Indian Journal of Basic and Applied Medical Research; June 2021: Vol.-10, Issue- 3, P. 360 - 366
DOI: 10.36848/IJBAMR/2020/29215.557850

**Original article:**

# A study of serum ferritin levels in type 2 diabetes mellitus and its correlation with HBA1c levels

**[1]Dr shashidhar Ramappa , [2]Rashwith U , [3]Aishwarya R , [4] Dr Narayanaswamy M**

[1, 2, 3] Resident, [4]Professor

Name of Institute /College: Department of Medicine, Bangalore Medical College and Research Institute, Bangalore

Corresponding author: Dr Shashidhar Ramappa

**Abstract :**

**Background:** Iron through oxidative injury, leads to resistant hyperglycaemia and also microvascular diabetic complications. There are few studies which show association between serum Ferritin and type 2 diabetes mellitus. Aims : The present study is conducted toknow the association between S.ferritin and DM and correlate the Diabetic nephropathyand retinopathy.

**Methods and study design:** 60 type 2 DM patients and 60 non diabetic patients meeting the inclusion criteriawere selected from Hospitals attached to Bangalore Medical College and ResearchInstitute , Bangalore from December 2017 to November 2018 were studied. Necessary Investigations like blood sugars, HbA1c, serum Ferritin, urinary Protein and Fundoscopy were done. Otherrelevantinvestigations were done to exclude patients falling under exclusion Criteria.

**Results:** This study included 60 patients with Type 2 Diabetic mellitus and 60 controls. The mean Serum Ferritin level is 379.55 mcg/dl in diabetics compared to non-diabetics withmean serum Ferritin of 81.66mcg/dl. In relation to mean Serum ferritin levels with urinary proteinuria, serumferritin was 315 mcg/l in diabetic patients with nil urinary protein, 433.29 mcg/l among1+ albuminuria, 474.06 mcg/l among 2+ albuminuria, 577.4 mcg/l among 3+ albuminuria. In relation to Serum ferritin level with diabetic retinopathy were 315.1 mcg/l indiabetic patients with no fundus changes, 408.91 mcg/l among grade 1 NPDR patients, 531 mcg/l among grade 2 NPDR patients, 541.4 mcg/l among grade 3 NPDR.

**Conclusion :** This study shows that the level of body iron measured in terma of Serum ferritin is higher in type 2 diabetic patients compared to Non-Diabetics.Diabetic Patients with MicroVascular Complications had higher levels of serim ferritin compared to without any micro vascular complications.

**Keywords**: Type 2 diabetis Mellitus, HbA1c (glycosylated hemoglobin): Serum Ferritin

## Introduction:

Diabetes mellitus is one of the most commonly seen metabolic disorder whichis characterized by hyperglycemia either due to insulin deficiency or insulin resistance.It is associated with microvascular complications like diabetic nephropathy,Diabetic retinopathy, Diabetic neuropathy and macro-vascular complications like coronary artery disease, peripheral vascular Disease etc. Because of these complications it is associated with increased morbidity as well as increased mortality. It causes economical burden to the family as well as to society. The etio-pathogenesis of Type 2 diabetes mellitus is multi-factorial and recent studies shows that the excess body iron levels are being associated with increased risk of type 2 diabetes Mellitus1 Currently, 4.0-11.6 per cent of India's urban population and three per cent of the rural population above the age of 15 have diabetes[1] 'Serum ferritin is a acute phase reactant and is a marker of iron stores in the Body. Increased accumulation of iron affects insulin synthesis and secretion in pancreas and liver[3]. Elevated iron stores may induce diabetes through a variety

of mechanisms, including oxidative damage to pancreatic beta cells, impairment of hepatic insulin extraction by the liver, and interference with insulin's ability to suppress hepatic glucose production[4]. Amongst the various markers of glycaemic control, HBA1c provides an accurate and objective measure of glycaemic control over a period of weeks to months13.This study aims to examine the relation between serum ferritin and HBA1c levels in T2Diabetes Mellitus[2].

**Aims and Objectives of the study**

1. To estimate Serum ferritin levels in type 2 DM.
2. To correlate serum ferritin levels and glycated hemoglobin levels in type 2 Diabetes mellitus. .

**Material and Method of collection of data** :

Source of Study: Patients presenting to Hospitals attached to Bangalore medical college, Bangalore

Study design: case control study

Study period: November 2017 to November 2018.

Place of study : Hospitals attached to Bangalore Medical College, Bangalore.

Sample size: Cases: 60 Controls: 60

Inclusion criteria:

Cases:

All patients of Type 2 Diabetes mellitus of more than 3-6 monthsduration.

Controls:

People with FBS, PPBS and HBA1c levels less than that definingDiabetes mellitus.

Exclusion criteria:

For both case and controls :

1) Type 1 Diabetes mellitus.

2) Age <18 yrs.

3) Other states associated with altered serum ferritin and HBA1c levels like:

a. Hemochromatosis

b. Chronic alcoholics

c. Chronic inflammatory conditions

d. Hepatitis

e. Patients with repeated blood transfusions

f. Iron deficiency anaemia

g. Hypothyroidism/Hyperthyroidism.

The cases for the study are selected in accordance with theabove mentioned inclusion and exclusion criteria, the purpose of the study is explained to the patients and informed consent is obtained.

The data is collected according to the proforma in terms of detailed history,clinical examination and the necessary investigations. Data collection :A detailed proforma is filled up for each patient which included age, sex, past history of hypertension. The age of onset and duration of diabetes ,whether the patient was treated with oral hypoglycemic agents or insulin or whether the patient was on diet control alone is also recorded.

Statstical analysis:

Laboratory parameters are obtained. Data will be analysed by descriptive Statistics, Pearson coefficient of correlation is used to identify relationship between Quantitative variables. Pvalue is less than 0.05

**Observation and Results:**

Table 1: Age wise Distribution

| Age group (years) | Diabetics (Cases) | Non-diabetics (Controls) |
|---|---|---|
| 41-45 | 9 | 19 |
| 46-50 | 7 | 10 |
| 51-55 | 10 | 13 |
| 56-60 | 8 | 10 |
| >60 | 26 | 8 |

Table 2 : Comparison of Serum Ferritin between Diabetics and Non – Diabetics

| Age group (years) | Diabetics (Cases) | Non-diabetics (Controls) |
|---|---|---|
| 41-45 | 9 | 19 |
| 46-50 | 7 | 10 |
| 51-55 | 10 | 13 |
| 56-60 | 8 | 10 |
| >60 | 26 | 8 |

Table 3- Comparison of Serum Ferritin between Diabetics and Non – Diabetics

| Population | Mean S. ferritin (µg/l)± Standard Deviation |
|---|---|
| Subjects (Diabetics) | 379.55±118.30 |
| Controls (Non-diabetics) | 81.66±26.85 |

Using 2 tailed t test, p value is <0.005 which is statistically significant

In this study mean serum ferritin level among diabetic patients is 379.55 µg/land among non-diabetic patients is 81.66 µg/l. Mean serum ferritin levels are more in diabetic population compared to non-diabetic population

Table 4 - Corelation of HbA1c and Serum Ferritin

| **HbA1c%** | **Diabetics** | **Mean S.ferritin±SD in diabetics (mcg/l)** | **Non-diabetics** | **Mean S.ferritin±SD in non-diabetics (mcg/l)** |
|---|---|---|---|---|
| <6.5 | 0 | | 60 | 85.66±20 |
| 6.5-7.5 | 9 | 209±73 | 0 | 0 |
| 7.6-9 | 33 | 270±106.3 | 0 | 0 |
| >9 | 18 | 355.1±117 | 0 | 0 |

60 controls had HbA1c less than 6.5 with their S. ferritin being 85.66 mcg/l. 9cases had HbA1c between 6.5-7.5 with their mean S.ferritin being 209.73 mcg/l, 33 cases had HbA1c between 7.6 to 9 with their mean S.ferritin being 270.2 mcg/l, 18 cases had HbA1c more than 9 had mean S.ferritin of 355.1 mcg/l

Table 4B - Corelation of Serum Ferritin and urine proteinuria

| **Grade of proteinuria** | **Diabetics** | **Mean S.ferritin±SD in diabetics (mcg/l)** |
|---|---|---|
| 0 | 35 | 315±69 |
| 1+ | 13 | 433.29±117 |
| 2+ | 8 | 474.06±86 |
| 3+ | 4 | 577.4±118 |

Using Cramer's V coefficient, p value <0.005 which is statistically significant

Table 5 -Correlation of Serum Ferritin and Diabetic Retinopathy

| **Grade of diabetic retinopathy** | **Diabetics** | **Mean S.ferritin±SD in diabetics (mcg/l)** |
|---|---|---|
| No retinopathy | 32 | 315.1±67 |
| Mild NPDR | 18 | 408.91±79 |
| Moderate NPDR | 9 | 531±156 |
| Severe NPDR | 1 | 541.4 |
| PDR | 0 | 0 |

Using Cramer's V coefficient, p value <0.005 which is statistically significant

Table 6 - Distribution of Diabetic proteinuria and diabetic retinopathy

| **Diabetic proteinuria** | | **Diabetic retinopathy** | |
|---|---|---|---|
| **Grade** | **Percentage** | **Grade** | **Percentage** |
| 0 | 58 | No retinopathy | 53 |
| 1+ | 22 | Mild NPDR | 30 |
| 2+ | 13 | Moderate NPDR | 15 |
| 3+ | 3 | Severe NPDR | 2 |
| | | PDR | 0 |

Table 7- Correlation of Serum Ferritin and Duration of Diabetes

| DURATION | NUMBER | MEAN FERRITIN |
|---|---|---|
| 0--3 | 3 | 312.3000 |
| 4--6 | 19 | 380.2321 |
| >6 | 38 | 384.5247 |
| Total | 60 | 379.5542 |

**Discussion:**

In the present era, there are many parameters to diagnose and prognosticate diabetic status of an individual. Here in this study, we are trying to compare levels of Serum Ferritin with diabetic status and long term complications like Diabetic Nephropathy and Diabetic Retinopathy. In the present study Mean serum ferritin levels of diabetics is 379.55+118 µg/dl which is significantly high compared to non-diabetics whose mean serum ferritin being 81.66+26 µg/l with p value being <0.05 which is statistically significant. In a study done by Maheshwari et al. mean serum ferritin among diabetics was 319+46.2 mcg/l and among non-diabetic it was 67+32.1 mcg/l. In a study done by Mahalakshmi et al. mean serum ferritin in diabetics was 487+37.1 mcg/l and among non-diabetics was 84+21.1 mcg/l. In a Case control study done by Dr. Pramiladevi. et al [5]on 50 type 2 diabetes mellitus in S.N.Medical college and HSK Hospital, Bagalkot there was significant correlation between serum ferritin and HbA1c levels in diabetes when compared to individuals with normal blood sugars and showed that hyper ferritinemia may be one of the causes for development of insulin resistance before overt diabetes.( mean S.Ferritin of cases: 110 ; mean S.Ferritin of controls: 74

In a similar study conducted by Sumesh raj[6] , et al on 86 Type 2 Diabetes subjects and controls serum ferritin was significantly higher in diabetic patients when compared tocontrols. In a study conducted by Jeevan K. Shetty, et al[7] on 50 type 2 diabetes cases under poorglycemic control associated with-complications, 53 type 2 diabetes cases under good glycemic control and 40 healthy controls, There was a significant increase in serum ferritin ($p<0.01$) in diabetes cases under poor glycemic control compared to diabetes cases under good glycemic control and healthy control . In 2008, Ramesh Chandra thanna, Shreya[8] conducted a study on 50 type 2 diabetics with poor glycemic control (group I), 53 type 2 diabetics with good glycemic control (group II) and 40 healthy non-diabetic controls, and found that serum ferritin was increased in group I, though the same correlation did not exist in group II . Study conducted by Wrede et al[10]. showed results similar to this study. In a study done by Ali Memoni et al,[9] Serum ferritin levels were 114.9 mcg/l in diabetic patients with HbA1c less than 7.5%, 174.9 mcg/l between 7.5 to 9%, 249.78 mcg/l in patients with HbA1c more than 9%.

**Limitation:**

Small sample size, hospital based study

**Conclusion :**

• High serum ferritin levels are associated with type 2 diabetes mellitus and its long term micro vascular complications.

• Higher levels of Serum ferritin are associated with high hba1c levels.

• High serum ferritin levels are suggestive of poor glycaemic control.

**Acknowledgement:** Corresponding author heartfully thanked to co authors, parents , tearchers, patients who are participated in study with profer consent.

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Date of Publication: 25 June 2021
Author Declaration: Source of support: Nil, Conflict of interest: Nil
Was informed consent obtained from the subjects involved in the study? YES
For any images presented appropriate consent has been obtained from the subjects: NA
Plagiarism Checked: Urkund Software

DOI: 10.36848/IJBAMR/2020/29215.55850