Cholesterol lowering property of garlic (*Allium sativum*) on patients with hypercholesterolemia

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Abstract

Background: Cardiovascular disease especially atherosclerotic coronary heart disease (CHD) accounts for a large population of all deaths and disability worldwide. Elevated lipid levels have a strong association with cardiovascular events.

Objectives: Study aim is to reduce cholesterol levels with garlic supplementation.

Materials and Methods: It is a prospective, interventional open-label study to see the effect of garlic on serum cholesterol levels. Study was conducted in the Department of Pharmacology and Therapeutics, Rajendra Institute of Medical Sciences, Ranchi. Fifty Healthy subjects with elevated cholesterol levels between 240 and 330 mg/dL were enrolled. Subjects were given 3 g of raw garlic daily for a total period of 90 days. Follow-up was done on 30th, 60th, and 90th day after starting treatment.

Results: In male patients, the serum cholesterol level showed significant decrease of 13% ($P < 0.001$) from mean baseline of 269.30 mg/dL to 233.93 mg/dL at 90th day. In female patients, the decrease was 10% ($P < 0.001$) from mean baseline of 260.30 mg/dL to 233.90 mg/dL at 90th day.

Conclusion: Garlic has a role in cholesterol management as an adjunctive therapy in most cases of significant hypercholesterolemia thereby reducing risk of atherosclerosis and cardiovascular events.

KEY WORDS: Garlic, hypercholesterolemia, cardiovascular, lipid lowering

Introduction

One of the major causes of death and early disability is atherosclerosis. Hypercholesterolemia is the best known independent risk factor implicated in the pathology of atherosclerosis.[1] Increased risk of cardiovascular disease, particularly coronary events and atherosclerosis has strong association with elevated serum lipid levels.[2–4] More than 224 million people in India have high cholesterol levels according to an Indian disease incidence and prevalence report released in 2013.[5] Despite life style modifications and pharmacological management of well-established risk factors, ischemic heart disease, stroke, and peripheral vascular disease remain known causes of mortality in developing countries. Increased serum cholesterol levels have been implicated as important risk factor for development of coronary artery disease.[6] Current practice is to prescribe lipid-lowering drugs such as statins all over the world with few patients experiencing adverse effects including myalgia, neuropathy, cognitive dysfunction, muscle weakness, and a possible risk of diabetes.[7]

Since ancient era of 1550 BC, garlic (*Allium sativum*) has been used as a medicinal product and an important dietary component of food enhancing flavor and taste. Garlic is a herb with complex action. It is still used as a cure for heart disease, headaches, and cancer. The allicin component obtained from garlic owns stronger bactericidal and fungicidal properties compared to other antibiotics. Daily intake of garlic is useful in fat metabolism and lowering of blood cholesterol levels. Garlic increases high-density lipoprotein (HDL) (good cholesterol), which protects heart and blood vessels, and lowers Low-density lipoprotein (LDL) (bad cholesterol) along with triglycerides (TGs). Activity of the enzyme HMG CoA reductase

involved in cholesterol synthesis is significantly reduced.[8] Another important property of garlic is stimulation of phagocytic function of macrophages and lymphocyte proliferation.[9] Hypoglycemic, anticoagulant, antihypertensive, antioxidant, hepatoprotective, and immunomodulatory properties have been reported.[10]

Materials and Methods

The objective of this study was to assess the potential benefit of garlic (*Allium sativum*) on serum cholesterol level in patients with hypercholesterolemia. The study was designed as a prospective, interventional open-label study to see the effect of garlic on serum cholesterol levels. Study was conducted in the Department of Pharmacology and Therapeutics, Rajendra Institute of Medical Sciences, Ranchi. Ethics approval was taken before starting the study. The subjects included were healthy volunteers with elevated cholesterol levels between 240 and 330 mg/dL. Subjects meeting the inclusion criteria of elevated cholesterol and willing to participate in study were enrolled. Written informed consents were obtained from participants. Fifty participants (30 males and 20 females) were randomly selected in the study. Both male and females of age between 40 and 60 years and no past history of cardiovascular events were included in the study. Cigarette smokers, hypertensive, diabetic, pregnant females and subjects with ongoing lipid-lowering drugs (statins or fibrates) were excluded from the study.

Detailed history of the subjects was noted down through scrutiny of available medical records and a meticulous clinical examination. A proper biochemical workup including fasting blood glucose (FBG), lipid profile including measurement of total cholesterol, HDL, serum TG, LDL, very-low-density lipoprotein (VLDL), and calculation of different ratio, that is, total cholesterol/HDL cholesterol and LDL cholesterol/HDL cholesterol ratio were done. Subjects were given 3 g raw garlic daily for a total period of 90 days at bedtime. Follow-up was done on 30th, 60th, and 90th day after starting treatment. Clinical history, body weight, and blood pressure were reviewed. Biochemical lipid profiles were also obtained. On completion of treatment at 90th day, blood samples were collected after an overnight fast. Blood (5 mL) was collected and was allowed to clot to obtain serum. This serum was centrifuged at 3000 revolutions per minute for 10 min to get a more clear serum for biochemical investigations. Estimation of serum cholesterol was done by enzymatic method. Results obtained were tabulated and different calculations were done for statistical analysis.

Results

All patients who participated in this study successfully completed the study with a co-operative attitude and bound to treatment nature. No adverse effects were reported of these herbal drugs during the follow-up visits or after completion of study.

According to Table 1 in the current study male population was 30 (60%), whereas female population was 20 (40%). Maximum numbers of male cases were in the 46–50 years age group, whereas maximum numbers of female cases were in the 40–45 years age group.

Table 2 depicts maximum number of patients who were in serum cholesterol range of 240–249 mg/dL and 280–289 mg/dL followed by other groups.

Table 3 tells us that the total serum cholesterol level in male patients decreased significantly ($P < 0.001$) from 269.30 mg/dL at baseline to 233.93 mg/dL and in female patients ($P < 0.001$) from 260.30 mg/dL at baseline to 233.90 mg/dL at 90th day.

Table 1: Gender distribution in different age group

Age group (in years)	No. of males	No. of females	Total
40–45	6	9	15
46–50	14	3	17
51–55	6	4	10
56–60	4	4	8
Total	30	20	50

Table 2: Gender distribution in different serum cholesterol level group

Serum cholesterol (mg/dL)	Total
240–249	11
250–259	10
260–269	5
270–279	10
280–289	11
290–299	3
≥300	0
Total	50

Table 3: Effect of garlic on serum cholesterol levels in males and females

Number of cases (n)	Mean serum cholesterol mean ± SD (mg/dL)		t	P
	Before treatment	After treatment		
Male (30)	269.30 ± 21.59	233.93 ± 10.18	10.54	<0.001
Female (20)	260.30 ± 16.95	233.90 ± 11.21	10.60	<0.001

Discussion

The present study was undertaken to establish the efficacy of garlic in reducing serum cholesterol level in patients with hypercholesterolemia. Healthy volunteers with elevated serum cholesterol level in the range of 240–300 mg/dL were selected and approximately 3 g raw garlic was given to them for a total duration of 90 days.

Baseline serum cholesterol was obtained before the initiation of treatment and again evaluated at 30th, 60th, and 90th day. At the end of the study, serum cholesterol level reduced by 12% ($P < 0.001$) from mean 265 ± 16.75 mg/dL at baseline to 232.72 ± 11.23 mg/dL at 90th day.

A meta-analytic study that included 39 primary trials of the effect of garlic preparations on total, LDL, HDL cholesterols and TGs interpreted garlic to be effective in reducing total cholesterol 17 ± 6 mg/dL, LDL cholesterol by 9 ± 6 mg/dL in individuals with elevated cholesterol levels (>200 mg/dL), provided garlic usage for more than 2 months in diet. Clinical relevance is associated if there is an 8% reduction in total serum cholesterol leading to a 38% reduction in risk of cardiovascular events at 50 years of age.[7]

Similar studies were done by Tohidi and Rahbani's trial (9% decrease of total cholesterol),[11] Steiner et. al. (6.1% of total cholesterol)[12], Alder and Holub's (11.5 % of total cholesterol).[13] All studies showed positive lipid-lowering effects of garlic on total cholesterol.

In animal experimental studies, garlic extracts have been shown to reduce plasma lipid and cholesterol in rats.[14,15] Moreover, a number of interventional studies have similarly shown that garlic and garlic preparations significantly reduced plasma lipids, especially total cholesterol and LDL cholesterol in humans.[16–18]

Our study of garlic to reduce hypercholesterolemia showed a significant reduction in total cholesterol levels. The best available evidence supports the use of garlic as one modality to decrease cholesterol levels in patients with increased levels. The strengths of our study were patients showing a positive interest being a part of the study and regular follow-ups. One of the limitations was failure to include HDL, LDL, and TG values which could have given up more precise results. As we mainly focused on total cholesterol levels, other parameters were not included. More studies including these parameters would be helpful.

Conclusion

Garlic has a role in cholesterol management as an adjunctive therapy in most cases of significant hypercholesterolemia. When patients have milder elevation of lipid levels or are intolerant to conventional medications, garlic therapy may provide a safe and effective alternative to standard agents. However, this is a preliminary study evaluating a small number of cases. More elaborate studies of larger number are required to substantiate the uses of garlic on different medical conditions.

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