



ETHNOPHARMACOLOGY AND TRADITIONAL ATTRIBUTES OF CLOVE (*SYZYGIUM AROMATICUM*)

Yogesh Yadav¹, Dinesh¹, Ashok Kumar¹, Megha Kumari¹, Raaz K Maheshwari^{1*}

¹Department of Chemistry, University of Rajasthan, Jaipur, Rajasthan

¹Department of Chemistry, SBRM Govt PG College, Nagaur, Rajasthan

Received on: 28.5.2022

Revised on: 11.6.2022

Accepted on: 17.6.2022

Abstract

Cloves are the sweet-smelling dried flower buds. Eugenol is the main bioactive compound of clove. With regard to the phenolic acids, gallic acid is the compound found in higher concentration. This essential oil mainly comprises eugenol, followed by β -caryophyllene, α -humulene, and eugenyl acetate as the main components. Other minor constituents including methyl amylketone, kaempferol, gallic acid, α -humulene, β -humulene, methyl salicylate, cratogeomycetic acid, and benzaldehyde are responsible for the characteristic pleasant fragrance of clove. Cloves help reduce inflammation, thereby preventing heartburns and stomach spasms. Anecdotal evidence suggests that chewing cloves have an alkaline and carminative effect on the stomach and gastrointestinal tract, which doesn't allow gas formation. Furthermore, cloves prevent flatulence and bloating.

Keywords

Eugenol, Anti-microbial, Antidiabetic, Clove bud, Clove essential oil.

INTRODUCTION

Clove are the aromatic flower buds of a tree in the family Myrtaceae, *Syzygium aromaticum*. The name comes from the Latin word *clavus*. The name comes from the French "clou" meaning nail. Clove generally are dried flower buds from the clove tree. Clove were important in the earliest spice trade and are believed to be indigenous to the Moluccas, or Spice Islands, of Indonesia. The clove tree is frequently cultivated in coastal areas at maximum altitudes of 200 m above the sea level. The production of flower buds, which is the commercialized part of this tree, starts after 4 years of plantation. Cloves are harvested mainly in Indonesia, India, Madagascar, Zanzibar, and Sri Lanka. [1-2] They have a numbing effect on mouth tissues. The clove tree is an evergreen that grows to a height ranging from 8–12 m, having large leaves and sanguine flowers in numerous groups of terminal clusters. The flower buds are at first of a pale color and gradually become green, after which they enlarge into a bright red, when they are ready for collect. Cloves are harvested when 1.5–2 cm long, and consist of a long calyx,

terminating in four spreading sepals, and four unopened petals which form a small ball in the center. [9] are collected in the maturation phase before flowering. Eugenol, the most important composition of Clove oil, has been accepted as food preservatives by China, US European Union, and other countries and regions. Majorly clove is consumed as a spice in Indian home kitchens. This plant contains active constituents that possess anti-fungal, anti-viral, anti-microbial, antidiabetic, anti-platelet, anaesthetic, anti-inflammatory, anti-oxidant, antithrombotic, pain-relieving, and insect repellent properties. This plant serves as the richest source of phenolic compounds such as eugenol, eugenol acetate, and gallic acid which is used in various applications like in agriculture, pharmaceutical, and in various food preservatives. This review includes the main studies reporting the biological activities of clove and eugenol. The antioxidant and antimicrobial activity of clove is higher than many fruits, vegetables and other spices and should deserve special attention. Pharmacokinetics and toxicological studies were also mentioned. [3-5]



Fig. 1: Clove plant, fresh and dried buds

Phytochemicals constituents of clove

Clove yields various kinds of volatile oil from leaves, stem, buds and the fruit. Stem oil differs extensively in yield and quality. The main extract of the oil is eugenol. Bud oil contains Eugenol (70–85%), eugenyl acetic acid (15%), and β -caryophyllene (5–12%), which together constitutes 99% of the oil. The constituents of the oil likewise incorporate methyl amyl ketone, methyl salicylate, α and β -humulene, benzaldehyde, β -ylangene, and chavicol. The fragrance of the clove is due to the presence of minor constituents like methyl amyl ketone, methylsalicylate. Stem oil also contains 76.4–84.8% eugenol and 1.5–8.0% eugenyl acetate. Both bud and stem oil contain 7.3–12.4% β -caryophyllene and 1.0–1.4% α -humulene. [6-8] There are 36 compounds extracted from the volatile oil of clove buds. Clove leaves yield 3.0–4.8% basic oil. Clove bud and leaf oil contain different classes of chemical extract, for example, monoterpenes, sesquiterpenes, aldehydes, and ketones. Clove stem contains 6% of oil. The stem oil consists of light yellow fluid containing 80.2% eugenol and 6.6% β -caryophyllene. It contains 2% of oil, which possesses 50–55% eugenol. Non-Volatile Chemical constituents: Few non-volatiles oils have been isolated from clove, which include tannins, sterols, triterpenes, and flavonoids. Tannins: 10–13% of tannins components are present in non-volatile oil among which Eugenol glucoside gallate, a chromone C-glycoside, galloyl, and hexahydroxy diphenyl esters of 2, 4, 6-trihydroxy acetophenone-3-glucopyranoside were extracted from leaves. The two ellagitannins, syzyginin A (1, 2, 3-tri-O-galloyl-4, 6-(S)-tergalloyl- β -D-glucoside) and syzyginin B, were also obtained from the clove leaves. Cloves have about 2% of the triterpene and oleanolic acid. Maslinic acid and 2 α -hydroxyoleanolic acids were also extracted from clove buds. Sterols extracted from clove include sitosterol, stigmasterol, and campesterol. A chromone C-glycoside, isobiflorin (5, 7-dihydroxy-2-methoxychromone-8-C- β -D-glucopyranoside), and biflorin were isolated from the ethanolic extract of cloves. The seed of the clove possesses various ailments viz., apigenin 6-C-(β -D-xylopyranosyl-(1 \rightarrow 2'')- β -D-galactopyranoside)-7-O- β -D-glucopyranoside and apigenin-6-C-(β -D-xylopyranosyl-(1 \rightarrow 2'')- β -D-galactopyranoside)-7-O- β -D-(6-O-pcoumaryl glucopyranoside). [5-10]

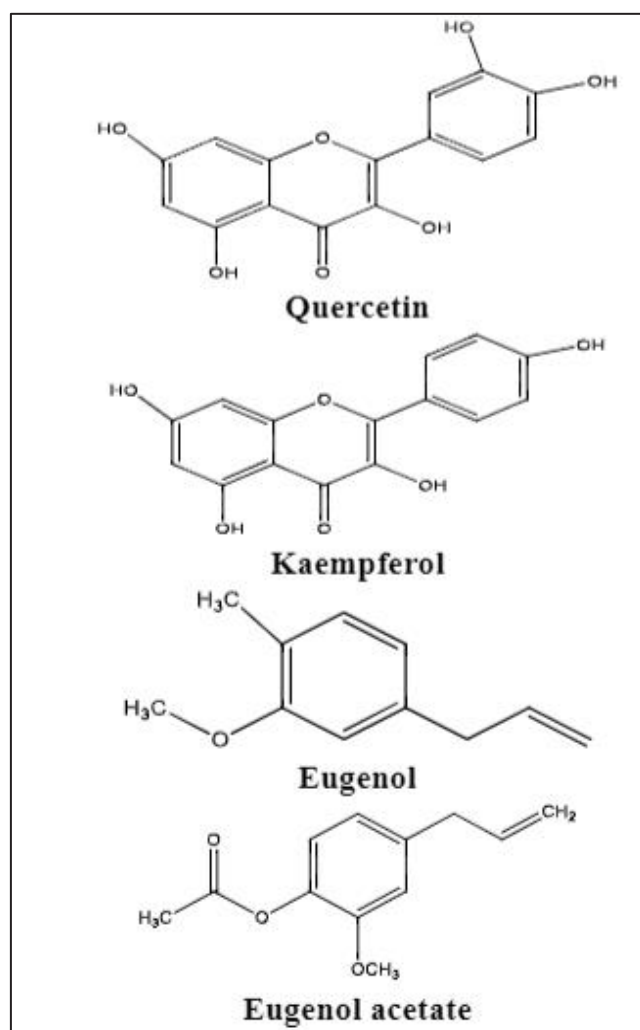


Fig. 2. Major chemical components of clove with their structures.

Ethnopharmacological relevance of Clove and its oil

Clove is known to possess antibacterial properties and is used in various dental creams, tooth pastes, mouth washes, and throat sprays to cleanse bacteria. It is also used to relieve pain from sore gums and improves overall dental health. In dentistry, eugenol in combination with zinc oxide is used for provisional filling of cavities. Clove is an anodyne (an agent that soothes or relieves pain) for dental emergencies. Cloves are aphrodisiac (an agent for arousing or increasing sexual desire or potency). Clove is used as an anti-inflammatory agent, due to its high content of flavonoids. Aroma therapists use pure clove oil to cure the symptoms of rheumatism and arthritis. Clove is used as a carminative, to increase hydrochloric acid in the stomach and to improve peristalsis.

[6-11] Apply the paste of clove powder in honey to treat spots. Paste of clove powder in water promotes faster healing of cut and bite. Cloves can efficiently cure many digestive problems. It is having medicinal qualities to cure flatulence, loose motions, indigestion and nausea. Cloves are useful in relieve the symptoms of diarrhea, gastric irritability and vomiting. Clove and clove oil boost the protected system by purifying the blood and help to fight against various diseases. Clove oil is effective in remedial Athlete's foot and nail fungus. Cloves are good expectorants that promote the free of mucous and secretions in the respiratory passage. The aromatic clove oil, when inhaled can help calm positive respiratory conditions like cold, cough, asthma, bronchitis, and sinusitis. It also helps in clearing the nasal tract. Cloves can successfully prevent the lung cancer as well as the skin cancer. Eugenol helps in minimizing the harmful effects of environmental wastes that can cause cancer of digestive system. Clove oil stimulate blood flow and circulation making it useful for the people having cold extremity. Cloves benefit the diabetic patients by controlling the blood glucose levels. Eugenol is powerful enough for preventing blood clots. Sucking of a clove bud reduce desire for alcohol. Muscular cramps are often relieved, when the oil of clove is applied as a poultice near the affected area. Cloves also help prevent the stop working in retina of the eye, which slows down macular collapse and aids vision in the old age. The underlying mechanism is through the prevention of the breakdown of docosahexaenoic acid, which preserves vision in elderly people. [11-13] Researchers found that sniffing the spicy aroma of cloves reduces drowsiness, irritability and headaches. One drop of clove oil applied to the roof of the mouth can instantly relieve many headaches. Clove enhances memory retention. It is recommended for relieving brain fog, lethargy and depressive state of mind. Research has shown that clove oil is an effective mosquito repellent. The most prominent use of clove oil in dental care. The germicidal properties of the oil make it very effective for relieve dental pain, tooth ache, sore gums and mouth ulcers. Clove oil contains the composite eugenol, which has been used in dentistry since numerous years. Gargles with diluted clove oil help in easing the throat. The character smell of clove oil helps removing bad breath. As a result, clove oil is added to numerous dental products and medications, including, mouth washes, and tooth pastes. Dentists also mix clove oil with zinc oxide and prepare a white filling material as a temporary alternative to root canal. Clove oil, it's still in dentistry today as antiseptic and pain reliever. According to a 2005 in vivo and in vitro study on immunosuppressed rat, the main compound in clove oil (eugenol) was found to be as effective in treating oral thrush. Clove contain eugenol is the most powerful of these, with antiseptic properties that have been shown to kill the *Candida* yeast cells. Eugenol is also an immune system stimulant, which means it helps to increase the body's disease fighting powers. Due to its antiseptic properties, clove oil is useful for wound, cuts, scabies, athlete's foot, fungal infections, bruises, prickly heat, scabies

etc. It can also be used insect bites and stings. Clove oil is aphrodisiac in nature and hence serves as an outstanding stress reliever. It has a exciting effect on the mind and removes mental collapse and fatigue. When taken internally, in proper amounts, it refreshes the mind. Clove oil also induces the sleeps and is helpful to insomnias patients. It is useful for treating mental problems such as loss of memory, depression and anxiety. Clove oil has a cooling and anti-inflammatory effect, and in this manner clear the nasal passage. This expectorant is useful in various respiratory disorders including coughs, colds, bronchitis, asthma, sinusitis, and tuberculosis. [14-19]

Culinary and other uses

Clove is a valuable kitchen spice which can be used for studding onions, tomatoes, salads, herbal teas, and soups. It is also used to flavor meat products, cookies, chewing gums, spiced fruits, pickles, chocolates, soft drinks, puddings, sandwiches, pastries, and candies. Volatile oil is used to impart essence to perfumes soaps, toothpastes, and pharmaceuticals. In Indonesia, mixture of clove and tobacco in a ratio of 1:2 is used to make a special cigarette "Kretek". Clove possesses antibacterial potential and is used in a variety of mouth washes, dental creams, throat sprays, and tooth pastes to kill pathogens. It is also used to relive sore gums. Mixture of eugenol (major bioactive constituent of clove) and zinc oxide is used for short-term filling of dental cavities. Clove oil has anti-inflammatory properties due to the presence of flavonoids. Pure clove oil is used in aromatherapy of arthritis and rheumatism. Paste of clove powder and honey is used to cure skin conditions. Paste of water and clove powder boosts healing process of bites and cuts. Clove is used to treat various digestive disorders including loose motion, flatulence, nausea, and dyspepsia. Clove oil improves body defense system and help to fight against invading microbes. It is also used to cure Onychomycosis and Athlete's foot disease. Inhalation of clove essential oil soothes various respiratory conditions such as asthma, cold, cough, sinusitis, and bronchitis. Cloves have anticancer potential and are used to cure skin and lung carcinoma. Clove is good for diabetic patients as it controls the blood level of glucose. Eugenol prevents the formation of blood clots. Topical application of clove oil relieves muscular cramps. Cloves also prevent the breakdown in eye's retina, which slows down muscles degeneration and assists vision in the old age. Sniffing of clove aroma reduces lethargy, restlessness, and headaches. Application of one drop of clove oil can soothe headache. Clove improves memory by relieving mental fog, drowsiness, and depression. Clove oil is mosquito repellent. Antioxidant potential of clove is higher than many other medicinal plants. One drop of clove oil is 400 times more potent than blueberries.

CONCLUSION

Clove (*Syzygium aromaticum*) is one of the most valuable spices that has been used for centuries as food preservative and for many medicinal purposes. This plant represents one

of the richest source of phenolic compounds such as eugenol, eugenol acetate and gallic acid and posses great potential for pharmaceutical, cosmetic, food and agricultural applications. Clove is a vital source of phenolic compounds such as flavonoids, hydroxycinnamic acids, hydroxybenzoic acids, and hydroxyphenyl propenes. Eugenol is the chief bioactive constituent of clove. Clove consist of acetyl eugenol, betacaryophyllene and vanillin; crategolic acid; tannins etc. Based on this above information it could be conclude that the clove is a very interesting and important plant which is used for the treatment of various medical conditions because it has various active constituent present in it but most important constituent that is eugenol have various pharmacological activity and for this all miraculous activity of this plant we can confirm that why this plants has been engaged for various centuries. With regard to the phenolic acids, gallic acid isfound in higher concentration. Other phenolic acids found in clove are caffeic,ferulic, elagic and salicylic acids. Flavonoids including kaempferol, quercetin and its derivates (glycosilated) are also found in trace amounts. Appreciable amounts of essential oil are present in aerial parts of clove. Good quality clove bud contains volatile oil which mainly comprises of eugenol, eugenyl acetate and betacaryophyllene.

REFERENCES

1. **Yadav M, Yadav P, Sahu S, Yadav V, Gupta SN.** *Review Literature On Clove.* 2021;9(1):1883-188.
2. **Milind P, Deepa K.** Clove: A Champion Spice. *Int J of Res Ayu Pharm.* 2011;2(1) 47-54.
3. **Hu Q, Zhou M, Wei S.** Progress on the Antimicrobial activity research of clove oil and eugenol in the food antiseptis field. *J Food Sci.* 2018; 83(6):13-17.
4. **Yadav S, Gupta SK, Bharti D, Yogi B.** Syzygium Aromaticum (clove): A Review on Various phytochemicals and pharmacological activates in medicinal plant. *World J. Pharmaceut Res.* 2020; 9(11):13-17.
5. **Pulikottil SJ, Nath S.** Potential of clove of Syzgium aromatiu in development of a therapeutic agent for periodontal disease: A review. *SADJ* 2015;70:108-115.
6. **Uddin AM., Shahinuzzaman M, Rana SM, Yaakob Z.** Study of chemical composition and medicinal Properties of volatile oil from clove buds: *Int J Pharmaceut Sci Res.* 2017; 8(2):24-30.
7. **Rojas DFC, Fernandes de Souza CR, Oliveira WP.** Clove (*Syzygium aromaticum*): a precious spice Asian *Pac. J Trop Biomed.* 2014;4(2): 90–96. doi: 10.1016/S2221-1691(14)60215-X.
8. **Gülçin I, Elmastaş M, Enein HYA.** Antioxidant activity of clove oil-A powerful antioxidant source. *Arab J Chem.* 2012;5(4):489–499.
9. **Hussain S, Rehman R, Mushtaq A, Belaskri PAEZ.** Clove: A review of a precious species with multiple uses *Int J Che Bioche Sci* 11(2017):129-133.
10. **Hussain S, Rahman R, Mushtaq A, Belaskri PAEZ.** Deepa MK. Clove: a champion spice. *Int J Res Ayurveda Pharm.* 2011;2(1): 47-54.
11. **Shan B, Cai YZ, M. Sun MH, Corke H.** Antioxidant capacity of 26 spice extracts and characterization of their phenolic constituents. *J Agri Food Chem.* 2005; 53(20):7749-7759.
12. **Thakur S, Choudhary S, Kumari I, Madhusudan S, Walia B, Kaurav H, Chaudhary G.** Clove (*Syzygium aromaticum*) – A review based upon its traditional therapeutic uses. *Int J Curr Res.* 2021;13(02):16368-16375. <https://doi.org/10.24941/ijcr.40804.02.2021>.
13. **Nonaka G, Harada M, Nishioka I.** Eugenin, a new ellagitannin from cloves. *Chem Pharmacol Bull.* 1980; 28: 685–687.
14. **Narayanan CR, Natu AA.** Triterpene acids of Indian clove buds. *Phytochem.* 1974; 13(9):1999–2000.
15. **Brieskorn CH, Munzhuber K, Unger G.** Crataegolsaure and steroid glukoside aus blutenknospen von *Syzygium aromaticum*. *Phytochem.* 1975; 14: 2308–2309.
16. **Zhang YW, Chen Y.** Isobiflorin, a chromone-C-glucoside from cloves (*Eugenia caryophyllata*). *Phytochem.* 1997; 45: 401–403.
17. **Nassar MI.** Flavonoid triglycosides from the seeds of *Syzygium aromaticum*. *Carbohy Res.* 2006; 341: 160–163.
18. **Cai L, CD Wu.** Compounds from *Syzygium aromaticum* possessing growth inhibitory activity against oral pathogens. *J Nat Prod.* 1996; 59(10): 987-990.
19. **Chaieb K, Hajlaoui H, Zmantar T, Nakbi ABK, Rouabhia M, Mahdouani K, Bakhrouf A.** The chemical composition and biological activity of clove essential oil, *Eugenia caryophyllata* (*Syzygium aromaticum* L. Myrtaceae): a short review *Phyther Res.* 2007;21(6):501-506. doi: 10.1002/ptr.2124.