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Original article

Effect of cumin and cinnamon on lipid profile in middle-aged women with dyslipidemia: a double blind, randomized controlled clinical trial

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Summary. *Abstract:* Hyperlipidemia is a risk factor for the cardiovascular disease. The aim of the present study is to compare the effect of cumin and cinnamon on lipid profile in middle aged women with dyslipidemia. *Materials & methods:* In this randomized clinical trial, 99 women with dyslipidemia were randomly assigned to consume 3 g/d cumin or cinnamon in the form of 6 capsules or placebo three times per day for 8 weeks. Dietary intake and physical activity were determined before and after the study. Quantitative data were compared using ANCOVA with adjusting dietary intake and physical activity. Demographic factors were compared using chi-square test. All statistical analyzes were at a significance level of 95%. *Results:* All variables had a normal distribution except LDL. Cumin and cinnamon reduced serum levels of total cholesterol ,triglyceride and also serum HDL-cholesterol levels (11). This study indicated that there were not any significant differences among three groups in terms of the amount of LDL and TG ($p>0.05$). Also there was no difference concerning the amount of HDL ($p>0.05$). However, total cholesterol in cumin and cinnamon significantly decreased after 8 weeks ($p=0.004$). Mean changes in the cholesterol concentrations in cumin and cinnamon groups were -31, -19 mg/dl. *Conclusion:* This study provided evidence that show using cumin and cinnamon have effect on reducing serum cholesterol levels , but more research is required.

Key words: cumin, cinnamon, lipid profile, middle-aged women, dyslipidemia

Introduction

Dyslipidemia is one of the important risk factors of cardiovascular diseases. It is rising in developed and developing countries (1-3). Nowadays, many pharmaceutical treatments such as statins are being used to control blood lipids (4). Consumption of statins results in different complications like digestive problems, flushing, high blood sugar and rhabdomyolysis (5).

The use of traditional medicines and medicinal plants has become prevalent in the treatment of many diseases. Medicinal plants can be a viable alternative for synthetic drugs. Extensive studies have been performed on the effects of different medicinal plants on plasma lipids and weight loss. Cumin, as one of these medicinal plants, contains more than 100 different chemicals, including essential fatty acids and volatile oils (6, 7).

Furthermore cinnamon with more than 50 different combinations (8) came up as a nutraceutical to improve health such as glycemic control in humans without documented potential toxic effects and a high therapeutic effect (9-10).

It is found that consumption of 1 to 6 grams cinnamon has a reducing effect on fasting blood glucose, triglycerides and low density lipoprotein cholesterol (LDL-c) (7). Consumption of 1 gram cinnamon for 3 months has reduced lipid profile in diabetic patients (11). Moreover, some studies have shown that cumin has a decreasing effect on blood lipids and body weight (12). Due to high prevalence of dyslipidemia in middle-aged women (13), and based on evidence regarding the potential beneficial effects of cumin and cinnamon, the aim of this study was to investigate the effects of these two spices on lipid profile in women with dyslipidemia.

Materials & methods

We carried out a, controlled, randomized, three-parallel arm trial (Experimental Group 1-Cumin, Experimental Group 2, Cinnamon,- and Control Group) with a 8-week follow-up conducted in community health centers of the Iranian National Health System.

Middle- aged women who referred to community health centers were recruited by convenience sampling. Inclusion criteria were being aged 30 to 59 years, having a de novo diagnosis of dyslipidemia based on the following classification a) Defined hypercholesterolemia: total cholesterol >250 mg/dl and triglycerides <200 mg/dl; b) Hypertriglyceridemia: total cholesterol <200 mg/dl and triglycerides >200 mg/dl; or c) Mixed hyperlipidemia: total cholesterol >200 mg/dl and triglycerides >200 mg/dl.

Exclusion criteria were: the presence of conditions that may cause secondary dyslipidemia and need medication; previous cardiovascular events or other chronic diseases such as diabetes or chronic obstructive pulmonary disease (COPD), cancer, chronic liver or renal failure, alcohol or other substance abusers; patients who were unable to comply with the study procedures or to be subject to loss to follow-up; having allergic reactions to cumin or cinnamon, pregnant or nursing women; and patients prescribed hypolipidemic drugs during the study.

After obtaining a written informed consent, a total of 99 participants who met the inclusion criteria of the study randomly (by using random number table) allocated to one of three following groups: One group received 3 gr/d Cuminum Cyminum (6 capsules cumin per day); the other group received 3 gr/d Cinnamomum Verum (6capsules cinnamon per day) ; the control group received placebo(Microcrystalline cellulose) for 8 weeks. Cinnamon verum and Carum carvi were obtained from local market and verified by a pharmacognosist. Participants were invited to receive advices about the study protocol and were allocated to their groups. Anthropometric measurement, dietary intake and physical activity were assessed. The weights of participants were recorded in light clothing with electronic scales, with accuracy of o.1 Kg (Omron, Japan). Heights were recorded at the first visit with a wall-mounted stadiometer with accuracy of 0.5 Cm. The waist circumference was measured at the high point of the iliac crest at minimal respiration, using a non-stretched tape meter, without any pressure to body surface to the nearest 0.1 cm. The body mass index (BMI) was calculated as weight in kilograms (kg) divided by height in meters (m) squared. Physical activity was calculated using the formula Metabolic Equivalent of Task – minutes / week.

Participants were instructed not to change their usual dietary habits and physical activities for the duration of the study and to take the experimental supplements with meals. To estimate the frequency of supplements consumption, a checklist was used and the consumption of supplements was controlled by telephone at the end of every week. Participants were instructed to return unused capsules and their Patient's compliance was measured by counting the remained capsules at the end of the study.

In this study, two 24-hour recalls were completed for each participant (before and after the study). The principal researcher, the participants, and laboratory staff were not aware of patients' group assignments.

The capsules were produced in laboratory and packed in packages labeled A, B or C by a third person. A code could belong to one of cumin, cinnamon or control groups. The sample size was estimated according to the study of Ziegenfuss et al (18). This sample size was 30 with Power 80%, assuming a two-sided alpha level of 0.05. Supplements were taken three times a day for 8 weeks. Also, the consumption of supplements was controlled by telephone at the end of every week.

The patients referred to a laboratory for biochemical assessment. After 12-14 hours of fasting, 5 ml venous blood was taken from all the individuals to measure blood triglycerides, total cholesterol, LDL-C, and HDL-C concentrations. Triglyceride and total cholesterol were measured using commercial assay kits (with sensitivity 3 mg/dl (0.08 mmol/l), (Pars Azmoon Co., Tehran, Iran) with glycerol oxidize and cholesterol oxidize enzymatic methods by the auto-analyzer (Echo plus Company, Italy). HDL cholesterol was measured after the precipitation of beta-lipoproteins by dextran sulfate and chloride magnesium using oxidizes cholesterol method and the auto-analyzer (with sensitivity 1 mg/dl). LDL cholesterol was calculated by Friedewald's formula.

Dosage of cumin and cinnamon was selected based on previous studies (9) (13). Duration of the study was 8 weeks. This period was a bit short but it was enough to show the decrease in lipid profile (15). We could not extend this period due to possible high attrition rate.

Dietary intakes were analyzed using Nutritionist IV software (Version 4.1, First Databank Division, The Hearst Corporation, and San Bruno, CA) to assess macronutrient and micronutrient intakes. The Iranian food composition table (FCT) was used as an alternative for traditional Iranian food items which are not included in the Food Composition Tables for USA (USDA FCT).

The normality of variables was tested by the Kolmogorov-Smirnov test.

All of the quantitative variables except LDL had normal distribution. Descriptive statistics are presented as mean ± SD or percentile. Quantitative data were compared by using ANCOVA, ANOVA, and LSD as post-hoc test. Adjustment has been made for the dietary intake and physical activity.

Chi- square test was employed for comparing categorical variables. All tests were two-sided and P-values less than 0.05 were considered significant. All statistical analyses were performed using SPSS 16.

The present study was approved by the Ethics Committee of Shahid Sadoughi University of Medical Sciences and registered at Iranian Registry of Clinical Trial (registration no.IRCT2016112310826N21, www.irct.ir).

Results

After 8 weeks, 90 women completed the study (Fig.1).

According to Table 1, basic data of anthropometric factors including body weight, BMI and waist circumference, were not significantly different between the groups receiving cumin, cinnamon and placebo($p>0.05$).

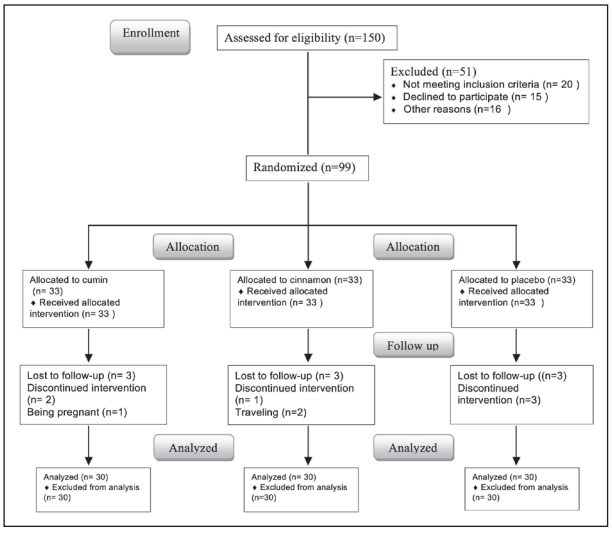

Figure 1. Flow diagram of the clinical trial

Table 1. Mean and standard deviation of anthropometric measurements among three groups before and after 8 weeks

Anthropometric Parameters	**Cumin (n=30)**		**Cinnamon (n=30)**		**Control (n=30)**		**p-value[1]**
	Before	**After**	**Before**	**After**	**Before**	**After**	
Body weight(kg)	76.4±4	73.3±1	73.5±1	72.7±1	76.7±1	73.2±2	0.30
BMI(kg/m2)	30.8±4	28.4±2	31.25±2	29.9±2	30.2±4	28.7±3	0.12
Waist Circumference (cm)	96.7±7	95.4±5	94.2±5	91.1±3	93.7±8	92.9±3	0.06

[1].between group comparison using ANOVA test after 8 weeks.

In Table 2, mean intakes of energy and macronutrients before and after the study in three groups are shown.

Total calorie, carbohydrate, and fat intake had significant changes after 8 weeks. So, physical activity and dietary intake were considered as confounding factors.

In Table 3, the mean and standard deviation of biochemical factors in three groups were compared. According to Table 3, decrease in total cholesterol concentration was significant after 8 weeks ($p< 0.05$) but there was no significant differences in concentration of HDL and TG ($p > 0.05$).

In Table 4, it can be seen that there was no significant difference in median of LDL-c among three groups using the Kruskal-Wallis test ($p>0.05$).

In Table 5, changes in biochemical factors in three groups are shown.

The average of total cholesterol was significantly decreased in cumin and cinnamon groups compared to control ($p<0.05$), but these changes were not significant for HDL and TG.

Discussion

In this study, administration of cumin consumption at 3 g/d for 8 weeks decreased cholesterol approximately by 14% in women with dyslipidemia. Also, cinnamon consumption decrease cholesterol concen-

Table 2. Mean and standard deviation of energy and macronutrients intake among three groups

Group	Cumin (n=30)		Cinnamon (n=30)		Control (n=30)		p-value[1]
	Before	After	Before	After	Before	After	
Energy (kcal)	2333.8±968.4	1923.7±754.9	2143.7±1245.8	2095.0±672.02	2239.6±772.2	0.03*	0.03*
CHO (% of energy)	55.0±14.3	52.2±17.7	58.7±12.7	62.2±9.6	48.2±12.7	0.001**	0.001**
Pro (% of energy)	19.3±8.2	20.1±8.4	18.1±7.8	17.9±5.7	20.6±6.1	0.44	0.44
Fat (% of energy)	25.5±11.5	27.4±17.5	23.1±12.1	19.7±10.1	31.0±11.5	0.001***	0.001***
Physical activity (MET-min/week)	2282.1±1852.6	2045.8±1697.05	1917.3±1812.6	1852.2±1722.8	638.46±412.8	648.8±412.8	0.01****

[1.] Between group comparisons using ANOVA and LSD post-hoc after 8 weeks.; *. Significant difference cumin group with control group after 8 weeks; **. Significant difference cumin, cinnamon groups with control group after 8 weeks; ***. Significant difference cumin, cinnamon groups with control group after 8 weeks; . Significant difference cumin, cinnamon groups with control group after 8 weeks****

Table 3. Mean and standard deviation of lipid profile among three groups

Lipid	Cumin (n=30)		Cinnamon (n=30)		Control (n=30)		p-value[1] Profile
	Before	After	Before	After	Before	After	
HDL-c (mg/dl)	48.6±16	48.6±15	49.9±10	44.4±10	45.4±13	44.4±13	0.824
Cholesterol (mg/dl)	224.6±51.2	193.1±44.6	226.4±54.0	207.4±48.5	214.1±35.3	214.6±37.0	0.004*
TG (mg/dl)	210.5±79	197.4±76	219.1±124.3	204.8±110.5	179.1±1	177.4±7	0.558

1. ANCOVA adjusted for dietary intakes and physical activity after 8 weeks; *. Significant difference between cumin group and control group after 8 weeks.

Table 4. Compare the median LDL levels in three groups

Lipid	Cumin (n=30)		Cinnamon (n=30)		Control (n=30)	
	Before	After	Before	After	Before	After
25 th percentile	120.7	119.7	121.0	119.7	118.0	117.5
50 th percentile	128.5	128.0	127.5	125.0	127.0	123.0
75 th percentile	142.0	165.2	140.2	141.5	136.2	143.0

1.p-value before intervention was 0.375; 2. p-value after intervention was 0.940

Table 5. Changes in biochemical factors in three groups

Measured Parameter	Cumin (n=30)	Cinnamon (n=30)	Control (n=30)
TG(mg/dl)	-14.3(-6.5%)	-13.1 (-6.2%)	-1.7(-1%)
HDL(mg/dl)	-0.4 (-0.98%)	0 (-0.6%)	-1(-2.08%)
C(mg/dl)	*-31.4(-14.01%)	*-19.0(-8.5%)	0.44(0.22%)

*. Significant difference with control group (p 0.004)

tration by 8%. Other indicators of lipid profile did not represent any significant changes.

The findings in terms of serum level of cholesterol support some other studies (14-15). However, the present findings were not in agreement with some other studies (16,17). Although, decrease in serum level of LDL in cumin group was consistent with one study (18). Soliman demonstrated that supplementation with 1.5 and 3 g/day of cinnamon for 45 days, significantly decreased TG,TC and LDL-C levels in pations with type 2 diabetes (19). Khadem et al showed that 1.5 g/day of cinnamon for 8 weeks, improved lipid profiles in type 2 diabetic patients (20).

The results discrepancies may partially due to the difference in the types of studied populations, different forms of cumin and cinnamon supplement, and the duration of the studies. Hypocholesterolemic effect of cumin could be partly due to its glycoside saponins which prevent cholesterol absorption and increase its fetal excretion by interfering with its enterhepatic circulation (22). Moreover, cumin has a substantial amount of some phytsterols such as beta-sitsterol, delta5-avenasterol, and delta7-avenasterol. Cumin has also small amounts of stigmasterol, campesterol and lanesterol . Other probable mechanisms regarding hypocholesterolemic effect of cumin can be related to up-regulation of the LDL-C receptor and inhibition of 3-hydroxyl-3- methylglutaryl coenzyme-A reducates (23).

Consumption of cumin and cinnamon do not have any effect on the levels of HDL that is consistent with some studies (18-21).

Cinnamon caused to activation of insulin kinas receptor and inhibition of insulin receptor dephosphorylation that leads to a peak of phosphorylation of insulin receptor. All of these effects lead to increased insulin sensitivity. This increase is associated with improvements in blood lipid levels. Because cinnamon has fiber and calcium, it affects fat burning and can be effective on reducing blood fat factor (25, 26).

One of the limitations of this study is considering only women with dyslipidemia. The reason is the availability of them. So, the results cannot be generalized to men or healthy women. Considering the patients of both sexes can help reach better results. Although, physical activity and dietary intake were considered as confounding factors among three groups. The short period of study was another limitation of this study. Further investigations with a longer period are warranted.

As far as we know, this is the first study that compared the effect of cumin and cinnamon consumption. The strengths of the present study were the double blind placebo-controlled design and low drop-out. Probably, this study can be effective on treatment of high cholesterol levels. However, due to no significant impact on reducing LDL and TG and no increase of HDL, more research is needed.

Conclusion

Overall, this study provides evidence that indicates the 8 weeks consumption cumin in a daily dose of 3 g/day has a hypocholesterolemic effect in women with dyslipidemia. It can be used as an adjuvant treatment with other drugs used to decrease cholesterol levels. Before establishing cumin as a therapeutically effective hypolipidemic agent, more research should be performed to determine the active ingredints responsible for hypolipidemic effect and its cellular mechanism of action.

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