Review Article

Plants with analgesic property - A review article

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ABSTRACT

Analgesic is any drug that relieves pain selectively without blocking the conduction of nerve impulses, markedly altering sensory perception, or affecting consciousness. Plants are rich source of analgesics. Herbal analgesics are considered superior to pharmacological painkillers because they do not carry the same side effects. Some of the herbal analgesics are discussed here. *Mentha piperita* is a herbal plant which has analgesic property. In *Adhatoda vasica* Linn., ethanolic extract acts an analgesic. In Lotus seeds, *Nelumbo nucifera*, methanolic extract has the analgesic property. *Aegle marmelos* is a natural analgesic, where a methanolic extract of leaves (Fitoterapia) is used as analgesics. In *Guiera senegalensis* Gmel, the aqueous extract serves as an analgesic. The plant remedies are more safe to the patients with less side effects. Plants with analgesic property have very good therapeutic potential in various pain disorders. The plants discussed in this article are with proven *in vitro* and *in vivo* analgesic potential. As plant products have minimum side effects compared to currently used opioid and non-opioid analgesics, proper formulations prepared from this plants may be useful in the future. The aim of this article is to compile and review various studies done on plants with analgesic properties.

KEY WORDS: Analgesic, Medicinal, Pain, Research, Therapeutic

INTRODUCTION

The Indian Medicinal Plants are considered a vast source of several pharmacologically active principles and compounds, which are commonly used in home remedies against multiple ailments.[1,2] The research into plants with alleged folkloric use as pain relievers and anti-inflammatory agents is definitely a fruitful and logical research.[3] Pain transmission is a mechanism that involves very complex interaction of peripheral and central structures from the skin surface to central cerebral cortex. In accordance with the International Association of Pain, pain has been defined as an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage. Opioid analgesics suppress your perception of pain and calm your emotional response to pain by reducing the number of pain signals sent by the nervous system and the brain's reaction to those pain signals.

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However, there are adverse reactions such as itch, nausea, vomiting, and constipation. Nonsteroidal anti-inflammatory drugs (NSAIDs) are also used as pain relievers, but a widespread use of NSAIDs has meant that the adverse effects of these drugs have become increasingly prevalent. The use of NSAIDs increases the risk of having a range of gastrointestinal (GI) problems.[4] When NSAIDs are used for pain management after surgery, they cause an increased risk of kidney problems.[5] Herbal plants are better comparatively. This article reviews a few plants with analgesic property.

MENTHA PIPERITA

M. piperita (peppermint) belongs to *Labiatae* family. It is a hybrid mint, a cross between watermint and spearmint. The plant, indigenous to Europe and the Middle East, is now widespread in cultivation in many regions of the world. It is a herbaceous rhizomatous perennial plant growing to 30–90 cm (12–35 in) tall, with smooth stems, square in cross-section. It is found wild occasionally with its parent species.[6,7] Phytochemical constituents include volatile oils (menthol, menthone, and methyl salicylate), flavonoids (methoxide and

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rutin), and carotenes (tannins and choline). It has also been shown to be a safe and effective short-term treatment for irritable bowel syndrome. According to Commission E, peppermint oil may also act as a carminative, cholagouge, antibacterial, and secretolytic, and it has a cooling action.[8] Peppermint oil is excellent for mental fatigue and depression, refreshing the spirit, stimulating mental agility, and improving concentration. Herbalists consider peppermint an astringent, antiseptic, antipruritic, antispasmodic, antiemetic, carminative, diaphoretic, mild bitter, analgesic, anticatarrhal, antimicrobial, rubefacient, stimulant, and emmenagogue. The aqueous extract of *M. piperita* leaf, at the i.p doses 200 and 400 mg/kg, showed significant analgesic effects against both acetic acid-induced writhing and hot plate-induced thermal stimulation in mice, with protection values of 51.79% and 20.21%. Topically, *M. piperita* essential oil is employed as an analgesic compound for diseases of the pharynx and in the relief of tension headache and migraines.

ADATHOA VASICA

A. vasica (Malabar nut tree) belongs to *Acanthaceae* plant family. It is a small evergreen, sub-herbaceous bush which grows commonly in open plains, especially in the Lower Himalayas. The phytochemicals include alkaloids such as vasicine and vasicinone, essential oil, and an organic acid called adathoa vasica. It is a highly reputed plant used in the Ayurvedic system of medicine for the treatment of various ailments of respiratory systems such as bronchitis and asthma, and it is also used in the treatment of malaria, dysentery, and diarrhea[9] and also has anti-inflammatory, analgesic, diarrhea, dysentery, antioxidant, hepatoprotective, sedative, antispasmodic, and anthelmintic properties.[10] The administration of ethanolic extract of the root of *A. vasica* at the doses of 200 and 400 mg/kg and morphine (10 mg/kg), a reference drug, significantly raised the pain threshold at observation time of 45 min in comparison with control ($P < 0.001$). Oral administration of the ethanolic extract of *A. vasica* significantly reduced the number of writhings induced by acetic acid in rat.

AEGLE MARMELOS

*A. marmelo*s belongs to the family *Rutacea*e, is also known as bael fruit tree, and is a moderate-sized, slender, aromatic tree, 6.0–7.5 m in height, and 90–120 cm in girth, with a somewhat fluted bole of 3.0–4.5 m growing wild throughout the deciduous forests of India, ascending to an altitude of 1200 m in the Western Himalayas and also occurring in Andaman Island. Phytochemicals include neutral alkaloid called aegelin. The methanolic extracts of this plant produced marked analgesic activity by reduction of the early and late phases of paw licking in mice. A significant reduction in hyperpyrexia in rats was also produced by most of the extracts. Kumar (2006) demonstrated that methanolic extract of the leaves of *A. marmelos* at a dose level of 200 and 300 mg/kg showed significant analgesic activity on acetic acid-induced writhing and tail flick test in mice.[11,12]

GUIERA SENEGALENSIS GMEL

G. senegalensis belongs to *Combretaceae* family, which is a herb of a wide range of geographical distribution in Africa, starting from rainforest region of Nigeria to the arid zone areas of Mali.[8,13] It is a common herbal, antimalarial, and antipyretic drug. Phytochemicals include anthraquinones, flavonoid, tannin, and saponin. This plant is known for is antibacterial and analgesic property. This is a medicinal plant whose aqueous decoction extracts are used as an analgesic. The aqueous methanol extracts at the various doses tested afforded varying protection against thermal stimulus in mice. However, AMRBE significantly ($P < 0.05$) increased the mean latency of pain response. The standard agent, morphine, afforded more than 400% protection against thermal stimulus.

NELUMBO NUCIFERA

N. nucifera, also known as Indian lotus, belongs to family *Nelumbonaceae*. This plant is an aquatic perennial. Under favorable circumstances, its seeds may remain viable for many years, with the oldest recorded lotus germination being from that of seeds 1300 years old recovered from a dry lakebed in Northeastern China. Phytochemicals include flavanol miquelianin as well as alkaloids and also nuciferine and aporphine. In *N. nucifer*a Lotus flower tea is used in Chinese medicine as an analgesic and for its sedating and antidepressant properties. Essential oils containing menthol or 1,8-cineol have cooling properties that can directly numb the pain and discomfort of a headache. Essential oils of this plant with hormone-balancing properties, such as lavender and clary sage, may be especially effective at reducing headaches caused by hormonal imbalances during a woman's menstrual cycle.

GLYCYRRHIZA GLABRA

G. glabra root (rhizome) includes glycerine which is 50 times more than sucrose. Its commercial extracts include glycyrrhizin in ammonium salt and *G. glabra* alcoholic extract which comprises of four active ingredients: Glycemia coumarin glycerine, hydro glia aspirin C, and dehydrogol aspirin D. Other ingredients of this herb are flavonoids including isoflavone, liquiritin, isoliquiritin, formononetin, polysaccharides, esteroles, coumarins, asparagine,

amino acids, resin, starch, oil essences, and saponins. This herb is a remedy for coughing; it has mucolytic, anti-inflammatory, and laxative properties and is used effectively to treat stomach and duodenum illnesses. It is also used in treating upper respiratory tract infections, bronchitis, peptic ulcers, duodenal ulcers, chronic gastritis, rheumatism, arthritis, and adrenal. Its products are widely used in pharmaceuticals as sweetener and binder. Liquorice is useful in treating skin complications such as dermatitis, eczema, and pruritus. It has anti-infectious, antiseptic, antibacterial, anti-hepatotoxicity, antivirus, and antiphlogistic characteristics. Liquorice causes antispasmodic effects in GI tract and visceral pain relief through inhibiting phosphodiesterase.[14,15] Its hydroalcoholic extract through increasing defensive factors of gastric mucosa induces anti-ulcer mechanisms. Glycyrrhizin is another one of the liquorice ingredients. Its oral use inhibits 11-beta dehydrogenase enzyme and consequently increases the blood cortisol level. It is probable that this ingredient reduces pain through reducing inflammation.

MELISSA OFFICINALIS

Shoots contain great concentrations of its essence. The most important ingredients of *M. officinalis* essence are citronella, citral, geraniol, ocimene, limonene, caryophyllene, linalool, and other ingredients such as tannin, flavonoid, and polyphenol. Its leaves contain aldehyde monoterpenoid, flavonoids (quercetin and luteolin), polyphenolic ingredients (rosmarinic acid and caffeic acid), and triterpenes. It also contains sesquiterpene and ingredients containing oxygen. *M. officinalis* is sedative, cardiac tonic, memory, and mental tonic. This herb is used for treating GI, cardiovascular, and neural illnesses, and its ointment is antiherpes. It is also used for treating insomnia, sleeping disorders, anxiety, depression, neural illnesses, migraine, nausea, nervous stomach, anorexia, colic, cough, irregular menstruation, toothache, and nervous tremors. Its lotion, obtained through brewing its herb, relieves pain if applied to scars and wounds. One of its most important analgesic effects has been attributed to limonene. Through reviewing the past studies on herbal extracts with analgesic effects, it may be concluded that it is probably limonene that is responsible for the analgesic and anti-inflammatory properties of Dracocephalum. This ingredient is present in celery essence, comprising >60%, and in *Anethum graveolens* comprising about 32% of its volume.

A. GRAVEOLENS

The most important active ingredient in *A. graveolens* is d-carvone which is present in both its herb and its seed. Its fruit (seed) contains 102 to 1.02 essence, dylanoside (a xanthoneglycoside), coumarin, kaempferol, vicenin, myristicin, and other flavonoids, phenol acids, protein, and fat. The main flavonol glycoside in its leaves is quercetin, quercetin 3-o-beta di glucuronide, and isorhamnetin 3-o-beta di glucuronide. This herb is used in traditional medicine as a body and stomach tonic, digestive, carminative, anti-convulsant, antiemetic, and sedative. It is used to increase the secretion of mother's milk. *A. graveolens* has a plethora of biological benefits. It has appetizing, carminative, diuretic, anti-spasm, anti-jaundice, anti-cholesterol, anticancer, and antioxidation properties. It reduces low-density lipoprotein and triglyceride and increases high-density lipoprotein L. Limonene ingredients, carvone, and kaempferol in dill have analgesic and anti-inflammatory effects. Analgesic effects of carvone are achieved through affecting glutamate receptors; furthermore, its analgesic activity may be through decreasing the neuropathy of the peripheral nerves. Kaempferol also has analgesic and anti-inflammatory effects. It acts by inhibiting cyclooxygenase 2 enzymes through suppressing SRC kinase. Limonene suppresses the activity of prostaglandins through inhibiting cyclooxygenase 1 and 2 enzymes and thus is effective in inhibiting pain and inflammation.

MATRICARIA RECUTITA

The essence in *M. recutita* blossoms includes proazulenes, farnesene, alfa-bisabolol, bisabolol oxide, spiroether, and flavonoids such as anthemidin, luteolin, tannin, rutin and bitter glucosides, coumarins, mucilage substances, and pectin compounds. This herb is used to decrease fever and sweating, to relieve headache and migraine pains and arthrosis, menstrual period disorders, and menopause, to reduce blood pressure, and to relieve spinal column complications. It is an anti-infection, stomach anti inflammation, appetizer, and carminative. It is used in treating rhinorrhea and agitation. It is also used to treat hemorrhoid, eliminate wrinkles around eyes, moisturize skin, and make hair shiny. *M. recutita* blossom contains some compounds such as benzodiazepines and is proved to have analgesic properties. Researches have proved that the simultaneous injection of compounds present in chamomile blossom such as flavonoid quercetin increases the tolerance to the analgesic effects of morphine. It also has been shown that flavonoid compounds of *M. recutita* blossoms act as central nervous system activator molecules. The plant remedies have limited side effects. It is prudent to create awareness among the people about the usefulness of these plants.[9,15] So far *M. recutita* blossoms have been used in treating skin inflammation, hemorrhoid, foot scars, and urine burns in infants, in relieving pain, and in increasing the recovery rate of damaged tissues.

LAVANDULA OFFICINALIS

The essence in *L. officinalis* shoots contains flavonoid, tannin, and coumarin. Its essence contains >40 compounds, and the most important ones being linalool, linalyl acetate, cineol, nerol, and borneol. Its other medical compounds are geraniol, alpha pinon, camphor, acid butyric, valeric acid, ursolic acid, and luteolin flavonoids. *L. officinalis* root is a strong anticonvulsant, and its leaves and blossoms are used to relieve pain. The essence of this herb has tranquilizing and anti-depression properties. It is also used for removing helminth, opening congestions, memory tonic, gout relief, and rheumatism and also for relieving skin diseases such as eczema, acne, and burns and as a burn relief and insect sting relief.[30] Linalool and linalyl acetate in *L. officinalis* shoots able to stimulate the parasympathetic nervous system and are efficient on relieving the pain following laparoscopic surgery. In clinical researches, it has been proved that *L. officinalis* shoots essence may prevent the degranulation of host cells and the releasing of histamines.[10-17] Plants with analgesic property have very good therapeutic potential in various pain disorders.[18,19] Medicinal plants may establish a biological equilibrium and prevent the accumulation of medical ingredients due to their active ingredients.[20-22]

CONCLUSION

The plants discussed in this article are with proven *in vitro* and *in vivo* analgesic potential. As plant products have minimum to no side effects, compared to currently used opioid and non-opioid analgesics, proper formulations prepared from this plants may be useful in future. The significant advantage is that their complications are low or non existent. The most important herbal ingredients with analgesic effect include flavonoids, volatile oils, phenol compounds, alkaloid compounds, organic acids, and essence. These compounds prevent the formation of cyclooxygenase enzyme and consequently prevent the formation of prostaglandins. The need of the hour would be to increase the awareness about herbal plants in the treatment of pain conditions.

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