

ORIGINAL RESEARCH

Association of serum ferritin with glycemic status among patients with type 2 Diabetes mellitus

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ABSTRACT

Background: Diabetes Mellitus is a prevalent metabolic disorder influenced by genetic and environmental factors, with India facing a substantial rise in its diabetic population. Recent research has highlighted the association between elevated body iron levels and the onset of diabetes and its complications. This study aimed to explore the relationship between Serum Ferritin, HbA1c%, and Blood Glucose in patients with Type 2 Diabetes Mellitus. To evaluate the association between Serum Ferritin, HbA1c%, and Blood Glucose in patients with Type 2 Diabetes Mellitus.

Material & Method: This cross-sectional study was conducted among patients with Type 2 Diabetes Mellitus attending the outpatient and inpatient departments of MNR Medical College & Hospital from June 2023 to January 2024. Patients meeting the inclusion criteria were enrolled, while those with specific exclusions were excluded. Detailed demographic and medical history data were collected, and blood samples were obtained for various biochemical analyses. Statistical analysis was performed using SPSS version 20.

Results: The study included 100 patients, with no significant demographic differences between groups. Participants with diabetes exhibited significantly higher fasting and postprandial blood glucose levels, glycemic control, and LDL cholesterol compared to controls ($p < 0.05$). Serum ferritin showed significant correlations with blood glucose (FBS=0.59, PPBS=0.69) and HbA1c ($r=0.62$).

Conclusion: Elevated Serum Ferritin levels correlated significantly with higher Blood Glucose and HbA1c levels in patients with Type 2 Diabetes Mellitus, suggesting a potential role of iron metabolism in glycemic control. These findings underscore the importance of further investigation into the link between iron status and diabetes management.

Keywords: Diabetes Mellitus, Serum Ferritin, HbA1c, Blood Glucose, Iron Metabolism, Glycemic Control.

Introduction

Diabetes Mellitus, a prevalent metabolic and endocrine disorder, results from an intricate interplay of genetic predispositions and environmental influences.¹ The significant surge in the diabetic population of India, escalating from 26 million in 1990 to 65 million in 2016, poses a substantial public health challenge. In 2019, approximately 77 million people in India were reported to have diabetes. Projections suggest that this number will surge to more than 134 million by 2045.² Consequently, numerous investigations have been undertaken to explore the risk factors and predictors of Diabetes Mellitus and its complications, aiming to curb the diabetic epidemic promptly. Recent research has highlighted the association between elevated body iron levels and the onset of glucose intolerance, type 2 Diabetes Mellitus, Gestational Diabetes Mellitus, and insulin resistance syndrome.^{3,4} Moreover, increased serum ferritin levels, indicative of heightened body iron stores, may also correlate with the emergence of both microvascular and macrovascular complications of Diabetes over the long term.⁵ The present study aimed to evaluate the relationship between Serum Ferritin and HbA1c% and blood glucose in patients with Type 2 Diabetes Mellitus.

Material and Method:

This cross-sectional study was conducted among the patients with diabetes mellitus attending OPD and IPD of MNR Medical College & Hospital, from June 2023 to January 2024. Patients with type 2 diabetes mellitus consenting to be part of the study. Patients with type 1 diabetes mellitus, iron deficiency, recent blood transfusions, blood donations, acute infections and chronic diseases like liver failure and renal failure were excluded in the study. The detailed proforma was filled up with each patient's demographic information, including age and sex, along with their dietary habits, menstrual history (for females), smoking and alcohol consumption status, past medical history of coronary artery disease and cerebrovascular accident, as well as a history of hypertension. Additionally, data regarding the age at which diabetes commenced and the duration of the condition were collected. Treatment modalities, such as oral hypoglycaemic drugs, insulin therapy, or dietary control alone, were also noted for each patient. Following strict aseptic measures, venous blood samples were obtained from patients following an overnight fast of 8 to 10 hours and 2 hours after a meal (postprandial, after breakfast). The fasting blood sample, collected in a clot accelerator tube, was utilized for assessing serum ferritin levels and lipid profiles. Another fasting blood sample, collected in an EDTA tube, was used for measuring fasting plasma glucose, HbA1c%, and hemoglobin levels. Postprandial blood glucose levels were determined using the blood sample collected 2 hours after the meal, also collected in an EDTA tube. The Statistical Package for Social Sciences (SPSS, version 20) was employed for statistical analysis. Descriptive statistics were utilized to summarize continuous variables, reported as mean ± Standard Deviation (SD), whereas categorical data were presented as percentages. The Chi-square test was used to compare percentages. A multivariate logistic regression analysis was conducted to evaluate the influence of particular variables on glycemic control, while adjusting for potential confounding factors. Statistical significance was defined as p-values less than 0.05.

Result: The present study included a total of 100 patients fulfilling inclusion criteria, with 50 participants in each group. There is no significant difference in the demographic details between the groups.

	Control		Diabetes Mellitus		p-value
	Mean	SD	Mean	SD	
Age	45.2	5.1	46.51	6.5	0.65
BMI	26.5	3.4	26.7	2.4	0.11
Systolic blood pressure	116.3	22.1	119.6	12.4	0.45
Diastolic blood pressure	76.33	6.68	78.1	8.4	0.46
Hemoglobin	11.22	1.45	11.5	1.3	0.21
FBS	84.71	10.02	152.61	22.5	0.01*
HbA1c	5.9	0.68	8.99	1.31	0.01*
Serum ferritin	35.38	15.74	73.44	11.21	0.01*
T. Cholesterol	194.82	46.2	210.78	28.2	0.079
Triglycerides	156.34	65.3	195.65	72.4	0.054
HDL	45.81	6.5	47.5	5.6	0.46
LDL	115.21	19.5	126.34	19.21	0.01*
VLDL	32.11	12.7	39.1	14.2	0.122

In the study there is significant increase in fasting blood glucose, postprandial blood glucose, glycemic control and LDL cholesterol in participants with diabetes mellitus compared to controls.(p<0.05)

Correlation of ferritin with (ng/ml)	Correlation	p-value
Hb%	0.203	0.07
FBS (mg/dL)	0.598	0.01*
PPBS (mg/dL)	0.69	0.01*
HbA1c%	0.62	0.01*

There is a significant correlation between serum ferritin and blood glucose (fbs=0.59, PPBS = 0.69) and HbA1c (r=0.62).

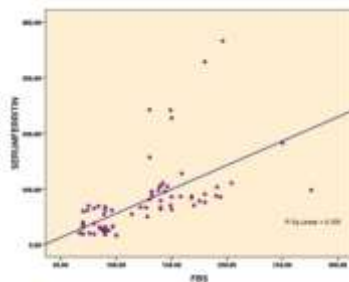


FIGURE 1: CORRELATION OF SERUM FERRITIN WITH FASTING BLOOD SUGAR

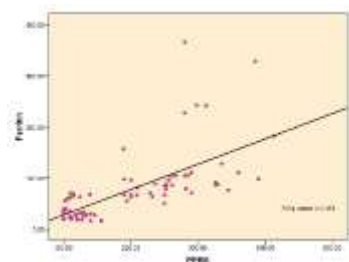


FIGURE 2: CORRELATION OF SERUM FERRITIN WITH POST-PRANDIAL BLOOD SUGAR

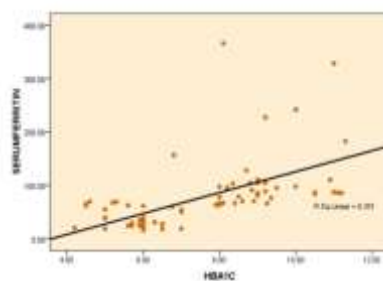


FIGURE 3: CORRELATION OF SERUM FERRITIN WITH HbA1c

Discussion:

Ferritin serves as a crucial protein in the body, aiding in the storage and safekeeping of iron while shielding cells from its harmful effects. Found in nearly all human cells, ferritin acts as a reservoir of iron readily accessible for the production of hemoglobin and other essential heme proteins. Its expression is tightly controlled at both the transcriptional and posttranscriptional levels, influenced by various factors such as iron levels, hormones, cytokines, and oxidative stress. The concentration of ferritin in the bloodstream generally mirrors the body's iron stores, functioning as a marker for iron levels. Additionally, it serves as a positive acute-phase reactant in inflammatory conditions. However, it's important to note that elevated levels of ferritin do not always indicate iron overload. Many conditions can lead to increased serum ferritin levels without a corresponding rise in iron content.^{6,7}

Hyperferritinemia or high ferritin levels, can be observed in a range of disorders, including infections, hyperthyroidism, liver and renal failure, chronic alcohol consumption, rheumatic and inflammatory diseases, malignancies, and metabolic syndrome, among others. Therefore, while elevated ferritin levels can provide valuable insights into various health conditions, they must be interpreted in conjunction with other clinical findings to accurately diagnose and manage underlying disorders.⁸ The present study included a total of 100 patients fulfilling inclusion criteria, with 50 participants in each group. There is no significant difference in the demographic details between the groups.

In the study, there is significant increase in fasting blood glucose, postprandial blood glucose, glycemic control and LDL cholesterol in participants with diabetes mellitus compared to controls.($p < 0.05$) There is a significant correlation between serum ferritin and blood glucose (fbs=0.59, ppbs = 0.69) and HbA1c ($r=0.62$). In concordance with the present study by Naik AP et al., the documented age and gender contrast between the two sets showed no significant statistical variance. However, in the diabetic group compared to the control group, notable differences were observed in serum ferritin levels, BMI, fasting blood glucose (measured in mg/dl), and glycated hemoglobin (HbA1c) values, all of which were significantly higher. Furthermore, as HbA1c values increased, there was a corresponding rise in serum ferritin levels. The association between serum ferritin and HbA1c was evaluated, revealing a positive correlation. This correlation was quantified using a Pearson correlation test, indicating a significant positive correlation with a coefficient of 0.507.⁹ In concordance, another study by Chandrashekhhar HR et al., documented a significant positive correlation of glycemic control with serum ferritin.¹⁰

Another study by Tummalacharia SC et al, the documented that serum ferritin was significantly higher in uncontrolled diabetes compared to controlled diabetes and control.¹¹ Hyperferritinemia is evident among uncontrolled T2DM patients.

Conclusion: Elevated Serum Ferritin levels correlated significantly with higher Blood Glucose and HbA1c levels in patients with Type 2 Diabetes Mellitus, suggesting a potential role of iron metabolism in glycemic control. These findings underscore the importance of further investigation into the link between iron status and diabetes management.

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