

A STUDY OF SERUM ZINC LEVELS AMONG PATIENTS OF CORONARY ARTERY DISEASE CONDUCTED IN A TERTIARY CARE HOSPITAL

SHAFQAT NAZIR,¹ EHSAN ULLAH,² SHAHADAT HUSSAIN CH³ AND S. H. RAZA BUKHARI³
Departments of Biochemistry, Pathology and Cardiology Quaid-e-Azam Medical College, Bahawalpur

ABSTRACT

Background: Zinc is an important trace element that has been increasingly implicated in coronary artery disease. The study was designed to compare serum zinc levels in patients of coronary artery disease and healthy controls.

Methods: It was a prospective, case control study. A total of 125 male participants were divided into healthy controls ($n = 25$), Ischaemic subjects without myocardial infarction ($n = 50$), and Ischaemic subjects with previous or present infarction ($n = 50$) were included in the study. The serum zinc was analysed by atomic absorption spectrophotometry.

Results: The mean age in the ischaemic heart disease patients without infarction (Group – A) and with infarction was comparable to the mean age of control group. Family history of ischaemic heart disease and history of smoking were more common among disease groups as compared to controls. Serum zinc levels were found to be significantly low in study sub-group B₂ ($83.68 \pm 5.55 \mu\text{g/dl}$) as compared to control group ($99.16 \pm 5.18 \mu\text{g/dl}$) and remaining study groups showed insignificant differences.

Conclusion: Decreased serum zinc levels are associated with coronary artery disease especially the acute myocardial infarction.

Key Words: Serum zinc, coronary artery disease, acute myocardial infarction, angina pectoris.

INTRODUCTION

The importance of trace elements in health and nutrition is unquestionable. Zinc is a critical micronutrient whose impact on human health is being increasingly appreciated and its deficiency may play a key role in the appearance of diseases. About two billion people in the developing world are deficient in zinc.¹ Zinc deficiency affects health in all age groups. In children it causes an increase in infections and diarrhea, contributing to the death of about 800,000 children worldwide per year.² Several studies have documented that growth retardation commonly observed in the developing countries may indeed be due to zinc deficiency.³ Zinc deficiency has been indicated as a risk factor for immune deficiency and susceptibility to infections in the elderly especially pneumonia.⁴ Because of the widespread prevalence of zinc deficiency and the multitude of its essential biological functions, nutritional correction of zinc deficiency may have a major impact on different disease states.⁵

Hsieh et al. have reported reduced serum zinc levels among the patients of Coronary Artery Disease (CAD).⁶ Other investigators have found zinc deficiency as a risk factor for ischaemic heart disease and its various clinical manifestations.⁷ Zinc deficiency also leads to reduced survival in the patients of

coronary artery disease.⁸

This study is designed to compare serum zinc levels among patients of coronary artery disease and healthy controls.

MATERIAL AND METHODS

Study Design and Setting

It was a case control study conducted at the outpatient and indoor departments of Cardiology, Bahawal Victoria Hospital Bahawalpur in collaboration with PCSIR Laboratories Lahore.

Study Population and Sampling

A total of 125 male participants were divided into following groups; Control Group – 25 healthy subjects, Group A – 50 Ischaemic subjects without infarction (stable and unstable angina), further divided into A₁ (stable angina, $n = 25$) and A₂ (unstable angina, $n = 25$), Group B – 50 Ischaemic subjects with previous or present infarction further divided into B₁ (post-infarction angina, $n = 25$) and B₂ (history of recent acute myocardial infarction, $n = 25$). Purposive sampling technique was used to select patients / subjects in various groups and sub-groups.

Data Collection

Clinical history, findings of physical examination

and relevant investigations were recorded in a specially designed proforma.

Laboratory Methods

About 5.0 ml of venous blood was drawn from the antecubital vein of each patient and control by using a disposable plastic syringe. The clotted blood was poured into distilled – demineralized water centrifuge tubes and centrifuged at 3000 for 10 minutes. Serum was separated in clean, sterilized, distilled demineralized water plastic capped tubes and stored at -20°C. Maximum care was taken to avoid contamination. All the samples were analyzed simultaneously to avoid the effect of alternate freezing and thawing. The serum was analyzed for zinc by atomic absorption spectro-photometry.⁹ The accepted reference range for zinc in plasma is 70 – 150 µg/dl. Serum zinc levels are generally 5 – 15% higher than plasma levels due to zinc released from platelets and erythrocytes during clotting. Plasma zinc levels exhibit both circadian and postprandial fluctuations. Fasting morning values of plasma zinc below 70 µg/dl represent deficient zinc status.

Statistical Analysis

All data was entered into and analysed with the help of SPSS version 17. Mean \pm S.D were given for quantitative variables e.g. age of patients, serum zinc level. Percentages and frequencies were given for qualitative variables e.g. family history of CAD etc. Quantitative variables were compared by applying Independent Samples t-Test. Qualitative variables were compared by Chi Square test. P value < 0.05 was taken as significant.

DISCUSSION

Zinc is a vital element in maintaining the normal structure and physiology of cells. The fact that it has an important role in states of cardiovascular diseases has been studied and described by several research groups. It appears to have protective effects in coronary artery disease and cardiomyopathy. Intracellular zinc plays a critical role in the redox signaling pathway, whereby certain triggers such as ischemia and infarction lead to release of zinc from proteins and cause myocardial damage. In such states, replenishing with zinc has been shown to improve cardiac function and prevent further damage. Thus, the area of zinc homeostasis is emerging in cardiovascular disease research.¹⁰ It now seems firmly established that the serum zinc concentration decreases after myocardial infarction.^{6,7} According to Halsted and

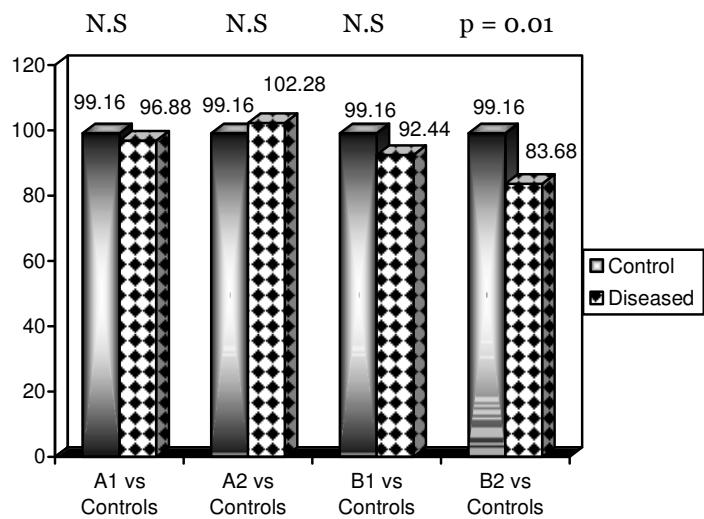


Fig. 1: Comparison of serum zinc between controls and various groups of coronary artery disease.

Foot notes: A₁: Stable angina group, A₂: Unstable angina group, B₁: Previous myocardial infarction group, B₂: Recent acute myocardial infarction group.

Smith, the value of serum zinc decreased within 24 – 48 hours and the low values persisted for two weeks.¹¹

Recent investigators including researchers from within Pakistan also reported reduced serum zinc levels among patients of ischaemic heart disease.¹² It has also been found that weight reduction improves serum zinc levels and also improves metabolic syndrome risk and coronary artery disease.¹³ The comparison of the mean serum zinc concentration in sub-group B₂ (having recent AMI) with that of control group showed a statistically significant decreased serum zinc level in sub-group B₂ ($P = 0.01$). The zinc is perhaps used in the reparative process in the necrotic myocardium, so it is taken up by non-necrosed myocardial tissue, proportional to the extent of the necrotic area, in an attempt to aid the reparative processes and its level decreases in the serum.^{14,15} However, the metabolic route between the plasma and the heart is not clear. A high zinc status has a protective effect on development of atherosclerosis and thus the risk of cardiovascular diseases.¹⁶

Decrease in serum zinc levels was observed following acute myocardial infarction in the present study. This is in conformity with the observations made by other workers mentioned above. The exact mechanism of changes in serum zinc levels in cases of acute myocardial infarction has not been clearly understood. This has been explained by the mobilization of serum zinc to the area of tissue injury to participate in the reparative process.¹⁷ Some other workers explained the fall of zinc in blood on the basis of transportation of zinc into necrosed myocar-

dium to take part in the synthesis of lactic dehydrogenase that is a metalloenzyme.¹⁸ Another scientist explained this on the basis of the humoral factor known as the leukocytic endogenous mediator released from polymorphonuclear leukocytes in the presence of myocardial necrosis.¹⁹

It is **concluded** that although explanations for the exact mechanism is yet to be established this study reports reduced zinc levels are associated with coronary artery disease especially acute myocardial infarction.

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