

Review Article

Egyptian Medicinal Plants and Respiratory Disease

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Abstract

The disease that affects in lungs makes the respiratory system very difficult and results in bad breath. This affects the other biological operations humans need to do because the lungs are the place of getting oxygen, which is necessary for life. There many factors that appear according to this disease such as coughs and nasal congestion. Medicinal plants contain natural ingredients that cure this disease, particularly an essential oil that helps clear mucus and relieve inflammation. Some medicinal plants help to strengthen the lungs and avoid respiratory illnesses, such as *Verbascum thapsu*, whose leaf is a supreme, safe, and profound respiratory tonic. It helps open the lungs, eases spasms, tightness, and cough, and soothes irritation and dryness. Thyme helps fight respiratory infections, is a natural expectorant that saves as an antiseptic, and helps expulse mucus. *Marrubium vulgare* is a plant with high bioactive potential. It contains marrubiin, a labdane diterpene characteristic of this genus, and a complex mixture of phenolic compounds. Eucalyptus for better breathing, the essential oils found in eucalyptus help clear mucus and relieve inflammation. Therefore, Thyme helps fight respiratory infections and is a natural expectorant that serves as an antiseptic and helps expulse mucus. It also good for soothing coughs and fighting nasal congestion. The present review article aims to clarify some medicinal plants' application to respiratory disease.

Keywords: *Nigella sativa*, *Origanum majorana* L, Peppermint, *Plantago* spp, *Plantago* spp.

1. Introduction

The human respiratory system is a biological system that consists of the upper and lower parts. The upper respiratory system comprises the nasal cavity, paranasal sinuses, and pharynx, while the lower is the larynx, trachea, bronchi, bronchioles, and alveoli. Respiration itself refers to external and internal processes. External respiration acts for the exchange of O₂ and CO₂ between the body's interstitial fluids and the external environment, while internal respiration represents the absorption of O₂ and the release of CO₂ by cells. Disorders of the respiratory system can affect both the upper and lower respiratory system and cause an immense worldwide health burden. Costs for the treatment of respiratory diseases by countries' healthcare systems are an extensive weight on the economy.

Rural individuals from developing countries tend to have more trust in traditional herbal medicine due to their considerable experience and lack of access to modern medicines. Hence, in-depth information on traditional and ethnomedical perspectives can facilitate community-centered approaches under the present medical system given that the

potential of traditional herbal medicines in the treatment of asthma not fully utilized. Thus, established preclinical studies needed. Several experimental animal models for asthma are accessible for preclinical screening. Lung inflammatory disorders comprise airway diseases including acute bronchitis and chronic obstructive pulmonary diseases (COPD) such as chronic bronchitis, chronic asthma and emphysema. Particularly, COPD is the fifth leading cause of death worldwide. They are essentially inflammatory diseases. Several drugs such as antitussives, mucolytics, and bronchodilators clinically used to treat the symptom, resulting in a relatively well-controlled condition. However, chronic diseases (COPD) are hard to control with the currently available drugs, which only relieve the symptoms of bronchitis. They do not affect or reverse the pathological progress of COPD. Thus, many pharmaceutical firms are trying to develop new drugs that target the pathological courses of COPD, eventually leading to a complete cure.

Respiratory tract infections (RTIs) refer to infections in any part of the respiratory tract that could affect the nasal passages, the bronchi, and the lungs, they are common, with

most of the world's population contracting at least one infection annually. The respiratory tract is highly susceptible to infections due to its continuous exposure to the gaseous environment including particulate organic material, such as bacteria and viruses. To reduce such risk of respiratory tract infections, the human body has developed a range of strategies including filtering out the nasal hairs, inertial impaction with mucus-covered surfaces in the posterior nasopharynx, and more. Despite the different strategies developed to defend microorganisms from reaching the lower respiratory tract, the frequency of infection occurrences, the respiratory tract poses serious problems due to their high prevalence with associated significant mortality rates and economic loss. Respiratory conditions include bronchitis, common cold, pharyngitis, sinusitis, and influenza. Coughing, sneezing, fever.

1.1. *Nigella sativa*

Cited that *N. sativa* is a grassy plant belonging to the Ranunculaceae family. It has been widely used in the Middle East, India, and North Africa [1-6]. There are many reports concerning the biological and pharmacological activity of this plant, such as immunomodulatory, anti-inflammatory, pain alleviating, antidiabetic, antibacterial, antifungal, anticancer, antioxidants, and anti-hypertensive effects. Black cumin (*Nigella sativa*) seed has widely used traditionally as a food ingredient and herbal remedy for the treatment of many inflammatory and allergic diseases in African, Arab and Indian nations especially in the southwest of Asia. [7-21] Identified and isolated many active ingredients from *N. sativa* of different varieties, they found oil, carbohydrates, protein, fiber, ash, and saponins are generally present in *N. sativa* seed. They added that there are trace amounts of non-oily and non-caloric components with pharmacological effects in the plant seed. These constituents are phyto-alkaloids, including pyrazol (nigellidine and nigellidine), isoquinoline (nigellimine and nigellimine-N-oxide) as well as a flavonoid (comferol), diglucoside and digalactoside, alpha-hederin, saponins, vitamins (riboflavin, pyridoxine, niacin, thiamin, folic acid and vitamin E) and minerals (sodium, potassium, calcium, magnesium, copper, iron, and phosphorus).

Nigella sativa, known as black cumin belongs to the Ranunculaceae family. *N. sativa* used worldwide in cooking and for its many medicinal properties. Various studies have confirmed the beneficial effects of *N. sativa* on the respiratory system, lung parenchyma, narrowing of the airways, stimulating the body's energy, and improvement fatigue, as well as its anti-inflammatory effects (22). The seeds of this plant are very useful and have different chemical compositions and contain amino acids, proteins, carbohydrates, and volatile oil (0.5 to a maximum of 1.5%), and fixed oil (30%). Many of the medicinal properties of *N. sativa* are due to the quinone compounds in its seed (13). The composition of this plant includes four types of alkaloids called Nigellamine (1) A, (2) A, (1) B, and (2) B, which are extracted from the seed of this plant. Thymoquinone (TQ), Dithymoquinone (TQ2), Thymohydroquinone (THQ), and Thymol are the main active ingredients in the aqueous extract of the *N. sativa* [23-35]. *Nigella sativa* is useful for improving and treating respiratory disorders,

such as asthma and bronchial spasms (14). They added that Nigellone is an *N. sativa* compound (a polymer in TQ or TQ2) that can relieve airway obstruction. Nigellone blocks the release of histamine, which causes the narrowing of the airways.

Generally, the constituents found in black cumin could divide into volatile and non-volatile compounds. The other category found in *N. Sativa* is non-volatile compounds e.g. alkaloids. Moreover, proteins, saponins, fatty acids, carbohydrates, and phenolic compounds such as flavonoids have also been reported. There is no standard dose of *N. sativa* except for some different doses studied by researchers. For example, 2 gs (Powder) for 12 weeks considered appropriate for most of the respiratory issues. In addition, 500 mg of black cumin oil can also be taken twice daily for 4 weeks (12). Shortness of breath, sore throat, and headache are the common signs associated with respiratory tract disease (26).

1.2. *Origanum majorana* L

Origanum majorana L. is an aromatic and medicinal plant distributed in different parts of Mediterranean countries. It belongs to the family Lamiaceae. (20), cited that it has a medicinal effect on respiratory diseases (e.g., asthma, cough, and chest pain). (8), noticed that the parts of sweet marjoram that used in folklore medicine are dried leaves, leaf extract, and essential oil. *Origanum majorana* leaves have claimed to have antimicrobial and emmenagogue properties and be useful for the treatment of respiratory and gastrointestinal problems. According to (9), Monoterpene hydrocarbons, including α and β -pinene, camphene, sabinene, α - and β -phellandrene, ρ -cymene, limonene, β -ocimene, γ -terpinene, terpinolene, α -terpinene, carvone, and citronellol have been detected in the essential oil of *O majorana*. He added that Terpinene 4-ol and cis-sabinene hydrate are 2 main oxygenated monoterpenes isolated from *O majorana* and Linalool, linalyl acetate, α -terpineol, trans- and cis-carveol, thymol, anethole, geraniol, and carvacrol are other oxygenated compounds identified in essential oil and leaves of *O majorana*. (34), arranged that *majorana* contain Vanillic acid, gallic acid, ferulic acid, caffeic acid, syringic acid, p- and m-Hydroxybenzoic acid, coumaric acid, neochlorogenic acid, protocatechuic acid, chlorogenic acid, cryptochlorogenic acid, caftaric acid are phenolic acids that have been detected in hydroalcoholic extract of sweet marjoram leaves. He added that Hesperetin, catechin, quercetin, kaempferol, naringenin, eriodictyol, diosmetin, luteolin, and apigenin are the most abundant flavonoids detected in sweet marjoram too.

It is a good general tonic, treating various disorders of the digestive and respiratory systems. It has indicated as tinctures or teas in respiratory. *Oregano vulgare* (L.) is an important aromatic plant widely used in many countries for seasoning foods (25). *Oregano* used in folk medicine to treat respiratory disorders, dyspepsia, painful menstruation, rheumatoid arthritis, scrofula, and urinary tract disorders (16).

1.3. Peppermint

Menthol, the main chemical component of peppermint, is an effective decongestant. Decongestants shrink the nose's

swollen membranes, making breathing easier. Menthol is also an expectorant. Expectorants loosen and bring up mucus from the lungs. (2), found that essential oils of herbal origin are widely used in the treatment of diseases of the upper and lower respiratory tract primarily due to their antibacterial and antiviral effects. Menthol, the major component of the essential oil of mint (*Mentha*) species, exhibits antispasmodic activity, which might result in improved lung function. Inhalation of essential oils from aromatic plants by an aerosol spray, nebulizer, or nasal treatment has regarded as a health enhancer due to their pain relief, and anti-inflammatory and anti-tumor properties. (1). Genus *Mentha* known as an aromatic species used for food flavoring and medicinal herbs worldwide, because the leaves, flowers, and stems of this genus are known to contain terpenes/essential oils. Essential oils (EOs) of the *Mentha* species, regarded as peppermint oil, reported to ameliorate histamine and ovalbumin (OVA)-induced bronchial asthma (31). Interestingly, healthy adults nebulized with *Mentha* essential oils (MEO) for 5 min following 1500 m running tests showed significant improvement in lung function and exercise performance. (33), published that menthol frequently used in over the counter medications for common colds and coughs. It formerly considered being under the class of herbal medicine, but the identification of the menthol receptor (TRPM8) moved it from the class of herbal medicine to molecular pharmacology. It has documented that menthol reduces dyspnoea and nasal obstruction via nasal cold or flow receptor stimulation. It has also antitussive and antiirritative effects. Menthol can also induce adverse reactions such as airway irritation, dyspnoea, chest tightness and potentially respiratory failure, mainly in children.

Peppermint oil (*Menthae piperitae aetheroleum*) obtained by steam distillation from the fresh aerial parts of the flowering plant of *Mentha piperita* L. The essential oil is a colorless, pale yellow or pale greenish-yellow liquid. It has a characteristic odor and taste followed by a sensation of cold by (11). The EO yield of peppermint is 1.2-3%, contains menthol (30-55%), menthone (14-32percentage), iso menthone (1.5-10%), menthyl acetate (2.8-10%), menthofuran (1-9%), 1, 8-cineole (3.5-14%), limonene (1-5%). Not more than 3% of pulegone and not more than 1% of carvone, with a higher ratio of cineole compared to that of limonene, according to (10).

1.4. *Pimpinella anisum* L.

Anise is an herbaceous annual plant, cultivated in many areas in the Middle East and Asia, but native to the Mediterranean region (30). The *Pimpinella anisum* belongs to *Pimpinella* Genus, the *Apiaceae* or *Ombelliferae* Family (15, 27), published that Aniseed (*Pimpinella anisum* L., *Apiaceae*) is a medicinal and aromatic plant widely cultivated in the Mediterranean area and used in foodstuffs, as an ingredient of famous liqueurs, confectionery and bakery products. Its essential oil is one of the most sold on the market and used on an industrial level. In addition, aniseed exploited as an herbal remedy to threat respiratory disorders.

It is also cultivated for food, where seeds and fruits constitute

the edible parts, as well as for extractions of bioactive compounds that used in medicine and other industrial purposes (8). Currently, many studies have addressed growth parameters to increase the productivity of this useful species. They addressed the germination of seeds, the growth of seedlings, and their impact on the quality, Content, and Chemical Composition (30). The cultivation of this plant aims to respond to increasing agronomic and industrial uses. In Algeria, plant parts counting seeds, leaves are habitually used against respiratory disorders, chronic uremic in Algerian inflammatory-malnutrition, and currently against COVID-19 infection (36).

Aniseed (*Pimpinella anisum* L., *Apiaceae*) is a medicinal and aromatic plant widely cultivated in the Mediterranean area and used in foodstuffs, as an ingredient of famous liqueurs, confectionery and bakery products. Its essential oil is one of the most sold on the market and used on an industrial level. In addition, aniseed exploited as an herbal remedy to threat respiratory disorders in addition to nascent influenza vaccination programs, some countries in Africa also treat severe influenza illnesses during influenza epidemics and pandemics with empiric antivirals, and/or deploy non-pharmaceutical interventions to prevent contagion during epidemics (eg, respiratory hygiene, social distancing, and hand washing campaigns), (7).

From the analysis of 11 samples of fruit essential oils belonging to European countries. (23) revealed that trans-anethole (76.9-93.7%) was the major component followed by γ -himachalene with 0.4-8.2%, trans-pseudoisoeugenyl 2-methylbutyrate with 0.4-6.4%, p-anisaldehyde, with 5.4%, and methyl chavicol with only 0.5-2.3%. while the minor components were nonanal with 0-1.4%, isogeijerene, 0-0.9%, cis-anethole (0-2.0%), pregeijerene (0-0.5%, and bourbonene (0-0.9%). These chemicals were variable from country to country. The highest content of trans-anethole with a fraction superior to 90% found in the samples of Greece, Scotland, Hungary, Italy, Lithuania, and Germany. In the Middle East, the analysis (GC-MS) of essential oil extracted from seeds showed 51 components, with the dominance of trans-Anethole or Anisole (71.52%), followed by benzocycloheptene (6.59%), and Isoeugenyl acetate (4.63%) in samples from Iraq (4), 4-allylanisole (85.28%), Limonene (5.53%), Fenchone (4.12%), Anethole (3.54%), Acide linoléique (trace), and Camphene (trace) in samples from Yemen. In North Africa, 4-allylanisole (76.70%), Limonene (9.75%), Anethole (7.40%), Fenchone (6.16%), linoleic Acide (trace), and Camphene (trace) were the principal chemicals in Moroccan samples, while in Algerian samples, trans-anethole (92.4%) followed by estragole (1.9%), o-isoeugenol (1.9%), and γ -himachalene (1.1%) were the major chemical constituents (.28). (13), cleared that Anise oil could use to treat respiratory complaints, mainly as an expectorant in coughs associated with colds.

1.5. *Plantago* spp.

(5), cited that *Plantago* major L. leaves have used as a wound healing remedy for centuries in almost all parts of the world and in the treatment of a number of diseases apart from

wound healing. These include diseases related to the skin, respiratory organs, digestive organs, reproduction, and circulation, against cancer, for pain relief and against infections. P. major contains biologically active compounds such as polysaccharides, lipids, caffeic acid derivatives, flavonoids, iridoid glycosides and terpenoids. Alkaloids and some organic acids have also detected. A range of biological activities has found in plant extracts including wound healing activity, anti-inflammatory, analgesic, antioxidant, weak antibiotic, immunomodulating and antiulcerogenic activity. Some of these effects may attributed to this plant's use in folk medicine.

Both (18, 19) published that medicinal plants occur naturally and are widely used in a large number of countries all around the world. People use them either in the form of traditional preparations or as pure active forms. Usually for their known therapeutic qualities and to avoid the harmful side effects of prescription medicine. One such plant is *Plantago major*, also known as Ribwort, which is readily available in many parts of the world; its leaves and seeds have been used for centuries as an anti-inflammatory, analgesic, antioxidant, anti-infective, immune-modulating, anti-ulcerogenic, anti-fungal, and anti-cancer agent, as well as for wound healing purposes. (39) cleared the properties of P. major are modulated by the different components of the plant contents are carbohydrates, lipids, alkaloids, caffeic acid derivatives, flavonoids, iridoid glycosides, and other terpenoids. The chemical analysis of the leaves revealed the presence of aucubin, a glycoside, which has reported in several studies to be a powerful anti-toxin. There are also some other effective ingredients in this plant such as baicalein, ascorbic acid, apigenin, benzoic acid, chlorogenic acid, citric acid, ferulic acid, oleanolic acid, salicylic acid, and ursolic acid. (24), cited that *Plantago major* is an annual plant belonging to the plantain family (Plantaginaceae). It has many therapeutic effects such as anti-inflammatory, analgesic, and antioxidant. It used traditionally to treat demodicosis, infectious and respiratory diseases, and tumors.

Plantago known for its pharmaceutical activities (20). *Plantago* has a wide range of uses, including raw materials for salads, soups, baking, and animal feed to improve health and reduce antibiotic use. Phytochemicals derived from the root, leaf, and stem of the genus *Plantago* have shown medicinal potential *Plantago* species have been widely used in phytochemistry since ancient times (29). Due to their high phytochemical content, they possess anti-inflammatory and antioxidant activity (37); they added that in particular, *Plantago* species have shown to contain high levels of iridoids, flavonoids, and tannins. In addition, information, they found that the high level of phytochemicals in *Plantago* species is responsible for the antioxidant and anti-inflammatory activity of the preparations. *Plantago major* (P. major) of Plantaginaceae family is commonly known as broadleaf plantain (3). It is popular in traditional medicine for wound healing as well as treating diseases related to skin, respiratory organs, digestive organs, reproduction, circulation, cancer, infection, and pain (29). Besides the traditional applications, many researches have done to prove its medicinal properties such as antiulcerogenic, anti-inflammatory, and immune-modulat-

ing activities and antioxidant, antiviral, and anticarcinogenic activities (22).

1.6. Rosemary (*Rosmarinus officinalis* L.)

Rosemary oil is one of the most loved essential oils of all time, having used in Eastern and Western cultures alike for thousands of years. Originating in the Mediterranean region, rosemary is a popular household herb with rich culinary and medicinal traditions. In Ayurveda, the ancient holistic healing tradition that originated in India about 5,000 years ago, rosemary extensively used for treating a range of common ailments, including headaches, colds, cough, flu, sinus congestions, bacterial and viral infections, and many other respiratory disorders. Furthermore, it advised for daily use as preventive medicine for people who are vulnerable to sinus congestion, especially during spring and winter seasons. Rosemary (*Rosmarinus officinalis* [family Lamiaceae], an herb of economic and gustatory repute, employed in traditional medicines in many countries. Rosemary contains carnosic acid (CA) and carnosol (CS), abietane-type phenolic diterpenes, which account for most of its biological and pharmacological actions, although claims have also made for contributions of another constituent, rosmarinic acid. Preventive medicine, rosemary oil offers many benefits for our respiratory health.

Rosemary oil works as an expectorant when inhaled, relieving throat congestion from allergies, colds or cases of flu. Inhaling the aroma can fight respiratory infections because of its antiseptic properties. It also has an antispasmodic effect, which helps in the treatment of bronchial asthma. Rosemary is a valuable essential oil for respiratory problems, helping conditions like the common cold, catarrh, asthma and sinusitis. Rosemary oil contains the oxide cineole, which is a strong expectorant. In addition, cineole and terpene alpha-pinene believed to provide rosemary oil with antibacterial activity. For example, Egyptian researchers have demonstrated the effectiveness of rosemary oil in vitro against cryptococcal meningitis, Cryptococci pneumonia, and systemic infections of mycobacterium- a bacteria responsible for diseases such as leprosy and tuberculosis by Leave. Meanwhile, (32) cited that Rosmarinic acid in rosemary extract has positive effects on the renin-angiotensin system. Rosemary affects the respiratory system by reducing oxidative stress, inflammation, and muscle spasm, and through anti-fibrotic properties.

2. Conclusion

Traditional medicine known as indigenous or folk medicine comprises knowledge systems that developed over generations within various societies before the modern medicine, the prevalence of folk medicine in certain areas of the world varies according to cultural norms. Some modern medicine based on plant phytochemicals that used in folk medicine. Traditional medicinal plants have ingredients such as alkaloids, flavonoids, terpenoids, polysaccharides, lactones, and glycoside products that are responsible for causing alterations Traditional medicine has been a productive resource for revealing novel lead molecules for modern drug discovery. It thought that plants have launched a terpene-based host defense during evolution, which also shows a cornu-

copla of effective remedial compounds for common human diseases. Consequently, natural products derived from medicinal herbs have the potential for respiratory disease. The previous showed that traditional medicinal plants could use in curing respiratory disease, these plants are very cheap and have rare inside effects.

References

1. Aziz, Z. A., Ahmad, A., Setapar, S. H. M., Karakucuk, A., Azim, M. M., Lokhat, D., ... & Ashraf, G. M. (2018). Essential oils: extraction techniques, pharmaceutical and therapeutic potential—a review. *Current drug metabolism*, 19(13), 1100-1110.
2. Anwar, F., Abbas, A., Mehmood, T., Gilani, A. H., & Rehman, N. U. (2019). *Mentha*: A genus rich in vital nutraceuticals—A review. *Phytotherapy Research*, 33(10), 2548-2570.
3. Nazarizadeh, A., Mikaili, P., Moloudizargari, M., Aghajanshakeri, S., & Javaherypour, S. (2013). Therapeutic uses and pharmacological properties of *Plantago major* L. and its active constituents. *J Basic Appl Sci Res*, 3(9), 212-221.
4. Al-Saadi, S. A. A. M., Al-Derawi, K. H., & Al-azem, D. A. (2016). Variation in essential oil content and composition (*Pimpinella anisum* L.). *J Biol Agric Healthc*, 6(2), 43-57.
5. Samuelsen, A. B. (2000). The traditional uses, chemical constituents and biological activities of *Plantago major* L. A review. *Journal of ethnopharmacology*, 71(1-2), 1-21.
6. Ashraf, S. S., Rao, M. V., Kaneez, F. S., Qadri, S., Al-Marzouqi, A. H., Chandranath, I. S., & Adem, A. (2011). *Nigella sativa* extract as a potent antioxidant for petrochemical-induced oxidative stress. *Journal of chromatographic science*, 49(4), 321-326.
7. Cohen, A. L., McMorro, M., Walaza, S., Cohen, C., Tempia, S., Alexander-Scott, M., & Widdowson, M. A. (2015). Potential impact of co-infections and co-morbidities prevalent in Africa on influenza severity and frequency: a systematic review. *PloS one*, 10(6), e0128580.
8. Das, S., Singh, V. K., Dwivedy, A. K., Chaudhari, A. K., & Dubey, N. K. (2021). Nanostructured *Pimpinella anisum* essential oil as novel green food preservative against fungal infestation, aflatoxin B1 contamination and deterioration of nutritional qualities. *Food Chemistry*, 344, 128574.
9. EL-MOURSI, A. B. D. A. L. L. A., TALAAT, I., & BALBAA, L. K. (2012). Physiological effect of some antioxidant polyphenols on sweet marjoram (*Majorana hortensis*) plants. *Nusantara Bioscience*, 4(1).
10. ESCOP (European Scientific Cooperative on Phytotherapy). (2003). *ESCOP Monographs: the scientific foundation for herbal medicinal products*. European Scientific Cooperative on Phytotherapy.
11. *European Pharmacopoea*, 5th Edn, Vol. 2 Directorate for the Quality of Medicines of the Council of Europe: Strasbourg, France, 2004; 1004, 1108, 1570, 2206, 2534, 2569.
12. Fallah Huseini, H., Amini, M., Mohtashami, R., Gharmarchehre, M. E., Sadeqhi, Z., Kianbakht, S., & Fallah Huseini, A. (2013). Blood pressure lowering effect of *Nigella sativa* L. seed oil in healthy volunteers: A randomized, double-blind, placebo-controlled clinical trial. *Phytotherapy Research*, 27(12), 1849-1853.
13. Gali-Muhtasib, H., El-Najjar, N., & Schneider-Stock, R. (2006). The medicinal potential of black seed (*Nigella sativa*) and its components. *Advances in Phytomedicine*, 2, 133-153.
14. Gilani, A. U. H., Jabeen, Q., & Khan, M. A. U. (2004). A review of medicinal uses and pharmacological activities of *Nigella sativa*. *Pak J Biol Sci*, 7(4), 441-51.
15. Giordano, M., Petropoulos, S. A., Kyriacou, M. C., Graziani, G., Zarrelli, A., Roupheal, Y., & El-Nakhel, C. (2022). Nutritive and phytochemical composition of aromatic microgreen herbs and spices belonging to the *Apiaceae* family. *Plants*, 11(22), 3057.
16. Gruenwald, J., Brendler, T., & Jaenicke, C. (2007). *PDR for herbal medicines*. Thomson, Reuters.
17. El-Tahir, K. E. D. H., & Bakeet, D. M. (2006). The black seed *Nigella sativa* Linnaeus—A mine for multi cures: a plea for urgent clinical evaluation of its volatile oil. *Journal of Taibah University Medical Sciences*, 1(1), 1-19.
18. Hung, J. Y., Yang, C. J., Tsai, Y. M., Huang, H. W., & Huang, M. S. (2008). Antiproliferative activity of aucubin is through cell cycle arrest and apoptosis in human non-small cell lung cancer A549 cells. *Clinical & Experimental Pharmacology & Physiology*, 35(9).
19. Park, K. S., & Chang, I. M. (2004). Anti-inflammatory activity of aucubin by inhibition of tumor necrosis factor- α production in RAW 264.7 cells. *Planta medica*, 70(08), 778-779.
20. Liolios, C. C., Graikou, K., Skaltsa, E., & Chinou, I. (2010). *Dittany of Crete*: a botanical and ethnopharmacological review. *Journal of ethnopharmacology*, 131(2), 229-241.
21. Zubair, M., Nybom, H., Lindholm, C., & Rumpunen, K. (2011). Major polyphenols in aerial organs of greater plantain (*Plantago major* L.), and effects of drying temperature on polyphenol contents in the leaves. *Scientia Horticulturae*, 128(4), 523-529.
22. Mokhtari-Zaer, A., Norouzi, F., Askari, V. R., Khazdair, M. R., Roshan, N. M., Boskabady, M., ... & Boskabady, M. H. (2020). The protective effect of *Nigella sativa* extract on lung inflammation and oxidative stress induced by lipopolysaccharide in rats. *Journal of ethnopharmacology*, 253, 112653.
23. Orav, A., Raal, A., & Arak, E. (2008). Essential oil composition of *Pimpinella anisum* L. fruits from various European countries. *Natural product research*, 22(3), 227-232.
24. Parhizgar, S., Rad, A. K., Hajzadeh, M. R., Hoseynian, S., & Havakhah, S. (2015). The effect of hydro-alcoholic extract of *Plantago major* on cisplatin-induced renal toxicity in rats. *Avicenna Journal of Phytomedicine*, 5.
25. Quiroga, P. R., Grosso, N. R., Lante, A., Lomolino, G., Zygodlo, J. A., & Nepote, V. (2013). Chemical composition, antioxidant activity and anti-lipase activity of *O riganum vulgare* and *L ippia turbinata* essential oils. *International journal of food science & technology*, 48(3), 642-649.
26. Naz, R., Gul, A., Javed, U., Urooj, A., Amin, S., & Fatima, Z. (2019). Etiology of acute viral respiratory infections common in Pakistan: A review. *Reviews in medical virology*, 29(2), e2024.

27. Iannarelli, R., Marinelli, O., Morelli, M. B., Santoni, G., Amantini, C., Nabissi, M., & Maggi, F. (2018). Aniseed (*Pimpinella anisum* L.) essential oil reduces pro-inflammatory cytokines and stimulates mucus secretion in primary airway bronchial and tracheal epithelial cell lines. *Industrial crops and products*, 114, 81-86.
28. Saibi, S., Belhadj, M., & Benyoussef, E. H. (2012). Essential oil composition of *Pimpinella anisum* from Algeria. *Analytical Chemistry Letters*, 2(6), 401-404.
29. Samuelsen, A. B. (2000). The traditional uses, chemical constituents and biological activities of *Plantago major* L. A review. *Journal of ethnopharmacology*, 71(1-2), 1-21.
30. SHAHRAJABIAN, M. H., KHOSHKHARAM, M., WENLI, S., & Cheng, Q. I. (2019). The effects of pretreatment factors on seed germination and seedling growth of anise (*Pimpinella anisum* L.). *Middle East Journal of Science*, 5(1), 86-93.
31. Sharma, S., Rasal, V. P., Patil, P. A., & Joshi, R. K. (2018). *Mentha arvensis* essential oil suppressed airway changes induced by histamine and ovalbumin in experimental animals. *Natural product research*, 32(4), 468-472.
32. Shiravi, A., Akbari, A., Mohammadi, Z., Khalilian, M. S., Zeinalian, A., & Zeinalian, M. (2021). Rosemary and its protective potencies against COVID-19 and other cytokine storm associated infections: A molecular review. *Mediterranean journal of nutrition and metabolism*, 14(4), 401-416.
33. Gavliakova, S., Buday, T., Shetthalli, V. M., & Plevkova, J. (2013). Analysis of pathomechanisms involved in side effects of menthol treatment in respiratory diseases.
34. Vallverdú-Queralt, A., Regueiro, J., Alvarenga, J. F. R., Martinez-Huelamo, M., Leal, L. N., & Lamuela-Raventos, R. M. (2015). Characterization of the phenolic and antioxidant profiles of selected culinary herbs and spices: caraway, turmeric, dill, marjoram and nutmeg. *Food Science and Technology*, 35, 189-195.
35. Tiruppur Venkatachallam, S. K., Pettekhan, H., Divakar, S., & Kadimi, U. S. (2010). Chemical composition of *Nigella sativa* L. seed extracts obtained by supercritical carbon dioxide. *Journal of food science and technology*, 47, 598-605.
36. Yasser, K., Abdallah, M., & Abdelmadjid, B. (2018). Étude ethnobotanique de quelques plantes médicinales dans une région hyper aride du Sud-ouest Algérien «Cas du Touat dans la wilaya d'Adrar». *Journal of Animal & Plant Sciences*, 36(2), 5844-5857.
37. Zhou, Q., Lu, W., Niu, Y., Liu, J., Zhang, X., Gao, B., ... & Yu, L. (2013). Identification and quantification of phytochemical composition and anti-inflammatory, cellular antioxidant, and radical scavenging activities of 12 *Plantago* species. *Journal of agricultural and food chemistry*, 61(27), 6693-6702.