

Garlic: A Miraculous Herb for Oral Diseases – A Review

Ahuja A¹, Ahuja V², Yadav S³

ABSTRACT

Garlic is a member of lily family that has been used worldwide as an incredible herb in the array of medicine. In Indian traditional medicine, garlic holds a special place and is used to cure variety of diseases. It has got the reputation of a powerful healing, antibacterial and antifungal agent. It has proved beneficial in treating systemic diseases like diabetes, hypertension etc in medicine. But it has got less importance in dentistry due to lack of clinical data assuring its safe usage in curing dental diseases. Drawback of garlic is its pungent odor which restricts its oral usage as an antibacterial agent, but now a days odor less garlic preparations are available which can be utilized in treating oral diseases. This review article throws a light on the clinical applications of garlic in the field of dentistry.

Keywords: Garlic, Allicin, Herb, Phytotherapy, Periodontitis

¹ Reader

Department of Periodontics
ITS Dental College and Research Centre,
Greater Noida, UttarPradesh, INDIA

² Reader

Department of Pedodontics and Preventive
Dentistry
Manav Rachna Dental College,
Faridabad, Haryana, INDIA

³ Tutor

Sudha Rustagi Dental College and Hospital,
Faridabad, Haryana, INDIA

INTRODUCTION

Periodontitis is a severe form of gingival disease which is caused by various microorganisms, that can result in tooth loss, and is often treated with common antibiotics such as amoxicillin, but antibiotic resistance is a growing problem. Finding effective cures that are less likely to induce resistance is important (1). Ayurveda is India's traditional natural system of medicine that has been practiced for more than 5,000 years. Ayurveda provides an integrated approach for preventing and treating illness. It has its root in ancient Vedic literature and encompasses our entire life, the body, mind and spirit. Today Ayurveda is fast regaining its rightful place in the field of oral health. Various ayurvedic preparations in the form of twigs, gels, mouth washes etc. have been in use since many years to treat oral health problems. As powerful antibiotics lose their punch against "superbugs" and scientists are searching for new antimicrobial agents from natural sources. Garlic, is one such miraculous herb. The word 'garlic' is of Anglo-Saxon

origin, being derived from gar (a spear) and lac (a plant), in reference to the shape of its leaves. This was anciently accounted the poor man's treacle, it being a remedy for all diseases and hurts. Garlic (*Allium sativum*) belongs to the oldest traditional medicinal plants. Garlic is mentioned in the Bible and the Talmud. Hippocrates, Galen, Pliny the Elder, and Dioscorides all mention the use of garlic for many conditions, including parasites, respiratory problems, poor digestion, and low energy. Its use in China was first mentioned in A.D. 510 (2). The anti-infective properties of garlic have long been known to Chinese and Indian civilizations and were first described in Europe by Louis Pasteur (3). During World War II, the Soviet army used garlic to prevent infections after it had run out of antibiotics, so garlic is also called "Russian Penicilin" (4).

Garlic is one of the most extensively researched medicinal plants and its typical odor and antibacterial activity depends on allicin produced by enzymatic activity of allinase

Contact Author

Dr. Vipin Ahuja
vipinanu_2006@yahoo.co.in

J Oral Health Comm Dent 2014;8(1)51-54

(a cysteine sulfoxide lyase) on alliin after crushing or cutting garlic clove. There is a good amount of literature on antibacterial effects of fresh garlic extract; it has been reported to inhibit growth of various gram-positive and gram-negative bacteria including: Micrococcus, Enterobacter, Escherichia, Klebsiella, Lactobacilli, Pseudomonas, Salmonella, Shigella, Proteus and Helicobacter pylori. Garlic extract is also active against MDR organisms such as Pseudomonas aeruginosa, Klebsiella pneumoniae and Mycobacterium tuberculosis (5).

The antifungal, antiparasitic, antiviral, antimicrobial, antihypertensive, blood glucose lowering, antithrombotic, antitumagenic and antiplatelet properties of garlic have been reported and many of these claims have been scientifically corroborated (4).

TYPES

Allium sativum, commonly known as garlic, is a species in the onion family Alliaceae. Allium sativum grows in the wild areas where it has become naturalized. Botanists classify all true garlics under the species Allium Sativum. There are two subspecies; Ophioscorodon, or hard-necked garlics (Ophios for short) and Sativum, or soft-necked garlics. The hard-necked garlics were the original garlics and the soft-necked ones were developed or cultivated over the centuries by growers from the original hard-necks through a process of selection. The following types are classified into following subtypes (6): Allium Sativum Ophioscorodon / Hard neck garlics:

- Porcelain
- Purple Stripe
- Marbled Purple Stripe
- Glazed Purple Stripe
- Rocambole

Allium Sativum Sativum / Soft neck garlics:

- Creole
- Asiatic
- Turban

- Artichoke
- Silverskin

Porcelain garlics tend to have bulb wrappers which tend to be very thick, luxuriant and parchment-like and tightly cover their few, but large, cloves. The outer bulb wrappers are often very white and tend to have some purple strips.

Rocambole garlics tend to have thinner bulb wrappers than other ophios and lots of purple striping and splotches. They are not as white as other ophios and seem to have a brownish cast to them. They are very, very flavorful garlics and most of them are very hot.

Purple Stripe garlics are ophios (hard-necks) and are usually vividly striped with purplish vertical stripes decorating the bulb wrappers, hence their name. In between the purple stripes, their bulb wrappers are usually very white and thick. They tend to be rather rich in flavor, but not overly pungent, though some are milder, and store fairly well. They have lots of cloves, usually somewhere between 12 and 20, with lots of smaller internal cloves.

Artichokes are generally very large, store well and have a wide range of flavors with some, like Simoneti and Red Toch, being very mild and pleasant and others, such as Inchelium Red and Susanville, have greater depth of flavor. Silverskins are generally the longest storing of all garlics and have a soft pliable neck that lends itself to braiding and holds up over time better than the artichokes whose necks tend to deteriorate earlier than the silverskins.

Creoles are one of three varieties classified as weakly bolting hardnecks in that not all plants grow a scape, only some of them. They are like a mix of hardneck and softneck. They have eight to twelve cloves per bulb arranged in a circular configuration. The other two weakly bolting hardnecks are the Asiatic and Turban varieties (6).

Chemical composition: Raw Garlic, Nutritional value per 100 g (3.5 oz)	
Carbohydrates	623 kJ (149 kcal)
Sugars	33.06 g
Dietary fiber	1.00g
Fat	2.1 g
Protein	0.5 g
Beta-Carotene	6.39 g
Thiamine (Vit. B ₁)	5 µg (0%)
Riboflavin (Vit. B ₂)	0.2 mg (15%)
Niacin (Vit. B ₃)	0.11 mg (7%)
Pantothenic acid (B ₅)	0.7 mg (5%)
Vitamin B ₆	0.596 mg (12%)
Folate (Vit. B ₉)	1.235 mg (95%)
Vitamin C	3 µg (1%)
Calcium	31.2 mg (52%)
Iron	181 mg (18%)
Magnesium	1.7 mg (14%)
Phosphorus	25 mg (7%)
Potassium	153 mg (22%)
Sodium	401 mg (9%)
Zinc	17 mg (1%)
Manganese	1.672 mg (12%)
Selenium	14.2 µg
<i>Percentages are relative to US recommendations for adults. Source: USDA Nutrient database (7)</i>	

ACTIVE ANTIMICROBIAL INGREDIENT IN GARLIC:

Garlic has an unusually high concentration of sulfur-containing compounds, and its antibacterial properties are largely due to one particular class of sulfur-containing compounds, the thiosulfates (8). The thiosulfate structure [S(O)S] appears to be essential for the bactericidal, antifungal, and antiprotozoal properties of garlic, likely reacting with SH-containing enzymes of oral pathogens (9). Allicin is the most abundant thiosulfate found in garlic and is generated when the enzyme alliinase, found naturally in garlic, reacts with its substrate alliin (10). Many lines of evidence indicate that allicin is primarily responsible for garlic's anti-infective properties

(11). Although studies have found that ajoene, a metabolite of allicin found when garlic is crushed specifically in oil, also has some antibacterial properties (12).

ALLICIN

Allicin is an organosulfur compound obtained from garlic, a species in the family Alliaceae. Allicin features the thiosulfinate functional group, R-S(O)-S-R. The compound is not present in garlic unless tissue damage occurs, and is formed by the action of the enzyme alliinase on alliin. Allicin begins to break down quickly, especially if heated. Conversely its breakdown can be slowed by refrigeration (13). It was first isolated and studied in the laboratory by Chester J. Cavallito in 1944 (14). This compound exhibits antibacterial and anti-fungal properties (14).

CLINICAL SIGNIFICANCE IN DENTISTRY

Gingivitis and Periodontitis

In a study, it was concluded that the garlic extract (57.1% (w/v), containing 220µg/ml allicin) inhibited the growth of gm-ve microorganisms; the minimal inhibitory and minimum bactericidal concentrations for the Gram-negative strains was found to be MIC range 35.7–1.1mg/ml; allicin mean MIC 4.1µg/ml; mean MBC 7.9µg/ml. These data indicate that garlic extract inhibits the growth of oral pathogens and certain proteases and so may have therapeutic value, particularly for periodontitis (1). A study done by A Jamil et al concluded that Garlic allicin extract has a potential use for prevention and treatment of periodontal disease. In their study they found that allicin was found to inhibit growth of all tested bacteria (*P. gingivalis*, *Fusobacterium nucleatum*, *Actinobacillus* (*Aggregatibacter*) *actinomycetemcomitans*, *Streptococcus mutans*, *S. sobrinus*, *Escherichia coli*, and *Actinomyces viscosus*). Allicin was also found to be a potent irreversible inhibitor of the *P. gingivalis* proteases. Allicin was also found capable of killing *S. mutans*

growth in biofilm (15).

In a study, garlic extract containing the major antimicrobial component, allicin, was found active toward Gram-negative pathogens (MIC = 1.1– 17.4mgmL⁻¹) but less active against Gram-positive bacteria (MIC = 35.7–142.7mgmL⁻¹). The extract almost completely inhibited trypsin-like protease activity (implicated in the pathogenesis of periodontitis) of *P. gingivalis*. Taken together, these observations suggest that garlic extract or allicin may be of therapeutic use against periodontal diseases (1).

ANTICARIOGENIC

In one study done in Bapuji dental college and hospital, Davangere, Karnataka, India, it was concluded that garlic mouth wash is significantly active against streptococcus mutans and lactobacilli, and found that garlic significantly reduced bacterial count on 14th day even after discontinuation of mouthwash on 7th day (16).

In an in vitro study (17), inhibitory activity of garlic extracts on multidrug-resistant (MDR) strains of *Streptococcus mutans* isolated from human carious teeth was assessed, all isolates MDR – and non MDR of *S. mutans* were sensitive to garlic extracts with the MIC ranging from 4 - 32µgml⁻¹

3) Oral thrush: Garlic cloves can be used as a remedy for, fungal infections such as thrush (18).

CHALLENGES AHEAD OF GARLIC THERAPY

- **Fibronolytic activity:** Aqueous garlic extracts and garlic oil have been shown in vivo to alter the plasma fibrinogen level, coagulation time, and fibrinolytic activity. Serum fibrinolytic activity increased after administration of dry garlic or garlic extracts to animals that were artificially rendered arteriosclerotic (19). Garlic inhibited platelet aggregation in both in vitro and in vivo studies. Inhibition

of the arachidonic acid cascade appears to be one of the mechanisms by which the various constituents and their metabolites affect platelet aggregation. Inhibition of platelet cyclic AMP phosphodiesterase may also be involved (20).

- **Bad breath, Burning sensation and Nausea:** Clinical trials have shown that “garlic breath” and body odor are the most common (and well-documented) complaints associated to garlic intake. In a study, assessment of bad breath, burning sensation and nausea to different mouthwashes were assessed, and they concluded that 2.5% Garlic mouth wash showed significant adverse effects than other mouthwashes (1).
- **Interference with drugs:** Garlic may interact with warfarin, anti-platelets, saquinavir, antihypertensives, calcium channel blockers, and hypoglycemic drugs. So in medically compromised patients who are on following medication garlic should be used with precaution (21).
- **Allergic reactions:** Case reports have highlighted the possibility that garlic use may cause allergic reactions (allergic contact dermatitis, generalized urticaria, angioedema, pemphigus, anaphylaxis and photoallergy), alteration of platelet function and coagulation (with a possible risk of bleeding), and burns (when fresh garlic is applied on the skin, particularly under occlusive dressings). Finally, garlic may enhance the pharmacological effect of anticoagulants (e.g. warfarin, fluindione) and reduce the efficacy of anti-AIDS drugs (i. e. saquinavir) (22).
- Garlic should not be taken during pregnancy since it has abortifacient properties. It should also be avoided during lactation as it has been shown to enter breast milk, altering the odour of the milk and affecting the suckling behaviour of the infant (23).

Advantages of garlic

- In antibiotic therapy, there may be development of resistance by bacteria but in case of garlic there is no resistance developed against garlic.
- Garlic preparations are easily available, cheaper alternative to antibiotics
- Garlic improves the digestion.
- Garlic can be used in pregnant patients in controlled doses and in patients where antibiotics are contraindicated.
- Garlic is also alleged to help regulate blood sugar levels. Regular and prolonged use of therapeutic amounts of aged garlic extracts lower blood homocysteine levels and has shown to prevent some complications of diabetes mellitus (24). Oral administration of garlic powder (800mg/day) to 120 patients for 4 weeks in a double-blind, placebo-controlled study decreased the average blood glucose by 11.6% (30). Another study found no such activity after dosing noninsulin-dependent patients with 700 mg/day of a spray-dried garlic preparation for 1 month (25).
- Garlic is an effective way to prevent scurvy, due to its vitamin C content (26).

CONCLUSION

Garlic has an effective antibacterial potential to combat oral pathogens and holds promise for the treatment of periodontal diseases, dental caries and other diseases of the oral cavity. As people are realizing that modern medicine is not the soul remedy for infections today. So, many of us are adapting 'Back to nature' approaches like phytotherapy. Garlic therapy is one such therapy. Its known fact that Garlic is used to ward off the evil effects; few studies are there to support its beneficial effects to remove the microbial devils from the oral cavity. It is a great challenge for

researchers over the world to make a proper use of garlic and enjoy its maximum beneficial effect as it is the cheapest way to prevent bacterial and fungal diseases.

REFERENCES

1. Bakri I, Douglas C. Inhibitory effect of garlic extract on oral bacteria. *Arch Oral Biol* 2005;**50**(7):645-51.
2. Indianmirror.com [homepage on the Internet]. Tamilnadu. Ayurveda>Garlic>History Available at <http://www.indianmirror.com/ayurveda/garlic.html>
3. Hahn G. Garlic: the science and therapeutic application of *Allium sativum* L. and related species. In: HP Koch, LD Lawson editors. History, folk medicine and legendary uses of garlic. 2nd ed. Williams and Wilkins, Baltimore; 1996:pp 1-24.
4. Yilmaz HH, Gormez O, Hastar E, Yildirim D, Aksoy MC. Garlic Burn in a Patient with Trigeminal Neuralgia: A Case Report. *Eur J Dent* 2010;**4**(1):88-90.
5. Jain RC. Antitubercular activity of garlic oil. *Indian J Pathol Microbiol* 1998;**41**:131-35.
6. Gourmetgarlicgardens.com. [homepage on the Internet]. Garlic information center and boutique. Texas. A Garlic Overview. Garlic, the sweet breath of life. (Updated Dec 29, 2010) Available at <http://www.gourmetgarlicgardens.com/overview.htm>
7. Usda.gov [homepage on the Internet]. United States Department of Agriculture. The National Agricultural Library. Nutrient database. Available at <http://www.nal.usda.gov>.
8. Lawson LD. Garlic: the science and therapeutic application of *Allium sativum* L. and related species. In: HP Koch, LD Lawson editors. The composition and chemistry of garlic cloves and processed garlic 2nd ed. Williams and Wilkins, Baltimore 1996;pp38-39.
9. Willis E. Enzyme inhibition by allicin, the active principle of garlic. *Biochem J* 1956;**63**:514-20.
10. Stoll AE. Seebeck Chemical investigations on alliin, the specific principle of garlic. *Adv Enzymol* 1951;**11**:377-400.
11. Ankri SD. Antimicrobial properties of allicin from garlic. *Microbes Infect* 1999;**1**:125-29.
12. Naganawa RN, Iwata K, Ishikawa H, Fukuda T, Fujino A, Suzuki Inhibition of microbial growth by ajoene, a sulfur-containing compound derived from garlic. *Appl Environ Microbiol* 1996;**62**:4238-42.
13. Eric Block. "The chemistry of garlic and onions". *Scientific American* 1985;**252**:114-19.
14. Cavallito CJ, Bailey JH, "Allicin, the Antibacterial Principle of *Allium sativum*. I. Isolation, Physical Properties and Antibacterial Action. *J Am Chem Soc* 1944;**66**:1950-51.
15. Jamil A, Steinberg D, Ludmer Z, Golan T, Naor R, Bachrach G. Garlic allicin as a means to control oral pathogens. Work submitted to the Hebrew university, Hadassah, Jerusalem, Israel. Available at http://iadr.confex.com/iadr/israel07/techprogram/abstract_96642.htm
16. Prabhakar AR, Vipin Ahuja, Basappa N. Effect of Curry Leaves, Garlic and Tea Tree Oil on Streptococcus Mutans and Lactobacilli in Children: A Clinical and Microbiological Study. *Pesq Bras Odontop Clin Integr, João Pessoa* 2009;**9**(3):259-63.
17. MM Fani, J Kohanteb, M Dayaghi. Inhibitory activity of garlic (*Allium sativum*) extract on multidrug-resistant Streptococcus mutans. *JISPPD* 2007; **25**(4):164-68.
18. Lemar KM, Passa O, Aon MA. "Allyl alcohol and garlic (*Allium sativum*) extract produce oxidative stress in *Candida albicans*". *Microbiology* 2005;**151**(10): 3257-65.
19. Bordia A, Verma SK. Effect of garlic on regression of experimental atherosclerosis in rabbits. *Artery* 1980;**7**:428-37.
20. Agarwal KC. Therapeutic actions of garlic constituents. *Medical Research Reviews* 1996;**16**:111-24.
21. Hogg Jennifer. UK Medicines Information Complementary Medicines Summary, "Garlic Supplements". [Serial on the Internet]. Cited 07-07-2007 Available At http://www.ukmi.nhs.uk/Med_info/documents/GarlicSupps.
22. Borrelli F, Capasso R, Izzo A. Garlic (*Allium sativum* L.): Adverse effects and drug interactions in humans. *Mol Nutr Food Res* 2007;**51**(11):1386-97.
23. Barnes J, Anderson LA, Phillipson JD. Herbal Medicines. 2nd edition. London: Pharmaceutical Press; 2002.
24. Patricia Andersen-Parrado. People with diabetes should say 'yes' to garlic. Better Nutrition, Sept 1996.
25. Sitprija S, et al. Garlic and diabetes mellitus phase II clinical trial. *J Med Assoc Thailand* 1987;**70**:223-27.
26. Jones W, Goebel RJ. "Garlic and Health". In Watson RR. Vegetables, Fruits, and Herbs in Health Promotion. Boca Raton: CRC Press 2001;pp205-16.