

Short Term Effects of Fresh Garlic (*Allium Sativum*) on Blood Lipids, Blood Pressure, Blood Glucose, Haemoglobin Concentration and Body Weight of Overweight Young Adults

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Abstract:

This study was done to observe the short term effect of fresh garlic on different lipid profiles, blood glucose, blood pressure (BP), body weight and haemoglobin (Hb) concentration in healthy but overweight (average weight 88.89 kg) adult (both male and female). Fresh garlic, one clove (average wt. 4 to 6 gm), was taken everyday with night meal by the volunteers for six weeks. The volunteers were mostly students and a few of them were office staff. Total number of volunteers were 25. Administration of garlic significantly lowered cholesterol ($p < 0.001$) and low density lipoprotein ($p < 0.05$), but there was no effect on BP, body weight and Hb concentration. Garlic administration reduced the level of blood glucose and triglyceride (TG) to some extent but they were not statistically significant.

Introduction:

Garlic has been known to have multiple medicinal role like cholesterol, triglyceride (TG) and low density lipoprotein (LDL) lowering effects; it has also beneficial effects on blood pressure and various aspects of cardiovascular diseases^{1,3}. Coronary artery disease and atherosclerosis are the major risk factors and causes of cardiovascular related death in recent times. The use of available lipid lowering drugs are not free of adverse effects. Fresh garlic and its various extracts (oil and powder) have been in use in herbal

medicine for many years and are considered to have not only hypolipidaemic effects, but also anti-inflammatory, antibacterial, anticancer, anticoagulation and antihypertensive effects^{4,10}. Many clinical and experimental trials claimed positive effects of garlic on hyperlipidaemia, hypertension, coagulation and also hyperglycaemia¹⁻⁴, but at the same time a good number of studies reported negative or insignificant effects on above mentioned conditions⁵⁻⁷. Inconsistent reports, therefore, made it difficult to reach at any conclusion regarding the good effects of garlic. The inconsistent results of garlic research may be due to, at least in part, problems in standardizing all of the active compounds within garlic preparations. In fact, the efficacy of garlic for lipoprotein metabolism might require certain degree of allicin (Allyl 2-propene thiosulfinate) availability. Most studies claimed that garlic's

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cholesterol lowering effects mainly depends on its allicin contents, which is produced when raw garlic is chopped or crushed. It inhibits the synthesis of cholesterol in test tubes and in animals⁴. However, the benefit has not consistently been demonstrated in humans. The chemistry of garlic is complicated. As a result the quality of garlic products depends on the manufacturing process. Peeling garlic and processing garlic into oil or powder can increase the number and variety of active compounds. Peeling garlic releases an enzyme called allinase and it starts a series of chemical reactions that produce diallyl disulfide (DADS). DADS is formed when raw garlic is cut or crushed. However, if garlic is cooked after peeling, the allinase is inactivated and the cancer fighting-benefit of DADS is lost. Again, the bioavailability, the duration of action and the quantity of allicin, which farther depends on conversion from a substance called allin (allylcysteine sulfoxide - responsible for typical garlic odor) by allinase, which is inhibited in acidic condition. It also contributes significantly to the above mentioned effects. Allinase is pH sensitive and its maximum action is produced in alkaline media¹¹. Heat as applied during cooking or commercial steam distillation of garlic to produce steam distilled garlic oil, converts the allicin of crushed garlic to allyl sulfides⁸. Allicin has very short duration of action and is not stable enough for which commercial preparations like garlic powder, garlic oil and garlic enteric coated tablets differ in producing action. Garlic's preparations and study design have a significant impact on the research result. Till today, most of the beneficial effects attributed to garlic are obtained from fresh garlic. The

aim of this study was to see: 1) Hb concentration, blood glucose, blood pressure (BP) and blood lipid profile such as, cholesterol, TG, high density lipoprotein (HDL) and LDL level of healthy young but overweight (average 88.89 kg) subject; and 2) the effects of fresh garlic on blood lipids, blood pressure, blood glucose, Hb concentration and body weight of the same subjects.

Materials and method:

Young healthy adults, both male and female aged from 18 to 28 years and having 80 to 110 kg of body weight were selected. Informed and written consent was obtained from all participants. Most of them were students and college staff. Participants were advised to take normal diet during the study period as before. Body weight and blood pressure were recorded before and after six weeks of garlic administration. One clove of garlic having average weight of 4 to 6 gm was taken fresh usually with night meal within five minutes of slicing it into pieces for a period of six weeks.

Blood samples were collected at fasting condition in the morning before and after six weeks of garlic administration.

All the tests were done calorimetrically by a semi-automated biochemistry analyzer (Stat Fax - 3300). All glassware were sterilized by autoclaving. Estimation of Hb was done by cyanomethemoglobin method. Glucose was estimated by enzymatic, colorimetric GOD-PAP method. Cholesterol was estimated by enzymatic, liquid colorimetric, CHOD/PAP method. Triglyceride was estimated by enzymatic, liquid, colorimetric GPO-PAP method. HDL-cholesterol was estimated by phosphotungstic-precipitation method.

For test of significance, paired student's 't' test was used after calculating mean±SE. Probability values considered significant at P = 0.05

Results:

There were no significant differences between pre- and post- administration of garlic on BP, body weight and Hb concentration. But blood cholesterol and LDL-C was significantly decreased after six weeks of fresh garlic administration. The reduction of blood

glucose and triglyceride (TG) level was although observed but were not statistically significant. Results are mean ± SD (n=20). The differences were significant at p<0.05 and p<0.001.

Discussion:

Garlic induced reduction of blood lipids in this study is consistent with that of many other research reports. It has been observed that reduction of blood cholesterol and LDL-C level occurred after six weeks of garlic

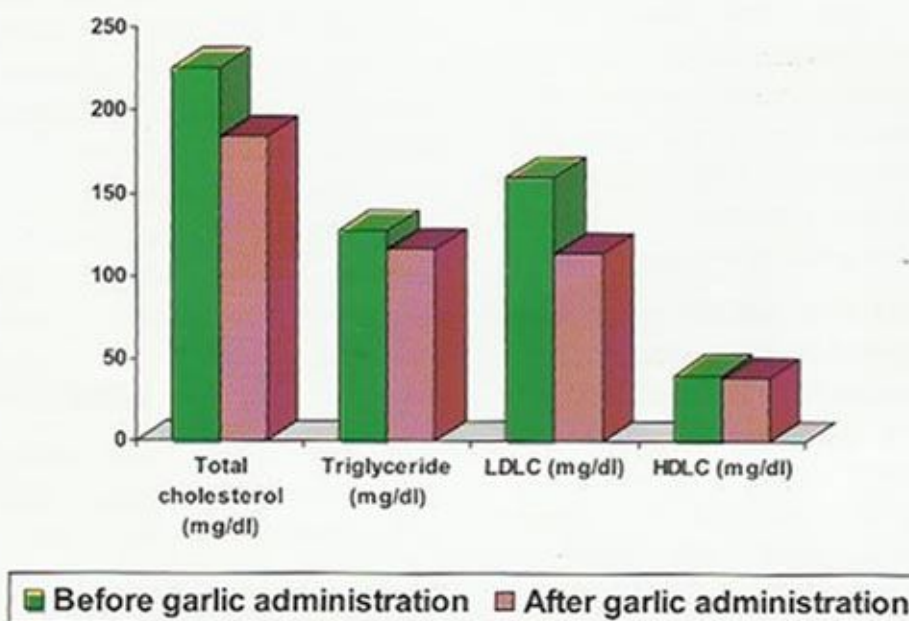


Figure- 1: Effects of garlic (before and after six weeks of administration) on serum lipid level.

Table: I: Effects of garlic (before and after six weeks of administration) on blood glucose, Haemoglobin (Hb) and blood pressure. Results are mean ± SD (n=20)

Time of administration	Blood glucose (mmol/L)	Hb%	Diastolic pressure (mmHg)	Systolic pressure (mmHg)
Before garlic administration	5.08	13.90	85	130
After garlic administration	4.75	11.97	83	122

administration. The effect of garlic was observed after administration for three to six months in different studies^{2,11}. Garlic also reduced blood glucose and TG which were not significant. Blood pressure and Hb concentration remain unchanged in this study. Research report varies from experiment to experiment due to experimental design, experimental subjects (animal or human) and of course, differences in garlic preparations. There is enhanced excretion of acidic and neutral steroids after garlic feeding which indicates that garlic increases the excretion of cholesterol^{3,13}. LDL was found to be significantly more resistant to oxidation when it was isolated from human subjects given aged garlic extract (AGE) and aqua garlic extract^{3,13}. Suppression of LDL oxidation may be one of the powerful mechanisms accounted for the benefits of garlic in atherosclerosis¹².

Allicin was identified initially as the active compound responsible for antiatherosclerotic effect. When mature garlic bulbs are crushed or garlic powder is mixed in water, it has been observed that allicin accounts for approximately 70% of total thiosulfates produced when the prodrug allin, isoallin and methin interact with allinase¹. Allinase is pH sensitive and maximum action may be obtained in an alkaline environment^{1,10}. Cooked supplement of garlic which is unable to produce allicin is associated with a lack of blood cholesterol lowering efficacy^{1,3}. So maximization of allicin yield seems a key component in relationship to lowering elevated blood cholesterol levels. It is recommended that waiting 15 minutes between peeling and cooking garlic allows the allinase reactions to occur⁴. Duration of administration of garlic and food habit are the other key factors that play vital role in determining plasma lipids in

experiments. Few in-vitro studies reported that water soluble organosulfur compounds, especially S-allyl cystein (SAC), present in aged garlic and diallyl-di sulfide (DADS) present in garlic oil are also potent inhibitors of cholesterol synthesis^{3,4}.

Gardenar et al reported that three forms of garlic such as raw garlic, garlic powder and aged garlic extract used in moderately elevated LDL-C (130 to 190 mg/dl) had no effect at all^{6,7}. Volunteers had taken garlic in sandwiches and also microwaved before taking it. Here, factors like heating garlic might loss its lipid lowering potency. Another important point is that high dietary intake of cholesterol-promoting sandwiches and the foods in one's daily diet may have a significant effect on the serum cholesterol and may interfere with garlic's cholesterol lowering effect. Normal American diet consists of high levels of cholesterol. That report did not mention what types of foods were taken daily other than sandwiches.

In this study it was also found that there was marked reduction of glucose after six weeks of garlic administration. The finding is similar to that of others. Studies suggest that garlic acts as an insulin secretagogue in diabetic rats^{14,15}.

Nonpharmacological interventions consisting largely of diet modifications and increased physical activity are the first line approach for both primary and secondary prevention of coronary heart disease⁵. Most of the experiments showed that six months administration of garlic lowered plasma lipid significantly. It was observed that enteric coated garlic powder supplements which release 9.6 mg allicin helps patients with moderate hypercholesterolemia and taking low fat diet^{1,4}. In this study, most of the

volunteers were medical students, and although they were advised to take normal foods as they took before, interestingly, they have an examination during the study. In fact, they were very tense during the examination, and some of them reported that they were very irregular at their day –time meal. During examination few female students reported that they were suffering from anorexia. No information is available regarding psychological stress and hypocholesterolemic effects of garlic. It may be considered that food habit and psychological stress as well influence the hypocholesterolemic effects of garlic in this observation. At the same time, it is felt that more studies on the hypocholesterolemic effects of fresh garlic and their relations with different factors like food habit, psychological stress and daily life style are needed to draw any conclusion.

References:

1. Kannar D, Wattanapenpaiboon N, Savage GS, Wahlqvist ML. Hypocholesterolemic effect of an enteric coated garlic supplement. *J Am Coll Nutr* 2001; 20: 20-25.
2. Bordia A. Effect of garlic on blood lipids in patients with coronary heart disease. *Am J Clin Nutr* 1981; 34: 2100-2103.
3. Yeh Y, Liu L. Cholesterol-lowering effect of garlic extracts and organosulfur compounds: Human and animal studies. *J Nutr* 2001; 131: 989s-992s.
4. Amagase H, Petesch BL, Matsuura H, Kasuga S, Itakura Y. Intake of garlic and its bioactive components. *J Nutr* 2001; 131: 955s-962s.
5. Stevinson C, Pittler MH, Ernst E. Garlic for treating hypercholesterolemia. *Ann Intern Med* 2000; 133: 420-430.
6. Gardner CD, Lawson LD, Block E, et al. Effect of raw garlic vs commercial garlic supplements on plasma lipid concentrations in adults with moderate hypercholesterolemia. *Arch Intern Med* 2007; 167: 346-353.
7. Berthold HK, Sudhop T, von Bergmann K. Effect of a garlic oil preparation on serum lipoproteins and cholesterol metabolism: a randomized control trial. *JAMA* 1998; 279: 1900-2.
8. Rahman K. Historical perspective on garlic and cardiovascular disease. *J Nutr* 2001; 131: 977s-979s.
9. Warshafsky S, Kamer RS, Sivak SL. Effects of garlic on total serum cholesterol. A meta-analysis. *Ann Intern Med* 1993; 119: 599-605.
10. Blania G, Spangenburg B. Formation of allicin from dried garlic (*Allium sativum*): a simple HPTLC method for simultaneous determination of allicin and ajoene in dried garlic and garlic preparations. *Planta Medica* 1991; 57: 371-375.
11. Jain RC. Effect of garlic on serum lipids, coagulability and fibrinolytic activity of blood. *Am J Clin Nutr* 1977; 30: 1380-81.
12. Lau Benjamin HS. Suppression of LDL oxidation by garlic. *J Nutri* 2001; 131 (3s): 958S-988S.
13. Borek C. Antioxidant health effects of aged garlic extract. *J Nutr* 2001; 131(3s): 1010S- 5S.
14. Augusti KT, Sheela CG. Antiperoxide effects of S-allyl cysteine sulfoxide, a insulin secretagogue in diabetic rats. *Experimentia* 1996; 52: 115-120.
15. Jain RC, Vyas CR. Garlic in alloxan – induced diabetic rabbits. *Am J Clin Nutr* 1975; 28: 684-685.