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Clove bud oil; a novel herbal medicine for future kidney researches

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Core tip

One of the most influential antioxidant medicinal herbs is the clove bud (*Syzygium aromaticum*) belonging to Myrtaceae family. It is one of traditional herbal medicines native to Indonesia and Madagascar. The principal clove components include eugenol, eugenyl acetate, β-caryophyllene, 2-heptanone, humulenol and α-humulene. Clove is one of the most powerful antioxidants among herbal medicines. The bioactive components of clove bud display many activities such as antioxidant, antibacterial, antiviral, antifungal, antimutagenic, anti-inflammatory, anti-allergic, and dental caries properties.

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Introduction

Free radicals are generated during the normal cell metabolism (1). Nevertheless, its excess production triggers many diseases including cancer, cirrhosis and atherosclerosis (2). In this regard, complication of chronic kidney disease in patients with cardiovascular disease is a major cause of mortality and morbidity in patients on hemodialysis which has been contributed to excess free radicals (3). Therefore, researchers have followed to find new natural strategies such as herbal medicine with antioxidant activity (4).

One of the most influential antioxidant medicinal herbs is the clove bud (*Syzygium aromaticum*) belonging to Myrtaceae family (5). It is one of traditional herbal medicines native to Indonesia and Madagascar (6,7). The principal clove components include eugenol, eugenyl acetate, β-caryophyllene, 2-heptanone, humulenol and α-humulene (6,7). The bioactive compounds existed in clove oil have been found to possess many biological properties including antioxidant (8), antibacterial (9), antiviral (10), antifungal (9), antimutagenic (11), and anti-inflammatory (12) activities.

Regarding these properties, the aim of this paper was to introduce a new and novel herbal medicine for further researches to control and to prevent chronic kidney disease induced by oxidative stress.

The antioxidant effects of clove oil

Antioxidants are considered to naturalize the free radicals and oxygen reactive species in lipid chains. Hence, they do not allow to initiate or to propagate further oxidation of lipids (2). Lee and Shibamoto (13) observed an inhibition of malondialdehyde formation from horse blood plasma oxidation as a result of clove extract. Jirovetz et al (14) found higher scavenging activity of clove oil against 2, 2-diphenyl-1-picryl hydracyl (DPPH) radical than butylated hydroxytoluene (BHT) and butylated hydroxyanisole (BHA). Similarly, Gülçin et al (8) studied the antioxidant activity of eugenol in vitro methods. They concluded that eugenol showed higher antioxidant activity as compared to BHT, BHA and α-tocopherol. Abd El Azim et al (15) noticed that clove extract manifested the strong antioxidant effect against DPPH when compared to vitamin C. Several proposed mechanisms of antioxidant activity of clove include scavenging action of free radicals and also chelating metal ions against Fe^{3+} leading to hydroxyl radical inhibition (14).

Antimutagenic effects of clove oil

Eugenol has been shown to display antimutagenic potential and to induce apoptosis of cancer cells (16). Eugenol decreased DNA damage resulting from carcinogenic agents via enzyme inhibition which is responsible for adducts formation (17). In addition, eugenol induces tumor growth delay, lowers tumor size and also inhibits tumor metastasis in mice (17).

Anti-inflammatory effect of clove oil

Inflammation is a process resulted from the increased expression and enzyme activity

of cyclooxygenase 1 and 2, resulting in production of inflammatory mediators including prostaglandin E2 (18). The essential oil of clove bud has the strong inhibitory activity against cyclooxygenase 1 and 2 (18). In addition, Raghavenra et al (19) reported that eugenol suppressed activity of lipoxygenase enzyme and leukotriene formation. Tanko et al (20) studied three dosages of clove bud extract in mice. They found that the ethanol extract of clove bud exert anti-inflammatory activity after using acetic-acid induced abdominal contractions.

Cardioprotective effects of clove oil

The oxidative damage induced by reactive oxygen species is one of the atherosclerosis accelerators (21). Because, lipid accumulation especially cholesterol in blood derived from the low-density lipoprotein oxidation in blood plasma might be associated with atherogenesis (21). Furthermore, eugenol serves as an efficient platelet inhibitor leading to blood clots prevention (21).

Hepatoprotective effects of clove oil

Clove extract was reported to manifest hepatoprotective effect against liver injury in female rats. It was reported that paracetamol treatment increased the serum alanine aminotransferase, aspartate aminotransferase and alkaline phosphatase activities in female rats (8). The hepatoprotective mechanism of clove oil might be related to its free radicals scavenging effects; thus, inhibiting interactions of free radicals with polyunsaturated fatty acids and consequently preventing lipid peroxidation processes (8).

Antibacterial effects of clove oil

Dorman and Deans (22) studied the antibacterial property of clove oil on 25 bacteria. They found that essential oil of clove is effective against both gram positive and gram negative bacteria. In this case, clove has antibacterial activity against many bacteria including *Salmonella enteritidis*, *Escherichia coli*, *Staphylococcus aureus*, and *Listeria monocytogenes* (23). Interestingly, the death rate of pathogens relies on the pH, time and the essential oil content (23).

Eugenol plays antibacterial role via several mechanisms. First, it participates in the cytoplasmic membrane disturbance and deformity as a consequence of hydroxyl group leading to an increase in solubility of this molecule; in turn, it passes through the hydrophilic proportion of the cell (24). The second, hydroxyl group of eugenol binds to membrane proteins of bacteria and consequently, permeates the vital cell components (23). Abd El Azim et al (15) reported that the clove extract at 0.1 and 0.3 mL concentration had suppressive effect on *Escherichia coli* and *Salmonella typhi* counts.

Antifungal effects of clove oil

Clove oil and its components especially eugenol exert antifungal action against *Candida albicans* and *Trichophyton mentagrophytes* as a consequence of cellular membrane disturbance and deformity (25). It was observed that clove extract at 0.3 mL concentration exerted inhibitory effect on *Trichoderma*, *Fusarium*, *Aspergillus* and *Penicillium* (15).

Conclusion

Taken together, evidence indicated that administration of clove bud essential oil seems to treat chronic kidney disease induced by oxidative stress in human due to its antioxidant property. Besides the kidney protective effect, it could prevent several disorders related to cardiovascular and liver, as well.

Author's contribution

EJ is the single author of the manuscript.

Conflicts of interest

The author declared no competing interests.

Ethical considerations

Ethical issues (including plagiarism, data fabrication, double publication) have been completely observed by the author.

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