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STUDY OF SERUM FERRITIN IN METABOLIC SYNDROME

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Conflicts of Interest: Nil

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ABSTRACT

Serum ferritin, a marker of iron stores and inflammation, has been linked to metabolic syndrome (MetS), a cluster of conditions including abdominal obesity, dyslipidemia, hypertension, and insulin resistance. Elevated serum ferritin levels have been associated with the pro-inflammatory state of MetS, suggesting its potential role as a biomarker for metabolic risk. This study evaluates serum ferritin levels in patients with MetS and investigates its correlation with individual components of MetS. Findings highlight the relevance of ferritin in understanding MetS pathogenesis and its utility in risk assessment.

Keywords: Serum ferritin, metabolic syndrome, inflammation, insulin resistance, biomarkers

INTRODUCTION

Metabolic syndrome (MetS) is a global health concern characterized by a combination of metabolic abnormalities, including central obesity, hyperglycemia, dyslipidemia, and hypertension. These factors collectively increase the risk of cardiovascular disease (CVD) and type 2 diabetes mellitus (T2DM) (1,2). The International Diabetes Federation (IDF) and the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) provide widely used diagnostic criteria for MetS (3).

Inflammation plays a critical role in MetS pathogenesis. Among inflammatory markers, serum ferritin, an acute-phase reactant and a marker of iron stores, has gained attention due to its association with MetS components (4,5). Elevated ferritin levels are linked to insulin resistance, oxidative stress, and chronic low-grade inflammation, all of which contribute to MetS development (6,7). Studies indicate that ferritin may not only reflect iron overload but also serve as a biomarker for metabolic dysfunction (8).

This study examines the relationship between serum ferritin and MetS, focusing on its association with individual MetS components and its potential as a risk marker. Understanding this relationship could aid in early identification and management of MetS-related complications.

Aim

To evaluate serum ferritin levels in patients with metabolic syndrome and its correlation with individual metabolic syndrome components.

Objectives

1. To determine serum ferritin levels in patients with and without metabolic syndrome.
2. To analyze the relationship between serum ferritin and individual metabolic syndrome components.

Materials and Methods

This cross-sectional study included 200 participants aged 30–60 years, recruited from

outpatient clinics. Patients were categorized into two groups: 100 with MetS (based on NCEP ATP III criteria) and 100 without MetS (control group). Serum ferritin levels were measured using chemiluminescent immunoassay. MetS components, including waist circumference, fasting blood glucose, triglycerides, HDL cholesterol, and blood pressure, were recorded.

Inclusion criteria:

- Adults aged 30–60 years
- Diagnosed with or without MetS

Exclusion criteria:

- Known inflammatory or infectious diseases
- Chronic liver or kidney diseases
- Recent blood transfusion or iron supplementation

Statistical analysis was performed to compare ferritin levels between groups and correlate them with MetS components.

Results

Table 1: Baseline Characteristics of Study Groups

Parameter	MetS Group (n=100)	Control Group (n=100)
Age (years)	48 ± 8	45 ± 7
Male (%)	55%	50%
BMI (kg/m²)	30 ± 4	24 ± 3
Waist circumference (cm)	102 ± 8	88 ± 7
Fasting glucose (mg/dL)	120 ± 15	90 ± 10
Triglycerides (mg/dL)	180 ± 20	110 ± 15
HDL cholesterol (mg/dL)	35 ± 5	50 ± 6
Serum ferritin (ng/mL)	200 ± 50	110 ± 30

Table 2: Correlation Between Serum Ferritin and MetS Components in MetS Group

MetS Component	Correlation Coefficient (r)	P-Value
Waist circumference	0.62	<0.001
Fasting glucose	0.58	<0.001
Triglycerides	0.54	<0.001
HDL cholesterol (inverse)	-0.48	<0.001
Systolic blood pressure	0.45	<0.01

Serum ferritin levels were significantly higher in the MetS group than in controls ($p < 0.001$). Positive correlations were observed between ferritin levels and waist circumference, fasting glucose, triglycerides, and blood pressure, while an inverse correlation was found with HDL cholesterol.

Discussion

This study demonstrates that serum ferritin levels are significantly elevated in individuals with MetS compared to controls, consistent with previous findings (4,9). Ferritin's role as an acute-phase reactant suggests its association with the pro-inflammatory state observed in MetS. Chronic low-grade inflammation and oxidative stress contribute to insulin resistance, further linking ferritin to MetS pathogenesis (5,6).

The positive correlation between ferritin and waist circumference underscores the association between visceral adiposity and inflammation. Adipose tissue releases pro-inflammatory cytokines such as IL-6 and TNF-α, which may upregulate ferritin expression (7,10). Similarly, the correlation with fasting glucose and triglycerides reflects ferritin's role in metabolic dysfunction and insulin resistance (11).

Inverse correlation with HDL cholesterol aligns with its anti-inflammatory properties and protective role against MetS. Elevated ferritin may impair cholesterol metabolism, contributing to dyslipidemia (12). Furthermore, increased ferritin levels are associated with

oxidative stress, which exacerbates metabolic derangements in MetS (8).

The findings support serum ferritin as a potential biomarker for identifying individuals at risk of MetS and its complications. However, confounding factors such as iron metabolism disorders and acute infections must be excluded to ensure diagnostic accuracy.

Future research should explore longitudinal associations and the impact of ferritin-lowering interventions on MetS outcomes.

Conclusion

Serum ferritin levels are significantly elevated in patients with metabolic syndrome, correlating positively with its components. These findings suggest that ferritin serves as both an inflammatory marker and a potential biomarker for metabolic dysfunction. Incorporating serum ferritin measurement in routine assessments could aid in early identification and management of metabolic syndrome. Further studies are warranted to validate its clinical utility and explore therapeutic implications.

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