Review article

Zinc: An overview and therapeutic uses in dermatology

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Abstract

Zinc is an essential component of various important enzymes in our body and its deficiency causes multi-enzyme defects and multisystemic disease. It ranks with biotin as a truly essential element in both cutaneous health and disease. Zinc deficiency may explain alopecia, ulcers, infections and a host of strange unexplainable skin changes.

Introduction

Zinc is an essential mineral that is found in almost every cell. It stimulates the activity of approximately 100 enzymes, which are substances that promote biochemical reactions in the body.[1,2] It must be obtained from the diet since the body cannot make enough. Next to iron, it is the most abundant trace mineral in the body. It is stored primarily in muscles, but is also found in high concentrations in red and white blood cells, the retina of the eye, bones, skin, kidneys, liver, and pancreas. In men, the prostate gland stores high amounts of it. Zinc plays an important role in the immune system and is helpful in protecting against infection,[3,4] is needed for wound healing,[5] helps maintain the sense of taste and smell,[6] and is needed for DNA synthesis.[2] Zinc also supports normal growth and development during pregnancy, childhood, and adolescence.[7,8] Zinc also has some antioxidant properties,[9] which means that it helps protect cells in the body from the potential damage caused by free radicals. Free radicals are believed to contribute to the aging process. The typical daily intake of zinc in the Western diet is approximately 10 mg, two thirds of the recommended dietary allowance (RDA).[2] Low zinc intake is often seen in the elderly, alcoholics, people with anorexia, and individuals on restrictive weight loss diets.[2] Zinc deficiency can also be caused by diseases that interfere with the absorption of nutrients from food, such as irritable bowel disease, celiac disease, and chronic diarrhea.[10,11] Some of the symptoms of zinc deficiency include loss of appetite, poor growth, weight loss, impaired taste or smell, poor wound healing, skin abnormalities (such as acne, atopic dermatitis and psoriasis), hair loss, lack of menstrual period, night blindness, hypogonadism and delayed sexual maturation, white spots on the fingernails and feelings of depression.[2,10,12-14] The body absorbs 20% to 40% of the zinc present in food. Dietary fiber, particularly phytates, can interfere with the body's ability to absorb zinc. Zinc is best absorbed when taken with a meal that contains protein.[15] The best sources of zinc are oysters (richest source), beef, liver, pumpkin seeds, pecans, poultry, cheese (ricotta,

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Swiss, gouda), shrimp, crab, and other shellfish. Other good, though less easily absorbed sources of zinc include legumes (especially lima beans, black-eyed peas, pinto beans, soybeans, peanuts), whole grains, miso, tofu, brewer's yeast, cooked greens, mushrooms, green beans, tahini, and pumpkin and sunflower seeds.[16-18] Zinc sulfate is the most frequently used supplement. This is the least expensive form, but it is the least easily absorbed and may cause stomach upset. Health care providers usually prescribe 220 mg zinc sulfate, which contains approximately 55 mg of elemental zinc.[15] The more easily absorbed forms of zinc are zinc picolinate, zinc citrate, zinc acetate, zinc glycerate, and zinc monomethionine. If zinc sulfate causes stomach irritation, another form such as zinc citrate should be tried.[15,19] Zinc should be taken with water or juice. However, if zinc causes stomach upset, it can be taken with meals. It should not be taken at the same time as iron or calcium supplements.[20] A strong relationship exits between zinc and copper. Too much of one can cause a deficiency of the other. Long-term use of zinc (including zinc in a multivitamin) should be accompanied by copper. For every 15 mg of zinc include 1 mg of copper. Daily intakes of dietary zinc, according to the US RDA, are: infants and children up to 3 years: 2 - 3 mg (RDA); children 4 to 8 years: 5 mg (RDA); children 9 to 13 years: 8 mg (RDA); males 14 to 18 years: 11 mg (RDA); females 14 to 18 years: 9 mg (RDA); pregnant females 19 years and older: 11 mg (RDA); breastfeeding females: 12 -14 mg (RDA).[2]

Therapeutic range of elemental zinc in men is 30 to 60 mg daily and in women is 30 to 45 mg daily. Doses over the amounts listed should be limited to only a few months under the supervision of a healthcare professional. Research has shown that less than 50 mg a day is a safe amount to take over time, but researchers are not sure what happens if more is taken over a long period. Taking more than 150 mg per day may interfere with the body's ability to use other minerals.[2,15] Common side effects of zinc include stomach upset, nausea, vomiting, and a metallic taste in the mouth. Other reported side effects of zinc toxicity are dizziness, headache, drowsiness, increased sweating, loss of muscle coordination, alcohol intolerance, hallucinations, and anemia.[21] High doses of zinc may also lower HDL ("good") cholesterol and raise LDL ("bad") cholesterol. This may be due to a copper deficiency brought on by the long-term use of zinc.[22] Zinc can have interactions with drugs like ACE inhibitors, quinolones, tetracycline, hormone replacement therapy (HRT), hydralazine, immunosuppressants, nonsteroidal anti-inflammatory drugs (NSAIDs) and penicillamine.[23-27]

Therapeutic uses in dermatology

Infections

Zinc is required for the development and activation of T-lymphocytes, a kind of white blood cell that helps fight infection.[2] People who are zinc deficient tend to be more susceptible to a variety of infections. Zinc supplementation enhances immune system activity and protects against a range of infections including upper respiratory tract infections, skin and mucocutaneous infections.[28-33]

HIV / AIDS

Zinc deficiency is common in people with HIV (even before symptoms appear) or AIDS. Zinc deficiency leads to increased susceptibility to opportunistic infections in people with AIDS. When studied, zinc supplementation has increased CD4 counts.[34]

Burns

When skin is burned, a substantial percentage of micronutrients, such as copper, selenium, and zinc may be lost. This increases the risk for infection, slows the healing process, prolongs the hospital stay, and even increases the risk of death. Although it is unclear which micronutrients are most beneficial for people with burns, many experts suggest that a multivitamin containing zinc and other vital nutrients be included in the therapy to aid recovery.[35]

Acne

There is some evidence that zinc supplementation (such as zinc gluconate) reduces acne inflammation. Studies to date have had certain limitations, however. Therefore, it is difficult to draw definite conclusions about how much zinc to use, what type of zinc is best, and the duration of treatment. Antibiotics such as erythromycin and tetracyclines are sometimes combined with zinc in topical preparations for inflammatory acne. It is unclear whether zinc enhances the effects of the antibiotics or simply serves as a mode of delivery for the antibiotics.[36-41]

Herpes simplex

Topical preparations of zinc have shown benefit in relieving symptoms and preventing recurrences of oral herpes lesions (canker sores).[42]

Acrodermatitis enteropathica

Zinc dramatically reverses the manifestations within hours to days in patients with acrodermatitis enteropathica (a skin disorder that is due to an inherited inability to absorb zinc properly; generally affects the limbs, mouth, or anus and may include hair loss and diarrhea.[43-45]

Skin wounds and ulcers

Zinc supplements are often given to help heal skin ulcers or bed sores but they do not increase rates of wound healing when zinc levels are normal.[2,46]

Conclusion

Zinc is a truly essential element required for a normal functioning healthy skin and it has a definite role in treating a variety of dermatological disorders. It pays to think zinc when looking at a strange dermatitis. Before ordering a plasma level determination, be sure that rubber stoppers are not used and specimen does not hemolyze because red cells and rubber stoppers are zinc rich.

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