Influence of zinc on cardiac and serum biochemical parameters in rabbits

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The pattern of lipid profiles and organic constituents of cardiac and serum tissues of rabbits were studied on treatment with cholesterol, zinc and zinc + cholesterol. Total carbohydrate and total protein levels were decreased with elevated lipid levels in cholesterol fed rabbits. However, the zinc and cholesterol + zinc fed rabbits showed decreased lipid fractions in cardiac and serum tissues leading to reduced atherosclerotic process in rabbits. These results suggest that the zinc is acting as a hypolipidaemic and anti atherogenic agent in experimental rabbits.

Considerable attention has been given towards the understanding of possible link between the nutritional deficiencies of certain micro elements and the risk of coronary heart disease (CHD). The levels of zinc are significantly altered in atherosclerotic patients as evidenced by abnormally low serum zinc concentration. A potential beneficiary effect of zinc supplementation in atherosclerotic patients was observed in long-term clinical studies by several investigators. Our previous studies revealed that the low concentrations of zinc induce the histopathological changes and reduces the atherogenic process in heart. However, much information is not available on the role of zinc in serum and cardiac biochemical changes in rabbits. Hence, in the present study an attempt has been made to analyse the effect of zinc on the biochemical constituents of heart.

New Zealand white breed male rabbits of 4 months old with weight of 1 kg (supplied by College of Veterinary Science, Tirupati) were acclimatised to the laboratory conditions (25°C temperature and photo period of 12 hr). They were fed with stock diet supplied by A.P. Government for rabbits. They were given free access to drinking water and diet ad libitum. The rabbits were divided into two sets. First set consisting of group I being control and the other set is experimental. After standardisation studies, the experimental rabbits were divided into 3 groups, i.e., II, III and IV and maintained for 6 months period.

Group I (Control)—Animals were fed with 100g of stock diet per day.
Group II—Animals were fed with 100g of stock diet and egg yolk (containing 113 mg of dietary cholesterol/day).
Group III—Animals were fed with stock diet and supplemented 10mg of anhydrous zinc sulphate containing 2.2 mg of elemental zinc.
Group IV—Animals were fed with stock diet, egg yolk (containing 113 mg of dietary cholesterol) and 10mg of anhydrous zinc sulphate containing 2.2mg of elemental zinc.

Blood samples were collected for the analysis of trace elements and lipid profile. The heart was isolated and kept in freezer for the analysis of biochemical and lipid profiles. The trace element levels were estimated by using Atomic Absorption Spectrophotometer manual. Total carbohydrates were estimated by the method of Caroll et al. Total proteins were estimated by Lowry et al. Total lipids were estimated by gravimetric method. Triglycerides, cholesterol and free fatty acids were estimated by the method of Natelson, glycerol according to Burton; Phospholipids by the method of Bieri and Privat respectively.

Statistical analysis—Mean ± SD values were calculated. Student's t test was calculated to find out the level of significance.

Data presented in Figs 1&2 show that total carbohydrates, total proteins are increased in heart tissue and serum of zinc treated rabbits than cholesterol fed rabbits, whereas, total lipids and other lipid fractions (cholesterol, triglycerides, phospholipids and glycerol) are decreased in serum and heart tissue of zinc treated group than control rabbits.
Considerable attention has been paid to understand the possible link between the nutritional deficiencies of certain micro-elements and the risk of coronary heart disease (CHD) from our earlier studies\(^1\). Certain trace elements influence enzymatic reactions in fat metabolism\(^1\). Zinc has shown positive effect on cardiovascular system\(^6\).

Decreased total carbohydrates and proteins with increased total lipids is observed in cholesterol fed rabbits than control. This might be due to increased breakdown or decreased biosynthetic activity. Increased total lipids indicate lowered lipase activity or enhanced lipogenesis. Increased serum and cardiac lipid profile may be due to the increased deposition of lipid components by elevated rate of absorption or due to the fatty infiltration from other tissues like liver and kidney. Cholesterol feeding has been shown to alter the distribution of apolipo proteins in HDL, in animals as well as in humans\(^5\). The increased blood lipid profiles in the present study were correlated with the elevated serum lipid fractions. The elevated phospholipids and cholesterol levels suggest their increased synthesis and decreased utilization or stress mediated *de novo* synthesis or possible improvement in the membrane organisa-
tion. Elevated triglycerides and glycerol might be due to continuous induction of cholesterol supplementation and reduced catabolic activity.

Decreased lipid levels in serum and cardiac tissue in zinc treated rabbits than control suggests elevated lipid catabolism in the cardiac tissue. No significant change in cholesterol and triglyceride content was observed in cardiac tissue even on cholesterol + zinc supplementation. This shows that in combination with cholesterol, zinc plays differential role than alone. It may be concluded from the present study that zinc act as hypolipidaemic agent. This observation was confirmed through histopathological studies in our earlier investigations6. The focus of the present research is the prevention of atherosclerosis than the secondary arrest of the progression of lesions in several cases of CHD.

The present study provides a significant information on how to regulate the disease in its primary condition itself and confirms the beneficial effect of zinc on atherosclerosis.

References
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