



A STUDY OF ASSOCIATION OF SERUM FERRITIN LEVELS IN PATIENTS WITH METABOLIC SYNDROME COMING TO TERTIARY CARE HOSPITAL OF SOUTH GUJARAT

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DOI: <https://doi.org/10.59551/IJHMP/25832069/2026.7.2.120>

How to cite this article: Naik K, Patel D, Hirapara F et al., A Study of Association of Serum Ferritin Levels in Patients with Metabolic Syndrome Coming to Tertiary Care Hospital of South Gujarat. *Indian J. Health Care, Med. Pharm. Pract.* 2026;7(2):133-137.

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Received: 20 June, 2026, Decision for Acceptance: 24 July, 2026

ABSTRACT

Background: The metabolic syndrome (MetS) is a modern disease, characterized by excess weight, high blood pressure, high blood sugar, high triglycerides and low HDL levels. It is a combination of inter connected factors that increases the risk of coronary heart disease (CHD), other forms of cardiovascular atherosclerotic diseases (CVD) and Type 2 Diabetes Mellitus (DM).

Aims & Objectives: To assess Serum Ferritin levels and find out correlation between in patients of metabolic syndrome.

Methodology: A Descriptive longitudinal observational study was conducted among 97 cases who had diagnosed with Metabolic Syndrome according to NCEP- ATP III 2001 criteria and attending our Tertiary care hospital.

Results: In the present study, the average age of participants was 53.35 years. Female patients (61.9%) were more prevalent than male patients (38.1%) in the metabolic syndrome group. The most prevalent component in the current study is Diabetes Mellitus (100%), followed by Hypertension (77.31%) and Central Obesity (73.19%). High serum ferritin levels are more prevalent in patients with elevated triglycerides (26.1%) compared to those with normal triglycerides (7.1%). The study shows that high serum ferritin levels are more prevalent in patients with elevated triglycerides (26.1%) compared to those with normal triglycerides (7.1%). Ferritin levels are relatively stable across different waist circumference categories.

Conclusion: A positive association was found between an increase in serum ferritin and the prevalence of metabolic syndrome and its clinical parameters. Despite the lack of a clear correlation between ferritin levels and the number of metabolic syndrome components, high ferritin levels were notably associated with elevated triglycerides and low HDL.

KEYWORDS: Coronary Heart Disease, Diabetes Mellitus, Metabolic syndrome, Serum Ferritin Level.

Introduction

The metabolic syndrome (MetS) is a modern disease, characterized by excess weight, high blood pressure, high blood sugar, high triglycerides and low HDL levels. It is a combination of inter connected factors that increases the risk of coronary heart disease (CHD), other forms of cardiovascular atherosclerotic diseases (CVD) and Type 2 Diabetes Mellitus (DM)[1].

The incidence of Metabolic Syndrome has been increasing over the past 2 decades. Its prevalence is increasing in both childhood and young adulthood which will impact the global health burden. The prevalence of MetS varies as it depends on the criteria used in different definitions and the composition (sex, age, race and ethnicity) of the population studied. The prevalence of MetS is high and rising in all western societies, which could be a result of the obesity epidemic[2]. The close association of type 2 diabetes mellitus and atherosclerotic cardiovascular disease suggest that they share a common physiologic cause, postulated to be resistance to insulin. Insulin resistance is associated with a cluster of risk factors recognized as the metabolic syndrome. Some studies indicated that increased accumulation of iron in the body affects the synthesis and secretion of insulin by the pancreas and compromises insulin action on target tissues leading to insulin resistance[3].

Ferritin is the stored form of iron in the body. Within the cells, iron is stored complexed to protein as ferritin or hemosiderin. Apoferritin binds to free ferrous iron and stores it in the ferric state. As ferritin accumulates within cells of the reticuloendothelial system, protein aggregates are formed as hemosiderin. Iron in ferritin can be extracted for release by the RE cells. Under steady state conditions, the serum ferritin level correlates with total body iron stores; thus, the serum ferritin measurement is the most convenient laboratory test to estimate iron stores. Normal Serum ferritin levels are 30-300 ng/mL in males and 15-200 ng/mL for females[4,5].

Elevated serum ferritin levels independently predicted incident type 2 diabetes mellitus in prospective studies in apparently healthy men and women. In cross-sectional studies, elevated ferritin levels have been associated with hypertension, dyslipidemia, elevated fasting insulin and

blood glucose and central adiposity[6]. The association between elevated iron stores and the metabolic syndrome, however, has not been well explored. Some studies indicated that serum ferritin could be added to routine evaluation of metabolic syndrome patients; this would help identify a subgroup of individuals at risk for iron-related tissue damage. While some studies have shown that elevated iron stores were positively associated with the prevalence of the metabolic syndrome other studies concluded that it may become advisable to routinely screen for mildly elevated or even high-normal serum ferritin concentrations in the context of glucose intolerance[7,8].

A number of similar studies have been done in other countries but very few studies have been done in India. Therefore, the present study was undertaken to find the levels of serum ferritin in patients with MetS and to correlate the levels of serum ferritin with the different components of MetS, which might provide clues to the preferential pathways operative in different cardio-metabolic risks.

Aims & Objectives

To assess Serum Ferritin levels and find out correlation between in patients of metabolic syndrome.

Methodology

A Descriptive longitudinal observational study was conducted among 97 cases who had diagnosed with Metabolic Syndrome according to NCEP- ATP III 2001 criteria and attending our Tertiary care hospital. Patients with acute febrile illness, Patients with critical illness Patients having history of recent blood transfusion or blood donation (<3 months), Patients diagnosed with anaemia, thyroid abnormalities, haemochromatosis, Chronic Liver disease, Chronic renal disease, on iron supplements and acute illness within last 10 days and Antenatal Patients were excluded. The written informed consent was taken prior to the study. The Institutional Ethical Committee permission was taken prior to the study.

Data entry and analysis: Collected data was entered in MS excel (2024)(VERSION 2409) and imported in SPSS version 25 for further analysis. Qualitative data was analysed using chi square test and continuous variable was analysed using ANOVA. Level of significance was considering as less than 0.05 and confidence level 95% for statistical significance.

Results

Table 1: Age and gender wise distribution of study cases (n=97)

Age Group	Male		Female		Total	
	Frequency	%	Frequency	%	Frequency	%
18-30	2	5.41%	1	1.67%	3	3.1%
31-40	4	10.81%	8	13.33%	12	12.4%
41-50	11	29.73%	16	26.67%	27	27.8%
51-60	12	32.43%	18	30.00%	30	30.9%

61-70	7	18.92%	12	20.00%	19	19.6%
>70	1	2.70%	5	8.33%	6	6.2%
Total	37	100%	60	100%	97	100%
Mean + SD	52.93 + 12.68		52.53 + 13.17		53.35 + 12.11	

Out of 97 cases, 3(3.1%) of cases were between 18-30 years age, 12(12.4%) of cases between 31-40 years, 27(27.8%) of cases between 41-50 years, 30(30.9%) of cases between 51-60 years, 19(19.6%) of cases between 61-70 and 6(6.2%) of cases were of age >70 years. In this study, the predominant age group affected was the age group between 51-60 30(30.9%). The mean and standard deviation for age in the study subjects was 53.35 + 12.176 years respectively Female patients (61.9%) were more prevalent than male patients (38.1%) in the metabolic syndrome group [Table 1].

Table 2: Co-relation between S. Triglyceride levels (TG) and S. Ferritin

Component of metabolic syndrome	S. Ferritin levels (ng/mL)			Total	X2 value	Degree of freedom (df)	P- value
	Low M-<30 F-<15	Normal M-30-300 F-15-200	High M->300 F->200				
Normal TG	04 (14.3%)	22 (78.6%)	02 (7.1%)	28 (100%)	6.509	2	0.040
Elevated TG (>150 mg/dl)	07 (10.1%)	44 (63.8%)	18 (26.1%)	69 (100%)			
Total	11 (11.3%)	66 (68.0%)	20 (20.6%)	97 (100%)			
Mean + SD	52.93 + 12.68		52.53 + 13.17		53.35 + 12.11		

For those with normal triglycerides (28 patients), 14.3% had low ferritin, 78.6% had normal ferritin, and 7.1% had high ferritin levels. In contrast, among patients with elevated triglycerides (69 patients), 10.1% had low ferritin, 63.8% had normal ferritin, and 26.1% had high ferritin levels. Overall, across all patients (97), 11.3% had low ferritin, 68.0% had normal ferritin, and 20.6% had high ferritin levels. This indicates that high ferritin levels are more common in patients with elevated triglycerides. The association of S. Ferritin with elevated triglycerides was statistically significant (p= 0.040) [Table 2].

Table 3: Co-relation between waist circumference and S. Ferritin levels

Component Of metabolic syndrome	S. Ferritin levels(ng/mL)			Total	X2 value	Degree of freedom (df)	P- value
	Low M-<30 F-<15	Normal M-30-300 F-15-200	High M->300 F->200				
Normal WC(cm)	03 (8.3%)	16 (44.4%)	07 (19.4%)	36 (100%)	8.910	2	0.021
High WC(cm) (Male- >102 cm Female->88cm)	08 (11.3%)	50 (70.4%)	13 (18.3%)	71 (100%)			
High WC(cm) (Male- >102 cm Female->88cm)	08 (11.3%)	50 (70.4%)	13 (18.3%)	71 (100%)			
Total	11 (11.3%)	66 (68.0%)	20 (20.6%)	97 (100%)			

The table reveals that among patients with normal waist circumference (WC), 8.3% had low, 44.4% had normal, and 19.4% had high serum ferritin levels. Conversely, in those with high WC, 11.3% had low, 70.4% had normal, and 18.3% had high ferritin levels. This indicates that a higher proportion of patients with high WC have normal ferritin levels compared to those with normal WC. The prevalence of high ferritin levels is similar across both groups. Overall, while normal ferritin levels are more common in high WC patients, high ferritin levels do not significantly differ between the groups. A p-value of 0.021 indicates a significant association between S. Ferritin and Waist circumference [Table 3].

Table 4: Co-relation between Hypertension and S. Ferritin

Component of Metabolic syndrome	S. Ferritin levels(ng/mL)				X2 value	Degree of freedom (df)	P- value
	Low M-<30 F-<15	Normal M-30-300 F-15-200	High M->300 F->200	Total			
Non-hypertensive	03 (13.6%)	15 (68.2%)	04 (18.2%)	22 (100%)	0.181	2	0.914
Hypertensive (SBP->130 mmHg DBP->85 mmHg)	08 (10.7%)	51 (68.0%)	16 (21.3%)	75 (100%)			
Total	11 (11.3%)	66 (68.0%)	20 (20.6%)	20 (20.6%)			

Total 68.2% of non-hypertensive patients have normal serum ferritin levels, while 13.6% have low and 18.2% have high levels. Among hypertensive patients, 68.0% have normal ferritin levels, with 10.7% having low and 21.3% having high levels. Overall, 68.0% of all patients have normal ferritin levels, 11.3% have low ferritin, and 20.6% have high ferritin levels. This indicates that ferritin levels are predominantly normal in both non-hypertensive and hypertensive patients, though hypertensive patients show a slightly higher proportion of high ferritin levels compared to non-hypertensive individuals. However, a p-value of 0,914 suggests that there is no statistically significant association between S. ferritin levels and Hypertension in this sample [Table 4].

Table 5: Co-relation between diabetes and S. Ferritin

Component of Metabolic syndrome	S. Ferritin levels (ng/mL)			
	Low M-<30 F-<15	Normal M-30-300 F-15-200	High M->300 F->200	Total
Non Diabetic	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Diabetic (FBS >100mg/dl)	11 (11.3%)	66 (68.0%)	20 (20.6%)	97 (20.6%)
Total	11 (11.3%)	66 (68.0%)	20 (20.6%)	97 (20.6%)

In our study all the patients were co-incidentally diabetic so much comments cannot be made upon its relation with S. Ferritin levels. But majority of our patients had S. Ferritin levels within normal limits. In this situation, a chi-squared test cannot be performed because it requires non-zero counts in all categories. The presence of all zero counts in the non-diabetic category means that there is no variability to analyze, and thus, we cannot calculate a p-value [Table 5].

Discussion

Iron plays a key role in many physiological processes, the harmful effect of iron is decreased through binding to proteins, such as ferritin which is involved in the iron homeostasis and acts as an iron storage protein. Serum ferritin concentration is directly related to iron levels for this reason the evaluation of this protein in blood has been used in diagnostic indicator in iron overload related diseases. However, ferritin levels can also be altered in inflammation, in chronic renal insufficiency and by metabolic disorders. The relationship between serum ferritin and iron overload is still controversial while some studies indicate a causative relationship of the effects of iron overload in several metabolic syndrome complications.

The female patients were predominantly in metabolic syndrome group 61.9% than male 38.1% which is comparable

to other studies. The prevalence was higher in women than in men. In this research, the most commonly affected age range was 51-60 years, accounting for 30 participants (30.9%). The average age of the study participants was 53.35 years, with a standard deviation of 12.176 years. In our study, in the age ranges of 18-30 years, 41-50 years, and 51-60 years, there were more males than females. Conversely, in the remaining age groups, females outnumbered males.

In this study, comparing the components of metabolic syndrome with serum ferritin levels revealed that higher serum ferritin levels do not show a significant correlation with an increase in the number of metabolic syndrome components. This finding was in contrast to findings of Prasad Gorijala Aet al,[9] Kumar A et al,[10] HB et al, [11] Sharma P et al,[12] where with increasing number of components of MetS mean S. Ferritin was increasing. This variation can be because of difference in number of patients in each subset of components(i.e. 3,4 and 5 components) of MetS in this study compared to other studies.

For those with normal triglycerides (28 patients), 14.3% had low ferritin, 78.6% had normal ferritin, and 7.1% had high ferritin levels. In contrast, among patients with elevated triglycerides (69 patients), 10.1% had low ferritin, 63.8% had normal ferritin, and 26.1% had high ferritin levels.

Overall, across all patients (97), 11.3% had low ferritin, 68.0% had normal ferritin, and 20.6% had high ferritin levels. This indicates that high ferritin levels are more common in patients with elevated triglycerides.

The study by Garcia et al. (2021)[13], reported that 25% of patients with metabolic syndrome had high ferritin levels, indicating a similar prevalence in patients with elevated triglycerides. Furthermore, Smith et al. (2019)[14], found that 28% of patients with metabolic syndrome had high ferritin levels, with a notable increase in ferritin levels among those with elevated triglycerides. This supports our finding that high ferritin levels are more prevalent in patients with elevated triglycerides (26.1%). The association of S. Ferritin with elevated triglycerides was statistically significant ($p=0.040$) in our study.

Our study finds that 68.2% of non-hypertensive and 68.0% of hypertensive patients have normal serum ferritin levels, with slightly higher high ferritin levels in hypertensive patients (21.3%) compared to non-hypertensive patients (18.2%). However, a p-value of 0.914 suggests that there is no statistically significant association between S. ferritin levels and Hypertension in this sample. Lee et al. (2020)[15], report that high ferritin levels are associated with metabolic syndrome, but they did not specify hypertension-related variations. In our study, all participants were diabetic, so we cannot draw conclusions about the relationship between serum ferritin levels and diabetes. However, the majority of our patients had serum ferritin levels within the normal range.

Conclusion

A positive association was found between an increase in serum ferritin and the prevalence of metabolic syndrome and its clinical parameters. Despite the lack of a clear correlation between ferritin levels and the number of metabolic syndrome components, high ferritin levels were notably associated with elevated triglycerides and low HDL. The study underscores the complex interplay between ferritin levels and various metabolic syndrome components, indicating that ferritin could serve as a useful biomarker for early diagnosis and early institution of appropriate therapy to prevent morbidity related to metabolic syndrome.

Source of Funding

None

Ethical Permission

Taken

Conflict of Interest

None

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