INE INSTITUTE OF NUTRITIONAL ENDOCRINOLOGY

Micronutrients: Zinc

Dr. Ritamarie Loscalzo

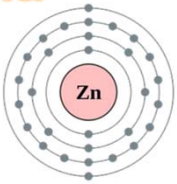
Medical Disclaimer: The information in this presentation is not intended to replace a one-on-one relationship with a qualified health care professional and is not intended as medical advice. It is intended as a sharing of knowledge and information from the research and experience of Dr. Ritamarie Loscalzo, drritamarie.com, and the experts who have contributed. We encourage you to make your own health care decisions based upon your research and in partnership with a qualified health care professional.

Zinc Basics

- ✓One of the **Microminerals:** required in small milligram (15-20 mg) doses
- ✓Important for **100 + enzymatic reactions** in the body
  - ➢Growth and repair
  - ➢Hormones
  - ➢Immune system
  - ➢Neurotransmitters
  - ➢Digestion
  - ➢...more

What We Will Cover

- ✓ Why zinc is so important
- ✓ Signs and symptoms of deficiency
- ✓ What happens when excess is consumed
- ✓ Where to find zinc in food supply
- ✓ When to supplement and best types
- ✓ Factors that help or hinder absorption
- ✓ When to use lab testing



Example of Zinc as a Cofactor

- ✓ **Omega-3 fats:** creation of DHA and EPA -- Delta 6 desaturase co-factor
  - ➢ **Mood**, mind, memory and behavior
  - ➢ Inflammation and immune control
  - ➢ Blood sugar
  - ➢ …lots more

Some Zinc Dependent Enzymes

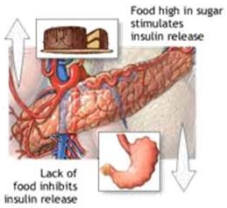
- ✓ **Carbonic anhydrase:** erythrocytes
- ✓ **Alkaline phosphatase:** bone and liver
- ✓ **Alcohol dehydrogenase:** converts alcohols to aldehydes
- ✓ **Carboxypeptidase A:** protein digestion from pancreas
- ✓ **Aminopeptidase:** protein digestion
- ✓ **Aminolevulinic acid dehydrase:** heme synthesis
- ✓ **Superoxide dismutase:** antioxidant
- ✓ **Collagenases:** digest collagen
- ✓ **Phospholipase C:** phospholipid metabolism
- ✓ **Polyglutamate hydrolase:** digestion of folate
- ✓ Polymerases, kinases, nucleases, transferases, phosphorylases, transcriptases

Zinc Functions

- ✓ Tongue: affects taste buds
- ✓ Stomach acid and digestive enzymes
- ✓ Skin, hair, nails – repair
- ✓ Endocrine (hormone) system
  - ➢ Testosterone
  - ➢ Estrogen – ratios
  - ➢ DHEA
- ✓ Protects prostate
- ✓ Maturation of egg
- ✓ Ratios between estrogen and testosterone
- ✓ Breast cancer protection
- ✓ Antioxidant
- ✓ Anti-inflammatory: relates to C-reactive protein
- ✓ Neuroprotective

Zinc and Insulin Regulation

- ✓ Transport of insulin into the cells
  - ➢ Neuropathy
  - ➢ Retinopathy
  - ➢ Thickening of lining of blood vessels
- ✓ Helps with creation of insulin in pancreas
- ✓ Affects sensitivity of cells to insulin



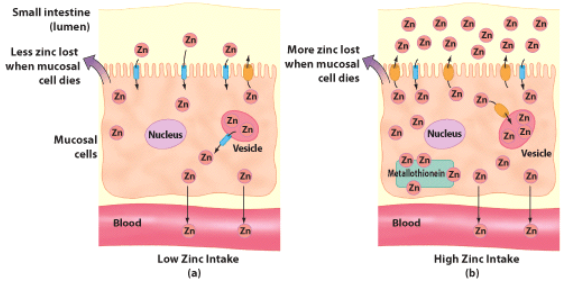
Other Zinc Functions

- ✓ Counteracts overdose of iron
- ✓ Chelates heavy metals out of the brain
- ✓ Effects on focus and memory (helping kids with ADD)
- ✓ Brain function: neurotransmitters, preventing depression

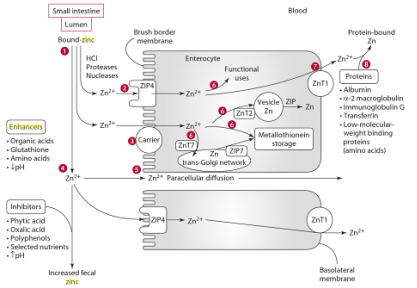
Zinc Absorption

- ✓ Mainly in proximal jejunum
- ✓ Absorbed via active transport at low intakes
- ✓ Possibly absorbed via diffusion at higher intake levels
- ✓ 15 – 35% of ingested zinc is absorbed
- ✓ A smaller percentage of zinc is absorbed at higher intakes
- ✓ A larger percentage of zinc is absorbed with low zinc intake

Zinc Absorption



Zinc Digestion and Absorption



1. Bound zinc is released from food components, primarily proteins and nucleic acids.
2. Most zinc is absorbed by Zrt- and Irt-like protein (ZIP) 4 across the brush border membrane.
3. Divalent mineral transporter (DMT) 1 and amino acids may play a minor role in zinc absorption across the brush border membrane.
4. Some zinc may be directed into the feces if bound to inhibitors, or absorption may be enhanced by organic acids, ↓pH, or chelators.
5. With high zinc intakes, zinc may be absorbed between cells (i.e., paracellularly).
6. Within cells, zinc may be used functionally or stored in vesicles, in the trans-Golgi network, or as part of metallothionein.
7. Zinc may be transported across the basolateral membrane by ZnT1.
8. Zinc binds any of several proteins for transport in the blood.

Influences on Zinc Absorption

Decreases Zn Absorption

- ✓ Phytates
- ✓ Oxalates
- ✓ polyphenols
- ✓ Non-fermentable fiber
- ✓ High calcium intake
- ✓ High copper intake
- ✓ High iron intake
- ✓ Excess fiber
- ✓ Antibiotics
- ✓ Diuretics

Increases Zn Absorption

- ✓ Citric acid
- ✓ Picolinic acid
- ✓ Pancreatic secretions
- ✓ Glutathione
- ✓ Tri-peptidases

Things That Interfere with Zinc Absorption

- ✓Copper excess
- ✓Medications: i.e. antacids (Tums)
- ✓Alcohol
- ✓Birth control pills
- ✓Grains – phytic acid

Things That Deplete Zinc

- ✓ Gluten
- ✓ Processed and overly cooked foods – they strip minerals from the body.
- ✓ Alcohol
- ✓ Herbicides and pesticides
- ✓ Refined sugar, corn syrup and artificial sweeteners
- ✓ Prolonged stress
- ✓ Antacids
- ✓ Low stomach acid
- ✓ Unfermented soy products
- ✓ Regular and decaffeinated coffee or black tea
- ✓ Excess iron, calcium, and copper

Zinc and Copper

- ✓Zinc stimulates thionein receptors
- ✓Thionein peptides have a higher affinity for copper than zinc
- ✓Dietary copper becomes trapped as part of the metallothionein within the enterocyte and never makes it into the blood

Zinc and Vitamin A

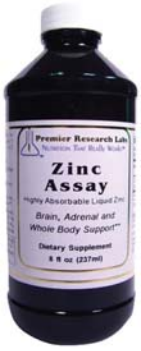
- ✓Zinc deficiency inhibits vitamin A activity.
- ✓Body stores excess vitamin A and enzymes activated by zinc release vitamin A from storage.
- ✓Zinc deficiency also decreases the amount of retinol binding protein that transports vitamin A to the tissues throughout the body.

How Much Zinc Do We Need?

- ✓Approximately 15-20 mg per day
- ✓Increases with pregnancy and nursing
- ✓Changes based on age, sex and activity level
- ✓Check out www.WHFoods.com for detailed list

Zinc Deficiency

- ✓Took 3 generations to replete in rats
- ✓**Home Test for Zinc Deficiency:** Zinc Taste Test – Zinc Sulfate
- ✓Regular testing recommended
- ✓Ionized minerals are best to replenish (Good State is a clean brand)
- ✓**Avoid sodium and potassium benzoate** as preservative
- ✓Look at signs and symptoms
- ✓Look at interfering factors



Signs of Zinc Deficiency

- ✓Slow wound healing
- ✓Brittle nails; poor nail growth
- ✓Unhealthy hair
- ✓Immune system imbalance

Zinc Deficiency Symptoms from Nutrient Assessment Chart

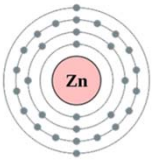
- ❑ Acne
- ❑ Decreased sense of taste
- ❑ Form scars easily
- ❑ History of Crohn's disease
- ❑ Overconsumption of sweets
- ❑ Poor perception of sweet
- ❑ Rashes
- ❑ Retarded growth and delayed sexual development in children
- ❑ Slow wound healing
- ❑ Smelly feet
- ❑ Tendency towards infections
- ❑ White spots on fingernails
- ❑ Puffy gums
- ❑ Cracked finger tips

LAB:

- ❑ Alkaline Phosphatase low

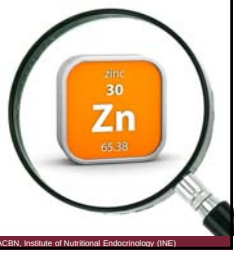
Why Zinc Deficiency is So Common

- ✓Needs strong stomach acid
- ✓Need zinc to make stomach acid
- ✓Deficiency in Mom and Grandma while pregnant can affect your ability to absorb and utilize zinc
- ✓Depleted soils
- ✓Poor diet and stressful life



Zinc Assessment

- ✓ Signs and symptoms
- ✓ Blood direct: not often done
- ✓ Blood indirect: low alkaline phosphatase and other enzymes
- ✓ Hair: not reliable
- ✓ Urine: done as part of toxic and essential elements
- ✓ Functional:
  - ➢ Organic acids
  - ➢ Fatty acids
  - ➢ Lingual taste
- ✓ White blood cells: SpectraCell
- ✓ Feces
- ✓ NutrEval



WHFoods.com: Chart of Zinc Sources

Food	Serving Size	Cals	Amount (mg)	World's Healthiest Foods Rating
Beef	4 oz	132.7	4.09	very good
Spinach	1 cup	41.4	1.37	very good
Asparagus	1 cup	39.6	1.08	very good
Mushrooms, Shiitake	0.50 cup	40.6	0.96	very good
Mushrooms, Crimini	1 cup	15.8	0.79	very good
Lamb	4 oz	350.4	3.87	good
Sesame Seeds	0.25 cup	206.3	2.79	good
Pumpkin Seeds	0.25 cup	180.3	2.52	good
Garbanzo Beans	1 cup	269.0	2.51	good
Lentils	1 cup	229.7	2.51	good
Cashews	0.25 cup	221.2	2.31	good
Quinoa	0.75 cup	222.0	2.02	good

WHFoods.com: Chart of Zinc Sources

Food	Serving	Cals	Amount	Rating
Turkey	4 oz	166.7	1.95	good
Tofu	4 oz	164.4	1.78	good
Scallops	4 oz	125.9	1.76	good
Green Peas	1 cup	115.7	1.64	good
Oats	0.25 cup	151.7	1.55	good
Yogurt	1 cup	149.4	1.45	good
Broccoli	1 cup	54.6	0.70	good
Summer Squash	1 cup	36.0	0.70	good
Swiss Chard	1 cup	35.0	0.58	good
Brussels Sprouts	1 cup	56.2	0.51	good
Miso	1 TBS	34.2	0.44	good
Sea Vegetables	1 TBS	10.8	0.33	good
Parsley	0.50 cup	10.9	0.33	good
Tomatoes	1 cup	32.4	0.31	good
Bok Choy	1 cup	20.4	0.29	good

Zinc Supplementation

- ✓ **Chelated Zinc:** the organic molecules have been given an electrical charge that allows them to positively attract the charged zinc
- ✓ **Zinc Picolinate:** chelated to picolinic acid
- ✓ **Zinc Gluconate:** bound to fermented glucose – poorly used
- ✓ **Zinc Acetate:** also known as zinc salt dihydrate and zinc diacetate - created by adding acetic acid
- ✓ **Zinc Oxide:** most commonly used in topical ointments and sunscreens - non-chelated, inorganic form
- ✓ **Zinc Sulfate:** Water-soluble and non-chelated
- ✓ **Ionic Liquid Zinc:** small particles and easily absorbed

Zinc Resources

- ✓ *Advanced Nutrition and Human Metabolism – Gropper, Smith and Groff*
  http://www.drritamarie.com/go/AdvancedNutritionHumanMetabolism
- ✓ *Dr. Carl C. Pfeiffer's Updated Fact/Book on Zinc and Other Micro-Nutrients* – June, 1978 by Carl C. Pfeiffer
  http://www.drritamarie.com/go/DrPfeifferZincBook
- ✓ Assessment Study
  http://www.drritamarie.com/go/ZincStatusAssessmentMethods
- ✓ Linus Pauling Institute:
  http://www.drritamarie.com/go/LPIZinc