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Essential Oils for the Musculoskeletal System

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Summary

Essential oils have been used to treat musculoskeletal ailments for thousands of years.[22] Evidence of the healing properties of these oils in humans is largely anecdotal, yet modern research does exist to validate some of these claims. We can also gain insight into the properties and efficacy of essential oils by examining their chemical makeup and active ingredients.

Introduction

The Musculoskeletal System is made up of bones, muscles, cartilage, tendons, ligaments, and connective tissue. Injuries to the musculoskeletal system such as joint sprains and muscle tears usually involve varying levels of pain and inflammation. Aromatherapy for the musculoskeletal system involves using essential oils to help treat or manage a variety of ailments such as back pain, neck pain, sports injuries and arthritis.

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What are Essential Oils?

Essential oils are volatile liquids, which are obtained from plant material including leaves, fruit, flowers, roots and stems. These can be extracted through steam distillation, cold pressing and chemical solvent extraction. Essential oils may contain anywhere from a few to hundreds of chemicals. These chemical constituents can represent up to 85% of the oil or trace amounts only.

In nature, plants use their essential oils for many important functions such as repelling insects, attracting pollinators, sun protection and viral/bacterial defence.

Scientific Research

The purpose of this paper is to showcase how modern research and chemistry can help to validate the use of essential oils for medicinal purposes that we know about through historical sources. There are now direct studies showing the healing properties of essential oils; such as the use of peppermint oil for treating Irritable Bowel Syndrome[1]. Some of the research involving the chemical components of essential oils has been conducted on mice or animal subjects. The mouse has many similarities to humans in terms of anatomy, physiology and genetics. The mouse genome is very similar to our

own, making mouse genetic research particularly useful for the study of human diseases. Having said this, clinical studies on human subjects would certainly provide a more reliable source of evidence.

When scientific studies are not available we can still look into the individual active ingredients of an essential oil to determine its scientific properties. For example, knowing that peppermint essential oil consists of a high percentage of **Menthol** we can infer that it will have topical analgesic properties[2].

There are many essential oils I would have liked to include in this paper however; they have been omitted due to the lack of clinical research on the oil or its chemical constituents. This is not to say that anecdotal claims about the benefits of these additional oils are untrue. Rather, they have not yet been subjected to the degree of scientific study required to comprehend their chemical constituents and understand the properties of their active ingredients. In this regard, it is likely that funding and resource limitations restrict the availability of research into essential oils.

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Chemical class

Without a wealth of clinical studies on humans, it is still possible to surmise the function of any essential oil by understanding the chemical class of each active ingredient within the oil. In particular, we can look at the carbon backbone of the organic compound to help determine the function.

Monoterpenes are molecules that contain at least one double bond: (C=C) formed by the joining of two isoprene units and have ten carbon atoms. Monoterpene rich oils, like Eucalyptus, Rosemary and Pines tend to be warming and stimulating.

Sesquiterpenes are heavier than monoterpenes. They commonly occur in roots, resins and woods. Sesquiterpenes have 15 carbon atoms are formed by joining three isoprene units. Sesquiterpenes tend to be anti-allergenic, anti-inflammatory, and sedative in nature: ie: Clary Sage, German Chamomile and Vetiver.

The therapeutic actions of the above terpene groups will change depending on the functional group those bonds to them. These include esters, ethers, aldehydes, ketones, alkenes, phenols, oxides and alcohols.

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Ester-rich essential oils are calming, relaxing and soothing. When applied topically they are gentle and warming to the skin. Examples include Lavender and Ylang ylang.

In contrast, **Phenol**–rich essential oils are stimulating and potent. When applied topically they will burn the skin if not sufficiently diluted with carrier oil. Examples include Clove and Oregano.

Aldehyde-rich essential oils are known for being strongly aromatic and are often used in fragrance products such as perfumes and scented candles. Examples include Lemongrass, Ginger and Citronella.

Alcohol-rich essential oils are used in many skincare products. This is because they nontoxic, mild and well tolerated by the skin. Examples include Rose, Lavender and Geranium

Method of Application

Topical use of essential oils is an effective method of application for musculoskeletal use. Essential oils can be added to massage creams or any appropriate carrier oil. Due to their lipophilic (fat-loving) characteristics, essential oils are able to pass through the fatty barriers of the skin, to directly enter the bloodstream. This is a quick and effective way to utilise the medicinal properties of essential oils.

Use for treatment of Inflammation

There are many essential oils that can be used in the treatment of inflammation. Below I have described some of them, and how they work in a chemical sense.

Frankincense *(Boswellia: carterii, sacra, papyrifera, frereana)*

Nicknamed the 'King of oils', Frankincense is abundant in the chemical **alpha-pinene.** This monoterpene from the alkene class has been shown to inhibit inflammatory pathways in the body [3,4].

Other common essential oils that contain alpha-pinene include Cypress, Juniper Berry, Coriander, Helichrysum and Rosemary

Wintergreen *(Gaultheria fragrantissima)*

Wintergreen essential oil consists almost entirely of the chemical ester **Methyl Salicylate**. After being absorbed by the skin it is rapidly broken down into salicylic acid in the blood and liver. This gives it almost identical properties to the drug Aspirin [5].

Eucalyptus *(Eucalyptus globulus, radiata)*

Eucalyptus has been used in Aboriginal Medicine for thousands of years for body aches, pains, fevers and chills. The active ingredient of eucalyptus essential oil is **1,8-Cineole** (eucalyptol). Belonging to the chemical class 'Monoterpene -Ether'; 1,8 Cineole has been shown to reduce inflammation in the upper and lower airways[6]. A 2013 study found that inhaling Eucalyptus for 30 minutes following a 'Total Knee Replacement' was effective in decreasing pain and blood pressure [7].

Other common essential oils that contain 1,8 Cineole include Rosemary, Laurel Leaf [23], Cardamom and Basil.

Tea Tree *(Melaleuca alternifolia)*

Tea tree is best known for is antibacterial and cleansing properties. Its anti-inflammatory properties are due to the abundance of Terpinen-4-ol within the essential oil. This monoterpene-alcohol was found to supress or interfere with the signals that would induce inflammation by activated white blood cells [8,9].

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Sweet Marjoram *(Origanum Majorana)*

Majoram essential oil also derives its anti-inflammatory properties from Terpinen-4-ol, however it contains significant levels of the monoterpene-alkene **Gamma-terpene**. A study from 2015 found that gamma-terpine could reduce swelling and pro-inflammatory cytokine production in mice [10].

Lavender *(lavandula angustifolia)*

Lavender is commonly known as the swiss-army knife of essential oils. It has numerous properties from antibacterial through to sedative. One such property that is not well known is its anti-inflammatory performance. Lavender consists of two main chemicals: Linayl Acetate and Linalool. The two components were studied together and found to play a major role in the anti-inflammatory activity displayed by the essential oils containing them[11]. Another study on mice study found that linalool reduced inflammation of acute lung injuries [12].

Rosemary *(Rosmarinus officinalis)*

Rosemary has the ability to produce essential oils of different chemistry when grown in different environments. This called a Chemotype (ct.), whereby the genus and species of the plant remain exactly the same but the predominant chemicals in the essential oil will differ.

Rosemary ct. 1,8-cineole is a chemotype of rosemary that contains higher levels of 1,8 cineole. **Rosemary ct. verbenone** contains high levels of alpha-pinene.

Dill *(Anethum graveolens)*

A 2012 study in rats compared the anti-inflammatory properties of 2 grams of Dill oil blend with 2 grams of Dicofenac Gel (commonly known as Voltaren Gel). The study found that the Dill group had a stronger reduction of inflammation compared to the Diclofenac group [20].

Analgesia (Pain relief)

As well as being effective in the treatment of inflammation, essential oils can assist with pain relief. Below I have listed some essential oils, which can be used for this purpose, and outlined the chemical basis for their success.

Copaiba *(Copaifera reticulata, officinalis, coriacea, and langsdorffii)*

This essential oil is extracted from Copaiba trees in South America. It is abundant in the chemical **beta-caryophyllene**. This 'Sesquiterpene Alkene' directly activates cannabinoid Type 2 receptors (CB2).

CB1 and CB2 receptors are usually spoken about when referring to Cannabidiol (CBD) a chemical compound in marijuana. CB1 receptors are responsible for the psychoactive effects associated with certain cannabinoids such as THC. However, CB2 receptors are responsible for reducing pain and inflammation in peripheral tissues[13, 14].

Other common essential oils that contain beta-caryophyllene include Black Pepper, Ylang Ylang, Clove and Melissa.

Peppermint

Peppermint contains **Menthol.** When applied topically, the compounds attach to the kappa opioid receptor in the skin[16], which produces a numbing effect. Menthol also creates a cooling sensation by stimulating thermo-receptors in the skin. The brain interprets this sensory input as cold, relieving the uncomfortable heat of inflammation [17].

Clary sage *(Salvia sclarea)*

Clary sage is known to have antispasmodic properties. Research undertaken with this oil has focussed on treating menstrual cramps and symptoms of dysmenorrhea. Massaging a blend of clary sage (Salvia sclarea), lavender (Lavandula officinalis), and rose (Rosa centifolia) into the abdomen has been shown to decrease the severity of menstrual cramps [18]. Another study from 2012 produced comparable results with a blend of Lavender, Clary Sage and Marjoram (Origanum Majorana) [19].

***Ginger** (Zingiber officinale)*

A 2012 study found that a massage with ginger and orange (C*itrus sinesis)* provided short term pain relief among the elder for moderate-to-severe knee pain [21].

Conclusion

In conclusion, the absence of a wealth of human clinical studies on the effectiveness of treating musculoskeletal issues with essential oils should not be a barrier to their use. Studies on mice and other mammals demonstrate the effectiveness of essential oils in treating both inflammation and pain. Perhaps even more critically, by looking into the chemical compounds (active ingredients) of essential oils we can understand why their use is so effective.

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