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# Zinc, metallothioneins and longevity: interrelationships with niacin and selenium

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## Abstract

Ageing is an inevitable biological process with gradual and spontaneous biochemical and physiological changes and increased susceptibility to diseases. Some nutritional factors (zinc, niacin, selenium) may remodel these changes leading to a possible escaping of diseases, with the consequence of healthy ageing, because they are involved in improving immune functions, metabolic homeostasis and antioxidant defence. Experiments performed "in vitro" (human lymphocytes exposed to endotoxins) and "in vivo" (old mice or young mice with low zinc dietary intake) show that zinc is important for immune efficiency (both innate and adaptive), metabolic homeostasis (energy utilization and hormone turnover) and antioxidant activity (SOD enzyme). Niacin is a precursor of NAD+, the substrate for the activity of DNA repair enzyme PARP-1 and, consequently, may contribute to maintaining genomic stability. Selenium provokes zinc release by Metallothioneins (MT), via reduction of glutathione peroxidase. This fact is crucial in ageing because high MT may be unable to release zinc with subsequent low intracellular free zinc ion availability for immune efficiency, metabolic harmony and antioxidant activity. Taking into account the existence of zinc transporters (ZnT and ZIP family) for cellular zinc efflux and influx, respectively, the association between zinc transporters and MT is crucial in maintaining satisfactory intracellular zinc homeostasis in ageing. Improved immune performance, metabolic homeostasis, antioxidant defence occur in elderly after physiological zinc supplementation, which also induces prolonged survival in old, nude and neonatal thymectomized mice. The association "zinc plus selenium" improves humoral immunity in old subjects after influenza vaccination. The association "zinc plus niacin" in elderly is actually in progress.

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