



CORRELATION BETWEEN SERUM FERRITIN WITH COMPONENTS OF METABOLIC SYNDROME

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ABSTRACT **Background:** Metabolic syndrome is described by WHO as a pathological disorder characterized by abdominal obesity, insulin resistance, hypertension, and hyperlipidemia. It is hypothesized that elevated serum ferritin levels, in the absence of high transferrin saturation, have appeared during the last years as a common characteristic in some patients with metabolic syndrome. **Objectives:** 1. To identify the correlation between serum ferritin and components of metabolic syndrome. **Methodology:** A cross-sectional study was carried out in 102 patients diagnosed with metabolic syndrome as per NCEP (National Cholesterol Education Program) ATP III (Adult Treatment Panel III) (2001) attending the NRI medical college and Hospital during the study period, and their serum ferritin levels were studied to find any significant association exists. **Results:** In the present study, the mean age group of the study population was 57.38 ± 8.05 . Gender distribution shows male 62.7% and female were 37.3. Study showed a significant correlation between serum ferritin and waist circumference ($r=0.33$, p -value <0.05), Total Cholesterol ($r=0.310$; p -value <0.0001), and LDL ($r=0.326$; p value <0.0001). **Conclusion:** A significant correlation was observed between serum ferritin and waist circumference ($r=0.33$, p value <0.05), Total Cholesterol ($r=0.310$, p value <0.0001), and LDL ($r=0.326$; p value <0.0001).

KEYWORDS :

INTRODUCTION

Metabolic syndrome is an accumulation of several conditions that together increase the risk of a person developing a cardiac atherosclerotic disease, insulin resistance and diabetes mellitus, and vascular and neurological complications such as a stroke¹

Metabolic syndrome is described by WHO as a pathological disorder characterized by abdominal obesity, insulin resistance, hypertension, and hyperlipidemia.²

According to CDC data published in 2017, nearly 30.2 million adults aged 18 years or older or 12.2% of adults in the United States had type 2 diabetes (T2DM). T2DM incidence increased with age, reaching a high of 25.2% among U.S. seniors (65 years of age or older). Around one-quarter of adults in the United States have metabolic syndrome³

Iron has an important role in the normal physiological functions of the human body. Ferritin, one of the vital proteins regulating iron homeostasis, is a widely available clinical biomarker to evaluate the iron status and especially important for detecting iron deficiency. However, growing evidence has shown that even moderately increased iron stores represented by high-normal ferritin concentrations- are associated with diabetes⁴

Elevated serum ferritin levels, in the absence of high transferrin saturation, have appeared during the last years as a common characteristic in some patients with metabolic syndrome.⁵ It has been reported that increased ferritin levels observed in subjects with metabolic syndrome are associated with insulin resistance and fatty liver but not with iron overload, determined in liver biopsies by quantitative phlebotomy⁶

The present study was undertaken with an aim to determine the relationship between serum ferritin and metabolic syndrome and also to evaluate the components of metabolic syndrome with serum ferritin among the patients with metabolic syndrome as per the criteria of National Cholesterol Education Panel(ATP) III attending NRI medical college and Hospital, Chinakakani, Guntur.

OBJECTIVES OF THE STUDY

1. To estimate the proportion of components under Metabolic syndrome
2. To Identify the Correlation between serum ferritin and components of metabolic syndrome.

MATERIALS AND METHODS

Study design: Cross-sectional study

Study area: NRI Medical College & Hospital, CHINAKAKANI, GUNTUR

Study population: Metabolic syndrome patients diagnosed as per NCEP (National Cholesterol Education Program) ATP III (Adult Treatment Panel III) (2001) attending the NRI medical college and Hospital during the study period.

Sample size: 102

Inclusion and Exclusion criteria

Inclusion Criteria

1. All patients with metabolic syndrome, as per the criteria of the National Cholesterol Education Panel ATP 3.

Exclusion criteria

1. Patients with anemia.
2. Persons who donated blood in the last four months
3. Patients with hemochromatosis
4. Positive inflammatory markers like (CRP> 1mg/dl, WBC> 11,000/cu mm or WBC <3000/cu mm)
5. Patients with hemolytic anemia

Method of Collection of Data :

After fulfilling the inclusion and exclusion criteria, 102 patients diagnosed with metabolic syndrome as per NCEP (National Cholesterol Education Program) ATP III (Adult Treatment Panel III) (2001) attending the NRI medical college and Hospital during the study period were included in the study after taking informed consent.

A detailed history of the patients followed by Clinical examination of the patients was made for all the study participants. All the study participants have undergone the following investigations: FBS, PPBS, Blood urea, Serum creatinine, Fasting Lipid Profile, CRP, Urine routine, Complete blood count with peripheral blood smear, Fasting serum ferritin levels (single-incubation two-site immunoradiometric assay, Serum ferritin was estimated by micro ELISA using human ferritin enzyme immunoassay test with desirable levels among males are 30-300 ng/ml and females 15-200 ng/ml.

Statistical Analysis :

Descriptive statistical analysis has used in the present study. Results on

continuous measurements presented on Mean ± SD (Min-Max) and effects on categorical measures shown in Number (%). Significance assessed at a 5% level of significance. Analysis of variance (ANOVA) has been used to find the importance of study parameters between three or more groups of patients, and Chi-square/ Fisher Exact test was used to find the significance of the study as mentioned above parameters on categorical scale between two or more groups. 95% Confidence Interval has been computed to see the significant features.

RESULTS:

In the present study, the mean age group of the study population was 57.38 ± 8.05. The majority of the study participants belonged to 51 – 60 years age group i.e., 40.2%, followed by 36.3% in 61 – 70 years age group. Gender distribution shows males 62.7% and females were 37.3%, and the majority of the male and female belonged to 51- 70 years age group. In the present study, based on Body Mass Index (BMI), overweight was 42%, and obese was 58%. (Table 1)

Majority i.e., 98.4%, had a waist circumference of >90 cm and among female majority i.e., 94.7% had a waist circumference of >85cm. (Table 2)

Table 1: Demographic profile

Age	Frequency	Percent
30 - 40	3	2.9
41 - 50	19	18.6
51 - 60	41	40.2
61 - 70	37	36.3
71 - 80	2	2.0
Total	102	100.0
Mean ± SD	57.38 ± 8.05	
Gender	Frequency	Percent
Male	64	62.7
Female	38	37.3
Total	102	100.0
BMI	Frequency	Percent
25 – 29.9	43	42.2
>30	59	57.8
Total	102	100.0

Table 2: Waist circumference

Waist circumference (male)	Frequency	Percentage
<90 cm	1	1.6%
>90 cm	63	98.4%
Total	64	100%
Waist circumference (female)	Frequency	Percentage
<85 cm	2	5.3%
>85 cm	36	94.7%
Total	38	100%

87.3% had systolic Blood pressure >130 mmHg, and 84.3% had Diastolic Blood pressure >85 mmHg. 62.7% were Hypertensives and were taking regular medications. 78.4% of the study population were diabetics. The mean duration of diabetes in the present study was 2.11 ± 0.84. 18.6% had a duration of diabetes <3 years, 3-6 years in 37.3%, and 22.5% had duration being >6 years. 22.5% had 1+ urine albumin, 2.9% with 2+ urine albumin.(Table 3)

Table 3: Biochemical parameters

	Minimum	Maximum	Mean	SD
HB%	12	16.1	13.91	0.96
Total count	3500	80600	8383.80	7471.80
MCV	88	103	94.40	3.96
MCHC	3.5	37.5	32.00	5.31
FBS	90	226	150.69	34.20
PPBS	135	387	235.21	64.33
Total cholesterol	150	316	219.82	45.09
Triglycerides	96	268	167.86	27.11
HDL	30	52	40.87	5.69
LDL	70	235	132.54	32.56
BUN	17	66	32.32	9.11
Sr creatinine	0.5	2	1.04	0.31
Sr ferritin	38.6	258	126.89	51.78

Based on the ATP III criteria, metabolic syndrome was classified.

20.6% had 3 components, 28.4% had 4 components, majority i.e. 51% had 5 components identified.(Figure 1)

Metabolic syndrome

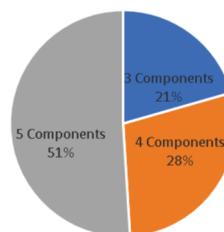


Figure 1: Proportion of Components under Metabolic syndrome

In the present study, a statistically significant association was observed between metabolic syndrome components and PPBS, Total cholesterol, Triglycerides, HDL, LDL as the p-value calculated to be <0.05.

Mean serum ferritin levels were 126.89 ± 51.77. there was a statistically significant association observed between components of metabolic syndrome and serum ferritin levels as the p-value calculated to be <0.05. (Table 4)

Study showed a significant correlation between serum ferritin and waist circumference (r=0.33,p-value <0.05), Total Cholesterol (r=0.310pvalue<0.0001), and LDL (r = 0.326; p-value <0.0001).(Table 5).

Table 4: Metabolic syndrome and Components

Metabolic Syndrome	Mean	Std. Deviation
Four components	100.72	38.72
Five components	126.52	52.24
Six components	137.67	53.13
Overall mean	126.89	51.77
F test : 4.03, df= 2, P-value <0.05*, Statistically significant		

Table 5: Correlation between serum Ferritin and Components of Metabolic Syndrome

Correlation	Variable	Correlation coefficient(r)	P-value
Serum Ferritin	BMI	0.139	>0.05
	Waist circumference	0.335	<0.0001*
	SBP	0.17	>0.05
	DBP	-0.05	>0.05
	FBS	0.104	>0.05
	PPBS	0.094	>0.05
	Total Cholesterol	0.310	<0.0001
	Triglycerides	0.143	>0.05
	HDL	-0.15	>0.05
	LDL	0.326	<0.0001
	BUN	-0.042	0.67
	Serum Creatinine	0.017	0.86

DISCUSSION:

The mean age group of the study population was 57.38 ± 8.05. The majority of the study participants belonged to 51 – 60 years age group i.e., 40.2%, followed by 36.3% in 61 – 70 years age group. Similar findings were observed in the studies conducted by Arun Kumar et al⁷, Sudhakar et al⁸, Sachin et al⁹, Preeti et al¹⁰, Prasad et al¹¹, Harikrishnan et al¹², Sawant et al¹³. The majority of the metabolic syndrome risk factors were more prevalent in older than younger adults.

In the present study, the majority of the study population were male i.e., 62.7% and females were 37.3%. Cohen et al¹⁴, in their study, reported that a cross-sectional sample of subjects with a normal BMI showed male gender to be an independent risk factor for all components of the MetS.

Tian et al. reported that Male adults and old females had the highest risk of getting MetS. More diversified diet decreased MetS risk for young females but increased the risk for male adults and old female¹⁵.

In the present study, overweight was 42%, and obese was 58%. The mean BMI of the present study was 30.25 ± 1.77. Preeti et al¹⁰ reported

that the mean BMI was 29.39 ± 1.76 . Arun Kumar et al⁷ reported that mean BMI among Male was 26.5 ± 2.23 and among females was 26.42 ± 2.52 .

Waist circumference in the Present study was 100.05 ± 6.86 study by Maiti et al¹⁶ reported that mean waist circumference was 92.3 ± 7.4 , and in Sivashankari et al¹⁷, it was 95.6 ± 5.2 .

Serum ferritin levels and metabolic syndrome

In our study, the mean serum ferritin levels were 126.89 ± 51.77 . there was a statistically significant association observed between components of metabolic syndrome and serum ferritin levels as the p-value calculated to be <0.05 and a significant correlation was observed between serum ferritin and waist circumference ($r=0.33$, p-value <0.05), Total Cholesterol ($r=0.310$, p-value <0.0001), and LDL ($r = 0.326$; p-value <0.0001).

Our study also include relation of serum ferritin with each component of metabolic syndrome that is TG, low HDL, central obesity, BP, and fasting blood glucose. a significant correlation was observed between serum ferritin and waist circumference ($r=0.33$, p-value <0.05), Total Cholesterol ($r=0.310$, p-value <0.0001), and LDL ($r = 0.326$; p value <0.0001).

CONCLUSION:

Metabolic syndrome was mostly prevalent in 51-60 year age group and was more common in males. Individual components of the metabolic syndrome also showed a positive association with the serum ferritin levels (p-value <0.001). Our study also includes the relation of serum ferritin with each component of metabolic syndrome that is TG, low HDL, central obesity, BP, and fasting blood glucose. A significant correlation was observed between serum ferritin and waist circumference ($r=0.33$, value <0.05), Total Cholesterol ($r=0.310$, p-value <0.0001), and LDL ($r=0.326$; p-value <0.0001).

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