ABSTRACT

The aim of the present study was to determine the alteration in the function, oxidative status and histology of heart and liver after the treatment with monosodium glutamate and to investigate the ameliorative potential of α-tocopherol using in vitro and in vivo model.

The effect of monosodium glutamate at low doses (50 and 100 mg/kg b.wt/day) and high doses (4 and 8 g/kg b.wt/day) were evaluated in an experimental model - albino Wistar rats. They were orally given monosodium glutamate for 180 days. Significant alterations were observed in high doses of monosodium glutamate treated rats. α-Tocopherol (100 and 200 mg/kg b.wt/day) was also administered with monosodium glutamate (4 g/kg b.wt) for the same duration. The results revealed that monosodium glutamate caused an imbalance in oxidative state in blood, heart and liver tissue, which is indicated by significant increase in the level of malondialdehyde and conjugated diene with a concomitant decrease in the antioxidants (superoxide dismutase, catalase, reduced glutathione, glutathione peroxidase and glutathione-S-transferase). Moreover, monosodium glutamate induced an increase in plasma glutamate and arginine; serum activities of liver function markers (alanine aminotransferase, alkaline phosphatase and γ-glutamyl transferase); cardiac enzymes (creatine phosphokinase, lactate dehydrogenase and aspartate aminotransferase) and calcium level. These results were supported by pathological evidences like cloudy swelling, fiber separation and vascular congestion in cardiac tissue; congestion and hemorrhages in liver parenchyma. Similarly, in vitro studies in H9c2 and Chang liver cells indicated significant increase in LDH release, intracellular calcium, lipid peroxidation markers with significant decrease in antioxidants and cell lysis.
Supplementation of α-tocopherol (200 mg/kg b.wt) along with monosodium glutamate (4 g/kg b.wt) treated rats significantly improved the alterations in oxidative stress, functional markers, calcium level and histopathology. In vitro studies also revealed the protection of cells from intracellular calcium accumulation, oxidative stress, LDH leakage and cell damage. α-Tocopherol showed protective effect against monosodium glutamate induced oxidative damage by scavenging free radicals, increasing antioxidant status and indirect control of intracellular calcium. Thus α-tocopherol may protect cardiac and hepatic cells from monosodium glutamate induced toxicity by its antioxidant and non-antioxidant properties.

Present study revealed that the chronic consumption of high concentration of monosodium glutamate could contribute to cardiotoxicity and hepatotoxicity. Therefore, its uncontrolled and continuous intake should be avoided. Current study also indicated administration of α-tocopherol ameliorated the toxic effect developed by monosodium glutamate. Thus the use of α-tocopherol to foods containing monosodium glutamate may protect heart and liver from harmful effects of monosodium glutamate.