

**ORIGINAL RESEARCH**

# To Determine Serum Ferritin and Lipid Profile in Type 2 Diabetes Mellitus

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**ABSTRACT**

**Background:**The present study was conducted for determining serum Ferritin and Lipid Profile in Type 2 Diabetes Mellitus.**Materials & methods:**A total of 50 type 2 diabetic patients and 50 healthy controls were enrolled. 10 ml of blood sample was withdrawn from all the subjects for evaluation of lipid profile and serum ferritin levels. For evaluation of serum ferritin levels, electrochemiluminescence method was used. Serum lipids were evaluated by standard enzymatic procedures (auto-analyzer). Mean HbA1c levels were evaluated and correlation of serum ferritin and serum lipid profile with HbA1c concentration was done. All the results were evaluated using SPSS software. **Results:**A total of 50 type 2 diabetic subjects and 50 healthy controls were enrolled. While comparing the lipid profile among type 2 diabetic patients and healthy controls, it was seen that serum lipid profile was significantly deranged among type 2 diabetic patients. Mean serum ferritin levels among type 2 diabetic patients and healthy controls was 243.5 ng/mL and 201.7 ng/mL respectively. On comparing the results statistically, significant results were obtained. On carrying out univariate analysis, it was seen that deranged lipid profile and ferritin profile was significantly correlated with HbA1c levels among diabetic patients. **Conclusion:**Serum lipid profile and serum ferritin levels are severely deranged among diabetic patients.

**Key words:** Ferritin, Lipid, Diabetes mellitus

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**INTRODUCTION**

Type 2 Diabetes Mellitus (T2DM) is one of the most common metabolic disorders worldwide and its development is primarily caused by a combination of two main factors: defective insulin secretion by pancreatic  $\beta$ -cells and the inability of insulin-sensitive tissues to respond to insulin.<sup>1, 2</sup> Patients with diabetes mellitus most commonly present with increased thirst, increased urination, lack of energy and fatigue, bacterial and fungal infections, and delayed wound healing. Some patients can also complain of numbness or tingling in their hands or feet or with blurred vision.<sup>3</sup> Insulin allows cells to absorb sugar from the blood, for instance in the liver and muscle tissue. If insulin stops having this effect, the body can no longer use the sugar in the blood properly. This leads to an increase in the amount of sugar in the blood. The medical term for blood sugar levels that are too high is hyperglycemia.<sup>4</sup>

Iron is essential for fundamental metabolic processes in cells and organisms. It circulates in plasma bound to the glycoprotein transferrin, and iron metabolism is balanced by a regulatory system, which functions systemically and relies on the hormone hepcidin (HAMP). As the central regulatory molecule of systemic iron homeostasis, HAMP was found to

decline in diabetic patients with hyperferritinemia, suggesting that HAMP plays a potential role in iron overload in T2DM.<sup>5, 6</sup>

Lipid abnormalities in patients with diabetes, often termed “diabetic dyslipidemia”, are typically characterized by high total cholesterol (T-Chol), high triglycerides (Tg), low high density lipoprotein cholesterol (HDL-C) and increased levels of small dense LDL particles. Low density lipoprotein cholesterol (LDL-C) levels may be moderately increased or normal. Lipid abnormalities are common in people with T2DM and prediabetes but the pattern of the different lipids may vary between ethnic groups, economic levels, and access to health care.<sup>6- 8</sup> Hence; the present study was conducted for determining serum Ferritin and Lipid Profile in Type 2 Diabetes Mellitus.

**MATERIALS & METHODS**

The present study was conducted for determining serum Ferritin and Lipid Profile in Type 2 Diabetes Mellitus. A total of 50 type 2 diabetic patients and 50 healthy controls were enrolled. Complete demographic and clinical details of all the diabetic patients as well as healthy controls was obtained. All the subjects were instructed for overnight fasting. 10

ml of blood sample was withdrawn from all the subjects for evaluation of lipid profile and serum ferritin levels. For evaluation of serum ferritin levels, electrochemiluminescence method was used. Serum lipids were evaluated by standard enzymatic procedures (auto-analyzer). Mean HbA1c levels were evaluated and correlation of serum ferritin and serum lipid profile with HbA1c concentration was done. All the results were evaluated using SPSS software. Chi-square test, student t test and Pearson's correlation was used for evaluation of level of significance.

## RESULTS

A total of 50 type 2 diabetic subjects and 50 healthy controls were enrolled. Mean age of the diabetic subjects and healthy controls was 43.5 years and 47.9 years respectively. Majority subjects of both the study groups were males. Mean total cholesterol, HDL,

LDL and triglycerides level among type 2 diabetic patients was 218.3 mg/dL, 51.9mg/dL, 119.2mg/dL and 236.0mg/dL respectively. Mean total cholesterol, HDL, LDL and triglycerides level among healthy controls was 172.9 mg/dL, 63.7mg/dL, 98.5mg/dL and 53.5mg/dL respectively. While comparing the lipid profile among type 2 diabetic patients and healthy controls, it was seen that serum lipid profile was significantly deranged among type 2 diabetic patients. Mean serum ferritin levels among type 2 diabetic patients and healthy controls was 243.5 ng/mL and 201.7 ng/mL respectively. On comparing the results statistically, significant results were obtained. On carrying out univariate analysis, it was seen that deranged lipid profile and ferritin profile was significantly correlated with HbA1c levels among diabetic patients.

**Table 1: Comparison of lipid profile among diabetic patients and healthy controls**

Lipid profile	Type 2 diabetic group	Control group	p-value
Total cholesterol (mg/dL)	218.3	172.9	0.001*
High density lipoprotein (mg/dL)	51.9	63.7	0.021*
Low density lipoprotein (mg/dL)	119.2	98.5	0.007*
Triglycerides (mg/dL)	236.0	53.5	0.039*

\*: Significant

**Table 2: Comparison of serum ferritin levels among diabetic patients and healthy controls**

Serum ferritin levels	Type 2 diabetic group	Control group	p-value
Mean (ng/mL)	243.5	201.7	0.000*
SD	39.4	23.8	

\*: Significant

**Table 3: Correlation of lipid profile and serum ferritin levels with HbA1c**

Variable	Pearson's correlation	p-value
Total cholesterol (mg/dL)	-1.245	0.001*
High density lipoprotein (mg/dL)	-2.881	0.003*
Low density lipoprotein (mg/dL)	-1.933	0.003*
Triglycerides (mg/dL)	-1.872	0.000*
Serum ferritin (ng/mL)	-2.652	0.004*

\*: Significant

## DISCUSSION

In type 2 diabetes mellitus, there is an inadequate production of insulin or the insulin produced does not meet its purpose of introducing glucose into the cells, thus depriving them of energy. This condition is called "insulin resistance" because while there is insulin, it cannot introduce glucose into the cells and thus there is an accumulation of glucose in the blood. This is also the main disorder that occurs in the early stages of type 2 diabetes.<sup>9, 10</sup>Type-2 diabetes carries significant morbidity and is the leading cause of kidney failure, lower-limb amputations, and new cases of adult blindness. Moreover, it is the seventh leading cause of death in the U.S., primarily as a result of cardiovascular morbidity. In terms of financial burden, total direct and indirect costs of the disease are projected to reach \$336 billion annually.

Despite the significant morbidity and mortality associated with this disease, treatment failure (i.e., not achieving goal HbA1c) is common, with one study reporting a failure rate of 63%.<sup>10, 11</sup>Lipid abnormalities are prevalent in DM patients because of IR which affects key enzymes and pathways in lipid metabolism: Apo protein production, regulation of lipoprotein lipase, action of cholesterol ester transfer proteins and hepatic and peripheral actions of insulin.<sup>12</sup>

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. Ferritin is a complex globular protein that stores iron as soluble and non-toxic component. In oxidative stress, Fe<sup>2+</sup> enters to

cells and then changes to Fe<sup>3+</sup>, linked to ferritin and then protect cells from oxidative stress. It has been suggested that disturbance of iron metabolism could cause insulin resistance, hyperinsulinemia, dyslipidemia, HTN and central obesity.<sup>13, 14</sup> Hence; the present study was conducted for determining serum Ferritin and Lipid Profile in Type 2 Diabetes Mellitus. A total of 50 type 2 diabetic subjects and 50 healthy controls were enrolled. Mean serum ferritin levels among type 2 diabetic patients and healthy controls was 243.5 ng/mL and 201.7 ng/mL respectively. On comparing the results statistically, significant results were obtained. Our results were in concordance with the results obtained by previous authors who also reported similar findings. In a study conducted by Zhang R et al, the mean serum ferritin level of T2DM participants was significantly higher than that of the control group (227 vs 203.5 ng/mL).<sup>15</sup> Kim NH et al, in another previous study, evaluated fifty type 2 diabetic patients who were selected according to NDDG/WHO criteria from those patients attending Korea University Hospital from 1997 to 1998. Twenty-five healthy non-diabetic subjects of comparable age and sex distribution acted as a control group. The results showed that the value of log ferritin was higher in the type 2 diabetes patients than the control subjects. In a stepwise multiple regression analysis, the diabetic group showed a significant correlation between fasting C-peptide and log ferritin.<sup>16</sup>

In the present study, mean total cholesterol, HDL, LDL and triglycerides level among type 2 diabetic patients was 218.3 mg/dL, 51.9mg/dL, 119.2mg/dL and 236.0mg/dL respectively. Mean total cholesterol, HDL, LDL and triglycerides level among healthy controls was 172.9 mg/dL, 63.7mg/dL, 98.5mg/dL and 53.5mg/dL respectively. While comparing the lipid profile among type 2 diabetic patients and healthy controls, it was seen that serum lipid profile was significantly deranged among type 2 diabetic patients. Our results were in concordance with the results obtained by previous authors who also reported similar findings. In a similar study conducted by Bhowmik, B et al, authors investigated serum lipids (separately or in combination) and their association with glucose intolerance status (T2DM and prediabetes). A sample of 2293 adults (≥20 years) were included in a community based cross-sectional survey. High Tg levels were seen in 26% to 64% of the participants, depending on glucose tolerance status. Low HDL-C levels were seen in all groups (>90%). Significant linear trends were observed for high T-Chol, high Tg and low HDL-C with increasing glucose intolerance. T2DM was significantly associated with high T-Chol, high Tg and low HDL-C. Prediabetes showed a significant association with high Tg and low HDL-C.<sup>16</sup>

In the present study, on carrying out univariate analysis, it was seen that deranged lipid profile and ferritin profile was significantly correlated with

HbA1c levels among diabetic patients.<sup>15</sup> In a study conducted by Zhang R et al, Serum ferritin level was an independent risk factor for T2DM.<sup>15</sup> In another previous study conducted by Yu et al, authors evaluated the relationship between serum ferritin and blood lipids and the influence of diabetes and different hs-CRP levels. A total of 8163 subjects were analyzed. Participants were classified according to serum ferritin, diabetes, and two hs-CRP levels. Blood lipids were determined using standardized methods and conditions. Except for HDL-C, there was a significant increase in blood lipids in the progressive ferritin group with normal hs-CRP levels. But HDL-C was just the opposite. In nondiabetic patients, TG, TC, and LDL-C were significantly elevated in the progressive ferritin group (P < 0.05). And, HDL-C was just the opposite. The generalized linear model and the parsimonious model showed that serum TG was positively correlated with ferritin, and LDL-C was negatively correlated with ferritin. But the correlation between LDL-C and ferritin was broken. After a sufficient adjustment, there was a positive correlation between serum TG and ferritin and a negative correlation between LDL-C and ferritin.<sup>18</sup>

## CONCLUSION

Serum lipid profile and serum ferritin levels are severely deranged among diabetic patients.

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