

Health Effects of Garlic

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Garlic has long been used medicinally, most recently for its cardiovascular, antineoplastic, and antimicrobial properties. Sulfur compounds, including allicin, appear to be the active components in the root bulb of the garlic plant. Studies show significant but modest lipid-lowering effects and antiplatelet activity. Significant blood pressure reduction is not consistently noted. There is some evidence for antineoplastic activity and insufficient evidence for clinical antimicrobial activity. Side effects generally are mild and uncommon. Garlic appears to have no effect on drug metabolism, but patients taking anticoagulants should be cautious. It seems prudent to stop taking high dosages of garlic seven to 10 days before surgery because garlic can prolong bleeding time. (*Am Fam Physician* 2005;72:103-6. Copyright© 2005 American Academy of Family Physicians.)

Garlic (*Allium sativum*) has been used for thousands of years for medicinal purposes. Sanskrit records show its medicinal use about 5,000 years ago, and it has been used for at least 3,000 years in Chinese medicine. The Egyptians, Babylonians, Greeks, and Romans used garlic for healing purposes.¹ In 1858, Pasteur noted garlic's antibacterial activity, and it was used as an antiseptic to prevent gangrene during World War I and World War II.²

Historically, garlic has been used around the world to treat many conditions, including hypertension, infections, and snakebites, and some cultures have used it to ward off evil spirits. Currently, garlic is used for reducing cholesterol levels and cardiovascular risk, as well as for its antineoplastic and antimicrobial properties.¹

Pharmacology

The root bulb of the garlic plant is used medicinally. It can be used fresh, dehydrated, or as a steam-distilled oil.

Garlic has a high concentration of sulfur-containing compounds. The thiosulfates, including allicin, appear to be the active substances in garlic. Allicin is formed when alliin, a sulfur-containing amino acid, comes into contact with the enzyme alliinase when raw garlic is chopped, crushed, or chewed. Dried garlic preparations containing alliin and alliinase must be enteric coated to be effective because stomach acid inhibits

alliinase. Because alliinase also is deactivated by heat, cooked garlic is less powerful medicinally. The antimicrobial, hypolipidemic, antioxidant, and antithrombotic effects that have been attributed to garlic are thought to be related to allicin and other breakdown products. The antineoplastic effects may be related to the sulfur compounds or to other, unknown components.¹

Uses and Efficacy

Garlic has been studied extensively in vitro, in animal and human clinical trials, and in epidemiologic evaluations for its multiple medicinal properties. The quality of human trials has been variable, making comparisons among the trials difficult. Some trials are not well blinded; some are only of short duration; some have only small numbers of patients; and many are not well controlled. In addition, many different garlic preparations have been used, with unpredictable release of active ingredients.

LIPID-LOWERING EFFECTS

Many randomized clinical trials have studied the effects of garlic on lipid levels. Results from two meta-analyses conducted in 1993³ and 1994⁴ of garlic's effect on total cholesterol show a significant reduction in total cholesterol levels (9 to 12 percent) compared with placebo. Since then, additional, better-designed trials have been published, with conflicting results.⁵⁻⁸ A meta-analysis published in 2000⁹ that included these trials con-

STRENGTH OF RECOMMENDATION

<i>Key clinical recommendations</i>	<i>Label</i>	<i>References</i>
Patients should be advised that garlic has a modest, short-term, lipid-lowering effect.	C	5 to 13
Patients at risk of thrombosis should be advised that garlic may have a modest but significant effect on platelet aggregation compared with placebo.	C	10
Patients should be advised that there may be a reduction in the risk of cancer, particularly stomach and colon cancer, with high consumption of garlic and other allium vegetables (e.g., onions, leeks, shallots, chives).	C	11, 20, 21

A = consistent, good-quality patient-oriented evidence; B = inconsistent or limited-quality patient-oriented evidence; C = consensus, disease-oriented evidence, usual practice, opinion, or case series. For information about the SORT evidence rating system, see page 15 or <http://www.aafp.org/afpsort.xml>.

cluded that garlic is superior to placebo in reducing total cholesterol levels, but that the extent of the effect is modest (4 to 6 percent). A more recent meta-analysis¹⁰ of placebo-controlled trials using standardized dried garlic powder showed significant reductions in total cholesterol levels (19.2 mg per dL [0.50 mmol per L]), low-density lipoprotein cholesterol levels (6.7 mg per dL [0.20 mmol per L]) and triglyceride levels (21.1 mg per dL [0.24 mmol per L]) at eight to 12 weeks; these reductions were not sustained at six months of treatment. This difference in reduction may be due to differences in the studies (i.e., shorter or longer follow-up periods, fewer long-term studies, time-dependent effects of garlic,¹¹ or nonadherence in the studies of longer duration).

A European trial¹² comparing garlic with a commercial lipid-lowering drug (bezafibrate, a fibric acid derivative not available in

the United States) found them to be equally effective in decreasing lipids to a statistically significant extent. One trial¹³ of garlic extract treatment in children with hypercholesterolemia found no adverse effects, but also no significant beneficial effect on lipid levels. A trial testing garlic's effect on lipid levels, sponsored by the National Center for Complementary and Alternative Medicine, is underway.¹⁴

ANTIHYPERTENSIVE EFFECTS

The antihypertensive effects of garlic have been studied but remain controversial. In a 1994 meta-analysis¹⁵ assessing the effect of garlic on hypertension, three trials showed significant reductions in systolic blood pressure (7.7 mm Hg greater reduction), and four trials showed reductions in diastolic blood pressure (5 mm Hg greater reduction) with garlic treatment compared with placebo. In a more recent meta-analysis,¹⁰ 23 placebo-controlled trials were analyzed. Only three trials showed a statistically significant reduction in diastolic blood pressure (2 to 7 percent), and one showed a statistically significant reduction in systolic blood pressure (approximately 3 percent) in patients treated with garlic compared with placebo.

OTHER CARDIOVASCULAR-RELATED EFFECTS

A recent review¹⁰ of 10 trials assessing the effect of garlic on thrombotic risk showed modest but significant decreases in plate-

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let aggregation with garlic compared with placebo, but mixed results on fibrinolytic activity and plasma viscosity were reported. The same review analyzed 12 trials of garlic supplementation in diabetic and nondiabetic adults; only one trial showed a significant decrease in glucose levels in nondiabetic patients who took garlic when compared with placebo. Atherosclerotic plaque volume reduction in humans also has been noted in two trials comparing garlic treatment with placebo.¹⁶⁻¹⁸ One observational study¹⁹ showed that regular garlic powder intake weakened age- and pressure-related increases in aortic stiffness.

ANTINEOPLASTIC EFFECTS

Epidemiologic evidence, primarily from case-control and some cohort studies, has shown a decreased risk of stomach and colon cancer with the high consumption of garlic and other allium vegetables (e.g., onions, leeks, shallots, chives), but many of these studies were not well controlled.^{11,20,21} In one cohort study, garlic supplementation did not confer the same protective benefit,¹¹ but there are no studies assessing the use of particular garlic supplements and cancer incidence.²¹

ANTIMICROBIAL EFFECTS

Small studies have shown that garlic exerts antimicrobial activity against gram-positive and gram-negative bacteria, viruses, fungi, and parasites.² Topical and dietary garlic traditionally has been used in the treatment of infections—particularly digestive, respiratory, and dermatologic infections—ranging from diarrhea and vaginitis to colds and warts, but few good clinical studies support this use.

Contraindications, Adverse Effects, Interactions

The ingestion of one to two cloves of raw garlic per day is considered safe in adults. The most common side effect of ingested garlic is breath and body odor. Consumption of excessive amounts of raw garlic, especially on an empty stomach, can cause gastrointestinal upset, flatulence, and changes in the

intestinal flora.^{1,10} There have been reports of allergic dermatitis, burns, and blisters from topical application of raw garlic.¹⁰

Garlic appears to have no effect on drug metabolism,²² although recent studies^{23,24} in healthy volunteers show conflicting results related to garlic's effect on protease inhibitor pharmacokinetics. It has been suggested that patients taking anticoagulants use caution when taking garlic because of its antithrombotic properties.^{10,22} It seems prudent to stop taking high dosages of garlic seven to 10 days before surgery because garlic can prolong bleeding time and has been associated (in one case report) with spontaneous spinal epidural hematoma.^{10,25}

Dosage

The effective dosage of garlic has not been determined. Dosages generally recommended in the literature for adults are 4 g (one to two cloves) of raw garlic per day, one 300-mg dried garlic powder tablet (standardized to 1.3 percent alliin or 0.6 percent allicin yield) two to three times per day, or 7.2 g of aged garlic extract per day.

TABLE 1
Key Points About Garlic

Efficacy	Antihypertensive activity: no consistent effect Antimicrobial activity: insufficient data Antineoplastic activity: epidemiologic suggestion of positive effect Antithrombotic activity: modest antiplatelet effect Hypoglycemic activity: no effect Lipid-lowering activity: modest, positive short-term effect
Adverse effects	Common: breath and body odor Less frequent: gastrointestinal upset, flatulence Rare: dermatitis, burns, blisters with topical use
Interactions	Effect on protease inhibitor pharmacokinetics is unclear; use caution when taken with anticoagulants; consider discontinuing high dosages 7 to 10 days before surgery.
Adult dosage	Raw garlic: 4 g per day (1 to 2 cloves) Dried powder (1.3 percent alliin): 300 mg, 2 to 3 times per day Aged extract: 7.2 g per day
Cost	\$1 to \$15 per month, depending on form and brand
Bottom line	Safe; may have antineoplastic and hypolipidemic activity.

Final Comment

Large, long-term, fully blinded, and well-controlled studies using a standardized preparation of garlic with known active components are necessary. They will allow reliable evaluation of garlic's effect on cardiovascular risk and, more important, on the end points of heart attack and stroke.

A diet rich in allium vegetables seems to be a good choice with low-risk antineoplastic potential, and good taste as a beneficial side effect. *Table 1* outlines the efficacy, safety, tolerability, dosage, and cost of garlic.

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