

# USANA Technical Bulletin

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## Chromium

### Technical Background

- Chromium is an essential mineral known to increase the efficiency of insulin action, thereby improving cellular glucose uptake and carbohydrate and lipid metabolism.<sup>1</sup>
- Chromium is believed to exert this action by binding with nicotinic acid and amino acids (glutathione) to form an organic complex called glucose tolerance factor (GTF). GTF is thought to initiate the disulfide bridge that allows insulin to bind to its receptor on cell membrane surfaces.<sup>2</sup>
- In a recent review of clinical trials involving chromium supplementation, 12 of 15 studies showed improved efficiency of insulin action among the subjects tested. People with some degree of impaired glucose tolerance were more responsive to chromium supplementation than other subjects.<sup>3</sup> Consequently, chromium is now receiving attention as a possible treatment for type II diabetes and hyperglycemia.<sup>4,5</sup>
- Chromium may also affect lipid metabolism. Significant increases in high density lipoprotein (HDL) cholesterol and decreases in total and low density lipoprotein (LDL) cholesterol concentrations have been demonstrated with chromium supplementation.<sup>2</sup> Additional studies have shown improvements in body composition (decreases in body fat and increases in nonfat mass) resulting from chromium supplementation.<sup>6</sup>
- Chromium is also thought to influence nucleic acid metabolism, with specific roles in gene expression and RNA synthesis.<sup>1</sup>
- Chromium exists in a number of valence states, but the trivalent form ( $\text{Cr}^{+3}$ ) is the most stable and active in biological systems.<sup>1</sup> Chromium picolinate is one of the forms that has received considerable attention as of late, particularly regarding its ability to influence insulin sensitivity.<sup>6,7</sup>

### Sources and Recommended Intake

- The recommended daily dietary intake for chromium is set at 50-200 mcg per day.<sup>8</sup>
- Several studies have shown that many – if not most – Americans consume less than this amount in their diets.<sup>1</sup>
- The best food sources for chromium include meats, whole grains, legumes, cheese, nuts, mushrooms, prunes, beer, and wine. Most vegetables and fruits appear to contain little chromium. (Note that the trace amounts of chromium in foods are difficult to measure, and there are no true authoritative studies that accurately assess the distribution of this essential mineral in foods.)<sup>1,2</sup>

- Processing and refining can significantly reduce the amounts of chromium in some food sources, particularly grains and cereals. Oppositely, preparation of foods in stainless steel (which typically contains 11-30% chromium) may add chromium to foods.<sup>1,2</sup>
- Inorganic chromium is poorly absorbed in the human gut. Studies conducted to date show that only 0.4-2.0% of chromium taken as chromium chloride is absorbed.<sup>5</sup> Much higher rates of absorption have been proposed for organically chelated or complexed forms.
- Most chromium in foods is trivalent chromium (or it quickly reduces to trivalent chromium), which is safe to ingest. The safety of supplementation at 200 mcg per day of trivalent chromium has been well-documented. Because it is poorly absorbed and rapidly excreted, much higher oral intakes would be necessary to attain toxic levels.<sup>8</sup>
- Hexavalent chromium, which is used to treat wastewater, is not found in foods.

## Abstracts

*Anderson RA. Chromium, glucose intolerance and diabetes. J Am Coll Nutr. 1998 Dec;17(6):548-55.* Within the last 5 years chromium (Cr) has been shown to play a role in glucose intolerance, Type 2 diabetes mellitus (Type 2 DM), and gestational diabetes. In addition, diabetes and the neuropathy of a patient on home parenteral nutrition were alleviated when supplemental Cr was added to total parenteral nutrition (TPN) solutions. In a study conducted in China that has been supported by studies in the United States, supplemental Cr as Cr picolinate improved the blood glucose, insulin, cholesterol, and hemoglobin A1C in people with Type 2 DM in a dose dependent manner. Follow-up studies of > 1 year have confirmed these studies. The requirement for Cr is related to the degree of glucose intolerance: 200 microg/day of supplemental Cr is adequate to improve glucose variables of those who are mildly glucose intolerant. However, people with more overt impairments in glucose tolerance and diabetes usually require more than 200 microg/day. Daily intake of 8 microg of Cr per kg body weight was also more effective than 4 microg/kg in women with gestational diabetes. The mechanism of action of Cr involves increased insulin binding, increased insulin receptor number, and increased insulin receptor phosphorylation. In summary, supplemental Cr has been shown to have beneficial effects without any documented side effects on people with varying degrees of glucose intolerance ranging from mild glucose intolerance to overt Type 2 DM.

## References

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