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A Review on Multipurpose (Local Anesthetic, Analgesic, Inflammatory) Effect of Datura Stramonium

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Abstract

Datura stramonium is a wild plant having various medicinal and pharmacological properties and these properties exploited for cancer, rheumatism, ear pain, headache, wound, burn, stress, depression, insomnia, asthma, boils and inflammation. Datura stramonium, exhibits pharmacological effect and prepared as herbal or botanical drugs by pharmaceutical industries for many diseases. Wound healing is the complex which requires proper healing from both internal and external. The development of the anti-inflammatory, antimicrobial gel aims to enhance better recovery of the wound and avoid any infection, especially during the postoperative phase, where there is lots of medications prescribed which suppress immune system,

making wound more prone to the microbial attack and resulting in late recovery of the wound. The main component of the plant is alkaloid, which shows the antimicrobial, anesthetic. Anti-inflammatory, cytotoxic and analgesic characteristic which accelerate the wound healing process and prevent microbial infestations. The findings suggest that the datura -based gel not only offers a natural alternative to synthetic antifungal agents but also presents a promising option for treating fungal infection. The purpose of current study concludes with recommendations for further research into the gel's formulation stability and potential application in clinical setting, emphasizing the importance of exploring herbal remedies in modern medicine.

Keywords: Datura Stramonium, Botanical Drugs, Anti-inflammatory, Anesthetic & Modern Medicine

Introduction

Herbal Medicine

Plants have been used for thousands of years as medicine in Egypt, China, India, and Greece [5]. Today, 80% of rural residents rely on herbal medicine, a product made from plant. The use of herbal remedies has increased in developed nations, with the European Scientific cooperative on phytotherapy offering monographs on specific herbs [2]. A committee was created in 1992 to create standards and guidelines for herbal medicine evaluation [3].

Herbal Plants

Medicinal plants throughout the ages, humans have relied on nature for their basic needs, for the production of food, shelter, clothing, transportation, fertilizers, flavors and fragrances, and medicines. Man relied on the healing properties of medicinal plants. Some people value these plants due to the ancient belief which says plants are created to supply man with food, medical treatment, and other effects. It is thought that about 80% of the 5.2 billion people of the world live in the less developed countries and the World Health Organization estimates that about 80% of these people rely almost exclusively on traditional medicine for their primary healthcare needs. Medicinal plants are the "backbone" of traditional medicine, which means more than 3.3 billion people in the less developed countries utilize medicinal plants on a regular basis. There are nearly 2000 ethnic groups in the world, and almost every group has its own traditional medical knowledge and experiences. [5]

Medicinal plants have been used in healthcare since time immemorial. Studies have been carried out globally to verify their efficacy and some of the findings have led to the production of plant -based medicines. The global market value of medicinal plant products exceeds \$100 billion per annum. This paper discusses the role, contributions and usefulness of medicinal plants

in tackling the diseases of public health importance, with particular emphasis on the current strategic approaches to disease prevention. A comparison is drawn between the 'whole population' and 'high-risk' strategies. The usefulness of the common factor approach as a method of engaging other help promoters in propagating the ideals of medicinal plants is highlighted. The place of medicinal plants in preventing common disease is further examined under the five core principles of the Primary Health Care (PHC) approach. Medicinal plants play vital roles in disease prevention and their promotion and use fit into all existing prevention strategies. However, conscious efforts need to be made to properly identify, recognize and position medicinal plants in the design and implementation of these strategies. These approaches present interesting and emerging perspectives in the field of medicinal plants. Recommendations are proposed for strategizing the future role and place for medicinal plants in disease prevention. Plants have formed the basis of sophisticated traditional medicine systems that have been in existence for thousands of years and continue to provide mankind with new remedies. Although some of the therapeutic properties attributed to plants have proven to be erroneous, medicinal plant therapy is based on the empirical findings of hundreds of probably thousands of years of use. [8]

Herbs

An herb is a plant part used for its scent, flavor, or therapeutic properties. Herbal medicines are a type of dietary supplement. They are sold as tablets, capsules, powders, teas, extracts, and fresh or dried plants. People use herbal medicines to try to maintain or improve their health.

Many people believe that products labeled "natural" are always safe and good for them. This is not necessarily true. Herbal medicines do not have to go through the testing that drugs do. Some herbs, such as comfrey and ephedra, can cause serious harm. Some herbs can interact with prescription or over-the-counter medicines.

If you are thinking about using an herbal medicine, first get information on it from reliable sources. Be sure to tell your health care provider about any herbal medicines you are taking.

Local Anesthetic

Local anesthesia (local anesthetic) is medication that provides use to temporarily numb a small area of your skin, subcutaneous tissue and peripheral nerves before minor procedures. Local anesthetics can also treat some painful conditions and relieve pain after surgery [9].

Local anesthesia numbs a small section of your body, like a specific area of skin on your arm or part of your gums, for example. It can affect your muscle function, as well, depending on which nerves are targeted. Unlike with general anesthesia, you don't lose consciousness with local anesthesia. But providers sometimes combine local anesthesia with sedation so you feel relaxed. Some medications containing mild local anesthetics – like cold sore gels – are also available as prescriptions or over-the-counter products.

Types

Local anesthetics come in many forms depending on their intended purpose, including:

- Creams

- Eye drops
- Gels
- Implants
- Injections
- Ointments
- Skin patches
- Sprays

A few examples of local anesthetics healthcare providers use include:

- Benzocaine
- Bupivacaine
- Cocaine
- Lidocaine
- Ropivacaine with or without mepivacaine
- Tetracaine

Datura

Datura is a genus of nine species of highly poisonous, vespertine – flowering plants belonging to the nightshade family (Solanaceae). They are commonly known as thornapples or jimsonweeds, but are also known as devil's trumpets or mad apple (not to be confused with angel's trumpets, which are placed in the closely related genus *Brugmansia*). Other English common names include moonflower, devil's weed, and hell's bells. All species of Datura are extremely poisonous and psychoactive, especially their seeds and flowers, which can cause respiratory depression, arrhythmias, fever, delirium, hallucinations, anticholinergic toxidrome, psychosis, and death if taken internally [14].



The name Datura originates from the Hindi and Sanskrit words for "thorn-apple" with historical and cultural significance in Ayurveda and Hinduism while the American term "jimsonweed" derives from its prevalence in Jamestown, Virginia, where it was called "Jamestown-Weed." Datura species are herbaceous annual or short-lived perennial plants up to 2 meters tall with trumpet-shaped flowers and spiny fruit capsules historically used in traditional medicine especially in India, where they hold cultural and ritual significance. Datura species classification is complex due to high variability and overlapping traits among species, with many "new species" later reclassified as local varieties or subspecies; most species are native to Mexico, though some have disputed native ranges outside the Americas, and the genus is closely related to *Brugmansia* and the recently established *Trompsettia*.



Due to their effects and symptoms, *Datura* species have occasionally been used not only as poisons, but also as hallucinogens by various groups throughout history. Traditionally, their psychoactive administration has often been associated with witchcraft and sorcery or similar practice in many cultures, including the western world. Certain common *Datura* species have also been used ritualistically as entheogens by some Native American groups.

Non – psychoactive use of plants in the genus is usually done for medicinal purposes, and the alkaloids present in some species have long been considered traditional medicine in both the New and Old World due to the presence of alkaloids scopolamine and atropine, which are also produced by plants associated with Old World medicine such as *Hyoscyamus niger*, *Atropa belladonna*, and *Mandragora officinarum*.

Taxonomical classification: -

Kingdom: Plantae
 Clade: Tracheophytes
 Clade: Angiosperms
 Clade: Eudicots
 Clade: Asterids
 Order: Solanales
 Family: Solanaceae
 Subfamily: Solanoideae
 Tribe: Datureae
 Genus: *Datura*

Pharmacological Activity of *Datura*

Datura is known to exhibit analgesic, antioxidant, anticancer, and antimicrobial properties. Especially, owing to the potent analgesic activities, *D. metel* acts as an effective painkiller. *D. stramonium* has antifungal activity against *Fusarium mangiferae* and *Fusarium oxysporum*, alkaloids found in *D. stramonium* are potential anticholinergic agents [31]. Atropine and scopolamine are muscarinic antagonists that may be utilized to cure Parkinson's disease and parasympathetic stimulation of the eye, respiratory, urinary, heart, and gastrointestinal tract [32]. They prevent parasympathetic nerve impulses by selectively blocking the binding site of the neurotransmitter acetylcholine to the receptor of nerve cells [33]. In addition, *Datura* has long been utilized as a beneficial therapy for asthma symptoms. Atropine is the active anti-asthmatic agent that triggers paralysis of pulmonary

branches of the lungs, removing the spasms responsible for the asthma attacks [34].

The technique of smoking *Datura* leaves through a pipe to alleviate allergies has its origins in the standard ayurvedic medicine in India. *D. stramonium* is utilized recreationally mainly for its anticholinergic consequences and can be produced by boiling the crushed seeds [13]. However, exposure of the fetus to *D. stramonium* causes a continuous release of acetylcholine, leading to desensitization of nicotinic receptors, resulting in permanent damage to the fetus [3].

Anti-asthmatic activity

A range of bronchodilating and anticholinergic alkaloids, including atropine and scopolamine, are found in *D. stramonium*. In order to relax bronchial smooth muscle and lessen asthmatic episodes, atropine and scopolamine operate on the muscarinic receptors by inhibiting them (especially the M2 receptors) on airway smooth muscle and submucosal gland cells. According to Charpin *et al.* (Charpin, 1979), employing as an *D. stramonium* antiasthmatic cigarette is a helpful bronchodilator in asthmatic patients with minor airway obstruction. The use of to treat asthma and potential effects on *D. stramonium* foetal development were investigated.

The mother's usage of throughout *D. stramonium* pregnancy will result in a constant release of acetylcholine, which will desensitise nicotinic receptors and eventually cause irreparable harm to the foetus. Thus, we draw the conclusion that pregnant women should use this African herbal treatment with care (Sharma, 2001)

Anticholinergic activity

The chemical esters called alkaloids, which are present in *D. stramonium*, are employed in medicine as anticholinergic drugs. Jimson weed has a history of misuse and was linked to unintentional human and animal poisoning. Acute jimson weed poisoning symptoms included severe thirst, dry mouth, dry skin, dilated pupils, blurred vision, urine retention, fast pulse, disorientation, restlessness, hallucinations, and loss of consciousness. Inhibition of muscarinic neurotransmission both centrally and peripherally causes the anticholinergic syndrome (Boumba, 2005).

Acaricidal, repellent and oviposition deterrent properties

On mature two-spotted spider mites (*T. urticae* Koch) (Acari: Tetranychidae), ethanol extracts from both the leaf and the seed of (*Solanaceae*) were tested for their ability to *D. stramonium* kill, fend off, and prevent oviposition. Using the Petri leaf disc spray tower technique, leaf and seed extracts were administered at quantities of 167.25 and 145.75 g/L, respectively, and after 48 hours, 98% and 25% of spider mite adults died. As a result of these findings, it seems possible to employ *D. stramonium* extracts to treat two-spotted spider mites (Kunal, 2009).

Antimicrobial activity

The methanol extracts from *D. stramonium*'s aerial parts shown dose-dependent bactericidal action against Gram-positive bacteria. *Escherichia coli* and *Pseudomonas aeruginosa*, however, had little to no antibacterial action (Eftekhar, 2005). *Staphylococcus aureus* *Salmonella typhi* and were the two bacteria that were most inhibited by

ethanol extract, whereas *Klebsiella pneumoniae* was the most susceptible. *Neisseria gonorrhoea* was resistant to both extracts, and the aqueous extract alone had action against *S. aureus*. The anti-microbial efficacy of mixed crude ethanolic extract of, *D. stramonium* *Terminalia arjuna* *Withania somnifera*, and in cup plate diffusion technique for antibacterial and antifungal activity The extracts were screened for possible antibacterial activity against *Staphylococcus aureus* *Bacillus subtilis* *Escherichia coli*, *Klebsiella pneumoniae*, *Micrococcus luteus*, and *Candida albicans* with comparison to the conventional antibiotic Ciprofloxacin (Sharma, 2010).

Anti-inflammatory

Activity Traditional anti-inflammatory remedies include *Coriandrum sativum* (*C. sativum*), *D. stramonium*, and *Azadirachta indica* (*A. indica*) *C*. Ethanolic-based extracts of *sativum* *D. stramonium* fruit and leaf material. The anti-inflammatory effect of ethanol extracts of fruit, *C. sativum* *D. stramonium* leaf, and *A. indica* leaf was initially screened in albino rats. In comparison to the usual medication diclofenac sodium, all ethanolic extracts significantly reduced inflammation when applied to rat paw edoema caused by carrageenan. Among them, shown the *A. indicahighest* anti-inflammatory activity per hour (Gupta, 2010).

Larvicidal and mosquito repellent activities

For their larvicidal and anti-mosquito properties against *Aedes aegypti*, *Anopheles stephensi*, and *Culex quinquefasciatus*, ethanol extracts of leaves *D. stramonium*were tested. The LD50 values for larvicidal activity were discovered to be 86.25, 16.07, and 6.25 mg/L against *Aedes aegypti*, *Anopheles stephensi*, and, *Culex quinquefasciatus*respectively. When used at greater concentrations (1%) against, and *Aedes aegypti* *Anopheles stephensi* *Culex quinquefasciatus* *D. The* ethanolic leaves extract of *stromonium* exhibited full protection times (mosquito repellency) of 2.7, 71.7, and 117.7 min (Swathi, 2012).

Antifungal activity

The combination of, *D. stramonium* *Calotropis gigantea*, *A. indica* (neem), and cow manure (T1), followed by methanol-water (70/30 v/v) extracts of, *D. stramonium* *Calotropis gigantea* *A. indica*, and T2, had antifungal activity against *Fusarium mangiferae*. The study established the effectiveness of the concoction-brewed compost T1 as a sustainable and environmentally friendly method of controlling floral malformation in mango when it is sprayed at the bud break stage and again at the fruit set stage (Usha, 2009).

Anti-rheumatic

Activity the infusion prepared from stem, branches and leaves exhibits anti- rheumatic potential [40].

Antibacterial Activity

The leaf extracts of *Datura stramonium* show antibacterial activity against various strains of bacteria including *Klebsiella pneumoniae*, *Staphylococcus aureus*, *Escherichia coli*, Gram positive and Gram negative bacteria [66]. It is reported that higher concentrations of ethanolic leaf extracts are required for antibacterial activity against *Klebsiella*

pnuomenae, *Staphylococcus aureus* and *Escherichia coli* to inhibit the growth. The antibacterial substance retard the formation of peptidoglycan and cells become died due to osmotic shocks. *Datura stramonium* exhibited a very significant antimicrobial activity against *Bacillus thuringiensis* and *Agrobacterium tumefaciens* with the zone of inhibition of 16 mm and 19 mm [17]. The antibacterial activity of methanolic extracts of thorn apple seeds reveals that it is very active against Gram positive as well as Gram negative bacteria. These extracts show highest zone of inhibition (20 mm) against *E. coli* followed by (17.50 mm) zone of inhibition against *S. aureus* (16 mm) zone of inhibition against *P. aeruginosa* and lowest zone of inhibition (15 mm) against *B. subtili* [87].

Antioxidant Activity

Flavonoids are polyphonic compounds. The content of flavonoids in the methanolic extracts of *Datura stramonium* was between 23.15-63.3 mg/g. It was observed that they have properties of free radical scavenging, inhibition of hydrolytic oxidative enzymes and they also exhibit anti-inflammatory activity and their role in human health care and nutrition is significant [47, 62]. The methanolic extracts can decrease the activity of DPPH free radicals just like Gallic acid which is a standard antioxidant [87]. The aqueous extract of *Datura stramonium* has more potent antioxidant activity as compared to organic extract [24].

Precautions and safety of usage

Almost all the parts of *D. stramonium* are reported to have toxic effects, and the toxicity of this plant is mainly due to the tropane alkaloids. Each part varies in the concentrations of alkaloids and other active substances. For this reason, it is very important for individuals, especially young people, to be aware of the toxicity and potential risks associated with the “recreational” use of this plant. *D. stramonium* in the form of a paste or solution to relieve local pain may not have a deleterious effect; however, oral and systemic administration of the *D. stramonium* may lead to severe anticholinergic symptoms. Various cases of toxic delirium and psychiatric symptoms have been reported after ingestion of *D. stramonium* [36, 37, 40, 41], indicating the necessity of extreme precaution while using this plant

Result & Discussion

The purpose of current study concludes with recommendations for further research into the gel's formulation stability and potential application in clinical setting, emphasizing the importance of exploring herbal remedies in modern medicine.

The formulations have shown stability over 45 days period at 37°C + 20and 45°C + 20°C The procured sample of *Datura gel* was tested for its identification. The quality of Diclofenac was confirmed by physical characterization, melting point, chemical test and UV-absorption maximum methanol. The results of these entire tests were in compliance with specification of Indian Pharmacopoeia. The IR- spectrum obtained for identification of Diclofenac. The different formulations using various water and ethanol Proportion were developed. Ethanol, propylene glycol has become recognized as a possible permeation enhancer in the topical drug delivery of drugs and to produce proper viscosity Carbopol 940 and h was used in combination.

Conclusion

Topical gels continue to emerge as a viable platform for localized and systemic drug administration, delivering a mix of patient comfort, excellent drug penetration, and convenience of application. Advances in polymer science, nanotechnology, and smart delivery systems have considerably broadened their therapeutic potential beyond conventional dermatological applications. Despite the advances, obstacles persist in obtaining constant skin penetration, long-term stability, and patient-specific personalization. Ongoing research focusing on bioresponsive materials, customized therapy, and regulatory harmonization is likely to further develop gel-based delivery methods. Overall, topical gels lie at the confluence of innovation and clinical usefulness, prepared to play an increasingly crucial role in contemporary pharmaceutical and cosmetic formulations.

Declaration of interest

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