

Use of Myrrh in Combatting COVID-19

Myrrh Tree

Medicinal plants are the primary sources of new drugs globally. There is a rapid growth with the use of such plants around the world due to the high demand for natural health products, herbal medications, and metabolites of medicinal plants, the utilization of medicinal plants (Chen et al., 2016). The medicinal plants are of various types, and they have been found to have medicinal activities. Singh 2015) pointed out that medicinal plants are believed to have medicinal activities against different types of diseases. They are in resources, which can be used to develop and synthesize new drugs as the basis to maintain good health. These plants provide significant contributions towards the World Health Organization (WHO) to make sure that the use of medicinal plants helps in improving mental, social, and mental wellbeing to all people globally, which, in turn, would lead to sustainable socioeconomic productive lives (Singh, 2015). Thus, medicinal plants have been useful throughout the world across generations. Gadir and Ahmed (2014) posited that from one generation to another, medicinal plants have a crucial role globally, especially in the pharmacological industries for drug development. As such, the studding of pharmacological and biological activities of essential oils in the medicinal plants has attracted special attention to gain deeper insights into their potential application from pharmacological and chemical investigation to their therapeutic use (Gadir & Ahmed, 2014). This paper thus addresses the use of Commiphora myrrh in different diseases. The paper is organized by sub-themed sections, nature and history of myrrh as used in different cultures, its chemistry action, its effect on virus or/and bacterial, its effect on the chest in case of infection and throat in case of a sore throat, and its effect on the gum. Further, the effects of myrrh on

nasal congestion, the benefits of using myrrh as a mouth rinse and gargle, and methods of using myrrh are discussed in the paper.

Nature and History of Commiphora Myrrh

Commiphora myrrh is a tree belonging to the genus *Commiphora* and is one of the most species-genus flowering plants in the *Burseraceae* family. The family of *Burseraceae* consists of 150 different species that originate from the arid tropical and subtropical areas (Germano, Occhipinti, Barbero, & Maffei, 2017) primarily. Myrrh evolved from the word murr, which is an Arabic word for bitter and is mainly produced by *Commiphora myrrha*, also termed as the *Commiphora molmol* (Shameem, 2018). The *Commiphora myrrha* is mainly found in India, East Africa, and Arabia. The *Commiphora myrrh* produces an aromatic resin called myrrh, which is used to treat ailments. Myrrh is an exudate from the bark of the plant, and its extracts have medicinal properties, which support its medicinal use (Gadir & Ahmed, 2014; Germano et al., 2017). It is a reddish-brown plant extract covered with brown, yellow dust and has an acrid and bitter taste with balsamic odor. When combined or mixed with water, it forms an emulsion with different constituents, which include 2% to 8% volatile oil, 23 to 40% resin known as the myrrhin, 40% to 60% gum (Shen & Lou, 2008). The essential oils found in myrrh are used for various purposes, which include cosmetics, perfumes, and secondary metabolites. These oils mainly consist of terpenoids and terpenes, which are the essential constituents of myrrh. Additionally, myrrh consists of pharmaceutical elements with sesquiterpene lactones that are used to treat some ailments (Gadir & Ahmed, 2014). Based on the essential components, myrrh was first introduced and described in the literature of Chinese medicine in 600 AD, where it was explained as the best herbal drug for good health (Ahmad, Al-Ghadeer, Ali, Qamar, & Aljarboa, 2017). The phytochemical research and therapeutic applications of myrrh started many years

ago, and its phytochemical activities have been determined. Secondary metabolites can be isolated from myrrh and used as traditional medicines, especially in Rome, India, Babylon, China, and Greece (Ahamad et al., 2017).

Uses Of Myrrh In Different Cultures

Myrrh is one of the oldest medicinal plants used in different cultures as a source of medicine for different diseases. According to Shameem (2018), myrrh is the oldest medicine used since ancient Rome because of its medicinal properties. It is used as medicinal plants as herbal or clinical medicine for various systemic ailments across countries. For instance, myrrh was used in Chinese culture as a traditional medicine for pain management. In the past centuries, Myrrh was used as the most famous Chinese medicine used together with resinous Frankincense to treat blood stagnation. It used as a blood moving medicine because of its antioxidant and anti-inflammatory activities (El Ashry, Rashed, Salama, & Saleh, 2003). Besides, in Chinese culture, myrrh is believed to relieve pain; hence used as an analgesic for pain management and in cleaning wounds (El Ashry et al., 2003). Additionally, it is documented that although China is not the leading producer of myrrh, it has the largest market globally, primarily for its use in Chinese traditional medicine (Shen & Lou, 2008). The resinous compounds from myrrh are culturally believed to be clinically effective as curative medicines for inflammation diseases and in treating blood diseases (Shen & Lou, 2008). Besides, gum from the myrrh is used in Chinese culture as the traditional medicinal extract for therapeutic activities. The extract is believed to have anti-cancer activities; hence its consumption induces apoptosis in different types of cancer cell lines, such as that of breast, lung, prostate, and pancreas cancer cell lines (Shen & Lou, 2008). More recent research that investigated the chemical compounds and pharmacological properties of myrrh and frankincense support their application in Chinese culture to treat cancer.

The research revealed that myrrh is used together with frankincense in traditional Chinese medicine, and their combination is presumed to have a therapeutic effect on different diseases, including cancer (Cao et al., 2019). Moreover, the research showed that myrrh has powerful pharmacological effects, which include synergistic analgesic, synergistic anti-inflammation, synergistic blood-activation, and synergistic antibacterial properties (Cao et al., 2019).

Besides, the Chinese traditional medicine literature shows that the myrrh resin is a crucial herbal remedy to vitalize blood circulations, especially in people with ailments associated with menstrual syndromes and stasis. It is also believed by Chinese traditional practitioners that myrrh is safe and effective in treating painful inflammation, traumatic injuries, and specific masses. Based on the highest consumption of myrrh resin in China, the People's Republic of China thus remains the leading consumer of nutraceuticals and medicinal development of *Commiphora myrrha*. However, due to the bitterness and strong smell, it is assumed that overdose of myrrh may lead to vomiting, nausea, and gastrointestinal tract injuries. As such, the Chinese practitioners advocate the use of myrrh resin in a capsular form or as a pill (Nomicos, 2007). In other cultures, myrrh is applicable to different types of infections.

Based on the traditions and culture in Egypt, *Commiphora myrrha* is believed to be more effective in treating infectious diseases, including the *Trichomoniasis vaginalis* infection. It is believed that the use of myrrh extracts is safe in treating and preventing infections only in the reproductive organs of males (El-Sherbiny & El Sherbiny, 2011). The extracts are used as herbal remedies because of anti-inflammatory and antibacterial activities; hence are safe and effective in preventing the occurrence of *Trichomoniasis vaginalis* infections (El-Sherbiny & El Sherbiny, 2011). Also, myrrh is culturally believed to have antiparasitic activities in Egypt. Abdul-Ghani, Loutfy, and Hassan (2009) asserted that in Egypt, people assumed that myrrh is the most

effective and safe antiparasitic agent to treat trematode infections. It is believed that the molluscicidal effects of the herbal product of myrrh help in causing permanent loss to the musculature in trematodes. Despite that, some culture support the medicinal use of myrrh in traditional medicinal product, Saudi Arabia culture rejects its consumption, especially among pregnant women (Al-Jaroudi, Kaddour, & Al-Amin, 2016).

Al-Jaroudi et al. (2016) explained that the use of traditional medicine remains a key aspect in Saudi Arabian culture in which many patients seek alternatives to use herbal remedies to treat their health conditions. However, there are cultural beliefs in Saudi Arabia that traditional medicine exposes people to different hazards. The authors also pointed out that the use of large amounts of herbal remedies from myrrh poses health hazards by causing infertility or recurrent miscarriages among pregnant women. It is evident that despite the cultural beliefs that traditional medicinal with a focus on herbal remedies and religious or spiritual healing to treat medical conditions, myrrh may not be accepted as the best remedy during pregnancy (Al-Jaroudi et al., 2016). In Arabian Peninsula, myrrh is the most commonly used herbal remedy; however, it is not recommended for pregnant women because it is believed to be a uterine irritant and can affect female reproductive organs and cause miscarriages or infertility (Al-Jaroudi et al., 2016). The medicinal use of myrrh depends on its chemical action. The compounds found in *Commiphora myrrh* or myrrh has confirmed a strong chemical activity that makes the extracts safe and effective for different ailments. Several compounds isolated from this myrrh resin are crucial in treating specific diseases (Khalil, Fikry, & Salama, 2020).

Chemistry Action of *Commiphora Myrrh* or Myrrh

Current research has demonstrated that the primary chemical action of myrrh includes anti-inflammatory, anticancer, and analgesic activities.

Anti-inflammatory action.

Myrrh has active compounds that are known to have strong anti-inflammatory effects. The most common compounds found in myrrh are guggulsterone (GS), an essential steroid that has anti-inflammatory effects on acute pancreatitis. The GS found in myrrh acts on acute pancreatitis by inhibiting the activation of c-Jun N-terminal kinase and extracellular-regulated protein kinase (Kim et al., 2015). In addition, administration of myrrh resin, known as the *Commiphora erythraea* acts by restoring ROS control and viability of microglia BV-2 cells and I reducing the production of nitric oxide and levels of pro-inflammatory cytokines, such as interleukin-6, interleukin-23, interleukin-17, tumor necrosis factor-B and Interferon gamma, which are induced by lipopolysaccharides. Similarly, the use of myrrh resin facilitates the reduced expression of tumor necrosis factor-alpha and interleukin-1 beta in the brain and liver (Bellezza et al., 2013). The 4-furanodien-6-one found in myrrh also acts by inhibiting a protein complex known as NF- κ B that is involved in controlling transcription in DNA. This action, thus, leads to attenuation of neuro-inflammation, therefore providing anti-inflammatory activity (Bellezza et al., 2013). Additionally, myrrh resin has been found to induce antibacterial activity by acting on specific pathways.

Cheng et al. (2011) asserted that myrrh resin acts by inducing haem oxygenase activity, which stops the degradation of IKBalpha as a response to the activation of inflammatory receptors. Such activation plays a crucial role in preventing the translocation of nuclear factor kappaB. It causes inhibition of gene expression under enzyme activity of cyclooxygenase-2 and nitric oxide synthase that inhibits p38 and c-jun N-terminal kinase (Manjula et al., 2006). In addition to anti-inflammatory effects on nuclear factor kappaB system, myrrh also has significant effects in inhibiting activator of transcription-1 and activator of transcription- 3 (STAT-1 and

STAT-3), as well as a signal transducer, which leads to a reduction in the production of cytokines through janus kinase/STAT pathway (Lv et al., 2008). It also decreases the down-regulation of suppressor of cytokine synthesis in response to the low production of interferon-gamma and interleukin-beta. This action acts as the auto-regulator of the JAK/STAT pathway through transcriptional control of the activator of transcriptions, which also inhibits pathway activation (Su et al., 2011).

Anticancer action of myrrh.

The pharmacological studies have demonstrated the chemical action of myrrh in inducing anticancer activity on cancer cells. The essential compound in myrrh that exerts anticancer effects is elemene, which has been proven to be safe and effective for cancers, including glioblastoma. Elemene, mainly the beta-elemene, has been found to exert the anti-proliferation effect by activating the p38MAPK in glioblastoma (Yao et al., 2008). Also, myrrh has the compound known as the furose-type sesquiterpene rel-1S, 2S-epoxy-4R-furanogermacr-10-3n-6-one, which contains a weak cytotoxicity activity against the cell line MCF-7 of breast cancer. Such a compound, together with bisabolene compound in myrrh acts effectively by reducing the growth of breast tumors, which indicates that myrrh can be used in pharmacology as a novel anti-breast cancer drug (Shen et al., 2008; Yeo et al., 2016). On the other hand, the cyclobolane triterpenoids found in myrrh acts by exerting moderate cytotoxic activity against the PC3 and DU145 of prostate cancer cell lines (Shen et al., 2008).

Also, the triterpenoids and guggulsterone in myrrh act chemically on cyclin in tumor cells. The steroids act by inhibiting cyclin regulation, which, in turn, affects the growth and multiplication of tumor cells. They induce cell death or apoptosis through the down-regulation of the anti-apoptotic gene product. It inhibits the proliferation of cells and induces apoptosis of

HepG2 cells, which, in turn, activates the intrinsic mitochondrion pathway (Shi et al., 2015; Shishodia, Azu, Rosenzweig, & Jackson, 2016). Besides, myrrh extracts act by interacting with the Bcl family of proteins, which facilitates the pro-apoptotic activity. Due to such interaction, myrrh induces pro-apoptotic protein expression while reducing the expression of Bcl proteins, mainly the Bcl-2 and Bcl-xl proteins (Shen, Li, Wang, & Lou, 2012). When taken at low doses, myrrh works by activating the mitogen-activated protein kinase (MAPK) pathway of cancer cells and such action promotes the phosphorylation of N-terminal kinase and P38, which have a crucial role in both adaptive and innate immune systems (Singh, Choi, Zeng, Hahm, & Xiao, 2007).

Analgesic action of myrrh.

Cao et al. (2019) explained that myrrh has proven to be useful analgesics in ancient times due to significant compounds that act effectively as pain relievers. The sesquiterpenes furanocudesma-1, 3-diene, and curzerene found in myrrh are essential compounds that act on the opioid receptors in the central nervous system by exerting analgesic activity. Such receptors are, therefore, blocked by the morphine antagonist naloxone (Mehta & Tripathi, 2015). In addition, the sesquiterpenes furanocudesma-1, 3-diene in myrrh, especially those extracted from *Commiphora mukul* has significant effects in relieving abdominal pain and alleviating health hyperalgesia. As a consequence, such extracts act by alleviating the pain in peripheral nerves from chronic compressive injuries that affect the sciatic nerves. Also, the extracts can be used as the alternative medication to treat nerve pains (Mehta & Tripathi, 2015). Additionally, the current study showed that compounds, such as lindestrene and sesquiterpenes furanocudesma-1, 3-diene found in myrrh have chemical action by acting on nerves and body joints to relieve pain. The compound acts by suppressing the production of prostaglandins and block the inward

sodium currents, hence alleviating feelings of pain (Su et al., 2011). The high content of furanodiene compounds works by alleviating low pain and fever-dependent pain (Germano et al., 2017).

Effect of Myrrh on Virus and Bacterial

The impacts of myrrh on viruses and bacteria are well documented in previously conducted studies. The existing empirical evidence shows that myrrh extracts have viral effects in which the extracts from such plants have antibacterial and antiviral activity against different strains of viruses (Brochot, Guilbot, Haddioui, & Roques, 2017; Khalil, Fikry, & Salama, 2020). A study by Brochot et al. (2017) that investigated the anti-bactericidal, antifungal, and antiviral activity of essential oils from myrrh extracts supported the efficacy of the extracts in reducing the growth of different strains of bacteria and viral strains. The study found that essential oils in myrrh provide antiviral activity against influenza virus type A (H1N1) and herpes simplex virus type 1 (HSV-1). The study found that myrrh acts by directly causing inactivation of free viral particles and interfere with the virion envelope structures, which are crucial for the virus to enter the host cells (Brochot et al., 2017). Also, the extracts act by inhibiting DNA polymerase in viral strains; therefore, preventing viral resistance to specific medications. As such, myrrh can be used as antiviral medication in which new drugs can be developed with the use of the extracts and ensure that they target DNA polymerase (Brochot et al., 2017).

In terms of bacterial effects of myrrh, a study by Khalil et al. (2020) showed that the essential oils in myrrh have antibacterial activity against different strains of bacteria, including *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Klebsiella pneumonia*. The study by Khalil and authors demonstrated that the Oleo gum resin from *Commiphora myrrha* or *molmol* and essential oil cream from myrrh play a crucial role in reducing the resistance of bacteria. The

study disclosed that the extracts have bactericidal activity and molluscicidal activity, which helps the bacterial from developing resistance to specific drugs. The extracts prevent multidrug resistance of bacteria; hence they are essential agents to use in multidrug pharmaceutical preparation of drugs (Khalil et al., 2020). Previously conducted studies showed similar information about the efficacy of myrrh resin in terms of antibacterial activity (Agwaya & Nandutu, 2016; Shoaib et al. 2017; Zengin & Baysal 2014). The studies showed that terpenoids found in myrrh extracts have antimicrobial, molluscicidal activity, anti-hyperglycemic, and cytotoxic activities, which make them essential therapeutic agents against Gram-positive and Gram-negative bacteria (Agwaya & Nandutu, 2016). Further, the study revealed that due to biological and bactericidal activities of myrrh, the extracts or resin from *Commiphora myrrha* could be used as broad-spectrum drugs against multidrug-resistant bacteria, such as *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Klebsiella pneumonia* (Khalil et al., 2020).

Effects of Commiphora Myrrha or Myrrh on the Chest In Case Of Infection and Throat In Case Of a Sore Throat

Commiphora myrrha or myrrh has also been found to have clinical effects on chest infection and sore throat. According to Khalil et al. (2020), myrrh extract and essential oils in *Commiphora myrrha* have clinical benefits in treating chest infections and sore throat. Based on the effects of *Commiphora myrrha* or myrrh on chest infections, the most recent review that investigated the Phytochemical & therapeutic potentials of *Commiphora myrrha* showed significant clinical benefits in suppressing inflammation during chest ailments (Shameem, 2018). The review found that *Commiphora myrrha* extracts and essential oils are used to develop expectorants, which are the essential medication for respiratory diseases, such as chest infections

and associated ailments (Shameem, 2018). Similarly, a study by Su et al. (2015) supported the effects of aromatic gum resin in myrrh on chest infections. The study revealed that the stem resinous exudate of *Commiphora myrrha* has medicinal effects in suppressing inflammation during chest problems. The resin acts by exerting anti-inflammatory and cytotoxic activity against bacterial or fungal infection, causing chest ailments. Su et al. (2011) also shared that resin or extracts in *Commiphora myrrha* have anti-inflammatory and analgesic activities, which, in turn, exert medicinal power to chest ailments, which made myrrh an essential traditional or herbal remedy for different chest infections.

Based on a sore throat, myrrh extract plays a crucial role because of its antiseptic properties. The existing body of evidence demonstrates that the volatile compounds, which include essential oils that are rich in furanosesquiterpenoids have antiseptic and antifungal properties, which are essential in treating mild inflammation that can lead to sore throat and related ailments in the pharyngeal and oral mucosa (Getasetegn & Tefera, 2016). Also, myrrh has antiseptic properties that help in treating sore throat. Öktemer, İpçi, Muluk, and Cingi (2015) explained that myrrh is used together with peppermint and menthol to treat sore throat. The authors shared that the myrrh gum can be used as a mouthwash, and since it has expectorant activities, it can act by reducing inflammation in the throat, hence preventing sore throat and related infections. It is evident that combining the myrrh extracts with peppermint oil and menthol, which, when administered as a mouthwash, it promotes mucosal circulation in the bronchial tract and throat (Öktemer et al., 2015). Thus, in swollen tissues that occur due to sore throat, the extracts exert anti-oxidant, antibacterial, and anti-inflammatory effects, which help to treat sore throat, and in turn, prevent the onset of gingivitis and tonsillitis because it helps in triggering regeneration of healthy tissues and cells (Öktemer et al., 2015).

Effects of *Commiphora myrrha* Or Myrrh on Gum

Based on significant clinical benefits of myrrh as a mouthwash, it may have essential effects on gums. Al-Mobeeriek (2011) pointed out that myrrh suspension in low quantities is more effective on gums, especially when treating intra-oral mucosal wounds. The authors shared that myrrh extracts can be used as a mouthwash to heal wounds in the buccal mucosa. Additionally, a pilot clinical study that examined the effects of using *Commiphora myrrha* as mouthwash supported the anti-plaque and anti-inflammatory activities (Zahid & Alblowi, 2019). The study was a randomized controlled trial that was conducted among healthy subjects in which gingivitis was allowed to develop, and the participants were assigned *Commiphoral myrrh* mouthwash. The trial revealed that the use of *Commiphora myrrha* extracts as the mouthwash has significant effects in treating gums by reducing gingival inflammation (Zahid & Alblowi, 2019). The study showed that with the use of *Commiphora myrrha* as a mouthwash, plaque formation in the gums was reduced, and this showed clinical improvement with the use of *Commiphora myrrha* in reducing plaque and gingival inflammation parameters (Zahid & Alblowi, 2019). From the findings of this clinical trial, myrrh can be acknowledged as the novel therapeutic agent to treat gum infections, which can lead to plaques and gingivitis. In comparison to other mouthwash agents, such as Miswak, it has been found the myrrh extracts are more effective in terms of anti-inflammatory and anti-plaque activity to prevent gingivitis in gums. This is evident in a study comparative clinical trial by Bassiouny and Al-Barrak (2014), which compared the efficacy of using Miswak and myrrh mouthwashes against chlorhexidine in reducing chronic gingivitis. The study revealed that myrrh is more effective in reducing gingivitis inflammation compared with Miswak and chlorhexidine, in which the subjects who participated in the study showed clinical improvement with myrrh mouthwash (Bassiouny & Al-

Barrak, 2014). The study showed that the use of myrrh mouthwash reduced plaque and gingivitis indices in which plaque accumulation and formation of gingival infections reduced as presented by a statistical difference of p-value of 0.006 than that of Miswak and chlorhexidine with a p-value of 0.26 and 0.01 respectively (Bassiouny & Al-Barrak, 2014).

Effect of *Commiphora myrrha* Or Myrrh on Nasal Congestion

Administration of myrrh or extracts from *Commiphora myrrha* helps in reducing nasal congestion. According to Ferrara (2019), the consumption of myrrh provides analgesic activity, which helps in reducing inflammation and headache associated with nasal congestion. The analgesic effects of myrrh reduce nasal congestion related to headaches. The myrrh resin can be used on cold and flu infections to prevent nasal congestion. This is evident in the information presented by Kalra, Khatak, and Khatak (2011) that Myrrh resin or *Commiphora myrrh* can be used as an immunostimulant during cold and flu season where it acts by strengthening the immune system and acts as an expectorant to treat nasal congestion. Myrrh may be used in inhalation to reduce nasal congestion. Few drops on myrrh oil can be added to hot water and inhaled in the form of steam. However, there are no studies that have investigated the effects of myrrh or *Commiphora myrrha* in inhalation and provocation. As such, further research is needed to determine the efficacy of the myrrh in developing inhalers and as a provocation in nasal congestion.

The Benefit of Using a Mouth Rinse and Gargle

In cases of sore throat and related problems in the mouth, mouth rinsing oral gargling is clinically essential in reducing oral health problems. Oral gargling and rinsing the mouth helps in promoting health in the oropharynx and in preventing bad odor in the mouth (Lin & Raman, 2012). Myrrh can be used for mouth rinsing and oral gargle to prevent the formation of plaques

and gingivitis. Al-Mobeeriek (2011) asserted that myrrh in the form of mouthwash could be used to rinse mouth and for oral gargling to prevent intra-oral mucosal wounds, the authors shared that when mouth rinsing with myrrh extracts help in preventing the accumulation of plaques and gingivitis inflammation; hence oral health diseases. Moreover, mouth rinsing and oral gargling with *Commiphora myrrh* mouthwash have clinical benefits in preventing plaque formation. Zahid and Alblowi (2019) explained that mouth rinsing and gargling with the use of *Commiphora myrrha* mouthwash practice helps in preventing the accumulation of bacteria on the surface of the tooth, which, in turn prevents dental plaques. The myrrh extracts exert anti-plaque activities in the mouth, which prevent bleeding gums and inflammation in gingival tissues.

Methods of using *Commiphora myrrh* to Treat Sore Throat, Gum Disease, and Chest Infection

When treating sore throat, myrrh can be used in the form of gum and as essential oils. The gum extracts are removed from the stem or back of the *Commiphora myrrh* and used as a mouthwash or through oral gargling where it exerts anti-inflammatory effects in the pharyngeal and oral mucosa (Getasetegn & Tefera, 2016). In terms of gum diseases, the most suitable method to use *Commiphora myrrh* is in developing expectorant, which is administered in the form of liquid. The myrrh is also used in the form of mouthwash, where the extracts can be used for mouth rinsing and in gargling to assist in preventing plaque formation and gingivitis inflammation (Al-Mobeeriek, 2011; Zahid & Alblowi, 2019). In chest infection, the most suitable method to use myrrh is in the form of extracts and essential oils to develop expectorants. The stem resinous exudate of *Commiphora myrrha* is obtained and used in developing expectorant that is administered orally in the form of liquid (Shameem, 2018).

Conclusion and Recommendation

Myrrh or *Commiphora myrrh* is one of the medicinal plants believed to have therapeutic effects in various diseases. It is believed that *Commiphora myrrh* has medicinal properties, such as immunomodulatory, anti-inflammatory, cytotoxic, antioxidant, antimicrobial, antioxidant, hepatoprotective, anti-tumor, anti-ulcer, and analgesic activities. As a consequence, myrrh can be used to treat different types of diseases because of their therapeutic activities. Besides, myrrh antiviral activities that helps in preventing different types of diseases. As such, there is a possibility that myrrh or *Commiphora myrrh* could be effective in treating the current cases of COVID-19. Since there are no studies that have investigated the antiviral effects of myrrh on coronavirus, the researchers in the clinical field should conduct extensive research on whether the extracts from myrrh may help in preventing and treating COVID-19. Future research is needed to determine whether myrrh in the form of mouthwash may assist in reducing the spread of COVID-19 from an infected person to uninfected people.

References

- Abdul-Ghani, R. A., Loutfy, N., & Hassan, A. (2009). Myrrh and trematodoses in Egypt: An overview of safety, efficacy, and effectiveness profiles. *Parasitology International*, 58(3), 210–214. doi:10.1016/j.parint.2009.04.006
- Agwaya, M. S., & Nandutu, A. M. (2016). Hypoglycemic activity of aqueous root bark extract zanthoxylum chalybeum in alloxan-induced diabetic rats. *Journal of Diabetes Research*, 1(10, 1-5.
- Ahamad, S. R., Al-Ghadeer, A. R., Ali, R., Qamar, W., & Aljarboa, S. (2017). Analysis of inorganic and organic constituents of myrrh resin by GC-MS and ICP-MS: An emphasis on medicinal assets. *Saudi Pharmaceutical Journal: SPJ: The Official Publication Of The Saudi Pharmaceutical Society*, 25(5), 788–794.
- Al-Jaroudi, D., Kaddour, O., & Al-Amin, N. (2016). Risks of Myrrh usage in pregnancy. *JBRA Assisted Reproduction*, 20(4), 257–258.
- Al-Mobeeriek A. (2011). Effects of myrrh on intra-oral mucosal wounds compared with tetracycline- and chlorhexidine-based mouthwashes. *Clinical, Cosmetic And Investigational Dentistry*, 3, 53–58. <https://doi.org/10.2147/CCIDEN.S24064>
- Bassiouny, G., & Al-Barrak, H. (2014). The anti-plaque effect of Miswak and myrrh mouthwashes versus chlorhexidine in the treatment of chronic gingivitis; a comparative clinical trial. *Medical Science, The International Weekly Journal for Medicine*, 9(33), 32-37.
- Bellezza, I., Mierla, A., Grottelli, S., Marcotullio, M. C., Messina, F., Roscini, L., ... & Minelli, A. (2013). Furanodien-6-one from Commiphora erythraea inhibits the NF-κB signalling

- and attenuates LPS-induced neuroinflammation. *Molecular Immunology*, 54(3-4), 347-354.
- Brochot, A., Guilbot, A., Haddioui, L., & Roques, C. (2017). Antibacterial, antifungal, and antiviral effects of three essential oil blends. *MicrobiologyOpen*, 6(4), e00459.
- Cao, B., Wei, X. C., Xu, X. R., Zhang, H. Z., Luo, C. H., Feng, B., ... & Zhang, D. K. (2019). Seeing the unseen of the combination of two natural resins, frankincense and myrrh: Changes in chemical constituents and pharmacological activities. *Molecules*, 24(17), 3076.
- Chen, S. L., Yu, H., Luo, H. M., Wu, Q., Li, C. F., & Steinmetz, A. (2016). Conservation and sustainable use of medicinal plants: problems, progress, and prospects. *Chinese Medicine*, 11(37), 1-10.
- Cheng, Y. W., Cheah, K. P., Lin, C. W., Li, J. S., Yu, W. Y., Chang, M. L., ... & Hu, C. M. (2011). Myrrh mediates haem oxygenase-1 expression to suppress the lipopolysaccharide-induced inflammatory response in RAW264. 7 macrophages. *Journal of Pharmacy and Pharmacology*, 63(9), 1211-1218.
- El Ashry, E., Rashed, N., Salama, O. & Saleh, A. (2003). Components, therapeutic value and uses of myrrh. *Pharmazie* 58(3), 163-168.
- El-Sherbiny, G. M., & El Sherbiny, E. T. (2011). The effect of Commiphora molmol (Myrrh) in Treatment of *Trichomoniasis vaginalis* infection. *Iranian Red Crescent medical journal*, 13(7), 480–486.
- Ferrara, L. (2019). Nutrition and phytotherapy: a winning combination against headache. *International Journal of Medical Reviews*, 6(1), 6-13.

- Gadir, S. A., & Ahmed, I. M. (2014). Commiphora myrrha and commiphora Africana essential oils. *Journal of Chemical and Pharmaceutical Research*, 6(7), 151-156.
- Germano, A., Occhipinti, A., Barbero, F., & Maffei, M. E. (2017). A pilot study on bioactive constituents and analgesic effects of MyrLiq®, a Commiphora myrrha extract with a high furanodiene content. *BioMed Research International*, 1-11.
- Getasetegn, M., & Tefera, Y. (2016). *Biological Activities and Valuable Compounds from Five Medicinal Plants. Natural Products Chemistry & Research*, 04(04), 1-10.
doi:10.4172/2329-6836.1000220
- Kalra, M., Khatak, M., & Khatak, S. (2011). Cold and flu: conventional vs. botanical and nutritional therapy. *International Journal of Drug Development and Research*, 3, 314-327.
- Khalil, N., Fikry, S., & Salama, O. (2020). Bactericidal activity of Myrrh extracts and two dosage forms against standard bacterial strains and multidrug-resistant clinical isolates with GC/MS profiling. *AMB Express*, 10(21), 1-10.
- Khalil, N., Fikry, S., & Salama, O. (2020). Bactericidal activity of Myrrh extracts and two dosage forms against standard bacterial strains and multidrug-resistant clinical isolates with GC/MS profiling. *AMB Express*, 10(1), 21.
- Kim, D. G., Bae, G. S., Choi, S. B., Jo, I. J., Shin, J. Y., Lee, S. K., ... & Seo, S. H. (2015). Guggulsterone attenuates cerulein-induced acute pancreatitis via inhibition of ERK and JNK activation. *International Immunopharmacology*, 26(1), 194-202.
- Lin, C. T. S., & Raman, R. (2012). Comparison of the efficacy between oral rinse, oral gargle, and oral spray. *Journal of Primary Care & Community Health*, 3(2), 80-82.

Ly, N., Song, M.-Y., Kim, E.-K., Park, J.-W., Kwon, K.-B., & Park, B.-H. (2008).

Guggulsterone, a plant sterol, inhibits NF- κ B activation and protects pancreatic β cells from cytokine toxicity. *Molecular and Cellular Endocrinology*, 289(1-2), 49–59.

doi:10.1016/j.mce.2008.02.001

Manjula, N., Gayathri, B., Vinaykumar, K. S., Shankernarayanan, N. P., Vishwakarma, R. A., &

Balakrishnan, A. (2006). Inhibition of MAP kinases by crude extract and pure compound isolated from *Commiphora mukul* leads to down regulation of TNF- α , IL-1 β and IL-2.

International Immunopharmacology, 6(2), 122-132.

Mehta, A. K., & Tripathi, C. D. (2015). *Commiphora mukul* attenuates peripheral neuropathic pain induced by chronic constriction injury of sciatic nerve in rats. *Nutritional Neuroscience*, 18(3), 97-102.

Nomicos, E. Y. H. (2007). Myrrh. *Holistic Nursing Practice*, 21(6), 308–323.

doi:10.1097/01.hnp.0000298616.32846.34

Öktemer, T., İpçi, K., Muluk, N. B., & Cingi, C. (2015). A pastille combining myrrh tincture, peppermint oil and menthol to treat the upper airway. *ENT Updates*, 5(3), 128-131.

Shameem, I. (2018). Phytochemical & therapeutic potentials of Murr makki (*Commiphora myrrha*): A review. *Indian Journal of Applied Research* 8(9), 102-104.

Shen, T., & Lou, H. X. (2008). Bioactive constituents of myrrh and frankincense, two simultaneously prescribed gum resins in Chinese traditional medicine. *Chemistry & Biodiversity*, 5(4), 540-553.

Shen, T., Li, G. H., Wang, X. N., & Lou, H. X. (2012). The genus *Commiphora*: a review of its traditional uses, phytochemistry and pharmacology. *Journal of Ethnopharmacology*, 142(2), 319-330.

Shen, T., Yuan, H. Q., Wan, W. Z., Wang, X. L., Wang, X. N., Ji, M., & Lou, H. X. (2008).

Cycloartane-type triterpenoids from the resinous exudates of *Commiphora opobalsamum*.
Journal of Natural Products, 71(1), 81-86.

Shi, J. J., Jia, X. L., Li, M., Yang, N., Li, Y. P., Zhang, X., ... & Dang, S. S. (2015).

Guggulsterone induces apoptosis of human hepatocellular carcinoma cells through
intrinsic mitochondrial pathway. *World Journal Of Gastroenterology*, 21(47), 13277.

Shishodia, S., Azu, N., A Rosenzweig, J., & A Jackson, D. (2016). Guggulsterone for
chemoprevention of cancer. *Current Pharmaceutical Design*, 22(3), 294-306.

Shoaib, M., Shah, I., Ali, N., Adhikari, A., Tahir, M. N., Shah, S. W. A., ... & Umer, M. N.

(2017). Sesquiterpene lactone! a promising antioxidant, anticancer and moderate
antinociceptive agent from *Artemisia macrocephala* jacquem. *BMC Complementary And
Alternative Medicine*, 17(1), 27.

Singh, R. (2015). Medicinal plants: A review. *Journal of Plant Sciences*, 3(1), 50-55.

Singh, S. V., Choi, S., Zeng, Y., Hahm, E. R., & Xiao, D. (2007). Guggulsterone-Induced
Apoptosis in human prostate cancer cells is caused by reactive oxygen intermediate–
dependent activation of c-Jun NH2-terminal kinase. *Cancer Research*, 67(15), 7439-
7449.

Su, S., Duan, J., Chen, T., Huang, X., Shang, E., Yu, L., Wei, K., Zhu, Y., Guo, J., Guo, S., Liu,
P., Qian, D., & Tang, Y. (2015). Frankincense and myrrh suppress inflammation via
regulation of the metabolic profiling and the MAPK signaling pathway. *Scientific
Reports*, 5, 1-14

- Su, S., Wang, T., Duan, J. A., Zhou, W., Hua, Y. Q., Tang, Y. P., ... & Qian, D. W. (2011). Anti-inflammatory and analgesic activity of different extracts of *Commiphora myrrha*. *Journal of Ethnopharmacology*, 134(2), 251-258.
- Yao, Y. Q., Ding, X., Jia, Y. C., Huang, C. X., Wang, Y. Z., & Xu, Y. H. (2008). Anti-tumor effect of β -elemene in glioblastoma cells depends on p38 MAPK activation. *Cancer Letters*, 264(1), 127-134
- Yeo, S. K., Ali, A. Y., Hayward, O. A., Turnham, D., Jackson, T., Bowen, I. D., & Clarkson, R. (2016). β -Bisabolene, a sesquiterpene from the essential oil extract of *opoponax* (*Commiphora guidottii*), exhibits cytotoxicity in breast cancer cell lines. *Phytotherapy research*, 30(3), 418-425.
- Zahid, T. M., & Alblowi, J. A. (2019). Anti-Inflammatory and anti-plaque effects of *Commiphora myrrh* mouthwash: a preliminary pilot clinical study. *The Open Dentistry Journal*, 13(1), 1-5
- Zengin, H., & Baysal, A. H. (2014). Antibacterial and antioxidant activity of essential oil terpenes against pathogenic and spoilage-forming bacteria and cell structure-activity relationships evaluated by SEM microscopy. *Molecules*, 19(11), 17773-17798.