Effects of Indian Culinary Spices Ginger and Garlic Consumption in hyperlipidemic patients

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Abstract

Elevated blood lipids generally termed as hyperlipidemia, is a major risk factor for cardiovascular disease. In the recent years, there is an enormous interest in use of dietary additives as an alternate therapy for the amelioration of hyperlipidemia.

Methods: In this single-blind, placebo controlled study, lipid profiles of 150 hyperlipidemic patients attending out-patient clinics of Anjarakandy Kannur Medical college were recruited for the study. After written consent of the patients and approval of the institution's ethical committee, volunteers were divided into three equal groups randomly (each composing of 50 patients). They were given enteric-coated garlic powder tablet (equal to 500 mg garlic) twice daily, ginger powder tablet (500 mg) twice daily, and placebo tablet. All patients were put on National Cholesterol Education Program (NCEP) diet for 10 weeks. At the end of 10 weeks, lipid profiles data collected.

Results: In garlic group cholesterol decreased significantly (decreased by 26.82 mg/dl, 12.1% reduction, and P value: 0.000), and LDL-cholesterol (decreased by 22.18 mg/dl, 17.3% reduction, and P-value: 0.000) dropped. HDL-cholesterol significantly increased (increased by 10.02 mg/dl, 15.7% increase, and P-value: 0.000) increased. Triglyceride decreased by 13.72 mg/dl (6.3%), the decrease was not significant statistically (P-value: 0.222). In ginger group: triglyceride increased by 14.74 mg/dl (6.0%). In ginger group the decrease in cholesterol by 0.4 % and LDL-cholesterol by 6.3% was not significant statistically (P-value: .828, and .210, respectively).

Conclusion: Garlic demonstrates a potent hypocholesterolemic and hypolipidemic effect while ginger has a mild effect in reducing hyperlipidemia. Hyperlipidemia is a major risk factor of cardiovascular disease. Use of garlic may prevent cardiovascular disease if garlic is used as a dietary additive regularly.

Keywords:*Garlic, Ginger, Hyperlipidemia, Cardiovascular disease*

I. INTRODUCTION

An increase in Cardiovascular disease is the major cause of death and premature disability. Hyperlipidemia is the big risk factor for cardiovascular diseases [1]. Drugs prescribed for the treatment of hyperlipidemia have several adverse effects. Therefore, the interest in herbal medications such as Garlic (Allium sativum) and Ginger as hypolipidemic agents has generated a great interest both among patients as well as the medical community.

Besides its culinary value, the therapeutic uses of garlic are well known for decades. [2-5]. Garlic has been known for stimulation of phagocytotic function of macrophages and lymphocyte proliferation [6] Allicin, the main organosulfur compound of garlic, has demonstrated activity against microbes [7].

Beneficial effects of garlic have been evaluated extensively in recent years. In animal experiments, garlic extracts have been shown to lower plasma lipid and cholesterol in rats [8,9], and [10], rabbits [11], chickens [12], and swine [13]. Moreover, several interventional studies have shown that garlic significantly reduced plasma lipids, especially total cholesterol and Low Density Lipoprotein (LDL) cholesterol [14,15 16]. Garlic in involved in antiplatelet aggregation and antithrombotic action [17], garlic reduced blood pressure [18,19], and [20] and stimulated fibrinolytic activity [21,23]. It was reviewed that aged garlic extract contains antioxidant compounds and increase nitric oxide production and decreases the output of inflammatory cytokines from cultured cells. Garlic may improve impaired endothelial function in patients with coronary disease treated with aspirin and statin [22]. Several clinical studies show potent hypocholesterolemia effects of garlic [24,25]. The analyses further detected that the extent of the cholesterol-lowering properties of garlic differed markedly from one study to another [24,25]. It was estimated from the five randomized clinical trials that hypercholesterolemia patients treated with garlic had a mean plasma cholesterol concentration that was 9% lower than that of patients treated with placebo [25]. Silage and Neil [25], concluded from the analysis of 17 clinical studies that plasma cholesterol concentrations of the patients treated with garlic were 12% lower than those receiving placebo. Furthermore, the two analyses detected a wide range of decrease in mean plasma cholesterol concentrations (i.e., 6–53 mg/dl) among the studies. However, garlic supplementation has been shown not to decrease plasma cholesterol concentrations in human [26,27], and [28]. Although the reasons for the inconsistent observations are not clear, it is worthwhile to note that garlic contains a variety of organosulfur compounds, amino acids, vitamins and minerals [2]. Some of the sulfur compounds such as allicin, ajoene, S-allyl cysteine (SAC), diallyl disulfide (DADS), S-methyl cysteine sulfoxide, and S-allyl cysteine sulfoxide may be responsible for the therapeutic properties of garlic [9]. Animal studies have shown that garlic supplementation in the diet depressed the hepatic activities of lipogenic and cholesterogenic enzymes such as 3-hydroxy-3-methyl-glutaryl-CoA(HMG-CoA) reductase [29, 30].

Ginger is another culinary spice in India with antihyperlipidemic effects. Ginger like garlic is known to exert hypocholesterolemic properties. Nowadays, there is wide spread belief among public that garlic and ginger have beneficial effects on hyperlipidemia. Irrespective of their effects, garlic and ginger is an unavoidable part of Indian and South Asian cuisine.

II. MATERIALS AND METHODS

A single-blind, randomized, placebo-controlled intervention study was conducted on patients with coronary artery disease with newly diagnosed hyperlipidemia. One hundredfifty patients attending out-patient clinics of Anjarakandy Kannur Medical college were recruited for the study. Exclusion criteria included; having significant hepatic, renal and gastrointestinal tract disease, acute myocardial infarction, uncontrolled endocrine disease, and underlying previous therapies for hyperlipidemia. One hundred and fifty patients had total cholesterol level ≥ 200 mg/dl and/or LDL-cholesterol ≥ 100 mg/dl after 10 hours of fasting with standard enzymatic methods. HDL-cholesterol and triglyceride analyzed. Written informed consent was obtained from each patient before any study-specific procedure. Study was approved by the institution’s ethical committee.

We randomly divided patients into three groups, each composing of 50 cases. Garlic group received enteric coated garlic powder tablet (equal to 1 mg allicin) twice daily. Patients of Ginger group were prescribed ginger tablet 500 mg twice daily. Placebo group were given placebo. Demographic information of different groups is in Table-1. After 10 weeks, we analyzed total cholesterol, LDL-cholesterol, HDL-cholesterol, and triglyceride after 10 hours of fasting. All patients were given NCEP type, i.e. protein about 0.6 g/kg desirable body weight per day, 55 % of total calories from carbohydrate, no more than 30 % of total energy intake be derived from dietary fat, polyunsaturated fats to <10 %, saturated fat & trans-fat should be limited to <10 % of calories, throughout the study. Data were analyzed by paired sample *t* test test). A difference was considered statistically significant when the probability value (P-value) was < 0.05.

III. RESULTS

Test component ginger and garlic did not show any adverse effect on any of the patients. Changes of lipid profiles after 10 weeks and results of paired *t* test are shown in table 2 and 3, respectively. It was observed that triglyceride, total cholesterol, LDL-cholesterol, and HDL-cholesterol were significantly different between three groups.

A. Placebo

Triglyceride, total cholesterol, and LDL-cholesterol increased and HDL-cholesterol was reduced. The changes in placebo group was not meaningful (P-value > 0.05).

B. Ginger

Ginger did not have significant effect on triglyceride (6.0% increase) and HDL-cholesterol (3.1% reduction). Though there was a small reduction in cholesterol, 0.4 % and LDL-cholesterol, 6.3 %, was noticed. But these changes were not significant statistically (P-value: .828, .210, respectively).

C. Garlic

At the end of the 10-week intervention period, triglyceride, total cholesterol, LDL-cholesterol, and HDL-cholesterol were significantly affected as compared to other groups. The mean total cholesterol concentration reduced in the garlic group by 26.82 mg/dl (P-value: .000.) Similarly, LDL-cholesterol was reduced by 22.18 mg/dl (P-value: .000), HDL-cholesterol was increased by 10.02 mg/dl (P-value: .000). Triglyceride dropped by 13.72 mg/dl but this was not meaningful (P-value: .222).

Table 1: Demographic Characteristics of Different Groups

	Garlic group	Ginger group	Placebo group	Total
NO. of Patients	50	50	50	150
Females	32	33	30	95
Males	18	17	20	55
Min. Mean Age	39	31	39	31
Max. Mean Age	78	75	74	78

Table 2: Changes in Lipid Profile After 10 Weeks

Lipid Parameters	Garlic		Ginger		Placebo	
	mg/dl	%	mg/dl	%	mg/dl	%
Triglyceride	↓ 13.72	↓ 6.3	↑ 14.74	↑ 6.0	↑ 4.44	↑ 2.0
T C	↓ 26.82	↓ 12.1	↓ 1.12	↓ 0.4	↑ 4.6	↑ 2.0
LDL	↓ 22.18	↓ 17.3	↓ 9.34	↓ 6.3	↑ 2.3	↑ 1.6
HDL	↑ 10.02	↑ 15.7	↓ 1.4	↓ 3.1	↓ 2.14	↓ 4.6

Table 3: Results of Paired T Test in Different Groups.

	Mean	Standard deviation	95% confidence interval of the difference		t-Values	P-values
			Lower	Upper		
Garlic						
TG1 – TG2	13.72	78.38	-8.56	36.00	1.238	0.222
TC1 – TC2	26.82	33.61	17.27	36.37	5.642	0.000
LDL1–LDL2	22.18	31.91	13.11	31.25	4.915	0.000
HDL1–HDL2	-10.02	10.55	-13.02	-7.02	-6.715	0.000
Ginger						
TG1 – TG2	-14.74	73.59	-35.65	6.17	-1.416	0.163
TC1 – TC2	1.12	36.24	-9.18	11.42	0.219	0.828
LDL1–LDL2	9.34	51.96	-5.43	24.11	1.271	0.210
HDL1–HDL2	1.42	10.30	-1.51	4.35	0.975	0.334
Placebo						
TG1 – TG2	-4.44	30.66	-13.15	4.27	-1.024	0.311
TC1 – TC2	-4.60	21.76	-10.78	1.58	-1.495	0.141
LDL1–LDL2	-2.30	14.71	-6.48	1.88	-1.106	0.274
HDL1–HDL2	2.14	7.90	-0.10	4.38	1.916	0.061

IV. DISCUSSION

A. Garlic

Data obtained in this study suggests that garlic reduces total cholesterol & LDL-cholesterol. This is similar to Alder and Holub's study (11.5% decrease of total cholesterol, and 14.2% decrease of LDL-cholesterol) [31]. Our results confirm the hypocholesterolemic and hyperlipidemic potency of garlic reported earlier by numerous studies [32]. Study of Steiner et al (6.1% showed a decrease of total cholesterol, 4.0% decrease of LDL-cholesterol) [18]. Also, other studies explained these benefits [24,25]. HDL-cholesterol should be investigated in more clinical trials. Stevinson et al [33] in meta-analysis of randomized clinical trials on antihyperlipidemic effect of garlic explained that a slight increase in HDL-cholesterol level in the garlic group was not significantly different from the effect of placebo. Our search could corroborate garlic effect on increasing HDL-cholesterol (P-value: 0.000, HDL-cholesterol increased by 15.7%) Triglyceride dropped by prescription of garlic tablet by 6.3% (13.72 mg/dl), Mader's trial [34]. But due to P-value: 0.222, this reduction was not significant difference from the effect of placebo.

B. Ginger

Therapeutic benefits of ginger are widely reported earlier [34]. Ginger could reduce total cholesterol and LDL-cholesterol (1.12 mg/dl and 9.34 mg/dl, respectively) but these differences were not significant (P-value: 0.828 and 0.210, respectively). Surprisingly, it reduced HDL-cholesterol (3.1%) and increased triglyceride level by 6.0%. The presumption is that enteric-coated garlic tablet can reduce total cholesterol, LDL-cholesterol and increase HDL-cholesterol, with no effect on triglyceride. On the other hand, ginger cannot be an antihyperlipidemic agent.

V. CONCLUSIONS

Garlic demonstrates a potent hypocholesterolemic and hyperlipidemic effect while ginger has a mild effect in reducing hyperlipidemia. Hyperlipidemia especially hypercholesterolemia, is the major risk factor of cardiovascular disease. Intake of a combination of ginger and garlic -as used in Indian culinary may have beneficial effect on lipid metabolism that needs further investigation in humans.

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CONFLICT OF INTEREST

This work has not received any financial funding from any agency. Therefore, there is no conflict of interest.

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