



Research Paper

## A Study Of Association Of Serum Iron And Serum Ferritin Levels In Type 2 Diabetes Conducted In A Tertiary Care Hospital.

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**ABSTRACT:** The objective is to correlate serum Iron and serum ferritin levels with glycated hemoglobin (HbA1c) and fasting blood sugar levels in patients with type 2 diabetes and normal healthy individuals. A case control study was conducted in 50 type 2 diabetes patients and 100 normal healthy controls who were attending out patients in department of General medicine at Gandhi hospital, Secunderabad. The blood samples were collected and analyzed for FBS, Hb A1c, iron and ferritin levels. In our study serum iron and ferritin levels in the cases were high with p value <0.01.

**KEYWORDS:** Type 2 diabetes, Fasting blood sugar, Iron, HbA1c

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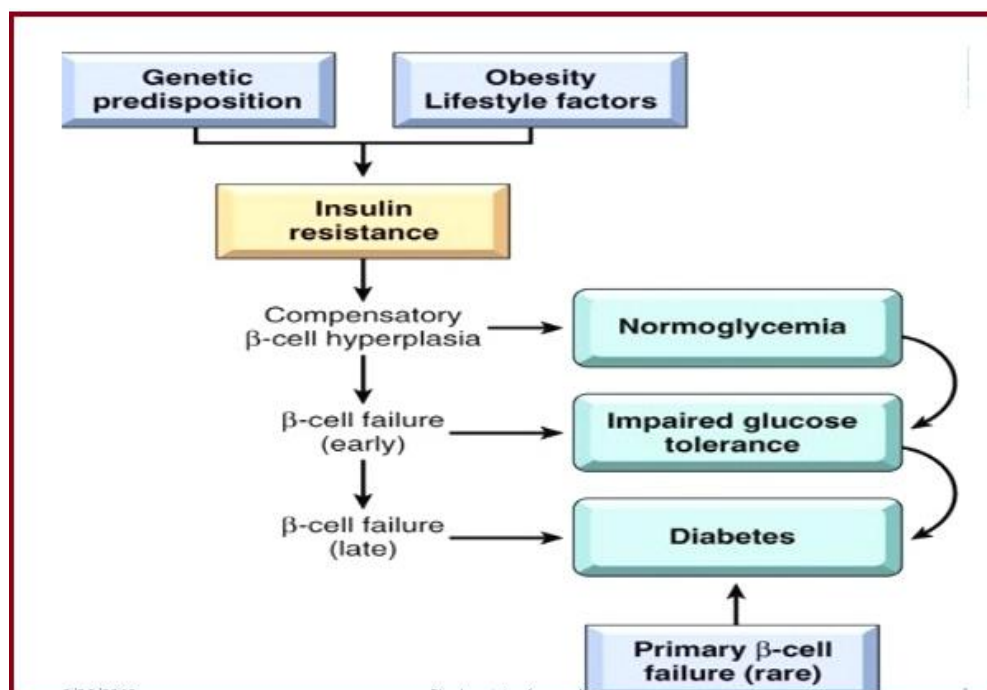
### I. INTRODUCTION:

Diabetes Mellitus is characterized by chronic hyperglycemia due to defects in either insulin secretion or insulin action or both [1]. It is the most widespread disease in the spectrum of metabolic disorders that share the common phenotype of hyperglycemia. Several distinct types of DM exist that are caused by a complex interaction of genetic and environmental factors.

The chronic hyperglycemia in Diabetes mellitus is associated with long-term macro and micro vascular complications like coronary artery disease, neuropathy, retinopathy and nephropathy [2]. These complications can progress to end stage outcomes such as, end stage renal disease, blindness and amputation [3].

#### Pathophysiology:

Insulin resistance in the insulin sensitive organs together with impaired insulin secretion due to progressive pancreatic  $\beta$ -cell failure [4][5] particularly in response to a glucose stimulus. Pathophysiology of type 2 diabetes depicted in figure 1.



**Figure 1:** pathophysiology of type 2 diabetes.

1. changes in intracellular Ferritin and Iron (Fe) concentrations seem to be involved in the pathogenesis of type 2 diabetes.
2. The association between raised iron stores and type 2 diabetes was reported almost a century ago. Increased iron stores are associated with the development of glucose intolerance and increased risk of T2DM. [6] Iron (Fe) acts as a strong pro-oxidant. It is participate in reduction-oxidation reactions leading to production of oxygen free-radicals from ROS. The generation of ROS by iron can damage numerous biological molecules (e.g., membrane lipids, proteins, DNA) [7] These free radicals interfere with insulin signaling at cellular level [8] [9] [10] and inhibit the translocation of GLUT4 to plasma membrane in insulin sensitive tissues [11].

Few studies showed the role of micronutrients in general and iron in the etiology of Type 2 Diabetes and also explained the positive association between excess iron stores and risk of Type 2 Diabetes mellitus [12]. The purpose of our study, was to establish whether iron levels and ferritin levels correlate with high hba1c and high fasting blood glucose levels consistent with uncontrolled diabetes.

#### **AIM OF OUR STUDY:**

To compare and correlate the levels of serum Ferritin, serum iron, FBS and Glycated Hemoglobin (HbA1c) in Type 2 Diabetic patients and normal controls.

#### **II. MATERIALS AND METHODS:**

The present study has been done in the department of Biochemistry in Gandhi medical college, secunderabad. The study was performed on 50 type 2 diabetes patients and 100 controls between the age group of 40-60 years of either sex during the period from 2016 – 2017.

##### **Inclusion Criteria:**

**Cases:** Clinically diagnosed cases of type 2 diabetes. The diagnosis of type 2 diabetes mellitus was established in accordance with the recommended criteria of American Diabetes Association and based on detail clinical history.

**Exclusion criteria:** Type 1 diabetes mellitus, Patients on repeated blood transfusion, Patients on iron supplementation, chronic alcoholics, chronic smokers, chronic kidney disease, pregnant women.

##### **Methods for estimation of these parameters by:**

1. Serum Ferritin: Chemiluminescent Microparticle Immunoassay (CMIA) by Abbott ARCHITECT plus ci 4100 Analyzer
2. Serum iron: ferrozine method by Transasia Erba Mannheim (XL 640)
3. HbA1c: Cation -exchange HPLC by BIO-RAD D-10 Hemoglobin Analyzer
4. FBS: by glucose oxidase method by Transasia Erba Mannheim (XL 640)

### III. RESULTS:

The results obtained in this study were from total number of 150 subjects; out of which 50 were type 2 Diabetic cases and other 100 were controls without diabetes.

**Table 1: Comparison of Mean values of Blood Glucose levels between two Groups**

Group	Mean	SD	p-Value
Controls(100)	78.7	±56.1	<0.01
Cases(50)	280	±77.3	

It is evident from table 1, Mean of Blood Glucose is higher in cases than in controls and the mean difference is statistically significant ( $p < 0.01$ ).

**Table 2: Comparison of Mean and SD of Ferritin between two Groups**

Group	Mean	SD	p-Value
Controls(100)	85.3	±11.4	<0.01
Cases(50)	174.1	±43.7	

It is evident from table 2 that levels of mean serum ferritin was increase in cases compared to controls .The increase is statistically significant ( $P < 0.01$ ).

**Table 3: Comparison of Mean values Serum Iron between Controls and Cases**

Group	Mean	SD	p-Value
Controls(100)	69.8	±19.3	<0.05
Cases(50)	85.7	±29.4	

It is evident from table 3, the levels of mean serum iron was increase in cases compared to controls. The increase is statistically significant ( $P < 0.05$ ).

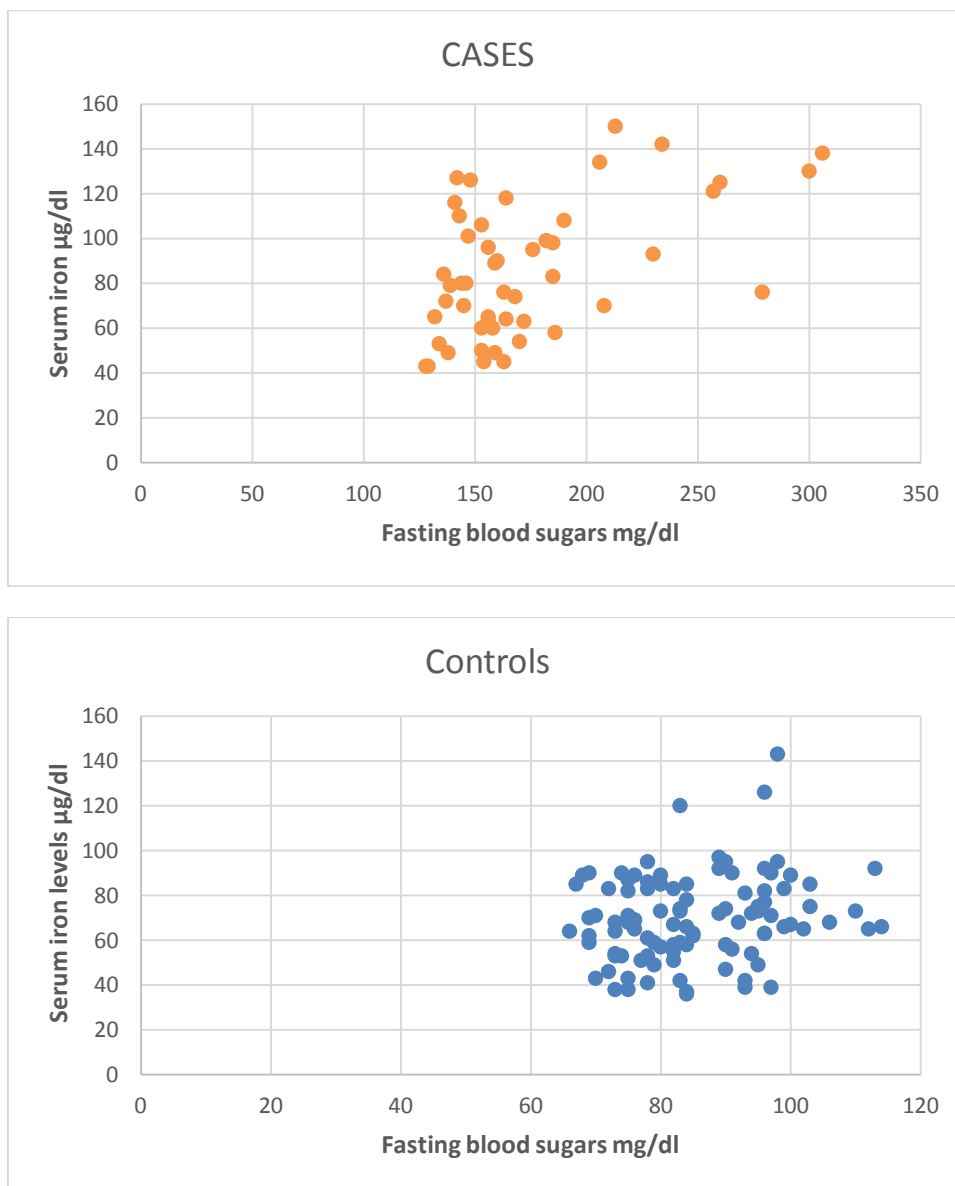
**Table 4: Comparison of Mean values of Glycated hemoglobin between Controls and Cases**

Group	Mean	SD	p-Value
Controls(100)	5.23	±0.45	< 0.01
Cases(50)	8.98	±1.84	

It is evident from table 4, Mean of Glycated hemoglobin is higher in cases than in controls and the mean difference is statistically significant ( $p < 0.01$ ).

#### STATISTICAL ANALYSIS:

The data was analyzed with SPSS software package version 15.0 and expressed in terms of mean, Standard deviation (SD).Continuous variables of serum ferritin,iron FBS and glycated hemoglobin concentrations of the two groups were compared by z score from analysis of variance(ANOVA).A p-value <0.05 was considered to be statistically significant.



#### IV. DISCUSSION:

With the increasing incidence of diabetes, which will be the 7<sup>th</sup> leading cause of mortality and morbidity in 2030 (13), this study acquires importance in evaluation of various inflammatory markers that can be a cause of complications in patients with uncontrolled diabetes. Particularly the increased iron and ferritin levels are consistent with inflammation in diabetes and have association with developing micro and macrovascular complications.

Iron being a micro nutrient is essential for several physiological functions in the body, it is a pro oxidant and leads to the formation of reactive oxygen species(ROS).Hyperglycemia causes increased glycation of hemoglobin which inturn increases the release of free iron and stimulates ferritin synthesis (14,15). With the generation of ROS there is increase oxidative stress, increasing circulating inflammatory and pro-inflammatory markers leading to diabetic vascular complications (16,17).

In our study, the mean iron levels (as shown in table3) is raised in cases (85.7) as compared with the controls (69.8) , which shows that there is significant raise in iron levels in patients compared with controls, with p value <0.05. This high iron level in our study correlate with the work carried by Rajpathak,S.N.Crandall et all (18), who showed the positive association between excess iron stores and risk of type 2 Diabetes Mellitus.

Some of the studies have also positively correlated with our results (19) showing epidemeological evidence of association between increase dietary iron and increase risk of Diabetes Mellitus.Another study carried by Fernández-Real et all,(7) has recognised that iron influences glucose metabolism even in the absence of significant iron overload.

According to the studies conducted (8,9,10,11), the authors have studied about oxidative stress caused by the ROS generated by fenton and haber weiss reaction which eventually forms hydroxyl radicals from hydrogen peroxide and superoxide radical which inturn damages numerous biological molecules such as membrane proteins,DNA etc. Hence it is associated with the subsequent increase in the level of oxidative stress.The increase in oxidative stress interferes with insulin signalling at cellular level and inhibits the translocation of GLUT-4 to plasma membrane in insulin sensitive tissues. Hence further aggreivating hyperglycemia.

Ferritin is an index of body iron stores and also an inflammatory marker. Increased levels of ferritin in the blood reflects both the involvement of inflammation and independent access of excess iron. Some of the studies have demonstrated that elevated levels of ferritin is associated with glucose intolerance and insulin resistance, suggesting that inflammation is also involved in the etiology of type 2 Diabetes(20,21).

Serum ferritin is a biomarker for iron stores which increase in response to inflammatory stress, so inceased ferritin in diabetics could simply reflect the inflammatory component of the disease . Concurrent with the other studies, our study results showed significant raise in serum ferritin levels with p value <0.01 in cases.

## V. CONCLUSION :

The present study suggests that estimating iron and ferritin levels provides a sensitive prediction of cardiovascular complications in type 2 diabetic subjects such that early precautions could be taken thus preventing cardiovascular complications.

On the basis of our above findings, it can be concluded that disturbance in serum ferritin and iron levels plays a significant role in pathogenesis of type 2 diabetes. There is further research scope to find out a single parameter which can quantitatively, predict cardiovascular complications and useful in prognosticating the patients.

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