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Dose-dependent influence of commercial garlic (*Allium sativum*) on rats fed cholesterol-containing diet.

Gorinstein S, Leontowicz M, Leontowicz H, Jastrzebski Z, Drzewiecki J, Namiesnik J, Zachwieja Z, Barton H, Tashma Z, Katrich E, Trakhtenberg S.

Department of Medicinal Chemistry and Natural Products, School of Pharmacy, The Hebrew University-Hadassah Medical School, Jerusalem, Israel.

The aim of this investigation was to evaluate the dose-dependent influence of commercial garlic on rats fed cholesterol-containing diets. It was found that commercial garlic contains high concentrations of dietary fibers, microelements, and total polyphenols, and its total antioxidant capacity as determined by two independent assays [1,1-diphenyl-2-picrylhydrazyl (DPPH) and 2,2'-azinobis(3-ethylbenzthiazoline-6-sulfonic acid) (ABTS)] was similar to that of the original garlic samples. Wistar rats (35) were randomly divided into five diet groups, named control, Chol, Garlic500, Garlic750, and Garlic1000. Control rats were fed basal diet (BD), which included wheat starch, casein, soybean oil, and vitamin and mineral mixtures. To the BD of the Chol group was added 1% of cholesterol. To the BD of the other three groups (Garlic500, Garlic750, and Garlic1000) were added 1% of cholesterol and commercial garlic equal to 500, 750, and 1000 mg of raw garlic per kilogram of animal weight. After 4 weeks of the experiment only in rats from the Garlic500 group were a significant hindering in the rise in plasma lipids and also a significant hindering in a decrease of plasma antioxidant activity registered. A significant decrease in plasma circulating fibrinogen and an increase in the clotting time were found in the same group of rats ($P < 0.05$ in both cases). The fibrinolytic effect of garlic diets was visualized by sodium dodecyl sulfate-polyacrylamide gel electrophoresis. In the fibrinogen fraction of Garlic500 the 66, 24, and 14 kDa protein bands were detected with weaker protein intensity than in the corresponding ones in the Garlic750 and Garlic1000 diet groups. In conclusion, the positive influences of commercial garlic on plasma lipids, proteins, antioxidant activity, and some indices of blood coagulation are dose-dependent. Therefore, commercial garlic (Elena, Zelazków, Poland) could be a valuable component of atherosclerosis-preventing diets only in optimal doses.

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- Pathobiology. 2005;72(6):325-34

The antiatherogenic effect of allicin: possible mode of action.

Gonen A, Harats D, Rabinkov A, Miron T, Mirelman D, Wilchek M, Weiner L, Ulman E, Levkovitz H, Ben-Shushan D, Shaish A.

Institute of Lipid and Atherosclerosis Research, Sheba Medical Center, Tel Hashomer, Israel.

OBJECTIVE: Garlic (*Allium sativum*) has been suggested to affect several cardiovascular risk factors. Its antiatherosclerotic properties are mainly attributed to allicin that is produced upon crushing of the garlic clove. Most previous studies used various garlic preparations in which allicin levels were not well defined. In the present study, we evaluated the effects of pure allicin on atherogenesis in experimental mouse models. **METHODS AND RESULTS:** Daily dietary supplement of allicin, 9 mg/kg body weight, reduced the atherosclerotic plaque area by 68.9 and 56.8% in apolipoprotein E-deficient and low-density lipoprotein (LDL) receptor knockout mice, respectively, as compared with control mice. LDL isolated from allicin-treated groups was more resistant to CuSO₄-induced oxidation *ex vivo* than LDL isolated from control mice. Incubation of mouse plasma with (3)H-labeled allicin showed binding of allicin to lipoproteins. By using electron spin resonance, we demonstrated reduced Cu(2+) binding to LDL following allicin treatment. LDL treatment with allicin significantly inhibited both native LDL and oxidized LDL degradation by isolated mouse macrophages. **CONCLUSIONS:** By using a pure allicin preparation, we were able to show that allicin may affect atherosclerosis not only by acting as an antioxidant, but also by other mechanisms, such as lipoprotein modification and inhibition of LDL uptake and degradation by macrophages.

Publication Types: Comparative Study

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- Phytomedicine. 2006 Mar;13(4):230-5. Epub 2005 Sep 15

The influence of garlic (*Allium sativum*) extract on interleukin 1alpha-induced expression of endothelial intercellular adhesion molecule-1 and vascular cell adhesion molecule-1.

Rassoul F, Salvetter J, Reissig D, Schneider W, Thiery J, Richter V.
Institute of Laboratory Medicine, Clinical Chemistry and Molecular Diagnostics, University Hospital Leipzig, Liebigstr. 27, D-04103 Leipzig, Germany.

Inflammation plays an important role in both the initiation of atherosclerosis and development of atherothrombotic events. The adherence of leukocytes/monocytes to the endothelium is an early event in atherogenesis. Phytotherapeutica as garlic and garlic extracts were shown to have beneficial modulating effects in patients with atherosclerotic disease. The aim of this study was to evaluate in vitro the influence of water-soluble garlic (*Allium sativum*) extract on the cytokine-induced expression of endothelial leukocyte adhesion molecules such as intercellular adhesion molecule-1 (ICAM-1, CD54) and vascular cell adhesion molecule-1 (VCAM-1, CD106). Cytokine-induced expression of cellular adhesion molecules was measured on primary human coronary artery endothelial cell (HCAEC) cultures. HCAEC were cultured in microvascular endothelial cell growth medium and preincubated with garlic extract at various concentrations (0.25-4.0 mg/ml), after which human interleukin-1alpha (IL-1alpha, 10 ng/ml) was added for 1 day. Fluorescein isothiocyanate (FITC)-labeled anti-ICAM-1 and FITC-labeled anti-VCAM-1 were used to analyze the IL-1alpha-induced expression of ICAM-1 and VCAM-1 by flow cytometry. Incubation of HCAEC with garlic extract significantly decreased ICAM-1 and VCAM-1 expression induced by IL-1alpha. In addition, we examined the effects of garlic extract on the adhesion of monocytes to endothelial cells, using the monocytic U937 cell line. The presence of garlic extract significantly inhibited the adhesion of monocytes to IL-1alpha-stimulated endothelial cells. These results indicate that garlic extract modulates the expression of ICAM-1 and VCAM-1, thus potentially contributing to the beneficial effects traditionally attributed to garlic.

Publication Types: Comparative Study, Research Support, Non-U.S. Gov't
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Including garlic in the diet may help lower blood glucose, cholesterol, and triglycerides.

Thomson M, Al-Qattan KK, Bordia T, Ali M.
Department of Biological Sciences, Faculty of Science, Kuwait University, 13060 Safat, Kuwait.

Raw and boiled aqueous extracts of garlic (*Allium sativum*) were administered daily to normal rats both orally and intraperitoneally for 4 wk. The serum levels of glucose, cholesterol, and triglycerides were measured. When the rats were treated with a low dose (50 mg/kg) of raw aqueous extract of garlic, no significant changes in the serum glucose levels were observed compared with the control group. However, there was a significant reduction in the cholesterol level of rats receiving a low dose of garlic (11-14%). Rats receiving garlic orally and intraperitoneally also showed a significant reduction in triglyceride levels (38%). When the rats were treated with a high dose (500 mg/kg) of raw garlic, glucose, cholesterol, and triglyceride levels were significantly affected. When boiled garlic extracts were administered at high concentrations (500 mg/kg), there was no effect on the level of serum glucose. However, a relatively small but significant decrease in the concentration of cholesterol and triglycerides was observed in the serum of the rats receiving boiled garlic. Raw garlic had a profound effect in reducing the glucose, cholesterol, and triglyceride levels, whereas boiled garlic had little effect in controlling these parameters. Therefore because hyperlipidemia is a major etiopathological factor for atherosclerosis, garlic may play an important role in the prevention of atherosclerosis.

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- J Ayub Med Coll Abbottabad. 2005 Jul-Sep;17(3):60-4

Effects of garlic on dyslipidemia in patients with type 2 diabetes mellitus.

Ashraf R, Aamir K, Shaikh AR, Ahmed T.

Department of Pharmacology and Therapeutics, Basic Medical Science Institute, Jinnah Postgraduate Medical Center, Karachi.

BACKGROUND: Garlic (*Allium Sativum*) has been used in herbal medicine for centuries for various ailments. In recent years garlic has been the focus of serious medical and clinical attention because of beneficial effects on several cardiovascular risk factors like reduction of serum lipids, blood pressure and plasma viscosity. There is also wide spread belief among general public that garlic has beneficial effects on cardiovascular system. The purpose of present study was to evaluate the effects of garlic on one of the major cardiovascular risk factors i.e. dyslipidemia in patients with type 2 diabetes mellitus. **METHOD:** This 12 week randomized, single-blind, placebo controlled study was conducted on Type 2 diabetic patients with newly diagnosed dyslipidemia (n=70). Patients were selected from Diabetic OPD of Jinnah Post Graduate Medical Centre, Karachi and were divided into two groups each comprising of 35 patients, they were given tablet garlic (Garlex-Bosch Pharmaceuticals) 300 mg (containing 1.3 % allicin) twice daily and identical placebo tablets respectively. Both groups were given diet and exercise plan. **RESULTS:** After 12 weeks the garlic treated group (n = 33) had a significant reduction in total cholesterol (-28 mg/dl, - 12.03 % P= <0.001), LDL - C (-30 mg/dl, - 17.99 % P=<0.001) while the placebo treated group (n=32) had a non significant decrease in total cholesterol (- 2 mg/dl, - 0.9 % p= ns) and LDL-C (-3 mg/dl, -1.6 % p=ns). HDL cholesterol was significantly increased in patients treated with garlic (3.35 mg/dl, 8.81% P= <0.05) compared with placebo group (0.62, 1.6% P= n.s) but there was no significant difference in triglyceride was observed between two groups. **CONCLUSION:** This study suggests possible small short term benefits of garlic on dyslipidemia in type 2 diabetic patients. Garlic significantly reduced serum total cholesterol and LDL cholesterol and moderately raised HDL cholesterol as compared to placebo. Controlled Clinical Trials of longer duration are needed to assess the long term benefit of garlic on vascular and circulatory disease processes.

Publication Types: Randomized Controlled Trial

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- Indian J Exp Biol. 2001 Aug;39(8):760-6

A comparative study on the beneficial effects of garlic (*Allium sativum* Linn), amla (*Emblica Officinalis* Gaertn)and onion (*Allium cepa* Linn) on the hyperlipidemia induced by butter fat and beef fat in rats.

Augusti KT, Arathy SL, Asha R, Ramakrishanan J, Zaira J, Lekha V, Smitha S, Vijayasree VM.

Department of Medical Biochemistry, School of Medical Education, M.G. University, Kottayam, India.

Three months feeding of butter fat (BUF) and beef (BF) separately as components of diet at a level of 21% by weight for albino rats, significantly raised their serum and tissue lipids, lipid peroxidation and activities of certain enzymes. BUF was found to be more atherogenic than BF. On incorporation of 5% garlic, amla or onion separately in the above diets, each of them ameliorated the deleterious effects of the animal fats. A higher hyperlipidemic effect of BUF as compared to that of BF may be due to the fact that the ratio of unsaturated to saturated fats is lower for the former (0.56) than for the latter (0.75) and also that the former is richer in cholesterol content than the latter. The order of the curative effects of the vegetables are garlic>amla>onion. The better hypolipidemic effects and correction of elevated levels of certain enzymes shown by garlic and amla may be due to the facts that they contain comparatively better active principles than that found in onions.

Publication Types: Comparative Study

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