Nutritional Yeast Supplement

GTF Excell®

BACK TO BASICS: **FOOD-BOUND CHROMIUM** AND THE SCIENTIFIC SUPPORT FOR **GTF EXCELL® CHROMIUM YEAST 250**

Renewed Interest in Glucose Tolerance Factor (GTF)

CHROMIUM WAS FIRST discovered to play a key role for blood sugar management in the 1950s when scientists found that rodents who ate nutrient-poor diets became obese and developed diabetes. By process of elimination, they found that feeding chromium as part of brewer's yeast was essential to keep the animals from developing diabetes (Schwartz and Mertz, 1957). Researchers later isolated an organic, amino-acid-bound chromium from brewer's yeast that they called Glucose Tolerance Factor (GTF).

At Cypress Systems, we've researched and thought a lot about the important role of GTF chromium. With rising rates of insulin resistance and its damaging effects that may lead to diabetes, GTF chromium is an important ingredient that potentiates insulin action by orchestrating the efficient conversion of energy from food carbohydrates. This improved glucose regulation is known to support healthy levels of body fat and a person's ideal body weight and composition

CYPRESS
OUR SCIENCE IS GOLDEN

WHAT THE BODY DOES WITH CHROMIUM

Chromium (Cr) is vital to the function of insulin, the hormone that drives the conversion of carbohydrates into energy. When blood sugar levels rise after a meal, the pancreas secretes insulin, which drives the sugar out of the blood and into cells where it can be used for energy. Cr enhances the action of insulin, increasing insulin sensitivity and the uptake of blood sugar by our cells. Cr potentiates insulin action in peripheral tissue. Improved insulin activity and the resulting improvements in blood glucose are associated with improved markers for energy metabolism, such as blood lipids and a healthy body weight. Optimal body weight and body fat are major benefits gained from the proper regulation of blood sugar and insulin, and Cr is critical for this process.

Chromium deficiency reduces the efficiency in metabolism of glucose and is associated with many chronic diseases related to insulin resistance, such as maturity-onset diabetes, cardiovascular diseases, and nervous system disorders.[3,4] Furthermore, the liver uses chromium to support the metabolism of dietary fat, including fatty acids, cholesterol, and lipoproteins. This lends support for the premise that chromium may positively affect blood fat levels and the liver filtration process.

The daily dietary intake of chromium for people in the U.S. and many other countries is suboptimal and below the Estimated Safe and Adequate Daily Dietary Intake (ESADDI) of 50 micrograms (mcg), roughly 25mcg for women and 33mcg for men.[5] Approximately 90% of normal American diets may be below the minimum suggested safe and adequate daily intake of 50 mcg.[6]

THE MINERAL CONTROVERSY: FOOD-BOUND OR NOT?

Micronutrient minerals are essential to all life. For the entire duration of human evolution, we have consumed our key micronutrients in their complex food forms as plants, animals or micro-organisms, like yeast. During the advent of modern Western science and nutrition in the 1900's, food processors fortified foods with micronutrient mineral salts and synthesized vitamins to ensure adequate nutrient intake in processed foods. These modern methods of nutritional fortification departed from the traditional whole-food sources of minerals.

The form of foods and supplements are important for the proper absorption of minerals in the gastrointestinal tract.[7] Most ingested chromium is excreted in feces, and most absorbed chromium is rapidly excreted in urine within a day or two.[8] Of the chromium that is not rapidly excreted, some remains distributed in tissues, mainly the liver, soft tissue and bone. Tissue-bound chromium has a longer half-life and may be considered "slow-release chromium" that can be continuously utilized by the body over a longer period.[9]

Inorganic chromium salts are associated with a lower bioavailability in tissues and circulation over the long term compared to food forms, despite their more rapid rate of initial absorption. Based on the excretion dynamics of chromium, rapidly absorbed chromium salts may not contribute to tissue chromium status like food forms.[10] The limitations in bioavailability of chromium, along with the discovery that GTF and food-bound chromium may be better absorbed into the body's tissues, led to the development of yeast fortified with chromium (GTF chromium) as a more bioavailable form of chromium.

FOOD-BOUND IS DIFFERENT THAN "ORGANICALLY" BOUND

Chromium is one essential micronutrient that has a long history of consumption in food, with an excellent safety profile in its food-bound form. Whether as a truly organically bound complex form within fruits and vegetables, or in yeast added to foods like bread and beer, food-based micronutrients have not been called into question for efficacy or safety like some non-food bound forms.

Then there are what may be called "pseudo-organic" forms of minerals, which are mistakenly called "organic." The term "organic" for these forms is misleading, because they are not derived from food forms and are not the same as the food form. The so-called "organic" minerals are often created through industrial chemical processes that typically use petrochemicals, harsh solvents, and processes.

Many studies have attempted to investigate the effect of non-food, chelated "organically bound" chromium, such as picolinate and nicotinate forms. The impact on the body of the so-called "organic" minerals, as well as salt-based micronutrients, such as chromium picolinate and nicotinate, have been studied in detail over the past 30+ years, often yielding conflicting results. The current state of the science on non-food forms of minerals like chromium poses more questions than answers.

> "SIMPLY SAID, THE HISTORY OF FOOD CONSUMPTION OF CHROMIUM, ALONG WITH THE SCIENCE, SHOWS THAT CHROMIUM IS BEST ABSORBED IN ITS COMPLEX FOOD FORM."

For example, studies on chromium picolinate, which is not found in food sources of chromium, generally show limited improvements in absorption, versus the inorganic salt form. Yet in test tube studies, the inorganic salt form of chromium can be pro-oxidant and toxic to DNA. Human case studies have documented potential toxicity from chelated forms. This toxicity has not been found with food-form minerals.

WHY GTF YEAST IS THE PERFECT FOOD MATRIX FOR CHROMIUM ABSORPTION

The current body of knowledge about mineral absorption in living organisms suggests that GTF is actually a variety of chromium-containing complexes integrated into a diverse number

TABLE 1

TYPE OF CHROMIUM	% BLOOD ABSORPTION	REFERENCE
CHROMIUM YEAST	5-10%	MERTZ 1971[11]
PICOLINATE	2.8%	GARGAS 1994[12]
CHLORIDE	0.7%	MERTZ 1971[13]

The absorption of chromium from various forms of chromium suggest that food-based forms such as yeast are superior to salt or chelated forms

of proteins, peptides and amino acids. A "low molecular weight chromium" molecule has been identified and hypothesized as the core element of GTF chromium and shown to act on the insulin receptor, but efforts to replicate its composition have been unsuccessful.

A number of studies have been performed to determine whether GTF can be isolated to a single molecule or chemical identity. Efforts to isolate a single species of chromium from food may be misleading because their results do not reflect how humans have consumed it for thousands of years. In truth, there may exist thousands of unique molecules that contain chromium in food. GTF comprises all of the various chromium-containing molecules that plants or yeast create on their own.

Because chromium is bound in the body to cell proteins, analyzing these tissues for their content necessarily destroys the true molecular structure. Food-bound chromium is not only bound as a single amino acid chelate molecule — it is bound in a number of ways that our body has adapted to over many years.

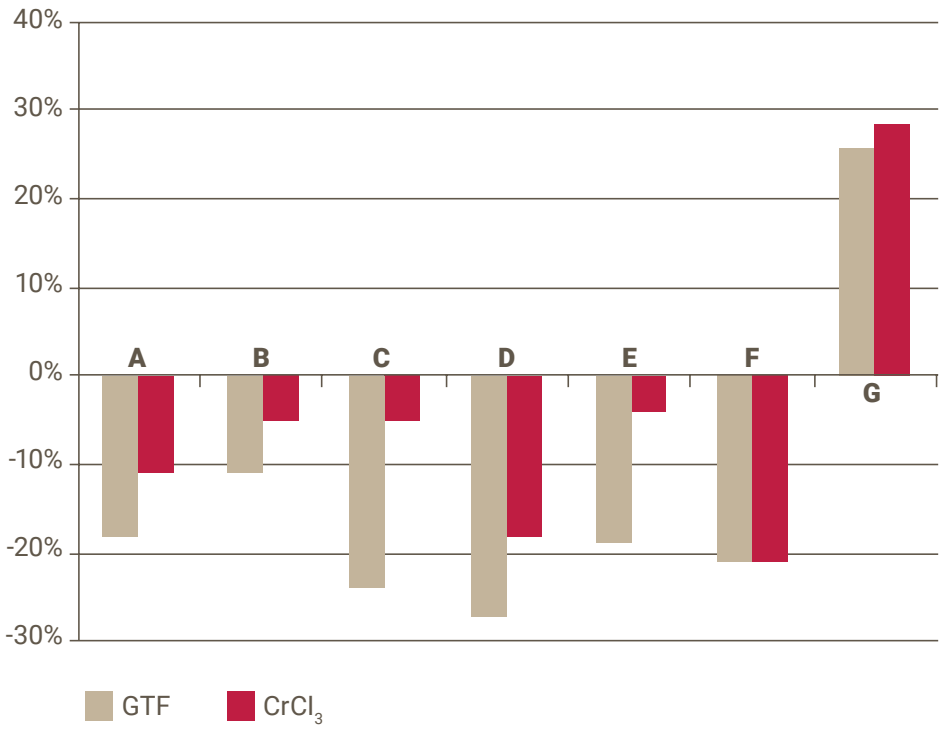
There has been no clear demonstration that just one or two molecules truly represent the composition and activity of any mineral form, including the GTF form. It may be no wonder that a weak scientific and historical basis exists for consuming single amino acid chelates versus a food-bound origin — even if similar chelate molecules have been isolated from food.

WHO NEEDS CHROMIUM SUPPLEMENTATION?

Public health agencies and the World Health Organization determined that chromium deficiency leads to a poor health status and have set acceptable intake (AI) values for chromium. In 1989, the National Academy of Sciences provided an estimated safe and adequate daily dietary intake range of trivalent chromium in adolescents and adults at 50 to 200 mcg per day (NAS 1989). The FDA selected a Reference Daily Intake for chromium of 120 mcg/d (U.S. DHHS, 1995).

FIGURE 1: THERE IS NO CLINICAL COMPARISON

Clinical data showing superiority of GTF yeast versus inorganic chromium:



GTF chromium outperforms inorganic chromium and at a much lower dose. A dosage of only 23.2µg Chromium from brewer's yeast (GTF) or 200 µg Cr/d (from inorganic chromium (Chromium chloride, CrCl3) or placebo for 8 weeks to 78 type 2 diabetics in a double-blind, placebo-controlled, cross-over trial[14] resulted in greater significant improvements for the GTF group: (A) 18% reduction in fasting blood glucose (FBG) with GTF versus 11% from inorganic Cr; (B) 11% reduction in oral glucose tolerance versus 5% from inorganic Cr; (C) 24% reduction in blood fructosamine versus 5% from inorganic Cr; (D) a 27% reduction in drug dosing (i.e., Glibenclamide; p=0.00004; vs 18% from inorganic Cr; (E) 19% reduction in insulin dose versus 4% reduction with inorganic Cr; (F) 21% reduction in serum triglycerides, versus 21% with inorganic chromium; (G) 26% increase in serum HDL versus 19% increase with inorganic chromium.

GTF CHROMIUM YEAST:

- Yeast is a food safely consumed for thousands of years as part of bread and fermented products like beer, preceding the consumption of mineral salts and chelates. Yeast is made of proteins, amino acids, dietary fiber, polysaccharides, and enzymes, which act to organically bind and release nutrients such as chromium into the gut slowly during digestion.
- Thousands of animal and human studies have been published on the nutritional supporting components of yeast, which include digestive health and immune balancing effects.
- GTF yeast is a pure strain banked in the ATCC and is made through a controlled natural fermentation process that produces no Candida or other yeast or bacteria strains.

THE CHROMIUM:

- Long-term human and animal studies have found that chromium absorption may be sustained longer, and it reaches higher levels, with chromium yeast versus synthesized 'organic' forms like picolinate.
- Because the mechanism of chromium absorption is via active transport, only so much can be absorbed at a single point in the gut through non-bound salt or 'organic' forms, while food-bound chromium may be absorbed as it is digested throughout the GI tract. Clinical studies suggest that nearly all dietary chromium is excreted in the urine, with higher levels being absorbed from food forms into target tissues.[15]
- Yeast is grown in a controlled environment using a specific strain optimized for quality and consistency. Yeast is the unparalleled micronutrient delivery form, permitting accurate and precise standardization of nutrient content within very narrow limits. Meanwhile, food-form nutrients from sources like plants or animals are subject to wide variation and contaminant levels due to differences in climate, origin, species or variety, and method of processing.
- Likewise, chromium salts and chelates are subject to a harsh chemical process, and some forms may contain measurable levels of highly toxic hexavalent chromium. Trace minerals containing chromium may contain unacceptable levels of heavy metals such as lead, arsenic, mercury and aluminum.
- Chromium is a micronutrient with clinical doses below 1mg. Due to the very small amounts used, extreme care during finished product blending needs to be taken for non-food forms, and variations can be present in many blends, which can become toxic. GTF chromium allows manufacturers to make a higher quality product from better dosage precision and lesser variation in potency.

As shown, several subpopulations in the U.S. are particularly vulnerable to chromium deficiency due to poor diet, malabsorption, age or health condition. The following subpopulations are particularly vulnerable to chromium deficiency:
People who are overweight or obese, diabetic, pre-diabetic, or have risk factors for metabolic syndrome. Chromium deficiency is strongly correlated with a higher risk of insulin resistance and predispose a person to obesity and type 2 diabetes.[16] Research on early onset Type-2 diabetics found an effective dose at 42 mcg per day chromium from chromium yeast.[17]

PREGNANT AND LACTATING WOMEN, AND CHILDREN

These groups are particularly susceptible to micronutrient deficiency, particularly in areas where locally grown food is low in chromium.[18] Chromium is lost through breast milk in lactating women and needs to be replaced through dietary consumption. Women do not appear to reduce chromium excretion during lactation to make up for increased demand for the baby.[19] Acceptable intake values for chromium are therefore higher for breastfeeding women than for non-lactating women. Transfer of chromium to neonatal rats from the mother was found with chromium yeast, but not chromium salt.[20]

FORMULARY DID YOU KNOW TIP

VITAMIN C (ascorbic acid) is known to **INCREASE ABSORPTION OF CHROMIUM. PLASMA CHROMIUM CONCENTRATIONS** were found to be **SIGNIFICANTLY HIGHER IN HUMANS WHEN TAKEN WITH ASCORBIC ACID**[21]

BIOAVAILABILITY GUIDANCE

CHROMIUM SALT *and* **CHELATES** *are generally* **POORLY ABSORBED**

CHROMIUM FROM YEAST ARE 1.5-2X BETTER ABSORBED *and* **MORE EFFECTIVE** than other forms of chromium[22]

AGING POPULATIONS

Older people often do not absorb nutrients and minerals as well as younger people. Chromium stores in our bodies reduce gradually as we age, which places many at risk for chromium deficiencies. A study on chromium-rich brewer's yeast in elderly people, with normal and borderline diabetic-fasting blood sugar levels, found a significant reduction in oral glucose tolerance, cholesterol and plasma triglycerides.[23] Medications that interfere with insulin response may also suppress chromium status.[24,25]

People on popular fad diets, as well as typical high-carbohydrate western diets, people on fasting diets or those who consume poor nutrition, low-carb, high fiber, calorie restriction or ketogenic diets often do not consume or absorb a sufficient amount of chromium. Most diets offer less than 60% of the recommended minimum intake of 50 mcg per day.[26] High consumption of dietary fiber and phytate and old age may also be associated with lower chromium status.[27,28] People on high-carbohydrate, high-sugar diets tend to excrete more chromium in urine, which requires supplementation to replace what is lost.[29,30] Vegetarians and vegans consuming diets low in whole grains and high in sugar may have low chromium levels as a result. Also, people with compromised gastrointestinal absorption, or those on long-term restricted diets, require chromium in order to maintain normal blood-glucose management.[31]

ATHLETES

A number of studies have found that aerobic exercise increases urinary excretion of

HOW DOES GTF COMPARE TO CHELATED CHROMIUM (PICOLINATE/ POLYNICOTINATE)?

- GTF is produced from a living organism (yeast), has been shown to be better absorbed, and may be more efficient for activation of membrane phosphotyrosine phosphatase in mammals.[32]
- Chromium picolinate is synthetically produced, not food-bound, and not generated by a living organism. Picolinate and polynicotinate are 'pseudo-organic' chemicals used to chelate chromium and are not found in the body at any appreciable level.[33]
- The absorption of non-food forms of chromium like chromium picolinate is low due to degradation in the stomach at low pH. Thus, picolinate has been shown to be about equally absorbed as inorganic chromium salt (Chromium trichloride).[34]
- Cytotoxic, genotoxic and mutagenic effects, mitochondrial damage and apoptosis (cell death) have been reported for chromium picolinate-using mammalian cell cultures, Drosophila and animal models. The potential toxicity of CrPic has raised concerns about the safety of supplements that contain this compound.
- The United States Food and Drug Administation (FDA) has concluded that that the relationship between chromium picolinate intake and insulin resistance is uncertain.

chromium. This may be due to the increased protein turnover during physical activity, which releases the body's stores of chromium.[35,36] Athletes and those undergoing high levels of physical exertion may require increased supplementation of chromium to replace excreted stores.

PEOPLE WITH ABNORMAL STOMACH ACIDITY

Dissolution and absorption of chromium appears to be highest under acidic conditions normally found in the stomach. People who take acid regulators or antacids may have reduced chromium absorption, based on limited evidence.[37]

KEY GTF CHROMIUM TAKEAWAYS

- Chromium (Cr) exists in various oxidation states. Nutritive effects are exclusively associated with food or supplement based intake of chromium III (trivalent Cr) within the range of 42-1,000 mcg per day.[38,39]
- Toxic effects are associated with chromium VI (hexavalent Cr), which is not found in chromium yeast, but may be present in trace amounts in chromium salts.[40]
- Chromium from chromium-enriched yeast is absorbed and is bioavailable. The EFSA Panel concluded that bioavailability is potentially up to ten times higher than that of chromium from chromium chloride.[41]
- The non-food bound forms of chromium, such as chromium salts, chromium picolinate and chromium polynicotinate are known to be poorly absorbed, with less than 2% absorption rate. The absorption rate of chromium yeast is 5-10%. The difference in absorption suggests that less chromium from yeast is needed to exert the same effect as other forms of chromium.

DOSAGE GUIDANCE

- Although most countries have not established a recommended daily intake, there is general scientific agreement that chromium within the safe range is beneficial in diet.
- The typical daily dietary intake of chromium in most countries, including the U.S. and European countries, is sub-optimal based on the ESADDI of 50mcg.[42]
- The safe range of chromium intake is between 50 – 200 mcg per day.[43]
- 100 mcg chromium is the most commonly researched dosage. It is shown to support insulin sensitivity and improved blood sugar levels as well as healthy body weight.
- 42 mg of chromium from Chromium yeast reduced FBG by 48% and HbA1c by 28% after 3 months in early onset diabetics.[44]

TABLE 2

CHROMIUM INTAKE	REFERENCE
40 - 1,000 mcg	DOSAGE RANGE FOR NUTRITIVE EFFECTS[45]
120 mcg	INTERNATIONAL RECOMMENDED DAILY ALLOWANCE
200 mcg	MAXIMUM RECOMMENDED INTAKE, FDA
100 mcg	MINIMUM EFFECTIVE DAILY DOSE (MEDD)
50 mcg	MAXIMUM AVERAGE INTAKE, USA
20 mcg	U.S.A. AVERAGE INTAKE, ADULTS

Ref: National Research Council, Food and Nutrition Board. Recommended Dietary Allowances, 10th Edition. National Academy Press, Washington, DC, 1989, The National Academy of Sciences established an "estimated safe and adequate daily dietary intake" range for chromium for adults and adolescents from 50 to 200 mcg.

- In vitro and clinical case studies suggest some potential safety issues on synthesized, non-food bound forms. In contrast, chromium yeast is associated with an excellent safety profile, in a form that is natural -- in our food.

EMERGING CHROMIUM MECHANISMS IN CLINICAL AND EXPERIMENTAL TRIALS

Ongoing research points to the significance of GTF chromium:

- Controls blood glucose by promoting uptake by muscles and organs.
- Stimulates burning of glucose for energy.
- Reduces fat levels in blood; Increases HDL & controls blood cholesterol.[46]
- Supports adrenal response, promoting healthy levels of cortisol.[47]
- Supports a natural immune response.[48]
- Suppresses appetite by reducing leptin, the hunger hormone.[49]

CLINICAL HIGHLIGHTS OF FOOD BOUND CHROMIUM

- GTF chromium is the superior form of chromium supporting healthy glucose metabolism and healthy body weight.
- Cr can lower triglycerides and raise HDL in people who are susceptible to abnormal levels.
- Some research suggests supplemental Cr may reduce body weight and food cravings in overweight/obese women and in people with binge-eating disorders at a dose of 1,000 mcg/day.
- Human clinical trials have provided strong support for the safety of Cr at levels of up to 1,000 mcg per day. No pattern of adverse effects has been observed in these trials. In 2014, the Council for Responsible Nutrition (CRN) concluded the available data indicates the safety of chromium to these levels.

FOOD, BEVERAGE AND DIETARY SUPPLEMENT APPLICATIONS

Given the dramatic rise in health problems associated with blood sugar management, there are multiple opportunities for manufacturers to include GTF Chromium in commonly used consumer products. Quick reference for common food and beverage supplement applications:

- Dietary Supplement Powders
- Tablets and Capsules
- Prenatal and Postnatal Multivitamins
- Anti-aging Supplements
- Blood Sugar Management Supplements
- Whole Foods
- RTD Beverages
- Meal Replacement
- Active Lifestyle Products
- Low-Carb Products
- Exercise and Nutrition Regimens
- Physician-guided, Professional, Dietition/Nutritionist Formulations
- Medical Foods and Special Medical Needs
- Diet Programs with Multivitamin Nutritional Interventions
- Weight Management Products
- Protein Drinks
- Complete Nutrition Products
- Sports Nutrition Products
- Nutrition Bars
- Keto-Friendly Products
- "Better-for-You" Natural Foods
- Organic and Non-GMO Products
- Beauty-from-Within Products

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CONCLUSION

Chromium is an essential micronutrient that plays a critical role in human and animal metabolism.

Clinical studies on GTF chromium (chromium yeast) have found significant clinical effects – and at lower doses than used for studies on chelated or salt-based chromium. Increased levels of absorption of chromium in GTF form have been shown over a long period of time.[50] The data indicates that food-based chromium is a superior form compared to chelates and salt forms.

BODYREADY

The new Cypress BodyReady platform, embraces the rich clinical research history of Cypress, and outlines a scientific validation process by which all current and future Cypress products will be measured. For Cypress customers, BodyReady is a confidence index, that assures science validation is our core commitment. The BodyReady approach to nutrient utilization clearly addresses why form makes a difference, and provides critical information as to the value of using a personalized nutrition matrix when formulating condition specific products.

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CYPRESS SYSTEMS

is the leader in food form minerals and nutritional yeast products, including **GTF Excell®, SelenoExcell® and Zinc Excell™.** Our products address the growing need for scientifically tested, high quality, GMP compliant nutritional ingredients.

For the health of your customers, Cypress Systems is here to provide your company with the highest quality materials available on the market today. Contact us for more information on GTF Excell and any of our other Gold Standard products.

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