Original Research Article

# A study on serum homocysteine levels in coronary artery disease patients

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## Abstract

**Background:** Globally, coronary artery disease (CAD) has become a major public health issue and main contributor to mortality and morbidity. The underlying pathological mechanisms involved in the development of CAD is remain poorly understood. The present study is aimed to measure serum homocysteine levels and lipid profile in CAD patients in comparison with healthy controls. **Materials and methods:** This prospective study was conducted in Department of Biochemistry, SVS Medical College, Mahabubnagar, Telangana. A total of 90 subjects were included in this study, among them, 45 were CAD patients as cases and 45 healthy subjects as controls. Age of the subjects was 30 to 65 years from both sexes. The diagnosis of CAD was based on clinical history (angina pain), ECG changes, elevated cardiac enzyme. Under aseptic conditions, 5 ml fasting venous blood samples were collected, centrifuged at 3000 rpm for 10 minutes. The obtained serum sample was used for the estimation of total cholesterol, triglycerides, HDL-C by using commercially available autoanalyzer kits and homocysteine was done by ELISA method. LDLC and VLDL were calculated. Demographic details were collected from the subjects. **Results:** In this study, serum homocysteine (27.8±5.4 µmol/l) levels were significantly elevated in CAD patients compared to controls. Lipid profile parameters such as serum cholesterol (204.7±46.6 mg/dl), TGL (208.2±115.2 mg/dl), LDLC (129.4±44.4 mg/dl), VLDL (41.2±10.2 mg/dl) were significantly increased and HDLC (38.7±11.5 mg/dl) levels were significantly decreased in CAD patients compared with healthy subjects. **Conclusion:** The present study concludes that significantly elevated homocysteine levels and dyslipidaemia in CAD patients compared to healthy controls.

**Key Words:** Hyperhomocystenaemia, Dyslipidaemia, coronary artery disease.

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## INTRODUCTION

Globally, coronary artery disease (CAD) has become a major public health issue and main contributor to mortality and morbidity and its prevention and effective treatment modalities are key strategies in reducing the mortality. India is in epidemiological transition.[1] According to the World Heart Federation, 35 % of all CVD deaths in India occur in those aged 35–64 years. 90–95 % of all cases and deaths are due to CAD. Approximately, one-sixth of world's population lives in India and CAD remains the highest cause of mortality in India.[2] Atherosclerosis is characterized by a thickening of the arterial wall due to smooth muscle cell proliferation, lipid deposits, and fibrosis. Rupture of the lipid-containing atherosclerotic plaques results in thrombosis (atherothrombosis) and leads to myocardial infarction (MI) and stroke.[3,4] Therefore, CAD is the narrowing or blockage of the arteries and vessels that supply oxygen and nutrients to heart. MI is one of the manifestations of CAD. MI is a disease of the vessel that feeds the cardiac muscle, called the coronary artery.

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Atherosclerotic plaque rupture with thrombosis is a well-established critical factor in the pathogenesis of MI.[5] The pathophysiological mechanisms involved in the development of CAD and MI remain incompletely understood, although a number of risk factors have been identified. The classical atherogenic risk factors for CAD including abnormal level of circulating cholesterol with elevated levels of low-density lipoprotein (LDL) and reduced level of high-density lipoprotein (HDL), hypertension, smoking, diabetes mellitus, advancing age, gender, family history of premature vascular disease.[6] More recently, homocysteine has received greater attention as an important risk factor for CAD. Moreover, direct causative role of this emerging CVD risk marker and the exact mechanism in pathology and development of CAD has not been fully explored. Elevated level of homocysteine has emerged as an important risk factor that is associated with the development of CAD.[5] Homocysteine, a sulfhydryl-containing amino acid, is an intermediate product in the normal biosynthesis of the amino acids methionine and cysteine. It is an amino acid produced via demethylation of dietary methionine, which is abundant in animal protein.[7,8] In the plasma it is present in four forms: around 1% circulates as free thiol, 70–80% remains disulphide bound to plasma proteins, mainly albumin and 20–30% combines with itself to form the dimer homocysteine or with other thiols. Homocysteine is a key determinant of the methylation cycle. Increased homocysteine levels have been associated with cardiovascular disease, stroke, endothelial dysfunction, inflammation etc.[9,10] However, few studies have reported the hyperhomocystenemia in CAD patients.[5,11,12] The present study is aimed to measure serum homocysteine levels and lipid profile in CAD patients in comparison with healthy controls.

## MATERIALS AND METHODS

This prospective study was conducted in Department of Biochemistry, SVS Medical College, Mahabubnagar, Telangana. After approval from the ethics committee and informed consent from the study subjects, a total of 90 subjects were included in this study, among them, 45 were AMI patients as cases and 45 healthy subjects as controls. Age of the subjects was 30 to 65 years from both sexes. Subjects with history of pregnancy, kidney disease, liver disease were excluded. The CAD diagnosis was based on clinical history (angina pain), ECG findings, elevated cardiac markers. Under aseptic conditions, 5 ml fasting venous blood samples were collected, centrifuged at 3000 rpm for 10 minutes. The obtained serum sample was used for the estimation of total cholesterol, triglycerides, HDL-C were done by using commercially available autoanalyzer kits and homocysteine by ELISA method. LDLC and VLDL were calculated. Demographic details were collected from the subjects.

**Statistical analysis:** The results were expressed in Mean±SD. Mann-Whitney U test was used for the comparison of non-normally distributed variables. P value <0.05 was considered as significant.

## RESULTS

In the present study, 90 subjects were recruited to evaluate homocysteine level in CAD patients. In this study, serum homocysteine (27.8±5.4 µmol/l) levels were significantly elevated in CAD patients compared to controls. Lipid profile parameters such as serum cholesterol (204.7±46.6 mg/dl), TGL (208.2±115.2 mg/dl), LDLC (129.4±44.4 mg/dl), VLDL (41.2±10.2 mg/dl) were significantly increased and HDLC (38.7±11.5 mg/dl) levels were significantly decreased in CAD patients compared with healthy subjects as depicted in table 1.

**Table 1:** comparison of biochemical parameters between healthy subjects and CAD patients

| Parameter | Healthy subjects | CAD patients | p-value |
|---|---|---|---|
| Age (years) | 45.0±8.3 | 45.6±9.7 | 0.987 |
| Serum Cholesterol (mg/dl) | 158.6±27.0 | 204.7±46.6 | 0.000* |
| Serum triglycerides (mg/dl) | 139.1±51.1 | 208.2±115.2 | 0.000* |
| Serum HDLC (mg/dl) | 35.6±10.0 | 38.7±11.5 | 0.215 |
| Serum LDLC (mg/dl) | 97.1±33.9 | 129.4±44.4 | 0.000* |
| Serum VLDLC (mg/dl) | 31.8±5.1 | 41.2±10.2 | 0.040* |
| Serum homocycteine (µmol/l) | 14.1±2.0 | 27.8±5.4 | 0.000* |

*significant

## DISCUSSION

The present study results showed significantly increased levels of serum homocysteine, cholesterol, TGL, LDLC, VLDL and significantly reduced HDLC in CAD patients compared to healthy controls, indicating the relation between hyperhomocystenemia, dyslipidaemia and CAD and its complications. Atherosclerosis is the common pathophysiological mechanism that leads to cardiovascular diseases. Arteriosclerosis is a continuous inflammatory damage to the arterial intima with increased permeability

to plasma, deposition of plasma lipids in plaques and fibrosis and calcification of plaques. [13] However, homocysteine plays a role in cardiovascular diseases in different mechanisms such as its adverse effects on vascular endothelium, leads to endothelial cell injury and dysfunction, and with resultant alterations in subclinical arterial structure and function. In addition to this, other proposed mechanisms of these effects include an increase in vascular smooth muscle cell proliferation, oxidative stress, elevated collagen synthesis, and abnormalities in the arterial wall elastic material. [14] In relation to our study findings, studies conducted by Schaffer [15] and Al-Obaidi [16] reported consistent relationship between homocysteine concentration and CAD risk. It has been reported that hyperhomocysteinemia leads to endothelial dysfunction, reduced vessel flexibility, and changes in haemostasis process. And also, some studies have reported that this emerging atherogenic risk factor may be secondary to preclinical vascular diseases and it was demonstrated that elevated homocysteine level is a causal risk factor for CAD not the effect.[16] Elevated homocysteine may enhance the effect of conventional risk factors, like hyperlipidaemia, hypertension and inflammation on CAD risk. A study conducted by Graham *et al.*. [17] reported that hyperhomocystenemia showed more effect on CAD risk in smoker, patients with hypertension and hyperlipidaemia compared to healthy subjects. Another study reported that hyperhomocysteinemia was not correlated to CAD in patients without hypertension, diabetes and dyslipidaemia. [18] In a study conducted by Pooja *et al.*. reported that increased homocysteine levels in CAD patients compared to healthy controls. [19] However, recent studies reported that homocysteine is an independent predictor of vascular diseases including stroke and CAD. In a study conducted by Mizrahi EH, *et al.*.[20] reported that hyperhomocysteinemia an independent risk factor for vascular disease, they concluded that hyperhomocysteinemia is an independent risk factor for vascular disease, including coronary disease. Patil SS, *et al.*.[21] they reported that hyperhomocysteinemia is an emerging and important risk factor for thromboembolic and cardiovascular disease'.

## CONCLUSION

The present study concludes that significantly elevated homocysteine and dyslipidaemia in CAD patients compared to healthy controls, suggesting that homocysteine and traditional cardiovascular risk factors may be synergistically prompt the formation and development of atherosclerosis in CAD patients. Further studies with large sample size are recommended.

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