CLOVE/QURANFUL (Syzygium aromaticum L.): A REVIEW ON ITS POTENTIAL BENEFITS IN UNANI MEDICINE, BIOACTIVITIES AND CURRENT SCIENTIFIC APPLICATIONS

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ABSTRACT

Background: Herbal drugs have been shown to be a valuable source of new pharmaceutical molecules that have been utilised to treat serious disorders. Clove (Syzygium aromaticum L.) is a plant-derived drug with a long history of usage in Unani medicine due to its numerous pharmacological benefits attributable to its phytoconstituents.

Aims and objectives: The basic aim of this article is to present a comprehensive report on the potential benefits of clove as described in the Unani system of medicine as well as present an analysis of contemporary scientific researches in order to explore the prospects for its application.

Materials and methods: Classical data were collected from the manuscripts of Unani medicine like Al Qanoon Fit Tib, Khazain al-Advia, Makhzan al-Advia, Muheet-i-Azam, Al-Jamili Mufradatal-Advia wa'l Aghziya, etc. An online search was performed in Pub Med, Scopus, Wiley Online Library and Google Scholar to elucidate the various pharmacological activities of clove.

Results: The potential of clove shown by its chemical composition, therapeutic use and bioactivities revealed its antibacterial, anti-fungal, anti-viral, anti-oxidant, anti-inflammatory, anticancer, hepatoprotective and nephroprotective effects. Sesquiterpenes, monoterpenes, hydrocarbon, and phenolic compounds, are found in abundance in S. aromaticum, with eugenyl acetate, eugenol, and β-caryophyllene being the most important phytochemicals reported in clove oil. Several in vitro and in vivo studies have demonstrated its multiple bioactivities, exhibiting its effect on diseases including halitosis, odontalgia, thyroid cancer, rheumatoid arthritis, nephrotoxicity, and vaginal candidiasis, among others.

Conclusion: The several studies evaluated in this article support clove’s traditional use in Unani medicine, indicating its usefulness for a variety of ailments. Future research should focus on developing new clove derivative-based formulations.

Keywords: Syzygium aromaticum; Clove; Unani; Chemical constituents; Bioactivities.
1. INTRODUCTION
The indigenous herbal approach plays an essential part in the healthcare system and has become increasingly popular in recent decades due to its natural composition, fewer side effects, and higher efficacy than synthetic drugs. Herbal medicine has the virtue of being both preventative and curative and diagnoses and treats illnesses [1]. Since phytoconstituents such as glycosides, saponins, flavonoids, steroids, tannins, alkaloids, terpenes, and others have been shown to have pharmacological effects, medicinal products have been recognised as a significant source for creating novel pharmaceutical molecules. Clove/Quranful (Syzygium aromaticum L. Merr. & L.M. Perry) is a dried flower bud and traditional Unani drug having numerous health benefits, particularly for people with a cold temperament, women, and the elderly [2].

1.1 Description and Distribution
Clove is the second most important spice in the world, next only to black pepper [3]. It's a medium-sized tree, 8-12 m in height from the Myrtaceae family and native to the Maluku Islands in eastern Indonesia. Indonesia, India, Malaysia, Sri Lanka, Madagascar, and Tanzania, particularly the island of Zanzibar, are the major clove-producing countries [4]. Clove trees are made up of leaves and buds (the tree's commercial part), and flowering bud development begins four years after planting. After that, they're harvested by hand or with the help of a natural phytohormone during the pre-flowering stage. Clove is one of the spices that might potentially be employed as preservatives in many foods, notably in meat processing, due to their antioxidant and antibacterial properties, and are widely used for various therapeutic uses and in the perfume industry [5].

1.2 Synonyms[6, 7]
Arabic: Qaranful  
Bengali: Lavang  
English: Clove  
Gujarati: Lavang, Laving  
Hindi: Lavanga, Laung  
Kannada: Lavanga  
Malayalam: Karayanpu, Krambu  
Marathi: Lavang, Laung  
Persian: Qaranful  
Roman: Qaraflun  
Sanskrit: Devapuspa, Lavangaha, Devakusuman  
Tamil: Kirambum, Lavangam  
Telegu: Lavangamulu, Lavangamuchettu  
Urdu: Qaranful, Laung.

1.3 Temperament (Mizaj)
Hot and dry in third degree [7].

1.4 Pharmacological action
- In the Unani system of medicine, clove is documented to haveMuhallil (Anti-inflammatory), Dāfi’-i-Ta’affun (Antiseptic), Muftarīh (Exhilarant), Musakkin (Analgiesic), Muqawwi-i-Qalb (Cardio tonic), Muqawwi-i-Diragh (Brain tonic), Munaffith-i-Balgham (Expectorant), Dāfi ’-i-Tashannuj (Antispasmodic), Muqawwi-i-Mi’dā (Stomachic), Muqawwi-i-Kabid (Liver tonic) and Muqawwi-i-Amā (General tonic) properties[6].
- It also possessesMuqawwi-i-Bah (Aphrodisiac) and Kasir-i-Riyah (Carminative) properties [8].

1.5 Therapeutic dose
0.5 to 1 g [6].

1.6 Part used
- Bud: The volatile oil derived from the dried buds contains free eugenol (70 to 90%), eugenol acetate and caryophyllene. Despite the fact that these compounds account for nearly all of the oil, they are not responsible for the fresh, almost fruity aroma of pure clove bud oil, which is owing to residues of other chemicals, the most important of which is methyl-n-amyl ketone. Clove bud oil differs from clove stem oil and clove leaf oil in that it includes a high percentage of eugenol acetate, whereas clove stem oil and clove leaf oil only contains traces of it [3].
- Stem: The main constituents found in clove bud oil are likewise found in clove stem oil, though in somewhat varying ratios. The percentage of free eugenol in stem oil is usually slightly higher than in bud oil. On the other hand, the stem oil contains only a trace of eugenol acetate, whereas the bud oil has been found to have up to 17% of this ester. Substances that give the bud oil its distinctive, almost fruity odour appear to be in even smaller quantities or absent totally in the stem oil, which explains the stem oil’s coarser and flatter fragrance [3].
- Leaf: Clove leaf oil typically includes a lower percentage of total eugenol than clove bud oil; eugenol acetate is present in the leaf oil, but in very minute amounts, as it is in the stem oil. The trace chemical methyl-n-amyl ketone, which gives the bud oil its distinctive, fruity odour, is found in much smaller concentrations in the leaf oil than in the stem oil,
resulting in a much coarser and flatter
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120 fragrance. Only the latter (traces) of the
compounds found in the stem oil (but not in the bud
oil), namely sesquiterpene alcohol and naphthalene
is detected in clove leaf oil [3].

1.7 Phytochemistry
Clove represents sources of phenolic compounds such as
flavonoids, hydroxybenzoic acids, hydroxycinnamic
acids and hydroxyphenylpropene. Eugenol is the main
bioactive compound of clove, which is found in
concentrations ranging from 9381.7 to 14650 mg per 100
g of fresh plant material. With regard to the phenolic
acids, gallic acid is the compound found in higher
concentration (783.50 mg/100 g). However, other gallic
acid derivates as hydrolysable tannins are present in
higher concentrations (2375.8 mg/100 g). Other phenolic
acids found in clove are the caffeic, ferulic, ellagic and
salicylic acids. Flavonoids such as kaempferol, quercetin
and its derivates are also found in clove in lower
concentrations. Concentrations up to 18% of essential oil
can be found in the clove flower buds. Roughly, 89% of
the clove essential oil is eugenol and 5%-15% is eugenol
acetate and β-caryophyllene. Another important
compound found in the essential oil of clove in
concentrations up to 2.1% is α-humulene. Other volatile
constituents present in lower concentrations in clove essential oil are β-pinene, limonene, farnesol,
benzaldehyde, 2-heptanone and ethyl hexanoate [4].
Additionally, the eugenol compound has a pleasant
carbon chain link with the aromatic ring and Gas
chromatography-mass spectroscopy (GC-MS) analysis
demonstrated the existence of 36 components in the
clove essential oil isolated by hydro-distillation
including eugenol, β-caryophyllene, eugenylacetate,
ethyl hexanoate, 2-heptanone, α-humulene, calacorene,
humulenol, and calamenene [5].

1.8 Therapeutic uses
• Clove is highly appreciated in medicine as a
carinative and stimulant because it is very
aromatic, has a good flavour, and imparts warming
characteristics. It's also used to treat dyspepsia and
flatulence. Clove, which is one of the constituents in
betelnut chew, has stimulating effects. It is utilised
in the making of a unique sort of cigarette for
smoking in Java. Clove oil is used as a digestive aid
as well as for its antibacterial and antimicrobial
capabilities in the treatment of toothaches. It has a
counter-irritant effect when applied externally. It is
used in a number of toothpastes and mouthwashes.

Clove Bud oil is also used to flavour oral
medications (dentifrices, gargles) and chewing
gums, among other things [3].
• Use of clove in the Unani system of medicine is
described in detail. It is reported to be effective in
Bakhr al- Fam (Halitosis), Waja ‘al-Asnan
(Odontalgia), Du‘f-i-Mi‘da (Gastric debility), Du‘f-i-
Jigar (Hepatic insufficiency), Sū‘-i-Haad
(Dyspepsia) Nafkh-e-Shikam (Flatulence) and
Qulanj (Collitis) [6].
• Cough, chronic bronchial asthma, palpitation, and
psychiatric illnesses are all relieved by clove use. It's
also helpful in cold temperament disorders like
dribbling and incontinence of urine [2].
• Clove strengthens Aza‘e Raesa (Vital organs) and
Arvah (Pneuma); useful for cold and moist
diseases including paralysis, apoplexy, bronchitis, nausea,
loss of appetite, and hiccups [8].
• According to one Unani physician Geelani, when the
clove is combined with rose petals, it has a powerful
exhilarating effect. Clove oil, also known as
Roghan-i-Quranful is also described as a mosquito
repellent and is thus utilised in the prevention of
malaria. When consumed with cold water, it helps to
quench thirst. When pregnant women ingest
powdered cloves mixed with rock sugar syrup
(Misri), they report less nausea. Constipation is
relieved by combining 125 mg clove with 125 mg
Jalapa (Mirabilis jalapa L.). Clove and Chiraita
(Swertia chirata L.), taken in equal amounts with
cold water, have been shown to help with fevers and
general malady. Clove oil is used to treat
Rheumatoid arthritis by applying it topically to the
affected area, and it also relieves headaches when
applied to the head [9].
• It is included in prescription liniments as a therapy
for skin conditions like vitiligo [10].
• Clove powder (Sufoof-i-Quranful), when taken in a
quantity of 1.75 gm with milk on an empty stomach
according to Unani physicians, acts as an
aphrodisiac and helps with sexual debility. It also
improves eyesight and helps treat corneal opacities
[7].
• Moreover, 3gms of cloves given orally is used to
treat vomiting in children, and a small amount of
emblica and cloves extract combined with quince
juice is taken orally to improve digestion [11].
1.9 Important compound formulations
The fact that clove is used in a variety of compound preparations, including Habb-i-Ambar, Habb-i-Ambar and Habb-i-Munaish, Habb-i-tursh Mushtahi, Qurs-i-Tutiyaa-i-Kahib, Kohal-i-Roshnai, Itrifal Ghudadi, JawarishJalinoos, Jawarish Narmushk, Jawarish Zarooni sada, JawarishBisbasaa, Majoone-Kundur, JawarishOod Tursb, JawarishUttrak, KhamiraAbresham Arshadwala, Majoone-Dabeedul Ward, Majoone-Fanjosh, Majoone Khadar, Majoone Lanaa, Majoone Muluki, MajooneSeer Alwi Khani, MajooneSuparipak, Roghan-e- Quranful, Roghane-Surkh, Araq-i- Ambar, Araq-i- Chobchini, Sunoon- i- Mujalli, Majoone Jalali, MajooneKalkalanaj, Dawa-i-Hindi demonstrates its value [6,12].

1.10 Substitute
Cinnamom and Bay leaf [9].

1.11 Contraindications
It is contraindicated in hot temperament individuals [9]. It is harmful to the kidneys and gut [2].

This article analyses and reports on a detailed and comprehensive description of Clove/Quranful, as well as several clinical, in vitro and in vivo studies that have been undertaken to determine the potential of clove.
Council for Research in Unani Medicine (CCRUM) and the World Health Organization (WHO). Unani medicine, ‘Clove,’ ‘Quranful,’ in vitro study, ‘in vivo study,’ traditional medicine, ‘phytochemistry,’ pharmacology, and ‘therapeutics,’ were among the keywords used.

RESULT AND DISCUSSION
Clove is an important drug in the Unani system of medicine and its essential oil as a food additive is recognized as safe by the FDA [14]. Figure 1 depicts the many parts of clove, as well as the main phytoconstituents and bioactivities. A considerable body of current scientific evidence supports views expressed in traditional medicine that clove has health benefits. These effects are mostly linked to antioxidant, analgesic, anaesthetic, anti-cancer, hepatoprotective, and anti-inflammatory attributes, among others.

Scientific evidences of clove

- **Antibacterial activity**: In one of its antibacterial studies, clove seeds increased membrane permeability and oxidative stress in Escherichia coli, Pseudomonas aeruginosa, and Staphylococcus aureus. It indicated that the minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) were 0.06 and 0.10 mg/mL, respectively, and that the optical density and colony-forming unit (CFU) were significantly reduced. The content of superoxide anion radicals in bacterial cells increased significantly, as did the activities of superoxide dismutase and catalase, while the level of glutathione decreased, malondialdehyde increased significantly in bacterial cells, and the extract at MBC also increased the leakage of 260 nm absorbing materials and outer membrane permeability [15]. In another clove oil’s antibacterial activity, it was found that it is effective against both Escherichia coli and Staphylococcus aureus and by integrating clove oil into a liposome composition, the stability of the oil was too studied. At a concentration of clove oil of 5 mg/mL, the optimal polydispersity index (PDI) (0.196), Zeta potential (24.5 mV), and entrapment efficiency (20.41 percent) of liposomes were obtained. Furthermore, by using pore-forming toxins (PFTs) to stimulate clove oil release from liposomes, selective antibacterial action for S. aureus was detected, and liposome-encapsulated clove oil displayed efficient antimicrobial activity for S. aureus [16].

- **Cytotoxic activity**: The ability of borneol and eugenol (clove oil derivatives) to modulate resistance against DNA damaging effects of H2O2 on different strains of human cells malignant hepatoma cells (HepG2), malignant colon cells (caco-2) and non-malignant human fibroblasts (VH10) was investigated. The results indicated eugenol's exceptional anti-oxidative capability at all levels tested, as well as proving that eugenol's cytotoxic potential was greater than that of borneol. It was also observed that eugenol has severe DNA damaging effects on human fibroblasts (VH10), medium damaging effects on colon cells (caco-2) and non-genotoxic effects on hepatoma cells (HepG2) [17].

- **Antioxidant activity**: In one of the studies, DPPH (2,2-diphenyl-1-picrylhydrazyl) free radical scavenging, BCB (beta-carotene bleaching), and FRP [Fe(III) reducing power] techniques were used to assess the antioxidant properties of clove, sage, and oregano essential oils and the typical antioxidant used as butylated hydroxytoluene. At an accelerated oxidation level, essential oils were added to soybean oil at concentrations of 0.006 and 0.01g/ml for thirty days. The results revealed that clove oil has the strongest antioxidant activity of all the oils tested, followed by oregano and sage oil [18]. One more antioxidant activity on clove essential oil reported strong DPPH scavenging capacity but low hydroxyl radical inhibition. It has a bactericidal and inhibiting action in vitro against S. aureus, E. coli, L. monocytogenes, and S. Typhimurium. Furthermore, it was also observed that clove oil outperformed nitrite in terms of in situ antibacterial activity against S. aureus. The essential oil particles that were encapsulated with sodium alginate and emulsifiers had a high encapsulation efficiency, limited antioxidant activity, and robust antibacterial inhibition [19].

- **Antiviral activity**: The antibacterial, antiviral, and molecular docking activities of clove oil with two polyelectrolytes, chitosan and carrageenan, in the form of beads, was examined. The maximum nontoxic concentration (MNTC) of chitosan/ carrageenan-clove oil beads was found to be 31.25 g ml, which demonstrated promising antiviral activity against Herpes simplex virus-1 (HSV-1) and was significantly higher than chitosan/carrageenan without clove oil, which had an antiviral activity of 82.94 percent and 57.64 percent [20]. In another research, eugenin was discovered to be a strong inhibitor of the Dengue virus protease (DENV). Eugenin had IC50 values of 94.7 nm and 7.5 nm
against DENV serotype-2 and 3 proteases, respectively. Isobiflorin and biflorin were the other DENV protease inhibitors studied, however their inhibitory activity was lower than eugenin's [21].

- **Anti-inflammatory activity and Antipyretic activity**: In a validated human dermal fibroblast system designed to replicate chronic inflammation and fibrosis, clove essential oil (CEO) was examined on 17 protein biomarkers that play crucial roles in inflammation and tissue remodelling. Four concentrations of CEO (0.011, 0.0037, 0.0012, and 0.00041%, v/v) were studied and the effect of 0.011% CEO on genome-wide gene expression was evaluated. CEO was found to be strong anti-proliferative effect on human dermal fibroblasts at a concentration of 0.011 percent, and it significantly reduced the increased production of several proinflammatory biomarkers like vascular cell adhesion molecule-1 (VCAM-1), interferon-induced protein 10 (IP-10), interferon-inducible T-cell chemoattractant (I-TAC), and monokine induced by interferon (MIG). Collagen-I, collagen-III, macrophage colony-stimulating factor (M-CSF), and tissue inhibitor of metalloproteinase 2 were all found to be strongly suppressed by CEO (TIMP-2). It also inhibited VCAM-1 and collagen III at both the protein and gene expression levels, affecting global gene expression and signalling networks essential for inflammation, tissue remodelling, and cancer signalling processes [22]. Carrageenan-induced paw oedema and brewer’s yeast-induced pyrexia were tested for their anti-inflammatory and antipyretic activities, respectively. When administered intraperitoneally (i.p.) at a dose of 33 mg/kg body weight, the effects of the clove oil were compared to those of reference drugs. Clove oil and indomethacin both exhibit anti-inflammatory properties, as indicated by a 50.6 percent and 70.4 percent reduction in carrageenan-induced mouse oedema, respectively. Furthermore, when compared to a paracetamol T-max of 2.70°C, with peak effects lasting 30-180 minutes and the estimated i.p. LD50 was found 161.9 mg/kg [23].

- **Anticancer activity**: The essential oil extracted from clove buds was used to make nanoscale-based emulsions using a spontaneous emulsion technique with varying concentrations of Tween 20 and Tween 80 surfactants, with cytotoxicity analysed using the MTT assay, colony formation assay, and Annexin V-FITC assay against the thyroid cancer cell line (HTh-7). All three approaches confirmed apoptosis and a decrease in cancer cell multiplication, indicating that it is a promising cancer drug alternative [24].

- **Analgesic activity**: Aqueous extract of clove was investigated for analgesic effect in mice demonstrated by hot plate test which was reversible by naloxone. The result revealed maximal percent effect (MPE) in the animal groups treated with 50, 100, and 200 mg/kg of aqueous extract significantly higher than the control group. Pre-treatment with naloxone reduced the analgesic effects of both 100 and 200 mg/kg of the aqueous extract. Administration of all three doses of the ethanolic extract (50, 100, and 200 mg/kg) also non-significantly increased the MPE [25].

- **Antihyperglycemic activity**: The effects of dietary clove bud powder (CBP) on biochemical markers in a type 2 diabetic rat model established by a high-fat diet combined with low-dose streptozotocin (35 mg kg\(^{-1}\)) for 30 days were investigated. Diabetic rats were fed a diet containing 20–40 g CBP per kg of body weight. The results showed that there was no significant (P > 0.05) difference in average feed intake and weight changes between the rat groups, and that CBP supplementation lowered blood glucose levels in diabetic rats over time compared to diabetic rats that did not receive CBP supplementation (DBC). Furthermore, when compared to the DBC rat group, the CBP and metformin-treated rat groups had lower glucosidase activity [26].

- **Hepatoprotective activity**: The hepatoprotective activity of a standardized polyphenol-rich extract of clove buds (clovinol) was evaluated on wistar rats designated into three groups. The first group was given a vehicle control, whereas the second group was given ethanol at a fixed dose of 12.5 g/kg body weight orally for 30 days to induce hepatotoxicity. In the third group, clovinol (100 mg/kg body weight) was given with ethanol. In addition to the calculation of liver marker enzymes, assays of antioxidant enzymes, inflammatory markers, and liver histology examinations were performed to assess liver toxicity. Ethanol treatment significantly increased (p<0.05) liver function markers (SGOT and SGPT) and reduced (p<0.05) the antioxidant enzymes (SOD, CAT, and GPx) and Glutathione (GSH). WBC count, inflammatory markers (nitrite,
CRP, COX-2, IL-6, and TNF-) and lipid peroxidation were all found significantly higher (p<0.05). Clovinol supplementation reversed all of these biochemical and molecular variables, suggesting clovinol efficacy in the downregulation of alcohol-induced oxidative stress and inflammatory alterations, resulting in a considerable reduction in the associated liver disease[27].

- **Nephroprotective activity:** Clove oil proved strong nephroprotective agent against kidney damage due to the chronic use of levofloxacin in one of the studies. Clove oil at a dose of 10 mg/kg reduced the nephrotoxicity of levofloxacin based on the serum levels of creatinine, urea, and the renal MDA analysis and was also found to lessen renal histopathological injury, which was otherwise intense and diffused in the levofloxacin rats treated with placebo only. The clove oil protected both the renal function and structures and the protective effect was comparable to that of curcuma extract (hepaprotective agent) treatment. The study found that the administration of clove bud extract for 90 days at doses up to 1 g/kg did not generate observable clinical signs of injury to the liver or kidneys in wistar rats and therefore oral administration of clove oil proved safe at doses under 1 g/kg in animal models [28].

- **Anaesthetic activity:** The efficacy of clove oil as an anaesthetic was assessed in red claw crayfish (Cherax quadricarinatus) as a model for freshwater crustaceans, and parameters such as body weight and sex of red claw crayfish influencing its efficacy was also observed. The test was replicated in two years, with redclaw juveniles being divided into three sizes: little (less than 5 g), medium (5–12 g), and giant (12–37 g) with each size class of at least 10 males and females placed individually in water containing clove oil concentrations of 375 and 500 l/L. Both concentrations resulted in rapid induction and recovery durations, with the 500 l/L concentration being the more effective. With the increase in crayfish size, induction and recovery times increased. Male and female crayfish had no significant differences in induction and recovery times and thus clove oil found to be an effective anaesthetic agent [29].

- **Anti-fungal activity:** *S. aromaticum* extract exhibited high antifungal activity against vaginal candidiasis and the anti-candida activity of different *S. aromaticum* extracts (methanol, ethyl acetate, n-hexane, and diethyl ether) against Candida albicans, Candida glabrata, and Candida tropicalis were evaluated using the disc diffusion method, and gas chromatography-mass spectrometry (GC-MS) analysis of different *S. aromaticum* extracts was performed, as well as cytotoxicity of different clove extracts against the HUH7 cell line was also evaluated. The antifungal activity of the ethyl acetate extract was found strongest, with inhibition zone diameters of 20.9, 14.9, and 30.7 mm, respectively and had a minimum inhibitory concentration of 250 g/disc against *C. tropicalis*, 500 g/disc against *C. albicans* and *C. glabrata*, and a minimum fungicidal concentration of 0.5 mg/disc against *C. tropicalis* and 1 mg/disc against *C. albicans* and *C. glabrata*. Also, the primary bioactive ingredient found in the ethyl acetate extract was eugenol (58.88 percent), followed by eugenyl acetate (23.86 percent), transcaryophyllene (14.44 percent), and -humulene (1.88 percent). The diethyl ether extract was reported to have lowest toxicological effect, with a relative IC50 of 62.43 g/ml and the methanolic extract found to have higher toxicity (IC50, 24.17 g/ml) in the cytotoxicity assay [30].

- **Anti-arthritic activity:** The study used an aqueous titration approach followed by micro fluidization to produce a controlled-release lipid platform for the efficient administration of clove oil (CO) for the treatment of rheumatoid arthritis (RA) in Freund’s complete adjuvant-induced arthritic rats. High-performance thin layer chromatography (HPTLC) analysis of toluene:acetone: glacial acetic acid (90:9:1 percent v/v/v) solvent systems indicated eugenol (RF = 0.58) as the predominant component in CO. In both in vitro and in vivo biological studies, the ultra-small nanostructured lipid carriers co-loaded with CO (CONCs) greatly increased the therapeutic impact of CO, and the improved formulation inhibited blood lysosomal enzymes and proinflammatory cytokines while also improving hind limb function [31].

4. CONCLUSION

The purpose of this review was to explore the usage of Clove/Quranful (*Syzygium aromaticum* L.) in the Unani system of medicine, and based on the data obtained, it is evident that clove is a drug that has been utilised therapeutically in the Unani medicine for millennia. Unani physicians recommended clove as a single drug in therapeutics as well as in compound formulations that...
are still in use today. The mechanism of action of clove pertaining to its physicochemical aspects has been verified by in vitro and in vivo pharmacological studies, demonstrating clove's multipotent effect. The principal components derived from clove essential oil are eugenol, eugenyl acetate and β-caryophyllene with eugenol being the major, active and safe substance as declared by FDA. Moreover, clove and its compounds have antibacterial, antioxidant, anti-inflammatory, analgesic, anticancer and anaesthetic benefits, as well as mosquito repellent, aphrodisiac, and antipyretic properties. Therefore, it is concluded that clove is an intriguing plant with tremendous potential and a rich source of valuable molecules. As the essential oil contains a number of potentially beneficial molecules, more research into their biological action is needed. Furthermore, it is proposed that future research be focused on essential oils and that experimental and clinical studies be conducted on the tested prescriptions to determine efficacy and safety in the patient's best interests.

Conflict of interest statement
We declare that we have no conflict of interest.

REFERENCES

10. Qamri, HMA, Ghina Muna, Central Council for Research in Unani Medicine, New Delhi, 2008; p-460.
18. Ghadermazi R, Keramat J, Goli SA. Antioxidant activity of clove (Eugenia caryophyllata Thunb), oregano (Origanum vulgare L) and sage (Salvia

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