Chromium

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General Features

Chromium is an essential trace element required for maintenance of normal glucose metabolism. The function of chromium is directly related to the function of insulin, as chromium enhances (potentiates) the activity of insulin. Some human studies demonstrate that chromium supplementation results in improvement of glucose intolerance. Thus, it may have important applications for diabetics, hypoglycemic patients, and in Syndrome X (the metabolic syndrome).

Insulin-chromium interactions are not restricted to glucose metabolism. Animal and human studies indicate that chromium stimulates amino acid transport into the cells with a corresponding increase in protein synthesis.

Only the trivalent state of chromium is biologically active (nutritional chromium). By contrast the hexavalent form of chromium used as metal alloys by industry (industrial chromium) can be extremely toxic.

The chromium concentration of most body tissue decreases steadily as we age. As well, increasing impairment of glucose tolerance throughout normal pregnancy has been amply documented, and the changes in chromium concentration in the plasma may reflect decreased glucose tolerance or may actually reflect deficiency.

Concentration of chromium in the hair is ten times higher than in blood, and hair concentration has been suggested as a means of assessing chromium status.

Absorption and Metabolism

The exact mechanism of chromium absorption is not known, but it is not simple diffusion. Chromium is transported in the plasma in combination with transferrin. Unlike other metals, once chromium is absorbed, it is almost entirely excreted in the urine. Thus, daily intake is important to optimize chromium's functions in the body. Generally speaking, absorption of inorganic chromium found in food and water appears to be only about one percent. Organically-bound chromium (e.g., GTF-chromium, chromium-chelates found in many supplements) permits a bioavailability of 10-25 percent.

The total amount of chromium found in the body averages less than 6 mgs. The hair, spleen, kidney and testes contain the highest concentrations.[1,2]

Recommended Daily Allowance (Chromium)

There is no official RDA for chromium, but the following recommendations have been suggested:

Age Group	Dosage (mcg)
0 – 6 mths	10 - 40
6 – 12 mths	20 - 60
1 – 3 yrs	20 - 80
4 – 6 yrs	30 - 120
7 years and older	50 – 200[3]

Supplementation Studies and Clinical Applications

1. **Glucose Intolerance**

   More than 15 controlled studies demonstrate that chromium supplementation has a positive effect on impaired glucose tolerance, by potentiating the action of insulin. This has important implications for hypoglycemics and Type II diabetics.[4]

   In clinical studies in non-insulin dependent diabetes mellitus (NIDDM), supplementation with chromium has been shown to decrease fasting glucose levels, improve glucose tolerance, lower insulin levels, decrease total cholesterol and triglycerides, and increase HDL-cholesterol levels.[5-8] In most of these studies, subjects ingested a minimum of 200 mcg of chromium from a supplement, daily.

2. **Cholesterol and Triglyceride Lowering**

   Chromium supplementation has been shown to lower cholesterol and triglycerides in both diabetic and non-diabetic subjects. Many forms of chromium have demonstrated this effect, but the value appears to be only in those with low initial chromium nutritional status. The typical changes are a 10 percent reduction in total cholesterol and triglycerides and a two percent increase in HDL.[9-14]

   These are significant changes as every one percent decrease in total cholesterol corresponds to a 2-3 percent reduction in heart disease and stroke. Every one percent increase in HDL-cholesterol levels carries a 2-4 percent decrease in risk of cardiovascular disease.[15]

3. **Body Fat Reduction and Lean Mass Gains**

   Chromium supplementation has been shown to facilitate reductions in body fat and increase lean muscle mass. Lean mass gains have been especially noteworthy in subjects taking chromium supplements in conjunction with resistance training, in both young males and females.

   However, even in older and elderly subjects chromium supplementation has produced significant reductions in body fat and moderate increases in muscle mass compared to placebo.

   Typical doses for weight loss and lean mass gains have used 200-400 mcg per day. Additional studies are underway to determine the degree to which chromium may be helpful as a weight loss and anabolic aid.[2,16,17,18] Presumably chromium is effective in these applications due to its ability to increase insulin sensitivity, thereby lowering plasma insulin levels. Higher insulin levels tend to convert more carbohydrates into fat and insulin resistance decreases protein synthesis in muscles and amino acid uptake.[2]

Dosage Ranges

1. Glucose Intolerance: 200-400 mcg per day
2. Cholesterol and Triglyceride: 200-1,000 mcg per day
3. Weight Loss and Lean Mass Gains: 200-400 mcg per day[2]
4. Type-II Diabetics: 500 mcg of chromium, taken twice per day has been shown to decrease glycosylated hemoglobin, glucose, insulin and cholesterol variables[19]

NB: Chromium supplementation has been shown to reverse corticosteroid–induced Diabetes (200-1000 mcg).[20]

Side Effects and Toxicity

Trivalent chromium (nutritional chromium) has a very large safety range and there have been no documented signs of chromium toxicity in any of the nutritional studies at levels up to 1 mg (1,000 mcg) per day.[21]

Some patients have reported increased dream vividness and decreased sleep requirements with chromium supplementation taken at 7:30 p.m., daily (50 mcg).[22]

At levels of intake between 1,200 mcg and 3,400 mcg of chromium picolinate a case of anemia, liver dysfunction and other problems appeared after four to five months.[23]

Drug-Nutrient Interactions

Chromium supplementation may enhance the effects of drugs for diabetes (e.g., insulin, blood-sugar lowering agents) and possibly lead to hypoglycemia. Therefore, diabetics taking these medications should supplement chromium only under the supervision of their attending physician.

Doses of glyburide (a hypoglycemic sulfonylurea drug used to lower blood sugar in type II diabetics) will need to be lowered if chromium supplementation is initiated, in most cases.

Insulin-dependent diabetics may also be required to lower their insulin dosage if chromium supplementation is implemented.[24]

1. Corticosteroid drugs - may increase urinary loss of chromium.[21]
2. Insulin (Type-I Diabetics) - chromium can potentiate the action of insulin, thus affecting insulin dose requirements (do not supplement with chromium without cooperation of attending diabetic physician).[25]

Nutrient-Nutrient Interactions

1. Refined Sugars: excess sugar intake has been shown to increase urinary loss of chromium.[26]
2. High Carbohydrate Diet: high carbohydrate consumption has been shown to increase the urinary loss of chromium.[27]

Pregnancy and Lactation

During pregnancy and lactation, the only supplements that are considered safe include standard prenatal vitamin and mineral supplements. All other supplements or dose alterations may pose a threat to the developing fetus and there is generally insufficient evidence at this time to determine an absolute level of safety for most dietary supplements other than a prenatal supplement. Any supplementation practices beyond a prenatal supplement should involve the cooperation of the attending physician (e.g., magnesium and the treatment of preeclampsia.)

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