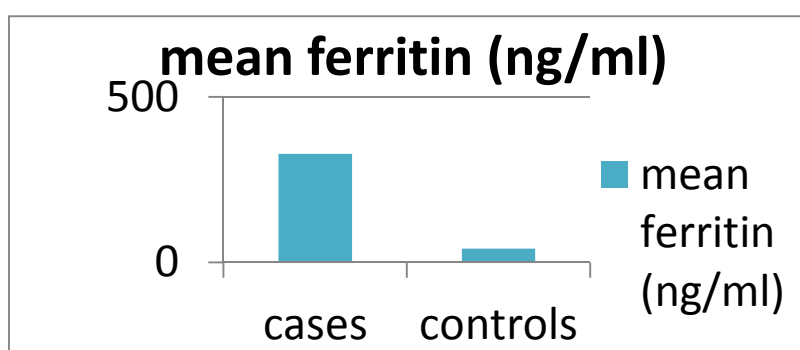


Table 2: serum ferritin, blood glucose, urea, creatinine and hemoglobin levels in the cases

Serum ferritin was found to be elevated in type 2 diabetes with chronic kidney disease as compared to the controls and this association is statistically significant. Several causes have been found regarding the role of iron in diabetes. Elevated serum ferritin concentrations may be due to elevated body iron stores or inflammation [5].

Free catalytic iron is reversibly oxidized and reduced thus making iron potentially hazardous because of its ability to produce reactive oxygen species. These reactive oxygen species will cause beta cell oxidative stress, thereby causing its apoptosis leading to insulin deficiency and thus diabetes [6]. Extracellular ferritin may be the source of iron for oxidative damage: when ferritin is glycated it releases the free iron [7].

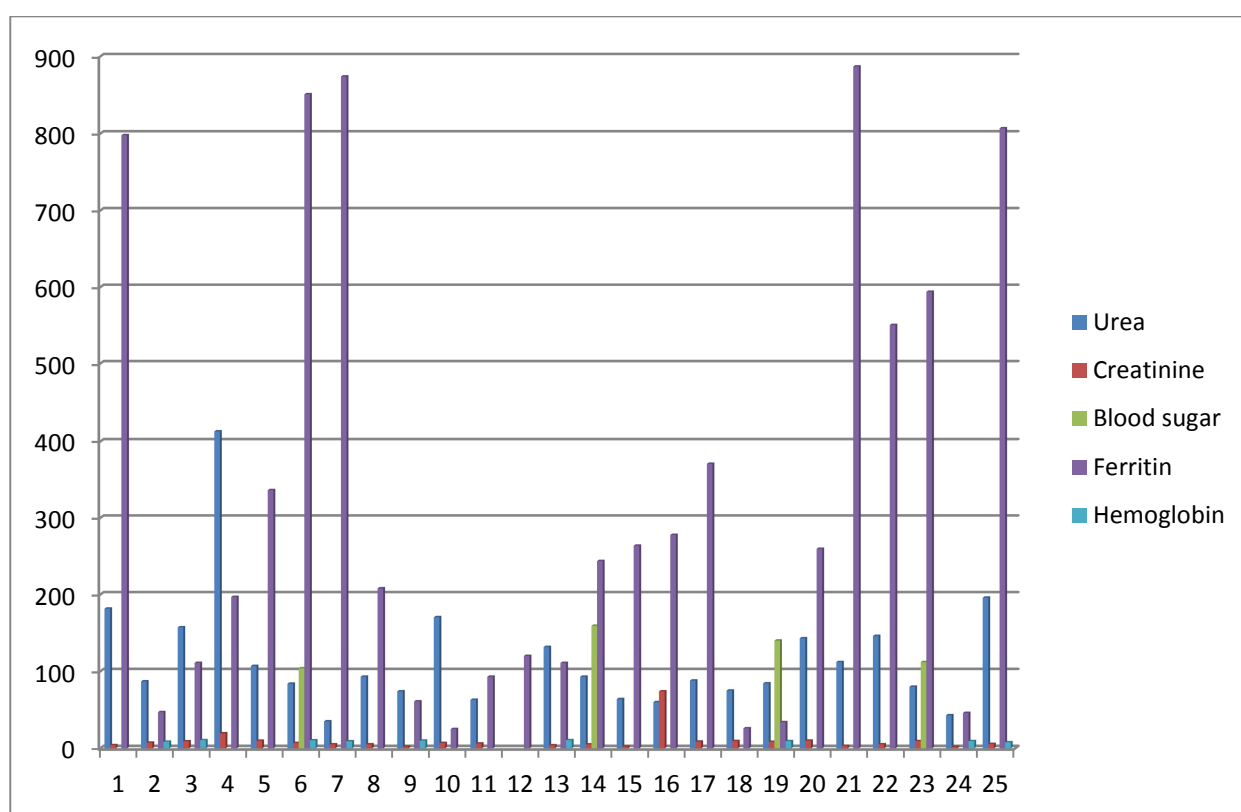
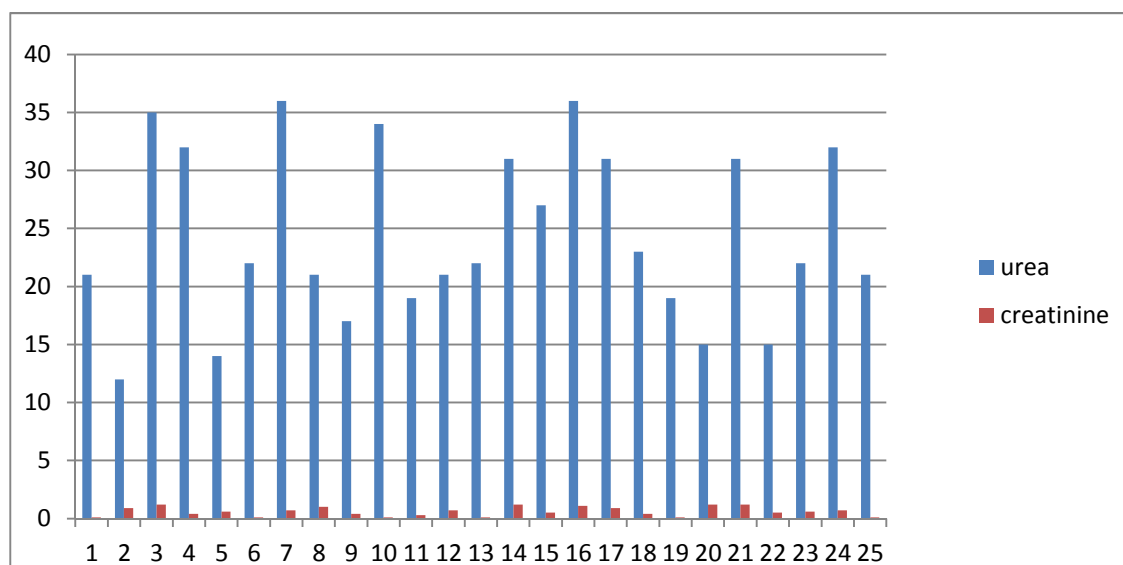


Table 3: Urea and creatinine levels in the controls



Beta cells are more prone for oxidative damage because they have a very low antioxidant system. Also they are found to have an increased expression of divalent metal transporter predisposing them for more iron accumulation than any other cells. This makes the beta cells susceptible to oxidative stress by free radicals [6].

Iron also accumulates in the liver and will derange the glucose metabolism in the liver. Iron accumulation in the liver will interfere with the glucose extracting capacity of the liver [1]. Iron also causes insulin resistance by interfering with the ability of insulin to suppress hepatic glucose production [8]. Oxidative stress can also lead to hyperglycemia through disturbed glucose metabolism [1]. Iron gets auto-oxidized and forms highly reactive complexes which will cause tissue and membrane damage [9, 10].

**In Chronic Kidney Disease:**

Iron facilitates protein glycation which causes oxidative stress, inflammation and renal damage. Iron is seen to accumulate in the lysosomes of proximal convoluted tubules in kidney biopsies of patients with chronic kidney disease [11]. The iron will generate reactive oxygen species and damage the kidney tubules. This shows that iron plays an important part in diabetes and its progression to CKD.

**Inflammation:**

Since serum ferritin is also an acute phase reactant it may also be elevated during an inflammation. Inflammation is the key process in the development of diabetes and its complications.

There is increasing evidence that a cytokine induced acute phase response is closely involved in the pathogenesis of type 2 DM and associated complications like dyslipidemia and atherosclerosis [12].

Inflammation in CKD causes mortality from cardiovascular complications by causing atherosclerosis [13].

Thus an elevation of serum ferritin can be due to an increase in body iron stores or an inflammation both of which are hazardous in patients with type 2 diabetes mellitus with CKD.

The limitation in our study is the small sample size. Though we have observed a high value of serum ferritin in type 2 diabetes mellitus with Chronic Kidney Disease, the correlation between ferritin level and duration of Chronic Kidney Disease was not possible.

**CONCLUSION**

Serum ferritin level was observed to be elevated in type 2 diabetes mellitus patients with chronic kidney disease, consistent with other studies. The reason for this elevation includes an increase in body iron stores or an inflammation. From the observation of our study it may be suggested that analysis of serum ferritin can be an additional parameter in the routine investigation for diabetic patients to assess the progression of Chronic Kidney Disease at the earliest.

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