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Research Article

ASSESSMENT OF INFLAMMATORY STATUS IN METABOLIC SYNDROME

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ABSTRACT

Objective: The aim of the present study was to assess the level of inflammation in metabolic syndrome (MetS) individuals by estimating C-reactive protein (CRP) in the individuals.

Methods: A total of 60 subjects were selected from those attending the outpatient department of a private hospital and divided into two groups (n=30): Group 1 - healthy individuals and Group 2 - individuals with MetS. Informed consent was obtained from the subjects before sample collection. 5 ml of fasting venous blood was collected and centrifuged at 3000 rpm to separate serum, and then, it was analyzed for fasting blood sugar (FBS) by glucose oxidase-peroxidase method, serum triglycerides (TGL) by colorimetric enzymatic method, and serum CRP by Turbilatex method using ERBA CHEM 5 plus analyzer.

Results: Mean body mass index level in control and MetS group is 22.73±2.14 and 35.53±3.57, respectively. Mean FBS levels in the control group and MetS group are 85.6±11.59 and 115.67±24.52, respectively. Mean TGL levels in the normal control group and MetS group are 105.63±30.26 and 181.07±47.76, respectively. Mean CRP levels in the normal control and MetS group are 3.17±1.22 and 8.34±2.48, respectively.

Conclusion: CRP level positively correlated with MetS. Evaluation of CRP can be used as a surrogate marker to assess the inflammatory status of MetS individuals.

Keywords: C-reactive protein, Metabolic syndrome, Disorder, Inflammatory.

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INTRODUCTION

The metabolic syndrome (MetS) is a common and a very important public health issue, worldwide. MetS confers a 5-fold rise in the risk of type 2 diabetes mellitus and 2-fold rise in the development of cardiovascular disease (CVD) over the next 5–10 years [1-3]. MetS is a type of disorder which includes a group of multiple metabolic abnormalities in a person. The World Health Organization and programs including the National Cholesterol Education Program demonstrated that MetS is a constellation of abnormalities which include high blood sugar, high blood pressure, abnormal obesity, high serum triglycerides (TGL), and low high-density lipoprotein levels.

Insulin resistance, visceral adiposity, atherogenic dyslipidemia, endothelial dysfunction, genetic susceptibility, elevated blood pressure, hypercoagulable state, and chronic stress are the several factors which constitute the syndrome. In abnormal obesity, a large quantity of circulating free fatty acids are produced by the upper body adipocytes while an intra-abdominal fat has been positively correlated with the splanchnic free fatty acid levels contributing to liver fat accumulation [4]. Therefore, CVDs and type 2 diabetes are deeply attributed with MetS [5-7]. There is a worldwide prevalence of MetS ranging from <10% to as much as 84%, based on the region, urban or rural environment as well as composition of the population [8].

A recent study demonstrates a linear relationship between the inflammatory marker C-reactive protein (CRP) and MetS [9]. Pro-inflammatory markers are elevated in the case of MetS. The pro-inflammatory markers which increase in MetS individuals with type 2 diabetes include CRP, fibrinogen, plasminogen activator inhibitor), and cytokines such as interleukin-1 (IL-1β) and IL-6. Increased levels of IL-8 aid in predicting cardiovascular events and mortality in populations affected by MetS-related diseases [10]. Most of the affected individuals are old, obese, and sedentary and have a degree of insulin resistance. Stress is one of the major contributing factors. The official cause of the MetS is under study [11,12]. MetS is one of the major risk factors for many neurological disorders [13].

The most common and well-standardized biomarker of inflammation is the CRP. Many studies show that there is an elevated level of CRP in patients with MetS [14]. Recent studies also aid in demonstrating the impairment of insulin signals by CRP [15,16]. Basically, CRP is synthesized in the liver in response to the stimulating factors elicited by macrophages and adipocytes.

The function of CRP is the activation of complement system, eliciting phagocytosis by macrophages, which clears necrotic and apoptotic cells and bacteria and gets elevated within 2 h of the onset of the inflammation and peaks at 48 h [17,18]. Plasma CRP levels are low in healthy individuals [14]. CRP levels above 10 mg/dl predispose an increased risk of myocardial infarction, ischemic stroke, and peripheral arterial disease [19,20]. IL-6 also gets released in response to elevated CRP levels in obese individuals [21,22]. Since MetS is a cluster of many inflammatory diseases, the aim of the current study was to assess the level of inflammatory marker - CRP in MetS individuals.

METHODS

Patients were selected from those attending the outpatient department of a private hospital and divided into two groups (n=30) as follows:

Group I - Normal healthy individuals
Group II - Patients with MetS.

Inclusion criteria

The following criteria were included in the study:

- Individuals with the age group of 35–55 years
- Individuals with type 2 diabetes mellitus (fasting blood sugar [FBS] ≥100 mg/dl)
- Individual with normal body mass index (BMI) (18.9–24.9) and obese BMI (≥30)
- Serum TGL levels more than 150 mg/dl.

Exclusion criteria

The following criteria were excluded from the study:

- Individuals with other systemic illness such as cardiovascular disease, renal failure,stroke, and endocrine illness.
- Individuals with acute illness like fever.
- Immunocompromised individuals.

Sample collection

Informed consent was obtained from the patient before sample collection. 5 ml of fasting venous blood was collected and distributed in plain collection tubes and centrifuged at 3000 rpm to separate serum, and then, it was analyzed for FBS by glucose oxidase-peroxidase method, serum TGL by colorimetric enzymatic method, and serum CRP by Turbilatex method using ERBA CHEM 5 plus analyzer.

Statistical analysis

All the data were analyzed using SPSS package. Student t-test analysis was done to find significant difference between the control and study groups. All tests were considered statistically significant at $p<0.05$ level.

RESULTS

In the present study, MetS group. Mean BMI level in control and MetS group was 22.73±2.14 and 35.53±3.57, respectively. Mean FBS levels in the control group and MetS group were 85.6±11.59 and 115.67±24.52, respectively. Mean TGL levels in the normal control group and MetS group were 105.63±30.26 and 181.07±47.76, respectively. Mean CRP levels in the normal control and MetS group were 3.17±1.22 and 8.34±2.48, respectively (Table 1and Figs. 1-4).

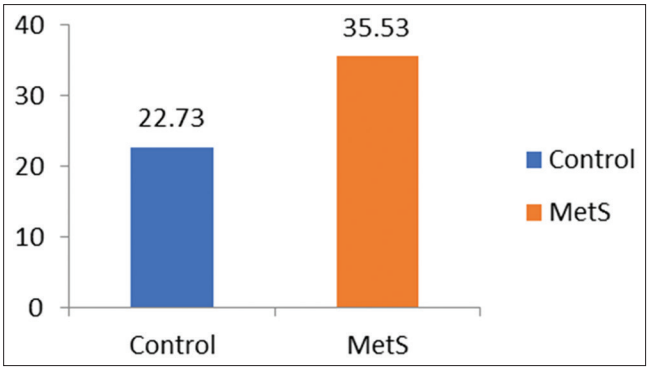

Fig. 1: Mean body mass index values in control and study group

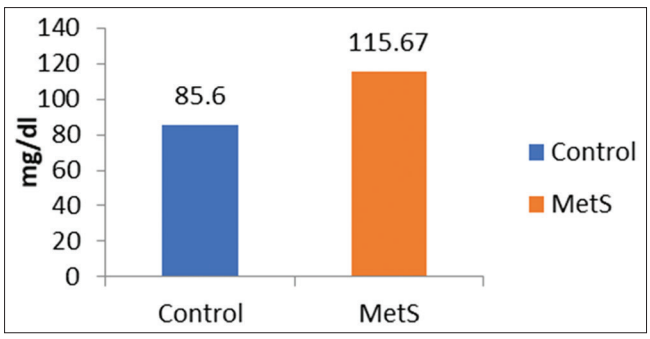

Fig. 2: Mean fasting blood sugar value in control and study group

DISCUSSION

Results of the study revealed that there is a significant difference between the mean BMI, FBS, TGL, and CRP levels of control group and MetS group. There is a significant difference between mean BMI, FBS, and TGL levels which indicates proper selection of subjects in both the groups. There is a significant difference between the mean CRP level in both the groups with the $p<0.00$ level.

Low-grade inflammation is the characteristic feature of the MetS. There are many inflammatory markers to diagnose inflammation, among which CRP is the simplest to diagnose the inflammatory state of the disease. Recent studies proved the CRP levels had a positive correlation with BMI, TGL, glucose, and uric acid. It was also found that subjects with high CRP levels had MetS and were obese [8,23,24]. In certain people, there was an increase in TGL level twice the fold due to MetS [25]. BMI was also found to be a predominant contributor in MetS [26]. There was also a release of IL6 by human subcutaneous adipose tissues which in turn elicits the production of acute phase proteins in the liver. From this, the studies were able to show a significant relationship between CRP and obesity [27,28]. The association of periodontitis and MetS is reported in literature [2]. Literature shows scientific evidence of association of inflammatory markers with obesity and diabetes mellitus [29,30].

Table 1: BMI, FBS, TGL, and CRP levels of control and study groups

Parameters	Mean±SD		
	Control	Metabolic syndrome	p value
BMI	22.73±2.14	35.53±3.57	<0.00
FBS (mg/dl)	85.6±11.59	115.67±24.52	<0.00
TGL (mg/dl)	105.63±30.26	181.07±47.76	<0.00
CRP (mg/dl)	3.17±1.22	8.34±2.48	<0.00

BMI: Body mass index, FBS: Fasting blood sugar, TGL: Triglycerides, CRP: C-reactive protein, SD: Standard deviation

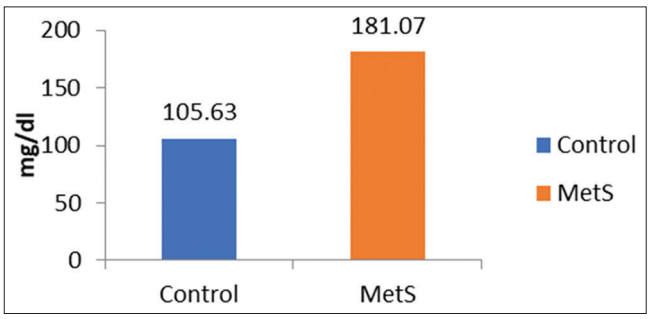

Fig. 3: Mean triglycerides value in control and study group

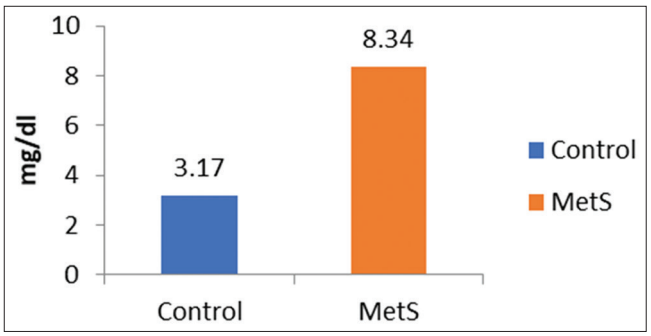

Fig. 4: Mean C-reactive protein value in control and study group

CONCLUSION

Emerging laboratory and clinical evidences have provided a strong relationship between the CRP and MetS. Hence, henceforth, the data showed a link between the inflammation, insulin resistance, and components of MetS. To conclude, this study helps to create awareness about CRP levels, to aid in the diagnosis and early prognosis of MetS in obese individuals.

AUTHOR'S CONTRIBUTION

Nivesh Krishna: Preparation of the manuscript. Anitha Roy: Design and compilation of final manuscript. Savitha G: Methodology and data interpretation.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest regarding publication of this article.

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