

FOODS TO HELP BALANCE BLOOD SUGAR LEVELS

Nutrients in Foods That May Help Include:

Fiber

Many studies have shown that a diet high in fiber has beneficial effects on diabetes. In particular, a fiber-rich meal leads to a much smaller rise in blood sugar and blood insulin levels compared to a meal low in fiber.

One theory suggests fiber slows down the rate at which sugar is absorbed in the gut, so blood sugar rises more slowly, which also results in blood insulin levels rising more slowly. Fiber also seems to help cells absorb glucose more easily. Diets high in fiber are associated with a much lower risk of developing diabetes than the standard low-fiber American diet.

The two main types of fiber are soluble fiber and insoluble fiber. Soluble fiber is the kind of fiber found mostly in fruits and vegetables, legumes, and certain grains like oats and barley. Insoluble fiber is found mainly in other kinds of whole grains.

Because these two types of fiber have slightly different actions in the body, it's important for diabetic patients to get a good mix of both. This can be easily achieved by eating a variety of fruits, vegetables, whole grains, and legumes.

Some excellent food sources of fiber include raspberries, mustard greens, turnip greens, collard greens, broccoli, cauliflower, and Swiss chard.

Omega-3 Fatty Acids

Omega-3 fatty acids are considered essential fats because they're needed by the body for daily activities and cannot be made from other nutrients but must be derived from the diet. In particular, the body uses omega-3 fats for making healthy, appropriately permeable cell membranes and blood vessels. Healthy cell membranes are able to appropriately respond to insulin and therefore absorb glucose better.

In addition, omega-3 fats have been shown to reduce the risk of atherosclerosis and heart disease and prevent poor blood circulation in diabetics. In addition, omega-3 fats can lower high triglyceride levels, another risk factor for heart disease commonly seen in diabetic patients.

Food sources of omega-3 fatty acids should be used to replace other high-fat foods in the diet, such as fatty meats and dairy products. Simply adding omega-3 fats to a diet that is already high in fat will not be helpful.

Food sources of omega-3 fatty acids include flax seeds, walnuts, and cold water fish, like salmon, cod, and halibut.

Vitamin E

Vitamin E is one of the major antioxidants in the body. Its main job is to roam the body searching for free radicals. When it comes into contact with these damaging chemicals, it neutralizes them, so they can't do any more harm.

Vitamin E has been shown to do great things for diabetic patients. First off, it may be able to improve the ability of cells to absorb glucose, thus lowering high blood sugar levels. It can also slow the progression of

atherosclerosis and reduce the risk of heart attack and stroke by inhibiting the formation of blood clots. In this way, vitamin E may also work to prevent retinopathy, a condition of blood clots in the vessels of the eyes that can lead to blindness in diabetic patients.

In addition, vitamin E has been shown to reduce the symptoms of poor circulation and nerve damage in patients with advanced diabetes. In general, vitamin E seems to be a very important nutrient for treating blood sugar problems as well as preventing some of the major long-term consequences of type 2 diabetes.

Vitamin E and Beta-Cryptoxanthin

A study published in the February 2004 issue of *Diabetes Care* suggests that a diet rich in vitamin E and certain carotenoids reduces the risk of type 2 diabetes. To assess diabetes risk in comparison with dietary intake of different kinds of antioxidants, a research team from Finland's National Public Health Institute followed a study population of 2,285 men and 2,019 women between 40-69 years of age, all of whom were free of diabetes when the study began.

From a dietary history interview, researchers calculated study participants' intake of vitamin C, four tocopherols and four tocotrienols (various forms of vitamin E), and six carotenoids during the year before the study began. Study subjects were then followed for the next 23 years, during which 164 men and 219 women developed diabetes.

While vitamin C intake did not appear to affect diabetes risk, eating foods rich in vitamin E and the carotenoid beta-cryptoxanthin were both found to significantly reduce risk of Type 2 diabetes.

Those eating the most vitamin E-rich foods had a 31% lower risk of developing diabetes compared to those eating the least, and those consuming the most beta-cryptoxanthin, which is found in citrus fruits, cut their chances developing type 2 diabetes by 42%.

Unfortunately, many diabetic patients have very low levels of vitamin E because diabetes results in the production of higher than normal amounts of free radicals. It's particularly important, therefore, for persons with diabetes to get plenty of vitamin E in their diets.

Excellent and very good sources of vitamin E include: mustard greens, Swiss chard, sunflower seeds, turnip greens, almonds, kale and spinach.

Concentrated sources of beta-cryptoxanthin include: red bell pepper, papaya, cilantro, oranges, corn, and watermelon.

Vitamin C

Vitamin E and vitamin C are allies in the war against free radicals. Vitamin C also roams the body, eliminating damaging free radicals before they can do more harm. In addition, vitamin C helps revitalize vitamin E that has gotten worn out by destroying free radicals.

However, diabetic patients also tend to have low levels of vitamin C in their bodies. If you increase your intake of vitamin E, it's very important that you also get more vitamin C, so the vitamin E can do a better job.

Excellent food sources of vitamin C include broccoli, parsley, bell peppers, strawberries, cauliflower, lemons, mustard greens, Brussels sprouts, papaya, kale, cabbage, spinach, kiwifruit, cantaloupe, oranges, grapefruit, tomatoes, chard, collard greens, raspberries, peppermint leaves, asparagus, celery, fennel bulb, pineapple, and watermelon.

Vitamin D3

Vitamin D is a nutrient used by the body for many purposes, especially the production of strong, healthy bones. Although it's unclear why, low vitamin D levels are strongly associated with insulin resistance.

Studies have shown that people with diets low in vitamin D are at higher risk for type 2 diabetes than people who get plenty of this vitamin. Low vitamin D also seems to be linked to many of the negative consequences of diabetes. Getting enough vitamin D may therefore be important for preventing the development and progression of type 2 diabetes. Shrimp and fortified milk are two very good sources of vitamin D.

Magnesium

Magnesium levels tend to be low in diabetic patients, especially those with kidney problems. Kidney damage causes magnesium to be flushed out in the urine, which can reduce the amount available for the many uses of magnesium in the body.

Unfortunately, low levels of magnesium are associated with an increased risk for heart disease, heart attack, high blood pressure, and stroke. The good news is that increasing the intake of magnesium can help to correct these low levels, as well as increase the ability of cells to absorb and use glucose.

Two new Harvard studies published in the January 2004 issue of the journal *Diabetes Care* have confirmed the association between a diet high in magnesium-rich foods and significantly lower risk of developing type 2 diabetes, especially in people who are overweight. The first, with a study population of 85,060 women followed for 18 years, and 42,872 men followed for 12 years, documented a 34% reduction in risk among women, and a 33% risk reduction in men eating the most magnesium-rich foods. And these substantial risk reduction statistics remained significant even after adjustments were made for dietary variables including glycemic load, polyunsaturated fat, trans fat, cereal fiber, and processed meat consumption. The second study reviewed data on 39,345 women, 45 years old or older, who were in the Women's Health Study and were followed for an average of 6 years. Again, a significant inverse relationship was found between consumption of magnesium-rich foods and risk of type 2 diabetes. Fasting insulin levels were found to be significantly higher in overweight women consuming the least magnesium compared to those eating the most magnesium-rich foods (53.5 versus 41.5 pmol/l). (A high fasting insulin level is a sign that the cells' sensitivity to insulin and thus ability to absorb blood sugar is becoming impaired). While overweight women with the lowest intake of magnesium were found to be almost certain to develop type 2 diabetes (their relative risk was 100%), those consuming the most magnesium-rich foods lowered their risk by 22%.

Two studies published in the January 2004 issue of *Diabetes Care* involving more than 170,000 people found a strong correlation between diets high in magnesium from green leafy vegetables, nuts and whole grains and a low risk of developing type 2 diabetes. In one of the studies, a research team from the Harvard School of Public Health followed 85,060 women for 18 years and 42,872 men for 12 years. None of the study participants had diabetes, cardiovascular disease or cancer when the study began. After adjustments were made to account for age, body mass index, smoking, alcohol consumption and other lifestyle factors, the data revealed that those individuals whose diets were richest in magnesium from leafy greens, nuts and whole grains, were least likely to develop type 2 diabetes. The second study, which evaluated data on 39,345 women participating in the Women's Health Study at Brigham and Women's Hospital and the Harvard Medical School, found that eating foods rich in magnesium improved the body's ability to maintain consistently healthy blood sugar levels and significantly reduced risk of developing type 2 diabetes, especially in overweight women.

Swiss chard and spinach are excellent sources of magnesium. Nuts and whole grains are also good to very good sources of this essential mineral.

Beta-carotene

Beta-carotene, another antioxidant like vitamin C and vitamin E, is found in foods such as fruits and vegetables. It's also able to eliminate harmful free radicals in the body.

Fruits and vegetables rich in beta-carotene are easy to spot since it provides their bright orange and yellow color.

Excellent food sources of beta-carotene include sweet potatoes, carrots, kale, winter squash, collard greens, chard, cantaloupe, mustard greens, romaine lettuce, spinach, parsley, cayenne pepper, peppermint leaves, Brussels sprouts, tomatoes, broccoli, asparagus, and apricots.

Folic Acid and Vitamin B12

Folic acid and vitamin B12 are two nutrients that are associated with reduced risk of heart disease and therefore may be important to those with type 2 diabetes. People who have high blood levels of a substance called homocysteine are at a much greater risk of heart disease than others.

Homocysteine is an intermediate compound produced in the body during a process called methylation. During methylation, the amino acid methionine is first changed into homocysteine, and then converted to cysteine with the help of folic acid and vitamin B12.

If a person does not have adequate amounts of folic acid and vitamin B12, levels of homocysteine build up, a situation to avoid since homocysteine is directly damaging to arteries, reduces the integrity of blood vessel walls, and interferes with the formation of collagen (the main protein in connective tissue).

High levels of homocysteine therefore contribute to the development and progression of atherosclerosis. Foods rich in folic acid and vitamin B12 should be staples in a healthy diet.

Excellent sources of folic acid include: spinach, parsley, broccoli, beets, turnip greens, asparagus, romaine lettuce, lentils, and calf's liver.

Excellent food sources of vitamin B12 include calf liver and snapper.

Chromium

Several studies have shown that insulin resistance can be caused by chromium deficiency. Chromium is a vital part of glucose tolerance factor, a substance needed by cells in order to take in glucose. Increasing chromium intake has helped some diabetic patients better control their blood sugar levels. Romaine lettuce is an excellent source of chromium and tomatoes and onions are very good sources.

What can high-chromium foods do for you?

- Help maintain normal blood sugar and insulin levels
- Support normal cholesterol levels

What events can indicate a need for more high-chromium foods?

- Hyperinsulinemia (elevated blood levels of insulin)

- High blood pressure
- High triglyceride levels
- High blood sugar levels
- High cholesterol levels
- Insulin resistance
- Low HDL cholesterol

Deficiency Symptoms

What are deficiency symptoms for chromium?

Dietary deficiency of chromium is believed to be widespread in the United States, a consequence of food processing methods that remove most of the naturally occurring chromium from commonly consumed foods. Chromium deficiency leads to insulin resistance, a condition in which the cells of the body do not respond to the presence of insulin. Insulin resistance can lead to elevated blood levels of insulin (hyperinsulinemia) and elevated blood levels of glucose, which can ultimately cause heart disease and/or diabetes.

In fact, even mild dietary deficiency of chromium is associated with a medical condition known as Syndrome X. Syndrome X represents a constellation of symptoms, including hyperinsulinemia, high blood pressure, high triglyceride levels, high blood sugar levels, and low HDL cholesterol levels, that increase one's risk for heart disease.

Toxicity Symptoms

What are toxicity symptoms for chromium?

In 2001, the Institute of Medicine at the National Academy of Sciences conducted a thorough review of the chromium research and concluded that excessive intake of chromium from foods or supplements is not associated with any adverse effects. As a result, no Tolerable Upper Intake Level (UL) was established for this mineral. However, the Institute of Medicine noted that people with liver or kidney disease may be more susceptible to adverse effects from excessive intake of chromium, and cautioned such individuals to avoid taking chromium supplements in higher than recommended amounts.

Factors that Affect Function

Which factors might contribute to a deficiency of chromium?

If you have diabetes or heart disease, the amount of chromium your body needs may be increased. You may also need extra chromium if you experience physical injury or trauma or mental stress. All of these conditions increase the excretion of chromium. But in addition, in the case of stress, the need for increased chromium may relate directly to blood sugar imbalance. Under severe stress, the body increases its output of certain hormones. These hormonal changes alter blood sugar balance, and this altered blood sugar balance can create a need for more chromium.

Drug-Nutrient Interactions

What medications affect chromium?

Chromium supplementation can cause blood sugar levels to drop. If you are taking insulin or an oral glucose-lowering medication (for example, Diabeta or Micronase), be sure to consult your physician before taking

chromium supplements, as you may need to decrease your current dose of medication to prevent your blood sugar levels from decreasing too much.

Calcium carbonate, found in calcium supplements and antacids, decreases the absorption of chromium, while aspirin is believed to increase chromium absorption.

Nutrient Interactions

How do other nutrients interact with chromium?

Diets high in simple sugars increase the urinary excretion of chromium and rob the body of some of the chromium it needs. Diets rich in whole grains can also decrease absorption of chromium, since whole grains contain a compound called phytic acid, which can bind to chromium, form an insoluble complex, and prevent it from being absorbed.

Whole grains, however, contain significant amounts of chromium, and the activity of phytic acid in grains does not prevent us from getting chromium from whole grain foods. As a result, a diet rich in whole grains is still unlikely to increase our risk of chromium deficiency.

Ascorbic acid (vitamin C) increases the absorption of chromium.

Health Conditions

What health conditions require special emphasis on chromium?

Chromium may play a role in the prevention and/or treatment of the following health conditions:

- Acne
- Glaucoma
- High cholesterol levels
- High triglyceride levels
- Hypoglycemia
- Obesity
- Psoriasis
- Type 2 diabetes

Form in Dietary Supplements

What forms of chromium are found in dietary supplements?

As a dietary supplement, chromium is available as chromium picolinate, chromium polynicotinate, chromium chloride, and chromium-enriched yeast. There is substantial debate about the preferred delivery form. Research studies have shown that chelated forms of chromium - like chromium picolinate, where chromium is hooked together with an organic acid called picolinic acid, or chromium polynicotinate, where chromium is hooked together with several molecules of vitamin B3 - are better absorbed into the body.

However, in the case of chromium picolinate, more chromium may also be excreted from the body as well, since picolinic acid binds chromium so tightly that it "doesn't let go," and the two substances stay bound together all the way through the bloodstream, and kidneys, and out through the urine. Because of vitamin B3's value in helping stabilize blood sugar, chromium in the polynicotinate form is often used in conjunction with blood sugar problems.

Food Sources

What foods provide chromium?

Although chromium occurs naturally in a wide variety of foods, many foods contain only 1 or 2 micrograms (mcg) of chromium per serving. In addition, food processing methods often remove the naturally occurring chromium. As a result, obtaining a sufficient amount of chromium in the diet can be difficult.

Furthermore, determining the chromium content of foods is problematic due to inadequate analytical tools. Consequently, currently available food composition databases do not contain accurate information about the amount of chromium found in various foods. While our food rating system qualified romaine lettuce as an excellent source of chromium and onions and tomatoes as very good sources, the following foods are also believed to provide a significant amount of chromium: brewer's yeast, oysters, liver, whole grains, bran cereals, and potatoes. Beer and wine can accumulate chromium during fermentation and are therefore considered to be dietary sources of the mineral.

World's Healthiest Foods ranked as quality sources of: chromium						
Food	Serving Size	Cals	Amount (mcg)	DV (%)	Nutrient Density	World's Healthiest Foods Rating
Romaine lettuce	2 cup	15.7	15.68	13.1	15.0	excellent
Onions, raw	1 cup	60.8	24.80	20.7	6.1	very good
Tomato, ripe	1 cup	37.8	9.00	7.5	3.6	very good
World's Healthiest Foods Rating	Rule					
excellent	DV>=75%	OR	Density>=7.6	AND	DV>=10%	
very good	DV>=50%	OR	Density>=3.4	AND	DV>=5%	
good	DV>=25%	OR	Density>=1.5	AND	DV>=2.5%	

Public Health Recommendations

What are current public health recommendations for chromium?

The Adequate Intake (AI) levels for chromium, set in 2001 by the Institute of Medicine at the National Academy of Sciences are as follows:

- 0-6 months: .2 micrograms
- 7-12 months: 5.5 micrograms
- 1-3 years: 11 micrograms
- 4-8 years: 15 micrograms
- Boys 9-13 years: 25 micrograms
- Girls 9-13 years: 21 micrograms
- Boys 14-18 years: 35 micrograms
- Girls 14-18 years: 24 micrograms
- Men 19-30 years: 35 micrograms
- Women 19-30 years: 25 micrograms
- Men 31-50 years: 35 micrograms
- Women 31-50 years: 25 micrograms

- Men 51-70 years: 30 micrograms
- Women 51-70 years: 20 micrograms
- Men greater than 70 years: 30 micrograms
- Women greater than 70 years: 20 micrograms
- Pregnant women 14-18 years: 29 micrograms
- Pregnant women 19-50 years: 30 micrograms
- Lactating women 14-18 years: 44 micrograms
- Lactating women 19-50 years: 45 micrograms

Zinc

One of zinc's main uses is regulating the immune system, which is responsible for fighting off harmful viruses and bacteria. Problems with the circulatory and immune systems can lead to poor wound healing and dangerous infections in diabetics. Sometimes these infections are severe enough to require amputations or even cause death.

Zinc has been shown to increase the number and activity of certain types of immune system cells that are especially important for fighting infections. In addition, zinc can help with blood sugar control. Since diabetic patients also tend to have low zinc levels, it's important that they get plenty of zinc in their diets. Calf liver, crimini mushrooms and spinach are three very good sources of zinc.

What can high-zinc foods do for you?

- Help balance blood sugar
- Stabilize your metabolic rate
- Prevent a weakened immune system
- Support an optimal sense of smell and taste

What events can indicate a need for more high-zinc foods?

- Impaired sense of taste or smell
- Lack of appetite
- Depression
- Growth failure in children
- Frequent colds and infections

Deficiency Symptoms

What are deficiency symptoms for zinc?

Because of the link between zinc and the taste-related protein called gustin, impaired sense of taste and/or smell are common symptoms of zinc deficiency. Depression, lack of appetite, growth failure in children, and frequent colds and infections can also be symptomatic of insufficient dietary zinc.

Toxicity Symptoms

What are toxicity symptoms for zinc?

Zinc toxicity has been reported in the research literature, and in 2000 the National Academy of Sciences set a tolerable upper limit (UI) of 40 milligrams for daily intake of zinc. (This limit applies to all individuals age 19

and over.) A metallic, bitter taste in the mouth can be indicative of zinc toxicity, as can stomach pain, nausea, vomiting, cramps, and diarrhea mixed with blood.

Factors that Affect Function

What factors might contribute to a deficiency of zinc?

In addition to dietary deficiency, problems in the digestive tract can contribute to zinc deficiency. These problems include irritable and inflammatory bowel disorders, as well as insufficient output by the pancreas that prevents proper digestion of food.

Protein deficiency, and deficiency of one particular part of protein - the amino acid cysteine - can also contribute to zinc deficiency by preventing synthesis of transport and storage molecules that are used to shuttle and store zinc in the body.

Loss of zinc through chronic diarrhea or profuse sweating (as might occur with heavy physical labor or athletic training) can also contribute to deficiency of this mineral.

Drug-Nutrient Interactions

What medications affect zinc?

Thiazide diuretics like Diuril™ or Enduron™ and ACE inhibitors like Capozide™ and Lotensin,™ both used to lower blood pressure, can compromise zinc status. The body's supply of zinc can also be reduced by use of antibiotics (like penicillinamine or tetracycline), ranitidine (often sold under the trade name Zantac™ and used as a stomach antacid), and oral contraceptives (birth control pills).

Nutrient Interactions

How do other nutrients interact with zinc?

A Tolerable Upper Limit (UL) for zinc of 40 milligrams per day was set by the National Academy of Sciences in 2000 for all adults 19 years and older. The establishment of this limit was largely related to the ability of zinc - particularly supplemental zinc - to impair the status of other nutrients.

The most important of these nutrients are copper and calcium. Even at moderate doses of 18-20 milligrams that can easily be obtained from food, zinc can compromise the body's supply of copper unless foods rich in copper are also included in the diet. When few foods high in calcium are included in the diet, high levels of zinc intake (usually obtained from supplements) can also decrease absorption of calcium from the intestine into the body.

Although zinc is associated with these potential detrimental effects on copper and calcium, it is also supportive of other nutrients. The best studied of these nutrients is vitamin A. Without zinc, vitamin A cannot be effectively transported around the body, and cannot efficiently be mobilized when it is needed.

Health Conditions

What health conditions require special emphasis on zinc?

Zinc may play a role in the prevention and/or treatment of the following health conditions:

- Acne

- Alcoholism
- Alopecia
- Alzheimer's disease
- Anorexia nervosa
- Atopic dermatitis
- Benign prostatic hypertrophy
- Cervical dysplasia
- Common cold
- Crohn's disease
- Diabetes
- Epilepsy
- Graves' disease
- Herpes simplex
- HIV/AIDS
- Infertility (male)
- Inflammatory bowel diseases
- Influenza
- Macular degeneration
- Osteoarthritis
- PMS
- Psoriasis
- Rheumatoid arthritis
- Seborrheic dermatitis
- Senile cataracts

Form in Dietary Supplements

What forms of zinc are found in dietary supplements?

Zinc cannot usually be absorbed into the body unless it is first linked up with other substances. For this reason, many supplement manufacturers have produced dietary supplements containing zinc in what is referred to as "chelated" form. "Chelated" means connected with another molecule.

In the case of zinc, the most common chelates fall into two categories. The first category is organic acids. These chelates include picolinic acid, orotic acid, citric acid and gluconic acid. The second category is amino acids. This category includes methionine, monomethionine, and aspartic acid. When supplements contain zinc in these chelated forms, the supplement label will usually read: zinc picolinate, zinc orotate, zinc gluconate, zinc monomethionine, and so forth.

Supplemental zinc is also available in what is called inorganic form. Here zinc is provided in a non-chelated form, usually as zinc sulfate or zinc oxide. Research studies on these different forms of zinc show mixed results.

Food Sources

What foods provide zinc?

Calf's liver, crimini mushrooms and spinach are very good sources of zinc.

Good sources include sea vegetables, basil, thyme, spinach, pumpkin seeds, yeast, beef, and lamb.

Good sources include beef, lamb, summer squash, asparagus, venison, chard, collard greens, miso, shrimp, maple syrup, broccoli, peas, yogurt, pumpkin seeds, sesame seeds and mustard greens.

World's Healthiest Foods ranked as quality sources of: zinc						
Food	Serving Size	Cals	Amount (mg)	DV (%)	Nutrient Density	World's Healthiest Foods Rating
Calf's liver, braised	4 oz-wt	187.1	10.80	72.0	6.9	very good
Crimini mushrooms, raw	5 oz-wt	31.2	1.56	10.4	6.0	very good
Spinach, boiled	1 cup	41.4	1.37	9.1	4.0	very good
Beef tenderloin, lean, broiled	4 oz-wt	240.4	6.33	42.2	3.2	good
Lamb loin, roasted	4 oz-wt	229.1	4.60	30.7	2.4	good
Summer squash, cooked, slices	1 cup	36.0	0.70	4.7	2.3	good
Asparagus, boiled	1 cup	43.2	0.76	5.1	2.1	good
Venison	4 oz-wt	179.2	3.12	20.8	2.1	good
Swiss chard, boiled	1 cup	35.0	0.58	3.9	2.0	good
Collard greens, boiled	1 cup	49.4	0.80	5.3	1.9	good
Miso	1 oz	70.8	1.14	7.6	1.9	good
Shrimp, steamed/boiled	4 oz-wt	112.3	1.77	11.8	1.9	good
Maple syrup	2 tsp	34.9	0.55	3.7	1.9	good
Broccoli, steamed	1 cup	43.7	0.62	4.1	1.7	good
Green peas, boiled	1 cup	134.4	1.90	12.7	1.7	good
Yogurt, low-fat	1 cup	155.1	2.18	14.5	1.7	good
Pumpkin seeds, raw	0.25 cup	186.7	2.57	17.1	1.7	good
Sesame seeds	0.25 cup	206.3	2.80	18.7	1.6	good
Mustard seeds	2 tsp	35.0	0.44	2.9	1.5	good

World's Healthiest Foods Rating	Rule					
excellent	DV>=75%	OR	Density>=7.6	AND	DV>=10%	
very good	DV>=50%	OR	Density>=3.4	AND	DV>=5%	
good	DV>=25%	OR	Density>=1.5	AND	DV>=2.5%	

Public Health Recommendations

What are current public health recommendations for zinc?

The Recommended Dietary Allowances for zinc, set in 1999 by the Institute of Medicine at the National Academy of Sciences, are as follows:

- Males and females, 0-6 months: 2 milligrams
- Males and females, 6-12 months: 3 milligrams
- Males and females, 1-3 years: 3 milligrams
- Males and females, 4-8 years: 5 milligrams
- Males and females, 9-13 years: 8 milligrams
- Males 14 years and older: 11 milligrams
- Females 14-18 years: 9 milligrams
- Females 19 years and older: 8 milligrams
- Pregnant females 18 years or younger: 12 milligrams
- Pregnant females 19 years and older: 11 milligrams

- Lactating females 18 years or younger: 13 milligrams
- Lactating females 19 years and older: 12 milligrams

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