

## **Bone Health: Looking Beyond Calcium**

We know that calcium is important for bone health, and most of us know about the role of vitamin D as well. However, your skeletal health is affected by many other vitamins and minerals in your diet, many that you probably do not even think about.

### **Phosphate**

A proportional amount of both phosphate and calcium is necessary for bone mineralization. If too much phosphorus is consumed with a concurrent low intake of calcium, bone loss is thought to result. This is referred to as nutritional secondary hyperparathyroidism, and contributes to a loss of bone density and mass. Individuals who consume many phosphorus-containing foods should make sure they consume an adequate amount of calcium, as well.

Phosphorous is found in:

- Meat
- Poultry
- Fish
- Eggs
- Milk
- Milk products
- Nuts
- Legumes
- Cereals
- Grains

### **Magnesium**

More than 50% of the total magnesium in your body is found in the bone, mostly in bone fluids. However, researchers have not determined the role of magnesium in bone function, but it seems prudent to make certain that your diet contains an adequate amount of this mineral.

Magnesium is found in:

- Seeds
- Nuts
- Legumes
- Milled cereal grains
- Dark-green leafy vegetables, such as:
  - Spinach
  - Broccoli
  - Cabbage
  - Turnip greens
  - Dark lettuces
- Milk

### **Vitamin K**

Vitamin K is very important for bone health and acts as a modifier of bone matrix proteins. It also may reduce urinary calcium excretion and aid intestinal calcium absorption. It seems that a low intake of this fat-soluble vitamin increases the risk for bone fracture.

Vitamin K is found in:

- Dark-green leafy vegetables, such as:
  - Spinach
  - Broccoli
  - Cabbage
  - Turnip greens
  - Dark lettuces
- Dairy products
- Meat
- Eggs

## **Vitamin A**

For many years, vitamin A was considered beneficial for skeletal health. However, in the past several years, fears have arisen that too much retinal (not derived from the carotenoids found in plant sources) may contribute to hip fractures, especially in postmenopausal Caucasian women.

Preformed vitamin A is found in:

- Liver
- Milk fat
- Fortified skim milk
- Eggs

Carotenoids are found in:

- Dark-green leafy vegetables, such as:
  - Spinach
  - Broccoli
  - Cabbage
  - Turnip greens
  - Dark lettuces
- Brussels sprouts
- Tomatoes
- Yellow-orange vegetables and fruit, such as:
  - Carrots
  - Orange juice
  - Sweet potatoes
  - Cantaloupe
  - Butternut squash
  - Peaches

## **Copper**

Copper is integral to the process of cross-linking of collagen and elastin molecules, and may have other roles in bone cells as well.

Copper is found in:

- Meat
- Poultry
- Shellfish
- Organ meats
- Chocolate
- Nuts
- Cereal grains
- Dried legumes
- Dried fruits

## **Manganese**

Manganese is necessary for the formation of bone matrix.

Manganese is found in:

- Whole grains
- Nuts
- Legumes
- Tea
- Instant coffee
- Fruits
- Vegetables

## **Iron**

Iron is important for collagen maturation, and has other roles in osteoblasts and osteoclasts.

Iron is found in:

- Organ meats, such as
  - Liver
  - Kidney
  - Heart
- Seafood
- Lean meat
- Poultry
- Dried beans
- Egg yolks
- Dried fruits
- Dark molasses
- Whole-grain and enriched breads
- Cereals

## **Zinc**

The enzymes in osteoblasts require zinc to synthesize collagen.

Zinc is found in:

- Meat
- Fish
- Poultry
- Fortified and whole-grain cereals
- Milk
- Milk products
- Shellfish
- Liver
- Dry beans
- Nuts

## **Other dietary considerations**

**Dietary fiber:** A high intake of dietary fiber may interfere with calcium absorption. This is generally not an issue for Americans. This may impact vegans, who consume 50 or more grams of fiber/day.

**Protein:** Excessive animal protein consumption may cause an increase in urinary calcium excretion.

**Sodium:** Excessive consumption of sodium increases the excretion of calcium from the body.

**Soy:** Soy seems to protect against osteoporosis and hip fractures.

**Alcohol:** Some studies refer to alcohol as a major contributor to bone loss. However, heavy alcohol consumption also is linked to tobacco usage and poor dietary habits, and these are possibly the reasons for the skeletal problems currently attributed to the alcohol usage.

## **Reference**

Anderson JJ. Nutrition and bone health. In: Mahan LK, Escott-Stump S. *Krause's Food, Nutrition, and Diet Therapy*. 11th ed. Philadelphia, PA: WB Saunders; 2004:652-654.

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