REVIEW ARTICLE

ZINC DEFICIENCY: A PREDISPOSING FACTOR FOR CORONARY ARTERY DISEASE

*Ifat Ara Begum

Department of Biochemistry, Dhaka Medical College, Dhaka, Bangladesh

ABSTRACT

Coronary Artery Disease (CAD), also called coronary heart disease is a leading cause of morbidity and mortality in developed /western countries and is emerging as an epidemic in developing countries. The role of micronutrients and trace elements in the pathogenesis of the CAD has been recently reported. Experimental and clinical studies indicate that zinc deficiency may predispose to CAD. Though this deficiency is more common in Third World countries, the dietary zinc intake is still below recommendations among certain population groups in industrialized countries even. The continued discoveries of the unique protective properties of zinc warrant further research in the role of zinc in endothelial cell metabolism and atherosclerosis. But the best way to deal with CAD, of course, is to prevent it and prevention of development and progression of atherosclerosis would play the major role here undoubtedly.

INTRODUCTION

Coronary Artery Disease (CAD) is a leading cause of morbidity and mortality in developed/western countries and is emerging as an epidemic in developing countries (Cebi *et al.,* 2011; Hughes and Samman, 2006). It is also called coronary Heart Disease (CHD) and is defined as a condition in which plaques build up in the walls of the coronary arteries (the vessels that supply oxygen-rich blood to heart muscles). These plaques can gradually obstruct the artery or they can suddenly rupture causing a more acute obstruction. As the heart muscles require a continuous supply of oxygen and nutrients to survive, obstruction of a coronary artery rapidly leads to significant problem.

Role of zinc in CAD

CAD has been associated with several risk factors including family history, age, gender, dyslipidaemia, elevated blood cholesterol, diabetes mellitus, hypertension, obesity, cigarette smoking and increased thrombogenicity (Cebi *et al.,* 2011; Hughes and Samman, 2006). Environmental factors play an important role in the development of CHD and although the effects of macronutrients, mainly dietary fats, have been investigated extensively, the potential effects of most of the inorganic nutrients especially zinc, have received limited attention (Hughes and Samman, 2006). However, whatever the risk factor there is, atherosclerosis plays the major role in

Corresponding author: Ifat Ara Begum,
Department of Biochemistry, Dhaka Medical College, Dhaka, Bangladesh.

producing CAD. Atherosclerosis is a multifactorial disease to which many factors contribute, defining the role of each of these has proved to be problematic (Stadler *et al.,* 2008). It is a disease of large and medium sized arteries and is characterized by endothelial dysfunction (malfunction of the cells lining the inside of the artery wall), vascular inflammation, migration of smooth muscle cells to the inner lining of the artery (intima) and the build-up of lipids, cholesterol and cellular debris within the intima of the vessel wall (http://www.lipidworld.com/content/9/1/2). The role of micronutrients and trace elements in the pathogenesis of the CAD has been recently reported. Experimental and clinical studies indicate that zinc deficiency may predispose to CAD (Singh *et al.,* 1998). Low serum concentration of zinc is found to be associated with CAD in some population groups, as revealed in some epidemiologic studies. However no large epidemiologic studies have examined the relationship of zinc deficiency with CAD (Singh *et al.,* 1998).

Although zinc deficiency is more common in Third World countries, dietary zinc intake is still below recommendations among certain population groups in industrialized countries (Reiterer *et al.,* 2005). Today, the elderly tend to avoid meat and other high zinc-content foods due to fear of cholesterol. Rather, they increase consumption of refined wheat products. Wheat was a main source of zinc in the historical diet, but today, zinc, magnesium and other critical nutrients have been depleted by the refining process. Therefore, zinc deficiency may play a major, perhaps the dominant role, in causing most advanced cardiac events (Eby and Halcomb, 2006). Theoretically, there are several mechanisms by which zinc

deficiency may cause atherogenesis. It is an important component of biomembranes and essential cofactor in a variety of enzymes. It has antioxidant like properties, thus it can stabilize macromolecules against radical induced oxidation in vitro as well as limit excess radical production. As an antioxidant, it has membrane-stabilizing properties and is said to preserve endothelial function because of its ability to inhibit the pathways of processes leading to apoptosis (Soinio *et al.,* 2007). Zinc may be antiatherogenic by interfering with signaling pathways involved in apoptosis (Hennig *et al.,* 1999).

Conclusion

The continued discoveries of the unique protective properties of zinc, possibly as membrane stabilizer and antioxidant and inhibitor of signaling pathways involved in inflammatory response and apoptosis, warrant further research in the role of zinc in endothelial cell metabolism and atherosclerosis (Hennig *et al.,* 1999). The best way to deal with CAD, of course, is to prevent it and prevention of development and progression of atherosclerosis would play the major role here undoubtedly.

REFERENCES

Abdelhalim MAK, Alhadlaq HA, Moussa SA. Elucidation of the effects of a high fat diet on trace elements in rabbit tissues using atomic absorption spectroscopy. Available from http://www.lipidworld.com/content/9/1/2

Cebi, A., Kaya, Y. and Gungor, H. *et al.* 2011. Trace Elements, Heavy Metals and Vitamin Levels in Patients with Coronary Artery Disease. *Int. J.Med.Sci.,* 8: 456-460.

Eby, G.A. and Halcomb, W.W. 2006. High-dose zinc to terminate angina pectoris: A review and hypothesis for action by ICAM inhibition. *Medical Hypotheses*, 66, 169-172

Hennig, B., Meerarani, P., Ramadass, P. *et al.* 1999. Zinc Nutrition and Apoptosis of Vascular Endothelial Cells: Implications in Atherosclerosis. *Nutrition,* 15: 744-748

Hughes, S. and Samman, S. 2006. The Effect of Zinc Supplementation in Humans on Plasma Lipids, Antioxidant Status and Thrombogenesis. *Journal of the American College of Nutrition,* Vol. 25, No. 4, 285-291.

Reiterer, G., MacDonald, R., Browning, J.D. *et al.* 2005. Biochemical and Molecular Actions of Nutrients. J. Nutr. 135: 2114-2118.

Singh, R.B., Niaz, M.A., Rastogi, S.S. *et al.* 1998. Current Zinc Intake and Risk of Diabetes And Coronary Artery Disease And Factors Associated with Insulin Resistance in Rural and Urban Populations of North India. *Journal of the American College of Nutrition,* Vol17, No. 6, 564-570.

Soinio, M., Marniemi, J., Laakso, M. *et al.* 2007. Serum Zinc Level and Coronary Heart Disease Events in Patients with Type 2 Diabetes. *Diabetes Care*, Volume 30, Number 3.

Stadler, N., Stanley, N., Heeneman, S. *et al.* 2008. Accumulation of Zinc in Human Atherosclerotic Lessions Correlates With Calcium Levels But Does Not Protect against Protein Oxidation. *Arterioscler. Thromb. Vasc. Biol.,* 28: 1024-1030

****