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Protective effect of selenium and zinc against cadmium toxicity in SHSY-5Y neurons

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Cadmium is a widespread heavy metal environmental toxicant and pollutant. Cadmium toxicity affects many tissues and organs including the central nervous system and cadmium exposure has been related to many neurodegenerative diseases (1). Cadmium-induced toxic effects include oxidative damage, apoptosis, interference with calcium/zinc-dependent mechanisms, inhibition of cellular respiratory processes and others, but the underlying mechanisms of cadmium neurotoxicity are not completely understood (2). On the other hand heavy metal toxicity can be counteracted by bioelements such as zinc, selenium and others mainly through the induction of metallothionein expression levels and other antioxidant pro-teins (3). Human neuroblastoma SHSY-5Y cell line, in both the undifferentiated and neuronal-like differentiated state, were used in this study to better elucidate the mechanisms un-derlying the protective effect of zinc and selenium against the cadmium neurotoxicity. Toxic effects of cadmium chloride (10 mM, 24h) observed by cell viability assay, western blot analysis of Bax and Gap-43, and immunostaining of b3 tubulin and cytochrome c proteins, were reverted to control values by a 24h-pretreatment with zinc chloride (50 mM) both in undiffer-entiated and differentiated neurons. Interestingly, the reverting effect of a 24h-pretreatment with sodium selenite (100 nM) against cadmium toxicity, was observed only in undifferentiat-ed neurons. In conclusion we can hypothesize that in undifferentiated and differentiated SHSY-5Y neurons, the protective effects of zinc and selenium compounds against cadmium toxicity depend on the activation of partially common signalling pathways. Moreover sodium selenite dont exert a significant protective effect in differentiated SHSY-5Y demonstrating that the differentiated and undifferentiated phenotypes show different responses.

References

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Keywords

Cadmium; SHSY-5Y cell line; zinc; selenium.