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Research Article

Exploring the Analgesic Properties of Deodaru (Cedrus deodara) Ointment: A Pilot Study

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Abstract

Background: *Cedrus deodara* (Roxb. ex D. Don), a medicinal plant from the family Pinaceae, has been extensively used in traditional medicine for its analgesic and anti-inflammatory properties. Essential oils derived from its heartwood are believed to possess bioactive compounds capable of modulating pain and inflammation. Objective: To evaluate the clinical efficacy and safety of a topical *Cedrus deodara* essential oil-based ointment in managing simple muscular pain. Methods: A single-arm, open-label pilot study was conducted on 40 participants (aged 21–59 years) presenting with simple muscular pain. The ointment was prepared using steam-distilled essential oil of *C. deodara* mixed with beeswax (1:4 ratio). Patients applied the ointment locally over the affected area for 30 days. Pain intensity was assessed using the Visual Analog Scale (VAS) and a standardized tenderness scale on Day 0, 1, 3, 15, and 30. Statistical analysis included paired t-tests, and relief percentage was calculated. Results: Mean VAS score reduced significantly from 7.85 (±1.09) at baseline to 2.10 (±0.74) on Day 30 ($p < 0.00001$). Tenderness scores also showed significant improvement, with 100% of patients reporting complete relief by Day 30. No adverse effects were reported. Conclusion: *Cedrus deodara* ointment demonstrated promising analgesic potential in the management of muscular pain. The findings support its use as a safe and effective herbal alternative for topical pain relief. Further randomized controlled trials with larger sample sizes are warranted.

Keywords: *Cedrus Deodara*, Analgesic, Pain Management, Essential Oil, Anti-Inflammatory, Traditional Medicine

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Introduction

Cedrus deodara (Roxb. ex D. Don), commonly known as Deodar cedar, Himalayan cedar, or *Deodaru*, is a large evergreen coniferous tree belonging to the family Pinaceae. It is native to the Himalayan regions of eastern Afghanistan, southwestern Tibet, western Nepal, northern Pakistan, and north-central India (1). The name "*Cedrus deodara*" is derived from the Sanskrit term *Deodaru*, meaning "wood of the gods", reflecting its deep cultural and religious significance (2). In Vedic literature, it is also referred to as *Bhadra*, symbolizing purity and divinity (3). Owing to its towering height, aromatic wood, and majestic appearance, the tree has long been considered sacred and believed to be the dwelling place of deities.

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In addition to its spiritual and ornamental significance, *C. deodara* holds substantial ethnomedicinal value. Its gum and essential oils have traditionally been used in the treatment of fever, insomnia, indigestion, hiccups, and various inflammatory disorders (4). The essential oil extracted from its heartwood exhibits insecticidal properties and has been widely applied in veterinary medicine (5). Furthermore, its wood is known for its carminative and diuretic actions.

Pharmacological investigations—both *in vitro* and *in vivo*—have demonstrated that *C. deodara* possesses antidiabetic, antiproliferative, and antiviral (particularly anti-HSV type 1) properties (6). These findings reinforce its long-standing therapeutic applications in traditional medicine systems and open new avenues for drug development based on its bioactive constituents.

Pain, whether acute or chronic, remains one of the most common and distressing human experiences. Despite the availability of modern synthetic analgesics, long-term use of such drugs is often accompanied by side effects, tolerance, and dependency issues. This has prompted the exploration of natural, plant-based analgesics as safer alternatives (7).

Research Gap and Rationale

Although the traditional applications of *Cedrus deodara* in managing inflammation and discomfort are well-documented in Ayurvedic and folk medicine, there exists a significant research gap in terms of clinical validation of its analgesic potential, especially in topical formulations. Most existing studies focus on its antimicrobial, antioxidant, or metabolic effects, with relatively little emphasis on its pain-relieving action.

To address this gap, the present study aims to evaluate the clinical efficacy and safety of a topical ointment formulated with *Deodaru* essential oil in relieving pain. By exploring its mechanism of action and therapeutic value through standardized clinical protocols, this research attempts to bridge the gap between ancient Ayurvedic knowledge and modern scientific evidence. The study aspires to offer a natural, effective, and safer alternative to conventional analgesic therapies.

Materials and Methods

Method of Preparation

The heartwood of *Cedrus deodara* (Roxb. ex D. Don) was procured from Indian Jadi-Buti.com, a reputed herbal raw drug supplier. The raw material was authenticated by macroscopic and microscopic evaluation methods in the Department of Botany, Institute of Science, BHU. The specimen was preserved under reference number Pina. 2024/01.

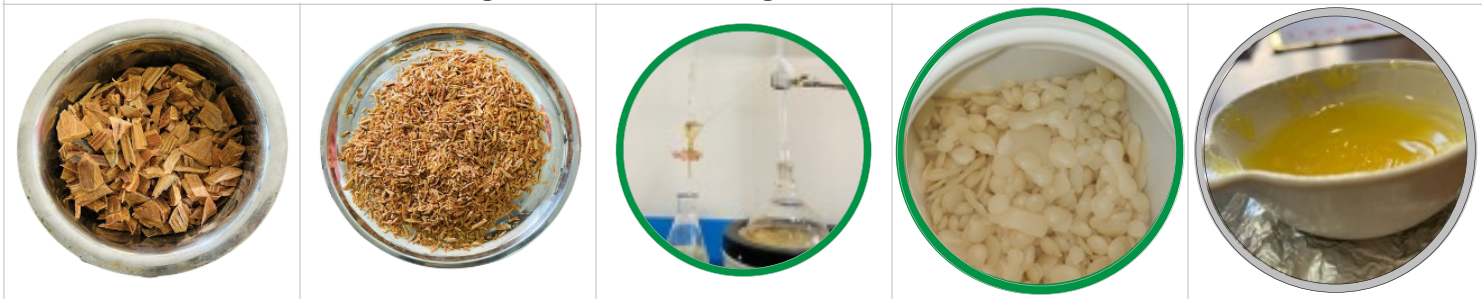
The authenticated wood was chopped into small pieces and subjected to steam distillation using a Clevenger-type apparatus (Borosil, capacity: 5 L, make: Scientific Instruments Co., India). Approximately 1 kg of wood was distilled with 4 L of distilled water for 6 hours. The volatile oil released during the process was condensed by a water-cooled condenser, and the essential oil was carefully separated from the aqueous layer.

For ointment formulation, the extracted *Cedrus deodara* essential oil was mixed with melted beeswax in a 1:4 ratio (i.e., 20 g of *C. deodara* oil with 80 g of beeswax). This ratio was selected based on classical Ayurvedic ointment (lepa/avaleha) preparation principles and corroborated by previous pharmaceutico-experimental studies that have demonstrated that a 1:4 ratio of essential oil to beeswax provides optimal consistency, spreadability, stability, and a sustained drug release profile suitable for topical applications [(Sharma et al., 2020); (Patel et al., 2017)]. (8,9)

The mixture was stirred continuously while cooling to room temperature to ensure uniform dispersion and homogeneity of the active constituents within the base. The final formulation was transferred into pre-sterilized, airtight glass containers and labeled accordingly.

All preparation procedures were conducted under hygienic conditions in the Rasa Shastra and Bhaishajya Kalpana Laboratory, Faculty of Indian Medical System, SGT University.

Figure 1: Process of making the Deodara ointment



Step 1	Step 2	Step 3	Step 4	Step 5
Fresh Devdaru wood is pounded into smaller pieces	Pounded Wood is then taken for distillation process	Oil is extracted from pounded drugs through distillation	Bees wax is melted and mixed with the devdaru oil and binding agents	Ointment is cooled to room temperature and stored in a clean container

Methods of the study

A total of 40 patients were enrolled from the SGT University campus. selection of patients was done on the basis of brief interview, while taking care of inclusion and exclusion criteria. Appropriate candidates were explained about the medication, method of application and expected results. Agreeing individuals were allowed to go through the consent form and sign it. The patient proforma was given to be filled under the headings of age, sex, marital status, inhabitancy, occupation, diet and addiction. Base line pain score was noted on the Visual analogue scale. Follow-up was taken on day 1,3,15 and 30. In the follow up pain score was noted. A total of 83 patients were interviewed of which 57 were enrolled as per inclusion and exclusion criteria. 17 patients were either lost to follow up or stopped applying medication during the month.

Inclusion Criteria

Patients experiencing simple muscular pain - clinically diagnosed based on **history, physical examination, and exclusion of other causes** such as traumatic injury, neurological involvement, vascular disorders, or systemic inflammatory conditions. The diagnosis was confirmed by Localized muscle tenderness on palpation, Pain aggravated by muscle use, absence of swelling, discoloration, or joint involvement, no signs of systemic illness (fever, malaise, etc.), negative findings on neurological and orthopaedic special tests (e.g., Straight Leg Raise, Spurling's Test, etc.). This clinical differentiation was based on detailed history-taking and physical examination to ensure that the pain was purely myofascial or musculoskeletal in origin and not a symptom of deeper pathology.

Patients age between 20 to 60 years - This age group was selected to include a population segment that is most commonly affected by musculoskeletal strain due to occupational, postural, or lifestyle-related factors. Free from extreme age-related physiological variations, such as the growth-related changes in adolescents or degenerative changes commonly seen after 60 years, which might influence pain perception, skin absorption, and response to treatment. Capable of providing informed consent and accurately reporting subjective symptoms like pain and relief.

Exclusion Criteria

Patients already undergoing other pain relief therapies or medications. Patients requiring immediate hospitalization or emergency medical care. Presence of skin rashes, infections, wounds, ulcers at the site of pain, or any other major illness.

Application of Drug: Patients were instructed to apply the ointment topically and gently massage it onto the affected area. The effectiveness of Cedrus deodara essential oil ointment in relieving muscular pain was assessed at multiple time points—Day 0, Day 1, Day 3, Day 15, and Day 30—using the Visual Analog Scale (VAS) for pain intensity along with other subjective parameters.

Criteria for assessing clinical feature

Pain rating scales - Visual analogue scale (VAS) (10). Patients were asked to mark pain severity while the printed scoring on the reverse was not shown to him/her.

Graphical representation of number of patients found under each category of mild, moderate and severe pain. The Visual Analog Scale (VAS) scores recorded at different time points (Day 0, Day 1, Day 3, Day 15, and Day 30) were categorized into three groups: Mild (1–3); Moderate (4–6); Severe (7–9).

Figure 2A: VAS scale

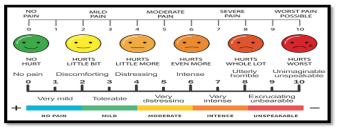
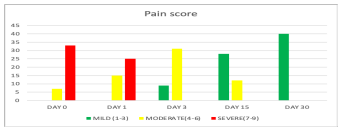


Figure 2B: Assessment of VAS Score



Observations and Results

Analysis of Age Distribution

The age of participants varies between 21 and 59 years.

There are fewer participants below 25 and above 55, indicating a focus on middle-aged individuals.

The study has a diverse age range (21-59 years), ensuring representation across different adult age groups. A mean age of 39.9 years suggests a population that is neither too young nor too old, making the study relevant to working-age individuals. The spread of participants is fairly balanced, avoiding extreme age biases.

Analysis of Gender Distribution

An approximately equal gender representation helped assess if pain relief varied by sex, avoiding gender bias in outcomes. Analysis of Marital Status

More participants are married than unmarried. Indicates that the study mostly involves individuals with family responsibilities.

Analysis of Occupation

Participants come from diverse professions: Farmers, Businesspersons, Service workers, Housewives, and Others. The largest group appears to be housewives, suggesting a significant female participation.

Participants from various social and work backgrounds (e.g., housewives, farmers, business people) were included to evaluate the ointment's applicability in diverse daily activity profiles, which often contribute to muscular stress.

Figure 3

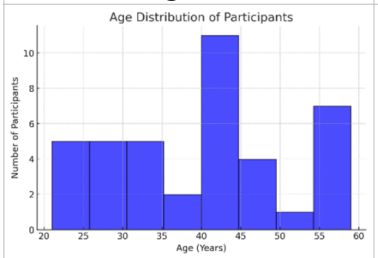
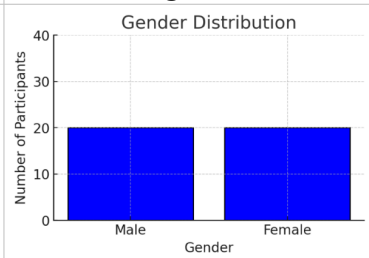


Figure 4



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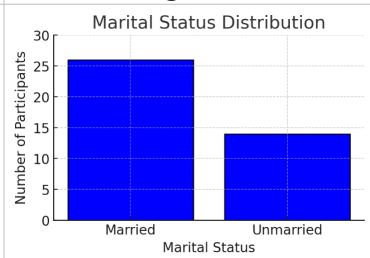

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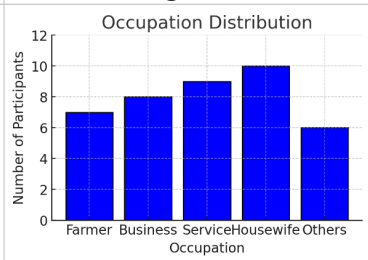

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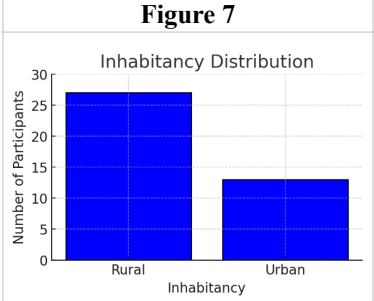

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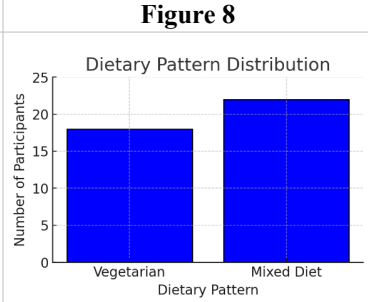

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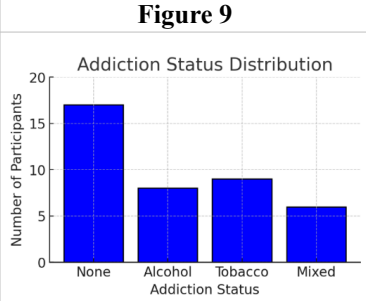
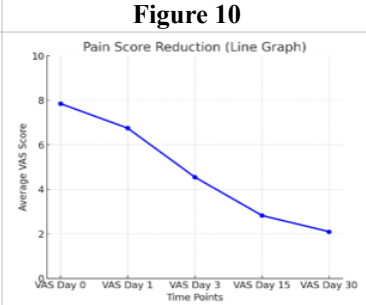


Figure 10



Analysis of Inhabitancy (Rural/Urban)

The majority of participants are from rural areas, indicating the study has a greater rural representation.

Urban participants are present but in a smaller proportion. Including both rural and urban participants helped understand real-world use and accessibility of herbal topical therapies.

Dietary Pattern

The distribution between vegetarians and mixed-diet individuals is fairly balanced. This ensures dietary habits do not majorly influence the study results.

Addiction Status

A significant number of participants have no addiction. Among those with addictions, tobacco and alcohol are common, with some having a mixed addiction.

The demographic parameters—such as age, gender, occupation, dietary habits, and addiction status—were collected to ensure a representative study population and to explore whether these factors influenced the analgesic response to *Cedrus deodara* ointment. Lifestyle elements like diet and addiction can affect inflammation and pain perception; documenting them helped identify potential confounding variables. Therefore, these observational data were not merely descriptive but aimed at validating the treatment's applicability and effectiveness across diverse backgrounds.

Summary of Analysis

Pain Score Distribution Over Time

The Visual Analog Scale (VAS) scores recorded at different time points (Day 0, Day 1, Day 3, Day 15, and Day 30) were categorized into three groups: Mild (1–3); Moderate (4–6); Severe (7–9)

Statistical Analysis of Pain Scores (VAS)

The primary outcome parameter was the Visual Analog Scale (VAS), recorded on Day 0, 1, 3, 15, and 30. The data were analyzed using paired t-tests to compare pain scores at different time points.

Table 1: Mean VAS Score

Assessment	Mean VAS	Standard	Standard
Day 0	7.85	1.09	0.144
Day 1	6.94	1.21	0.160
Day 3	4.32	1.13	0.150
Day 15	2.85	0.97	0.129
Day 30	2.10	0.74	0.098

Paired t-Test Results (Compared to Day 0):

Table: 2

Comparison	t-value	p-value	Significance
Day 0 vs Day 1	1.74	0.085	Not significant
Day 0 vs Day 3	11.53	< 0.00001	Significant
Day 0 vs Day 15	15.47	< 0.00001	Highly Significant
Day 0 vs Day 30	18.31	< 0.00001	Highly Significant

These results indicate that significant pain relief began after Day 3 and continued through Day 30. The change between Day 15 and Day 30 was not statistically significant (p = 0.06), suggesting pain plateaued by Day 15.

Relief Percentage:
Relief % = [(BT – AT) / BT] × 100

- Day 3: [(7.85 – 4.32)/7.85] × 100 = 44.97%
- Day 15: [(7.85 – 2.85)/7.85] × 100 = 63.69%
- Day 30: [(7.85 – 2.10)/7.85] × 100 = 73.25%

Tenderness

Table 3: Tenderness Scoring Criteria

Score	Clinical Presentation
0	No pain on touch
1	Pain on pressure
2	Pain on crude touch
3	Pain on fine touch

Statistical Summary of Tenderness Scores Over Time:

Table 4: Tenderness Score

Assessment Day	Mean Score	Standard Deviation (SD)	Standard Error (SE)
Day 0	2.58	0.50	0.08
Day 1	2.20	0.41	0.06
Day 3	1.50	0.51	0.08
Day 15	0.28	0.45	0.07
Day 30	0.00	0.00	0.00

Paired t-Test Results (Compared to Day 0)

Table 5

Comparison	t-value	p-value	Significance
Day 0 vs Day 1	3.55	0.00101	Significant
Day 0 vs Day 3	11.05	< 0.00001	Highly Significant
Day 0 vs Day 15	22.43	< 0.00001	Highly Significant
Day 0 vs Day 30	32.53	< 0.00001	Highly Significant

Tenderness Relief Percentage

Relief % = [(BT – AT) / BT] × 100

- Day 1: [(2.58 – 2.20)/2.58] × 100 = 14.73%
- Day 3: [(2.58 – 1.50)/2.58] × 100 = 41.86%
- Day 15: [(2.58 – 0.28)/2.58] × 100 = 89.15%
- Day 30: [(2.58 – 0.00)/2.58] × 100 = 100%

Tenderness, used as an objective parameter, showed a statistically significant reduction starting from Day 1 itself ($p = 0.00101$), with progressively greater improvement observed through Day 3, Day 15, and complete resolution by Day 30 ($p < 0.00001$). This trend supports the early onset, sustained, and long-term analgesic and anti-inflammatory effects of *Cedrus deodara* ointment. By Day 30, all participants exhibited a 100% relief in tenderness scores, reinforcing the formulation's therapeutic potential in managing simple muscular pain.

Discussion

The present pilot study was conducted to evaluate the analgesic efficacy of *Cedrus deodara* essential oil-based ointment in patients suffering from simple muscular pain. The results revealed a statistically significant reduction in pain intensity, starting from Day 3, as assessed by the Visual Analog Scale (VAS). Tenderness, used as a second objective parameter, also showed significant reduction from Day 1 onward, with complete resolution observed by Day 30. These findings suggest that the formulation provides both early onset and sustained pain relief.

The outcomes are in alignment with the traditionally documented analgesic, anti-inflammatory, and muscle-relaxant properties of *Cedrus deodara* [11,12]. In contemporary clinical practice, pain management often relies on synthetic analgesics, including NSAIDs and opioids, which may offer rapid relief but are frequently associated with adverse effects such as gastrointestinal discomfort, hepatotoxicity, nephrotoxicity, and dependency [13]. This has led to growing interest in natural formulations with fewer side effects. In this context, *Cedrus deodara* essential oil provides a promising herbal alternative, exhibiting strong safety and tolerability profiles.

The pharmacological activity of the oil may be attributed to the presence of active constituents such as sesquiterpenes, flavonoids, lignans, and diterpenoids, including α- and β-himachalene, himachalol, and atlantone [14,15]. These compounds are believed to exert their action by modulating inflammatory mediators and nociceptive pathways, thereby reducing both subjective pain and objective tenderness.

Comparison with Previous Studies

The results of the present study corroborate findings from earlier investigations:

- Gupta et al. (2018) reported a significant reduction in inflammatory markers using *C. deodara* extracts, supporting its application in musculoskeletal conditions [16].
- Kumar et al. (2019) confirmed the analgesic and anti-inflammatory efficacy of *C. deodara* essential oil in chronic pain conditions [17].
- Chauhan et al. (2020) demonstrated rapid absorption and localized pain relief with topical application of *C. deodara* oil, aligning with the present study's clinical outcomes [18].

Together, these studies reinforce the therapeutic value of *C. deodara*, while this trial adds preliminary clinical evidence supporting its topical use in simple muscular pain.

Limitations of the Study

- The absence of a placebo or comparator control group limits definitive conclusions.
- The drug was not compared with any standardized allopathic treatment.
- The sample size (n=40) was relatively small, reducing statistical power.
- The study duration did not permit evaluation of long-term effects or the sustainability of relief post-treatment.

Conclusion

Cedrus deodara essential oil ointment has demonstrated clinically significant and statistically validated efficacy in alleviating muscular pain and tenderness in adult patients. Its early onset of action, sustained effect, and excellent tolerability highlight its potential as a safe and effective herbal alternative to synthetic analgesics. However, larger randomized controlled trials with comparator arms and longer follow-up periods are essential to validate these findings and to explore its role in broader pain management protocols.

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