Semin Cancer Biol. 2021 Aug:73:219-264. doi: 10.1016/j.semcancer.2020.11.020. Epub 2020 Dec 7.

Anticancer potential of garlic and its bioactive constituents: A systematic and comprehensive review

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Abstract

Vegetables of the Allium genus, such as garlic (Allium sativum L.), onions, shallots, leaks, and chives, have been used for many years for food consumption and for medicinal purposes. Historical medical texts have indicated the therapeutic applications of garlic as an antitumor, laxative, diuretic, antibacterial and antifungal agent. Specifically, garlic's antitumor abilities have been traced back 3500 years as a chemotherapeutic agent used in Egypt. Other beneficial effects of garlic consumption include lowering blood pressure, blood cholesterol, sugar and lipids. The processing and aging of garlic result in the production of non-toxic organosulfur by-products. These sulfur-containing compounds, such as allicin, diallyl sulfide, diallyl disulfide, diallyl trisulfide, alliin, S-allylcysteine, and S-allylmercaptocysteine, impact various stages of carcinogenesis. The anticancer mechanisms of action of these garlic-derived phytochemicals include altering mitochondrial permeability, inhibiting angiogenesis, enhancing antioxidative and proapoptotic properties, and regulating cell proliferation. All these effects of garlic's sulfur-compounds have been demonstrated in various human cancers. The intent of this literature research is to explore the potential of garlic-derived products and bioactive organosulfur compounds as cancer chemopreventive and chemotherapeutic agents. This investigation employs criteria for systematic review and critically analyzes published in vitro, in vivo and clinical studies. Concerns and limitations that have arisen in past studies regarding standards of measurement, bioavailability, and method of delivery are addressed. Overall, it is hoped that through this systematic and comprehensive review, future researchers can be acquainted with the updated data assembled on anticancer properties of garlic and its phytoconstituents.

Keywords: Allium sativum; Apoptosis; Cancer; Garlic; Phytochemicals; Preclinical and clinical studies; Prevention; Proliferation; Therapy.

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PMID: 37140645 Review.

Garlic [Allium sativum]: a review of its potential use as an anti-cancer agent.

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Curr Cancer Drug Targets. 2003 Feb;3(1):67-81. doi: 10.2174/1568009033333736.

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