All About Chromium

Chromium has become a subject of much interest in recent years, and we continue to learn more about it. Chromium was long thought to be a toxic mineral until it was discovered in 1957 to be the essential part of glucose tolerance factor (GTF). GTF (and thus chromium) is a vital molecule in regulating carbohydrate metabolism by enhancing insulin function for proper use of glucose in the body. GTF is composed of one chromium molecule in the trivalent state (a +3 charge), two niacin molecules, and three amino acids—glycine, cysteine, and glutamic acid.

Trivalent chromium is the biologically active form. Hexavalent chromium (+6) is fairly unstable and is potentially toxic in the body. Chromium is not found in nature as a free metal, so it must be reduced to its elemental form to make the "chrome" used in the auto industry. This form, however, is not available to the body, so we cannot meet our daily chromium needs by sucking on car bumpers. The chromium in the blood is in the organic active form in the trivalent state, as part of GTF or carried with a beta-globulin protein.

Chromium is really considered an "ultra-trace" mineral, since it is needed in such small quantities to perform its essential functions. The blood contains about 20 parts per billion (ppb), a fraction of a microgram. Even though it is in such small concentrations, this mineral is important to health. There are about 6 mg. of chromium stored in the bodies of people who live in the United States; tissue levels of people in other countries are usually higher, and those higher levels tend to be associated with a lower incidence of diabetes and atherosclerosis. There is less hardening of the arteries in people of Asian countries, who it is estimated have five times higher chromium tissue levels than Americans. People of Near Eastern countries who have about four times the average U.S. levels and African people who have twice our chromium levels seem to experience less diabetes than Americans. These higher tissue levels of chromium are due primarily to better soil supplies and a less refined diet. Chromium may be only one of the factors accounting for the differences in rates of diabetes and atherosclerosis between cultures, but it is probably a major one.

Chromium is a difficult mineral to absorb. Figures range from 0.5,3 percent absorption for the inorganic chromium salts often found in food. The organic complexes of chromium, such as GTF, are absorbed better, at about 10,20 percent. The kidneys clear any excess from the blood, while much of chromium intake is eliminated through the feces. This mineral is stored in many parts of the body, including the skin, fat, brain, muscles, spleen, kidneys, and testes.

Tissue levels of chromium tend to decrease with age, which may be a factor in the increase of adult-onset diabetes, a disease whose incidence has risen more than sixfold in the past 50 years. This increase may mirror the loss of chromium from our diets because of soil deficiency and the refinement of foods. Much of the chromium in whole grains and sugarcane is lost in making refined flour (40 percent loss) and white sugar (93 percent loss). In addition, there is some evidence that refined flour and sugar deplete even more chromium from the body. Reduced absorption related to aging, diets that are stressful to the digestive system, and the modern refined diet all contribute to chromium deficiency. Higher fat intake also may inhibit chromium absorption. If chromium is as important as we think it is to blood sugar metabolism, its deficiency may be in part responsible, along with the refined and processed diet, for the third leading cause

of death (more than 300,000 yearly) in this country, diabetes mellitus, and this figure does not reflect other deaths that may be related to chromium deficiency, since high blood sugar levels seen in diabetes also increase the progression of atherosclerosis and cardiovascular disease, our number one killer. Diagnosing and treating chromium deficiency is simple and should be done as early as possible, as it is much easier to prevent diabetes than to treat it.

Chromium is an essential mineral—that is, it is not made by the body and must be obtained from the diet. As the central part of GTF, it enhances the effect of insulin in the body. GTF is necessary for proper insulin function in the utilization of glucose and is needed in both human and animal nutrition for carbohydrate metabolism. Specifically, chromium/GTF improves the uptake of glucose into the cells so it can be metabolized to produce energy (ATP). GTF is thought to bind both to insulin and to the cell receptors to utilize and thus help lower the blood sugar. This function of the glucose tolerance factor prevents continued elevations of blood sugar, which can lead to diabetes. If glucose does not enter the cells, the excess circulating sugar can cause damage to the cells, the retina of the eye, and the arteries, for example. Therefore, proper control of blood sugar may help to prevent atherosclerosis and its subsequent problems.

Chromium recently has been shown to lower blood cholesterol while mildly raising HDL (high-density lipoprotein), the good portion of cholesterol. This lowers the risk ratio for coronary artery disease. (Exercise is a key factor in raising HDL cholesterol and reducing coronary artery disease risk. Exercise also promotes the efficiency of insulin-mediated uptake of glucose into cells.)

Uses

Chromium and GTF are used in the treatment of both hypoglycemia and diabetes mellitus, two problems of blood sugar utilization and metabolism. Preventing chromium deficiency is the key here. The earlier treatment is begun, especially with potential diabetes, the more helpful it may be. Preformed GTF is not readily available, though formulas that contain all of its components seem to work better than chromium alone, and small amounts given daily have been shown to both increase glucose tolerance and decrease blood fats, both cholesterol and triglycerides, as well as to raise HDL. Chromium also does this and has been used along with niacin (also a part of GTF) in the treatment of high blood cholesterol.

Henry Schroeder, M.D., who has done numerous studies with chromium, has shown that 2 mg. of inorganic chromium given daily reduced cholesterol levels by about 15 percent. He has produced diabetes in lab animals by feeding them chromium-deficient diets. Such a diet raises not only blood sugar but blood cholesterol as well; both conditions return to normal with chromium supplementation. When Dr. Schroeder fed rats a chromium-rich diet, they showed improved longevity along with a reduction of atherosclerotic plaque found in the blood vessels at death. Chromium is used to help reduce atherosclerosis in people, especially in those who show low chromium levels. Cultures with higher tissue levels of chromium also appear to have lower incidences of atherosclerosis and heart disease.

Deficiency and toxicity: Because of the low absorption and high excretion rates of chromium, toxicity is not at all common in humans, especially with the usual forms of chromium used for supplementation. The amount of chromium that would cause toxicity is estimated to be much more than the amount commonly supplied in supplements.

Chromium deficiency is another story, however, with an estimated 25,50 percent of the U.S. population deficient in chromium. The United States has a greater incidence of deficiency than any other country, because of very low soil levels of chromium and the loss of this mineral from refined foods, especially sugar and flours. Deficiencies are more common in both the elderly and the young, especially teenagers on poor diets. Even though chromium is needed in such small amounts, it is difficult to obtain. Given these factors, and the fact that the already-low chromium absorption rate decreases even further with age, chromium deficiency is of great concern. It may even be the missing link in the development of adult-onset diabetes, a serious problem increasing rapidly in our culture. Nearly one in five adult Americans now develops diabetes.

A high-fat, high-sugar diet that contains refined flour products is probably the most important risk factor for diabetes. Such a diet tends to be low in chromium content and also causes more insulin to be produced, which requires even more chromium. Milk and other high-phosphorus foods tend to bind with chromium in the gut to make chromium phosphates that travel through the intestines and are not absorbed.

Even mild deficiencies of chromium can produce symptoms other than problems in blood sugar metabolism, such as anxiety or fatigue. Abnormal cholesterol metabolism and increased progress of atherosclerosis are associated with chromium deficiency, and deficiency may also cause decreased growth in young people and slower healing time after injuries or surgery. Most important, the low chromium levels seen in the United States are associated with a higher incidence of diabetes and arteriosclerosis. Further research is needed to confirm these associations and to determine whether correcting the chromium deficiency would actually reduce the incidence of these diseases.

Requirements

There is no specific RDA for chromium. Average daily intake may be about 80,100 mcg. We probably need a minimum of 1 to 2 mcg. going into the blood to maintain tissue levels; since only around 2 percent of our intake is absorbed, we need at least 100,200 mcg. in the daily diet. A safe dosage range for chromium supplementation is between 200, 300 mcg. Children need somewhat less. Many vitamin or mineral supplements contain about 100,150 mcg. of chromium. Some people take up to 1 mg. (1,000 mcg.) per day for short periods without problems; this is not suggested as a long-term regimen but rather to help replenish chromium stores when deficiency is present. All of the precursors to the active form of GTF are used in some formulas, but usually with chromium in lower doses, such as 50 mcg., since it is thought to be better absorbed with niacin and the amino acids glycine, cysteine and glutamic acid.