



DOSSIER · SUBSTANCE

Chromium (Chromium Picolinate)

Chromium is a trace element that in research is almost always associated with glucose metabolism. The most cited finding in the field is not a therapy study, but the observation in a single patient under artificial nutrition — from it arose the deficiency hypothesis that shapes the entire field. This page classifies what controlled studies support and what remains open.

797

STUDIES IN
TOTAL

272

IN HUMANS

129

OF WHICH
CONTROLLED

162

IN ANIMALS

23

IN THE LAB

Figures from the IHR study database · Last updated 2026-10-16

How to Read This Dossier

ESTABLISHED

measured in humans, with a comparison group

PLAUSIBLE

supported by mechanism, animal studies or observation

HYPOTHESIS

a likely connection that still needs to be tested

Chromium (Chromium Picolinate) at a Glance

ORIGIN:
Chromium is a trace element that appears in research almost exclusively in connection with glucose metabolism. In controlled studies it occurs predominantly as chromium picolinate, a compound of chromium and picolinic acid. Picolinic acid, a metabolite of tryptophan, forms stable complexes with transition-metal ions, resulting in improved bioavailability of the chromium ion.

EVIDENCE BASE:
797 evaluated papers · 129 controlled human studies · 143 observational studies · 48 review articles · 162 animal studies · 16 cell-culture studies

- STRONGEST EVIDENCE:**
- Glucose metabolism: The meta-analysis ¹ evaluated 20 randomised studies, 15 of which provided data on 618 participants; in non-diabetics no association was found with glucose or insulin values.
 - Overweight and obesity: The meta-analysis ⁷ included 20 studies and found reductions in HOMA-IR (WMD -0.26) and insulin (WMD -12.55 pmol/l); glucose and HbA1c missed significance.
 - PCOS: The evaluation ⁶ pooled 5 randomised studies; chromium picolinate lowered BMI and fasting insulin, raised the fasting glucose-to-insulin ratio and increased the chance of ovulation.
 - Dose dependence: In the randomised, double-blind study ⁴⁸ in 180 treated type-2 diabetics, fasting glucose after 4 months was lower in the high-dose group (500 µg twice daily).
 - Breadth of endpoints: The randomised, double-blind study ²⁰ in 64 diabetics with coronary heart disease found reductions in body weight, fasting glucose, insulin, insulin resistance and hs-CRP over 12 weeks.

- LIMITATIONS:**
- Blood pressure: The dose-response study ⁴ and study ⁵ reach opposing results, illustrating dependence on study selection and subgroups.
 - Compound: Chromium picolinate, chromium chloride, chromium dinicocysteinate, chromium yeast and brewer's yeast were used differently; none of the pooled analyses cleanly separates them.
 - Combinations: From the multi-ingredient studies ²⁹, ⁵³ and ⁵⁰ no effect of chromium picolinate alone can be inferred; study ⁵⁴ examined chromium dinicocysteinate.

CLASSIFICATION:
Chromium is a trace element whose controlled research is almost entirely focused on glucose metabolism; the findings depend on baseline status and compound.

1. What Chromium Is

Chromium is a trace element that appears in research almost exclusively in connection with glucose metabolism. In controlled studies it occurs predominantly as **chromium picolinate**, a compound of chromium and picolinic acid; numerous papers, however, refer simply to chromium supplementation without naming the compound in the title. The mechanistic literature describes chromium in the context of insulin signalling and insulin resistance. The substance is therefore not a medicinal product in the strict sense, but a trace element whose intake via food or supplements varies — and it is precisely from this that the central question of the field arises: whether additional intake produces any change where no deficiency exists.

Decisive for understanding all studies is the origin of the field hypothesis. The most-cited investigation is an observation in a single patient on long-term artificial nutrition: glucose intolerance and neuropathy resolved under chromium administration. A second case report from the same period describes chromium deficiency under the same conditions. From these individual observations arose the model that chromium deficiency impairs insulin signalling. It follows that an effect is to be expected primarily where a deficiency exists. How such a deficiency can be reliably determined in humans remains open — a measurement value on which the studies uniformly rely is still lacking. Consequently, the informative value of every controlled study depends on how well the participants' baseline status was captured.

2. What the Studies Show in Detail

The human studies, ordered by application and the controlled studies first — with participants, duration, preparation, measured variable and result as reported in the original papers. Numbers appear only where the work states them.

Distribution of **controlled human studies** by field of application — the figures are not additive, as one paper may be assigned to several fields:

FIELD OF APPLICATION	CONTROLLED STUDIES
Metabolism	72
Safety and tolerability	32
Inflammatory processes	21
Heart and circulation	21

FIELD OF APPLICATION	CONTROLLED STUDIES
Fatigue and stress	11
Bones and joints	10
Oncology	7
Oxidative stress	7

Chromium (Chromium Picolinate) Taken: Human Studies

Chromium preparations achieved the highest rank for lowering fasting glucose and the HOMA insulin-resistance index (SUCRA 90.4 % and 78.3 % respectively), with low to very low certainty of evidence. Vitamin K led for HbA1c and fasting insulin, vanadium for total cholesterol. The authors compared vitamin and mineral preparations with one another; the ranking describes relative positions, not absolute effect sizes.

The older meta-analysis by ¹ evaluated 20 randomised studies, 15 of which supplied sufficient data on 618 participants (193 with type-2 diabetes, 425 healthy or with impaired glucose tolerance). In non-diabetics no association was found between chromium and glucose or insulin concentrations. One study with 155 diabetics in China showed a reduction in glucose and insulin; the pooled data of the remaining 38 diabetics did not. Three studies reported HbA1c data. The work forms the starting point for the later, larger evaluations.

The meta-analysis by ³ included 10 randomised studies with 509 patients (269 in the chromium group, 240 in the control group) and examined HbA1c, fasting glucose, triglycerides, total, LDL and HDL cholesterol. Only HbA1c differed statistically significantly; the remaining indicators showed no significant differences. The work is thus the most conservative of the pooled analyses on glycaemia and explicitly names the heterogeneity of the included studies.

The dose-response meta-analysis by ⁴ pooled 11 randomised studies with 637 participants and found a reduction in systolic blood pressure (WMD -2.51 mmHg; 95 % CI -4.97 to -0.05; $p = 0.04$) and diastolic blood pressure (WMD -1.04 mmHg; 95 % CI -1.96 to -0.12; $p = 0.026$). In the subgroup analysis a significant systolic reduction appeared only in diabetics with chronic heart disease. The second meta-analysis by ⁵ with 10 studies and 624 participants found no significant effect on systolic (WMD -0.642; 95 % CI -2.15 to 1.30; $p = 0.312$) or diastolic blood pressure (WMD -0.10; 95 % CI -1.39 to 1.18; $p = 0.070$). Together the two works show that the blood-pressure question depends on study selection and subgroups.

The meta-analysis by ⁷ on overweight and obese patients comprised 20 studies with 1 to 137 participants per study. For fasting glucose (WMD -1.60 mg/dl; 95 % CI -3.28 to 0.07; $p = 0.06$) and HbA1c (WMD -0.05 %; 95 % CI -0.19 to 0.07; $p = 0.38$) no significant reduction appeared; HOMA-IR (WMD -0.26; 95 % CI -0.48 to -0.03; $p = 0.02$) and insulin (WMD -12.55 pmol/l; 95 % CI -23.62 to -1.47; $p = 0.02$) fell, with slight decreases in lipid profile and anthropometric measures. The authors themselves point to the small individual studies and the heterogeneity; the glucose and HbA1c values missed significance.

The randomised, double-blind study by ²⁰ examined 64 diabetics with coronary heart disease over 12 weeks with 200 µg chromium or placebo (32 participants each). Chromium lowered body weight (-0.9 ± 1.6 vs. +0.1 ± 0.8 kg; $p = 0.001$), BMI (-0.4 ± 0.7 vs. +0.1 ± 0.3 kg/m²; $p = 0.002$), fasting glucose (β -11.03 mg/dl; 95 % CI -18.97 to -3.09; $p = 0.007$), insulin (β -1.33 µU/ml; 95 % CI -1.90 to -0.76; $p < 0.001$) and insulin resistance (β -0.44; 95 % CI -0.62 to -0.25; $p < 0.001$), raised insulin sensitivity (β 0.007; 95 % CI 0.003 to 0.01; $p < 0.001$) and lowered hs-CRP (β -0.49 mg/l; 95 % CI -0.91 to -0.06; $p = 0.02$) as well as malondialdehyde (β -0.22 µmol/l; 95 % CI -0.35 to -0.10; $p = 0.001$), with an increase in total antioxidant capacity (β 84.54 mmol/l; 95 % CI 31.05 to 138.02; $p = 0.002$). The study is small but unusually complete in its range of endpoints.

The randomised, double-blind study by ⁴⁸ allocated 180 treated type-2 diabetics to three groups: placebo, 100 µg chromium as chromium picolinate twice daily or 500 µg twice daily, over 4 months, with unchanged medication and lifestyle. Fasting glucose was lower in the high-dose group after 2 and 4 months (4-month values: placebo 8.8 ± 0.3 mmol/l; 19.2 µmol 7.1 ± 0.2 mmol/l), as was 2-hour glucose. Dose dependence is the strongest single finding in the older literature.

The randomised, double-blind study by ²⁹ tested in 348 type-2 diabetics with HbA1c ≥ 7 % a combination of 600 µg chromium as chromium picolinate and 2 mg biotin (226 participants) against placebo (122) over 90 days. In the main analysis the combination lowered HbA1c ($p < 0.05$) and glucose ($p < 0.02$); other lipid values did not change. In the subgroup with hypercholesterolaemia and type-2 diabetes significant changes in total cholesterol, LDL cholesterol and atherogenic index appeared ($p < 0.05$). Because two substances were combined, the contribution of chromium alone cannot be derived from this work.

The randomised, double-blind study by ⁵³ allocated 120 persons with insulin resistance aged 45 to 59 years to four groups: placebo, 160 µg/day chromium, 200 mg/day magnesium or both, over 3 months. Significant decreases in fasting glucose (0.37 mmol/l; $p < 0.01$), fasting insulin (2.91 µU/ml; $p < 0.01$) and insulin-resistance index (0.60; $p < 0.01$) occurred only in the combination group, as did a 2.9-fold increase in GLUT4 and a 2.2-fold decrease in GSK3β mRNA in activated T-lymphocytes ($p < 0.05$). Chromium alone was also tested but did not show the mentioned significant changes.

The randomised, double-blind study by ⁵⁴ examined 100 type-2 diabetics, of whom 74 completed the study (25 placebo, 25 chromium picolinate, 24 chromium dinicocysteinate), after a one-month stabilisation phase with placebo and 3 months of supplementation. In the chromium dinicocysteinate arm insulin resistance ($p = 0.02$), protein oxidation ($p = 0.02$) and TNF-α ($p = 0.01$) fell versus baseline; in the chromium picolinate and placebo arms these markers showed no statistically significant change. The work compares two chromium compounds and points to differing activity profiles.

With chromium supplementation BMI ($p < 0.001$) and fasting insulin ($p = 0.007$) fell, the fasting-glucose-to-insulin ratio rose ($p = 0.045$), as did ovulation chance ($p = 0.011$) and cycle regularity. The analysis by ⁶ pooled 5 randomised studies on chromium and insulin resistance in PCOS and reports data on women of reproductive age according to ESHRE/ASRM or NIH criteria; the pooled effects were calculated as weighted mean differences.

The double-blind, multicentre replication study by ³⁵ randomised 113 adult outpatients with atypical depression in a 2:1 ratio to 600 µg elemental chromium as chromium picolinate or placebo over 8 weeks. Primary endpoints were the 29-item Hamilton Depression Scale and the Clinical Global Impressions Improvement Scale. Of 113 randomised patients, 110 formed the intention-to-treat population (70 chromium picolinate, 40 placebo); 75 were evaluable (50 vs. 25). No significant difference was found between the groups. The work is a replication of a small pilot study and returned negative.

The QTc interval was comparable at baseline (422 ± 34 ms vs. 425 ± 24 ms; $p = 0.77$) and after 3 months shorter in group A (406 ± 35 ms vs. 431 ± 26 ms; $p = 0.01$). The author presents the study as an observational study; blinding is not reported.

The randomised study by ⁵⁵ allocated 16 overweight men (BMI 31.1 ± 3.0 kg/m²) to 600 µg/day chromium as picolinate ($n = 8$) or placebo ($n = 8$) over 4 weeks. After supplementation a supramaximal cycling bout to deplete glycogen was followed by carbohydrate-rich meals over 24 hours; muscle biopsies were taken at rest, immediately after exercise and at 2 and 24 hours thereafter. Glucose and insulin rises did not differ; the lactate response was significantly higher under chromium. The glycogen synthesis rate in the first 2 hours did not differ (chromium 25.8 ± 8.0 vs. placebo 17.1 ± 4.7 mmol/kg/h). The study supplies an indication and is reported as a randomised study.

The randomised study by ⁵⁶ allocated 15 female softball players to a chromium group ($n = 8$) and a placebo group ($n = 7$) and administered 500 µg chromium picolinate daily for 6 weeks, accompanied by strength training three times weekly with 2 to 3 sets of 8 to 12 repetitions at 80 % of one-repetition maximum. Muscle strength and body composition (weight, body-fat percentage, fat-free mass) did not differ significantly after 6 weeks; 24-hour urinary chromium excretion rose significantly in the treatment group. The work belongs to the early negative studies in the sports context.

The study by ⁵⁷ treated 76 patients with established atherosclerotic disease for 7 to 16 months (mean 11.1 months) daily with 250 µg chromium as chromium chloride or placebo. Total cholesterol and blood glucose did not change. The work is reported as an observational study and uses a different chromium compound from the remaining works.

The study by ⁵⁰ randomised 148 patients with impaired fasting glucose or impaired glucose tolerance who were not taking glucose-lowering agents, double-blind to a nutraceutical containing berberine, curcumin, inositol, banaba and chromium picolinate or placebo over 3 months, one tablet daily with breakfast. The combination lowered fasting glucose and postprandial glucose (each $p < 0.05$ versus baseline and versus placebo), as well as HbA1c and fasting insulin (each $p < 0.05$), the HOMA index ($p < 0.05$) and raised the M-value ($p < 0.05$); total cholesterol also fell ($p < 0.05$ versus baseline). From the multi-substance mixture no effect of chromium picolinate alone can be derived.

The review by ⁵⁸ places the molecular mechanisms by which chromium may alleviate insulin resistance and notes that chromium lowered insulin resistance in some but not all studies and that the mechanisms remain difficult to grasp. The review by ⁶⁰ describes possible pathways via the renin-angiotensin system, angiotensin-converting-enzyme activity, lipid metabolism, inflammation and oxidative stress and calls chromium an important mineral in the regulation of insulin action. Both works are mechanistic and supply no own clinical endpoints.

The review by ⁵⁹ addresses chromium compounds in the environment and in lifestyle and their effect on male fertility, with emphasis on antioxidant activity and oxidative stress. It points out that animal studies showed degenerative changes in spermatogenesis after chromium picolinate, while the literature is contradictory and long-term effects on the antioxidant system have not been sufficiently investigated. The review by ²⁵ examines the effect of chromium picolinate on testicular steroidogenesis and antioxidant balance, names the inhibition of steroidogenic enzymes, mutagenesis and apoptosis in Leydig cells as well as changes in ROS, testosterone and sperm parameters, and explicitly names gaps and contradictions in the literature.

The systematic review by ⁶¹ evaluated 65 epidemiological and biomonitoring studies on oral chromium exposure in the general population. It reports an inverse association between prenatal chromium exposure and normal foetal development, rising parameters of oxidative stress and biochemical changes in adults, contradictory findings on renal function and a non-negligible risk for urothelial carcinomas, with overall contradictory results on internal chromium concentrations and tissue changes. The work concerns predominantly chromium(VI) and must be separated from the supplement studies.

The review by ⁶² addresses the neuroprotective contribution of chromium in heat-stress-induced neuroinflammation and establishes a link via insulin-like growth factor 1 (IGF-1), which unfolds anti-inflammatory and antioxidant effects. The authors note that chromium showed neuroprotective effects in human and animal studies, yet mechanistic evidence is lacking. The work is a mechanistic perspective without own clinical endpoints.

The controlled studies by ^{40, 41, 42, 43, 39, 19, 44, 38, 45, 37, 46, 47, 49, 51} and ⁵² concern coronary stents, scaffolds, antiplatelet strategies and hip or knee arthroplasty. They test cobalt-chromium alloys as material or device carrier, not chromium as a dietary supplement. ⁴⁰ compared in IRONMAN-II across 36 centres in China a sirolimus-eluting, bioresorbable iron scaffold with cobalt-chromium everolimus stents for 2-year late lumen loss as primary endpoint. ⁴¹ examined in the ILUMIEN-IV substudy 247 patients with in-stent restenosis, in whom target-lesion failure at 1 year occurred in 18 cases (7.4 %; upper one-sided 97.5 % CI 11.5 %), below the predefined target of 20 % ($p < 0.001$). ⁴² and ¹⁹ compared in STOPDAPT-2 and STOPDAPT-2 ACS clopidogrel with aspirin monotherapy after PCI over 5 years. ³⁹ tested in ABILITY Diabetes Global at 74 centres in 16 countries a sirolimus-eluting stent against an everolimus stent in diabetics. ³⁸ describes the design of the INFINITY-SWEDEHEART study on the DynamX Bioadaptor. ⁴⁵ reports 5-year results of the NeoVas study with 560 patients. ³⁷ compared in BIOHEART-II at 22 Chinese centres 434 patients with Bioheart scaffold or cobalt-chromium everolimus stent. ⁴⁶ compared in the SENS-ILIAC study at 17 centres in South Korea 201 patients with balloon-expandable cobalt-chromium or self-expanding nitinol stent for iliac-artery occlusion. ⁴⁷ reports a single-arm study in 193 patients on an everolimus stent on a cobalt-chromium platform. ⁴⁹ and ⁵¹ examined in randomised studies polyethylene wear and cup migration in total hip arthroplasties with cobalt-chromium or oxidised zirconium heads over 10 and at least 20 years respectively. ⁵² compared in a randomised study in 120 patients a multilayer hypoallergenic coating with the standard implant in knee arthroplasty over 10 years. These works demonstrate the biocompatibility and long-term behaviour of cobalt-chromium as an implant material, not the effect of chromium preparations for ingestion.

What is missing for ingestion: a large, independently funded study with HbA1c as primary endpoint that tests a single chromium compound at a pre-specified dose over at least 6 months and resolves the heterogeneity of existing studies.

Reviews and Mechanisms of Action

Across all applications two findings stand out: chromium preparations lower fasting glucose, insulin and HOMA index in several meta-analyses in type-2 diabetes and insulin resistance, and the blood-pressure effect has differed in two independent meta-analyses. The older work by ¹ found an effect on glucose metabolism only in diabetics, not in non-diabetics, and the work by ³ confirms a significant difference only for HbA1c. The dose-response work by ⁴ and the work by ⁵ reach opposing results on blood pressure, illustrating the dependence on study selection and subgroups.

The question of the compound remains open: chromium picolinate, chromium chloride, chromium dinicocysteinate, chromium yeast and brewer's yeast were used differently across the works, and none of the pooled analyses clearly separates the compounds. Equally open is the transferability of the combination studies by ^{29, 53, 50} and ⁵⁴ to the single substance. The reviews by ^{58, 60, 59, 25, 61} and ⁶² name mechanistic pathways and safety questions without deciding them clinically.

Overall Picture

3. How Robust the Research Is

The research is broadly designed and unevenly distributed. The largest block consists of basic research, followed by animal studies. A smaller group exists in humans, which divides roughly half into observational and controlled studies. Within the controlled studies, one application area clearly dominates: metabolism, that is, glucose and insulin metabolism including lipids. Safety, inflammation and the cardiovascular system are significantly smaller; exhaustion, bone, cognition and the immune system are touched only by individual controlled studies. For a substance that has been investigated over decades, clinical research thus concentrates almost completely on a single question, while the remaining fields stand at the margins.

PROVEN Systematic reviews and meta-analyses of randomised studies from 2002, 2007 and 2014 exist for glucose metabolism and lipids. This is unusual for a trace element and speaks to the relevance of the question. The weakness lies one level deeper, in the individual studies: the populations examined range from people with type 2 diabetes through obese adults without diabetes to older people; the chromium forms and observation periods differ, and many studies are small. One of the most frequently cited controlled studies found no improvement in the examined features of the metabolic syndrome in obese non-diabetics. Such null findings disprove nothing, but indicate that an effect is likely tied to the baseline situation.

Does chromium act only in chromium deficiency?

The thesis of the field states: chromium acts where chromium is lacking. It originates from observations in patients on exclusively artificial nutrition and to this day has not been secured by an independent marker. Consequently, the interpretation of almost all controlled studies stands or falls with a question that would have to be answered before treatment: did the participants actually have an undersupply? If the baseline status is not determined, a null finding cannot be distinguished from a missing indication and a positive finding cannot be distinguished from group differences or a placebo effect.

PLAUSIBLE: That the findings turn out so inconsistent fits with an effect site in deficiency. Individual controlled studies report changes in glucose, HbA1c and lipids in disturbed glucose metabolism; in obese adults without diabetes the examined features remained unchanged in one of the most frequently cited studies. The decisive test would be a controlled study that measures chromium status before treatment, analyses by status group and tests the same compound. As long as it is pending, the deficiency hypothesis remains a viable but untested basic assumption, and the question of whether chromium changes anything in people without deficiency remains unanswered.

4. What Is Frequently Claimed — and What the Data Provide

STATEMENT	STUDY SITUATION
Chromium picolinate lowers blood glucose in type 2 diabetes	Systematic reviews and controlled individual studies are available on this subject. The results vary depending on the initial situation and the tested compound.
Chromium improves blood lipid values	Individual controlled studies report changes in cholesterol and triglyceride levels in diabetes and in general samples. In the review papers, lipids are recorded.
Chromium acts antidepressively	A placebo-controlled study examined chromium in atypical depression and reports an effect. This is an indication from a single study, not proof; an independent study is needed.
Chromium acts antioxidatively	The studies available examined chromium in combination with zinc or with vitamin C and E respectively. No effect of the individual trace element can be derived.

5. Profile: Molecule and Charge

Chromium (chromium picolinate) is not a single molecule but a **mixture** — there is no molecular formula and no fixed molecular mass. What can be described are functional groups, charge behaviour and redox properties; that is exactly what the next section addresses.

6. Charge, Electrons, Radicals

In humans, no charge or electron-transfer quantities have been measured for chromium, only radical and antioxidant measures. In chronic hyperglycaemia the production of reactive oxygen species (ROS) rises and is accompanied in diabetics by insulin resistance, beta-cell degeneration, dyslipidaemia and glucose intolerance ²³. In diabetes mellitus radical formation is elevated while the antioxidants chromium, vanadium, selenium and manganese are reduced ²⁴. **Plausible:** Chromium participates in the radical equilibrium; this has been measured, not its charge.

Cr(III) binds to pea peptides via carboxyl, carbonyl and amino groups; C=O, NH and OH groups could be the binding sites ²⁶. The chromium-peptide conjugate (CPP) surpassed the peptide in vitro in scavenging DPPH and hydroxyl radicals and in iron(III) reduction ²⁶; the latter is a measured electron transfer. In the insulin-resistant HepG2 cell model CPP regulated the Keap1/Nrf2/HO-1 signalling pathway and promoted nuclear translocation of Nrf2 with activation of HO-1 ²⁷. **Hypothesis:** These measurements apply to a chromium-peptide conjugate, not to chromium picolinate; whether charge and electron transfer behave identically there remains to be clarified.

7. Interactions with Other Substances

With which other substances on the platform this substance has been **jointly** investigated or discussed in human studies and reviews — combination, comparison or shared mechanism of action. The number indicates studies in which both occur.

SUBSTANCE	SHARED STUDIES	OF WHICH CONTROLLED IN HUMANS
Acceptance and Commitment Therapy (ACT)	72	22
Resistance Training	66	25
Art Therapy	59	25
Therapeutic Fasting and Intermittent Fasting	58	39
Stress, Cortisol and Inflammation	42	11
High-Intensity Interval Training (HIIT)	40	15
Zinc	37	2
Transcranial Direct Current Stimulation (tDCS)	37	14
Chronic Inflammation	36	15
Magnesium	29	4

Combinations of chromium picolinate with other substances are described in particular. Another controlled study examined chromium picolinate plus biotin in hypercholesterolaemic type 2 diabetes ²⁹, a review summarises a study on chromium yeast with vitamin C and E as well as two studies on chromium picolinate plus biotin ⁹. A controlled study combined chromium with vitamin C and E in type 2 diabetes ²⁸.

Complex formation is described for absorption: picolinic acid, a metabolite of tryptophan, forms stable complexes with transition metal ions, resulting in improved bioavailability of the chromium ion ³². Further controlled studies examined chromium picolinate in fixed combinations, for example with inulin, capsicum, L-phenylalanine and other lipotropic nutrients ³³, with red yeast rice and guggulipid ³⁴ as well as with a polyphenolic composition in addition to existing antidiabetic therapy ³⁰. A combination of chromium and zinc in a cascade-fermented plant-based food supplement showed no effect on glucose metabolism under everyday conditions ³¹. It would need to be examined which of these combinations hold independently of the single substance and whether the described complex formation affects the absorption of other substances.

8. Overdosage, Tolerability, Limits

Treatment effect and adverse events were estimated via mean difference and odds ratio ⁹. A dose or an upper intake limit is not stated in these evidence sentences; information on toxicity or contraindications is not found there. It would need to be examined whether the included studies systematically evaluated dose-response data and maximum quantities.

For a combination of chromium picolinate and biotin, no significant adverse events were observed in the verum or placebo group in people with type 2 diabetes ³⁶. The participant numbers are not stated in these evidence sentences. It remains open how higher doses act over longer periods and for which persons chromium is unsuitable.

9. The Most Robust Studies

Ordered by strength of evidence, not by familiarity: review articles and studies with many participants first. The complete evaluation comprises considerably more studies; the most robust ones are listed here.

Controlled Human Studies

- ¹ Glucose and insulin responses to dietary chromium supplements: a meta-analysis (2002) — review article, 618 participants
- ² Comparative effects of vitamin and mineral supplements in the management of type 2 diabetes in primary care: A systematic review and network ... (2023) — review article, 14.223 participants

- ³ Effect of Chromium Supplementation on Blood Glucose and Lipid Levels in Patients with Type 2 Diabetes Mellitus: a Systematic Review and Meta-analysis (2022) — review article, 509 participants
- ⁴ The Impact of Chromium Supplementation on Blood Pressure: A Systematic Review and Dose-Response Meta-Analysis of Randomized-Controlled Trials (2021) — review article, 637 participants
- ⁵ The effects of chromium supplementation on blood pressure: a systematic review and meta-analysis of randomized clinical trials (2022) — review article, 624 participants
- ⁶ The Effects of Supplementation with Chromium on Insulin Resistance Indices in Women with Polycystic Ovarian Syndrome: A Systematic Review and ... (2018) — review article, 156 participants
- ⁷ The effect of chromium supplementation on cardio-metabolic risk factors in overweight and obese patients. A systematic review and meta-analysis of ... (2025) — review article, 137 participants
- ⁸ Effect of chromium supplementation on glucose metabolism and lipids: a systematic review of randomized controlled trials (2007) — review article, 10 participants
- ⁹ Systematic review and meta-analysis of the efficacy and safety of chromium supplementation in diabetes (2014) — review article
- ¹⁰ Effects of chromium supplementation on glycemic control in patients with type 2 diabetes: a systematic review and meta-analysis of randomized ... (2020) — review article
- ¹¹ Effects of chromium supplementation on blood pressure, body mass index, liver function enzymes and malondialdehyde in patients with type 2 diabetes ... (2021) — review article
- ¹² Chromium supplementation for adjuvant treatment of type 2 diabetes mellitus: Results from a pooled analysis (2018) — review article
- ¹³ [Chromium supplementation in patients with type 2 diabetes and high risk of type 2 diabetes: a meta-analysis of randomized controlled trials] (2016) — Review article
- ¹⁴ Chromium-Containing Traditional Chinese Medicine, Tianmai Xiaoke Tablet, for Newly Diagnosed Type 2 Diabetes Mellitus: A Meta-Analysis and Systematic ... (2018) — Review article
- ¹⁵ Effects of chromium supplementation on body composition in patients with type 2 diabetes: A dose-response systematic review and meta-analysis of ... (2024) — Review article
- Outcomes of Flapless Er:YAG and Er,Cr:YSGG Laser-Assisted Crown Lengthening: A Systematic Review (2024) — Review article
- ¹⁶ Effect of Chromium Supplementation on Serum Levels of Inflammatory Mediators: An Updated Systematic Review and Meta-analysis on Randomized Clinical ... (2025) — Review article
- ¹⁷ Chromium Supplementation to Reduce Cardiometabolic Risk Factors: A Novel Dose-Response Meta-Analysis of Randomized Clinical Trials (2023) — Review article
- ¹⁸ Comments on "The effects of chromium supplementation on blood pressure: a systematic review and meta-analysis of randomized clinical trials" (2023) — Review article
- ¹⁹ Clopidogrel vs Aspirin Monotherapy Beyond 1 Year After Percutaneous Coronary Intervention (2024) — 2.934 participants
- 5-Year Outcomes After Bioresorbable Coronary Scaffolds Implanted With Improved Technique (2023) — 2.604 participants
- ²⁰ The Influences of Chromium Supplementation on Metabolic Status in Patients with Type 2 Diabetes Mellitus and Coronary Heart Disease (2020) — 2.018 participants
- ²¹ Chromium picolinate supplementation for overweight or obese adults (2013) — 622 participants
- ²² Improved meta-analytic methods show no effect of chromium supplements on fasting glucose (2014) — 809 participants

10. Summary

Several pooled analyses show reductions in fasting glucose, insulin and HOMA index in type 2 diabetes and insulin resistance, while the blood pressure effect differed in two independent meta-analyses.

The field's thesis states that chromium acts where chromium is lacking; it originates from the observation in a single patient under exclusively artificial nutrition, in whom glucose intolerance and neuropathy regressed under chromium administration. A measurement value on which the studies uniformly rely is still lacking. **Hypothesis:** Without determination of the baseline status, a null finding cannot be distinguished from a lack of indication and a positive finding cannot be distinguished from group differences or a placebo effect. It could follow from this that part of the heterogeneity of the pooled analyses concerns the recruitment of the participants and not the supply of the trace element.

The first question to clarify would be that of the compound: chromium picolinate, chromium chloride, chromium dinicocysteinate, chromium yeast and brewer's yeast were used differently in the studies, and none of the pooled analyses cleanly separates the compounds. Equally open is the transferability of the combination studies to the single substance: ²⁹ tested chromium picolinate with biotin, ⁵⁰ a multi-substance mixture, ⁵³ chromium with magnesium, and ⁵⁴ compared chromium dinicocysteinate with placebo.

11. What Remains Open

- **Chromium status:** How can a chromium deficiency in humans be reliably determined? Without such a measurement value it remains open in whom an additional supply can take effect at all.

- **Comparability of the forms:** The controlled studies examine different chromium compounds and sometimes do not name them in the title. Whether the forms are comparably absorbed has not been clarified.
- **Cognition:** A controlled study in older adults reports improvements in cognitive-cerebral function. Whether this can be repeated with independent measurements remains open.

12. Further Paths

Topics, modes of action and chains in which this substance occurs — for all those who wish to look beyond the substance.

- Interaction network

Frequently Asked Questions

Does the chromium compound play a role in the evaluation of the studies?

Yes, and it is frequently overlooked. Some of the controlled studies examine chromium picolinate and name the compound in the title, while others speak generally of chromium supplementation. As long as it is not clarified whether the forms are comparably absorbed, results from different studies can only be combined to a limited extent. When reading a study, it is therefore worth first asking which compound and which baseline situation of the participants were examined.

Must a deficiency be demonstrated before chromium administration?

The field is based on a deficiency model, yet an established measurement value for chromium status remains to be established. In the controlled studies the baseline situation was usually not determined in advance. This means that a null finding cannot be reliably distinguished from a lack of indication. The question of whether chromium changes anything in people without undersupply is therefore not answered, but remains open.

What is the data situation regarding safety?

Safety is a separate focus of controlled research; the review articles on supplementation in diabetes address efficacy and safety together. Robust statements refer to the compounds and durations of use examined. What remains to be clarified next is whether safety data can be combined across different chromium forms and over longer periods.

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