

Research Article

Serum Ferritin Levels In Type II Diabetes Mellitus

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Abstract: In recent times much is talked about of serum ferritin, an acute phase reactant a marker of iron stores in the body and its association with diabetes mellitus. Studies implicate that increased body iron stores and subclinical hemochromatosis has been associated with the development of glucose intolerance, type 2 diabetes, and its micro as well as macrovascular complications. This study was carried out to examine and to observe for any relationship between serum ferritin with Type 2 diabetes mellitus and HbA1c levels and its complications. Study population included 50 type 2 diabetes patients (M:F=32:18, mean age 55.5±9.7 years, mean BMI 23.8kg/m²). Majority were healthy outpatients who had come for regular checkup and were matched with controls. FBS, PPBS, HbA1c, serum ferritin and lipid profile were estimated and other investigations where ever required. Results showed that although Serum ferritin was in the normal range value it was increased in type 2 diabetes patients when than in controls and was statistically significant, we did get a positive correlation with duration of diabetes. It can be concluded that there was positive correlation between serum ferritin and type 2 diabetes. There was no correlation between serum ferritin and HbA1c, age, sex, metabolic syndrome, coexistent hypertension, total cholesterol, LDL (low density lipoprotein) and serum triglycerides.

Keywords: BMI, Diabetes, Ferritin, FBS, Glycosylated hemoglobin

INTRODUCTION

Diabetes is a major public health concern both in developing and developed countries worldwide. Metabolic syndrome is also on an increasing trend. The metabolic syndrome is closely linked to insulin resistance and studies too tried to associate with iron overload. Increased serum ferritin, reflecting body iron overload, is often associated with measures of insulin resistance, such as elevated blood glucose and insulin levels [1].

We undertook this study to know serum ferritin levels in diabetes and to determine whether it is just an association or it contributes to development of insulin resistance and also its relation to diabetes complications.

METHODS

The study was designed as a case control study. The study was conducted over a period of six months. Fifty type 2 diabetes patients who were treated on an outpatient basis in S. N. Medical College and HSK hospital, Bagalkot were included in the study. Age and sex matched normal healthy controls were selected for study.

Inclusion criteria

Type 2 diabetes mellitus patients on treatment, in the age group-30-80 years.

Control: Healthy controls in the age group 45-75 years.

Exclusion criteria

- Anemia of any cause
- Serious infections
- Chronic kidney disease
- Chronic liver disease
- On corticosteroid therapy

Data collection

A detailed proforma was filled up for each patient which included age, sex, past history of coronary artery disease, cerebrovascular accident, history of hypertension. The age of onset and duration of diabetes was recorded. Also recorded was treatment history of patient whether on oral hypoglycemic agents, insulin or diet control alone.

Laboratory parameters including Serum ferritin, hemoglobin, fasting and postprandial blood sugar, glycosylated hemoglobin, renal function tests, liver function tests, serum lipid profile for all patients and other investigations done where ever required.

Serum ferritin was done by Chemiluminescence immunoassay (CLIA) using Snibe Maglumini1000 with magnetic nano bead technique with reference ranges for males and females.

A detailed physical examination was done which included measuring height and weight and waist circumference. BMI was estimated. Blood pressure was

recorded .A fasting plasma glucose ≥ 126 mg/dl or previous history of diabetes mellitus was required for the diagnosis of diabetes. Also done was retinal, cardiac evaluation.

Blood sample was collected from patients after an overnight (8 hr) fasting and 2 hr postprandial .Statistical analysis was done using SPSS software.

RESULTS

Majority of the patients with diabetes were male (64% vs. 36%). The mean age group of patients with diabetes was 55.5 ± 9.7 years and that of the controls is 54.8 ± 6.9 years. 20 % of the patients in the cases group had a past history of coronary artery disease or cerebrovascular accident compared to 7 % of the controls ($p < 0.001$). Systemic hypertension was seen to be significantly higher in the cases (32% of the cases and 10% of the controls were hypertensives). The age of onset of diabetes in 80% of patients was between 40 and 62 years. The duration of diabetes was between 5-10 years in 30% and 10-15 years in 32% more than 15 years were 30 %. 67% patients were on oral hypoglycemic agents and 39% on insulin therapy and remaining (4%) were on diet control.

Table 1 shows the comparison of serum ferritin in case and controls, there is statistical significant increase in diabetics with $p < 0.01$.

Table 1: Serum ferritin levels in cases and controls

Groups	Serum ferritin (Mean \pm SD)	t	p
Cases	110.7 \pm 65.75	2.65	0.01*
Controls	74.07 \pm 29.09		

Fig.1 shows that as duration of DM increases there was increase in serum ferritin levels compared to recent onset.

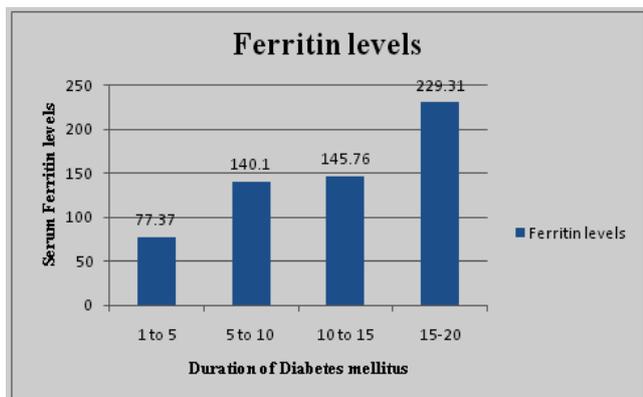


Fig. 1: Duration of DM in years and serum ferritin (ng/ml)

Fig. 2 AUC for serum ferritin in DM was found to be with diagnostic accuracy of 63% which is statistically significant at cut off value of serum ferritin at 140ng/ml.

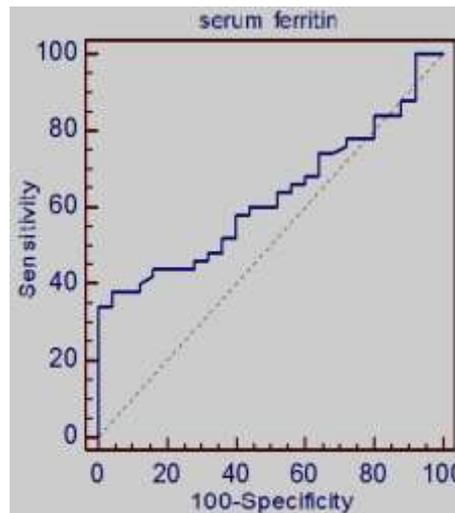


Fig. 2: Recievers operating characteristic curve of serum ferritin in diabetes (Area under the ROC=0.626, P<0.001)

Table 4 shows that majority of male and female patients were in lower limit of normal range of serum ferritin level.

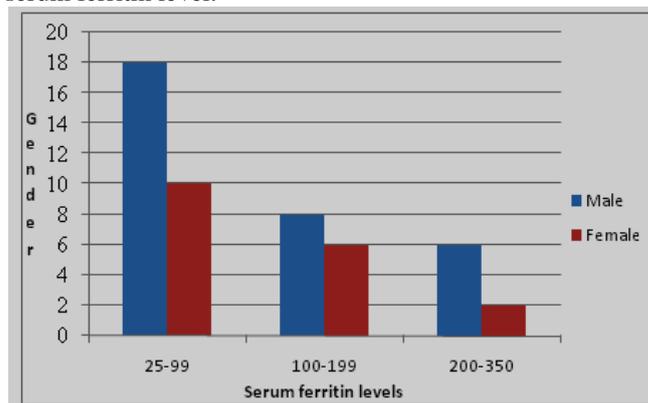


Fig. 3: Serum ferritin level ranges in male and female patients

The secondary dyslipedemia associated with DM like high levels of total cholesterol and serum triglyceride was seen in the cases compared to controls and was of no statistical significance.

Serum ferritin was increased in type 2 diabetes compared to controls. No increase in serum ferritin of patients with past history of CVA and high blood pressure. Our patients had mean HbA1c was 6.7 indicating a very good diabetic control.

Table 5: Comparison with other study

Groups	Variables	Sushma <i>et al.</i> [2]	Our study
Controls	S. ferritin	126 \pm 45.6	74.07 \pm 29.09
	HbA1C	5.2 \pm 4.1	
Cases	S. ferritin	234.5 \pm 62.98	110 \pm 65.75
	HbA1C	7.6 \pm 0.8	6.7 \pm 0.2

Majority (93%) of our patients had normal BMI had serum ferritin in lab ranges and even in 7% of obese patients levels were normal and were not higher than normal BMI individuals.

DISCUSSION

Serum ferritin, a reflector of body iron stores was increased in diabetic patients compared to controls although it was in normal lab ranges and this association was of statistical significance and shown in all these studies [1-6]. Subclinical hemochromatosis may contribute significantly for development of type 2 diabetes [7-10].

The mechanism for the association between ferritin and type 2 diabetes is not established, but iron deposition in the liver may cause insulin resistance by interfering with the ability of insulin to suppress hepatic glucose production [10, 11]. Iron is auto-oxidized to form highly reactive, lipid-soluble iron-oxygen complexes. These free radicals are powerful pro-oxidants, which can change membrane properties and result in tissue damage [12, 13]. Oxidative stress can also lead to hyperglycemia through disturbed glucose metabolism [14]. In addition, iron accumulation in hepatocytes may interfere with the insulin-extracting capacity of the liver [15], and affect insulin synthesis and secretion in the pancreas. Iron excess probably contributes insulin resistance and subsequently to decreased insulin secretion [16].

This possibly reflects that it may be an emerging risk factor among already existing and established etiologies, risk factors of the disease.

Serum ferritin levels increased as the duration of diabetes increased as in Sumeshraj *et al.* [1] and other similar studies [6, 11]. Table 5 shows comparison of increase in serum ferritin levels in between ours and Sushma *et al.* study [2]. Our study correlated well with Sushma *et al.* [2] study and all other studies [1, 3, 6, 11].

No correlation was found with BMI, age, sex, dyslipidemias and HbA1c as in few studies [1].

In our study the mean HbA1c was 6.7 in case group indicates good control of sugar levels this probably could have altered the serum ferritin levels unlike in all studies that indicate hyperferritinemia with poorly controlled diabetes [1, 2, 8] and likewise this in complications.

In conclusion our study shows that there is significant correlation between increased serum ferritin in diabetes compared to individuals with normal blood sugars in this part and hyperferritinemia may be one of the causes for development of insulin resistance before overt diabetes [17].

We recommend large studies to confirm whether these findings have implications for increasing our understanding of the etiology of type 2 diabetes and merit further study in future that help to clarify causality and advance in this area of research.

ACKNOWLEDGEMENT

We thank Dr. Manjula, for her statistical work and Siddalingayya Math for helping in the completion of this article.

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