

Review Article

# Could apple cider vinegar be used for health improvement and weight loss?

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## Summary

This non-systematic review outlines the current knowledge concerning provenance, chemical composition and properties of apple cider vinegar, its general health effects, as well as the currently available knowledge concerning its action on fat storage, physiological mechanisms of its effects, as well as its safety and recommended dosage for treatment of obesity.

## Introduction

Obesity is one of the most common physiological dysfunction, which, via several signalling pathways can promote development of metabolic syndrome, cancer, cardiovascular, inflammatory and other illnesses [1,2]. Apple cider vinegar could be promising food additive for prevention and treatment of obesity. The present non-systematic review outlines the current knowledge concerning provenance, chemical composition and properties of apple cider vinegar, its general health effects, as well as the currently available knowledge concerning its action on fat storage, physiological mechanisms of its effects, as well as its safety and recommended dosage for treatment of obesity.

Search for literature was performed in agreement with the PRISMA (= preferred reporting items for systematic review) criteria [3] (<http://prisma-statement.org/>). To search the related articles, Pubmed, Web of Science and SCOPUS databases between the year 2000 and 2021. In cases of repeated or conflicting information or references, more recent sources have been preferred. Words used to search were Cider, vinegar, fat, obesity, weight loss and mechanisms.

### Provenance and properties

Apple cider vinegar is made of apples (*Malus domestica*), which have undergone bacterial fermentation – a process in which sugar is first converted to alcohol (for example in production of cider) and that is then fermented to acetic acid. Besides apple cider vinegar, the product of apple fermentations contains also other biologically active components – gallic acid, catechin Y, epicatechins and chlorogenic acid, caffeic

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acid, p-Coumaric acid, ferulic acid, citric acid, and folic acid. It also contains phosphor, calcium, copper, sodium, potassium, vitamins A, B1, B2, B6, C, E, pectin, mineral salts, amino acids and flavonoids with antioxidant effect [4] <https://www.zdravieastyl.sk/potraviny-a-vyziva/193-sila-jablcneho-octu>.

### Positive effects on human health

Apple cider vinegar has antioxidant, antimicrobial, anti-tumour, antidiabetic and other effects beneficial to health [4]. It lowers blood pressure and treats hypertension [5]. Thanks to its antioxidant effect, it prevents oxidative stress and the related damage to internal organs and diseases linked to oxidative stress [6]. It can improve the condition of gastrointestinal tract and digestion [7], <http://dni.skwww.plusden.sk/zena/chudnutie/dieta-tento-tyzden/jablcnny-ocot-naozaj-roztopituk-potvr dili-aj-vedci.html>.

It reduces the concentration of glucose and insulin in blood, especially after meals high in carbohydrates [8-16]. Therefore, it is considered a prospective natural treatment against diabetes [13,15,17].

### Positive effects on weight reduction

It can serve as an efficient tool in weight loss [17-19] as it reduces weight through several mechanisms:

- It suppresses the centre of hunger in the central nervous system [20] and reduces appetite [18,21].



- It reduces the level of saccharides and lipids in blood, which act on the centre of hunger (see above).
- It is assumed that it could slow faecal output after a meal and therefore extend the sensation of satiety [8].
- It activates genes and the enzyme AMPK (activated protein kinase), which stimulates burning of fat [11,17]
- It reduces production and accumulation of lipids in the body and liver [17,18,21].

In both the obese [19] and healthy [21] people, consumption of apple cider vinegar reduced body weight, volume of fat and level of triacylglycerols in blood. Nazıroğlu, et al. [6] on the other hand, determined in mice that this vinegar, due to its antioxidant effect, prevented oxidation of lipids in internal organs.

In addition to acetic acid, involved in weight reduction might be also another component of apple cider vinegar – vitamin C. People with higher concentration of vitamin C oxidate 30% more lipids during physical activity than people with lower concentration [18].

On the other hand, the systematic review of Launholt, et al. [16] indicated, that due to inadequate research of high quality, the evidence for the health and anti-obesity effects of vinegar are insufficient. Therefore, more large-scale, long-term clinical studies with a low risk of bias are needed before definitive conclusions can be made.

### Possible adverse side-effects

Excessive doses of acetic acid can cause adverse side-effects such as stomach irritation, heartburn, and irritated throat [22], (<https://sk.thefreespiritedwoman.com/1888-5-side-effects-of-apple-cider-vinegar-nobody-told-you-about>), tooth decay [23], (<https://sk.thefreespiritedwoman.com/1888-5-side-effects-of-apple-cider-vinegar-nobody-told-you-about>), nausea [21] and increased risk of diabetes (<https://sk.thefreespiritedwoman.com/1888-5-side-effects-of-apple-cider-vinegar-nobody-told-you-about>). Hypocalcaemia can cause osteoporosis (reduced bone density, bone thinning) as well as constipation, muscle weakness, abnormal heart rhythm and exhaustion (<https://sk.simpleaslife.com/20805-side-effects-of-apple-cider-vinegar-tablets.html>). There are historical evidence of death after overconsumption of vinegar for weight loss [24].

Acetic acid can alter the effects of some medication – insulin, digoxin, diuretics, furosemide, torsemide and bumetanide, there it is not recommended to combine them (<https://sk.simpleaslife.com/20805-side-effects-of-apple-cider-vinegar-tablets.html>).

### General evaluation and recommendations

Previous research carried out on laboratory animals and

livestock as well as humans (both healthy and suffering from obesity and diabetes) conclusively validated the application of apple cider vinegar and its molecules had positive effects on numerous physiological processes and health. In particular, reduction of fat stores and body weight. Application of apple cider vinegar at a dose of 45 ml a day should be beneficial for normalization of fat stores and body weight without adverse side-effects.

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