

## Single blind placebo-controlled study on effects of Garlic tablets to reduce serum lipids

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### ABSTRACT

**Background:** In many countries of the world, herbal medicine is replacing conventional therapies due to cost effect, low compliance of allopathic drugs regarding their frequent adverse effects and easy availability of medicinal herbs in natural environment. Garlic is one of the medicinal herb which is cultivated in many countries of the world including China, South Korea, Egypt, India, Russia, Ethiopia, Burma, US, Ukraine, Bangladesh and Pakistan. Since prehistoric times, Garlic was and is being used as routinely cooking substance in socially sound and rich cultures of the world. Its medicinal uses and benefits are mentioned in far past historical references. New slant on Pharmacology of herbal medicine has leded new research designs and trends of therapeutics. Garlic's antihyperlipidemic effects are well explained and accepted by all disciplines of research schools. Important is its acceptance on reduction in morbidity and mortality rates in humans due to Myocardial Infarction. Its effects on metabolism of lipoproteins are still being researched.

**Methods:** It was single blind placebo controlled study, conducted at General Hospital Lahore, Pakistan from January 2010 to June 2010. One hundred and twenty male and female hyperlipidemic patients were enrolled, age range between 20 to 70 years. Already approved written consent was taken from all participants. Patients were divided in two groups, one group was on placebo therapy and another on drug Garlic tablets 300 mg, thrice daily for the period of three months. Their baseline values of total-cholesterol, triglycerides, LDL and HDL-cholesterol were taken and filed in especially designed proforma. Fortnightly clinical visit was advised to all patients. After three months treatments their serum for lipid profile was taken and then evaluated. Serum cholesterol and triglycerides were estimated by the enzymatic calorimetric method. Serum HDL-Cholesterol was determined by direct method, at day zero and at last day of the treatment. LDL-Cholesterol was calculated by Friedwald formula ( $LDL = TC - (TG/5 + HDL-C)$ ).

**Results:** When results of lipid profile values of day-0 and day-90 were compared, it was observed that use of tablet Garlic 300 mg, thrice daily for the period of three months reduced total cholesterol 9.37 %, triglycerides 1.30 %, LDL-cholesterol 17.59% and increased HDL-cholesterol 5.54 %. When evaluated individually all parameters of lipid profile were changed significantly statistically.

**Conclusion:** We concluded from this treatment trial that hyperlipidemic patients do get benefit to lower their harmful plasma resident fats and to increase beneficial fat particles (HDL-cholesterol) and may save their life time morbidity/mortality due to myocardial infarction.

**Keywords:** Single blind placebo, garlic tablet, serum lipids

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### INTRODUCTION

Lipid abnormalities play a critical role in the development of atherosclerosis<sup>1</sup>. Early experiments in animals demonstrated accelerated atherosclerosis with a high-cholesterol diet. This was followed by epidemiologic studies conducted in countries around the world that showed an increasing incidence of atherosclerosis when serum cholesterol concentrations were elevated<sup>2</sup>. Intervention trial data collected over the past 2 to 3 decades have also

demonstrated that cholesterol modification, especially statin therapy (3-hydroxy-3-methylglutaryl coenzyme A [HMG-CoA] reductase inhibitor therapy) and its resulting reduction in low-density lipoprotein cholesterol (LDL-C) levels, is associated with favorable effects on reduction in coronary heart disease (CHD) events, especially in patients at high risk for CHD or those who have already manifested CHD<sup>3-4</sup>. Fibrates, psyllium husk, and Niacin are other standard p-drugs for lowering plasma lipids. The effect of garlic on blood lipids has been studied in numerous trials and summarized in meta-analyses, with interesting results. This meta-analysis, the most comprehensive to date, includes 39 primary trials of the effect of garlic preparations on total cholesterol, low-density lipoprotein cholesterol, high-density

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lipoprotein cholesterol, and triglycerides<sup>5-16</sup>. The cardiovascular-protective 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, rabbits, chickens, and swine. Moreover, a number of intervention studies have similarly shown that garlic significantly reduced plasma lipids, especially total cholesterol and Low Density Lipoprotein (LDL) cholesterol in humans. Garlic powder extracts also acts as an antioxidants both in vitro<sup>13</sup> and in vivo<sup>14</sup>. In contrast, some studies failed to show any significant beneficial effect of dried garlic powder on blood lipids, fibrinolysis, coagulation<sup>3</sup>, and platelet aggregation<sup>15,16</sup>. Therefore, we conducted a trial on human subjects to reevaluate the effects of garlic on plasma lipid profile of hypercholesterolemic patients.

## SUBJECTS AND METHOD

It was single blind placebo controlled study, conducted at General Hospital Lahore, Pakistan from January 2010 to June 2010. One hundred and twenty hyperlipidemic patients were enrolled, of both sex, male and female, age range between 20 to 70 years. Written consent was taken from all participants, and was approved by Research Ethics Committee, General Hospital Lahore. Patients were divided in two groups. Group-I (sixty patients) was on drug Tablet Garlac 300mg, taken thrice daily after meal for the period of three months. Group-II (sixty patients) was on placebo; especially tablets were made by grinded wheat. They were advised to take placebo tablets thrice daily after their regular meals for the period of three months. They were advised to come for follow up visit fortnightly. Their Treatment record file was designed especially, showing their name, age, gender, occupation, address, their previous diseases, and previous drugs taken. Individuals treated with lipid lowering drugs, corticosteroids, hormones, diuretics, anticoagulants, fish oil or those who received garlic preparations during three months prior to the study, were excluded from the trial. Pregnant women, diabetic individuals and those with clinically significant renal, hepatic, pulmonary, hematologic, thyroid, cardiovascular, or active gastrointestinal disease, were also excluded from the study. Also patients with a positive history of sensitivity to garlic were not included in the trial. Their baseline laboratory measurements (urinalysis, liver and renal function tests, hematologic indices, a full

chemistry panel) and a two-day diet recall with Food Frequency Questionnaire, were obtained for each subject at the start of treatment. Serum cholesterol and triglycerides were estimated by the enzymatic calorimetric method. Serum HDL-Cholesterol was determined by direct method, at day zero and at last day of the treatment. LDL-Cholesterol was calculated by Friedwald formula ( $LDL = Tc - (TG/5 + HDL-C)$ ). Data were expressed as the mean  $\pm$  SD and "t" test was applied to determine statistical significance of results. P value lesser than 0.05 was the limit of significance.

## RESULTS

Out of 120 hyperlipidemic patients, 14 patients discontinued treatment either due to low drug compliance or their personal reasons. In placebo group 51 patients completed treatment and in drug group 55 patients completed their treatment. When results summed up, it was observed that 55 patients when treated with tablet garlic 300 mg, thrice daily for three months, their mean total serum cholesterol decreased from  $228.2 \pm 4.8$  mg/dl on day-0 to  $199.2 \pm 2.3$  mg/dl on day-90. This reduction in total cholesterol was highly significant ( $P < 0.001$ ) when levels on day-0 and those on day-90 were compared. The average percentage reduction in total cholesterol was -12.7%. The mean serum triglycerides level of 55 patients treated with garlic tablets was  $169.27 \pm 9.92$  mg/dl on day-0 which reduced to  $164.5 \pm 8.56$  mg/dl on day-90. The mean value differences were highly significant ( $P < 0.001$ ) when levels on day-0 and those on day-90 were compared. The percentage change between day-0 to day-90 was -2.81. In 55 primary hyperlipidemic patients, when started treatment with garlic, their mean serum LDL-C level at day-0 was  $159.72 \pm 5.70$  mg/dl. This level reduced to  $129.55 \pm 2.81$  mg/dl at day-90. When compared between day-0 to day-90, this change was highly significant ( $< 0.001$ ). The percentage change was -18.88. In 55 patients treated with tablet garlic, the mean HDL-C at day-0 was  $34.61 \pm 1.85$  mg/dl, which increased to  $36.77 \pm 1.96$  mg/dl on day-90. The result was highly significant ( $P < 0.001$ ) when values were compared at day-0 to day-90. The percentage increase in HDL-C from day-0 to day-90 was +6.24. In placebo group, changes in pretreatment and post-treatment values of all parameters were non-significant ( $p$ -value  $> 0.05$ ). Results of all parameters are shown in table 1.

Table 1: showing changes in total cholesterol triglycerides, LDL-cholesterol and HDL-cholesterol between placebo and drug group of patients in three months treatment.

Parameter	Placebo group (n=51)			Drug group (n=55)			% Difference in groups
	Day-0	Day-90	P Value	Day-0	Day-90	P Value	
T-C	215.95±2.47	208.70±5.38	>0.05	228.27±4.89	199.22±2.30	<0.001	9.37
TG	148.45±4.80	146.20±4.20	>0.05	169.27±9.92	164.50±8.56	<0.001	1.30
LDL-C	150.75±2.67	148.80±2.28	>0.05	159.72±5.70	129.55±2.81	<0.001	17.59
HDL-C	35.50±1.13	35.75±1.07	>0.05	34.61±1.85	36.77±1.96	<0.001	5.54

Key: T-C = Total-Cholesterol, TG = Triglycerides, LDL-C = Low-density lipoproteins, HDL-C = High-density lipoproteins, P Value >0.05 = non significant, P Value <0.05 = significant, P Value <0.001 = highly significant. All parameters are measured in mg/dl.

## DISCUSSION

We keeping in mind new slant on herbal medicines, did tried to observe pharmacological/therapeutic effects of Garlic for prevention of atherosclerosis, CAD and heart attack (MI). Our research design was single blind placebo-controlled, comprises of 120 hyperlipidemic patients. In our observation mean total serum cholesterol of 55 hyperlipidemic patients decreased from 228.2±4.8 mg/dl to 199.2±2.3 mg/dl. Difference between pretreatment and post treatment values is around 12.72 %, which is highly significant change with p-value <0.001. Our results match with results of study conducted by Durak I et al<sup>16</sup> who proved same changes in plasma total cholesterol in 500 primary hyperlipidemic patients when they used 400 mg of Garlic tablets TID for the period of only 6 weeks. They also observed same changes in serum LDL-cholesterol and triglycerides as in our results, ie in our results 2.81 % serum TGs and 18.88 % LDL-cholesterol were reduced, while in their results TGs decreased 3.44 % and LDL-C decrease was 22.87 %. These results are in contrast with results observed by Jabbari A et al<sup>17</sup> who proved 3 % change in serum total cholesterol, 1.98% reduction in TGs levels and only 6.66% LDL-C reduction. This mismatch in results may be due to selection of patients with other diseases. They included patients with renal transplant, while our inclusion criteria was primary and secondary hyperlipidemic patients. In our results TGs in plasma were 169.27±9.92 mg/dl on day-0 which reduced to 164.5±8.56 mg/dl on day-90. The mean value differences were highly significant (P <0.001) when levels on day-0 and those on day-90 were compared. The percentage change between day-0 to day-90 was -2.81. These results match with results obtained by Tohidi M, Rahbani M<sup>18</sup> who proved 3.2 % decrease in plasma TGs concentrations. They also proved significant reduction in VLDL levels in 100 hyperlipidemic patients when 400 mg of garlic was used for the period of 7 weeks. In our results LDL-cholesterol at baseline was 159.72±5.70 mg/dl. This level reduced to 129.55±2.81 mg/dl at day-90. When compared

between day-0 to day-90, this change was highly significant (<0.001). The percentage change was -18.88. These results match with results of reaserch study by Stevinson C et al<sup>19</sup> and Mathew BC et al<sup>20</sup> who proved significant changes in LDL-cholesterol and summarized their results in meat analysis. Our results regarding HDL-cholesterol are in contrast to results of research conducted by Gardner C et al<sup>21</sup> who proved much higher increase in HDL-C in 567 hyperlipidemic patients as compared with our results proving mean HDL-C at day-0 was 34.61±1.85 mg/dl, which increased to 36.77±1.96 mg/dl on day-90. The result was highly significant (P <0.001) when values were compared at day-0 to day-90. The percentage increase in HDL-C from day-0 to day-90 was +6.24. Gardner C et al<sup>21</sup> proved 12.99% increase in HDL-C in their patients. This contrast in results may be due to different preparation of garlic by getting garlic extract using ethanol. We used already prepared tablet form of garlic in specific doses. Our results in HDL-C are matching with results of study of Steiner M et al<sup>22</sup> who proved 7.00% increase in HDL-C in 87 hyperlipidemic patients, further authenticating our results.

## REFERENCES

1. C. Cruz, R. Correa-Rotter, D. J. Sánchez-González et al., "Renoprotective and antihypertensive effects of S-allylcysteine in 5/6 nephrectomized rats," American Journal of Physiology 2007;293(5): F1691-F1698.
2. Demirkaya, A. Avci, V. Kesik et al., "Cardioprotective roles of aged garlic extract, grape seed proanthocyanidin, and hazelnut on doxorubicin-induced cardiotoxicity," Canadian Journal of Physiology and Pharmacology 2009; 87( 8):633-640.
3. Williams MJA, Sutherland WHF, McCormick MP, Yeoman DJ, de Jong SA: Aged garlic extract improves endothelial function in men with coronary artery disease. *Phytother Res* 2005, 19:314-319.
4. Cavallito, Chester J.; Bailey, John Hays. Allicin and related compounds: Biosynthesis, synthesis and pharmacological activity. *Facta universitatis* 2011;9 (1): 9-20.

5. Andrianova I, Fomchenkov I, Orekhov A. Hypotensive effect of longacting garlic tablets Allicor (a double blind placebo-controlled trial) *Ter Arkh.* 2002;74:76–78.
6. Ried K, Toben C, Fakler P. Effect of garlic on serum lipids: an updated meta-analysis. *Nutr Rev.* 2013; 71(5): 282-99.
7. Colín-González, A. Ortiz-Plata, J. Villeda-Hernández, et al., "Aged garlic extract attenuates cerebral damage and cyclooxygenase-2 induction after ischemia and reperfusion in rats, *Plant Foods for Human Nutrition* 2011; 66(4): 348–354.
8. Libby P: Prevention and treatment of atherosclerosis. In *Harrison's principles of internal medicine.* McGraw Hill 2005:1430.
9. T. Ago, J. Kuroda, M. Kamouchi, J. Sadoshima, and T. Kitazono, "Pathophysiological roles of NADPH oxidase/NOX family proteins in the vascular system review and perspective," *Circulation Journal* 2011; 75(8): 1791–1800.
10. Saravanan G, Prakash J: Effect of garlic (*Allium sativum*) on lipid peroxidation in experimental myocardial infarction in rats. *J Ethnopharmacol* 2004; 94:155-158.
11. Shin SH, Kim MK: Effect of dried powders or ethanol extracts of garlic flesh and peel on lipid metabolism and antithrombotic capacity in 16-month-old rats. *Hanguk Yongyang Hakhoechi* 2004;37:515-524.
12. V. Calabrese, C. Mancuso, M. Calvani, E. Rizzarelli, D. A. Butterfield, and A. M. Stella, "Nitric oxide in the central nervous system: neuroprotection versus neurotoxicity, *Nature Reviews Neuroscience* 2007; 8(10): 766–775.
13. Y. I. Chirino, M. Orozco-Ibarra, and J. Pedraza-Chaverri, "Role of peroxynitrite anion in different diseases, *Revista de Investigacion Clinica* 2006;58(4): 350–358.
14. Stevinson C, Pittler M, Ernst E. Garlic for treating hypercholesterolemia: a meta-analysis of randomized clinical trials. *Ann Intern Med.* 2000;133:420–429.
15. Lawson L, Wang J, Papadimitriou D. Allicin release under simulated gastrointestinal conditions from garlic powder tablets employed in clinical trials on serum cholesterol. *Planta Med.* 2001;67:13–18.
16. Durak I, Kavutcu M, Aytac B. Effects of garlic extract consumption on blood lipid and oxidant/antioxidant parameters in humans with high blood cholesterol. *J Nutr Biochem.* 2004;15:373–377.
17. Jabbari A, Argani H, Ghorbanihaghjo A, Mahdavi R: comparison between swallowing and chewing of garlic on levels of serum lipid, cyclosporine, creatinine and lipid peroxidation in renal transplant recipients. *Lipids in health and disease* 2005, 4:11.
18. Tohidi M, Rahbani M: Evaluation of the effect of garlic powder on blood pressure, serum lipids and lipoproteins. *Pharmacy journal of Tabriz Univ Med Sci* 2000;4:16-20.
19. Stevinson C, Pittler MH, Ernst E: Garlic for treating hypercholesterolemia (a meta-analysis of randomized clinical trials). *Ann Intern Med* 2000;133:420-429.
20. Mathew BC, Prasad NV, Prabodh R: Cholesterol-lowering effect of organosulphur compounds from garlic: a possible mechanism of action. *Kathmandu Univ Med J* 2004; 2(2):100-2.
21. Gardner C, Chatterjee L, Carlson J. The effect of a garlic preparation on plasma lipid levels in moderately hypercholesterolemic adults. *Atherosclerosis.* 2001; 154: 213–220.
22. Steiner M, Khan AH, Holbert D, Lin RI: A double-blind crossover study in moderately hypercholesterolemic men that compared the effect of aged garlic extract and placebo administration on blood lipids. *Am J Clin Nutr* 1996; 64 :866-870