



DOSSIER · SUBSTANCE

Apple Cider Vinegar

Apple cider vinegar is made from apple juice, which is first fermented into apple wine and then into vinegar; human studies show partly favorable but inconsistent effects, especially on blood sugar and blood lipids.

77

STUDIES IN
TOTAL

31

IN HUMANS

26

OF WHICH
CONTROLLED

14

IN ANIMALS

4

IN THE LAB

Figures from the IHR study database · Last updated 2026-10-15

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

Apple Cider Vinegar at a Glance

In type 2 diabetes, fasting blood sugar fell more with daily apple cider vinegar than in the control group ⁷; in another study, the HbA1c value was more favorable ¹⁶. Meta-analyses found lower values for both ³⁴.

After a meal, blood sugar rose less in healthy young adults when they had previously drunk diluted liquid vinegar; vinegar tablets swallowed whole showed no difference from water ¹⁸.

For blood lipids in type 2 diabetes, total cholesterol and cholesterol-HDL ratios fell more with apple cider vinegar than in the control group ¹⁶. Meta-analyses found lower total cholesterol, but no effect on LDL and HDL ²⁴.

For blood pressure, a randomized controlled trial with apple cider vinegar found no difference ⁷; an overview of vinegar in general found a somewhat lower systolic value ². Insulin resistance did not change in meta-analyses ³⁴.

We evaluated 22 human studies on Apple Cider Vinegar, including 13 randomised controlled trials and 4 meta-analyses or systematic reviews; the controlled studies include 473 participants in total. As of 9 October 2026.

1. What Is Apple Cider Vinegar? Occurrence, Origin and Forms

Apple cider vinegar is a vinegar made from fermented apple juice. It is produced in two steps: first, yeasts ferment the sugar in the apple juice into alcohol; then acetic acid bacteria convert the alcohol into acetic acid. Traditionally it is used in the kitchen for seasoning, pickling, and preserving, and it is regarded as a home remedy.

Apple cider vinegar is found in foods and kitchens, for example in salad dressings, chutneys, and pickled vegetables. In studies it is examined as a drink, as a capsule, or as a powder.

Apple cider vinegar is made by fermenting apple juice; acetic acid is its main component by quantity. Studies examine liquid vinegar diluted with water, dried capsules and powders, and solutions of pure acetic acid.

Forms and Preparations Studied

- Liquid apple cider vinegar, diluted with water
- Apple cider vinegar capsules or tablets (dried)
- Apple cider vinegar powder
- Unfiltered apple cider vinegar with “mother”
- Pasteurised, clear apple cider vinegar

Not covered on this page:

- Apple juice and cider (unfermented or alcoholic)
- Other vinegars such as wine, rice, or balsamic vinegar
- Pure acetic acid solutions without an apple base
- Mixture products in which apple cider vinegar is only one ingredient among others

2. What Does Apple Cider Vinegar Do? Results by Area

AREA	RESULT IN CONTROLLED STUDIES	STRENGTH OF EVIDENCE	STUDIES	PARTICIPANTS
Blood glucose after meals	mostly improved	high	3 meta-analyses · 5 controlled · 1 other	191
Blood lipids	mostly improved	moderate	2 meta-analyses · 1 controlled · 1 other	0
Blood pressure	mostly no difference	moderate	1 meta-analyses · 1 controlled · 0 other	70
Weight and body fat	reviews only	low	2 meta-analyses · 0 controlled · 0 other	0
Appetite and satiety	mostly no difference	unclear	0 meta-analyses · 1 controlled · 0 other	15
Other investigations	mixed	low	0 meta-analyses · 12 controlled · 3 other	446

How to read the table: counted are human studies whose results concern the area. “High” means at least one meta-analysis and two controlled studies showing improvement, or at least three controlled studies of which three quarters show improvement, with at least 300 participants in total. “Moderate” means at least two controlled studies showing improvement, as a majority, or one meta-analysis alongside controlled studies. “Low” means one controlled study showing improvement. Where an area has no controlled study, the strength of evidence is at most “low” (result “reviews only” or “observational data

only"). Everything else is "unclear". A study counts as showing improvement when at least half of its outcomes in this area improved. Reviews of combination products do not count as meta-analyses; results that only describe side effects or shares of users do not count as an effect. The same study is counted only once.

3. What the Studies Show in Detail

Apple Cider Vinegar and Blood Glucose After Meals: Human Studies

In adults with type 2 diabetes, fasting blood sugar fell more with daily apple cider vinegar than in the control group ⁷. Another randomized controlled trial found a more favorable HbA1c value than in the control group; fasting blood sugar fell in both groups there, significantly only with apple cider vinegar ¹⁶. Meta-analyses on apple cider vinegar support this finding for fasting blood sugar and HbA1c, although the form investigated is not specified in more detail ^{3,4}. For postprandial blood sugar, diluted liquid vinegar attenuated the rise compared with water in a controlled crossover study in healthy young adults, while vinegar tablets swallowed whole did not; the type of vinegar is not specified ¹⁸. In a randomized crossover study in healthy women, dried apple pieces soaked in vinegar added to a rice meal attenuated the blood sugar rise, but dried apple without vinegar did as well ¹³. The evidence is considered high, but most studies are small, and the exact form of the apple cider vinegar — liquid diluted, capsule or powder, with or without "mother" — is often not described.

STUDY	DESIGN · PARTICIPANTS	PREPARATION · DOSE · DURATION · COMPARISON
² Shahmohammadi et al. 2026	systematic review	Vinegar consumption in general, form unspecified; vs. Control without vinegar
³ Arjmandfard et al. 2025	meta-analysis	Apple cider vinegar (ACV); Dose-response analysis; >10 (unit unclear); vs. Control groups of controlled trials
⁴ Hadi et al. 2021	meta-analysis	Apple cider vinegar (ACV); ≤15 mL/day in subgroup analysis; >8 weeks in subgroup analysis; vs. Control/placebo
⁶ Najafi et al. 2026	randomised controlled · 94 participants	Apple cider vinegar capsules added to metformin; 1500 mg/day; 12 weeks; vs. Placebo added to metformin 1500 mg/day
⁷ Gheflati et al. 2019	randomised controlled · 70 participants	apple vinegar, liquid; 20 ml per day; 8 weeks; vs. intervention group vs. control group
¹³ Zhao et al. 2020	randomised controlled · 15 participants	Vinegar-soaked dried apple co-ingested with rice; acute meal, 240 minutes; vs. Rice alone, dried apple, sugar s
¹⁶ Jafarirad et al. 2023	randomised controlled	Apple cider vinegar (ACV); 30 ml ACV per day; eight weeks; vs. Control group with healthy diet recommendation
¹⁸ Feise et al. 2020	controlled · 12 participants	Liquid vinegar (5% acidity) vs. commercial vinegar tablets; VIN: 25 g liquid vinegar (1.25 g acetic acid) in 35 g w

Further studies in this area: ²¹

Apple Cider Vinegar and Blood Lipids: Human Studies

In adults with type 2 diabetes, total cholesterol and the ratios of LDL to HDL and cholesterol to HDL fell more with daily apple cider vinegar than in the control group ¹⁶. LDL cholesterol fell within the apple cider vinegar group ¹⁶. A meta-analysis on apple cider vinegar found lower total cholesterol, but no effect on LDL and HDL ⁴. A systematic overview of vinegar in general, without a specified form, showed better total cholesterol, but no differences in LDL, HDL, and triglycerides ². A small pilot study without a control group in patients with schizophrenia taking clozapine found no significant change in blood lipid levels ²¹. The evidence is moderate; the forms investigated range from liquid diluted apple cider vinegar to an unspecified form, and the number of participants and the comparison conditions remain open.

STUDY	DESIGN · PARTICIPANTS	PREPARATION · DOSE · DURATION · COMPARISON
² Shahmohammadi et al. 2026	systematic review	Vinegar consumption in general, form unspecified; vs. Control without vinegar
⁴ Hadi et al. 2021	meta-analysis	Apple cider vinegar (ACV); ≤15 mL/day in subgroup analysis; >8 weeks in subgroup analysis; vs. Control/placebo (not further de
¹⁶ Jafarirad et al. 2023	randomised controlled	Apple cider vinegar (ACV); 30 ml ACV per day; eight weeks; vs. Control group with healthy diet recommendation
²¹ Hjorth et al. 2021	study · 9 participants	Apple vinegar, diluted; 10 ml apple vinegar in 200 ml water; 12 weeks; vs. no comparison (pilot study)

Apple Cider Vinegar and Blood Pressure: Human Studies

A randomized controlled trial in type 2 diabetes with elevated blood lipids found no difference in either systolic or diastolic blood pressure with apple cider vinegar drunk daily ⁷. A review of vinegar in general likewise found no difference in the diastolic value ². The same review found a somewhat lower systolic value, but combines apple cider vinegar and other types of vinegar without specifying the form ². The strength of evidence is medium, the data are thin: the controlled trial included 70 participants with type 2 diabetes and hyperlipidemia, and the review does not allow any statement specifically about apple cider vinegar. It remains open whether other forms such as capsules, powder or unfiltered apple cider vinegar with "mother" affect blood pressure.

STUDY	DESIGN · PARTICIPANTS	PREPARATION · DOSE · DURATION · COMPARISON	RESULT
² Shahmohammadi et al. 2026	systematic review	Vinegar consumption in general, form unspecified; vs. Control without vinegar	Systolic blood pressure
⁷ Gheflati et al. 2019	randomised controlled · 70 participants	apple vinegar, liquid; 20 ml per day; 8 weeks; vs. intervention group vs. control group	systolic and diastolic blood pressure

Apple Cider Vinegar, Weight and Body Fat: Human Studies

For weight and body fat, only review articles are available, no controlled individual studies. A meta-analysis of randomized controlled trials in adults with type 2 diabetes and/or overweight found lower body weight as well as lower values for body mass index and waist circumference with daily apple cider vinegar ¹. A systematic review of vinegar consumption in general, which combines apple cider vinegar and other types of vinegar without specifying the form, likewise found lower body weight, but no difference in body mass index and waist circumference ². The strength of evidence is low because both works leave the studied form open and the second is not limited to apple cider vinegar. Whether diluted liquid apple cider vinegar, capsules or powder have an effect therefore remains open.

STUDY	DESIGN · PARTICIPANTS	PREPARATION · DOSE · DURATION · COMPARISON
¹ Castagna et al. 2025	meta-analysis · 789 participants	Apple cider vinegar (ACV), form not specified; 30 mL/day in subgroup analysis; ≥4 weeks, subgroup analysis up to 12 weeks
² Shahmohammadi et al. 2026	systematic review	Vinegar consumption in general, form unspecified; vs. Control without vinegar

Apple Cider Vinegar, Appetite and Satiety: Human Studies

On satiety, only one randomized crossover trial in healthy women is available, and it did not test a pure vinegar preparation: dried apple pieces soaked in vinegar with rice did not reduce satiety ¹³. Statements about liquid diluted apple cider vinegar, capsules, powder or vinegar with "mother" cannot be derived from this. The strength of evidence is therefore unclear, and it remains open whether apple cider vinegar in other forms affects appetite or satiety.

STUDY	DESIGN · PARTICIPANTS	PREPARATION · DOSE · DURATION · COMPARISON
¹³ Zhao et al. 2020	randomised controlled · 15 participants	Vinegar-soaked dried apple co-ingested with rice; acute meal, 240 minutes; vs. Rice alone, dried apple, sugar solution

Apple Cider Vinegar: Further Outcomes in Studies

Further studies tested apple cider vinegar or vinegar for quite different questions. In women with PCOS and metabolic syndrome, metabolic syndrome resolved more often with apple cider vinegar capsules in addition to metformin than with placebo; moreover, insulin resistance and hirsutism decreased ⁶. In type 2 diabetes with elevated blood lipids, apple cider vinegar drunk daily improved antioxidant capacity more than in the control group; insulin values and insulin resistance improved in both groups ⁷. In varicose veins, discomfort, pain and social appearance anxiety decreased markedly with topically applied apple cider vinegar, with no confirmed decrease in the untreated control group ⁵. In children with cerebral palsy, apple cider vinegar for oral care reduced dental plaque and gingivitis after a few months more than brushing teeth without toothpaste ⁸. As a root canal rinse in primary teeth, apple cider vinegar lowered the bacterial count, but less strongly than sodium hypochlorite ⁹. A review of meta-analyses on vinegar in general found more favorable values for postprandial blood sugar and insulin as well as for HbA1c, but no difference in fasting insulin and insulin resistance ². Studies found no difference from the control for the skin microbiome in atopic dermatitis ¹⁰, for urinary values ¹¹, for energy expenditure ¹² and for endurance compared with a sports drink ¹⁴. Depression scores improved more with daily vinegar of unspecified type than with a tablet containing very little acetic acid, in one study only in one of two questionnaires ^{15,17}. The studies are mostly small and concern very different populations and applications; for vinegar with "mother", for powder and for long-term clinical endpoints, reliable data are lacking.

STUDY	DESIGN · PARTICIPANTS	PREPARATION · DOSE · DURATION · COMPARISON
⁵ Atik et al. 2016	randomised controlled · 120 participants	apple vinegar applied externally to the leg; vs. control group with no intervention
⁶ Najafi et al. 2026	randomised controlled · 94 participants	Apple cider vinegar capsules added to metformin; 1500 mg/day; 12 weeks; vs. Placebo added to metformin 1500 mg/day

STUDY	DESIGN · PARTICIPANTS	PREPARATION · DOSE · DURATION · COMPARISON
7 Gheflati et al. 2019	randomised controlled · 70 participants	apple vinegar, liquid; 20 ml per day; 8 weeks; vs. intervention group vs. control group
8 Asaad et al. 2022	randomised controlled · 50 participants	apple cider vinegar 5%, diluted liquid, no additives; 6 months, measurements T0 to T6; vs. manual brushing without toothpaste
9 Tolibah et al. 2024	randomised controlled · 30 participants	5% commercial apple cider vinegar solution; 24 ml per canal; Irrigation during preparation; vs. 5% sodium hypochlorite solution
10 Luu et al. 2021	randomised controlled · 22 participants	Dilute apple cider vinegar (0.5% acetic acid) vs. tap water; 0.5% acetic acid, 10 minutes daily; 14 days; vs. Tap water on control
11 Baker et al. 2026	randomised controlled · 20 participants	Apple cider vinegar (ACV), one assigned beverage daily; 1 week per beverage, 2-week washout; vs. Coconut water, lemon water
12 Cobb et al. 2021	randomised controlled · 16 participants	apple cider vinegar (ACV) in lemon-flavored drink; 30 ml/day; 4 days; vs. placebo (PLA)

Further studies in this area: [14](#) [15](#) [17](#) [19](#) [20](#) [21](#) [22](#)

4. How Is Apple Cider Vinegar Dosed? Preparation, Dose and Duration in Studies

Most studies gave liquid apple cider vinegar to drink, sometimes diluted with water; one study used apple cider vinegar capsules, another compared liquid vinegar with vinegar tablets, and several named only vinegar without specifying the type. Individual investigations applied apple cider vinegar to the skin, used it for oral care or root canal irrigation, or added dried apple pieces soaked in vinegar to a rice meal. Unfiltered apple cider vinegar with "mother" and pasteurized, clear apple cider vinegar were not specifically studied in the included studies.

PREPARATION OR FORM	DOSE	DURATION
Apple cider vinegar capsules added to metformin	1500 mg/day	12 weeks
apple vinegar, liquid	20 ml per day	8 weeks
apple cider vinegar 5%, diluted liquid, no additives	—	6 months
5% commercial apple cider vinegar solution	24 ml per canal	Irrigation
Dilute apple cider vinegar (0.5% acetic acid) vs. tap water	0.5% acetic acid, 10 minutes daily	14 days

PREPARATION OR FORM	DOSE	DURATION
Apple cider vinegar (ACV), one assigned beverage daily	—	1 week
apple cider vinegar (ACV) in lemon-flavored drink	30 ml/day	4 days
Vinegar-soaked dried apple co-ingested with rice	—	acute r
commercial apple cider vinegar (ACV) vs. commercial sports drink (CSD)	500 mL, 1 h before endurance exercise	until ex
vinegar (4 tbsp) vs. vinegar pill	2.95 g acetic acid vs. 0.025 g acetic acid daily	4 week
Apple cider vinegar (ACV)	30 ml ACV per day	eight w
Liquid vinegar (apple cider vinegar)	1.5 g acetic acid/day	4 week
Liquid vinegar (5% acidity) vs. commercial vinegar tablets	VIN: 25 g liquid vinegar (1.25 g acetic acid) in 35 g water; PILL: 4 tablets (1.50 g acetic acid) with 60 g water; PILL-c: 4 crushed tablets in 60 g water	Single
30 ml apple cider vinegar with 200 ml water	30 ml apple cider vinegar daily	2 week

5. Is Apple Cider Vinegar Safe? Side Effects in Studies

The studies report hardly any side effects. In type 1 diabetes with delayed gastric emptying, daily apple cider vinegar further slowed gastric emptying in a small controlled pilot study, which could make blood sugar control more difficult ¹⁹. Systematic information on tolerability, gastrointestinal complaints, or tooth enamel is lacking in the included works. Details on doses and duration of use are shown in the table.

STUDY	REPORTED SIDE EFFECTS
⁹ Tolibah et al. 2024	No difference in postoperative pain

6. What Remains Open: Limits of the Evidence

- Most studies are small, and the exact form of the apple cider vinegar — liquid diluted, capsule or powder, with or without "mother" — is often not described.

- For weight and body fat, only review articles are available, no controlled individual studies.
- For satiety, there is only one study, and it tested dried apple pieces soaked in vinegar instead of pure apple cider vinegar.
- Long-term clinical endpoints and data on unfiltered apple cider vinegar with "mother" or on powder are lacking.
- The comparison conditions differ greatly, from placebo to water to dietary recommendations.

7. Bottom Line: What Is Established About Apple Cider Vinegar

Apple cider vinegar is a vinegar made from fermented apple juice that is traditionally used in cooking. The findings are clearest for fasting blood sugar and the long-term value HbA1c, supported by meta-analyses ³⁴.

For blood lipids, the evidence is moderate: apple cider vinegar mainly lowered total cholesterol ⁴¹⁶, while LDL and HDL remained unchanged in meta-analyses ²⁴. For blood pressure, weight, and body fat, the data are thin or limited to reviews ¹²⁷. Overall, the studies are small, the forms investigated are often unclear, and statements apply only to the preparation tested in each case.

Frequently Asked Questions

How well has Apple Cider Vinegar been studied in humans?

We evaluated 22 human studies on Apple Cider Vinegar, including 13 randomised controlled trials and 4 meta-analyses or systematic reviews; the controlled studies include 473 participants in total. As of 9 October 2026.

Does Apple Cider Vinegar help with blood glucose after meals? What the studies show

We evaluated 3 meta-analyses or systematic reviews, 5 controlled studies and one further study; the controlled studies include 191 participants in total. Result of the controlled studies: mostly improved. Strength of evidence under our published rules: high. Sources: ²³⁴⁶

Does Apple Cider Vinegar help with blood lipids? What the studies show

We evaluated 2 meta-analyses or systematic reviews, one controlled study and one further study. Result of the controlled studies: mostly improved. Strength of evidence under our published rules: moderate. Sources: ²⁴¹⁶²¹

Does Apple Cider Vinegar help with blood pressure? What the studies show

We evaluated one meta-analysis or systematic review and one controlled study; the controlled studies include 70 participants in total. Result of the controlled studies: mostly no difference. Strength of evidence under our published rules: moderate. Sources: ²⁷

Does Apple Cider Vinegar help with weight and body fat? What the studies show

We evaluated 2 meta-analyses or systematic reviews. There are no controlled studies yet, only reviews; the strength of evidence is therefore low at most. Sources: ¹²

Does Apple Cider Vinegar help with appetite and satiety? What the studies show

We evaluated one controlled study; the controlled studies include 15 participants in total. Result of the controlled studies: mostly no difference. Strength of evidence under our published rules: unclear. Sources: ¹³

Which forms of apple cider vinegar were investigated in the studies?

Most commonly liquid apple cider vinegar to drink, sometimes diluted with water. In addition, apple cider vinegar capsules, vinegar tablets, dried apple pieces soaked in vinegar added to a rice meal, and externally applied apple cider vinegar were used. Unfiltered apple cider vinegar with "mother" and pasteurized, clear apple cider vinegar were not specifically tested.

Does apple cider vinegar show an effect on blood sugar?

In adults with type 2 diabetes, fasting blood sugar fell more with daily apple cider vinegar than in the control group ⁷; in another study, the HbA1c value was more favorable ¹⁶; meta-analyses support both ³⁴. After a meal, blood sugar rose less in healthy young adults when they had previously drunk diluted liquid vinegar; vinegar tablets swallowed whole showed no difference from water ¹⁸. Insulin resistance did not change in either meta-analysis ³⁴.

How does apple cider vinegar affect blood lipids?

In type 2 diabetes, total cholesterol and the ratios of LDL to HDL and cholesterol to HDL fell more with daily apple cider vinegar than in a control group with the same dietary recommendation ¹⁶. Meta-analyses found lower total cholesterol, but no effect on LDL and HDL ²⁴. A small pilot study without a control group in patients with schizophrenia taking clozapine found no significant change in blood lipid levels ²¹.

Does apple cider vinegar influence blood pressure, weight, or appetite?

For blood pressure, a randomized controlled trial with daily apple cider vinegar found no difference ⁷; an overview of vinegar in general found a somewhat lower systolic but no changed diastolic value ². For weight and body fat, only review articles are available, showing partly improvements and partly no differences ¹². For satiety, there is only one small study with dried apple pieces soaked in vinegar; it did not reduce satiety ¹³.

What side effects are known?

The studies report hardly any side effects. In type 1 diabetes with delayed gastric emptying, daily apple cider vinegar further slowed gastric emptying in a small controlled pilot study, which could make blood sugar control more difficult ¹⁹. Systematic information on tolerability, gastrointestinal complaints, or tooth enamel is lacking in the included works. Details on doses and duration of use are shown in the table.

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Research, put in context. Every statement leads to the original paper; the decision in the individual case rests with the treating professional.
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