

Pain management by alternative therapies and herbal bioactive

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Abstract

Herbal medicines and other complementary & alternative therapies are now a part of the mainstream healthcare system. Adults frequently utilizing herbal remedies to treat pain, which is one of the most prevalent ailments. Although herbal remedies are frequently not the most effective analgesics in the market, they can be very helpful for mild to moderate pain. Herbal bioactive substances may reduce the effectiveness of conventional treatments for pain. Life quality suffers, and excessive medical costs rise as a result of pain. Western medicine may have too many negative effects, such as addiction and tolerance. Alternative pain-management approaches may be offered by herbal medicines. Neuropathic pain is one of the many types of chronic pain that results from damage to the neurological system, including the peripheral nerves. There are few treatments for neuropathic pain now available. Recent studies have also shown the value of dietary bioactive compounds in the management of pain like Ginger, Curcumin, Omega-3 polyunsaturated fatty acids, soy isoflavones and Lycopene. The goal of this review paper is to determine the function of various bioactive and some traditional alternative therapies in the treatment of pain.

Keywords: Pain Management; Herbal Bioactive; Superficial heat; Alternative therapy; Hydrotherapy

1. Introduction

Pain is an unpleasant sensation for everyone. Although the sensation may be of different types but it always causes discomfort. Pain is best defined as “It is an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage” by the International Association for the Study of Pain [1]. The four major categories of nociception, pain perception, suffering, and pain behaviors help to explain why there are so many different types of pain [2]. Pain is an unpleasant sensory and emotional experience that is frequently brought on by strong or harmful stimuli and is linked to numerous medical disorders. Pain lowers quality of life and results in higher health care costs [3]. Most often, analgesic medications are used to relieve pain. On the peripheral and central neural systems, analgesic medications have a variety of effects. Acetaminophen, non-steroidal anti-inflammatory medicines (NSAIDs), such as salicylates, ibuprofen, and COX-2 inhibitors, as well as opioid drugs like morphine and oxycodone, are all examples of pain relievers. Anti-inflammatory and anti-nociceptive NSAIDs are the mainstay of current pain management techniques [4-5].

2. Regulators and pathway of pain sensation

When a tissue get injured, chemicals are released into the extracellular tissue that influence the transmission of pain. Chemical mediators in charge of Histamine, substanceP, bradykinin, and others can all activate Leukotrienes,

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prostaglandins and acetylcholine in pain. At the mediators may cause further reactions at the site of damage, such as capillary alterations, vasodilatation, or vasoconstriction permeability. Among other things, prostaglandins cause inflammation. The necessary enzyme for the synthesis of prostaglandins like Cyclooxygenase is inhibited by aspirin. These drugs are frequently recommended for inflammation-related painful conditions [6-8].

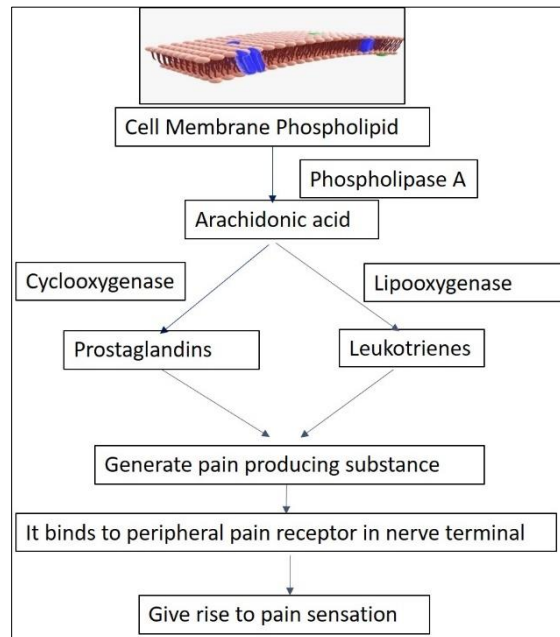


Figure 1 Pathway of pain sensation

3. Alternative therapy

3.1. Superficial heat therapy

A non-pharmacological therapy method known as superficial heat application includes applying a heat source to the body in order to raise the local tissue temperature. Low-level, superficial heat stimulates temperature-sensitive nerve endings (thermo-receptors), which then send messages to the spinal cord and lumbar dorsal fascia that prevent the processing of pain signals (nociception) [9-11].

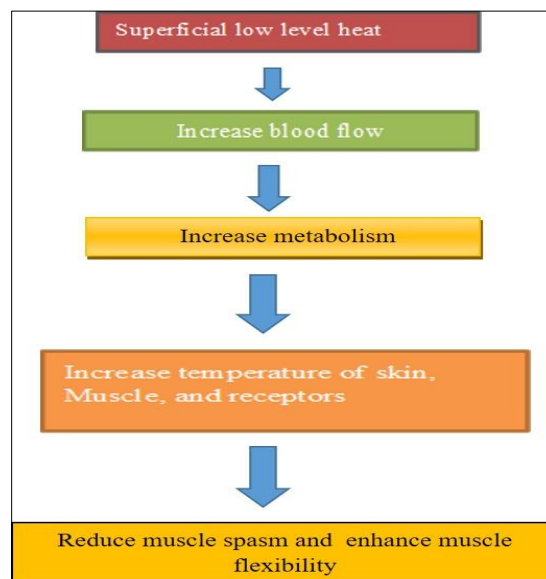


Figure 2 Superficial heat therapy mechanism for pain [12]

Increase in temperature tends to reduce the stiffness in Facial tissues [13].

3.2. Cryotherapy

Cold therapy is also known as cryotherapy. Swelling can be reduced with cryotherapy, which also helps to alleviate the pain. Additionally, it lessens pain sensitivity. When you are managing pain and swelling, especially around a joint or tendon, cryotherapy may be extremely helpful. Cryotherapy is the use of freezing materials to cure certain diseases or some of their symptoms. The body temperature might be lowered for treatment. The term "hypothermia" refers to a drop in body temperature that affects the entire body. "Cryotherapy" or "ice therapy" refers to a drop in body temperature that just affects the surface of the body [14]. The effectiveness of thermotherapy and cryotherapy for pain reduction in patients with lower back pain was found in studies [15-16]. In most studies, thermotherapy and cryotherapy were effective, in long term, on pain relief in the patients suffering from low back pain [17-18]

Cryotherapy causes reduction in edema and inflammation to the site of pain and results in relief from pain [19]. It was concluded by Costello *et al.* that on application of cryotherapy either pain is relieved immediately or 15 minutes after muscle tone [14].

3.3. Massage

For patients undergoing medical or surgical procedures, massage has been found to be an effective pain management strategy and offers the potential to reduce pain intensity scores. The effects of massage on stress levels, overall health, inflammation and healing have all been determined to be positive [20]. In a comprehensive study and meta-analysis, Kukimoto and colleagues discovered that massage was effective in easing pain [21]. According to studies, massage helps with pain management, relaxation, and sleep [22].

3.3.1. Chair Massage

Chair massage is a beneficial prophylactic to relax and get relief from pain. It may be carried out on the job. It is a therapy that takes place in a particular chair for 15 to 20 minutes. During a massage, the neck, head, upper limbs, and back are mostly targeted [23-24]. Other professional groups who are susceptible to musculoskeletal overload have also adopted chair massage as a preventative measure [25].

3.4. Yoga

Yoga is practiced as a science-based health discipline that impacts the body and mind to treat or improve quality of life. It is also utilized as a supplementary, integrative, and auxiliary medical therapy [26]. Yoga mostly concentrates on controlled breathing and mild to moderate physical and mental exercises such as [27]

- Breathing exercise (pranayama)
- Meditation (dhyana)
- Postural yoga (Asana)

By restoring normal circulation levels (1L-6, 1L-17A) and mRNA transcript levels of pro-inflammatory cytokines, yoga reduces both systemic and local inflammation in RA [28]. Additionally, yoga enhances autonomic reflex control systems and rebalances the sympathetic and parasympathetic limbs' role in inflammatory response [29]. Additionally, practicing yoga improves antioxidant levels and lowers oxidative stress [30]. As an integrated health treatment, yoga is suitable as an additional management strategy for severe autoimmune arthritis like RA because it involves both psychological and physical components [31-32]. Yoga helps people to achieve the homeostatic balance of life by working with their psycho-neuro-immune systems [33]. Yoga improved RA patients' quality of life by reducing pain perception, disease activity, and depressive symptoms [34]. Yoga reduces hypothalamus pituitary adrenal arousal and feeling of stress, which improves metabolic and psychological profiles [35-36].

3.5. Acupressure

The National Clinical Guideline Centre in the UK and the American Academy of Orthopedic Surgeons both support alternate pain management therapies for osteoarthritis treatment like Acupressure [37-38]. Chinese medicine's acupressure technique, which includes applying pressure to certain acupoints or meridian points, is non-invasive and inexpensive [39]. Acupressure is employed for a variety of things. The effectiveness or influence of acupressure as the only intervention on pain has been examined in previous systematic reviews [40-41] and also in combination of neck pain, labour pain and low back pain treatment [42-44]. Other studies looked at acupressure as a supplemental treatment for cancer pain to acupuncture [45-46].

3.6. Aromatherapy

Aromatherapy is a supplementary therapy that involves using the pure oil that is taken from a plant's blossoms, bark, stems, and leaves to improve psychological and physical health. Lavender, eucalyptus, and rosemary are just a few of the fragrant oils that are employed in aromatherapy [47]. Because of its anti-inflammatory and analgesic qualities, lavender essential oil is frequently used in aromatherapy [48-50]. Aromatic lavender oil has apparently been effective in reducing pain [51-52]. Numerous nations employ aromatherapy as a patient-centered and all-encompassing approach [53].

3.7. Music Therapy

In the context of a therapeutic relationship, music therapy, a field of allied health, is the clinical and evidence-based use of music interventions to accomplish customized goals." It includes numerous pain-relieving approaches, including guided imagery, relaxation techniques, music interventions, and back massage. A tool for postoperative patients' pain relief is known as pain management [54-55]. The American Music Therapy Association defines the use of therapeutic music as either music therapy or music medicine [56]. Healthcare professionals use MP3 players with headphones or speakers to play pre-recorded music as part of music therapy for patients [57]. Music can psychologically increase the release of endorphins from the brain, which has a painkilling effect akin to morphine [58].

3.8. Tai Chi

Tai chi (TC) is a classical systematic exercise that has been practiced for thousands of years and has many practitioners worldwide [59-60]. Tai chi uses breathing exercises and physical movement routines to improve physical health and emotional well-being [61-63]. Previous research has also concentrated on the benefits of tai chi for people with conditions like knee osteoarthritis in terms of pain alleviation and physical improvement [64-65].

3.9. Hydrotherapy

Hydrotherapy is a water-based therapy that can be used internally or externally and in any form, including ice, steam, and cold water. One of the naturopathic treatments utilized more frequently in ancient India is this one [66]. Physiological and therapeutic effects on numerous body systems and parts are produced by hydrotherapy [67]. In addition to increasing blood thickness and stickiness and decreasing oxygen consumption, the cold application also helps to decrease blood flow [68]. Mechanical hydrotherapy, which involves warm water soaks and towel massage, reduces arthritis-related joint discomfort. Warm water therapy is now employed as an adjunctive treatment for arthritis [69-70]. In addition to stimulating sweat glands and dilating superficial blood vessels, hot water also aids in the removal of waste from bodily tissue [71]. Patients can simply do hydrotherapy at home without experiencing any negative side effects, which helps to alleviate discomfort [72-73].

3.10. Acupuncture

The use of acupuncture in the management of chronic pain disorders [74] include osteoarthritis and shoulder discomfort [75-76], low back and neck ache [77]. A form of complementary therapy called acupuncture uses very tiny needles to treat patients. To cure pain, practitioners place needles in various places and depths [78-79]. When receiving acupuncture therapy, two or four acupuncture needles are attached to an electrical device, which produces a small electrical current to stimulate the needles. According to reports, laser acupuncture stimulates acupuncture points without the use of needles [80].

So, there are a number of alternative therapies (Figure 3) that can help in either pain management or pain alleviation. These are also a good alternative to conventional therapies because of no any side effects or discomfort to patient.



Figure 3 Different alternative therapies for pain management

4. Herbal Bioactive in Pain Management

Herbal bioactive are the active chemical constituents of plants that have a lot of therapeutic applications. These bioactive include Alkaloids, terpenoids, coumarins, flavonoids, phenolics, and other bioactive substances that are present in plants. These substances display a broad range of bioactivities, including anti-inflammatory, immune-stimulatory, antioxidant, antipyretic, analgesic etc. These raw resources are regarded as being both economically and environmentally advantageous. Some of them are following-

4.1. Ginger

- Biological name: *Zingiber officinale*
- Family : Zingiberaceae
- Part used: Rhizomes

4.1.1. Chemical constituents

Ginger contain 5 to 8% resinous substances and the main constituent is gingerol. Ginger also contains 0.25 to 3% volatile oil, which contains Zingiberene, Citral, 50% starch, 2 to 3% proteins and small quantity of sugar.

Because of its antibacterial, antiviral, and analgesic qualities, ginger rhizomes have been suggested as a supplemental treatment for rheumatoid arthritis, musculoskeletal discomfort, and throat pain. They are also used as prophylactic [81-84]. Ginger has been shown to be effective in treating osteoarthritis pain in recent research [85-86]. Cyclooxygenase (COX) and lipoxygenase (LOX) pathways involved in the metabolism of arachidonic acid were hindered by ginger's active ingredients [87]. According to reports, ginger relieves muscle pain, rheumatoid arthritis, osteoarthritis, and edema without causing any negative side effects in the patients [88]. Ginger could be an effective treatment for menstrual pain also [89-90].

4.2. Turmeric

- Biological name: *Curcuma longa*
- Family: Zingiberaceae

- Part used: Rhizomes

4.2.1. Chemical constituent

Yellow pigment Curcumin or diferuloylmethane makes up to 60% to 70% of crude turmeric extract, also contains sugar, proteins, resins, and volatile oils such as tumerone and atlantone.

Asian cuisine uses *Curcuma longa* as a spice and medicinal plant to alleviate inflammation, pain and wound healing. Numerous chronic diseases can be impacted by turmeric's bioactive curcuminoid polyphenols. Curcuminoids are also used to treat diabetes, metabolic syndrome, and rheumatoid arthritis [91-95]. It has recently been incorporated to processed foods, beverages, and nutraceuticals. Among the various bioactive components in turmeric, demethoxycurcumin is one of the three curcuminoids, which is the most common [96-97]. A range of possible health benefits, such as the treatment of heart disease, arthritis, and Alzheimer's disease, have been identified by numerous preclinical studies [98-99]. It has been proven that the anti-inflammatory, antioxidant, and antiapoptotic qualities of turmeric and curcumin help to reduce pain [100].

4.3. Rosemary

- Biological Name: *Salvia rosmarinus*
- Family : Lamiaceae
- Part used : Leaves

4.3.1. Chemical constituent

Rosmarinic acid, camphor 5.0-21%, 1,8-cineole 15-55%, borneol 1.5-5.0%, camphene 2.5-12%, limonene 1.5-5.0%.

The phenolic acids, phenolic diterpenes, and phenolic triterpenes are the components of *Rosemary officinalis* that are most potent. According to phytochemical analysis, Rosemary has alkaloids, flavonoids, terpenoids, and essential oil [101-104]. Many illnesses, such as stomachaches, headaches, rheumatoid arthritis, and memory loss, have been managed and treated using Rosemary bioactive [105]. Another product that contained rosemary, jojoba, and lavender essential oils relieved joint pain and rheumatic discomfort by increasing blood flow [106-108]

4.4. Peppermint

- Biological Name: *Mentha piperita*
- Family : Lamiaceae
- Part used : Leaves and Flowers

4.4.1. Chemical Constituents

Peppermint yields 0.1-1.0% of volatile oil that is composed mainly of menthol (29-48%), menthone (20-31%), and methyl acetate (3-10%) with menthofuran(1-7%), pulegone (1-11%), 1,8-cinole (6-7.5%), piperitone and limonene is also present[109].

The topical application of peppermint oil is recommended for conditions like headache, muscle aches, joint discomfort, and itching. Peppermint oil is recommended for treating coughs and colds, as well as for easing pain and stress, in aromatherapy [110-112]. Today, researchers are putting a great deal of emphasis to alternative medicine [113]. Aromatherapy is a supplemental treatment that can assist individuals to manage their pain and anxiety [114-115]. Reflexology stimulates the neurological system and the neurons' release of endorphin and noradrenaline has a positive impact on both the mind and body [116]. Analgesic effects are evident in the fragrant plant *Mentha piperita* [112]. The key bioactive chemicals present are carvone, limonene, and menthol for analgesic action [109]. Additionally, by raising cells' thresholds for stimulation and lowering synoptic stimulations and transmissions, menthol is useful in reducing pain [117].The beneficial effects of peppermint in aromatherapy for the pain of childbirth were found in review of literature [118][114].

4.5. Eucalyptus Oil

- Biological Name: *Eucalyptus globule*
- Family : Myrtaceae
- Part used : Leaves

4.5.1. Chemical constituents

The main chemical components of eucalyptus oil are α -pinene, β -pinene, α -phellandrene, 1,8-cineole, limonene, terpinen-4-ol, piperitone and globulol [119-120].

The volatile molecules produced by any component of the plant, such as the leaves, stems, or flowers, are referred to as essential oils [121]. This plant is a rich source of phytochemicals such as alkaloids, flavonoids, propanoids, tannins, and about 20–80 substances that have been found in several eucalyptus species and used to treat pain [122]. Essential oils are the by-products of a plant's metabolic processes and are created by distilling volatile and nonvolatile components [123-124]. α -pinene (1.27 to 26.35%) and cineol (49.07 to 83.59%) are the two primary volatile metabolites [125]. A proposed treatment method for pain alleviation involves antagonistic activity on receptors [126-127]. The spinal cord P2X2 receptor mRNA and protein levels were lowered by 1,8-cineol oral treatment [128].

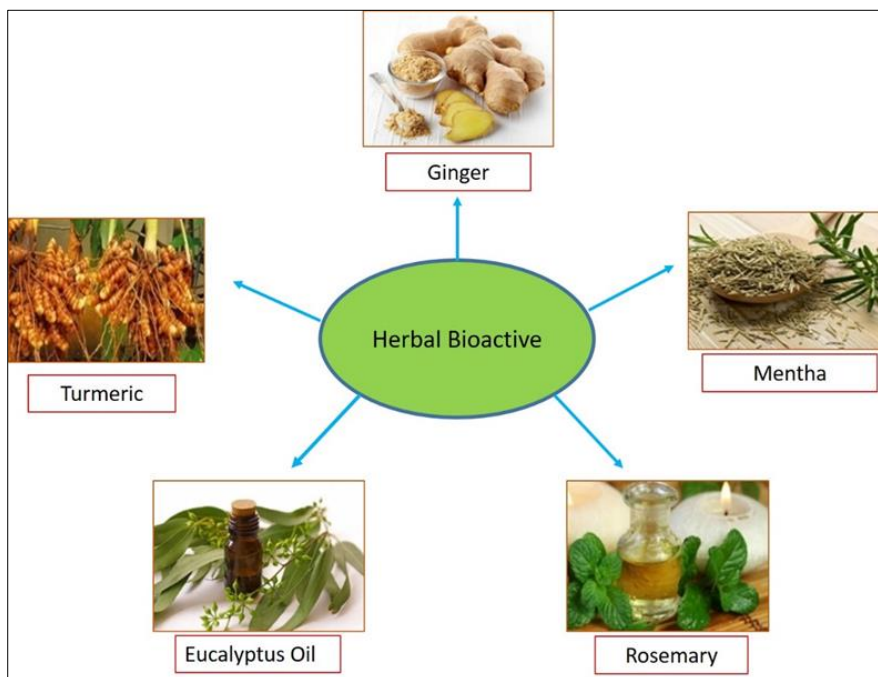


Figure 4 Herbal bioactive effective in pain management

Some other plants are also helpful in the management of pain. A brief detail of these is mentioned in table 1.

Table 1 Some Indian medicinal plants used for pain management

S. No.	Name	Part used	Active constituent	Uses	References
1.	<i>Chillipepper capsicum</i> (Solanaceae)	Fruit	Capsaicin.	Used in the treatment of joint muscle pain.	129,130
2.	<i>Oleaeuropaea</i> (Oleaceae)	Fruit	Oleic acid, phenolic constituents, squalene.	Used in natural pain relieving	131
3.	<i>Tripterygium wilfordii</i> (Celastraceae)	Leaves and roots	Celastrol and triptolide.	Used in rheumatoid arthritis, joint pain.	132, 133
4.	<i>Tanacetum partheniumli</i> (Asteraceae)	Leaves	Flavonoids, glycosides and pinenes	Used in migraine	134

5.	<i>Willows salix.alba L.</i> (Salicaceae)	Bark	Flavonoids, Tannissalicin glycosides.	Used for pain	135- 136
6.	<i>Hypericum perforatum</i> (Hypericaceae)	Flowers	Hyperforin, Hypericin	Neuropathic chroic pain.	137-138

5. Conclusion

Pain is a major problem these days for all age groups. A number of allopathic medicines are available but many of them can cause other side effects in human body. That's why natural and traditional & alternative therapies for pain relief are becoming popular. These are safe and acceptable all over the world. These can be used for all types of pain and also validated as safer treatment for pain management.

Compliance with ethical standards

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Disclosure of conflict of interest

All authors declare no any conflict of interest.

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