



Need To Know: The Zinc-Atherosclerosis Link

Zinc is an essential nutrient known for its wound healing, antiinflammatory and antioxidant properties. Could this powerhouse help protect arteries from damage caused by atherosclerosis, otherwise known as hardening of the arteries?

Quite possibly. Researchers at Wayne State University School of Medicine and University of Michigan School of Medicine sought to answer that question in a new study published online April 2010 in *American Journal of Clinical Nutrition*.

Older adults are subject to the ravaging effects of atherosclerosis—and prone to zinc deficiency. Chronic inflammation and oxidative stress, per the study authors, are “common risk factors” for the disease. An essential micronutrient, zinc may just be part of the treatment plan.

Study plan. Investigators studied 40 healthy older men/women aged 56-83 years in a randomized, double-blind, placebo trial of zinc supplementation. Half the subjects were given a daily supplement of 45 mg zinc (as a gluconate) for 6 months; the other half were given a placebo.

Plasma zinc concentrations in the supplemented group increased by about 10% after 6 months. But the larger jumps appeared in the corresponding changes in the inflammatory markers:

- 26% increase in antioxidant power
- 22% decrease in high-sensitivity C-reactive protein (hs-CRP, a risk predictor for coronary events—higher hs-CRP levels equate to a higher risk for heart attacks; hs-CRP increases during systemic inflammation)

- Reduced level of oxidative stress markers, inflammatory cytokines (small protein cells released by the immune system) and endothelial cell adhesion (see below)—all of which, along with C-reactive protein, are indicators of atherosclerosis or cardiovascular disease risk

Per lead author Bin Bao, the study confirmed “zinc supplementation decreased oxidative stress in elderly subjects and human vascular endothelial and monocytic cells.” Monocytic cells—a type of white blood cells functioning within the immune system—are believed to be primarily responsible for triggering atherosclerosis.

Zinc inhibits the inflammatory cycle.

The researchers theorized that zinc is beneficially down-regulating the development of atherosclerosis using this process:

1. Inflammation causes oxidative stress by increasing reactive oxygen species (ROS)
2. ROS modifies LDL (bad cholesterol) into oxidized LDL (very bad cholesterol)
3. Oxidized LDL activates NF-kB, a cell-signaling protein for inflammation
4. NFkB increases activation of inflammatory cytokines, proteins, enzymes and adhesion molecules, leading to the development of atherosclerosis
5. Zinc supplementation breaks the cycle by inhibiting NF-kB activation via negative cross-talk using 2 zinc finger proteins with antiinflammatory properties

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The real impact: endothelial dysfunction from zinc deficiency. The endothelium is the largest secreting organ in your body, forming a thin layer of cells that line the interior surface of blood vessels and your vascular tree. A highly active organ, the endothelium acts as a selective barrier, an interface between the blood vessels and blood allowing for a smooth flow within those vessels.

It also secretes substances to help regulate homeostasis and put a check on vascular tone, inflammation, coagulation and oxidation. An endothelial dysfunction paves the way to poor vascular health and is the first step toward atherosclerosis or other cardiovascular disease.

But studies have shown that zinc—needed for normal membrane function and stability—can disrupt the integrity of the vascular endothelium by decreasing its barrier function, per a study published in an early 90s issue of the *American Institute of Nutrition*. In their research, low zinc concentrations in the culture media “caused a major decrease in endothelial barrier function.”

Lead researcher Bernhard Hennig and his cohorts wrote that “zinc is needed in wound healing and because atherosclerosis is believed to begin with a vessel wall injury or dysfunction, a low zinc concentration may be involved in either initiation of injury or inadequate vascular tissue repair.”

Zinc-Rich Foods

- Oysters
- Wheat germ
- Veal liver
- Sesame flour/tahini
- Low-fat roast beef
- Roasted pumpkin/squash seeds
- Dried watermelon seeds
- Cocoa powder/chocolate
- Lamb
- Peanuts
- Alaska king crab
- Pork shoulder
- Chicken leg

Zinc Deficiencies: Global Alert

Almost 30% of the world population—about 2 billion people—are not getting enough of the essential nutrient zinc in their diet. The problem is especially severe in developing countries. Even here in the U.S. it's estimated that 12% of the population is zinc-deficient.

As many as 40% of older Americans may have low zinc levels due to an inadequate diet and decreased ability to absorb the nutrient. “Zinc deficiencies have been somewhat under the radar because we don't know that much about the mechanisms that control its absorption, role or even how to test for it in people with any accuracy,” said Emily Ho, international zinc expert and researcher at Linus Pauling Institute at Oregon State University.

Cause for concern. Ho and other researchers are concerned that this widespread zinc deficiency may hold severe health implications, especially for infectious disease, cancer, DNA damage, immune function, diabetes and vascular disease. One recent study by Ho's team found that even small zinc deficiencies were linked to DNA damage.

Prostate cancer. According to Ho, many studies have sought to link dietary zinc with prostate cancer, the second-leading cause of cancer deaths among American men. The prostate gland has one of the densest concentrations of zinc in the body, but zinc's effect on prostate cancer is still unclear.

In *The Real Vitamin and Mineral Book* by Shari Lieberman, CNS, FACN, PhD, zinc is said to inhibit the binding of androgens to receptors in the prostate, which could prevent cancer or other diseases.

In concert with that, some studies suggest that supplementing with zinc may help prevent prostate cancer in zinc-deficient men.

Note: Excessive zinc supplementation may do more harm than good to the prostate. One study found that men who received a daily dose of 100 g of zinc were twice as likely to develop advanced prostate cancer.

Zinc Stats

- 2 billion of us have zinc-deficient diets
- Aging lowers zinc levels
- Zinc deficiency opens the doorway to chronic diseases and other concerns: infectious disease, immune function, cancer, DNA damage
- Zinc deficiency breaks strands of DNA
- Zinc deficiency negatively impacts cellular health

How much zinc is enough? Take a look at the US Recommended Daily Allowance (RDA) for zinc.

- 11mg for men
- 8mg for women

And yet . . . some studies suggest these levels may not provide adequate protection against disease.

- In Lieberman's book, optimal intake falls between 25mg - 50mg daily of elemental zinc. Labels, she warns, are misleading since zinc is always combined with another compound, i.e. 220mg of zinc sulfate delivers 50mg of elemental zinc.
- The Michigan atherosclerosis study supplemented with 45mg zinc per day, more than 4 times the recommended dosage.
- Another study found that 80mg zinc oxide per day helped prevent blindness in older patients with age-related macular degeneration. Because more than 50mg zinc per day depletes the body of copper, participants in the blindness study took a daily supplement of 2mg copper. In addition to copper deficiency, excessive amounts of zinc (more than 150mg) have been linked with altered iron function, reduced immune function and lowered HDL levels.

One last word: vegetarians beware. Vegetarians can require as much as 50% more zinc than meat-eaters because plant sources of zinc are less bioavailable (phytates found in whole-grain breads, legumes, cereals, etc. inhibit its absorption). And some other populations are also susceptible to zinc deficiency: elderly, people with digestive disorders, those with sickle cell disease, pregnant and lactating women, older breastfed infants and alcoholics.

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