



Steam Inhalation with *Eucalyptus globulus* Oil as an Alternative Remedy for COVID-19 in Asymptomatic and Patients with Mild Symptoms: A Perspective

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ABSTRACT

The Coronavirus Disease 2019 (COVID-19) caused by a new coronavirus SARS-CoV-2 caused an outbreak of atypical viral pneumonia which has drastically impacted global public health. Coronaviruses are capable of causing disorders of the respiratory, digestive, and neurological systems. While there are severe COVID-19 cases, it is reported that most of the infected individuals exhibit mild to moderate symptoms. Several medicinal and alternative products have been studied to be potential agents and remedies for COVID-19 symptoms as there is a lack of interventions for this disease. Steam inhalation belongs to the most utilized home remedies to ease respiratory symptoms such as cold or sinus disease. As steam inhalation makes use of heat, it is said to provide subjective relief from respiratory symptoms. Heat can help in combating SARS-CoV-2 as it can shorten the lifespan of coronaviruses. Through virion inhibition and mucociliary clearance, heat improves the immune response of the upper respiratory tract, removing impure and pathogenic matter. Essential oils from *Eucalyptus globulus* and other Eucalyptus species contain Eucalyptol (1,8-cineole) which plays a significant role in exerting various biological activities including immunomodulatory and major antiviral activities. Eucalyptol is specifically seen as a potential inhibitor of viral replication by targeting the enzyme Main proteinase (Mpro). This study elucidates the potential use of steam inhalation with Eucalyptus essential oil as they can synergistically exert stronger immunomodulatory and antiviral properties beneficial for COVID-19 treatment.

Keywords: COVID-19, Essential Oil, Eucalyptol, *Eucalyptol globulus*, Steam inhalation

1. Introduction

The Coronavirus Disease 2019 (COVID-19) pandemic has been a major challenge to worldwide public health. A novel coronavirus SARS-CoV-2 that arose in the Chinese city of Wuhan in late 2019 caused the emergence of COVID-19, an outbreak of atypical viral pneumonia. This unique coronavirus illness has expanded swiftly, surpassing MERS and SARS in terms of the number of patients afflicted in various regions throughout the world. The previous emergence of the Middle East Respiratory Syndrome Coronavirus (MERS-CoV) and the Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV) had caused devastating respiratory infections in humans. For this reason, emerging coronaviruses have become a healthcare concern in the modern days^[1]. COVID-19 has been causing economic and social instability, increasing the likelihood of sliding into severe poverty, and increasing the number of undernourished individuals. Moreover, COVID 19 still lacks interventions since it is a new type of coronavirus which is why an emergence of several medicinal and alternative products has been studied to assess and evaluate their safety and efficacy as potential agents and remedies for COVID-19^{[2][3]}. As coronaviruses is a diverse group, it may also infect a wide range of animals and it can also cause mild to severe respiratory infections in people. It is estimated that 5-10% of COVID-19 cases have severe symptoms while the majority of the cases were mild to moderate symptoms^{[1][4]}. As a result,

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effective therapies and remedies have been an urgent need in order to address COVID-19 symptoms. At the moment, the standard for COVID-19 treatment is supportive care like control of ventilation, oxygenation, and hydration. With that, several clinical trials are in the process of determining the best effective treatment or combination against this virus. Chloroquine, corticosteroids, monoclonal antibodies, antisense RNA, convalescent plasma, and vaccines are among the interventions currently being explored and evaluated in the pursuit of combating COVID-19^[5].

SARS-CoV-2 is said to have similar characteristics with SARS-CoV's natural host. Its phylogenetic study of coronavirus sequences discovered that SARS-CoV-2 belongs to the Beta coronavirus genus which makes it genetically similar to SARS-CoV and more than 85% identical to bat SARS-like CoV (bat-SL-CoVZC45). SARS-CoV-2 enters cells by sticking to the angiotensin-converting enzyme 2 (ACE-2) receptor, which is identical to SARS-CoV, according to the Wuhan Institute of Virology^{[6][7]}. SARS-CoV-2 seems to resemble a solar corona when seen using transmission electron microscopy. Its viral particle has a spherical form with sizes ranging from 60 to 140 nm. This has a single-stranded positive-strand RNA that ranges in length from 26 to 32 Kb, making it the longest genome among the RNA viruses. This genome has a 5'-3' UTR, and six open reading frames (ORFs). The first ORF encodes 16 non-structural proteins near the 5', that are important for transcription and viral replication, whereas the other ORFs encode the four major structural proteins (S, M, N, and P), as well as the eight auxiliary proteins (3a, 3b, p6, 7a, 7b, 8b, 9b, and ORF14) at the end of 3' UTR that plays important roles of the viral particle's assembly^{[6][8][9]}.

The virus spread fast throughout China, and then to many other nations around the world. By the 6th of May 2020, in 215 countries, the virus has caused more than millions of laboratory-confirmed cases and more than 243,000 fatalities. As a result, the World Health Organization (WHO) has declared a global public health emergency with a risk level of "very high"^[10]. Incubation period is an important index to know when does the infection disease would spread and to the formulation of quarantine measures, such COVID-19 infection has a median (interquartile range (IQR)) or a wide range of incubation time of 2.87 days to 17.6 days^{[10][11]}. Common symptoms of COVID-19 include fever, cough, and fatigue. Septic shock as well as the acute respiratory distress syndrome can develop fast in severe instances. COVID-19 infection, on the other hand, is clinically and biochemically indistinguishable from pneumonia brought about by normal respiratory parcel infections such as flu infection, *Streptococcus pneumoniae*, and *Mycoplasma pneumoniae*. Therefore, early conclusion of SARS-CoV-2 contamination is essential for giving proper clinical consideration and forestalling transmission by isolating^[10].

Coronaviruses may have a shorter life span when exposed to higher temperatures and humidity than when exposed to colder or dryer settings^[12]. When exposed to UV radiation, particularly in the sun, coronaviruses can die quickly. However, the reason for the condition of inactivation to the heat sensitivity of SARS-CoV-2 is unknown, yet there are a lot of reports and studies that coronaviruses such SARS-CoV-2 are heat-sensitive and may be destroyed in 30 minutes at 56°C. They thrive best at room temperature and cold temperatures with low relative humidity since it is an encapsulated virus. For this reason, heating with a 56°C temperature could be a viable method for inactivating SARS-CoV-2. On the other hand, the outcome of heating in antibody detection remains unknown. In connection to that, it is essential to note that inactivation of the virus by means of heat may significantly interfere with antibody levels and result in false-negative results^[13].

Steam inhalation is among the well-known home remedies to alleviate respiratory symptoms such as cold or sinus disease manifestations. Also called steam treatment, it includes the internal breath of water exhaust. The warm, soggy air is presumed to reduce thickened mucus in the nasal areas, throat, and lungs. This might let indications free from aroused, enlarged veins in the nasal sections. While steam inhalation will not fix contamination, similar to a cold or this season's virus, it might assist with causing you to feel much better while your body wards it off. Like any other home cure, learn best practices so that no one hurts themselves all the while. Moreover, steam inhalation can deliver subjective relief and consolation from the symptoms of a cold and other upper respiratory infection^[14].

SARS-CoV-2, the causative agent of COVID-19 which is an RNA infection encased in a capsid and peri-capsid that is crossed by glycoprotein proteins. The outer protein structure, which targets human cells, could be a therapeutic target for supportive therapies to prevent contamination reproduction in the airways. Because high temperatures can cause irreversible protein denaturation and loss of its infectivity after warming at 56 degrees Celsius for 15 and 30 minutes in liquid conditions, respectively. Despite the fact that the negative effects of COVID 19 contamination have aided clinical consideration toward clearly resolved clinical techniques, it is also mentioned by the European Pharmacopoeia VI edition that steam inhalation breathes a way to cure respiratory ailments^{[15][16]}.

The warm, clammy air during steam inhalation is presumed to function by unwinding the natural liquid in the nasal segments, throat, and lungs. This might free side effects from excited, enlarged veins in your nasal sections. A stodgy nose is set off by aggravation in the veins of the sinuses. The veins can become bothered on account of an intense upper respiratory disease, like a cold or a sinus infection. The primary advantage of taking in clammy, warm steam is that it might assist with facilitating sensations of aggravation and enlarged veins in the nasal passages. The dampness may likewise assist with diminishing the bodily fluid in your sinuses, which permits them to discharge all the more without any problem. This can permit your breathing to get back to business as usual, essentially for a brief timeframe^[13].

Steam itself has such restorative impacts, as well as it encompasses us, supporting us in sustaining warmth, assisting us with unwinding and delivery strain. During steam inhalation it alleviates breathing blockage by moistening the air and makes breathing better as it loosen up mucus in the nasal passages and airways. Also, adding a little medicinal balm to the steam not only extends its effectiveness but also its advantages^[17]. Steam inhalation has been utilized both as a customary home cure and as extra in the treatment of various respiratory conditions, including diseases like normal colds,

bronchiolitis, and croup. The training depended on speculated impacts of both hotness and moistness of warm, sodden air. For normal colds, one reason was the diminished replication in vitro of the human rhinoviruses (the most predominant reason for the normal cold) at temperatures of 33 to 43 degrees Celsius (OC). On the other hand, moistness might be secretolytic in bronchiolitis. In croup, it might mitigate excited laryngeal mucosa, decrease the thickness of the bodily fluid, and straightforward wind current. Steam inhalation can prompt alleviation of the chilly side effects of these cycles ^{[18][19]}.

Essential oil is a compound that can be extracted from different plant parts like flowers, leaves, stalks, fruits, bark, seeds, and roots. It can also be distilled from resins. They appear in pleasant colorless liquids with an increased refractive index. The essential oil contains a mixture of saturated and unsaturated hydrocarbons, and functional group such as alcohol, aldehydes, ester, ethers, ketones, and terpenes that generate a characteristic odor of a unique sweet-smelling that would give trademark to every fundamental oil. Essential oils are mostly administered in small quantities including inhalation which is the best treatment for respiratory symptoms and nervous disorder, massage, simple application in the skin for the treatment of skin disease and rarely for internal ^{[20][21]}. The oils are acquired through refining (by means of steam as well as water), dry distillation or mechanical strategies, like in piercing and squeezing. When the fragrant synthetic compounds have been removed, they are joined with a transporter oil to make an item that is prepared for use ^[22]. Essential oils are now gaining importance in the use of therapeutic, cosmetic, aromatic, fragrant and spiritual. A few oils can assist with treating viral diseases, while others can diminish fever ^[21].

The essential oil obtained from eucalyptus (*Eucalyptus globulus*) leaves, fruits, and branch tips is commonly known to treat different respiratory illnesses such as pharyngitis, bronchitis, and sinusitis ^[23]. The major bioactive constituent of eucalyptus essential oil is eucalyptol, chemically known as 1,8-cineole. Eucalyptol contained in from eucalyptus plant is present in some over-the-counter decongestants such as chest rubs, where numerous researchers acknowledge that this oil can allow the signs to be released from colds and hacks, including sinus stop-up and dullness. Eucalyptus oil can be used in much the same way as peppermint oil. People routinely utilize eucalyptus oil in steam showers, and like peppermint oil, it may alleviate or clear tediousness and blockage in the nose ^{[24][25][26]}. Moreover, eucalyptus oil has been seen as a potential antiviral therapy that can probably treat and prevent infectious viral diseases. This is because of the eucalyptol (1,8-cineole) content that is present in the plant of eucalyptus. Based on the data resulting in the molecular docking technique, eucalyptol showed binding to (Mpro) of the SARS-CoV-2, a primary viral protease, which plays a critical role in the maturation of the viral protein and predominantly the potential for drug targets. Through the binding process between the eucalyptol and Mpro there is an occurrence of inhibition in viral production ^{[23][24][27]}. To sum up, direct inactivation is the primary molecular mechanism in the antiviral activity of Eucalyptus. The direct inactivation mechanism to control viral infection is conducted to free viruses by direct binding of monoterpenes particularly, with viral proteins affected in penetrating the host ^[28].

This article review aims to establish possible health benefits of using eucalyptus essential oils in the form of steam inhalation which may have potential antiviral activity that can help in lessening or treating symptoms of SARS-CoV-2 as eucalyptus can help in the improvement of nasal mucociliary clearance and steam reduces mucosal inflammation or that the heat slows viral replication which may hasten the combat against the coronavirus infection.

2. Methods

This article review was conducted using journal databases such as Google Scholar, PubMed, Elsevier, and ResearchGate. The search technique was established for articles on each database without hindrance on language or the timeframe in which the study was undertaken. The article search started in November 2021. Topics searched were all focused on steam inhalation, Eucalyptus globulus oil, SARS-Cov-2 Virus, and antiviral activity. The articles were analysed, and a summary was created. Articles that mention the antiviral activity of Eucalyptus globulus oil and Steam inhalation as an alternative remedy for Covid-19 were highly focused. The review was done comprehensively in order to establish possible health benefits of Eucalyptus and Steam inhalation.

3. SARS-Cov-2 Virus: Its Characteristics and Function

Coronaviruses can be found in a broad variety of animals and are capable of causing moderate to severe respiratory illnesses in humans. Additionally, they may spread to other species as well. ^[1]. Numerous animals would get ill from Coronaviruses belonging to the γ and δ genera. SARS-CoV, MERS-CoV, and SARS-CoV-2 all belong to the β -genera and are capable of infecting and transmitting from animal to human which can result in patients suffering from respiratory disease. SARS-CoV-2 is a previously unknown virus which explains why it was initially named as a novel coronavirus. The new coronavirus was found to have a 79% genome sequence similarity to SARS-CoV and 50% genome sequence identity to MERS-CoV. SARS-CoV-2 has the ability to be easily passed from person to person making it spread rapidly throughout the world causing millions of deaths, making it the world's most severe health problem and has now been declared a global pandemic ^{[27][29]}.

An RNA virus called SARS-CoV-2 has one strand and is part of the subfamily of Coronavirinae, which is part of the Coronaviridae family of the order Nidovirales. When exposed to this coronavirus, it may cause respiratory system problems such as acute pneumonia and difficulty breathing as well as a range of other conditions that can affect other parts of the body. It can also cause disease in digestive, and neurological systems in humans and a variety of other species ^{[30][8]}. In terms of epidemiological characteristics, SARS-CoV-2 development is mainly within 14 days in 3 to 4 days ^[28]. The genetic data of SARS-CoV-2 represents the metagenomic next generation sequencing procedure that shows the length of base pair and amino acids which is related to other coronaviruses.

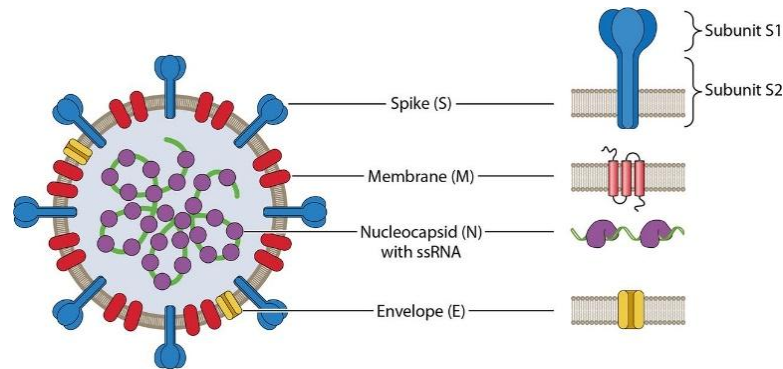


Fig. 1 - Structure and protein localization of Coronavirus ^[31]

This virus carries two flanked untranslated regions, thus the encoding of fragments of genes in 5'3' UTR are proteins both structural and non-structural. S, E, M, N (Fig. 1) are the structural proteins that are being encrypted by the 3' open reading while on the contrary the 5' long open reading frame cleaved into the polyprotein and encoded the non-structural proteins that produce nsp3, nsp5, nsp12, nsp13 (helicase), and other NSPs that could play a role in transcription and replication of the disease ^{[29][28]}. SARS-CoV-2 has overlapped the external with a glycosylated S protein that is in control of the attachment to the host cell receptor, the ACE2 making the entry of virus replication inside the cell. After the replication, the virus would go through transcription, cleavage, and replication-transcriptase complex assembly. The virus's RNA is then replicated together with the structural protein generated, resulting in a new replicate virus that is discharged and infects the other host cell^[28].

4. How SARS-CoV-2 Induces Infection

SARS-CoV-2 is deadly and a life-threatening infection. This is because of its transmittable capabilities, where it can infect other individuals through exposure to droplets or objects used or touched by an infected individual, directly or indirectly. Coronavirus particles are composed of 4 major structural proteins (Fig. 1). 1st S subunit of the S protein is in charge of the linking of the host cell receptor while the 2nd S subunit is on attachment to the plasma membranes ^[31].

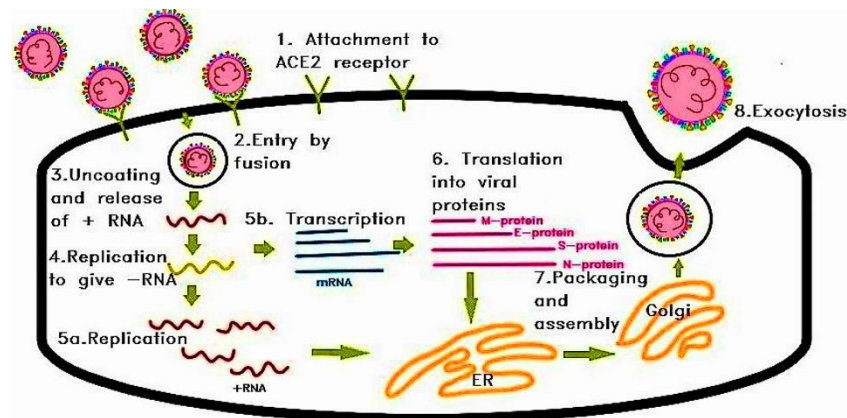


Fig. 2-SARS-CoV-2 stages of replication within the host cell ^[33]

SARS-CoV-2 can cause infection when the S protein of the virus is attached to the host vital receptor the Angiotensin-Converting Enzyme 2 (ACE2) of the cell membrane making a way for the virus to enter the host cell. This host receptor is very functional for SARS-CoV-2 and it was expressed highly in alveolar type 2 cells (AT2) in the lung which is potential for high-risk infection. Also, it can be expressed in the upper esophagus, olfactory neuroepithelium, ileum, large intestine, cardiac muscle cells, proximal tubule cells, and urothelial cells ^[32]. Moreover, when the virus enters the cell directly via fusion or endocytosis to the host cell, it would go into the cytoplasm and release a ribonucleic acid (RNA) and translate into polyproteins (pp1a and pp1ab) where it can assist in the replication and transcription. When replicates and transcribes are done, the mRNAs will be translated after and produce viral proteins (S,E,M,N) that will be carried by the endoplasmic reticulum (ER) to the Golgi apparatus, where the packaging and transporting of proteins happen via vesicles. Through that, there is a formation of new replicate viruses and be released to the host cell by exocytosis. By then, it will infect other cells that may cause the death of the host cell or apoptosis. When the cells are infected, a slow appearance of symptoms is detected and divided into 3 stages. First, the Asymptomatic Stage, wherein innate immunity response is limited and symptoms may not be physically shown at all but the virus can already be detected through the use of RT-PCR (swab test). Second, the Upper Airway Infection stage where there is already a trigger to the innate immune response and the virus slowly shifts to the upper respiratory tract. Third and last, the Acute Respiratory Distress Syndrome (ARDS) and

Hypoxia stage wherein the lungs have already been infected which damages the alveoli. Then the damaged cells will release dangerous molecules, which trigger the release of interferons and activation of immune cells that would lead to an uncontrollable release of immunity such as cytokine release storms causing damage to the immune-mediated hosts, which resulted in severe injury of infected tissues^[33]. With these said, SARS-CoV-2 can be detected in the upper airway together with bronchial epithelium and submucosal gland epithelium, which is an advantage when steam inhalation alongside essential oil is utilized as an alternative remedy in combating SARS-CoV-2.

5. Eucalyptus Essential Oil: Characteristics and Potential Antiviral Activity



Fig.3 -Eucalyptus globulus^[34]

Eucalyptus globulus is the species known as the primary source of the globally used eucalyptus oil. It is a widely used species where essential oil with great medicinal value can be extracted. The essential oil extracted from eucalyptus is described as a colourless liquid with a strong, sweet, and woody smell. Eucalyptus essential oil is among the well-known herbs utilized as herbal remedies owing to its biological activities and medicinal qualities. In line with this, Eucalyptus essential oil is reported to have various clinical applications including antiviral, antibacterial, anti-inflammatory, immunomodulatory, and antioxidant properties^{[35][36]}. The constituents of Eucalyptus oil include Eucalyptol, Citronellal, Geranial, Myrcene, Isopulegol, Cuminaldehyde, and Pinene^[37]. In connection to that, the health benefits exerted by Eucalyptus is due to bioactive terpenes that are present in its essential oil. The eucalyptus constituent 1,8-cineole also known as Eucalyptol is the major provider of various biological activities from eucalyptus^[38,35]. Eucalyptol is a monocyclic terpene with an ether bridge in its chemical structure (Fig. 3).

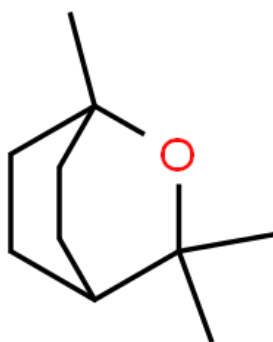


Fig.4 -Structure of eucalyptol (1,8-cineole)^[39]

High content of eucalyptol makes eucalyptus oil beneficial as a home remedy aromatherapy in easing respiratory tract conditions like nasal congestion, colds, flu, fever, and asthma. In alleviating respiratory symptoms, eucalyptol can effectively exert mucolytic, anti-inflammatory, bronchodilatory, and immunomodulatory activities that can help the respiratory tract in combating infections and eventually stopping the progression of symptoms^{[40][41]}. Moreover, Eucalyptus oils containing eucalyptol are reported to have major antiviral properties which could be used against herpes simplex virus, influenza, SARS-CoV-2, and other viruses^{[42][43][28]}. The potential use of eucalyptus essential oil for the treatment of COVID-19 as well as the mechanism involved in exerting antiviral effects are also revealed. Eucalyptol is particularly seen as an inhibitor of Main protease (Mpro), an enzyme important for the coronavirus replication to proceed^{[24][44]}. Eucalyptol can halt viral replication which makes the use of eucalyptus essential oil helpful in COVID-19 treatment^[44].

6. Steam Inhalation: How Does It Help for COVID-19 Infection

For many centuries steam inhalation was considered the prime treatment for conditions such as the common flu and the influenza virus. Now it may be considered as an adjunct in the treatment of coronavirus disease ^[45]. Due to its classification as an enveloped virus, the SARS-CoV-2 virus may be eliminated through heat which is intense enough to kill it but leave humans unscathed. This has to do with the fact that it is sensitive to heat, however, it may only be utilized in coronavirus disease cases that are considered mild to moderate as those who are experiencing a severe one cannot undergo steam inhalation due to dyspnea. In many cases, it was seen that after steam inhalation there was a radical decrease in COVID-19 symptoms in terms of duration and severity. Steam inhalation may be utilized alongside other methods such as frequent handwashing and social distancing to ensure treatment and prevention are given against COVID-19 ^[19].



Fig. 5 - Illustration on steam inhalation ^[46]

Aside from convenience and low cost, heat has also shown significant effects in improving the defense mechanism of the body. It can help mitigate viral infections due to its ability to activate both acquired and innate immune responses, imitating a fever ^[47]. By means of virion inhibition and mucociliary clearance, heat improves the immune response of the upper respiratory tract and removes impure matters and pathogenic microorganisms ^[48]. Moreover, the psychological and physiological importance of heat were also cited. Heat was found to enhance mental wellness that increases the chances to think positively as well as enables thermoregulatory mechanisms that help in maintaining homeostasis ^{[49][50]}. The effects of heat in combating viral infections can be improved when used alongside eucalyptus essential oil which also has profound immunomodulatory and antiviral effects owing to its high content of eucalyptol ^{[40][41]}. Steam inhalation involves the use of heat and eucalyptus oil has a high content of eucalyptol. For this reason, steam inhalation with eucalyptus oil can provide a stronger immune response and boosted effects indirectly targeting the virus, thereby synergistically inhibiting the progression of SARS-CoV-2 infection.

7. Discussion

Viral infections, which are not living organisms, can stay alive in a wide range of temperatures, from very cold to very hot, even though they are not living. A lot of respiratory tract illnesses, like SARS-CoV and SARS-CoV-2 infections, happen when enveloped viruses like rhinoviruses and coronaviruses are active in cold and dry places. This is because these viruses are more active in these places. Some viruses, like coronaviruses, can be killed by temperatures between 55 and 65°C for 15 to 30 minutes. This is because viruses are very sensitive to heat, so this is a common way to kill viruses inside vaccines ^[49].

When it comes to combating COVID-19, a variety of heat-based therapies may be employed in conjunction with other personal hygiene practices. Heating and humidifying the indoor environment, for example, can help to keep the nasal mucosa from drying out, improve nasal patency, and ease symptoms in some cases. In this case, when steam is used with essential oils that have antiviral, cough suppressant, and antistress properties, and other characteristics, it may be even more effective in promoting mucociliary clearance and lowering viral load, while also bringing about physical and psychological comfort ^[51].

People with COVID-19 have problems with their upper respiratory tract and the majority of the infected individuals exhibiting mild to moderate symptoms are treated at home. Essential oils have been used in many ways to help people with COVID-19 feel better. The volatile phytochemicals found in essential oils (EOs) include monoterpenes, sesquiterpenes, and phenylpropanoids, among others. EOs have been studied a lot due to its ability to provide benefits for the skin, free radical scavenging, and antimicrobial effects. This group of EOs has been shown to be effective against different viruses, including seasonal flu, human herpesviruses (HSV), and human immunodeficiency virus (HIV). In addition, it has long been believed that essential oils extracted from the Eucalyptus globulus tree might help cure a wide range of respiratory disorders, such as bronchitis and pharyngitis as well as sinusitis. 1,8-cineole, the active ingredient in eucalyptus oil, has been found to reduce airway smooth muscle contractions induced by several treatments, which are the symptoms of COVID-19 ^[23].

Coronavirus-related infections in patients with mild and uncomplicated symptoms may benefit from using eucalyptol and essential oils or blends high in it as an integrative therapy. If the person has COVID-19, they should not use menthol because Menthol should not be used in patients with COVID-19 because it may decrease the person's sense of dyspnea, which may induce them to postpone medical treatment and underestimate the severity of their illness.

Furthermore, steam inhalation with 30° Celsius is the temperature at which most influenza viruses are inactivated^{[52][45]}. According to Pawar et al. (2020)^[45], the study found that SARS-CoV-2 virus lost its viability when temperatures reached greater than 38° Celsius and relative humidity is greater than 95%. It should be noted that steam has a temperature of about 70-80° Celsius which is vastly greater than temperatures where the virus would lose its viability. Old and new data state that regular sauna bathing may improve one's respiratory, cardiovascular, and immune functions. Some also state that it could also improve the quality of life and mood of a person^[53].

SARS-CoV-2 mostly infects the upper respiratory tract which covers the nasal passages, throat, and trachea. The infection would stay there around 5-6 days. However, its residence time may extend up to 14 days^[54]. The patient would feel sore throat, tiredness, dry cough, shortness of breath, pain, loss of taste, loss of smell, and fever in the early stage of infection^[55]. The upper respiratory tract is the target in the early stages of COVID-19 infection which is why treatments aimed at the nasal epithelial cells are ideal in preventing the progression of the disease^[56].

According to the study of la Marca et al. (2021)^[16], ten medical professionals tested positive with RT-PCR while being asymptomatic and having symptoms of mild to moderate. The study protocol comprises exposure of steam inhalation through the airway mucosae for at least 4 cycles at 5 mins a total of 20 minutes in 1 hour, with a maintained temperature of 55 to and 65 °C within the first 5 minutes when the water boils. The patients are instructed to use a towel to cover their heads and lower it with a distance of 25 to 30 cm away from the steam. Results show that there were 6 patients with symptoms, and 1 asymptomatic patient reported clinical improvement due to steam inhalation on the first day. The rest of the patients, such as patient number 8 with mild headache and nasal congestion, the symptoms cleared on day 10 with a negative result of RT-PCR. Moreover, patient number 10 with moderate symptoms completely stopped on day 10 with proof of negative test results^[16].

Aside from that, a study by Swain et al. (2021)^[19] was conducted to 52 asymptomatic patients labelled as Group A and 44 symptomatic COVID-19 patients labelled as Group B. The age range of the patients is 22 to 68 years old. All patients were treated with steam inhalation along with a continuation visit during the first week, second week, first month, and second month. Group A results reveal that only 48 asymptomatic patients became symptom-free prior to follow-up visit at 2 weeks whereas 4 patients developed mild symptoms. On the other hand, Group B results show that 36 patients were mildly symptomatic while 8 patients were moderately symptomatic. With 5 days of steam inhalation, patients with mild COVID-19 symptoms become symptom-free while patients with moderate COVID-19 symptoms, except for one, become symptom-free after 7 days. On day 10 of treatment, out of 96, 84 COVID-19 patients tested negative after all groups underwent the reverse transcription-polymerase chain reaction (RT-PCR) test. Week 2 was where all Group A patients were tested negative due to 14 days of treatment whereas, in group B, they were all tested negative on the 20th day. All patients under the category of Group-A and B who utilized steam inhalation were shown to be negative for COVID-19, recovered, and no death was reported among the patients^[19].

8. Limitation of the Study

This study focuses on reviewing the findings on how steam inhalation with Eucalyptus globulus oil will work as an alternative remedy for COVID-19 in mild and asymptomatic patients. It is limited to discuss topics on the aspect of COVID-19's sensitivity to heat and how it may alleviate some of its symptoms with the use of eucalyptus and steam inhalation. Finally, the study will not delve into in-depth pharmacological concepts and focus on collating and reviewing the results from other studies; this study will only cite trends and findings from other studies.

9. Conclusion

This paper helped elucidate what the SARS-CoV-2 virus can do, its characteristics, and how Eucalyptus essential oil, with its potential antiviral properties, in conjunction with steam inhalation would help treat mild to moderate symptoms and asymptomatic COVID-19 patients. Eucalyptus globulus is a widely used genus for essential oil extraction due to its health benefits and diverse applications. It is also commonly used for aromatherapy in easing upper respiratory conditions like colds, flu, asthma, and bronchitis. Exploration of Eucalyptus essential oil against the COVID-19 virus is still ongoing, but it was seen to be effective in different types of viruses, and other microorganisms like bacteria, and fungi. Steam inhalation has the tendency to be utilized as an adjuvant remedy for those with mild COVID-19, but anything more severe might be deemed ineffective as dyspnea occurs. While these results may lead one to consider the utilization of Eucalyptus essential oil and steam inhalation plausible, further investigation is needed and more experiments should be done. Future studies on this may lead to finding more ways to ensure that an alternative and non-invasive way to treat COVID-19 infections will be assured.

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