INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: https://www.ijpsjournal.com

OPEN ACCESS

**Review Article**

# Effect Of Active Constituents of Garlic on Cardiovascular Disorders

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ARTICLE INFO

Published: 24 Mar. 2025
Keywords:
Garlic, hypertension, thrombosis, atherosclerosis, hyperlipidemia, cardiovascular, experimental and clinical.
DOI:
10.5281/zenodo.15076179

## ABSTRACT

Garlic and its preparations have been extensively recognized as medicines for the prevention and treatment of cardiovascular and other metabolic illnesses, diabetes, hypertension, thrombosis, atherosclerosis, and hyperlipidemia. Garlic's therapeutic value in cardiovascular diseases was more hopeful in experimental studies, which provoked several clinical trials. Many clinical trials show a favorable impact on practically all of the cardiovascular problems previously listed; nevertheless, some unfavorable studies have recently raised doubts about the effectiveness of garlic, particularly its ability to decrease cholesterol. As the least expensive method of preventing cardiovascular disease, using garlic properly to reap its full benefits is a major problem for experts worldwide. World. This review is a little attempt to make a connection between experimental and clinical studies and to discuss the possible mechanisms of such therapeutic actions of garlic.

## INTRODUCTION

Dietary variables are important in the development of many human diseases, including cardiovascular disease. Diets high in fruits, herbs, and spices are linked to a lower risk of cardiovascular disease, according to epidemiological research. Garlic established a reputation over generations as a horrible preventative and therapeutic medicinal ingredient in the traditions of many civilizations. Because garlic is used medicinally all over the world and because it is widely believed to help prevent sickness and boost vitality, it has garnered special attention in modern medicine. Nowadays garlic preparations and extract have been shown to have numerous positive experimental and clinical benefits. The majority of research has linked these biological reactions to i) lowering the risk of cardiovascular and cancer disorders, and ii) boosting immunological function. iii) Improved detoxification of foreign compound, iv) hepatoprotection, v) antimicrobial and antioxidant effect. This article provides an overview of the effectiveness of garlic in treating illnesses other than cardiovascular disease.

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**Relevant conflicts of interest/financial disclosures**: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Historical Perspective of Garlic

It's amazing to see how societies who were never in contact with one another evolved to the same beliefs regarding the use of garlic in health care disease and health. It may teach us valuable lessons if folk knowledge is not ignored. Sumerian clay tablets from 2600–2100 BC provide some of the earliest records of this culinary herb and medicine. According to the medical treatise Codex Ebers (published before 1550 BC), garlic was considered a significant medicinal herb by the ancient Egyptians, particularly for those engaged in hard labor. [1,2]. There is evidence that during the first Olympics in Greece, athletes were given garlic to help them become more stamina-efficient. [1]. Garlic was prescribed as a remedy for respiration and digestion, mostly in cases of diarrhea and worm infestation in traditional Chinese medicine [3]. Garlic was widely used in the ancient Indian medical systems of Tibbi, Unani, and Auryveda as a key component of the healing power of plants. [2]. Garlic has long been used to cure heart disease and arthritis, according to the renowned Indian ancient medical treatise Charaka-Samhita. Garlic was used to treat leprosy, tiredness, and parasite diseases. Bower Manuscript, a different ancient Indian medical treatise (c. 300 AD), [4]. As a new era began, Europe began to pay more attention to the medicinal application of garlic. Pietro Mattiali, a renowned physician from Siena in the sixteenth century, recommended garlic to treat kidney problems, worm infestations, and digestive issues, and to support mothers going through difficult childbirths [2]. Garlic was used to treat plague, dropsy, constipation, and toothaches in England. [4]. Researchers have been attempting to verify several garlic characteristics, particularly in identifying the active therapeutic components, and mechanisms of action and exploring the probable benefits as food supplements modern era.

## Atherosclerosis and Lipid Metabolism

Atherosclerosis is a multifarious disease characterized by an excessive inflammatory, fibro-fatty, proliferative response to artery wall damage involving several cell types, like smooth muscle cells, monocyte-derived macrophages, T-lymphocytes, and platelets [7]. Hyperlipidemia constitutes a most importantetiopathologicalaspect for atherosclerosis. The medicinal significance of garlic is best known to prevent atherosclerosis. Garlic's medical value is mostly recognized for its ability to decrease cholesterol and prevent atherosclerosis.

## Human Studies

Since 1975, there have been more than 46 human studies (found via a Medline search) examining the potential of garlic and garlic products to decrease cholesterol. These studies, in hyperlipidemic patients, were mostly placebo-controlled, double-blind, and randomized using garlic powder instead of raw garlic for 4–16 weeks. These trials show a significant reduction in serum triglycerides and cholesterol. Of these investigations, only around one-third measured lipoproteins, where significant favorable changes in LDL-cholesterol levels (11–26% decrease) were consistently observed. Very few examinations using garlic powder (with low allicin yields) were unsuccessful in demonstrating any effects on lipid levels [24,25]. Regarding the hypolipidemic impact of garlic, eighteen clinical research have been published in the previous ten years (1993–2002). Out of nine studies, all revealed poor outcomes, with seven of these investigations utilizing garlic powder. Shows the result as specified in Table- 1(Table-1) [26-34]. Additional variables could be the study's length, diet restrictions, way of life, and cholesterol analysis techniques [35, 36].

**Table 1**
**Studies Showing No Cholesterol-Lowering Effect:**

| References | Preparation | Duration | Dose |
|---|---|---|---|
| Ziaei et al., 2001 [26] | Garlic powder (Garlet) | 3 months | 800 mg/day |
| Gardner et al., 2001 [27] | Garlic powder | 12 weeks | 500, 1000 mg/day |
| Rahman et al., 2000 [28] | Aged garlic extract | 13 weeks | 5 ml/day |
| Superko et al., 2000 [29] | Garlic powder | 3 months | 900 mg/day |
| Byrne et al., 1999 [30] | Garlic powder (Kwai) | 6 months | 900 mg/day |
| McCrindle et al., 1998 [31] | Garlic powder (Kwai) | 8 weeks | 900 mg/kg |
| Berthold et al., 1998 [32] | Steam-distilled garlic oil | 12 weeks | 10 mg/day |
| Isaacsohn et al., 1998 [33] | Garlic powder (Kwai) | 12 weeks | 900 mg/day |
| Simons et al., 1995 [34] | Garlic powder (Kwai) | 12 weeks | 900 mg/day |
| Luley et al., 1986 [25] | Commercial dried garlic | 6 weeks | 600 mg/day |
| Lutomski, 1984 [24] | Commercial garlic preparation | 12 weeks | – |

## Possible Mechanism/s

Garlic's ability to lower cholesterol content in artery walls has been linked to its preventive impact against atherosclerosis. Garlic has direct antiatherogenic (preventive) and antiatherosclerotic (causing regression) actions at the arterial wall level. [39]. the hepatic activity of cholesterogenic and lipogenic enzymes, including 3-hydroxy-3- methyl-glutaryl-CoA (HMG CoA) reductase, fatty acid synthase, malic enzyme, and glucose-6 phosphate dehydrogenase was depressed by garlic [40]. The increased production of acidic and neutral steroids following garlic consumption indicates the excretion of cholesterol feeding, was increased by Garlic [20]. Aqueous garlic extract [42] and LDL removed from people who received AGE [41] were discovered to have a noticeably higher oxidation resistance. These findings suggest that reduced LDL oxidation may be one of the potent mechanisms accounting for garlic's advantages in atherosclerosis. [43]. At first, allicin was shown to be the active ingredient with antiatherosclerotic activity. However, recent in vitro research has shown that water-soluble organosulfur compounds—particularly S-allyl cysteine (SAC) found in old garlic extract and diallyl-di-sulfur (DADS) found in garlic oil—are also highly effective at inhibiting the formation of cholesterol. [40,4]

## Fibrinolytic Activity

Insufficiency of the relevant components or suppression of fibrinolytic activity (FA) could throw off the hemostatic equilibrium and permit an excessive build-up of fibrin. Disturbance in the

coagulation-fibrinolytic system could be a significant contributing factor to the development of ischemia and thrombosis in diabetes, hypertension, hypercholesterolemia, and other conditions. Therefore, the antithrombic action is more favorable the higher the FA. The time required for euglobulin lysis usually determines FA. Patients with acute or elderly myocardial infarctions died while their plasma fibrinogen, euglobulin lysis time, and antiplasmin values were at their greatest infarction. This suggests that prediction in Part of what causes myocardial infarction is the extent to which plasma fibrinolysis is impaired [45].

**Human Studies**

Every human study on garlic's fibrinolytic action has demonstrated its beneficial effects (Table – (Table –2).2. Both short-term and long-term consumption of raw garlic and garlic improved Fibrinolytic activity (FA) was improved by. Bordia first, in 1975, demonstrated that Garlic oil enhanced FA three hours after administration. According to Bordia, chronic (3 weeks to 3 months) treatment of garlic oil (dose: equivalent to 1 gm/kg of fresh garlic) significantly raises FA in both acute myocardial infarction patients and healthy individuals, ranging from 36% to 130%. [49-52]. The same results are also found in some other investigators [53-55]. Moreover, dried garlic powder has been experienced for its fibrinolytic activity. Two studies [24,25] showed no distinction [56] showed Tissue plasminogen activator activity following consumption of both acute and long-term garlic powder as well as increased FA. Frying removes the strong acrid aroma of garlic but conserves its useful properties on FA. The rise in FA, It is noted that garlic has a quick start of action and that the effect lasts for as long as the garlic is consumed within six hours after administration. Bordia Rescently (1998) discovered that consuming an ethyl acetate extract for three months compressed raw garlic also increased FA [57].

**Table 2**
**Fibrinolytic Activity in Humans:**

| References | Preparation | Duration | Effect |
|---|---|---|---|
| Bordia et al., 1975 [46] | Essential garlic oil | Acute effect | Increased FA |
| Bordia et al., 1977 [10] | Essential garlic oil | 3 months | Increased FA |
| Bordia et al., 1978 [50] | Essential garlic oil | 20 days | Increased FA |
| Bordia et al., 1978 [58] | Essential garlic oil | 3 months | Increased FA |
| Chutani and Bordia, 1981 [52] | Fresh and fried garlic | acute effect and 4 weeks | Increased FA |
| Arora and Arora, 1981 [54] | Essential garlic oil | Acute effect | Slightly increased FA |
| Arora et al., 1981 [55] | Essential garlic oil | 12 weeks | Increased FA only after 4 weeks |
| Bordia et al., 1982 [51] | Essential garlic oil | 3 weeks | Increased FA |
| Lutomski, 1984 [24] | Dried garlic powder | 12 weeks | No increase in FA |

| | | | |
|---|---|---|---|
| Luley et al., 1986 [25] | Dried garlic powder | 6 weeks | No increase in FA |
| Legnani et al., 1993 [56] | Dried garlic powder | Acute and 14 days | Increased FA |
| Bordia et al., 1998 [57] | Ethyl acetate extract of garlic | 3 months | Increased FA |

**Platelet aggregation**

Obstruction of blood flow results in thromboembolic diseases and myocardial infarction. It is simply called platelet activation. ADP and thrombin Platelet aggregation which is superimposed, an antecedent incidence on an artery with atherosclerosis causing total are also responsible for platelet activation. These activated platelets change shape, put out pseudopodia, discharge their granules, and adhere to other platelets, initiating the process of platelet aggregation. Aggregation is fostered by a cytokine secreted by neutrophils, platelet activating factors (PAF), monocytes, and platelets [59]. The conclusion is that garlic has great potential to inhibit platelet aggregation.

**Human Study**

Studies conducted on humans have shown that garlic elicits a favorable reaction. Garlic also improves fibrinolysis and platelet adhesion or aggregation in humans. (Table- (Table-3).3). The dose-dependent reduction in platelet aggregation by garlic is first shown by Bordia (1978) [72]. Inhibition of In vitro platelet aggregation triggered by arachidonate, calcium ionophore, collagen, epinephrine, and ADP [57,61,73-75] is shown by Garlic oil, raw garlic, and other forms of garlic extract. Inhibition of platelet aggregation is also due to regular consumption of garlic powder and garlic oil [28,50,55,76-79].

**Table 3**
**Inhibition of Platelet aggregation (PA) in humans:**

| References | Preparations | Duration | Effect |
|---|---|---|---|
| [72 Bordia, 1978] | Garlic | In-vitro | Dose-dependent Platelet aggregation |
| Vanderhock et al., 1980 [73] | Garlic oil | In vitro | Inhibit PA |
| Boullin, 1981 [80] | Fresh garlic | Single Dose | Inhibit PA |
| Ariga et al., 1981 [85] | Methyl allyl trisulfide | In vitro | Inhibit PA |
| Arora and Arora, 1981 [54] | Ether extract of garlic | Single Dose | Increased coagulation time |
| Bordia et al., 1982 [51] | Ether extract of garlic | 3 weeks | Inhibit PA |
| Samson, 1982 [76] | Essential garlic oil | 10 days | No PA activity |
| Apitz-Castro et al., 1983 [74] | Garlic extract and 3 pure component | In vitro | Inhibit PA |
| Block et al., 1984 [86] | Ajoene | In vitro | Inhibit PA |
| Srivastava, 1984 [61] | Aqueous extract of garlic | In vitro | Inhibit PA |

| | | | |
|---|---|---|---|
| Srivastava, 1986 [75] | Aqueous extract of garlic | In vitro | Inhibit PA |
| Harenberg et al., 1988 [77] | Dried garlic powder | 4 weeks | No PA activity |
| Kiesewetter et al.,1991 [78] | Garlic powder | 4 weeks | Inhibit PA |
| Kiesewetter et al.,1993 [87] | Garlic powder | 4 weeks | Inhibit PA |
| Legnani et al., 1993 [56] | Garlic powder | Single Dose and 14 days | Inhibit PA |
| Morris et al., 1995 [88] | Oil extract (equivalent to 15 gm of raw garlic) | In-vitro and in vivo (5 days) | Inhibit PA in in-vitro No in-vivo PA activity |
| Bordia et al., 1998 [57] | Ethyl acetate extract of garlic | In-vitro study | Inhibit PA |
| Sreiner and Lin, 1998 [79] | Aged garlic extract | 10 months | Inhibit PA |
| Rahman and Billington, 2000 [28] | Aged garlic extract | 13 weeks | Inhibit PA |
| Steiner and Li, 2001 [89] | Aged garlic extract | 6 weeks | Dose-dependent inhibition of PA |

| References | Preparation | Duration | Effect |
|---|---|---|---|
| Bordia et al., 1978 [50] | Essential garlic oil | 20 days | Increased FA |
| Bordia et al., 1978 [58] | Essential garlic oil | 3 month | Increased FA |
| Chutani and Bordia, 1981 [52] | Fresh and fried garlic | acute effect and 4 weeks | Increased FA |
| Arora and Arora, 1981 [54] | Essential garlic oil | Acute effect | Slightly increased FA |
| Arora et al., 1981 [55] | Essential garlic oil | 12 weeks | Increased FA only after 4 weeks |
| Bordia et al., 1982 [51] | Essential garlic oil | 3 weeks | Increased FA |
| Lutomski, 1984 [24] | Dried garlic powder | 12 weeks | No increase in FA |
| Luley et al., 1986 [25] | Dried garlic powder | 6 weeks | No increase in FA |
| Legnani et al., 1993 [56] | Dried garlic powder | Acute and 14 days | Increased FA |
| Bordia et al., 1998 [57] | Ethyl acetate extract of garlic | 3 months | Increased FA |

**Possible Mechanism/s**

The antiplatelet mechanism of garlic is often more predictable than its other biological effects. The thromboxane formation inhibits the results of lipoxygenase and phospholipase activity produced in platelets is reduced by garlic. These effects give details about the inhibition of platelet aggregation. As garlic inhibits aggregation caused by calcium ionophore A23187, it is suggested that the

antiaggregation effect is possible because of intraplatelet enlistment of calcium. Inhibiting Garlic extract may have inhibited epinephrine-induced aggregation, decreasing cytosolic calcium concentrations via facilitating calcium uptake into platelets [75]. Studies by Jamaluddin et al. (1988) [84] show that ajoene interacts with a purified hemoprotein linked to platelet activation. The hemoprotein's binding to ligands is thought to be physiologically significant as efGarlic extract may have inhibited epinephrine- induced aggregation, decreasing cytosolic calcium concentrations via facilitating calcium uptake into platelets [75]. Studies by Jamaluddin et al. (1988) [84] show that ajoene interacts with a purified hemoprotein linked to platelet activation. The hemoprotein's binding to ligands is thought to be physiologically significant as effects modified by Ajoene. Allicin reduces the aggregation of platelets but does not change the action of vascular prostacyclin synthase. It blocks ionophore A23187-stimulated human neutrophil lysosomal enzyme release. For this purpose, garlic shows important components and its effects at various steps involved in the process of platelet aggregation.

**Animal Studies**

Garlic extracts administered intravenously to experimental animals caused modest decreases in both the diastolic and systolic blood pressure [91, 92]. Dogs' blood pressure has been shown to drop dramatically for a few hours after an intragastric dosage (as low as 2.5 mg/kg b.wt) of garlic powder) was administered [94]. According to other animal trials conducted on rats and dogs, garlic has a 'normalizing' impact on raised blood pressure [93, 95-98]. Garlic's antihypertensive effect has been shown time and time again in various research. The antihypertensive properties of allicin, a significant component of garlic, were also investigated. In hypertensive rats, long-term oral allicin therapy reduced blood pressure [99, 100]. In a rat's isolated lung, allicin also produced pulmonary vasodilatation [101]. In the '2 kidney 1-clip' model of rat hypertension, single and multiple doses of aqueous garlic extract decreased prostaglandin E2 and thromboxane B2, which in turn decreased hypertension [102]. , garlic also reduced endothelin-1-induced contraction in a dose-dependent manner, in isolated rat pulmonary arteries [103].

**Human Research**

The capacity of garlic to lessen blood pressure in people is shown in Table 4.4. Garlic's hypotensive properties were identified by Leoper and DeBray in 1921 [106]. Damrau (1941) examined previous research, as well as his studies on 26 cases [107]. An average loss in systolic (SBP) blood pressure of 12.3 mm Hg and diastolic (DBP) blood pressure of 6.5 mm Hg, a decrease in blood pressure was noted in 85% of the patients. Higher than 25% of the participants had an SBP decline of 20 millimeters of mercury or Hg or higher.

**Table 4**

**Blood pressure lowering effect in Humans:**

| References | Preparation | Duration | Dose | Effect |
|---|---|---|---|---|
| Ziaei et al., 2001 [26] | Garlic tablet (Garlet) | 3 months | 800 mg/day | ↓ hypertension |
| Qidwai, 2000 [115] | Garlic in diet | Chronic intake | 134 gm/month | ↓ SBP |
| McCrindle et al., 1998 [31] | Kwai | 8 weeks | 900 mg/day | No changes |

| | | | | |
|---|---|---|---|---|
| Steiner et al., 1996 [116] | Aged garlic extract | 6 months | 7.2 gm/day | ↓ SBP & DBP |
| Simons et al., 1995 [34] | Kwai | 12 weeks | 900 mg/day | No changes |
| Jain et al., 1993 [117] | Kwai | 12 weeks | 900 mg/day | No changes |
| Mcmahan& Vargas, 1993 [118] | Garlic powder | Acute | 2400 mg | ↓ BP |
| Kiesewetter et al., 1991 [78] | Garlic powder | 4 weeks | 800 mg/day | ↓ DBP |
| Auer et al., 1990 [119] | Kwai | 12 weeks | 600 mg/day | ↓ SBP & DBP |
| Zimmerman et al., 1990 [120] | Kwai | 3 weeks | 900 mg/day | No changes |
| Vorberg et al., 1990 [121] | Kwai | 16 weeks | 900 mg/kg | ↓ SBP & DBP |
| Piotrowski, 1948 [108] | Alcoholic extract of garlic | 1 week | 0.6–1.2 gm/day | ↓ SBP |

Among the first clinical trials in which patients with hypertension received garlic under carefully monitored conditions were examined by Piotrowski (1948) [108]. Within a week of starting administration of 0.6–1.2 g of a dialyzed, alcoholic garlic extract, two-fifths of the 100 patients showed a 20 mm Hg or higher drop in SBP. Research using dried garlic powder (Kwai tablets) revealed that taking 0.6 g of garlic powder daily could lower blood pressure by approximately 9% on average [77,109]. Additionally, a randomized double-blind trial showed that garlic had a positive effect on blood pressure and blood lipids in mildly hypertensive participants [110]. According to those reports, garlic may be helpful in the management of mild hypertension. Pektov (1979) references numerous research papers, predominantly from Bulgaria and the Soviet Union. Showing that the qualities of garlic and its compounds include lowering blood pressure. These findings also suggest an improvement in how patients feel, along with a noticeable decrease In terms of systolic blood pressure (SBP), by 20–30 mm Hg and diastolic blood pressure (DBP) by 10–20 mm Hg. Additionally, a study conducted in China in 1986 with 70 individuals with high blood pressure, who were administered 50 grams of garlic oil of raw garlic daily, found that 47 of them experienced a significant to moderate decrease in their blood pressure levels. Neil and Silagy conducted just one meta-analysis. (1994) [113]. Eight trials that were particularly carried out in hypertensive participants were all identified using the same method. Three of the seven trials evaluating the effect of garlic vs a placebo demonstrated a statistically significant decrease in systolic blood pressure (SBP), and four in diastolic blood pressure (DBP). Participants treated with garlic had a higher overall pooled mean difference in the absolute change (from baseline to final measurement) of SBP than participants treated with a placebo. The equivalent decrease in the patients treated with garlic was marginally less for DBP. "Garlic powder preparation may Be of some clinical use in subjects with mild hypertension," according to this meta-analysis. However, It is currently not supported by enough data to be advised as a standard clinical treatment for hypertensive patients. Firm conclusions require

further trials that are carefully planned, assessed, and conducted.

**Possible Mechanism/S**

Rashid and Khan (1985) suggested that the mechanism of the antihypertensive effect of garlic is through a prostaglandin-like effect that reduces peripheral vascular resistance (92). Gamma-glutamylcysteine is a compound found because garlic has the potential to inhibit the angiotensin-converting enzyme in vitro, which may reduce blood pressure (114). Garlic may protect against hypoxic pulmonary disease because it alters the synthesis and activity of endothelium-derived relaxing and constricting components. Vasoconstriction. [103] Garlic induces nitric oxide- dependent relaxation of pulmonary arteries. This hypothesis is explained by the fact that the NOS inhibitor NG- nitro-L-arginine methyl ester (L-NAME) blocks the vasodilatory action of garlic [103,104]. However, another study showed that the pulmonary vasodilatory action of allicin is independent of NO synthesis, ATP-sensitive channels (K+), and activation of cyclooxygenase enzymes (101).

**Human Studies**

Aortic stiffening is a valid surrogate marker for clinical endpoints such as myocardial infarction and cerebrovascular accident, and it is also a significant cardiovascular risk factor for morbidity and mortality. High systolic blood pressure, elevated pulse pressure with increased ventricular afterload, decreased subendocardial blood flow, and increased pulsatile stress in the peripheral arteries are all caused by elevated aortic stiffness [154]. Long-term garlic consumption has been shown to attenuate the increase in aortic stiffness with aging in the population. This implies a preventive influence on the aorta's elastic characteristics associated with human aging [155]. This study demonstrated that regular long-term consumption of garlic powder shielded endothelial cells, additionally from oxidative damage. [155]. Patients with found that a 12-week course of therapy with 800 mg/day of garlic powder was effective.

**Table 5**
**Direct cardioprotective effect of garlic in Humans:**

| References | Preparation | Duration | Dose | Effect |
|---|---|---|---|---|
| Li et al., 2000 [137] | Garlicin | 10 days | 64 mg/day i.v. drip | ↓ Unstable angina |
| Breithaupt-Grogler et al., 1997 [155] | Garlic powder | 7 years | 300 mg/day | ↑ the elastic property of blood vessels |
| Kiesewetter et al; 1993 [87] | Garlic powder | 12 weeks | 800 mg/day | ↓peripheral arterial occlusive disease |
| Kiesewetter et al., 1991 [78] | Garlic powder | 4 weeks | 800 mg/day | ↓ plasma viscosity |
| Jung et al., 1991 [157] | Garlic powder | Single dose | 900 mg/day | ↓ plasma viscosity & ↑ skin perfusion |
| Kiesewetter et al; 1990 [156] | Garlic powder | Acute | – | ↑ capillary perfusion |

**Adverse Effects**

We take it due to its longstanding use as a mainstay in our diet, we take it for granted that garlic is safe in a range of dosages. Countless years. However, a few rare reports draw attention to some of the harmful and poisonous effects of garlic. Human investigation Clinical trials employing garlic and the preparations therefore revealed relatively few side effects. The

majority of side effects that were reported were vague. The most common complaints were nausea and digestive discomfort [170]. According to a survey conducted by Koch (1995), there were there were 39 articles. Between 1938 and 1994 that detailed reactions to garlic allergies. [171]. The majority of these instances comprised allergic contact dermatitis, which has been linked to occupational exposure to allergens and can occasionally be severe [172] which has been documented in individuals who have been exposed to garlic at work. Additionally, there have been isolated reports of allergic rhinitis, conjunctivitis, or bronchospasms brought on by ingesting or inhaling garlic [173,174]. Bloating, headaches, dizziness, and excessive perspiration were among other side effects that were reported [170]. Fresh garlic with garlic powder may interact negatively interacting with platelet aggregation or anticoagulant aggregation inhibitors, potentially causing a potentially fatal bleeding episode [175 – 179].

## CONCLUSION

Garlic consumption is inversely correlated with a lower chance of cardiovascular disease progression, according to epidemiological research [180–182]. The idea that eating garlic has a major cardioprotective effect is supported by a large body of research, including studies on both humans and animals. However, some aspects of using garlic correctly, such as using the various preparations that are available, the dosage, the length of time it takes, and how it interacts with generic medications, need to be optimized. To pinpoint the precise compounds in garlic or garlic-derived products that account for the majority of its biological effects, more research needs to be done.

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HOW TO CITE: Darshana Maheshan*, Gauri Mehtre, Akanksha Kadam, Dr. Giri A. B., Recent Trends in The Management of Viral Hepatitis: A Review, Int. J. of Pharm. Sci., 2025, Vol 3, Issue 3, 2111-2126 https://doi.org/10.5281/zenodo.15076179