Research Article

# Effects of apple cider vinegar on diabetic and obese patients

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**ABSTRACT**

**Introduction:** Apple cider vinegar (ACV) is made from fermented apple juice, it is used for reducing cholesterol, regulating blood pressure, sore throats, to get rid of toxins, arthritis, osteoporosis, stimulate thinking and so on. The aim of this study is to determine the effects of ACV among diabetic and obese individuals. **Materials and Methods:** A total of 10 diabetic patients (mean 140.6 + 2.13 mg/dl; range 105–156 mg/dl) of age group of 45–57 years and 10 obese patients (body mass index [BMI] 27.4 + 0.33 kg/m$^2$; range 25–31.2 kg/m$^2$) of age group of 18–59 years were made to drink 20 ml ACV in 200 ml water every day before bed. This was continued for 30 days regularly. The fasting blood glucose level of each patient was measured using glucometer before the experiment was conducted in case of diabetic patients. BMI of the patient was used as a parameter to note the weight change before and after consumption of ACV. **Results:** The BMI of before and after consumption of ACV was 27.4 ± 0.33 and 26.9 ± 0.32, we can observe the significant decrease in BMI. The diabetic patient had a decrease in blood glucose level from 140.6 ± 2.13 to 121.9 ± 2.28. The result was proved significant with $P < 0.05$.

**KEY WORDS:** Apple cider vinegar, Diabetes, Obesity

## INTRODUCTION

Apple cider vinegar (ACV) has a long history as a folk remedy. Discovery of wine which was formed from the unattended grape juice leads to the eventual discovery of vinegar.[1] Since the 1970s, it has been promoted for its numerous applications. ACV is made by crushing the apples, then squeezing out the juice. For the fermentation to initiate bacteria and yeast are added to the juice, and this results in the conversion of alcohol into vinegar by acetic acid-forming bacteria (*Acetobacter* species).[3] The unpasteurized ACV contains "the mother" which is the natural bacteria produced by the apple cider or "must." This gives the liquid a distinctive cloudy amber color. All beneficial bacteria are retained in this raw product which is why it is used as a "tonic."[2] It is 94% water, with calories and all nutrients at a negligible level.[3] The uses of ACV are vast which includes everything from curing hiccups to alleviating cold symptoms, and some people believe that the ACV helps with health concerns including diabetes, cancer, heart problems, high cholesterol, and weight loss.[4]

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### Cardio Vascular Effects

Kondo *et al*.[5] reported a significant reduction in systolic blood pressure (approximately 20 mm Hg) in spontaneously hypertensive rats fed with a standard laboratory diet mixed with vinegar (approximately 0.86 mmol acetic acid/day for 6 weeks). Further researchers proved that the consumption of ACV alters the calcium absorption and blood pressure regulation in humans.

### Antitumor Activity

Vinegar induces apoptosis in human leukemia cells and inhibits the proliferation of cancer cells in a dose-dependent manner. A prolonged lifespan due to tumor regression was also noted in the mice ingesting rice-shochu vinegar as compared with controls, and *in vitro*, the rice-shochu vinegar stimulated natural killer cell cytotoxic activity.[6]

### Anti-inflammatory Effect

ACV relieves inflammation, fights bacteria and thus have potent antimicrobial effects. It is rich in Vitamin

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Received on: 14-12-2018; Revised on: 19-01-2019; Accepted on: 11-02-2019

C which enables the reduction of inflammation, stress, and contributes to a healthy immune system to keep our body strong.[7] Drinking a small amount of ACV can help with the art

### Antidiabetic Effect

It is one of the most important properties of ACV which helps the people the most. Studies have found that people with type 2 diabetes who were not taking insulin had a lower glucose level by morning when they took two teaspoons of ACV before bed.[4] This is, therefore, much useful in case of insulin-resistant people.

### Weight Loss

About 22 g calories in 100 g ACV, this makes it a low-calorie drink. Adding a tablespoon of ACV into a glassful of water and drinking it every day acts as a potential weight loss booster along with numerous other benefits. It enhances satiety and, in turn, helps in weight loss.

Studies have demonstrated that ACV can help reduce hyperglycemia, hyperinsulinemia, hyperlipidemia, and obesity. Several mechanisms have been proposed to explain these metabolic effects, including delayed gastric emptying and absorption, suppression of hepatic glucose production, increased glucose utilization, upregulation of flow-mediated vasodilation, facilitation of insulin secretion, reduction in lipogenesis, increase in lipolysis, stimulation of fecal bile acid excretion, increased satiety, and enhanced energy expenditure.[8] Diabetes and obesity being the growing problem globally can be treated by adding ACV in the patient's diet. The aim of the study is to evaluate the influence of ACV on the diabetic and obese patients.

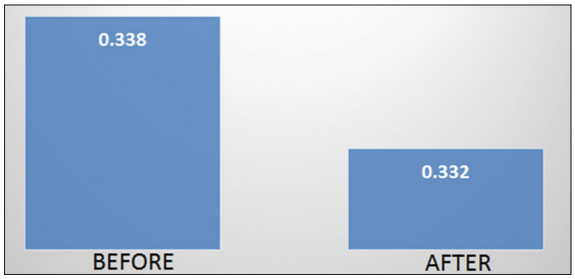


**Figure 1:** Body mass index of before and after consumption of ACV

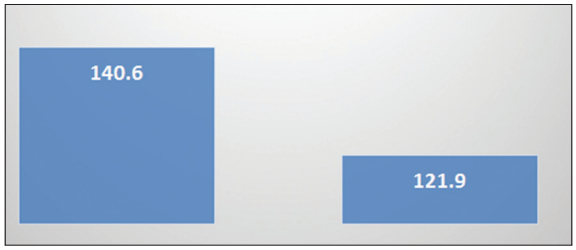


**Figure 2:** Blood glucose of before and after consumption of ACV

## MATERIALS AND METHODS

A total of 10 diabetic patients (mean 140.6 + 2.13 mg/dl; range 105–156 mg/dl) of age group of 45–57 years and 10 obese patients (body mass index [BMI] 27.4 + 0.33 kg/m$^2$; range 25–31.2 kg/m$^2$) of age group of 18–59 years were made to drink 20 ml ACV in 200 ml water every day before bed. This was continued for 30 days regularly. The fasting blood glucose level of each patient was measured using glucometer before the experiment was conducted in case of diabetic patients. BMI of the patient was used as a parameter to note the weight change before and after consumption of ACV. Participants were instructed to continue the usual prescription medication use during the study and were asked to follow the typical diet.

## RESULTS AND DISCUSSION

This research demonstrated the antiglycemic property of vinegar in individuals with marked insulin resistance or type 2 diabetes and the weight loss in obese patients. There was over 10–20% decrease in blood glucose level [Figure 2] and over 2–3 kg decrease in weight [Figure 1]. Over 70% of people had a decrease in body weight that is 7 out of 10. This research if continued for longer days might show a wide difference in body weight and blood glucose level. The patients BMI before was 27.4 ± 0.33 and after consumption of ACV was 26.9 ± 0.32, we can observe the significant decrease in BMI [Table 1]. The diabetic patient had a decrease in blood glucose level from 140.6 ± 2.13 to 121.9 ± 2.28 [Table 2]. The result was proved significant with $P < 0.05$.

Vinegar is widely available, it is affordable, and it is appealing as a remedy, but much more work is required to determine whether vinegar is a useful adjunct therapy for individuals with diabetes. Investigations have to be done to study the mechanisms by which vinegar alters postprandial glycemia and fasting glucose and to examine the efficacy of vinegar ingestion in individuals with inadequately controlled diabetes.[9,10] The antiglycemic activity of vinegar was first studied by Ebihara and Nakajima.[11] However, too much of

**Table 1: BMI before and after consumption of ACV**

| Effect | BMI | Weight |
|---|---|---|
| Before | 27.4±0.33 | 72.9±1.17 |
| After | 26.9±0.32 | 71.6±1.13 |

ACV: Apple cider vinegar, BMI: Body mass index

**Table 2: Blood glucose level before and after consumption of ACV**

| Effect | Blood glucose level |
|---|---|
| Before | 140.6±2.13 |
| After | 121.9±2.28 |

ACV in diet can also lead to some complications in the metabolism.[12] Researches have been done on the influence of ACV on blood lipids.[13]

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Source of support: Nil; Conflict of interest: None Declared