

## Original Research

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

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Received: 22 November, 2023

Accepted: 22 December, 2023

### Abstract

**Background:** The objective of the current study was to assess serum ferritin and lipid profiles in individuals diagnosed with Type 2 Diabetes Mellitus.

**Materials & methods:** The research included 30 participants with Type 2 diabetes and 30 healthy controls, with thorough documentation of demographic and clinical details for all subjects. Serum ferritin levels were assessed using the electrochemiluminescence method, while serum lipid profiles were determined through standard enzymatic procedures using an auto-analyzer. All the results were evaluated using SPSS software.

**Results:** The study enrolled a total of 30 individuals with Type 2 diabetes and 30 healthy controls. The mean age for diabetic subjects was 40.2 years, and for healthy controls, it was 46.5 years. The mean serum ferritin levels for Type 2 diabetic patients and healthy controls were 245.6 ng/mL and 203.2 ng/mL, respectively, with statistically significant differences. Univariate analysis demonstrated a significant correlation between deranged lipid profiles, ferritin levels, and HbA1c levels among diabetic patients.

**Conclusion:** Diabetic patients' exhibit pronounced abnormalities in both serum lipid profiles and serum ferritin levels.

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

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### Introduction

Type 2 Diabetes Mellitus (T2DM) stands out as one of the most prevalent metabolic disorders globally, primarily stemming from a dual interplay of factors: compromised insulin secretion by pancreatic  $\beta$ -cells and the diminished responsiveness of insulin-sensitive tissues. Individuals grappling with diabetes commonly manifest symptoms such as heightened thirst, increased frequency of urination, fatigue, susceptibility to bacterial and fungal infections, and impaired wound healing.<sup>1,2</sup> Additionally, some patients report sensations of numbness or tingling in their extremities and blurred vision. In functional terms, insulin serves as the facilitator for cells to uptake sugar from the bloodstream, particularly in the liver and muscle tissue.<sup>3</sup> When insulin's effectiveness diminishes, the body encounters challenges in utilizing blood sugar efficiently, resulting in elevated blood sugar levels, clinically termed hyperglycemia. Iron stands as a crucial element for fundamental cellular and organismal metabolic processes. It traverses the bloodstream,

intricately bound to the glycoprotein transferrin. Maintaining a delicate balance in iron metabolism is governed by a systemic regulatory system, with a pivotal role played by the hormone hepcidin (HAMP). Notably, in individuals with Type 2 Diabetes Mellitus (T2DM) exhibiting elevated ferritin levels, a decline in HAMP has been observed. This intriguing finding suggests that HAMP may wield influence in the context of iron overload within the realm of T2DM.<sup>4,5</sup>

### Materials & methods

This study aimed to investigate serum ferritin and lipid profiles in individuals with Type 2 Diabetes Mellitus. The research included 30 participants with Type 2 diabetes and 30 healthy controls, with thorough documentation of demographic and clinical details for all subjects. To standardize conditions, participants were instructed to undergo overnight fasting before blood sample collection. Serum ferritin levels were assessed using the electrochemiluminescence method, while serum lipid profiles were determined through

standard enzymatic procedures using an auto-analyzer. Mean HbA1c levels were also measured, and the study explored correlations between serum ferritin, lipid profiles, and HbA1c concentrations. Statistical analysis was performed using SPSS software, employing Chi-square tests, student t-tests, and Pearson's correlation to determine the significance levels of the results. This comprehensive approach enhances our understanding of the interplay between serum ferritin, lipid metabolism, and glycemic control in Type 2 Diabetes Mellitus.

## Results

The study enrolled a total of 30 individuals with Type 2 diabetes and 30 healthy controls. The mean age for diabetic subjects was 40.2 years, and for healthy controls, it was 46.5 years. The majority of participants in both groups were male. Among Type 2 diabetic patients, the mean levels of total cholesterol, HDL,

LDL, and triglycerides were 214.8 mg/dL, 55.4 mg/dL, 117.6 mg/dL, and 232.7 mg/dL, respectively. In healthy controls, these values were 169.3 mg/dL, 65.2 mg/dL, 97.2 mg/dL, and 55.6 mg/dL, respectively. A comparative analysis revealed a significant disturbance in the lipid profile among Type 2 diabetic patients compared to healthy controls. The mean serum ferritin levels for Type 2 diabetic patients and healthy controls were 245.6 ng/mL and 203.2 ng/mL, respectively, with statistically significant differences. Univariate analysis demonstrated a significant correlation between deranged lipid profiles, ferritin levels, and HbA1c levels among diabetic patients. These findings contribute to our understanding of the interconnectedness of lipid metabolism, serum ferritin, and glycemic control in individuals with Type 2 Diabetes Mellitus.

**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)	214.8	169.3	0.005*
High density lipoprotein (mg/dL)	55.4	65.2	0.019*
Low density lipoprotein (mg/dL)	117.6	97.2	0.009*
Triglycerides (mg/dL)	232.7	55.6	0.035*

\*: Significant

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

Serum ferritin levels	Type 2 diabetic group	Control group
Mean (ng/mL)	245.6	203.2
SD	37.9	26.9

\*: Significant

## Discussion

In Type 2 Diabetes Mellitus, there is a deficiency in insulin production or an inability of the produced insulin to effectively facilitate the entry of glucose into cells, resulting in an energy deprivation for the cells. This condition, termed "insulin resistance," signifies that although insulin is present, it fails to introduce glucose into cells, leading to an accumulation of glucose in the bloodstream. Insulin resistance is a primary disorder in the early stages of Type 2 diabetes.<sup>6</sup>Type 2 diabetes is associated with significant morbidity, being a major contributor to kidney failure, lower-limb amputations, and incidents of adult blindness.<sup>7</sup> Additionally, it stands as the leading cause of mortality in the U.S., predominantly due to cardiovascular complications. Lipid abnormalities are prevalent in individuals with diabetes due to insulin resistance, which adversely affects crucial enzymes and pathways in lipid metabolism. This includes disturbances in Apo protein production, the regulation of lipoprotein lipase, the functioning of cholesterol ester transfer proteins, and the actions of insulin in both the

liver and peripheral tissues.<sup>8</sup> Acute phase reactants encompass proteins that react to acute stressors such as infection, trauma, surgery, and tissue necrosis. Among these agents are alpha-acid glycoprotein, haptoglobin, fibrinogen, C-reactive protein (CRP), and ferritin. Ferritin, a complex globular protein, serves as a storage unit for iron, storing it in a soluble and non-toxic form. During oxidative stress, Fe<sup>2+</sup> enters cells, transforms into Fe<sup>3+</sup>, binds to ferritin, and subsequently shields cells from oxidative damage. This protective mechanism is crucial in mitigating the effects of oxidative stress.<sup>9</sup>

There is a growing understanding that disruptions in iron metabolism may contribute to various metabolic disturbances, including insulin resistance, hyperinsulinemia, dyslipidemia, hypertension, and central obesity. In light of these considerations, the current study was undertaken to assess both serum ferritin and lipid profiles in individuals with Type 2 Diabetes Mellitus. This investigation aims to shed light on the intricate relationship between iron metabolism, lipid abnormalities, and metabolic dysfunction in Type

2 diabetes.<sup>10,11</sup>The mean serum ferritin levels for Type 2 diabetic patients and healthy controls were 245.6 ng/mL and 203.2 ng/mL, respectively, with statistically significant differences. In a study led by Zhang R et al, it was observed that the average serum ferritin level in participants with Type 2 Diabetes Mellitus (T2DM) was notably higher than that in the control group.<sup>12,15</sup>

In the present study, the mean levels of total cholesterol, HDL, LDL, and triglycerides were 214.8 mg/dL, 55.4 mg/dL, 117.6 mg/dL, and 232.7 mg/dL, respectively. In healthy controls, these values were 169.3 mg/dL, 65.2 mg/dL, 97.2 mg/dL, and 55.6 mg/dL, respectively. When comparing the lipid profiles of individuals with Type 2 Diabetes Mellitus (T2DM) and healthy controls, our study revealed a significant disturbance in the serum lipid profiles among those with Type 2 diabetes. These findings align with the results obtained by previous researchers who reported similar observations. For instance, in a study conducted by Bhowmik, B et al,<sup>17</sup> the authors explored serum lipids and their association with glucose intolerance status, encompassing both Type 2 diabetes and prediabetes. Their community-based cross-sectional survey included 2293 adults, revealing high triglyceride levels in majority of participants, varying based on glucose tolerance status. Low high-density lipoprotein cholesterol (HDL-C) levels were prevalent in all groups, exceeding 90%. The study identified significant linear trends for high total cholesterol (T-Chol), high Tg, and low HDL-C with increasing glucose intolerance. Type 2 diabetes was notably associated with elevated T-Chol, high Tg, and low HDL-C, while prediabetes exhibited a significant association with high Tg and low HDL-C.<sup>13</sup> These collective findings emphasize the consistency of lipid abnormalities in individuals with diabetes and underscore the importance of understanding and managing lipid profiles in the context of glucose intolerance.

In the current study, upon conducting univariate analysis, a significant correlation was observed between deranged lipid profiles and ferritin levels with HbA1c levels among individuals with diabetes. This finding underscores the interconnection between glycemic control, lipid abnormalities, and iron metabolism in diabetic patients.<sup>14,15</sup> In a study led by Zhang R et al, serum ferritin levels were identified as an independent risk factor for Type 2 Diabetes Mellitus (T2DM). This aligns with our study's observation and emphasizes the potential role of ferritin in the pathogenesis of diabetes.<sup>15</sup>These collective findings emphasize the intricate relationships between ferritin, lipid metabolism, and diabetes, shedding light on potential pathways for further exploration and intervention.

## Conclusion

Diabetic patients exhibit pronounced abnormalities in both serum lipid profiles and serum ferritin levels.

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