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# ADVANCED FORMULATION AND PACKAGING OF GINGER OIL-BASED MEDICATED AROMA-INHALERS

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## ABSTRACT

Present inhalers are vaporizers producing only local effect therefore there is a need of special aroma-inhalers which may promote better body mind and spiritual health. Aroma inhalers uses aromatic essential oil which improves mental and emotional wellbeing. This concept utilizes principle of aroma therapy which is based on total wellbeing for taking care of related problem. Now-a-days there are lot off infectious out brakes therefore there is a need to strengthen our immune power and take care of different infectious out brake. Medicated aroma-inhaler may help in this regard and also take care of infection. To enhance health and wellbeing, aromatherapy uses natural organic extracts from natural sources. In this formulation we utilize different types of ingredients like Pudina crystals, Camphor, Methyl salicylate, Eucalyptus oil, Tulsi oil, Garlic oil, Clove oil and Rose oil to create a beneficial synergistic mixture

**KEYWORDS:** Effleurage, Hydrodistillation, Hydrodiffusion, Hypolipidemic, Phytotherapy.

## INTRODUCTION

Three routes of medicine delivery are available gobbled, oral and parenteral which are used alone or in combination.

Inhalation remedy offers the stylish eventuality for optimal delivery to the lungs with reduction in systemic side goods. The development and distribution of inhaler medicines and technologies have brought about major advancements in the forestalment and treatment of asthma, so that utmost cases with access to treatment can lead a basically normal life.[1] Inhalation remedy with anti-inflammatory agents and bronchodilators has the advantage of producing the topmost original effect on airway smooth muscle with lower eventuality for systemic toxin. In other words, the rate between remedial effect and side goods similar as cardiovascular or central nervous system stimulation may be lower for oral and parenteral phrasings than for the gobbled styles of administration.[2] Delivery of medicine to the airway mucosa by inhalation remedy depends on numerous factors, including the pattern of breathing, the figure of lungs and airways (Frequently altered in cases with lung complaint), and the size of the aerosol patches. patches below roughly 1 μm in size generally don't strike the mucosa and are exhaled, whereas the indolence of patches lesser than roughly 5 μm causes them to be deposited in the delivery bias and the upper airway.[3]

Aromatherapy is a holistic remedial fashion that promotes health and well- being by using natural factory excerpts. It's also known as essential oil painting treatment.[4]

Aromatherapy is a medical practice that employs ambrosial essential canvases to promote the health of the body, mind, and soul. It benefits both physical and internal heartiness.

Aromatherapy is considered both an art and a wisdom. Aromatherapy has lately acquired fashionability in the disciplines of wisdom and drug.[5] The oil painting has a number of unique remedial parcels, uses, and consequences. Adding essential canvases to make a synergistic admixture provides fresh benefits.

### ❖ What exactly is aromatherapy?

Aromatherapy is a holistic remedial fashion that promotes health and well- being by using natural factory excerpts. It's also known as essential oil painting treatment. Aromatherapy is a medical practice that employs ambrosial essential canvases to promote the health of the body, mind, and soul. It benefits both physical and internal heartiness.[6]

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❖ **What is the history of aromatherapy?**

Aromatherapy has been utilised by humans for thousands of times. sweet factory factors were used in resins, redolence's, and canvases by ancient societies in China, India, Egypt, and away. These natural chemicals had medicinal and religious functions. They were known to have physical as well as cerebral advantages.

The Persians are credited with the invention of essential oil painting distillation in the 10th century, still the practise may have was for much longer. In the 16th century, information about essential oil painting distillation was published in Germany. In the nineteenth century, French croakers recognised the remedial eventuality of essential canvases.[8]

In the nineteenth century, medical interpreters grew more established and concentrated on the use of chemical specifics. still, French and German croakers recognised the function of natural botanicals in sickness treatment.[9]

❖ **Brain-targeted nasal delivery by EO or VO**

Therapeutic drugs are delivered to brain tissue through odorous molecules by aromatic plant extracts breathed through the nose, which stimulate the olfactory system. By controlling brain chemistry, these neurotransmitters reduce symptoms of anxiety and sadness and enhance the quality of sleep.[10-12] The olfactory epithelium of the nasal mucosa receives aromatic Odour molecules through the nose chamber, which are evoked by first-order neurons in the olfactory bulb. The olfactory tract is formed by mitral cell axons and secondary neurons, with selective mitral cell axons reaching the ipsilateral olfactory bulb. The amygdala, entorhinal cortex, piriform cortex, and olfactory tubercle are among the key olfactory regions to which secondary neurons project after entering the olfactory striatum. Subsequently, these impulses reach the orbitofrontal cortex after partially reaching the hippocampus. As a link connecting the nervous system and the body's processes, the central olfactory region sends an extra olfactory signalling channel to the prefrontal cortex, releasing neurotransmitters like endorphins and serotonin.[13]

## MATERIAL AND METHOD

### Ginger oil

Ginger and its constituents have numerous medicinal properties such as anti-emetic, carminative, stimulant, anti-inflammatory, cardiotonic, antioxidant, antitussive, antibacterial,

cholagogue actions as well as to promote gastric secretions, increase intestinal peristalsis, lower cholesterol levels and anti-thrombotic.

- **Biological source:** Dried rhizome of *Zingiber officinale*
- **Family:** Zingiberaceae
- **Geographical source:** Indigenous to tropical areas such as Asia (India and China), West Africa, Jamaica.

**Morphology/Macroscopical characters**

- The perennial plant is 2-4 feet tall with a green purple flower in terminal spikes.
- Ginger's rhizome is fibrous and lacks a cork, alternatively it is buff in colour with longitudinal striations. With a length of around 2.75 to 6 inches and a width of 1 to 1.5 cm, the rhizomes are laterally compressed.
- The branches (1-3cm length) arising from the rhizome are oblique to it and end in undeveloped buds or depressed scars.
- Depending on the quantity of cork removed, ginger might be "coated" or "unscraped."
- When the rhizome is broken it yields a short fracture with fibrovascular bundle fibre's protruding from the broken surface.
- Because the rhizome is used as a spice, it is linked to a pleasant, fragrant scent and strong flavour.

**Uses**

- Ginger is used as an anti-emetic, and unlike antihistamines, it has been suggested that its fragrant, carminative, and potentially absorbent qualities help to reduce the symptoms of motion sickness directly in the GI tract. Additionally, it works effectively to reduce postoperative nausea and vomiting as well as hyperemesis gravidarum.
- The cardiovascular activity shown by ginger is mainly due to the gingerols and shogaols. The inhibition of prostaglandin synthetase, which prevents the gingerols from producing prostaglandins, is the suggested mechanism for these actions.
- Ginger also has antiplatelet aggregation property which is due to the inhibition of thromboxane synthesis.
- Ginger also lowers cholesterol levels by inhibition of cholesterol biosynthesis under the assumption of inhibiting HMGCoA reductase.
- Ginger also possess antitussive, anti-pyretic and analgesic effects.

- Ginger rhizome also has been reported to have fungicidal, antibacterial and anthelmintic properties.
- Sesquiterpenes hydrocarbons are responsible for the anti- ulcer activity.

**Risks and Side effects**

- It's rare to have side effects from ginger essential oil. However, in high doses, ginger oil may cause mild heartburn, diarrhoea and irritation of the mouth.
- Pregnant or breastfeeding women should consult their doctors before taking ginger essential oil, and pregnant women should not take more than one gram per day. Children over 2 years may take ginger to treat nausea, stomach cramping and headaches, but ask your doctor first.
- If you take a blood thinner medication, talk to your doctor before taking ginger essential oil because it can increase the risk of bleeding. If you take diabetic medication, avoid using ginger essential oil since it may cause your blood sugar to drop.
- If you are on high blood pressure medications, don't take ginger essential oil because it can also lower your blood pressure, which can make it too low.

**Chemical composition of ginger oil**

The ginger essential oil of OD form mainly comprises sesquiterpenes hydrocarbons (34.97%) and α-curcumene (9.44%), the most prevalent compound. Monoterpenes, oxygenated monoterpenes, and oxygenated sesquiterpenes hydrocarbons constituted 20.32%, 12.74% and 12.57%, respectively

**Methods of Extraction and Isolation of ginger oil**

Essential oils have been isolated in a variety of forms, each of which boosts their bioactive and therapeutic properties in some way. The most successful procedures used in these extraction processes are freeze drying, rotary evaporation, steam distillation, hydrolyzation,[14,15] and GC chromatography tests, among others. Figure 2 depicts numerous techniques for Obtaining essential oils from various plants.[16]

Demonstrated the efficacy of using GC to extract essential oils from the leaves of edible (Arachis hypogaea L.) and perennial (Arachis glabrata Benth.) peanut plants. Steam distillation is a method of separating chemicals that disintegrate at high temperatures by distilling them while introducing steam into the input material. Steam distillation extracts 93% of essential oils, and the remaining 7% can be extracted further using different

techniques [17]. Hydrolysis is a procedure that includes completely immersing plant components in water and then boiling them. This procedure preserves the extracted oils to some extent since the surrounding water acts as a barrier to keep it from scorching.[18]

Common techniques used for the extraction of essential oils are;

- Hydrodistillation.
- Hydrodiffusion.
- Effleurage.
- Cold pressing.
- Steam distillation.
- Solvent extraction.
- Microwave Assisted Process (MAP).
- Carbon dioxide extraction.

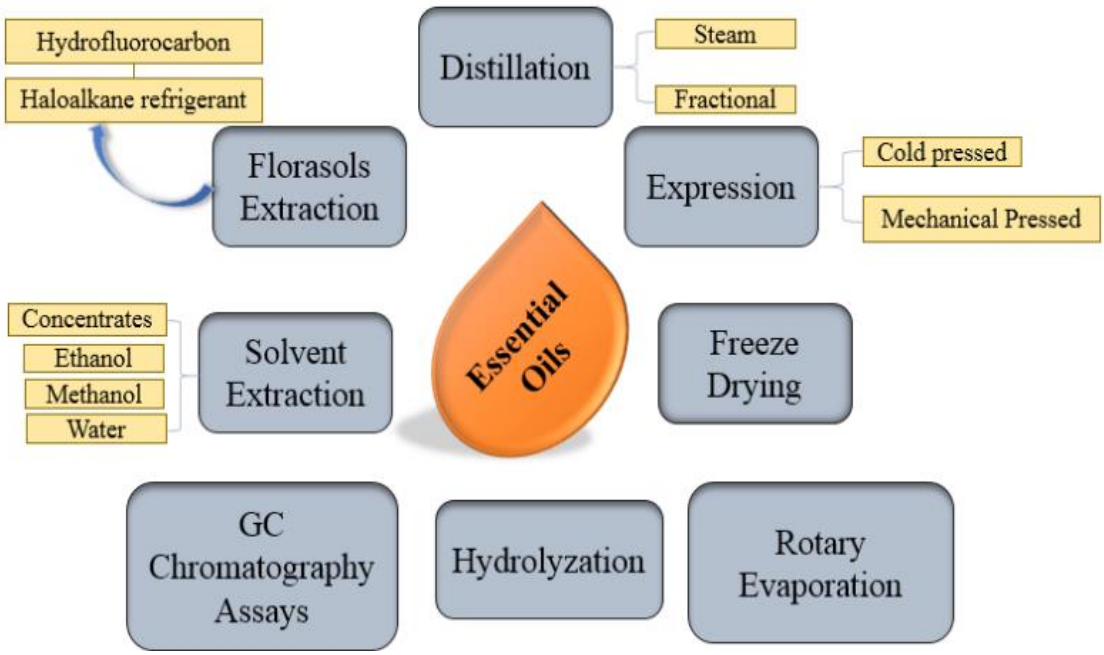


**Figure 1: Several methods for extracting essential oils form different plants.**

➢ **Hydrodistillation**

Distillation of water in direct contact with fresh or occasionally dried macerated plant materials is used in this process. The plant material is ground and weighed before being transported to the Clevenger setup. Plant material is heated using direct steam at a rate two to three times that of water weight. The distillation vessel is heated over a heating mantle, and the water vapour and oil are extracted via a water-cooled condenser.[19]

- **Hydrodiffusion**

Hydrodiffusion is a technique of extracting essential oils in which atmospheric pressure steam (0.1 bar) is pushed through the plant material from the top of the extraction chamber, resulting in oils that preserve the plants' inherent aroma.

- **Enfleurage**

This method is appropriate for flowers with little essential oil concentration and those are so delicate that boiling would damage the petals before releasing the essential oils, such as jasmine or tuberose. Flower petals are laid on trays of odourless vegetable or animal fat, which absorbs the essential oil of the flower. After the vegetable or fat has absorbed as much essential oil as possible, the exhausted petals are removed and replaced with fresh ones every day or every few hours. This process is repeated until the fat or oil is saturated with the essential oil.

- **Cold pressing**

Cold pressing is another method of extracting essential oils that has not seen widespread use in scientific study. It is used to extract citrus oils such as bergamot, grapefruit, lemon, lime, and so on. The extracted fruits are rolled over a trough with sharp projections that puncture the peels and pierce the small pouches carrying the essential oil. The entire fruit is pressed to extract the juice, which is then separated from the juice by centrifugation.

- **Steam distillation**

This is the most popular method of extracting oils and the oldest way of obtaining essential oils. The selected plant (Fresh or occasionally dried) is first inserted into the jar in this approach. Following that, steam is introduced and circulated through the plant, which contains the aromatic molecules or oils. Once the plant has released these aromatic molecules, the fragrant molecules flow within a closed system to the cooling equipment. To chill vapours, cold water is employed. They condense and turn into a liquid when they cool.

- **Solvent extraction**

This approach includes the extraction of oils from oil-bearing materials using a solvent. The solvent utilised is determined by the section of the plant being extracted. For example, leaves, roots, and fruits are extracted with benzene in the cold or at boiling temperatures, with or without a combination of acetone or petroleum ether, whilst flowers are extracted with ethers. The solvent is introduced into the plant to dissolve the oil waxes and colour. Following

extraction, the solvent is removed by distillation at low pressure, leaving behind the semisolid concentrate, which is next extracted with 100% ethanol. The second extract is cooled and filtered to precipitate the waxes. This wax-free alcoholic solution is distilled at low pressure to extract the alcohol and, lastly, the essential oil.[20]

- **Microwave Assisted Process (MAP)**

The water molecules in plant tissue are excited by the microwave, which causes the cells to burst and release the essential oil that is kept in the extracellular tissue of the plant. Numerous writers have have developed and reported on this technique for essential oil extraction in order to obtain a high yield of the essence while reducing extraction time.

- **Carbondioxide extraction**

Plant material is put in a high pressure vessel and carbon dioxide is circulated through the tank in this procedure. The carbon dioxide condenses and serves as a solvent to extract the essential oil from the plant material. When the pressure is reduced, the carbon dioxide converts to a gas, leaving no trace behind. The chemical makeup of the oil determines the qualities of essential oil extracted using any of the processes discussed above.

**Analysis of ginger oils**

**The two major goals of essential oil analysis are**

(i) Identifying and quantifying as many elements as feasible.

(ii) To assess the quality of the oils and detect any probable adulteration that may have an impact on their use. Gas chromatography (Qualitative analysis) and Gas chromatography-mass spectroscopy (Qualitative analysis) are commonly used in the analysis of essential oils. A popular confirmatory test is gas chromatography analysis.

- **Gas Chromatography Analysis (GC)**

Gas chromatography analysis is a chemical equipment that separates compounds from a complicated sample and produces a representative spectrum output. The gas chromatography equipment vapourizes the sample before separating and analysing its constituents. Each component should ideally create a distinct spectral peak. "Retention time" refers to the period between injection and assessment. A hypodermic needle and syringe are used to inject the sample into the injection port, which is kept at a temperature that causes the sample to vaporise quickly. The carrier gas forces the oils down the column, and the oil spreads uniformly over the column's cross section, allowing the different substances to partition

themselves. Substances that do not want to cling to the column or packing are hampered but eventually elute. The different chemicals in the sample should ideally separate before eluting from the column end. The detector detects various substances as they exit the column.[21]

❖ **Gas Chromatography-Mass Spectroscopy Analysis (GC/MS)**

Gas Chromatography-Mass Spectroscopy analysis combines the properties of gas, liquid, and mass chromatography to detect distinct chemicals within a test sample. The device for gas chromatography-mass spectroscopy is divided into two parts: The gas chromatography (GC) component separates the chemical mixture into pure chemical pulses, and the mass spectrometer (MS) component detects and quantifies the chemicals. The chemical pulses proceed to the MS after the material has gone through the GC. The molecules are bombarded with electrons, causing them to shatter and transform into positively charged particles known as ions. This is significant because charged particles must pass through the filter. As the ions pass through, they are filtered depending on their mass by an electromagnetic field. The number of ions with different masses that went through the filter is shown on a graph called the mass spectrum. The mass spectrometer's data is transferred to a computer and displayed on a graph called the mass spectrum. The purpose of analysis is to determine the quality of the constituent so that it may be used in a variety of ways.[21]

**Pharmacological applications of essential oils**

Essential oils have been regarded as having a wide range of pharmacological characteristics. Individuals and corporations have recently discovered methods for influencing the effects of pharmaceutical items. Six Lamiaceae herbs that are widely utilised in China include Perilla frutescens (L) Britt, Pogostemon cablin (Blanco) Benth, Mentha haplocalyx Briq, Rosmarinus officinalis Linn, Lavandula angustifolia Mill, and Scutellaria baicalensis Georgi. These herbs and extracts have been used to treat cancer, as antioxidants, antimicrobials, and as anti-inflammatory agents. Luo et al. used a 12-O-tetradecanoylphorbol-13-acetate (TPA)-induced ear inflammation model to demonstrate the anti-inflammatory activities of six essential oils, and their results showed that these six essential oils inhibited inflammation to some extent in a dose-dependent manner and markedly relieved ear edoema.[22]

Bacterial pathogens are becoming resistant to multidrug drugs, which has increased illness severity. They have the ability to create biofilms associated with drug tolerance, and inadequate immunity in host cells leads to a rise in the number of potentially fatal bacterial infections in the human body.[23] As a result, essential oils and their chemical composition

have been extracted from plants as a possible means of controlling multidrug resistant pathogenic microorganisms and combating numerous infectious disorders.[24]

Essential oils extracted from therapeutic aromatic herbs, such as peppermint (Mentha piperita), thyme (Thymus vulgaris), and fennel (Foeniculum vulgare), have also been shown to be effective against Gram-negative and Gram-positive bacteria, viruses, fungus, and yeast. EOs are considered to help higher plants' defence mechanisms.[25] According to Bisht, Copaifera officinalis essential oil includes -cadinene, germacrene D, -humulene, -copaene, germacrene B, caryophyllene, and bisabolene, which inhibit E. coli and S. aureus.[26]

Furthermore, essential oils of include camphene, terpineol, -pinene, -thujone camphor, -thujone, which inhibits Enterococcus faecalis, Pseudomonas aeruginosa, Pseudomonas vulgaris, and Klebsiella pneumonia.[27] These essential oils, along with others, have been employed in oral and dental therapies.[28] The antioxidative and insect-repellent effects of essential oils have been proven.[29]

## CONCLUSION

The concept of vapo-inhalers was combined with aromatherapy to create a successful scent inhaler composition and packaging.

### Future prospective

In the future, aroma-inhalers might be developed to promote immunity, alleviate headaches and migraines, and relieve stress and agitation.

## REFERENCES

1. Roman S, LM Sanchez-Siles and M Siegrist The importance of food naturalness for consumers: Results of a systematic review. Trends in food science & technology, 2017; 67: 44-57.
2. Granata G, Stracquadanio S, Leonardi M, Napoli E, Consoli GML, et al. Essential oils encapsulated in polymer-based nanocapsules as potential candidates for application in food preservation. Food chemistry, 2018; 269: 286-292.
3. WHO Estimates of the Global Burden of Foodborne Diseases. World Health Organization, 2015.
4. Rawat S Food Spoilage: Microorganisms and their prevention. Asian Journal of Plant Science and Research, 2015; 5: 47-56.

5. Linda Scott Kantor, Kathryn Lipton, Alden Manchester and Victor Oliveira Estimating and Addressing America's Food Losses. Food Review, 2017; 20: 02-12.
6. Thierry R, C Sandra and DP Wilma Essential Oils and Other Plant Extracts as Food Preservatives, in Progress in Food Preservation. John Wiley & Sons, Ltd: New York, USA, 2022; 539-579.
7. Eigenmann PA and CA Haenggeli Food colourings and preservatives- allergy and hyperactivity. Lancet, 2016; 364: 823-824.
8. McInerney JO, Pisani D, Bapteste E, O'Connell MJ The public goods hypothesis for the evolution of life on earth. Earth Biology Direct, 2021; 6: 41.
9. Mahato N, Sharma K, Koteswararao R, Sinha M, Baral E, et al. Citrus essential oils: Extraction, authentication and application in food preservation. Crit Rev Food Sci Nutr, 2019; 59: 611-625.
10. Tongnuanchan P and S Benjakul Essential oils: extraction, bioactivities, and their uses for food preservation. Journal of food science, 2016; 79: R1231-R1249.
11. Burt S Essential oils: their antibacterial properties and potential applications in foods-a review. International journal of food microbiology, 2019; 94: 223-253.
12. Tajkarimi M, SA Ibrahim and D Cliver Antimicrobial herb and spice compounds in food. Food control, 2020; 21: 1199-1218.
13. Solórzano-Santos F and MG Miranda-Novales Essential oils from aromatic herbs as antimicrobial agents. Current opinion in biotechnology, 2022; 23: 136-141.
14. Willem SV and A Tjakko The role of sB in the stress response of Gram-positive bacteria-targets for food preservation and safety. Current Opinion in Biotechnology, 2015; 16: 218-224.
15. Pichersky E, JP Noel and N Dudareva Biosynthesis of plant volatiles: nature's diversity and ingenuity. Science, 2016; 311: 808-811.
16. Bassolé IHN and HR Juliani Essential oils in combination and their antimicrobial properties. Molecules, 2018; 17: 3989-4006.
17. Xirley Pereira Nunes, Fabrício Souza Silva, Jackson Roberto Guedes da S Almeida, Julianeli Tolentino de Lima, Luciano Augusto de Araújo Ribeiro, et al. Biological oxidations and antioxidant activity of natural products, in Phytochemicals as nutraceuticals-Global Approaches to Their Role in Nutrition and Health. IntechOpen, 2022.

18. Angnes SIA Isolation, chemical characterization and evaluation of insecticide property of essential oil Piper amplumKunt, in Masters IDissertação (chemistry) R.U.o. Blumenau, Editor. Blumenau-SC, 2015; 88.
19. De Almeida Cde F, Ramos MA, de Amorim EL, de Albuquerque UP A comparison of knowledge about medicinal plants for three rural communities in the semi-arid region of northeast of Brazil. Journal of ethnopharmacology, 2020; 127: 674-684.
20. De Lima EQ, E de Oliveira and HR de Brito Extraction and characterization of the essential oils from Spondias mombin L.(Caj), Spondias purpurea L.(Ciriguela) and Spondia ssp (Cajarana do serto). African Journal of Agricultural Research, 2016; 11: 105-116.
21. José M Barbosa-Filho, Adriana A Alencar, Xirley P Nunes, Anna C from Andrade Tomaz, José G Sena-Filho, et al. Sources of alpha-, beta-, gamma-, delta-and epsilon-carotenes: A twentieth century review. Revista Brasileira de Farmacognosia, 2018; 18: 135-154.
22. Asuquo, CE Fischer, OE Mesembe, AO Igiri, JI Ekom Comparative study of aqueous and ethanolic leaf extracts of Spondias mombin on neurobehaviour in male rats. IOSR Journal of Pharmacy and Biological Sciences, 5: 29-35.
23. Constanza Karen, Tallury Shyamalrau, Whaley Jeffrey, Sanders Timothy, Dean Lisa Chemical composition of the essential oils from leaves of edible (Arachis hypogaea L.) and Perennial (Arachis glabrata Benth.) peanut plants. Journal of Essential Oil Bearing Plants, 2015; 18: 605-612.
24. Masango P Cleaner production of essential oils by steam distillation. Journal of Cleaner Production, 2015; 13: 833-839.
25. Frauke Thrun, Joaquim Henrique Teles, Albert Werner, Richard Dehn, Ralf Pelzer, et al. Use of novel cyclic carbaldeydes as an aromatic substance, 2018. Google Patents.
26. Rolf D Inhalation antiviral patch as per approved, 2020.
27. Park JB Identification and quantification of a major anti-oxidant and anti-inflammatory phenolic compound found in basil, lemon thyme, mint, oregano, rosemary, sage, and thyme. International journal of food sciences and nutrition, 2021; 62: 577-584.
28. Lawless J The Encyclopedia of essential oils: the complete guide to the use of aromatic oils in aromatherapy, herbalism, health, and wellbeing, 2023 Conari Press.
29. Jones M The Complete Guide to Creating Oils, Soaps, Creams, and Herbal Gels for Your Mind and Body: Natural Body Care Recipes. Atlantic Publishing Company, 2021; 101.