|| ISSN(online): 2589-8698 || ISSN(print): 2589-868X ||
International Journal of Medical and Biomedical Studies
Available Online at www.ijmbs.info
NLM (National Library of Medicine ID: 101738825)
Index Copernicus Value 2020: 79.44
Original Research Article
Volume 5, Issue 1; January: 2021; Page No. 427-430

Study of Serum Ferritin in Metabolic Syndrome

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Article Info: Received 18 December 2020; Accepted 22 January 2021
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Conflict of interest: No conflict of interest.

Abstract

Background: Metabolic syndrome (MetS) is a cluster of risk factors that increase the likelihood of developing cardiovascular disease and type 2 diabetes. The syndrome includes abdominal obesity, hypertension, hyperglycemia, and dyslipidemia. Recent studies have suggested that inflammation plays a significant role in the development of metabolic syndrome. Serum ferritin, an acute-phase reactant, has been proposed as a marker of inflammation and is thought to be elevated in individuals with metabolic syndrome.

Objective: To study the serum ferritin levels in individuals with metabolic syndrome and its association with the components of the syndrome.

Methods: A total of 100 individuals (50 with metabolic syndrome and 50 age and sex-matched controls without metabolic syndrome) were enrolled. Serum ferritin levels were measured using an immunoassay. The participants were assessed for MetS components, including waist circumference, blood pressure, fasting blood glucose, triglycerides, and HDL cholesterol levels. Statistical analysis was performed to examine the relationship between serum ferritin and MetS components.

Results: The mean serum ferritin levels were significantly higher in individuals with metabolic syndrome compared to the control group. Serum ferritin levels correlated positively with waist circumference, triglyceride levels, and fasting blood glucose levels. No significant correlation was found between serum ferritin and HDL cholesterol levels.

Conclusion: Elevated serum ferritin levels may be associated with the presence of metabolic syndrome. Ferritin could potentially serve as a useful biomarker for assessing the risk of metabolic syndrome, though further studies are needed to explore its exact role in the pathophysiology of the syndrome.

Keywords: Metabolic syndrome, serum ferritin, inflammation, cardiovascular disease, dyslipidemia, obesity.

Introduction

Metabolic syndrome (MetS) is a cluster of interrelated metabolic risk factors that increase the risk of cardiovascular disease, type 2 diabetes, and other health complications. The components of MetS include abdominal obesity, hypertension, elevated fasting glucose, elevated triglycerides, and low levels of high-density lipoprotein (HDL) cholesterol (1). With the rising prevalence of obesity and sedentary lifestyles, MetS has become a global public health concern.

Inflammation is widely recognized as a key factor in the development and progression of metabolic syndrome. Many studies have shown that individuals with MetS have elevated levels of pro-inflammatory markers such as C-reactive protein (CRP) and interleukins (2). Among various biomarkers of inflammation, serum ferritin has gained attention in recent years. Ferritin, an iron-binding protein, is not only a marker of iron status but also an acute-phase reactant that increases during inflammation and oxidative stress (3).

The relationship between ferritin levels and metabolic syndrome is of particular interest, as it may provide insights into the pathophysiology of MetS. Elevated ferritin levels have been observed in individuals with obesity, insulin resistance, and type 2 diabetes, all of which are components of MetS (4). However, the exact role of ferritin in the development of MetS remains unclear, and studies investigating this relationship have yielded mixed results. Some studies suggest that elevated ferritin levels are associated with an increased risk of MetS, while others suggest that ferritin may reflect the inflammatory processes occurring in MetS rather than being a causal factor (5).

This study aims to evaluate the serum ferritin levels in individuals with metabolic syndrome and to explore their association with the individual components of the syndrome, including abdominal obesity, hypertension, hyperglycemia, and dyslipidemia.

Aim and Objectives

Aim:

To study the serum ferritin levels in individuals with metabolic syndrome and determine its association with the components of the syndrome.

Objectives:

1. To compare serum ferritin levels in individuals with metabolic syndrome and healthy controls.
2. To assess the correlation between serum ferritin levels and the individual components of metabolic syndrome (waist circumference, blood pressure, fasting blood glucose, triglycerides, and HDL cholesterol).

Materials and Methods

Study Design:

This case-control study was conducted at a tertiary care hospital. A total of 100 participants were included, with 50 individuals diagnosed with metabolic syndrome and 50 age and sex-matched controls without metabolic syndrome.

Inclusion Criteria:

- Adults aged 30 to 60 years.
- Diagnosis of metabolic syndrome according to the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) criteria.
- Healthy controls with no history of metabolic syndrome or any cardiovascular disease.

Exclusion Criteria:

- Individuals with chronic inflammatory diseases, liver disease, or malignancies.
- Individuals on medications that affect serum ferritin or lipid levels (e.g., iron supplements, statins, etc.).
- Individuals with a history of alcoholism or acute infections.

Data Collection:

Participants underwent a thorough clinical examination, including measurement of waist circumference and blood pressure. Blood samples were collected after a 12-hour fast to measure fasting blood glucose, triglycerides, and HDL cholesterol levels. Serum ferritin levels were measured using a commercially available immunoassay kit.

Statistical Analysis:

Data were analyzed using SPSS version 22. Descriptive statistics were used to summarize the demographic and clinical characteristics of the participants. Comparisons between the two groups (MetS vs. controls) were made using independent t-tests for continuous variables and chi-square tests for categorical variables. Pearson's correlation coefficient was used to assess the association between serum ferritin levels and the components of metabolic syndrome.

Results

Table 1: Demographic and Clinical Characteristics of Participants

Characteristic	Metabolic Syndrome Group (n=50)	Control Group (n=50)
Age (mean ± SD)	45.6 ± 7.4	46.2 ± 7.1
Male (%)	56%	54%
Waist Circumference (cm)	102.5 ± 12.3	80.1 ± 6.8
Systolic BP (mm Hg)	130 ± 14	118 ± 10
Diastolic BP (mm Hg)	85 ± 9	75 ± 8
Fasting Blood Glucose (mg/dL)	110 ± 20	90 ± 15

Table 2: Comparison of Serum Ferritin Levels

Group	Serum Ferritin (ng/mL)
Metabolic Syndrome Group	215 ± 56
Control Group	130 ± 39

Description:

The MetS group had significantly higher serum ferritin levels (215 ± 56 ng/mL) compared to the control group (130 ± 39 ng/mL), with a p-value < 0.01. Additionally, serum ferritin levels correlated positively with waist circumference (r = 0.52), triglycerides (r = 0.47), and fasting blood glucose (r = 0.43), indicating a potential association between ferritin and these components of MetS.

Discussion

Metabolic syndrome is a complex condition that involves multiple metabolic abnormalities, including obesity, hypertension, dyslipidemia, and insulin resistance. Inflammatory markers such as C-reactive protein (CRP) have been shown to be elevated in individuals with MetS, suggesting that inflammation plays a crucial role in the pathophysiology of the syndrome (6). Serum ferritin, an acute-phase reactant, has been proposed as a potential biomarker for inflammation, and its levels are often elevated in individuals with conditions that involve chronic low-grade inflammation, such as obesity and metabolic syndrome (7).

Our study found significantly higher serum ferritin levels in individuals with metabolic syndrome compared to healthy controls, which is consistent with previous studies (8, 9). The correlation between ferritin and waist circumference, triglycerides, and fasting blood glucose suggests that ferritin may be linked to key components of MetS, such as obesity and insulin resistance. These findings support the hypothesis that ferritin could serve as a useful biomarker for monitoring inflammation in MetS.

However, the exact role of ferritin in the pathogenesis of metabolic syndrome remains unclear. Elevated ferritin could reflect the inflammatory state associated with MetS, but it may also have a direct role in the development of insulin resistance and other metabolic abnormalities. Further research is needed to explore the mechanistic relationship between ferritin and metabolic syndrome and to determine whether ferritin can serve as a reliable predictor of MetS-related complications.

Conclusion

This study indicates that serum ferritin levels are significantly elevated in individuals with metabolic syndrome compared to healthy controls. The positive correlation between ferritin levels and key components of MetS suggests that ferritin may play a role in the inflammatory processes associated with the syndrome. Further studies are warranted to investigate the potential of ferritin as a biomarker for early detection and management of metabolic syndrome.

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