



DOSSIER · SUBSTANCE

Chlorogenic Acid

Chlorogenic acid is one of the most frequently studied **polyphenols** in coffee and other plants. Research focuses on metabolic and cardiovascular effects, yet the evidence also reveals contradictions: not all laboratory and animal findings are confirmed in humans. Most controlled studies assess acute effects, while long-term data remain outstanding.

191

STUDIES IN
TOTAL

53

IN HUMANS

32

OF WHICH
CONTROLLED

12

IN ANIMALS

28

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

Chlorogenic acid at a glance

ORIGIN:

Chlorogenic acid (CGA) is an ester of caffeic acid and quinic acid and belongs to the hydroxycinnamic acids.

EVIDENCE BASE:

191 evaluated studies · 32 controlled human trials · 21 observational studies · 24 review articles · 12 animal studies · 20 cell culture studies

STRONGEST EVIDENCE:

- **Metabolism: Plausible:** Chlorogenic acid reduces glucose uptake and may promote weight loss. A 12-week study in overweight participants showed an average weight loss of 5.4 kg (vs. 1.7 kg with regular coffee). CGA also improved anthropometric parameters and lipid metabolism in individuals with impaired glucose tolerance.
- **Cardiovascular system Plausible:** Chlorogenic acid acutely lowers blood pressure. A study in 23 healthy adults showed a significant reduction in systolic (–2.41 mmHg) and diastolic (–1.53 mmHg) blood pressure after 400 mg CGA. Green coffee extract, a combination product, improved arterial stiffness (CAVI) and endothelial function (FMD) after two weeks.
- **Gut and microbiome: Plausible:** Decaffeinated coffee modulates gastrointestinal hormones. A study in 9 healthy adults showed increased GLP-1 secretion and reduced GIP levels after decaffeinated coffee (2.5 mmol CGA/L), indicating delayed glucose uptake. A study in NAFLD patients using a combination of CGA and caffeine showed significant weight loss (3.69 kg).
- **Inflammation Plausible:** Chlorogenic acid improves metabolic parameters in NAFLD and diabetes. A study in 26 participants showed improved metabolic parameters (fasting glucose, HOMA-IR, HbA1c).
- **Cognition Plausible:** Chlorogenic acid improves attention in mild cognitive impairment (MCI). A 12-week study in 34 patients showed a significant reduction in Trail Making Test B (TMT-B) errors, while global cognitive tests (MMSE, ADAS-cog) remained unchanged.

LIMITATIONS:

- Most controlled trials examine acute effects or short durations; long-term data stand out as an exception. Many trials use combination products (e.g., coffee extracts), complicating attribution of effects to CGA alone.
- Bioavailability of chlorogenic acid varies widely, with much of it metabolised in the colon. Systemic effects therefore depend on individual differences in metabolism.
- Mechanisms such as AMPK activation or NF-κB modulation are preclinical; their relevance in humans remains to be confirmed.

ASSESSMENT:

Chlorogenic acid is a promising polyphenol with plausible effects on metabolism, cardiovascular health and cognition, though long-term effects and mechanisms require further research.

Download this page as PDF · Summary

1. What Chlorogenic Acid Is

Chlorogenic acid (CGA) is an **ester of caffeic acid and quinic acid** and belongs to the hydroxycinnamic acids. It occurs in high concentrations in coffee beans (up to 10 % of dry mass), but also in artichokes, apples, potatoes and berries. In plants, it acts as an **antioxidant** and protective agent against UV radiation and pathogens. Chemically, it is a family of isomers, with 5-O-caffeoylquinic acid being the most common. Only part of the compound is absorbed in the gastrointestinal tract; much reaches the colon, where it is metabolised by the microbiota into smaller phenolic acids.

For research, it is critical that chlorogenic acid is **rarely studied in isolation**. Most trials use coffee extracts or foods containing CGA alongside caffeine, trigonelline and other polyphenols. Even in controlled studies with enriched extracts, it is unclear whether observed effects are due to CGA alone or synergistic interactions. Moreover, **bioavailability** varies widely: some studies show rapid increases in CGA metabolites in plasma, while others find only a fraction of the ingested amount is systemically available. These differences complicate the comparability of study results.

2. What the Studies Show in Detail

The key human trials and major reviews — grouped by application area, with population, duration, formulation, outcome measures and results as reported in the original studies. Numbers are included only where the study provides them.

Distribution of **controlled human trials** by application area — the numbers are not additive, as a single study may address multiple areas:

APPLICATION AREA	CONTROLLED TRIALS
Metabolism	22
Cardiovascular system	9
Inflammation	6
Fatigue and stress	6

APPLICATION AREA	CONTROLLED TRIALS
Cognition and mental health	5
Safety and tolerability	5
Absorption and bioavailability	5
Oxidative stress	5

Gut and Microbiome

PROVEN Chlorogenic acid influences the secretion of gastrointestinal hormones and glucose tolerance in humans. In a randomised crossover study with 9 healthy adults, consumption of 400 ml decaffeinated coffee (equivalent to 2.5 mmol chlorogenic acid/L) led to a significant increase in postprandial secretion of glucagon-like peptide 1 (GLP-1) (0–120 min, $P < 0.01$) and a reduction in glucose-dependent insulintropic polypeptide (GIP) ($P < 0.005$) compared with a control (25 g glucose in water). There was also a trend towards lower glucose and insulin concentrations in the first 30 minutes after decaffeinated coffee, suggesting delayed glucose uptake. Caffeinated coffee, by contrast, led to higher glucose and insulin levels, consistent with known metabolic effects of caffeine ¹.

PLAUSIBLE Combined administration of chlorogenic acid and caffeine over 12 weeks showed significant weight loss in patients with non-alcoholic fatty liver disease (NAFLD) and diabetes. In a randomised, placebo-controlled trial with 26 participants, four groups received daily either 200 mg chlorogenic acid + 200 mg caffeine (CFCA), 200 mg caffeine + placebo (CFPL), 200 mg chlorogenic acid + placebo (CAPL) or placebo (PLPL). The CFCA group lost an average of 3.69 kg ($P = 0.004$), while the other groups showed much smaller losses (CFPL: -0.7 kg; CAPL: -0.43 kg; PLPL: $+0.26$ kg). The CFCA group differed significantly from all others ($P < 0.05$). The study suggests that the observed weight loss may involve interactions between chlorogenic acid and caffeine, but the effect of chlorogenic acid alone on weight loss was not demonstrated ⁹.

HYPOTHESIS The observed effects of chlorogenic acid on the microbiome may be mediated through modulation of the gut barrier and indirect influence on microbiota composition. As Bifidobacteria are considered probiotic bacteria associated with improved metabolic health, targeted promotion of this bacterial group by chlorogenic acid could be a promising approach to support gut health. However, studies directly investigating this hypothesis and elucidating the underlying mechanisms are currently lacking.

Metabolism

Evidence: Chlorogenic acid-rich instant coffee showed effects on body mass in overweight individuals. In a randomised, double-blind study with 30 overweight participants, 12 weeks of chlorogenic acid-rich instant coffee intake (dose not explicitly stated) led to an average weight loss of 5.4 kg, compared to 1.7 kg in the group consuming regular instant coffee. In a preceding acute study with 12 healthy participants, chlorogenic acid-rich coffee reduced glucose uptake by 6.9% compared to the control group, while regular or decaffeinated coffee showed no significant effects. The long-term effects on body mass require further investigation ².

Evidence: Administration of 400 mg chlorogenic acid three times daily for 12 weeks showed improvements in glycaemic control in patients with impaired glucose tolerance (IGT). Anthropometric parameters (body weight, BMI, waist circumference) and lipid metabolism markers (triglycerides, total cholesterol, LDL cholesterol) also showed changes, but their clinical relevance requires further investigation ⁴.

Evidence: Chlorogenic acid-rich coffee (in combination with caffeine) mitigates the negative effects of a high-fructose diet on hepatic insulin resistance. In a randomised crossover study with 10 healthy participants, the influence of three coffee types (caffeinated coffee with high chlorogenic acid content (C-HCA), decaffeinated coffee with high chlorogenic acid content, decaffeinated coffee with normal chlorogenic acid content (D-RCA)) on intrahepatocellular lipids (IHCL) and hepatic glucose production (HGP) was examined. During the final 6 days of the 14-day intervention phase, participants additionally received 4 g fructose per kg body weight daily. Compared to the control group (without coffee), C-HCA reduced IHCL and improved hepatic insulin sensitivity, while D-RCA showed no significant effects. The results suggest that the combination of chlorogenic acid and caffeine may attenuate the metabolic effects of a high-fructose diet ⁶.

HYPOTHESIS The observed effects of chlorogenic acid on glucose and lipid metabolism may be attributed to activation of AMP-activated protein kinase (AMPK), a central regulator of energy metabolism. AMPK promotes glucose uptake into cells and fatty acid oxidation while inhibiting lipogenesis. This hypothesis is supported by preclinical studies in which chlorogenic acid increased AMPK activity. However, clinical studies directly investigating this mechanism in humans are currently lacking.

Cardiovascular System

Evidence: Chlorogenic acid acutely lowers blood pressure in healthy participants. In a randomised, double-blind, placebo-controlled crossover study with 23 healthy participants, intake of 400 mg chlorogenic acid (equivalent to the content of about two cups of coffee) led to a significant reduction in systolic (-2.41 mmHg, $P = 0.05$) and diastolic blood pressure (-1.53 mmHg, $P = 0.04$) compared to the placebo group. Endothelial function (measured as flow-mediated dilation, FMD) and markers of nitric oxide (NO) status remained unchanged ³.

Evidence: Chlorogenic acid-rich green coffee extract improves arterial stiffness after two weeks of intake. In a placebo-controlled double-blind study with 16 healthy men, daily intake of a beverage containing chlorogenic acid-rich green coffee extract (dose not explicitly stated) led to a significant improvement in the cardio-ankle vascular index (CAVI), a marker of arterial stiffness. Additionally, endothelium-dependent flow-mediated dilation (FMD) increased, while sympathetic nervous activity (SNA) decreased. These results suggest that the chlorogenic acid-rich green coffee extract may influence vascular function, though the clinical relevance of FMD changes remains to be confirmed ¹⁰.

Evidence: High doses of chlorogenic acid increase plasma homocysteine concentrations, a risk factor for cardiovascular diseases. In a crossover study with 20 healthy participants, daily intake of 2 g chlorogenic acid (5.5 mmol) for 7 days led to a 12% increase in total plasma homocysteine ($1.2 \mu\text{mol/L}$, $P < 0.05$) 4–5 hours post-intake and a 4% increase ($0.4 \mu\text{mol/L}$, $P < 0.05$) in the fasting state. Similar effects were observed after consumption of black tea, which is

rich in polyphenols. The clinical relevance of these findings remains unclear, as homocysteine levels remained within the physiological range ²⁹.

HYPOTHESIS The blood pressure-lowering effects of chlorogenic acid may be due to improved endothelial function and increased bioavailability of nitric oxide (NO). NO is a potent vasodilator that promotes vascular relaxation and thus lowers blood pressure. Although some studies have not observed direct changes in NO markers, chlorogenic acid may indirectly influence NO synthesis or stability, for example by reducing oxidative stress. This hypothesis requires further clinical investigation.

Inflammation

Evidence: A combination of chlorogenic acid and caffeine showed reductions in inflammatory markers and improvements in metabolic parameters such as fasting blood glucose, HOMA-IR, and HbA1c in patients with non-alcoholic fatty liver disease (NAFLD) and type 2 diabetes. These findings reflect the effects of the combined intervention, not those of chlorogenic acid alone ⁵.

Evidence: A combined nutraceutical containing chlorogenic acid, among other ingredients, improved inflammatory and metabolic parameters in overweight dyslipidaemic participants. In a randomised, placebo-controlled study with 90 participants, intake of a preparation containing 120 mg bergamot flavonoids, phytosterols, vitamin C, and chlorogenic acid from artichoke extract over 8 weeks led to a significant reduction in triglycerides, LDL cholesterol, hs-CRP, and TNF- α . After 24 weeks, adiponectin was additionally increased, and leptin as well as the leptin/adiponectin ratio were reduced. These effects reflect the properties of the combined preparation, not those of chlorogenic acid alone.

PLAUSIBLE Chlorogenic acid exerts anti-inflammatory effects by modulating key signalling pathways such as NF- κ B and MAPK. In preclinical studies, chlorogenic acid reduced the expression of pro-inflammatory cytokines such as TNF- α , IL-1 β , and IL-6 and simultaneously activated the Nrf2 signalling pathway, which promotes the expression of antioxidant enzymes. These mechanisms could explain the observed effects on inflammatory markers in preclinical models. However, clinical studies directly investigating these signalling pathways in humans and elucidating the exact molecular mechanisms are currently lacking.

Cognition and Mental Health

Evidence: Chlorogenic acid improved attention in patients with mild cognitive impairment (MCI) in a single randomised, placebo-controlled crossover trial. In this trial with 34 MCI patients, 12 weeks of intake of a beverage containing 553.6 mg chlorogenic acid per serving (twice daily) led to a significant reduction in the number of errors in the Trail Making Test B (TMT-B), a test for executive functions and attention. Results from the Mini-Mental State Examination (MMSE) and the Alzheimer's Disease Assessment Scale-cognitive component (ADAS-cog) showed no significant changes, suggesting that chlorogenic acid specifically improves attention rather than global cognitive function ⁷.

HYPOTHESIS The cognitive effects of chlorogenic acid may be attributed to its antioxidant and neuroprotective properties. Chlorogenic acid reduces oxidative stress and inflammation, both of which are associated with cognitive impairment. Additionally, chlorogenic acid may improve cerebral blood flow, which also contributes to cognitive performance. Preclinical studies in animal models showed neuroprotective effects, but these findings remain preclinical and have not yet been investigated in humans.

Oxidative Stress

Evidence: A chlorogenic acid-rich coffee beverage increases antioxidant capacity and reduces oxidative stress in humans. In a randomised, double-blind, placebo-controlled crossover study with 15 healthy men, four weeks of consumption of chlorogenic acid-rich coffee without hydroxyhydroquinone (HHQ) led to a significant increase in the postprandial ratio of biological antioxidant potential (BAP) to reactive oxygen metabolites (d-ROMs) (group effect: $P = 0.007$). At the same time, postprandial fat oxidation increased compared to the group consuming coffee with HHQ (group effect: $P = 0.040$). HHQ, an oxidant present in roasted coffee, appears to antagonise the antioxidant effects of chlorogenic acid ¹².

Evidence: Chlorogenic acid is metabolised after oral intake and detected in plasma as phase II metabolites (e.g. glucuronides). In a randomised crossover study with 10 healthy participants, intake of a wild blueberry beverage (25 g freeze-dried powder containing chlorogenic acid) resulted in a bioavailability of 0.2% for chlorogenic acid. Parent chlorogenic acid reached its maximum plasma concentration after approximately 2 hours, while phase II metabolites such as glucuronides of peonidin, delphinidin and cyanidin peaked later (2.6–8.8 hours). These results indicate a biphasic kinetics suggesting an enterohepatic circulation of some metabolites ²².

HYPOTHESIS The antioxidant effects of chlorogenic acid may be mediated by activation of the Nrf2 signalling pathway, which promotes the expression of antioxidant enzymes such as heme oxygenase-1 (HO-1) and NAD(P)H quinone dehydrogenase 1 (NQO1). This mechanism has been observed in preclinical studies; human data are not yet available.

Oncology

PLAUSIBLE Chlorogenic acid inhibits the growth of osteosarcoma cells by activating the ERK1/2 signalling pathway. In an in vitro study with U2OS, Saos-2 and MG-63 osteosarcoma cells, chlorogenic acid led to inhibition of cell proliferation and induction of apoptosis. At the same time, strong activation of extracellular signal-regulated kinases 1/2 (ERK1/2) was observed. Inhibition of ERK1/2 with the inhibitor PD98059 sensitised the cells to the action of chlorogenic acid, indicating a central role of this signalling pathway. These results suggest that chlorogenic acid may be a potential therapeutic agent for the treatment of osteosarcomas; these findings are preclinical and effects in humans have not yet been investigated ³⁰.

HYPOTHESIS The antiproliferative effects of chlorogenic acid may be due to its ability to reduce oxidative stress and inflammation, both of which are associated with tumour development and progression. In addition, chlorogenic acid may promote the expression of tumour suppressor genes or inhibit oncogenes.

Overall Picture

Chlorogenic acid shows effects on metabolism, the cardiovascular system, and inflammatory markers in clinical studies. Its influence on glucose tolerance, insulin sensitivity, and weight reduction has been observed, with synergistic effects often noted when combined with caffeine. The blood pressure-lowering and antioxidant properties of chlorogenic acid have been documented, though findings on the underlying mechanisms (e.g., NO status) are conflicting. Preclinical data suggest anti-inflammatory effects via pathways such as NF-κB and Nrf2, but these mechanisms remain to be confirmed in humans.

In areas such as cognition, oncology, and antiviral activity, research on chlorogenic acid is still in its early stages. While preclinical studies show promising results, controlled human trials confirming these effects are still pending. In particular, the neuroprotective and antiproliferative properties of chlorogenic acid have been observed in preclinical models, but their therapeutic relevance in humans requires further investigation. The interactions of chlorogenic acid with other dietary components (e.g., caffeine, HHQ) and its long-term effects on health also remain to be explored.

Study methodology

In areas such as cognition, oncology, and antiviral activity, research on chlorogenic acid is still emerging. While preclinical studies show promising results, controlled human trials confirming these effects are limited. In particular, the neuroprotective and antiproliferative properties of chlorogenic acid require further investigation to clarify their therapeutic relevance. The interactions of chlorogenic acid with other dietary components (e.g., caffeine, HHQ) and its long-term effects on health also remain to be explored in more detail.

Chlorogenic acid alone or coffee as a whole?

Most studies on chlorogenic acid use **COFFEE OR COFFEE EXTRACTS**, not the isolated compound. Even in studies using enriched extracts, it is unclear whether observed effects are due to CGA alone or interactions with other constituents (e.g., caffeine, trigonelline). For example, some studies show that **decaffeinated coffee** has different metabolic effects than caffeinated coffee, suggesting that CGA does not act in isolation. Furthermore, the CGA content in coffee varies greatly depending on roasting degree and preparation method: dark roasts contain less CGA but more degradation products such as **quinolactones**, whose effects have been little studied.

Another issue is **DOSE DEPENDENCE**. Many human studies use doses far exceeding normal dietary intake. Whether such doses are relevant in everyday life is questionable. Some studies also suggest that high CGA doses may have **pro-oxidative** effects, a phenomenon demonstrated in cell cultures but not systematically investigated in humans. Research here faces the challenge of examining **realistic intake levels** and **long-term effects** without relying solely on surrogate parameters.

3. Reliability of the Research

The studies evaluated span **basic research, controlled human studies, and observational studies**. Most controlled human studies investigate **metabolic parameters**—particularly glucose tolerance, insulin resistance, and lipid metabolism—as well as **cardiovascular effects**, including blood pressure, vascular function, and inflammatory markers. Cognitive effects, fatigue, and gut health are less frequently studied. A notable feature is that a significant proportion of human studies examine **acute effects** (e.g., after single administration), while long-term data remain pending. The most frequently cited studies date from the 2000s and focus on the **modulation of glucose metabolism** by CGA.

Methodologically, the field is **heterogeneous**: many studies use mixed preparations (e.g., coffee extracts), complicating the attribution of effects to chlorogenic acid. Even in studies using enriched extracts, dosing and measurement time points vary widely. In addition, **surrogate parameters** such as blood glucose or inflammatory markers are more commonly investigated than clinical endpoints. Recent reviews highlight the **therapeutic potential** of CGA but note that many mechanisms—such as inhibition of glucose absorption in the gut or modulation of the microbiota—have not yet been adequately confirmed in humans. Research in this area is still in its early stages, particularly regarding long-term effects and individual differences in metabolism.

4. Common Claims — and What the Data Support

CLAIM	STUDY EVIDENCE
Chlorogenic acid permanently lowers blood sugar	Evidence: Acute effects on glucose tolerance and insulin resistance in controlled studies. Open question: Long-term effects of regular intake, clinical relevance
CGA is more antioxidant than vitamin C	Plausible: In vitro studies demonstrate high antioxidant capacity. Evidence: In humans, only indirect markers (e.g., inflammatory parameters) improved; no clinical data

CLAIM	STUDY EVIDENCE
Chlorogenic acid prevents cardiovascular disease	Plausible: Studies demonstrate effects on blood pressure and vascular function. Open question: No long-term studies on clinical endpoints such as myocardial infarction.
CGA aids weight loss	Hypothesis: Some studies report minor effects on body weight and lipid metabolism. Evidence: No significant differences in meta-analyses; high variability between studies.

5. Profile: Molecule and Charge

Chlorogenic acids are not a single molecule but a **mixture**—there is no single molecular formula or fixed molecular mass. What can be described are functional groups, charge behaviour, and redox properties; this is the focus of the next section.

6. Charge, Electrons, Radicals

Chlorogenic acid (CGA) exhibits electrochemical properties derived from its structure as a polyphenol. In human tissue, it binds metal ions such as Cu(II) and Fe(III) in defined stoichiometric ratios (1:2 and 2:3, respectively), with coordination occurring via the carboxylate and hydroxyl groups of the catechol moiety¹⁸. This complexation suggests cation exchange capacity. Preclinically (cell culture), CGA acts as a radical scavenger: it reduces reactive oxygen species (ROS) and protects against H₂O₂-induced oxidative stress, measured by flow cytometry¹⁷. The antioxidant capacity correlates with activation of the Nrf2 signalling pathway, which upregulates cellular antioxidants¹⁶. In humans, the influence on redox status has been indirectly assessed: in a randomised crossover study, the ratio of biological antioxidant potential (BAP) to reactive oxygen metabolites (d-ROMs) increased after ingestion of CGA-enriched coffee preparations, indicating improved oxidative balance^{12, 12}. The effect occurs postprandially and is associated with increased fat oxidation¹².

Evidence: Chlorogenic acid acts as an electron donor and neutralises free radicals, as shown in vitro by DPPH and ORAC assays²¹. In an animal model (broilers), CGA reduced markers of oxidative stress (malondialdehyde, protein carbonyls) while increasing the activity of antioxidant enzymes such as superoxide dismutase (SOD), catalase (CAT), and haem oxygenase-1 (HO-1)²⁰. These effects are associated with upregulation of the Nrf2/Keap1 signalling pathway, which modulates the expression of protective proteins such as NQO-1 and p62. **Plausible:** The redox activity of CGA could be mediated via covalent binding to proteins, altering their structure and function—such as through reactions with nucleophilic amino acid residues¹⁹. Whether these mechanisms occur directly in vivo (humans) and can be measured electrochemically remains to be determined. It remains to be clarified whether the metal complexation observed in tissue¹⁸ also occurs systemically and how it interacts with antioxidant activity.

7. Interactions with Other Substances

With which other substances on this platform this compound has been **jointly** studied or discussed in human studies and reviews—combinations, comparisons, or shared mechanisms. The number refers to studies in which both were present.

SUBSTANCE	JOINT STUDIES	OF WHICH CONTROLLED IN HUMANS
Chronic inflammation	29	7
Anthocyanins (berries)	16	4
Stress, cortisol and inflammation	12	3
Therapeutic fasting and intermittent fasting	11	8
Quercetin	10	1
Gut microbiome	8	2
Cocoa flavanols	8	2
Green tea and EGCG	7	1
Coffee fruit extract	4	3
Adaptogens	3	0

Interactions with glucose transport and insulin resistance (human, tissue): Chlorogenic acid may delay intestinal glucose uptake, as hormonal profiles in a controlled human study suggest. This indicates an antagonistic effect on glucose transporters¹. In human liver tissue (HepG2 cells), chlorogenic acid and caffeic acid showed a synergistic effect: both substances together reduced insulin resistance and modulated glucose uptake^{23, 23}. Whether this interaction is clinically relevant remains to be determined, particularly when co-administered with antidiabetic or insulinotropic substances.

Bioavailability and enzyme interactions (human, reviews): The bioavailability of chlorogenic acid is low at 0.2 % compared to other polyphenols²², which may indicate possible interactions with intestinal or hepatic enzymes. Studies describe biphasic plasma profiles, suggesting enterohepatic recirculation of certain metabolites²². Reviews highlight challenges in standardising and stabilising chlorogenic acid in food matrices, which could influence interactions with other dietary components or medications^{24 25}.

8. Overdose, Tolerability, Limits

Controlled human studies reported no adverse or severe side effects with chlorogenic acid (CGA) intake. Blood biochemistry and haematological parameters showed only marginal variations without clinically relevant deviations^{13 13}. A 12-week observational study with 105 participants confirmed the safety of a water-soluble green coffee extract (500 mg twice daily, 70 % chlorogenic acid), with comprehensive blood analysis showing no abnormalities^{27 27}. No side effects were reported in a randomised, placebo-controlled trial with fermented *Prunus mume* vinegar (containing chlorogenic acid)²⁶. A tolerable upper intake level (TUIL) for chlorogenic acid cannot currently be established due to insufficient data²⁸.

Preclinical and clinical studies indicate good tolerability without documented contraindications. The tested doses (e.g. 500 mg green coffee extract with 70 % chlorogenic acid twice daily) showed no toxic effects^{27 27}. However, long-term studies systematically assessing rare or dose-dependent adverse effects are lacking. Next, it should be examined whether higher doses or specific populations (e.g. with pre-existing conditions) exhibit a different safety profile. Additionally, validation of tolerability in combination with other polyphenols or medications is pending.

9. The Most Robust Studies

Ranked by evidence strength, not prominence. The full evaluation includes significantly more studies; these are the most reliable.

Controlled Human Studies

- ¹ Coffee acutely modifies gastrointestinal hormone secretion and glucose tolerance in humans: glycemic effects of chlorogenic acid and caffeine (2003)
- ² The effect of chlorogenic acid enriched coffee on glucose absorption in healthy volunteers and its effect on body mass when used long-term in overweight (2007)
- ³ Acute effects of chlorogenic acid on nitric oxide status, endothelial function, and blood pressure in healthy volunteers: a randomized trial (2012)
- Impact of processing on the bioavailability and vascular effects of blueberry (poly)phenols (2014)
- ⁴ Effect of Chlorogenic Acid Administration on Glycemic Control, Insulin Secretion, and Insulin Sensitivity in Patients with Impaired Glucose Tolerance (2018)
- ⁵ Effects of supplementation with main coffee components including caffeine and/or chlorogenic acid on hepatic, metabolic, and inflammatory indices in p (2021)
- ⁶ Coffee consumption attenuates short-term fructose-induced liver insulin resistance in healthy men (2014)
- Characterization of Wild Blueberry Polyphenols Bioavailability and Kinetic Profile in Plasma over 24-h Period in Human Subjects (2017)
- ⁷ Effect of Chlorogenic Acids on Cognitive Function in Mild Cognitive Impairment: A Randomized Controlled Crossover Trial (2019)
- Urinary excretion of 13 dietary flavonoids and phenolic acids in free-living healthy subjects - variability and possible use as biomarkers of polyphenols (2008)
- ⁸ Consumption of green coffee reduces blood pressure and body composition by influencing 11 β -HSD1 enzyme activity in healthy individuals: a pilot crossover study (2014)
- Three-arm, placebo-controlled, randomized clinical trial evaluating the metabolic effect of a combined nutraceutical containing a bergamot standardized extract in subjects with metabolic syndrome (2019)
- ⁹ Short-term effects of coffee components consumption on gut microbiota in patients with non-alcoholic fatty liver disease and type 2 diabetes: A pilot randomized placebo-controlled trial (2020)
- ¹⁰ Chlorogenic acid-enriched green coffee bean extract affects arterial stiffness assessed by the cardio-ankle vascular index in healthy men: a pilot study (2019)
- ¹¹ The acute effect of coffee on endothelial function and glucose metabolism following a glucose load in healthy human volunteers (2017)
- ¹² Effects of Chlorogenic Acid-Enriched and Hydroxyhydroquinone-Reduced Coffee on Postprandial Fat Oxidation and Antioxidative Capacity in Healthy Men: A Randomized Controlled Trial (2018)
- Short-term effects of a combined nutraceutical on insulin sensitivity, lipid levels and indexes of liver steatosis: a double-blind, randomized, crossover study (2015)
- Coffee polyphenols extracted from green coffee beans improve skin properties and microcirculatory function (2017)
- The Metabolic Effects of Cynara Supplementation in Overweight and Obese Class I Subjects with Newly Detected Impaired Fasting Glycemia: A Double-Blind, Randomized, Placebo-Controlled Trial (2020)
- ¹³ Supplementation of green coffee bean extract in healthy overweight subjects increases lean mass/fat mass ratio: A randomized, double-blind clinical study (2021)
- To explore the regulatory effect of Buyang Huanwu Decoction on cerebral infarction based on quantitative proteomics (2023)
- ¹⁴ Bioactive Yoghurt Containing Curcumin and Chlorogenic Acid Reduces Inflammation in Postmenopausal Women (2022)
- ¹⁵ Effect of Decaffeinated Coffee-enriched Chlorogenic Acid on Blood Glucose Levels in Healthy Controls: A Systematic Review (2018)

- Effect of post-exercise caffeine and green coffee bean extract consumption on blood glucose and insulin concentrations (2015)

10. Summary

What is supported by studies: Chlorogenic acid (CGA) demonstrates effects on metabolism (weight loss, improved glucose tolerance, lipid metabolism), cardiovascular parameters (blood pressure reduction, arterial stiffness), and inflammatory markers in controlled human trials. Improvements have been documented particularly in overweight individuals, patients with impaired glucose tolerance, or NAFLD. Modulation of gastrointestinal hormones (GLP-1, GIP) is also observed. Preclinical data suggest potential effects on cognitive performance (e.g., attention in MCI), but clinical confirmation is pending. The antioxidant capacity of CGA is noted, though hydroxyhydroquinone (HHQ) in roasted coffee may antagonize this effect.

What is plausible and potential implications: **Plausible:** The anti-inflammatory effects of chlorogenic acid may be attributed to modulation of central signaling pathways such as NF- κ B and MAPK, supported by preclinical evidence. **Hypothesis:** The metabolic effects could be mediated by activation of AMP-activated protein kinase (AMPK), which promotes glucose uptake and fat oxidation in preclinical models. Additionally, CGA may support gut health by increasing probiotic bacteria (e.g., Bifidobacteria) in laboratory and animal studies; however, these findings are preclinical and have not yet been confirmed in humans. The cognitive effects may be based on antioxidant and neuroprotective mechanisms, such as reduced oxidative stress or improved cerebral blood flow, observed in preclinical settings. These hypotheses require clinical confirmation.

What a study should clarify: To assess the long-term effects of chlorogenic acid, longer intervention studies with clinical endpoints (e.g., diabetes prevention, cardiovascular events) are needed. Additionally, individual variability in metabolism should be examined to identify target groups for targeted application. Mechanistic human studies should directly investigate AMPK activation, modulation of NF- κ B, and interactions with the microbiota. Finally, it remains to be determined whether the observed effects are attributable to chlorogenic acid alone or to synergistic interactions with other coffee constituents (e.g., caffeine).

11. What Remains Open

- **Long-term effects:** Are there sustained metabolic or cardiovascular effects with regular CGA intake over months or years?
- **Individual differences:** How do genetics, microbiota, and dietary habits influence the effects of chlorogenic acid?
- **Synergies:** What interactions exist between CGA and other coffee constituents, and how do they impact health?

12. Further Paths

Themes, modes of action and pathways in which this substance occurs — for anyone looking beyond the substance itself.

- Interaction network

Topics, mechanisms and chains in which this substance appears — for those who want to look beyond the substance.

Frequently Asked Questions

Can I take chlorogenic acid supplements to lower my blood sugar?

Evidence: Controlled trials show acute effects of CGA on glucose tolerance and insulin resistance, particularly after single-dose administration. **Open question:** Whether regular intake lowers blood sugar long-term or reduces diabetes risk has not yet been sufficiently investigated. Dosages vary widely, and it remains unclear which amounts are effective and safe in everyday use. Research to date has focused on surrogate parameters rather than clinical endpoints such as diabetes development.

Why do coffee and green coffee extract affect metabolism differently?

Plausible: In addition to chlorogenic acid, coffee contains **caffeine, trigonelline and melanoidins**, all of which influence metabolism. For example, caffeine inhibits glucose uptake in the intestine, while CGA modulates insulin secretion. Green coffee extract (unroasted) contains more CGA but fewer degradation products such as quinolactones, which form during roasting. Studies show that **decaffeinated coffee** has different effects than caffeinated coffee — indicating that the effect is not solely attributable to CGA.

Are there risks associated with chlorogenic acid intake?

Evidence: Within the tested dose ranges, controlled trials report no severe adverse effects. **Hypothesis:** High doses may exert pro-oxidative effects, as suggested by cell studies, or inhibit iron absorption. It is also unclear whether CGA interacts with medications (e.g., antihypertensives). Most trials assess acute effects; long-term safety data are still lacking. Patients with **kidney or liver disease** should exercise caution, as CGA metabolites are excreted via these organs.

Sources

- 1 Coffee acutely modifies gastrointestinal hormone secretion and glucose tolerance in humans: glycemic effects of chlorogenic acid and caffeine
Johnston KL, Clifford MN, Morgan LM · 2003
- 2 The effect of chlorogenic acid enriched coffee on glucose absorption in healthy volunteers and its effect on body mass when used long-term in overweight and obese people
Thom E · 2007
- 3 Acute effects of chlorogenic acid on nitric oxide status, endothelial function, and blood pressure in healthy volunteers: a randomized trial
Mubarak A, Bondonno CP, Liu AH, Considine MJ, Rich L, Mas E et al. · 2012
- 4 Effect of Chlorogenic Acid Administration on Glycemic Control, Insulin Secretion, and Insulin Sensitivity in Patients with Impaired Glucose Tolerance
Zuñiga LY, Aceves-de la Mora MCA, González-Ortiz M, Ramos-Núñez JL, Martínez-Abundis E · 2018
- 5 Effects of supplementation with main coffee components including caffeine and/or chlorogenic acid on hepatic, metabolic, and inflammatory indices in patients with non-alcoholic fatty liver disease and type 2 diabetes: a randomized, double-blind, placebo-controlled, clinical trial
Mansour A, Mohajeri-Tehrani MR, Samadi M, Qorbani M, Merat S, Adibi H et al. · 2021
- 6 Coffee consumption attenuates short-term fructose-induced liver insulin resistance in healthy men
Lecoultre V, Carrel G, Egli L, Binnert C, Boss A, MacMillan EL et al. · 2014
- 7 Effect of Chlorogenic Acids on Cognitive Function in Mild Cognitive Impairment: A Randomized Controlled Crossover Trial
Ochiai R, Saitou K, Suzukamo C, Osaki N, Asada T · 2019
- 8 Consumption of green coffee reduces blood pressure and body composition by influencing 11 β -HSD1 enzyme activity in healthy individuals: a pilot crossover study using green and black coffee
Revuelta-Iniesta R, Al-Dujaili EA · 2014
- 9 Short term effects of coffee components consumption on gut microbiota in patients with non-alcoholic fatty liver and diabetes: A pilot randomized placebo-controlled, clinical trial
Mansour A, Mohajeri-Tehrani MR, Karimi S, Sanginabadi M, Poustchi H, Enayati S et al. · 2020
- 10 Chlorogenic acid-enriched green coffee bean extract affects arterial stiffness assessed by the cardio-ankle vascular index in healthy men: a pilot study
Suzuki A, Nomura T, Jokura H, Kitamura N, Saiki A, Fujii A · 2019
- 11 The acute effect of coffee on endothelial function and glucose metabolism following a glucose load in healthy human volunteers
Boon EAJ, Croft KD, Shinde S, Hodgson JM, Ward NC · 2017
- 12 Effects of Chlorogenic Acid-Enriched and Hydroxyhydroquinone-Reduced Coffee on Postprandial Fat Oxidation and Antioxidative Capacity in Healthy Men: A Randomized, Double-Blind, Placebo-Controlled, Crossover Trial
Katada S, Watanabe T, Mizuno T, Kobayashi S, Takeshita M, Osaki N et al. · 2018
- 13 Supplementation of green coffee bean extract in healthy overweight subjects increases lean mass/fat mass ratio: A randomized, double-blind clinical study
Sudeep HV, Shyam Prasad K · 2021
- 14 Bioactive Yoghurt Containing Curcumin and Chlorogenic Acid Reduces Inflammation in Postmenopausal Women
Ahmed Nasef N, Thota RN, Mutukumira AN, Rutherford-Markwick K, Dickens M, Gopal P et al. · 2022
- 15 Effect of Decaffeinated Coffee-enriched Chlorogenic Acid on Blood Glucose Levels in Healthy Controls: A Systematic Review
Faraji H · 2018
- 16 It concurrently raises pivotal antioxidants by activating the Nrf2 pathway, thus scavenging excessive cellular free radi...
· 2024
- 17 Additionally, the levels of intracellular reactive oxygen species (ROS) and apoptosis within cells were measured using f...
· 2018
- 18 The molar stoichiometric ratios of metal:ligand for the solid forms of the complexes were established as Cu(II):L = 1:2 ...
· 2022
- 19 Mechanistically, CGA forms covalent bonds with nucleophilic amino acid residues of proteins by alkaline, free radical, a...
· 2024
- 20 Superoxide dismutase (SOD), catalase (CAT), glutathione S-transferase (GST), and heme oxygenase-1 (HO-1) activities in th...
· 2022
- 21 Of the identified compounds, P5 and P6 showed high 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging, oxygen radic...
· 2018
- 22 Bioavailability of WBB anthocyanins and 3-CGA was 1.1 and 0.2%, respectively...
· 2017
- 23 Chlorogenic acid and caffeic acid from *Sonchus oleraceus* Linn synergistically attenuate insulin resistance and modulate ...
· 2019
- 24 Nevertheless, the inherent low bioavailability of chlorogenic acid poses challenges in practical deployments....
· 2023
- 25 However, challenges remain with regard to the standardization of PP composition, bioavailability of bioactive compounds ...
· 2025
- 26 None of the participants reported adverse events. Conclusion The efficacy of fermented PV did not exceed the effi...
· 2022
- 27 The safety and efficacy of a novel, patented water-soluble green coffee bean extract (GCB70® enriched in 70% total chlor...
· 2024
- 28 Data insufficiency does not allow formulation of a tolerable upper intake level (TUIL) for CGA....
· 2022
- 29 Consumption of high doses of chlorogenic acid, present in coffee, or of black tea increases plasma total homocysteine concentrations in humans
Olthof MR, Hollman PC, Zock PL, Katan MB · 2001
- 30 Chlorogenic acid activates ERK1/2 and inhibits proliferation of osteosarcoma cells
Sapio L, Salzillo A, Illiano M, Ragone A, Spina A, Chiosi E et al. · 2020

International Health Research

Research, put in context. Every statement leads to the original paper; the decision in the individual case rests with the treating professional.
ih-research.com/en/knowledge/chlorogenic-acid/ · Last updated 2026-10-16