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# Nephrotoxicity and Hepatotoxicity Induced by Chronic Aluminium Exposure in Rats: Impact of Nutrients Combination versus Social Isolation and Protein Malnutrition

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**Abstract :** Background: Exposure to Aluminium (Al) has been increased recently. It is found in food products, food additives, drinking water, cosmetics and medicines. Chronic consumption of Al causes oxidative stress and has been implicated in several chronic disorders. Liver is considered as the major site for detoxification while kidney is involved in the elimination of toxic substances and is a target organ of metal toxicity. Social isolation (SI) or protein malnutrition (PM) also causes oxidative stress and has negative impact on Al-induced nephrotoxicity as well as hepatotoxicity. Coenzyme Q10 (CoQ10) is a powerful intracellular antioxidant with mitochondrial membrane stabilizing ability while wheat grass is a natural product with antioxidant, anti-inflammatory and different protective activities, cocoa is also potent antioxidants and can protect against many diseases. They provide different degrees of protection from the impact of oxidative stress. Objective: To study the impact of social isolation together with Protein malnutrition on nephro- and hepato-toxicity induced by chronic Al exposure in rats as well as to investigate the postulated protection using a combination of Co Q10, wheat grass and cocoa. Methods: Eight groups of rats were used; four served as protected groups and four as un-protected. Each of them received daily for five weeks AlCl3 (70 mg/kg, IP) for Al-toxicity model groups except one group served as control. Al-toxicity model groups were divided to Al-toxicity alone, SI- associated PM (10% casein diet) and Al- associated SI&PM groups. Protection was induced by oral co-administration of CoQ10 (200mg/kg), wheat grass (100mg/kg) and cocoa powder (24mg/kg) combination together with Al. Biochemical changes in total bilirubin, lipids, cholesterol, triglycerides, glucose, proteins, creatinine and urea as well as alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), lactate deshydrogenase (LDH) were measured in serum of all groups. Specimens of kidney and liver were used for assessment of oxidative parameters (MDA, SOD, TAC, NO), inflammatory mediators (TNF-α, IL-6β, nuclear factor kappa B (NF-κB), Caspase-3) and DNA fragmentation in addition to evaluation of histopathological changes. Results: SI together with PM severely enhanced nephro- and hepato-toxicity induced by chronic Al exposure. Co Q10, wheat grass and cocoa combination showed clear protection against hazards of Al exposure either alone or when associated with SI&PM. Their protection were indicated by the significant decrease in Al-induced elevations in total bilirubin, lipids, cholesterol, triglycerides, glucose, creatinine and urea levels as well as ALT, AST, ALP, LDH. Liver and kidney of the treated groups also showed significant decrease in MDA, NO, TNF-α, IL-6β, NF-κB, caspase-3 and DNA fragmentation, together with significant increase in total proteins, SOD and TAC. Biochemical results were confirmed by the histopathological examinations. Conclusion: SI together with PM represents a risk factor in enhancing nephro- and hepato-toxicity induced by Al in rats. CoQ10, wheat grass and cocoa combination provide clear protection against nephro- and hepatotoxicity as well as the consequent degenerations induced by chronic Al-exposure even when associated with the risk of SI together with PM.

**Keywords :** aluminum, nephrotoxicity, hepatotoxicity, isolation and protein malnutrition, coenzyme Q10, wheatgrass, cocoa, nutrients combinations
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