

# A review of inflammatory markers and metabolic syndrome

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## ABSTRACT

Metabolic syndrome (MetS) is a major public health problem with pro-inflammatory changes leading to cardiovascular disease at a very young age. Various studies have been conducted so far on the effect of various inflammatory markers such as serum uric acid, serum homocysteine, and highly sensitive C-reactive protein. Most of them have reported a positive correlation between these inflammatory markers and the various components of MetS such as abdominal obesity, elevated blood pressure, fasting blood glucose, and lipid profile abnormalities such as elevated triglycerides and low high-density lipoprotein cholesterol (HDL-C). A review of the various studies confirms the role of these inflammatory markers in causing endothelial dysfunction and premature cardiovascular events. Various studies by Prabhakar *et al.* have reported a positive correlation between serum uric acid and MetS. In yet another study, a positive correlation between serum homocysteine and the components of (MetS) has been reported.

**KEY WORDS:** Cardiovascular disease, Metabolic syndrome, Pro-inflammatory, Serum homocysteine, Triglycerides

## INTRODUCTION

As the name suggests, metabolic syndrome (MetS) includes a cluster of factors that increase the risk of cardiovascular disease (CVD) and Type 2 diabetes mellitus (DM) at an earlier age as compared to normal counterpart. MetS has turned out to be a global public health concern.<sup>[1]</sup> Its major components are central obesity, dyslipidemia,<sup>[2]</sup> hypertension, hyperinsulinemia,<sup>[3]</sup> glucose intolerance,<sup>[4]</sup> reduced levels of high-density lipoprotein cholesterol (HDL-C), and hypertriglyceridemia, all of which are major risk factors for CVD.<sup>[5]</sup>

Various studies have postulated that inflammatory markers such as serum uric acid, homocysteine levels, and highly sensitive C-reactive proteins are positively associated with MetS which may result in cardiovascular events at an earlier age.

Under conditions of increased oxidative stress, there is depletion of the local antioxidants.<sup>[6]</sup> Higher UA levels

may be a risk factor for hypertension and CVD and lipid abnormalities leading to atherosclerosis,<sup>[7,8]</sup> mild kidney disease, endothelial dysfunction, and chronic inflammation.<sup>[9,10]</sup>

Homocysteine a sulfur-containing amino acid formed from methionine is yet another inflammatory marker whose normal level is 5–15  $\mu$  mol/l. An increase in plasma homocysteine has been associated with pro-inflammatory and prothrombotic consequences.<sup>[11]</sup> Hyperhomocystinemia causes endothelial dysfunction by reducing nitric oxide and vasodilatation by worsening oxidative stress. This leads to a proliferation of smooth muscle and intimal thickening.<sup>[12,13]</sup>

## DISCUSSION

Patients with higher UA levels showed elevated systolic blood pressure, body mass index, waist circumference, and high blood pressure, which are important components of MetS.<sup>[14,15]</sup> Besides, it is also associated with mild kidney disease, endothelial dysfunction, and chronic inflammation.<sup>[16]</sup>

Finally, UA levels may be elevated in DM and MetS patients as a response to oxidative stress.

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The findings of the study “evaluation of uric acid level, a new biomarker in patients with MetS” was done in earlier studies.<sup>[17]</sup>

A positive correlation between serum uric acid levels, triglycerides (TAG), and HDLC, in patients with concurrent diabetes and MetS, was noted. According to the previous study,<sup>[18]</sup> an elevated serum uric acid level was a contributory factor for an increased risk of MetS. However, the study by Prabhakar *et al.*, on a group of 200 patients with MetS and 200 controls in a Tertiary Care Hospital at Pondicherry showed a positive correlation between serum uric acid levels, TAG, and HDLC, in patients with MetS as compared with controls. Thus, it appears that uric acid alone acts as a risk marker for DM and MetS, mild kidney disease, endothelial dysfunction, and chronic inflammation.<sup>[19]</sup> However, in the study by Prabhakar *et al.*, on homocysteine levels and MetS, it was shown that MetS group had a significant increase in serum homocysteine levels as compared to controls. This finding was consistent with the findings of Kodama *et al.*<sup>[20,21]</sup>

## CONCLUSION

MetS is a global health problem, especially among young adults. Since it is more of a lifestyle disease, it is very much preventable especially if attended earlier. More awareness has to be created even at the high school level regarding the ill effects of sedentary lifestyle and fast food. More emphasis should be made on healthy eating habits and physical activity.

We would humbly request the high school authorities and Medical Council of India to include at least an hour of compulsory physical training in schools, as well as in medical colleges. Besides, screening for MetS should be done even at school levels so that an awareness is created at a young age. Further studies are required to determine whether genetic, nutritional deficiencies or abnormalities in homocysteine metabolism accounts for hyperhomocystinemia observed in patients of MetS. Future prospective gender-wise studies are essential to strengthen the role of inflammatory markers in MetS. All these measures would help our youngsters to grow healthy, to avoid cardiovascular events and the burden of developing DM at an earlier age.

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