

<https://doi.org/10.48047/AFJBS.6.Si4.2024.6199-6209>



African Journal of Biological Sciences

Journal homepage: <http://www.afjbs.com>



Research Paper

Open Access

Effect of Different Amount of Locally Manufactured Red Apple Vinegar on the Body Weight and Diabetes

Bawer Jamil Younis ¹, Sawen Manaf Ezzalddin ², Zeen Tahsin Essa ³

¹ Department of Food technology, College of Agricultural Engineering Sciences, Salahaddin University-Erbil, Erbil, Kurdistan Region, Iraq

² Department of Food technology, College of Agricultural Engineering Sciences, Salahaddin University-Erbil, Erbil, Kurdistan Region, Iraq

³ Department of Food technology, College of Agricultural Engineering Sciences, Salahaddin University-Erbil, Erbil, Kurdistan Region, Iraq

Volume 6, Issue Si4, Aug 2024

Received: 09 June 2024

Accepted: 19 July 2024

Published: 08 Aug 2024

doi: [10.48047/AFJBS.6.Si4.2024.6199-6209](https://doi.org/10.48047/AFJBS.6.Si4.2024.6199-6209)

Abstract

Obesity and type II diabetes represents a great problem on public health systems worldwide. Apple vinegar is a natural product traditionally has been used in food and various amount forms in alternative medicine to treat a certain number of diseases especially type II diabetes. In this preset study, the effect of consumption of apple vinegar on the obesity and type II diabetes has been evaluated. The study was carried out on seventy-two volunteers with obesity and type II diabetes which are divided into three groups based on the age which are 20-30 age, 30-40 age and 40 and over age. Also, the concentrations of 10% and 20% and 30% of apple vinegar were used in drinking water for 90 days. The test studies were repeated at four, eight and twelve weeks of consumption and the results were analyzed using body weight balance and glucometer. There was significant lowering body weight in (G1) in a high level compared to in both (G2) and (G3) were not effective after 21 days of the start of its administration. Moreover, Glucose tolerance test indicated that apple vinegar was effective in lowering blood glucose level after 7 days of the start of its administration and after 3-week period apple vinegar had a beneficial effect in significant reductions in blood glucose level in all groups but in (G3) was more effective than the (G1) and (G2). The present study is aimed to assess hypoglycemic levels and body weight by consumption of red apple vinegar and evaluate their effects on volunteers age.

Keywords: Red apple vinegar, Vinegar manufacturing, Obesity, Type II diabetes.

Introduction

Vinegar is known as an alcoholic fermentation of fruits and some vegetables usually obtained by the acidification of glucose sugar that is present in fruits such as apple, grape, berry, potato and many other foods that are rich in carbohydrates (Budak et al., 2014). Apple vinegar is a light medium colored vinegar commonly produced either by the traditional methods called Orleans method and by the rapid which is called Submerged method. Apple vinegar is considered as a safe and natural food without any additions, recognized as safe (FDA., 2020).

Nutritionally, apple vinegar contains all carbohydrates, organic acids like (acetic, formic, malic and tartaric) amino acids and peptides. Moreover, vitamins, minerals salts, polyphenolic substances such as gallic acid, catechin, caffeic and ferulic acid have been found in natural apple vinegar (Kousar et al., 2022). Medically, apple vinegar may be able to play an important role in the improves the health and functions of the vital organs of the body and management of type II diabetes as developing research has verified that certain aspects of the beverage assist in controlling hyperglycemia, as well as lowering cardiovascular disease risks during body weight loss, reducing blood pressure and blood lipids (Samad et al., 2016). However, various research demonstrated that apple vinegar has to be beneficial effects in the treatment of many others diseases which including arthritis, asthma, osteoporosis, cancer, high cholesterol, muscle cramps, diabetes, diarrhea, gallstones, kidney stones, headaches, heartburn, preventing high blood pressure, metabolism and weight loss (Wolman, 1987; Tannock, 2008).

Generally, manufacturing of vinegar is based on the fermentation process. Traditionally apple vinegar is produced by a two-step fermentation where the yeast and bacteria are added to the juice that is produced from crushed apples. The first stage is converting sugars in apple fruit to ethanol by yeast, usually *Saccharomyces* after that the ethanol is oxidized to acetic acid by acetic acid bacteria usually *Acetobacter*, which is the second stage of fermentation (Iman et al., 2014).

Currently, obesity has become a critical challenge worldwide in recent years and is associated with too many public health problems such as dyslipidemia, cardiovascular disease, and type 2 diabetes (Health, 2000; Khezri et al., 2018). The most effective approaches for obesity management are energy intake limitation, increased physical activity, behavioral modifications, pharmacotherapy, and bariatric surgery (Health, 2000). On the other hand, the diabetes mellitus is a global health issue and considered as one of the most widespread endocrines, metabolic disorders which is characterized by the irregular metabolism of fat, protein, and carbohydrate due to decreased efficacy of insulin secretion or changed insulin activity (Kausar et al., 2019).

The effect of apple vinegar has been investigated for hundreds of years. Lately, apple vinegar has attracted a lot of interest for its health beneficial effects on regulating body weight and visceral fat accumulation (Kondo et al., 2009). Numerous studies demonstrated that apple vinegar

administration has favorable influence on anthropometric parameters, especially body weight regulation (Lim et al., 2009; Ok et al., 2013; Seo et al., 2014).

Conversely, apple vinegar may be able to play an important role in the daily management of type II diabetes as developing research has demonstrated that certain aspects of the beverage assist in controlling hyperglycemia, as well as decreasing the risks of cardiovascular disease through weight loss, lowering blood pressure and lowering blood lipids (Samad et al., 2016).

Materials and Methods

Sample Collection and Volunteer Selection

For this research, red apples were collected from Duhok - Amedi in Kurdistan Region, Iraq in September and October, 2023. The samples were harvested directly from trees then vinegar was manufactured. However, seventy-two volunteers aged from 20 and over 40 were selected for both cases. Data on age, diabetes status and body weight were collected in march to June, 2024 from Layla Qasim Diabetes Center located in Erbil, Iraq and then analyzed.

Manufacturing Steps of Vinegar

1. Apples Collecting and Preparing

Apples should be firm and ripe when harvested. Apples were sorted, washed without soap to remove impure and the flesh of apples sliced into small to medium chunks. Then fill a clean glass container halfway with apples. The glass container must be clean with hot water, no soap residue, for fermentation supplies (Kousar et al., 2022).

2. Add Water and Sugar

Filtered tap water was added over the apples in the ratio (1:0.25) one kilogram of flesh apple per 0.25 milliliter of water in the clean container. Afterward, table sugar was added in the ratio (1:1) one teaspoon per one liter of water and stirred until all sugar dissolves.

3. Let to Ferment and Stir

After mixing apples, water, and sugar, close the glass container and place in a dark spot ideally at 22-27°C. After two weeks of fermentation, the glass container was opened and one to two time stirred the fermented apples and the glass container was covered with breathable material like a tea towel and medical head cover then stored in a dark, temperate place, the waiting game begins for about three weeks or forty days. During the process bacteria convert sugar or alcohol to acetic acid, turning it into vinegar.

4. Filtering and Bottling

The fermented apple was filtered with clean cheesecloth two times to prevent any residue of the fermented apple then the apple vinegar bottled and stored at room temperature.

Procedure

This experiment study was classed in to two cases which are obesity and blood glucose level in diabetes (type II). The test was randomly performed on 72 patients. In the case of obesity, 36 volunteers were selected and grouped into the three classes which are 20-30 age, 30-40 age and 40-over age. Apple vinegar was taken by volunteers every day as follows for the age 20-30, 10 ml, for the age 30-40, 20 ml and for the age 40 and over, 30 ml. The ratio was mixed with a cup of water (Cho et al., 2010). In addition, it is advised to ingest the specified measurement with a glass of water 10 minutes' post-lunch, coupled with daily weight assessments conducted on an empty stomach. On the other hand, the diabetes cases possessed the same amount or quantity of apple vinegar but diabetes tests should be conducted twice a week, specifically on an empty stomach before breakfast (Beheshti et al., 2012).

Results

Table 1. The effect of apple vinegar on the body weight losing after fourth, eighth and twelfth weeks with baseline by G1, G2 and G3 volunteers.

No.	Baseline (kg)	Participants	Intervention	4 weeks	8 weeks	12 weeks	Change during 12 weeks (kg)
1	68.7	20-30 years (G1)	10 ml of Apple vinegar in one glass of water	67.7	66.4	65.2	3.5
2	75			74.7	73.4	71	4
3	69.7			69	68.4	67.1	2.6
4	62			61.6	59.8	59	3
5	90.1			89.7	88.9	87.5	2.6
6	83.4			82.7	81.6	80.1	3.3
7	64.5			63.9	62.7	61.8	2.7
8	73.2			72.6	71.8	70.9	2.3
9	78.3			77.6	77.1	76	2.3
10	88.3			87	86.5	85.3	3
11	83.4			81.7	79.9	79	4.4
12	54.3			52.6	51.3	50	4.3
13	87.6	30-40 years (G2)	20 ml of Apple vinegar in one glass of water	86.7	85.9	84.6	3
14	77.3			76.9	76	75.7	1.6
15	89.9			89.7	88.5	87.6	2.3
16	90.1			89.7	89	88.4	1.7
17	84			83.7	82.9	83.3	0.7
18	75.4			74.9	74.2	73.8	1.6
19	98.9			98.5	97.6	97.1	1.8
20	81.9			81.1	80	79.5	2.4
21	95.6			94.9	94.7	93	2.6
22	93.3			92.6	91.9	90	3.3
23	90.3			89.8	87.9	87	3.3
24	98.6			97.6	96.5	94.5	4.1
25	85.6	40-over years (G3)	30 ml of Apple vinegar in one glass of water	84.9	83.7	83.1	2.5
26	79.8			79.6	79	78.9	0.9
27	95.4			95	94.6	94.2	1.2
28	82			81.7	81.3	81	1
29	99.2			98.8	98.1	96	3.2
30	87.3			86.9	86.3	85	2.3
31	90.6			90	89.7	89	1.6
32	90.7			90.2	89.8	89.1	1.6
33	82.9			82.5	81.7	80.6	2.3
34	79.7			78.8	77.9	77.6	2.1

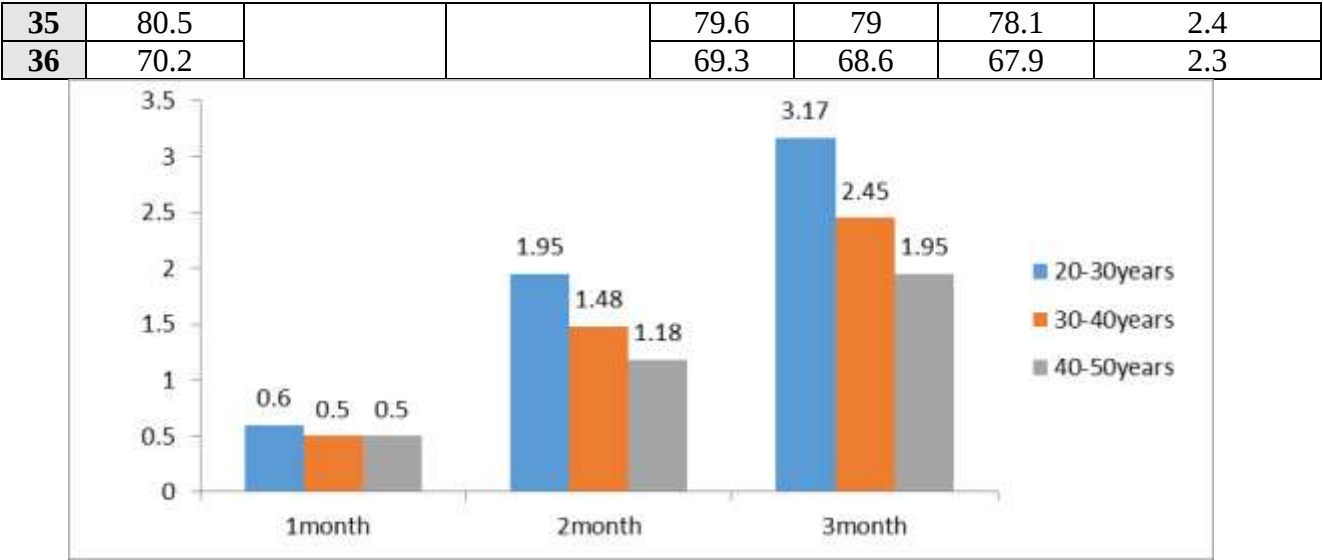


Figure 1. The average of lowering body weight during one, two and three-month in G1, G2 and G3 groups.

Table 2. The effect of apple vinegar on the blood glucose level (BGL) in diabetics (type II) after fourth, eighth and twelfth weeks with baseline by G1, G2 and G3 volunteers.

No.	Baseline (mg/dL)	Participants	Intervention	4 weeks	8 weeks	12 weeks	Reduce (BGL) during 12 weeks (mg/dL)
1	157	20-30 years (G1)	10 ml of Apple vinegar in one glass of water	152	149	143	14
2	160			155	153	149	11
3	334			329	326	324	10
4	276			271	267	251	25
5	153			149	149	144	9
6	350			347	344	329	21
7	243			239	235	213	30
8	150			143	141	130	20
9	357			351	347	342	15
10	400			394	393	381	19
11	345			340	338	333	12
12	263			259	254	240	23
13	289	30-40 years (G2)	20 ml of Apple vinegar in one glass of water	282	275	267	22
14	150			144	139	130	20
15	250			243	237	231	19
16	300			295	289	278	22
17	165			159	151	141	24
18	275			267	266	255	20
19	176			172	164	153	23
20	236			228	222	209	27
21	196			190	186	180	16
22	240			233	225	225	15
23	257			253	241	235	22
24	258			253	245	238	20
25	194	40-over years (G3)	30 ml of Apple vinegar in one glass of water	155	136	120	74
26	436			416	393	370	66
27	378			359	346	309	69
28	400			360	354	344	56
29	498			462	458	421	77
30	287			237	234	227	60
31	396			381	376	350	46
32	500			468	440	422	78
33	330			277	271	264	66
34	487			467	443	404	83
35	272			220	200	189	83
36	160			150	143	135	25

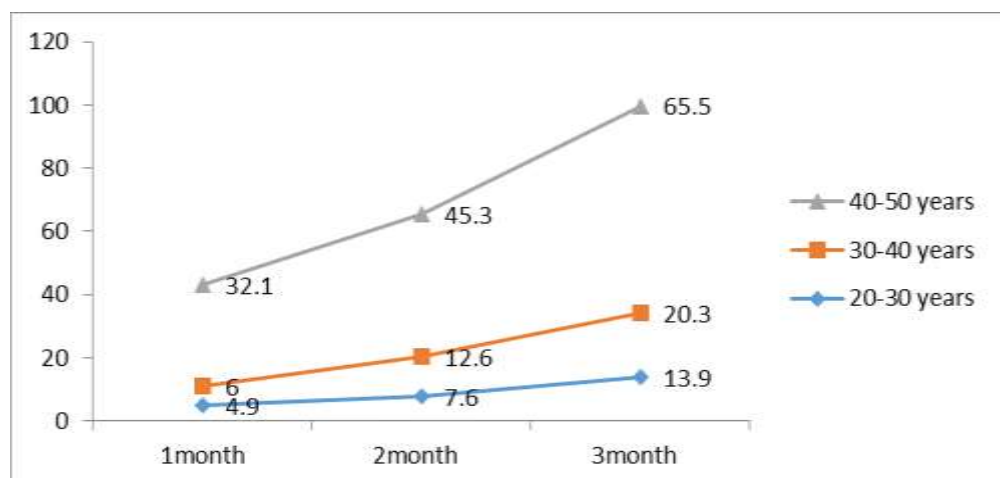


Figure 2. The average reducing the level of blood glucose in diabetics (type II) after fourth, eighth and twelfth weeks in G1, G2 and G3 groups.

Discussion

Body weight

The effect of apple vinegar on the obesity or body weight losing are summarized in Table 1. The results displayed that apple vinegar in all groups significantly reduced the body weight of participants. At baseline and the end of week 12, about (2.3- 4.4) kg of weight was down from the participants of group one (G1) compared to the participants of group three (G3), about (0.9 - 3.2) kg of weight was down. However, participants of group two (G2) down the body weight approximately 1.5-3.3 kg. Among all participants (G1) recorded highest level of body weight felling based on the physical activity of participants of this age. (Khezri et al., 2018) stated the effect of the apple cider vinegar on the body weight management and the study was performed on the 39 participants and the body weight down was recorded about 4 kg during 12 weeks.

Diabetics (Type II)

The results of present experiments study that was conducted on 36 volunteers getting 10 ml, 20 ml and 30 ml in a cup of water of apple vinegar indicated that the level of blood glucose had been reduced over the course of the 12-week trial. However, the obtained results show that the apple vinegar had more effect on the participants of group (G3) and (G2) with the range (9-23) mg/dL and (25-83) mg/dL, compared to the participants of group (G1) with the range (15-27) mg/dL, the effects is less with consumption of apple vinegar. (Shishehbor et al., 2008), found that the apple vinegar had a stronger ability to reduce the level of blood glucose. This study stated that it was not until 3 weeks that the apple vinegar significantly lower glucose levels in diabetic. However, the effect of apple vinegar on blood glucose level in diabetics was studied by (Iman et al., 2014). This study was conducted on 60 participants divided into six group and

found that blood glucose levels significantly reduced on day 7 and at triple doses has anti hyperglycemic effects.

Conclusion

The present study concluded that the daily consumption of approximately 15 ml of apple vinegar after regular meals can beneficially effect on the lowering blood glucose sugar and felling of the body weight. In the case of body weight, our results showed that the apple vinegar was more effective after 12 weeks in the ages between (20-30). While the apple vinegar was slightly effective on the reducing body weight in the ages between (30-40 and 40 and over). However, in the case of blood glucose in type II diabetics, the apple vinegar was more effective on all ages after 3 days of the start of its administration in diabetic mice. Moreover, the findings of the present investigation indicated that blood glucose levels in the ages between (20-30) were more effective comparable to the ages between (40 and over). In the ages between (40 and over) blood glucose levels significantly lowered and has a great effect.

Recommendation

They recommended that the impacts of apple vinegar to be investigated on body weight and blood glucose level. Finally, we recommended that use the natural apple vinegar as a drag instead to use the medical drag. The mechanism of this action and its significance remain to be elucidated in future investigations.

Reference

- Ali, Z., Ma, H., Wali, A., Ayim, I., Rashid, M.T. and Younas, S., (2018) A double-blinded, randomized, placebo-controlled study evaluating the impact of dates vinegar consumption on blood biochemical and hematological parameters in patients with type 2 diabetes. *Tropical Journal of Pharmaceutical Research*, 17(12), pp.2463-2469.
- Banna, A.A. and Kwarar, N.S., (1982) Behavior of parathion in apple juice processed into cider and vinegar. *Journal of Environmental Science & Health Part B*, 17(5), pp.505-514.
- Beheshti, Z., Chan, Y.H., Nia, H.S., Hajihosseini, F., Nazari, R., Shaabani, M. and Omran, M.S., (2012) Influence of apple cider vinegar on blood lipids. *Life Science Journal-Acta Zhengzhou University Overseas Edition*, 9(4), pp.2431-2440.
- Budak, N.H., Aykin, E., Seydim, A.C., Greene, A.K. and Guzel-Seydim, Z.B., (2014) Functional properties of vinegar. *Journal of food science*, 79(5), pp.R757-R764.
- Cho, A.S., Jeon, S.M., Kim, M.J., Yeo, J., Seo, K.I., Choi, M.S. and Lee, M.K., (2010) Chlorogenic acid exhibits anti-obesity property and improves lipid metabolism in high-fat diet-induced-obese mice. *Food and chemical toxicology*, 48(3), pp.937-943.
- FDA, U., (2020) US Food & Drug Administration. *Center for Food Safety and*.
- Gispen, W.H. and Biessels, G.J., (2000) Cognition and synaptic plasticity in diabetes mellitus. *Trends in neurosciences*, 23(11), pp.542-549.
- Hassan, S.M., (2018) The effect of apple cider vinegar (ACV) as an antifungal in a diabetic patient (Type II diabetes) with intraoral candidosis. *International Journal of Dental and Oral Health*, 4, pp.5-54.
- Heart, N., (2000) Lung, and Blood Institute & North American Association for the study of obesity. The practical guide: identification, evaluation, and treatment for overweight and obesity in adults. Bethesda: US Department of Health and Human Services. *Public Health Service, National Institutes of Health, National Heart, Lung, and Blood Institute*.
- Iman, M., Moallem, S.A. and Barahoyee, A., (2014) Effect of apple cider vinegar on blood glucose level in diabetic mice. *Pharmaceutical Sciences*, 20(4), pp.163-168.
- Kausar, S., Humayun, A., Ahmed, Z., Abbas, M.A. and Tahir, A., (2019) Effect of apple cider vinegar on glycemic control, hyperlipidemia and control on body weight in type 2 diabetes patients. *Health Sciences*, 8(5), pp.59-74.
- Khezri, S.S., Saidpour, A., Hosseinzadeh, N. and Amiri, Z., (2018) Beneficial effects of Apple Cider Vinegar on weight management, Visceral Adiposity Index and lipid profile in overweight

or obese subjects receiving restricted calorie diet: A randomized clinical trial. *Journal of functional foods*, 43, pp.95-102.

Kondo, T., Kishi, M., Fushimi, T., Ugajin, S. and Kaga, T., (2009) Vinegar intake reduces body weight, body fat mass, and serum triglyceride levels in obese Japanese subjects. *Bioscience, biotechnology, and biochemistry*, 73(8), pp.1837-1843.

Kousar, M., Manzoor, B., Rafiq, A. and Jabeen, A., (2022) A perfect detoxifying drink–Apple cider vinegar. *Just Agric*, 2, pp.1-8.

Lim, S., Yoon, J.W., Choi, S.H., Cho, B.J., Kim, J.T., Chang, H.S., Park, H.S., Park, K.S., Lee, H.K., Kim, Y.B. and Jang, H.C., (2009) Effect of ginsam, a vinegar extract from *Panax ginseng*, on body weight and glucose homeostasis in an obese insulin-resistant rat model. *Metabolism*, 58(1), pp.8-15.

Ok, E., Do, G.M., Lim, Y., Park, J.E., Park, Y.J. and Kwon, O., (2013) Pomegranate vinegar attenuates adiposity in obese rats through coordinated control of AMPK signaling in the liver and adipose tissue. *Lipids in Health and Disease*, 12(1), pp.1-8.

Rathmann, W. and Giani, G., (2004) Global Prevalence of Diabetes: Estimates for the Year 2000 and Projections for 2030: Response to Wild et al. *Diabetes care*, 27(10), pp.2568-2569.

Samad, A., Azlan, A. and Ismail, A., (2016) Therapeutic effects of vinegar: a review. *Current Opinion in Food Science*, 8, pp.56-61.

Seo, K.-I., Lee, J., Choi, R.-Y., Lee, H.-I., Lee, J.-H., Jeong, Y.-K., ... Lee, M.-K. (2014) Anti-obesity and anti-insulin resistance effects of tomato vinegar beverage in diet-induced obese mice. *Food & Function*, 5(7), 1579–1586

Shishehbor, F., Mansoori, A., Sarkaki, A.R., Jalali, M.T. and Latifi, S.M., (2008) Apple cider vinegar attenuates lipid profile in normal and diabetic rats. *Pakistan journal of biological sciences: PJBS*, 11(23), pp.2634-2638.

Tannock, L.R., (2008) Advances in the management of hyperlipidemia-induced atherosclerosis. *Expert review of cardiovascular therapy*, 6(3), pp.369-383.

Wing, R.R. and Hill, J.O., (2001) Successful weight loss maintenance. *Annual review of nutrition*, 21(1), pp.323-341.

Wolman, P.G., (1987) Management of patients using unproven regimens for arthritis. *Journal of the American Dietetic Association*, 87(9), pp.1211-1214.