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Chromium: A Nutritional Trace Mineral

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Chromium is an essential trace element needed for maintenance of proper sugar and fat metabolism. Chromium is present throughout our body, with the highest concentration being in the liver, kidney, spleen, bone, brain and muscle.

Chromium supplements are available in various forms including chromium picolinate, niacin-bound chromium (also called chromium polynicotinate), and chromium-enriched yeast. Brewer's yeast is considered the most biologically active and absorbable form of chromium. Chromium picolinate and polynicotinate are widely available dietary supplements marketed for many afflictions, and gaining popularity among those seeking a weight-loss program.

Biological Functions

Chromium functions primarily by regulating the action of insulin, the hormone that transports glucose (a simple sugar that our body uses for fuel) from the bloodstream into cells. Optimal chromium intake appears to decrease the amount of insulin required to maintain normal blood sugar. Insulin not only helps control blood sugar levels, but also helps regulate the metabolism of fats.

Chromium is absorbed poorly, only two to 10 percent of dietary intake is generally absorbed. Organic chromium (such as chromium picolinate, Chromax manufactured by Nutrition 21 of Purchase, NY; and niacin-bound chromium, ChromeMate by InterHealth of Benicia, CA) is absorbed more efficiently than inorganic chromium such as chromium chloride.

Absorption may decline with age, and most absorbed chromium is eliminated through the kidneys. Antacids may also decrease chromium absorption. The average adult body contains between 0.4 and 6 mg of chromium.

Deficiency

Chromium deficiency is relatively common in patients with Type II diabetes. Chromium deficiency may also lead to hypoglycemia (low blood sugar), and heart disease. Poor chromium dietary intake may be linked to high blood cholesterol levels and therefore increased risk of atherosclerosis. Patients with advanced heart

disease often have low chromium levels in their blood.

Symptoms of chromium deficiency include impaired glucose tolerance, high blood fat and cholesterol levels and diabetes-like symptoms such as weakness, weight loss, thirst, hunger and frequent urination.

In a 1997 study, researchers analyzed chromium levels in hair, sweat, and serum samples obtained from over 40,000 patients. The results showed highly significant age-related decreases, which may play a part in the increased risk of diabetes and atherosclerosis in older people.

Sources

Good sources of chromium include liver, eggs, brewer's yeast, beef, poultry, broccoli, whole grain cereals, bran, wheat germ, nuts, oysters, mackerel, spinach, and yeast.

Diet Recommendations

The Estimated Safe and Adequate Daily Dietary Intakes for adults are between 50 to 200 mcg per day. The average dietary intake in the U.S. is 30mcg/day.

Toxicity/Safety

Both solubility and oxidation state affects the potential for toxicity; furthermore, the type of complex may impact toxicity. Hexavalent chromium is much more toxic than the trivalent form. The hexavalent chromium compounds may be carcinogenic. The acidity of the stomach promotes reduction of hexavalent chromium to the trivalent form. Most of the chromium absorbed from the gastrointestinal tract is trivalent.

A test-tube experiment found that chromium picolinate caused severe damage to Chinese hamster ovary cells grown in the laboratory. However, in recent studies chromium picolinate failed to induce mutations in the standard mutagenicity test known as the AMES test.

Cautions

Chromium supplements may decrease insulin requirements in diabetics. Diabetics should consult their health care provider before taking chromium supplements, since chromium may cause blood sugar levels to drop and reduce the need for insulin.

Research Studies

Diabetes: Chromium supplements have been successfully used to treat diabetes, and hypoglycemia. In one study, chromium picolinate was found to improve glucose tolerance and insulin of people in China with Type II (non-insulin-dependent) diabetes. The

study was carried out by the United States Department of Agriculture on 180 Chinese subjects with non-insulin-dependent diabetes mellitus (NIDDM) who were divided into three groups of 60 subjects each and supplemented with placebo, 100 or 500 mcg of chromium picolinate two times per day for four months.

Improvements in the glucose/insulin system were highly significant in the 500 mcg-chromium group, and fewer or no significant improvements were found in both the placebo and 100 mcg-chromium group. Plasma total cholesterol also decreased after four months in the subjects receiving 500 mcg chromium picolinate. These results indicate that the beneficial effects of chromium in individuals with diabetes are observed at levels higher than the upper limit of the Estimated Safe and Adequate Daily Dietary Intake.

A limited study (1999) showed that treatment with chromium picolinate (600 mcg per day) for three days reversed steroid-induced diabetes in three subjects. The patients' blood glucose decreased from 250mg/dl to 150mg/dl, and their urinary chromium increased significantly.

However, in a more recent randomized, double-blind, placebo-controlled trial (2000), 19 subjects (aged 63 to 77 years) received either placebo or 1,000 mcg per day chromium picolinate for eight weeks. No significant change in serum lipids, insulin sensitivity, or body composition was observed in the chromium group compared with the placebo group. The study concluded that chromium picolinate supplementation alone does not appear to improve insulin sensitivity, serum lipids, or change body composition in non-obese, healthy men and women of advanced age.

Chromium supplements have also been shown to improve the symptoms of hypoglycemia in some people.

Researchers at the University of Vermont reported that the combination of chromium picolinate (Chromax of Nutrition 21) plus biotin works synergistically to decrease elevated blood sugar levels, to improve lipid profiles (significantly increasing HDL cholesterol levels, and decreasing total cholesterol levels), and to enhance glucose metabolism in human skeletal muscle cells.

Weight management: Research suggests that chromium supplements may cause weight loss, reduce fat and increase muscle mass. Researchers in Austria assessed the effects of chromium yeast and chromium picolinate on body composition in 36 obese and non-diabetic patients (average age 45 years) during (8 weeks) and after (18 weeks) weight reduction with a very low calorie diet. Patients were randomly assigned to either placebo or chromium yeast (200 mcg per day) or chromium picolinate (200 mcg per day) in a double-blind fashion. After the treatment period,

the chromium picolinate group showed increased lean body mass whereas the other treatment groups still had reduced lean body mass.

The combination of chromium nicotinate supplementation with exercise training was examined on obese young women by researchers at the University of Texas. The researchers found that exercise training combined with chromium supplementation resulted in significant weight loss and lowered the insulin response to an oral glucose load. The study suggested that exercise training combined with chromium supplementation may be more beneficial than exercise alone.

Cardiovascular protection: In 1994, researchers in Texas reported that chromium picolinate supplements taken for a period of two months significantly reduced triglyceride levels in 14 men and 16 women.

Another study involving 14 healthy adults and five adults with diabetes mellitus showed that daily supplementation with 200 mcg of chromium and nicotinic acid lowered total and LDL cholesterol, triglycerides, and glucose concentrations in patients with Type II diabetes. An earlier double-blind crossover study (1990) also showed the ability of chromium picolinate (200 mcg daily for six months) to lower blood lipids in humans.

These studies suggest that chromium supplementation can lower total cholesterol and improve blood lipid profiles.

Other Therapeutic Benefits

Researchers at the University of North Carolina found that chromium picolinate significantly improved symptoms and functioning in eight depressed patients with refractory mood disorders.

Chromium picolinate may help to preserve bone density and therefore prevent osteoporosis. In a study involving postmenopausal women, chromium picolinate was found to raise serum levels of dehydroepiandrosterone, which may play a role in preserving bone density.

High chromium yeast has been reported to treat acne with some success.

Summary

Chromium supplements are available in various forms, including brewer's yeast. Chromium supplementation has been shown to improve glucose tolerance and lower insulin levels in Type II diabetics. Chromium supplements may help with high cholesterol, diabetes, hypoglycemia, heart disease, acne, and as part of a weight loss program. Research also suggests that chromium

supplementation may indeed help build lean tissue and reduce fat in adults who exercise. VR