Effectiveness of Apple Cider Vinegar on Reduction of Blood Cholesterol Level Among Clients with Hyperlipidemia

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Abstract
Apple cider vinegar supplementation has been shown to be beneficial in reducing blood cholesterol level in some but not all studies. Hence the benefits of apple cider vinegar on reduction of blood cholesterol level among hyperlipidemia clients remain inconclusive. The current study aims to evaluate the effect of apple cider vinegar on reduction of blood cholesterol level among hyperlipidemic clients. A quantitative approach with quasi experimental pretest post test control group was adopted for the present study.50 patients diagnosed as hyperlipidemia were recruited using purposive sampling technique and were assigned into experimental and control group. A self-structured questionnaire method was adopted to collect the demographic information. Followed by that, apple cider vinegar was given orally once a day (15ml) to the experimental group and the routine hospital care was followed for the participants in the control group. The results revealed that there was a significant difference identified in pre and post test level of blood cholesterol was calculated using paired " t " test which was statistically significant difference (P< 0.001) with reference to reduction in total cholesterol triglycerides and LDL. Hence, the findings of present study concluded that, oral supplementation of apple cider vinegar was found to be effective in reducing blood cholesterol among clients with Hyperlipidemia.

Keywords: Apple Cider Vinegar, High Density Lipids (HDL), Hyperlipidemia, Low Density Lipid (LDL), Total Cholesterol (TC), Triglycerides.

1. Introduction

Hyperlipidemia is characterised by an increase in one or more plasma lipids, such as triglycerides, cholesterol, cholesterol esters, phospholipids. It also has plasma lipoproteins, including very low-density lipoprotein,low-density lipoprotein, and lower levels of high-density lipoprotein[1]. Globally increased prevalence of hyperlipidemia is identified.[2]. The mechanism of lipid metabolism, fat accumulation and body fat reduction is mainly due to the reduction in lipogenesis, increased lipolysis, acid bile excretion stimulation, and increased energy expenditure reduced energy intake due to increased satiety [3]..In Brazil the prevalence of hypercholesterolemia is 4.1 percent and hyperglyceridemia is 17.1 percent . In Portuguese population, it has been reported that, 56.7 had elevated levels of cholesterol and triglycerides [4] . Changes in lifestyle eating (fast food, increased calorie consumption, stored food and physical inactivity) are major factors in the emergence of metabolic diseases and a variety of illnesses [5]. Dyslipidemia is considered as a risk factor for cardiovascular disease [6]. According to WHO (2015), 17.7 million deaths occurred due to CVD, with the number expected to rise to more over 23.6 million by 2030 [7]. Hyperlipidemia and oxidative stress (OS) are well-known factors for the development of atherosclerosis [8].In individuals with hyperlipidemia, the major goal of treatment is to lower the risk of developing ischemic heart disease or the occurrence of future cardiovascular or cerebrovascular disease [9].To treat these metabolic disorders, dietary adjustments and physical activity, as well as pharmaceutical therapies such as statins, fibrates, and insulin sensitizers, are commonly employed [10]. Fruits may have healthy beneficial effects due to the presence of phytoconstituents such as sugars, vitamin, dietary fibre and phenolic compounds [11].

Inclisiran be the first and only LDL lowering treatment [12]. Statins have established as a first line treatment for decreasing low density lipoprotein cholesterol due to their efficacy [13]. Evinacumab works by inhibiting angiopoietin – like 3[14]. All these drugs will have an adverse impact on the health status of the individual [15]. Various studies reported and identified herbal products including garlic, Allium ampeloprasum, basil, tarragon, barberry, fenugreek, and Apium have anaffect graveolens, sour orange

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juice, acetic acid, affect blood lipids. Apple cider vinegar have an positive effect on reducing hyperlipidemia [16]. vinegars made from fermented apples is ACV (apple cider vinegar) [17]. The primary active ingredients in apple cider vinegar are acetic acid, polyphenolic chemicals, succinic, formic oxalic, formic ,citric ascorbic acids and other organic acid compounds are present [18.] It is made up of pribiotics, B- vitamins and polyphenols [19] . Apples are considered as one of the healthiest foods a person can consume. They are rich in fibre and vitamin with few calories. They have no fats or cholesterol and only a trace of sodium. Apples are strong in polyphenols which make them excellent antioxidants [20]. Apple vinegar is well-known for its previously unknown health advantages and it is high in bioactive molecules such as polyphenolic chemicals, which have a variety of medicinal actions and such as antioxidant, antimicrobial, antitumor and antidiabetic [21][22]. Apple cider vinegar regulates blood sugar levels in weight management by lowering body fat and breaking down cholesterol [23]. Therefore, the objective of the current study is to evaluate the effectiveness of apple cider vinegar on reduction of blood cholesterol level among clients with hyperlipidemia and to find out the association between the post test levels of blood cholesterol among clients with hyperlipidemia with their selected demographic variables.

2. Materials and Methods

Study Design

The quantitative approach with quasi experimental pretest posttest control group was designed to investigate the effectiveness of apple cider vinegar on reduction of blood cholesterol level among hyperlipidemic clients. This study was conducted at General Medicine OPD at Saveetha Medical College and Hospital. After obtaining ethical clearance from the Institutional Ethical Committee (IEC) of Saveetha College Institute of Medical and Technical Sciences (SIMATS) and formal permission from the Departmental Head of General Medicine, the main study was conducted [29].

Study Participants

Clients with both genders aged above 35 years diagnosed with hyperlipidemia (Total cholesterol level >200 mg/dl, triglycerides level >150 mg/dl, low density lipids > 130 mg/dl, High density lipids > 60 mg/dl) who are willing to participate, understands read, and write English and Tamil and attended the General Medicine Clinic at SMCH were recruited by using purposive sampling technique as the study participants .The exclusion criteria are the clients suffering with renal dysfunction, with history of cardiac disorders , stroke, known allergy or intolerance to vinegar, clients who are critically ill and non- cooperative , clients who are not able to follow verbal comments, mother who are pregnant and lactation ,clients who are not available during the study period .The purpose of the study was explained clearly in depth, by the investigator to each of the study participants, and a written informed consent was obtained from each of them. The demographic variables and the level of blood cholesterol was monitored by estimating the blood samples of total cholesterol, high density lipoprotein, low density lipoprotein and triglycerides. After recruiting the patients through purposive sampling technique all the 50 study participants were assigned equally to both experimental and control group.

Intervention Details

Apple cider vinegar was given orally for 30 days once a day (15ml) for the study participants in the experimental group and the study participants in the control group were continued with their own medications. Adherence to the schedule was confirmed by calls and short message service through mobile phone.

Outcome Assessment

The study participants level of blood cholesterol was reassessed after the intervention by estimating the serum Total Cholesterol (TC), Low Density Lipids (LDL), High Density Lipids (HDL) and TriGlycerides (TG).

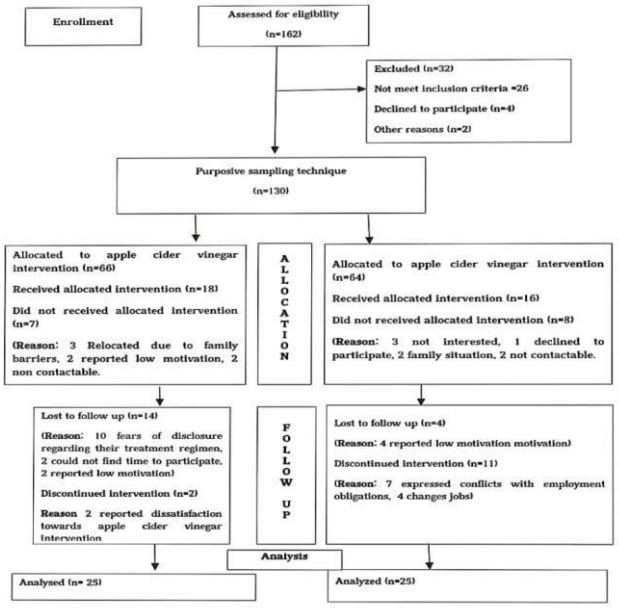

Figure:1 Consort Flow Chart Depicting the Recruitment of Study Participants

3. Results and Discussion

Demographic and clinical characteristics

With regards to demographic characteristics of clients with hyperlipidemia in the experimental group, 9 (36%) were aged persons <35 years, above 20 (80%) were males , 12 (48%) had non formal education, moreover 22 (88%) were married , 11 (44%) were working as a daily wages, 11 (44%) had an monthly income of 5001 – 10,000, 13(52%) were Hindus, 13 (52%) was a heavy workers and 18 (72%) had vegetarians. With regards to demographic

characteristics clients with hyperlipidemia in the experimental group, 18 (72%) had not practicing any exercising regularly, 9 (36%) had the illness for <2 years and 2 – 5 years respectively, 19 (76%) had BMI value of 25 – 29.9, 20 (80%) had borderline value of total cholesterol of 200 – 238, 11(44%) had borderline low density lipids of 130 to 159, 12 (48%) had HDL of men less than 40 and 18 (72%) had the borderline triglycerides of 150 to 199.

Estimation of serum lipid profile levels among study participants in the experimental and control group

In experimental group ,the pretest mean score of total cholesterol was 229.24±11.86 and the post test mean score was 219.03±11.78 , the pretest mean score of LDL was 139.86±20.51 and the post test mean score was 127.64±18.64, the pretest mean score of HDL was 39.96±14.38 and the post test mean score was 47.35±12.10, the pretest mean score of triglyceride was 221.37±97.96 and the post test mean score was 171.44±59.16.In control group, the pretest mean score of total cholesterol in the control group was 229.24±11.75 and the post test mean score was 229.02±11.71.Thepretest mean score of LDL was 138.62±19.01 and the post test mean score was 138.75±19.10.The pretest mean score of HDL was 39.80±13.99 and the post test mean score was 39.49±11.99.The pretest mean score of triglyceride was 221.33±96.03 and the post test mean score was 221.22±96.12.(Table:1 and Figure: 2).

Table 1: Estimation of serum lipid profile including Total cholesterol (TC), Low Density Lipoprotein (LDL), High Density Lipoprotein (HDL), TriGlycerides (TG) levels among study participants in the experimental and control group n = 50

Biochemical Parameters	Experimental Group				Control Group			
	Pretest		Post Test		Pretest		Post Test	
	Mean	S. D	Mean	S. D	Mean	S. D	Mean	S. D
Total Cholesterol (TC)	229.41	11.86	219.03	11.78	229.24	11.75	229.02	11.71
Low Density Lipoprotein (LDL)	139.86	20.51	127.64	18.64	138.62	19.01	138.75	19.10
High Density Lipoprotein (HDL)	39.96	14.38	47.35	12.10	39.80	13.99	39.49	11.99
TriGlycerides(TG)	221.37	97.96	171.44	59.16	221.33	96.03	221.22	96.12

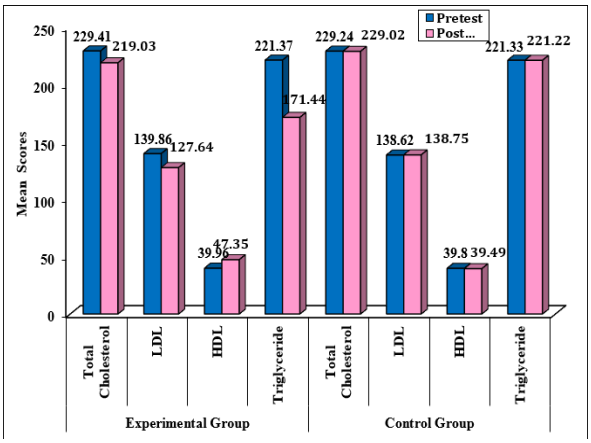

Figure:2 Comparison Of Mean Scores of Total cholesterol (TC), Low Density Lipoprotein (LDL), High Density Lipoprotein (HDL), TriGlycerides (TG) levels among study participants in the experimental and control group

The present study findings is supported by a quasi-experimental study conducted by Zahra Beheshti et al (2012) among 19 patients diagnosed with hyperlipidemia aiming in analysing the impact of apple cider vinegar on lowering the levels of blood lipids. The end results of the study after consumption of eight weeks of apple cider, it has been reported that, there was a significant declination in the levels of total serum cholesterol, triglycerides and Low-Density Lipoprotein (LDL) and concluded that apple cider vinegar is considered as cost-effective measure for treating hyperlipidemia.[24]

The present study is supported by a meta-analysis study conducted during January 2020 by Amir Hadi et al (2021) aiming in investigating the impact of apple cider vinegar on lipid profile. A total of nine studies were analysed in this present study and the results of the study reported that, after administration of apple cider vinegar for clients with hyperlipidemia there was a significant reduction in the serum total cholesterol and triglyceride levels.[25]

Hence the present study also concluded that, administration of apple cider vinegar for clients with hyperlipidemia was found to be beneficial, safe for consumption without side effects and cost effective in reducing the levels of serum total cholesterol, low density lipoprotein and triglycerides.

Impact of apple cider vinegar on reduction of serum lipid profile – Total Cholesterol (TC), Low Density Lipoprotein (LDL), High Density Lipoprotein (HDL), TriGlycerides (TG) levels among study participants in the experimental and control group

Table 2: Comparison Of Post Test levels of serum lipid profile Total Cholesterol (TC),Low Density Lipoprotein (LDL), High Density Lipoprotein (HDL), triglycerides (TG) levels among study participants in the experimental and control group N = 50 (25+25)

Biochemical Parameters	Experimental Group		Control Group		Student Independent 't' test Value
	Mean	S. D	Mean	S. D	
Total Cholesterol (TC)	219.03	11.78	229.02	11.71	t = 3.009 p=0.004, S**
Low Density Lipoprotein (LDL)	127.64	18.64	138.75	19.10	t = 2.082 p=0.043, S*
High Density Lipoprotein (HDL)	47.35	12.10	39.49	11.99	t = 2.306 p=0.025, S*
TriGlycerides (TG)	171.44	59.16	221.22	96.12	t = 2.205 p=0.033, S*
**p<0.01, *p<0.05, S – Significant					

Table: 2 depicts that, the mean score of total cholesterol is 219.03±11.78, LDL is 127.64±18.64, HDL was 47.35±12.10 and the triglycerides was 171.44±59.16 in the experimental group. the mean score in the control group was 229.02±11.71, LDL was 138.75±19.10, HDL was 34.49±11.99 and triglycerides was 221.22±96.12 in the control group. The calculated student independent 't' test value of t = 3.009, t = 2.082, t = 2.306, t = 2.205 was found to be statistically significant at $p<0.01$ level , $p<0.05$ level, $p<0.05$ level and $p<0.05$ level. These above findings clearly show the effectiveness of Apple Cider Vinegar on reduction of blood cholesterol level after the administration among clients with hyperlipidemia in the experimental group than the control group who had undergone normal hospital routines.

The present study findings is supported by an interventional study conducted by Deepak Sethi et al (2017) aiming in estimating the effect of apple cider vinegar among hyperlipidemic clients twice a day for about 4 months. The end results of the study reported that, there was a significant reduction in the levels of both total cholesterol and low density lipoprotein.[26].The present study is also supported by a quasi-experimental study by sofia kausar (2019) revealed a hypolipidemic property of apple cider vinegar among hyperlipidemic patiens and the study results concluded that , after administration of 8 weeks of apple cider vinegar significantly reduced the levels of serum total cholesterol and low density lipids. [27]. The present study was also supported by a randomised clinical trial conducted by solaleh sadat khezri (2018) among 39 patients diagnosed with hyperlipidemia to monitor the impact of apple cider among these clients, were 30 ml of apple cider vinegar was administered for 12 weeks which results a significant decrease in both total cholesterol and triglycerides levels and significantly increase in the high density lipoprotein.[28]

Hence the present study also concluded that, administration of apple cider vinegar for clients with hyperlipidemia was found to be effective in reducing the levels of serum total cholesterol, low density lipoprotein and triglycerides.

Section D: Association of Level of Blood Cholesterol with Selected Demographic Variables

None of the demographic variables had shown statistically significant association in the reduction of blood cholesterol level among hyperlipidemic clients.

4. Conclusion

Based on the findings of the current study, it was evident that there was significant effect of apple cider vinegar lowers the levels of Total Cholesterol (TC), Low Density Lipoprotein (LDL) and TriGylcerides (TG) among clients with hyperlipidemia. Therefore, apple cider vinegar can be used as an alternative treatment which is highly feasible, cost-effective method to treat hyperlipidemia as a part of nursing care.

5. Acknowledgment

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6. Conflict of Interest

Authors declare no conflict of interest.

7. Funding Support

None.

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