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Comparative Study on the Influence of Different Drugs against Aluminium-Induced Nephrotoxicity and Hepatotoxicity in Rats

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Abstract : Background: Environmental pollution with the different aluminium (Al) containing compounds especially those in industrial waste water exposes people to higher than normal levels of Al that represents an environmental risk factor. Cosmetics, Al ware, and containers are also sources of Al besides some foods and food additives. In addition to its known neurotoxicity, Al affects other body structures like skeletal system, blood cells, liver and kidney. Accumulation of Al in kidney and liver induces nephrotoxicity and hepatotoxicity. Coenzyme Q10 (CoQ10) is a pseudo-vitamin substance primarily present in the mitochondria. It is a powerful antioxidant and acts as radical scavenger. Wheat grass is a natural product that contains carbohydrates, proteins, vitamins, minerals, enzymes and has antioxidant, anti-inflammatory, anticancer and cardiovascular protection activities. Cocoa is an excellent source of iron, potent antioxidants and can protect against many diseases. Vinpocetine is an antioxidant and anti inflammatory while zinc is an essential trace element involved in cell division and its deficiency is observed in many types of liver disease. Objective: To evaluate and compare the potency of different drugs (CoQ10, wheatgrass, cocoa, vinpocetine and zinc) against nephro- and hepato-toxicity induced by Al in rats. Methods: Rats were divided to seven groups and received daily for three weeks either saline for control group or AlCl3 (70 mg/kg, IP) for Al-toxicity model groups. Five groups of Al-toxicity model (treated groups) were orally received together with Al each of the following; CoQ10 (200mg/kg), wheat grass (100mg/kg), cocoa powder (24mg/kg), vinpocetine (20mg/kg) or zinc (32mg/kg). Biochemical changes in the serum level of Alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), lactate deshydrogenase (LDH) as well as total bilirubin, lipids, cholesterol, triglycerides, glucose, proteins, creatinine and urea were measured. Liver and kidney specimens from all groups were also collected for the assessment of hepatic and nephrotic level of inflammatory mediators (TNF-α, IL-6β, nuclear factor kappa B (NF-κB), Caspase-3, oxidative parameters (MDA, SOD, TAC, NO) and DNA fragmentation. Histopathological changes in liver and kidney were also evaluated. Results: Three weeks of AlCl3 (70 mg/kg, IP) exposure induced nephro- and hepato-toxicity in rats. Treatment by the all used drugs showed protection against hazards of AlCl3. The protective effects were indicated by the significant decrease in ALT, AST, ALP, LDH as well as total bilirubin, lipids, cholesterol, triglycerides, glucose, creatinine and urea levels which were increased by Al. Liver and kidney of the treated groups showed decrease in MDA, NO, TNF-α, IL-6β, NF-κB, caspase-3 and DNA fragmentation which were increased by Al, together with significant increase in total proteins, SOD and TAC which were decreased by Al. The protection against both nephro- and hepato-toxicity was more pronounced especially with CoQ10 and wheat grass than the other used drugs. Histopathological examinations confirmed the biochemical results of toxicity and of protection. Conclusion: Protection from nephrotoxicity, hepatotoxicity and the consequent degenerations induced by Al can be achieved by using different drugs as CoQ10, wheatgrass, cocoa, vinpocetine and zinc, but CoQ10 as well as wheat grass possesses the most superior protection.

Keywords : aluminum, nephrotoxicity, hepatotoxicity, coenzyme Q10, wheatgrass, cocoa, vinpocetine, zinc
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