

ORIGINAL RESEARCH

ASSESSMENT OF CORRELATION OF SERUM FERRITIN WITH HBA1C IN TYPE 2 DIABETIC PATIENTS

¹Dr. Simrat Bhullar, ²Dr. Ashish Gupta, ³Dr. Harnoor Singh, ⁴Dr. Kamalpreet Kaur, ⁵Dr. Jaspreet Singh, ⁶Adewale Mark Adedoyin

^{1,3,4,5}MBBS, Government Medical College, Patiala, Punjab, India

²MBBS, Punjab Institute of Medical Sciences College, Jalandhar, Punjab, India

⁶Lagos State University College of Medicine, Nigeria

Correspondence:

Dr. Simrat Bhullar

MBBS, Government Medical College, Patiala, Punjab, India

ABSTRACT

Background: Type 2 diabetes mellitus (DM2) is an important health problem worldwide affecting about 8 percent of population. The present study was conducted to assess correlation of serum ferritin with HbA1c in type 2 diabetic patients.

Materials & Methods: 74 type II diabetes patients of both genders were put in group I and age matched control in group II. Parameters such as Hb%, Ferritin, hemoglobin, HbA1c and fasting plasma sugar were measured in blood samples. The blood sugar was measured after 12 hours of fasting by glucose oxidase method.

Results: Out of 74 patients, males were 44 and females were 30. The mean BMI in group I was 27.3 kg/m² and in group II was 27.1 kg/m². FPG was 7.4 mmol/L in group I and 5.8 mmol/L in group II. The mean HbA1c level was 8.7% in group I and 5.2% in group II. The mean S. ferritin level in group I was 198.3 µgm/L in group I and 64.8 µgm/L in group II. The difference was significant (P< 0.05). There were 28 subjects with HbA1c level <6% and serum ferritin level <150 µgm/L and 9 subjects with >15 µgm/L. There were 13 subjects with HbA1c level >6.1% with serum ferritin level <150 µgm/L and 24 with serum ferritin level >150 µgm/L. The difference was significant (P< 0.05). OR of 11.7 in subjects with higher serum ferritin level are in 11.7 times at risk to develop type II DM than those with lower serum ferritin level.

Conclusion: There was significant increase in serum ferritin in diabetes mellitus compared to control group. Positive correlation between HbA1c and serum ferritin has also been found.

Key words: Diabetes mellitus, serum ferritin, cytokines

INTRODUCTION

Type 2 diabetes mellitus (DM2) is an important health problem worldwide affecting about 8 percent of population. The prevalence of disease continued to rise over the recent decades. The probable role of inflammatory factors and cytokines in producing DM was described by Pickup JC in 1998.¹The fundamental molecular defects in type 2 DM are insulin resistance

and impaired insulin secretion results from a combination of environmental and genetic factors. It is a major public health concern both in developing and developed countries.² It is one of the four priority non-communicable diseases along with cardio-vascular disease, malignancy and chronic respiratory diseases. Complications of DM are the cause of many deaths. It is the leading cause of adult blindness, amputation, renal failure, heart attacks and strokes.³

There is little ferritin in human plasma proportionate to the total stores of iron in the body. Plasma ferritin levels are thus considered to be an indicator of body iron stores. Ferritin is one of the key proteins that play an important role in regulating iron homeostasis.⁴ The mechanism for the association between serum ferritin and type 2 DM is not established yet, but iron deposition in the liver may cause insulin resistance by interfering the ability of insulin to suppress hepatic glucose production.⁵ The present study was conducted to assess correlation of serum ferritin with HbA1c in type 2 diabetic patients.

MATERIALS & METHODS

The present study comprised of 74 type II diabetes patients of both genders. All were informed regarding the study and their written consent was obtained.

Data such as name, age, gender etc. was recorded. Patients were put in group I and age matched control in group II. Parameters such as Hb%, Ferritin, hemoglobin, HbA1c and fasting plasma sugar were measured in blood samples. Weight and height were measured by a standard device and body mass index (BMI) was calculated based on weight / (height)² formula. The blood sugar was measured after 12 hours of fasting by glucose oxidase method. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I Distribution of patients

Total- 74		
Gender	Males	Females
Number	44	30

Table I shows that out of 74 patients, males were 44 and females were 30.

Table II Comparison of parameters

Parameters	Group I	Group II	P value
BMI (kg/m ²)	27.3	27.1	0.84
FPG (mmol/L)	7.4	5.8	0.05
HbA1c (%)	8.7	5.2	0.02
S. Ferritin(µgm/L)	198.3	64.8	0.01

Table II, graph I shows that mean BMI in group I was 27.3 kg/m² and in group II was 27.1 kg/m². FPG was 7.4 mmol/L in group I and 5.8 mmol/L in group II. The mean HbA1c level was 8.7% in group I and 5.2% in group II. The mean S. ferritin level in group I was 198.3 µgm/L in group I and 64.8 µgm/L in group II. The difference was significant (P< 0.05).

Table III Association of serum ferritin level with HbA1c

HbA1c (%)	Serum ferritin (<150µgm/L)	Serum ferritin (>150µgm/L)	P value
<6	28	9	0.01
>6.1	13	24	0.04

Table III shows that there were 28 subjects with HbA1c level <6% and serum ferritin level <150 µgm/L and 9 subjects with >15 µgm/L. There were 13 subjects with HbA1c level >6.1% with serum ferritin level <150 µgm/L and 24 with serum ferritin level >150 µgm/L. The difference was significant (P< 0.05).

Table IV Risk measurement of serum ferritin in type II DM

Serum ferritin(µgm/L)	With DM	Without DM	OR
>151	26	13	11.7
<150	11	24	

Table IV shows that OR of 11.7 in subjects with higher serum ferritin level are in 11.7 times at risk to develop type II DM than those with lower serum ferritin level.

DISCUSSION

Acute phase reactants are proteins that respond to acute stress such as infection, trauma, surgery and tissue necrosis. Some of these agents are alpha-acid glycoprotein, haptoglobin, fibrinogen, C-reactive protein (CRP) and ferritin. CRP is produced by liver cells and could activate complement system and T and B lymphocytes. Erythrocyte Sediment Rate (ESR), as an acute phase reactant, is less important than CRP for evaluation of inflammation.⁶ Ferritin is a complex globular protein that stores iron as soluble and non-toxic component. In oxidative stress, Fe²⁺ enters to cells and then changes to Fe³⁺, linked to ferritin and then protect cells from oxidative stress. Increasing concentration of iron and ferritin in cells could cause resistance to insulin and dysfunction of β cells of pancreases.⁷ Hyperinsulinemia due to resistance to insulin may be responsible for increasing serum ferritin. It has been suggested that disturbance of iron metabolism could cause insulin resistance, hyperinsulinemia, dyslipidemia, HTN and central obesity.^{8,9} The present study was conducted to assess correlation of serum ferritin with HbA1c in type 2 diabetic patients.

We observed that out of 74 patients, males were 44 and females were 30. Khondker et al¹⁰ examined the relationship between serum ferritin as a marker of iron overload with DM and HbA1c. In this case control study, 46 patients with type 2 diabetes were taken as cases and 46 normal individuals were included as the control group. Mean serum ferritin was significantly higher in diabetics than in the control group (197.97±75.99 µgm/L vs. 64.24±27.83 µgm/L).

We observed mean BMI in group I was 27.3 kg/m² and in group II was 27.1 kg/m². FPG was 7.4 mmol/L in group I and 5.8 mmol/L in group II. The mean HbA1c level was 8.7% in group I and 5.2% in group II. The mean S. ferritin level in group I was 198.3 µgm/L in group I and 64.8 µgm/L in group II. Momeni et al¹¹ evaluated relationship of these two acute phase reactants with some indices of diabetic control. 67 patients with type 2 diabetes, serum CRP, ferritin, fasting blood sugar (FBS), post prandial BS, hemoglobin A1c (HbA1c), triglyceride, low density lipoprotein cholesterol (LDL) and high-density lipoprotein cholesterol (HDL) were checked before and 3 months after the control of hyperglycemia and

hyperlipidemia. The mean age of the patients was 56.5 ± 9.7 (30 to 82) years. There was no significant difference between CRP before and after study; however, serum ferritin significantly decreased after study with control of hyperglycemia. FBS, 2 hours post-prandial blood sugar (2hppBS), HbA1c and triglyceride of patients decreased significantly after control of hyperglycemia and hyperlipidemia ($P < 0.05$); however, HDL and LDL cholesterol didn't change ($P > 0.05$).

We observed that there were 28 subjects with HbA1c level $<6\%$ and serum ferritin level $<150 \mu\text{gm/L}$ and 9 subjects with $>15 \mu\text{gm/L}$. There were 13 subjects with HbA1c level $>6.1\%$ with serum ferritin level $<150 \mu\text{gm/L}$ and 24 with serum ferritin level $>150 \mu\text{gm/L}$. Chang et al¹² had shown that individuals with moderately high serum ferritin level had 1.3 times (95% CI) higher risk for developing hyperglycemia. They also shown that this risk increased to 2.16 times (95% CI) for individuals with severely high serum ferritin level.

We observed that OR of 11.7 in subjects with higher serum ferritin level are in 11.7 times at risk to develop type II DM than those with lower serum ferritin level. Fernandez et al¹³ found in general population that increased body iron store was possibly associated with the occurrence of glucose intolerance, type 2 DM and gestational diabetes. Similar results also were found by other studies which showed that acute phase reactants may be useful for predicting DM; however, these findings were not found in some other studies.^{14,15}

The limitation the study is small sample size.

CONCLUSION

Authors found that there was significant increase in serum ferritin in diabetes mellitus compared to control group. Positive correlation between HbA1c and serum ferritin has also been found.

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