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Review Article

Therapeutic and Nutritional Effect of Clove: A Miracle Spice

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ABSTRACT

Clove, also known as Syzygium aromaticum (Family Myrtaceace), is the most important and second-most precious spice traded worldwide. Clove is a rich source of nutrients. Eugenol was discovered to exist in clove essential oil as a significant component. An examination of the essential oil's phytochemistry revealed the presence of steroids, glycosides, alkaloids, flavanoids, saponins, and flavonoids. Numerous pharmacological actions, including antihyperlipidemic, antibacterial, antifungal, anticancer, and anti-inflammatory, are present in clove.

INTRODUCTION

The tree *Syzygium aromaticum* (L.) (also known as Eugenia caryophyllus) belongs to the family Myrtaceae and is indigenous to Indonesia. Cloves are the plant's fragrant flower buds, and they are frequently used as spices. Madagascar, Comoro Islands, Seychelles, Tanzania, and India, Pakistan, and Sri Lanka are among the African nations where cloves are economically harvested. The medicinal benefits of *S. aromaticum* have been recognized in numerous ways. In China and Western nations, the clove plant is used as drugs for a variety of conditions of illnesses [1]. Additionally, the plant is utilized to reduce pain, start uterine contractions, create stomach distension, and gastrointestinal spasm, as well as to regulate nausea, vomiting, coughing, diarrhoea, dyspepsia, flatulence, and stomach cramps [2]. In conventional medicine, cloves are also used as a diuretic and as a spice with stimulating and carminative properties. This fragrant plant's essential oil is used as a flavoring and fragrance ingredient as well as a dietary antioxidant that is thought to protect against a number of ailments brought on by free radicals. Only around 10% of cloves are reportedly used for medicines; the bulk are reportedly used by Indonesian kretek cigarette producers [3].

Nutritional Composition of Clove

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As demonstrated in table 1, adding whole or ground cloves to food to add taste can supply certain essential nutrients because cloves include fiber, vitamins, and minerals[4].

Nutrients	Per 100 g
Total Fats	13 g
Total Carbohydrates	66 g
Total Protein	6 g
Magnesium	259 mg
Iron	11.8 mg
Calcium	632 mg
Potassium	1020 mg
Vitamin C	0.2 mg
cholesterol	0 mg

Table 1: Nutritional Composition of Clove

Distribution

Cloves are the second most valuable and significant spice traded worldwide. The North Maluku Islands in Indonesia are home to the widely grown clove plant. Clove farming is only permitted in Kerala, Tamil Nadu, and Karnataka in India. Since different countries have distinct harvest seasons, cloves are accessible all year long[5-8].

Chemistry of Clove

Numerous researches have shown that *S. aromaticum* is one of the major vegetal sources of phenolic compounds, as well as terpenoids. Eugenol, which makes up between 72% and 90% of the volatile oil in cloves, is primarily responsible for the aroma of the clove [9-11]. Eugenyl acetate, vanillin, methyl salicylate, -caryophyllene, pinene, and -humulene are other components of essential oils that are frequently found in plants.

Clove Essential Oil

Clove essential oil's components and content vary according on the variety, agroecological conditions, pretreatments, processing, and extraction techniques[12-13]. Using whole or ground cloves is beneficial because they contain fiber, vitamins, and minerals. The methanol extract of *S. aromaticum* was shown to contain the phenolic components biflorin, 7-dihydroxy-2-methylchromone 8-C-d-glucopyranoside, rhamnocitrin, kaempferol, myricetin, ellagic acid, gallic acid, and the terpenoid oleanolic acid. 18 hydrolyzable tannins were also present in an aqueous acetone extract of dried *S. aromaticum* flower buds [8]. Tellimagrandin II, casuarin, rugosin D, rugosin F, heterophylliin D, euprostin A, 1,2-di-Ogalloyl-3-O, aromatinin A, platycaryanin A, bicornin, syzyginin A, alunusnin A, rugosin C, and rugosin are some examples of these compounds.

Pharmacological Activity

Numerous Health benefits of clove (clove bud, clove powder, clove oil)are shown in figure 1.

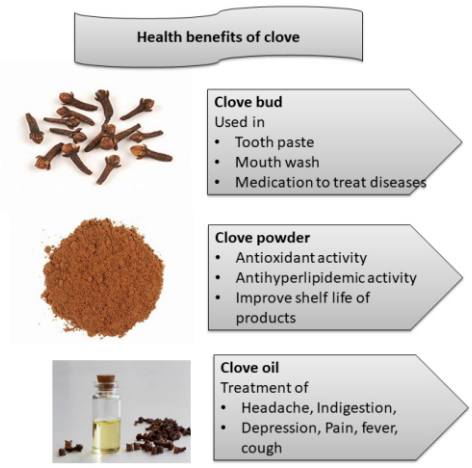

Figure 1: Health Benefits of Clove

Antihyperlipidemic Effect

Eugenol, a substance has demonstrated anti-hypercholesterolemic efficacy in piper betle extract. In rats given HFD and high fructose diets, the medication had the beneficial benefits of preventing hepatic fat formation and improving the structural integrity of the pancreas and liver[14-19].

Antimicrobial Activity

Clove and rosemary oils greatly slow the growth of bacteria and fungi that were put to the test. Using agar well diffusion method, ten bacterial strains and seven fungus strains were examined. When compared to extract and sodium propionate, clove oil had a stronger antibacterial impact [20-22]. The antibacterial activity of essential oils from *S. aromaticum* was tested against 25 bacterial strains, including those associated with food-borne, animal, and plant illnesses. Cinnamon, garlic, and clove significantly inhibited the activities of these strains in a dose-dependent manner. Ginger and mint showed very little inhibition at the same dose[23, 24].

Cytotoxic Activity

The capacity of borneol and eugenol, derivatives of clove oil, to control resistance to the DNA-damaging effects of H_2O_2 was investigated. Eugenol caused substantial levels of DNA damage to human fibroblast cells (VH10), but no genotoxic effects on hepatocyte cells(HepG2)[25].

Antioxidant Activity

The antioxidant activity of clove, sage, and oregano essential oils was evaluated. Soybean oil was treated with 0.006 and 0.01 g/ml of essential oils for 30 days at an accelerated oxidation level. More potency than any other oil tested was shown for clove oil[26].

Antiviral Activity

At a concentration of 10 g/ml, eugenin, which was extracted from clove bud essential oil, effectively inhibits the herpes simplex virus[27].

Hepatoprotective Activity

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In Wistar albino rats, the hepatoprotective activity of the paracetamol high liver damage assay was used to examine clove aqueous extract at doses of 0.1 and 0.2g/kg. Increased levels of cytopalsmic enzymes were used to gauge the extent of liver injury (aspartate aminotransferase and alanine aminotransferase). The serum enzyme concentrations were returned to normal by clove extract [28].

Analgesic Activity

Rabbits were given eugenol intravenously and intragastrically to test its analgesic effects. It was commonplace to use paracetamol. Eugenol had a stronger ability than paracetamol to reduce fever [29].

Anesthetic Activity

"Eugenol," a derivative of clove oil, as an anaesthetic is being investigated by researchers at the University of Bristol. Eugenol induces anaesthesia at a considerably lower concentration than typical drugs. Recovery durations for fish exposed to eugenol were 6–10 times greater than for fish subjected to tricaine methanesulfonate [30].

Toxicity

When taken in small doses (1.5g/kg), clove oil is regarded as safe. The recommended dose of clove for humans, according to the World Health Organization, is 2.5 mg/kg/day. *Poecilia reticulata* and *Danio rerio* aquarium fish were used to test the toxicity of clove oil. In *Danio rerio* and *Poecilia reticulate*, the LD_{50} values were 18.2 ± 5.52 mg/ml and 21.7 ± 0.8 mg/ml respectively, at 96 hours [31].

CONCLUSIONS

Based on the facts provided, it is possible to draw the conclusion that clove is a highly intriguing plant with a great deal of promise and a wealth of antioxidant chemicals. It has been demonstrated that biological processes point to the creation of therapeutics for both humans and animals and support the long-standing use of this plant.

Conflicts of Interest

The authors declare no conflict of interest.

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REFERENCES

[1] Wankhede TB. Evaluation of antioxidant and antimicrobial activity of the Indian clove Syzygium aromaticum L. Merr. and Perr. International Research Journal of Science and Engineering. 2015; 3:166-72.

[2] Shukla V, Mendiratta S, Zende R, Badhe S. Evaluation of the in-vitro antimicrobial activity of clove and oregano essential oils against foodborne microbes and its comparison with antibiotics. The Pharma Innovation Journal. 2022; 11:732-8.

[3] Picanço JMA, Limberger RP, Apel MA. Where should I start? A scoping review about the publications on clove cigarettes. Critical Reviews in Toxicology. 2022 Apr; 52(4):259-293. doi: 10.1080/10408444.2022.2097053

[4] Adebisi AA, Olumide MD, Akintunde AO. Nutritive value and phytochemical screening of turmeric and clove as a potential phyto-additive in livestock production. Nigerian Journal of Animal Science. 2021 Dec; 23(2):142-52.

[5] Soh WK and Parnell J. A revision of Syzygium gaerth (Myrtaceace) in Indochina (Cambodia, Laos and Vietnam). Adansonia. 2015; 37:179-275. doi: 10.5252/a2015n2a1

[6] Kaur K and Kaushal S. Phytochemistry and pharmacological aspects of Syzygium aromaticum: A review. Journal of Pharmacognosy and Phytochemistry. 2019; 8:398-406.

[7] Danthu P, Simanjuntak R, Fawbush F, Tsy JL, Raza6imamonjison G, Abdillahi MM, et al. The clove tree and its products (clove bud, clove oil, eugenol): prosperous today but what of tomorrow's restrictions?. World. 2020; 161(58,172):52-915.

[8] ByNg JW, Barthelat F, SNoW N, BerNardINI B. Revision of Eugenia and Syzygium (Myrtaceae) from the Comoros archipelago. Phytotaxa. 2016 Mar; 252(3):163-84. doi: 10.11646/phytotaxa.252.3.1

[9] Kumar V, Mishra D, Joshi MC, Mishra P, Tanwar M. Herbs and Spices—New Processing Technologies. Syzygium aromaticum: Medicinal Properties and Phytochemical Screening. InHerbs and Spices-New Processing Technologies 2021 Nov 2. IntechOpen.

[10] Vitalini S, Orlando F, Iriti M. Selective phytotoxic activity of eugenol towards monocot and dicot target species. Natural Product Research. 2022 Mar; 36(6):1659-1662. doi: 10.1080/14786419.2021.1897810

[11] Parham S and Zargar Kharazi A. Cellulosic textile/clove nanocomposite as an antimicrobial wound dressing: In vitro and in vivo study. Colloidal and Surfaces B Biointerfaces. 2022 Sep; 217:112659. doi: 10.1016/j.colsurfb.2022.112659

[12] Boughendjioua H. Essential oil composition of Syzygium aromaticum (L.). IRJPMS. 2018; 11:26-8.

[13] Alma MH, Ertas M, Nitz S, Kollmannsberger H. Chemical composition and content of essential oil from the bud of cultivated Turkish clove (Syzygium aromaticum L.). BioResources. 2007 May; 2(2):265-9. doi: 10.15376/biores.2.2.265-269

[14] Venkadeswaran K, Muralidharan AR, Annadurai T, Ruban VV, Sundararajan M, Anandhi R, et al. Antihypercholesterolemic and Antioxidative Potential of an Extract of the Plant, Piper betle, and

DOI: https://doi.org/10.54393/pbmj.v5i9.798

Its Active Constituent, Eugenol, in Triton WR-1339-Induced Hypercholesterolemia in Experimental Rats. Evidence Based Complementary and Alternative Medicine. 2014; 2014:478973. doi: 10.1155/2014/478973

[15] Yan Y, Wang S, Gu J, Min Z, Wang R. Effect of Nano-Oleanolic Acid Combined with Lipid-Lowering Ketones on Insulin Resistance in Rats with Gestational Diabetes. Journal of Biomedicine Nanotechnology. 2022 Feb; 18(2):474-480. doi: 10.1166/jbn.2022.3262

[16] Djeziri FZ, Belarbi M, Murtaza B, Hichami A, Benammar C, Khan NA. Oleanolic acid improves diet-induced obesity by modulating fat preference and inflammation in mice. Biochimie. 2018 Sep; 152:110-120. doi: 10.1016/j.biochi.2018.06.025

[17] Fernández-Aparicio Á, Correa-Rodríguez M, Castellano JM, Schmidt-RioValle J, Perona JS, González-Jiménez E. Potential Molecular Targets of Oleanolic Acid in Insulin Resistance and Underlying Oxidative Stress: A Systematic Review. Antioxidants. 2022 Aug; 11(8):1517. doi: 10.3390/antiox11081517

[18] Su S, Wu G, Cheng X, Fan J, Peng J, Su H, et al. Oleanolic acid attenuates PCBs-induced adiposity and insulin resistance via HNF1b-mediated regulation of redox and PPARγ signaling. Free Radical Biology and Medicine. 2018 Aug; 124:122-34. doi: 10.1016/j.freeradbiomed.2018.06.003.

[19] Pérez-Jiménez A, Rufino-Palomares EE, Fernández-Gallego N, Ortuño-Costela MC, Reyes-Zurita FJ, Peragón J, et al. Target molecules in 3T3-L1 adipocytes differentiation are regulated by maslinic acid, a natural triterpene from Olea europaea. Phytomedicine. 2016 Nov; 23(12):1301-11. doi: 10.1016/j.phymed.2016.07.001.

[20] Gosavi NS, Koli SS, Jire DS, Shaikh AZ. Clove (Syzygium Aromaticum): A Miraculous Spice.

[21] Abdullah BH, Hatem SF, Jumaa W. A comparative study of the antibacterial activity of clove and rosemary essential oils on multidrug resistant bacteria. Pharmaceutical and Biosciences Journal. 2015 Feb 27:18-22. doi: 10.20510/ukjpb/3/i1/89220

[22] Pérez Gutiérrez RM, Arrioja MW. Rapid Model to Evaluate the Anti-Obesity Potential of a Combination of Syzygium aromaticum (Clove) and Cuminun cyminum (Cumin) on C57BL6/j Mice Fed High-Fat Diet. Journal of Visualized Experiments. 2021 Jul; (173). doi: 10.3791/62087

[23] Saxena A, Mukhopadhyay AK, Nandi SP. Antibacterial activity of selected plants extract against pathogenic bacteria and detection of phytochemicals. Journal of Environmental Biology. 2020 Nov 1;41(6):1486-92. doi: 10.22438/jeb/41/6/MRN-1550

[24] Nelson S. The antibacterial activity of essential oils from Tagetes erecta and Thuja occidentalis. Cantarus. 2019; 27:29-33.

[25] Jannuzzi A. Eugenol aggravates UVA-induced cytotoxic and genotoxic response in HaCaT human keratinocytes. Journal of Research in Pharmacy. 2022; 26(2). doi: 10.29228/jrp.133

[26] Ghadermazi R, Keramat J, Goli SA. Antioxidant activity of clove (Eugenia caryophyllata Thunb), oregano (Oringanum vulgare L) and sage (Salvia officinalis L) essential oils in various model systems. International Food Research Journal. 2017 Jul; 24(4):1628.

[27] Batiha GE, Beshbishy AM, El-Mleeh A, Abdel-Daim MM, Devkota HP. Traditional uses, bioactive chemical constituents, and pharmacological and toxicological activities of Glycyrrhiza glabra L.(Fabaceae). Biomolecules. 2020 Mar; 10(3). doi: 10.3390/biom10030352

[28] Nerdy N and Ritarwan K. Hepatoprotective activity and nephroprotective activity of peel extract from three varieties of the passion fruit (Passiflora sp.) in the albino rat. Open access Macedonian Journal of Medical Sciences. 2019 Feb 28;7(4):536. doi: 10.3889/oamjms.2019.153

[29] Hassan HA, Geniady MM, Abdelwahab SF, Abd-Elghany MI, Sarhan HA, Abdelghany AA, et al. Topical Eugenol Successfully Treats Experimental Candida albicans-Induced Keratitis. Ophthalmic Research. 2018; 60(2):69-79. doi: 10.1159/000488907

[30] Sedigh Bazkiagourab M, Sattari M, Imanpour Namin J. Anesthetic effects of valerian extract (Valeriana officinalis), lemongrass extract (Cymbopogon citratus) and clove powder (Eugenia caryophyllata) on Sterlet sturgeon (Acipenser ruthenus). Aquatics Physiology and Biotechnology. 2021 Sep 22;9(2):59-86. doi: 10.22124/japb.2021.6718.1141

[31] Guldiken B, Catalkaya G, Ozkan G, Ceylan FD, Capanoglu E. Toxicological effects of commonly used herbs and spices. InToxicology. Academic Press. 2021 Jan: 201-13.