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ZINC AND VITAMIN-E IMPACT ON CADMIUM INDUCED BIOACCUMULATION IN LIVER AND KIDNEY OF MALE ALBINO RAT

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ABSTRACT

Cadmium (Cd) is a toxic, non-essential and industrial pollutant. The aim of the present work is to know the zinc (Zn) and vitamin-E impact on Cd induced bioaccumulation in liver and kidney of Cd treated rats. Wistar strain male albino rats were treated with cadmium chloride at a dose of $1/10^{th}$ LD50 / 48h i.e. 22.5 mg/Kg body weight for 7, 15 and 30 days (d) time intervals. Then 15d Cd treated rats were divided into three groups. The first group received Zn (12 mg/Kg), second group vitamin-E (300 mg/Kg) alone and third group supplemented with both Zn and vitamin-E for again 7, 15 and 30d long sojourn. After the specific time intervals, rats were decapitated and tested for Cd bioaccumulation levels by Atomic Absorption Spectrophotometer (AAS – Schimadzu AA6300). There was a significant elevation in Cd concentrations in both the test tissues with increased period of Cd treatment. Maximum Cd accumulation was found in 30d Cd treated rat kidney (32.78 ± 0.29µg / gm). However there was a significant reduction in Cd bioaccumulation with Zn and vitamin-E supplementation. Maximum decrease in Cd accumulation was found in 30d rat kidney (8.62±0.15µg / gm) supplemented with the combination of Zn and vitamin-E. Our findings clearly envisage that combined supplementation of Zn and vitamin-E is more effective in reducing the Cd body burden when compared to the other modes of supplementation.

KEYWORDS: Cadmium, Bioaccumulation, Zinc, Vitamin-E, Rat.

INTRODUCTION

Environmental pollution was caused by numerous chemicals, xenobiotics, heavy metals and so on. Among the different heavy metals, Cadmium (Cd) is one of the most toxic, non- essential industrial pollutant and can contribute to a well-defined spectrum of diseases in animal models as well as in humans.[1,2] Cd has an extremely long half-life (20-30 Years) and is highly accumulate mainly in the liver and kidney of an organism.[3-9] The main sources of Cd are storage batteries, electroplating, pigments, plastics, fertilizer industries and cigarette smoking. The kidney is considered as the critical organ in long term low level exposure to Cd.[10, 11]

Cd has been shown to affect cells by multiple modes, making the elucidation of its mechanism of action a very complex task. It can cause damage to cell membrane and certain organelles, alter signal transduction pathways and / or affect the intracellular enzymatic systems. Chronic Cd exposure has been involved in a variety of pathological conditions such as hepatotoxicity, nephrotoxicity, neurotoxicity, carcinogenicity, metabolic activities, histological changes, membrane damage, gene expression and apoptosis.[12,13] Some of the toxic effects of Cd exposure are hepatic damage, renal dysfunction, hypertension, central nervous system injury and testicular atrophy.[14-16]

Cd like many other heavy metals is antagonistic to essential trace elements like zinc (Zn), selenium (Se), iron (Fe), copper (Cu), calcium (Ca) etc., and antioxidant vitamins. The heavy metals always compete with these trace elements and antioxidant vitamins for binding sites as transport and storage.[17]

Zn is an essential trace element for good health. It is a ubiquitous antioxidant with numerous functions in biological systems. It occurs in all living cells as a constituent of metallo enzymes involved in major metabolic pathways. It plays a catalytic, inhibitory or accessory role in the regulatory enzymes such as kinases or phosphatases. Zn controls several enzymes of intermediary metabolism, DNA and RNA synthesis, gene expression, immunocompetence and plays a significant role in homeostasis of hormones.[18-20] Zn also takes part in the defense against excessive amounts and following damage of certain metals, and it does so