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, diarrhea, 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**
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].

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>Per 100 g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Fats</td>
<td>13 g</td>
</tr>
<tr>
<td>Total Carbohydrates</td>
<td>66 g</td>
</tr>
<tr>
<td>Total Protein</td>
<td>6 g</td>
</tr>
<tr>
<td>Magnesium</td>
<td>259 mg</td>
</tr>
<tr>
<td>Iron</td>
<td>11.8 mg</td>
</tr>
<tr>
<td>Calcium</td>
<td>632 mg</td>
</tr>
<tr>
<td>Potassium</td>
<td>1020 mg</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>0.2 mg</td>
</tr>
<tr>
<td>cholesterol</td>
<td>0 mg</td>
</tr>
</tbody>
</table>

**Table 1: Nutritional Composition of Clove**

**Distribution**

Clove is 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 bi florin, 7-dihydroxy-2-methylchormone 8-C-d-glucopyranoside, rhamnocitrin, kaempferol, myricetin, ellagic acid, gallic acid, and the terpenoid oleanolic acid. 18 hydroxylable tannins were also present in an aqueous acetone extract of dried *S. aromaticum* flower buds [8]. Tellimagrandin II, casuarin, rugosin D, rugosin F, heterophyllin D, euprobin 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.

**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 benets 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. O** was investigated. Eugenol caused substantial levels of DNA damage to human broblast 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**

[Image: Health benefits of clove]
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 cytoplasmic 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 reticulata, the LD50 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**


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


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


