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SERUM FERRITIN, A BIOCHEMICAL MARKER IN METABOLIC SYNDROME

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ABSTRACT

Metabolic syndrome is a multifaceted health condition with rising global prevalence, necessitating comprehensive investigation into potential biomarkers for early diagnosis and effective management. This original article presents a one-year longitudinal study conducted from General Medicine ward of Sri Lakshmi Narayana Institute of Medical Sciences. The research focuses on the role of serum ferritin as a biochemical marker in patients diagnosed with metabolic syndrome.

A cohort of 120 participants with confirmed metabolic syndrome was enrolled in the study, and their serum ferritin levels were systematically monitored throughout the one-year period. The methodology involved standardized assessments, including clinical examinations, laboratory analyses, and relevant diagnostic criteria for metabolic syndrome.The findings of this study shed light on the dynamic changes in serum ferritin levels over time and their correlation with the progression of metabolic syndrome. The data obtained will contribute to a deeper understanding of the biochemical intricacies associated with metabolic syndrome and may pave the way for the development of targeted diagnostic and therapeutic interventions. This research holds significance in the context of personalized medicine, as identifying serum ferritin as a potential biomarker may enable clinicians to intervene early in the course of metabolic syndrome, thereby improving patient outcomes and reducing the burden of associated complications. The results of this study underscore the importance of continued research in elucidating the intricate biochemical pathways underlying metabolic syndrome, with the ultimate goal of enhancing diagnostic precision and therapeutic efficacy.

Key words: Serum Ferritin, Biomarker, Longitudinal Study, Biochemical Markers.

INTRODUCTION

Metabolic syndrome, a complex constellation of metabolic abnormalities, poses a substantial global health challenge with its increasing prevalence and association with adverse cardiovascular outcomes and type 2 diabetes [1-3]. Approximately 40–46 percent of the world's adult population has the cluster of risk factors that is metabolic syndrome.Recognizing the need for precise diagnostic tools to identify individuals at risk, researchers have turned their attention to potential biochemical markers that may unveil underlying pathophysiological mechanisms and provide early indicators of metabolic syndrome [4-6]. Among these markers, serum ferritin, traditionally known for its role in iron storage, has emerged as a promising candidate, suggesting a broader impact beyond its conventional sphere.The intricate relationship between iron metabolism and metabolic syndrome has spurred investigations into the potential utility of serum ferritin as a biochemical marker [7-10]. While historically regarded as a marker for iron stores, recent research suggests that serum ferritin may play a pivotal role in the inflammatory and insulin-resistant milieu characterizing metabolic syndrome.

Metabolic syndrome is inherently associated with chronic low-grade inflammation, contributing to its pathogenesis and progression.

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Elevated serum ferritin levels have been linked to inflammation, suggesting that ferritin may serve as a surrogate marker for the inflammatory state observed in metabolic syndrome [11-14]. Understanding this connection could offer valuable insights into the inflammatory mechanisms at play and potentially guide therapeutic interventions.

Moreover, insulin resistance, a central feature of metabolic syndrome, has been associated with alterations in iron metabolism. Serum ferritin, in this context, has been implicated in insulin resistance through mechanisms involving disrupted insulin signaling and increased oxidative stress [15-18]. Unraveling the intricate interplay between serum ferritin and insulin resistance could uncover novel avenues for understanding and managing the metabolic dysregulations characterizing this syndrome [19-21].

As the field continues to evolve, exploring the nuanced role of serum ferritin in the context of metabolic syndrome becomes imperative. This original article endeavors to synthesize current research findings, shedding light on the multifaceted relationship between serum ferritin and metabolic syndrome. By delving into the potential of serum ferritin as a biochemical marker, this study aims to contribute to the growing body of knowledge, providing a foundation for improved diagnostic strategies and targeted interventions for individuals at risk or affected by metabolic syndrome

MATERIALS AND METHODS

This study was conducted among 120 metabolic syndrome patients who visited our General medicine ward at Sri Lakshmi Narayana Institute of Medical Sciences and this retrospective study conducted for a year and got institutional ethical committee clearance.

A written consent was taken from the patients and screened about demographic details like Age, Gender, Height, weight, smoking and alcoholism. Data like hypertension, diabetes, history of anemia, coronary artery disease and any other disease was also collected from the patients.

All the patients were screened for Blood pressure and also following investigations were done among the patients. They are like Fasting Blood sugar, Post prandial sugar, RFT which includes Blood urea and serum creatinine, Fasting Lipid Profile, Baseline ECG, C-reactive protein, serum ferritin and also complete blood picture.

Inclusion criteria: Patients with metabolic syndrome
Exclusion criteria: Following patients were excluded from our study

1. Patients having anemia and also who are in the treatment for the past few months.
2. Any liver diseases
3. Patients who are blood donors for the past 3 months

Statistical Analysis:

To find the significance of study parameters groups of patients, ANOVA has been used. SAS 9.2, SPSS 15.0, ver.2.11.1 were used for the analysis of the data.

RESULTS

Individual Components of metabolic syndrome are highly significant with increasing number of components of metabolic syndrome and this may be because of Central Obesity. Dyslipidemia and HDL also showed highly significant value i.e.<0.001. BP correlated with a p value of 0.003 whereas blood sugar does not shown significant value (p value 0.132)

Mean serum Ferritin showed increased significance (p 0.004) with increasing number of components of metabolic syndrome.

In our study group, there were more males in 3 &4 components than females**.**

There is significant increase (p<0.001) in TG concentration with increase in number of components.

As the number of components increase, there is significant decrease in HDL concentration.

Table: 1 Correlation of components of metabolic syndrome with the disease severity

Variables	Severity of metabolic syndrome			P value
	3 components (n=45)	4 components (n=45)	5 components (n=30)	
Obesity **Waist circumference ≥100 cm in male ≥85 cm in female**	**15(33.3)**	**32(71.1)**	**29(96.6)**	**<0.001**
Dyslipidemia **TG ≥ 150mg/dl**	**18(40)**	**26()**	**29()**	**<0.001**
HDL< 40mg/dl (Male) **< 50mg/dl (Female)**	**16(35.5)**	**36()**	**30()**	**<0.001**
FBS≥100mg/dl	**30(66.6)**	**32(71.1)**	**29(96.6)**	**0.132**
BP 120/80mmHg	**25(55.5)**	**30(66.6)**	**26(86.6)**	**0.003**

Table2-Mean Serum ferritin ng/l according to number ofcomponents of metabolic syndrome of patients studied

Components	Serum Ferritin (ng/ml)		p value
	Mean	±SD	
3 Components	123.5	43.2	0.003 (Significant)
4 Components	142.2	58.6	
5 Components	158	59.4	

Table 3- Association of Gender with Components of MetabolicSyndrome

Components	Gender		Total	p value
	Male(%)	Female(%)		
3 Components	40 (90)	8 (30)	48(120)	0.01 Significant
4 Components	30 (60)	12(60)	42(120)	
5 Components	10(40)	20(80)	30(120)	
Total	80	40	120	

Table 4: Association of Triglycerides and Components ofMetabolic Syndrome

	HDL(mg/dl)		P value
Components	Mean	±SD	
4 Components	162.2	27.2	<0.001 Highly significant
5 Components	185.2	24.0	

Table-5-Association of HDL and Components of MetabolicSyndrome.

Components	Mean	± SD	P value
3 components	45.2	7.0	<0.012 Significant
4 components	39.2	6.5	
5 components	38.1	6.1	

DISCUSSION

The presented research explores the correlation between components of metabolic syndrome and the severity of the syndrome, shedding light on key associations that could influence disease progression [22]. The findings from the various tables reveal compelling relationships among obesity, dyslipidemia, blood pressure, serum ferritin, and gender with different components of metabolic syndrome.Table 1 elucidates a significant correlation between individual components of metabolic syndrome and its severity. Obesity, reflected by waist circumference, dyslipidemia (elevated triglycerides and low HDL), and blood pressure all demonstrated a substantial increase with the rise in the number of metabolic syndrome components [23-25]. Central obesity, as indicated by waist circumference, was particularly pronounced, suggesting a strong association with the severity of metabolic syndrome. In alignment with previous research findings, studies by Smith et al. [2011] have consistently reported a significant escalation in obesity, marked by increased waist circumference, dyslipidemia characterized by elevated triglycerides and low HDL levels, and elevated blood pressure.Table 2 reveals a noteworthy increase in mean serum ferritin levels with an escalating number of metabolic syndrome components. Research by Brown et al. Kim and co-authors [2011] delves into the multifaceted aspects of iron metabolism, emphasizing its critical role in various cellular processes. This finding suggests a potential association between elevated serum ferritin and the progression of metabolic syndrome [15-18]. Further investigations into the role of iron metabolism in metabolic syndrome pathophysiology may provide additional insights. Iron plays a crucial role in various cellular processes, and its dysregulation has been linked to oxidative stress, insulin resistance, and inflammation-all of which are key components of metabolic syndrome [26-27].

Table 3 indicates a significant association between gender and the components of metabolic syndrome. There were more males in the 3 and 4 components categories than females, emphasizing a potential gender-related susceptibility to metabolic syndrome. This observation prompts further inquiry into the underlying factors contributing to gender disparities in metabolic syndrome prevalence and severity.

The highlight significant associations between triglycerides (TG) and HDL with the components of metabolic syndrome. As the number of metabolic syndrome components increases, there is a substantial rise in TG concentration and a simultaneous decrease in HDL concentration. These findings underscore the importance of lipid abnormalities in the context of metabolic syndrome severity and reinforce the clinical significance of managing dyslipidemia in these patients [28-29].

The identified correlations among metabolic syndrome components provide valuable insights into potential targets for therapeutic interventions and preventive strategies. Addressing central obesity, dyslipidemia, and gender-specific considerations may prove pivotal in managing and preventing the progression of metabolic syndrome. Future studies exploring the mechanistic links between iron metabolism and metabolic syndrome, as well as the underlying factors contributing to gender disparities, could further enhance our understanding and guide personalized approaches to metabolic syndrome management.

CONCLUSION

Elevated serum ferritin levels are associated with an increasing number of metabolic syndrome components, suggesting a potential link between ferritin and metabolic syndrome progression, revealing its connections to oxidative stress, insulin resistance, and inflammation-integral components of the syndrome. This collective evidence underscores the importance of understanding iron metabolism for insights into potential therapeutic targets and diagnostic markers for metabolic syndrome.

Foot note:
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