Pharmacology and therapeutics

Evidence supporting zinc as an important antioxidant for skin

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Abstract

Antioxidants play a critical role in keeping skin healthy. The antioxidant benefits of vitamin C and E are well known, but the importance of the trace mineral, zinc, has been overlooked. This article reviews the evidence supporting zinc's antioxidant role in protecting against free radical-induced oxidative damage. Zinc protects against UV radiation, enhances wound healing, contributes to immune and neuropsychiatric functions, and decreases the relative risk of cancer and cardiovascular disease. All body tissues contain zinc; in skin, it is five to six times more concentrated in the epidermis than the dermis. Zinc is required for the normal growth, development and function of mammals. It is an essential element of more than 200 metalloenzymes, including the antioxidant enzyme, superoxide dismutase, and affects their conformity, stability, and activity. Zinc also is important for the proper functioning of the immune system, and for glandular, reproductive and cell health.

Abundant evidence demonstrates the antioxidant role of zinc. Topical zinc, in the form of divalent zinc ions, has been reported to provide antioxidant photoprotection for skin. Two antioxidant mechanisms have been proposed for zinc: zinc ions may replace redox active molecules, such as iron and copper, at critical sites in cell membranes and proteins; alternatively, zinc ions may induce the synthesis of metallothionein, sulfhydryl-rich proteins that protect against free radicals. No matter how they work, topical zinc ions may provide an important and helpful antioxidant defense for skin.

Introduction

In this article we review the role of zinc in the body, manifestations of severe and mild zinc deficiency, the role of zinc as an antioxidant, the potential mechanisms of this antioxidant function, and evidence that it protects skin.

Zinc and the body

Zinc is present in all organs, tissues, and fluids of the body. The skin and appendages are rich in zinc: containing approximately 20% of the body's total.[1,2] Zinc binds to a number of biologic molecules and influences their conformation, stability and activity. Zinc serves as a catalyst for enzymes responsible for DNA replication, gene transcription, and RNA and protein synthesis. At the cellular level, zinc is critical for cell survival and affects signal transduction, transcription and replication.[3,4] Zinc is important for several human functions, including growth and development, bone metabolism, neuropsychiatric and immune functions, and wound healing.[1] In addition, zinc decreases the relative risk of cancer and cardiovascular disease[5] and protects against ultraviolet radiation.[2]

Zinc was not considered an essential human nutrient until 1974 when the National Research Council set a recommended daily allowance for oral intake of 15 milligrams.[6] Interestingly, 40 years earlier zinc was reported to be required for normal growth and development in rats.[7]

In humans, zinc is absorbed in the jejunum and ileum. Body control mechanisms make it difficult to ingest too much zinc.[3] However, negative zinc balances are possible, and in rats only a few days of a zinc-deficient diet are needed before a rapid reduction in DNA synthesis occurs.[8] Approximately 99% of the total body's zinc is intracellular. In plasma, zinc is almost completely protein bound.[9] Good food sources of zinc include seafood, beef, lamb, eggs, whole grains, nuts and yogurt.[10] To maximize absorption, oral supplements should contain zinc with methionein, an amino acid that is easily absorbed; vitamin B_6 (pyridoxine) also helps with zinc assimilation. Calcium can retard zinc absorption, so calcium and zinc supplements should be taken at different times of the day.

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