Protective Effects of Hydrolyzed Clinoptilolite Zeolite Against Cadmium Toxicity in Human Intestinal Cells

John Bibidakis[1], Viktoriia Goriainova[2], Judith T. Zelikoff[2], Terry Gordon [2], Nikolaos Drakoulis[1]
[1]Research Group of Clinical Pharmacology and Pharmacogenomics, Faculty of Pharmacy,
School of Health Sciences, National and Kapodistrian University of Athens, Athens, Greece
[2] Department of Medicine, Division of Environmental Medicine, NYU Grossman School of Medicine, New York, NY, USA

Heavy metal toxicity is one of the leading causes of carcinogenicity in humans. With the development of more research techniques and the advancement of medicinal sciences, an increasing amount of data proves that various metals are carcinogens or probable carcinogens. Among the metals, cadmium (Cd) is known to be responsible for DNA damage, resistance to apoptosis, degradation of proteins, and deregulation of cell growth that can all play a role in the cancer process. Cadmium is absorbed mainly via inhalation and secondarily via consumption in foods and digestion. Zeolites, are porous crystalline aluminosilicate compounds that have. Been showing great heavy metal attracting and retaining properties even since the age of the Roman Empire. In modern days, zeolite clinoptilolite (the most prominent form of zeolite) has been used pharmaceutically in humans as a detoxifying agent in suspensions or powders that are being consumed orally. Oral consumption of non-water-soluble zeolite suspensions poses the problem of low bioavailability as the largest portion of the suspensions cannot be absorbed by the gastrointestinal (GI) track. In this study, the effects of water-soluble hydrolyzed clinoptilolite zeolite (HCZ), a water solution of water-soluble zeolite clinoptilolite fragments with high bioavailability, were tested on human epithelial small intestinal cells in relationship to cadmium toxicity. In the experiments, HCZ and Cd were subsequently studied together in co-treatment, pre-treatment, or post-treatment protocols, with the viability of the treated cells quantified by using the trypan blue assay. For the co-treatment group the average cell viability difference was at 6% with statistical significance and in the post-treatment group the average cell viability difference was at 12% with statistical significance. The pre-treatment group showed an average cell viability difference that was only 1% with no statistical significance. Taken together, the results indicated that HCZ can positively impact human epithelial small intestinal cells and can yield higher viability under specific toxin exposure circumstances. Based on these results, HCZ could potentially be used to mitigate cadmium toxicity under the appropriate circumstances.