TRADITIONAL AND INTEGRATIVE MEDICINE

Trad Integr Med, Volume 10, Issue 4, Autumn 2025

Original Research

Ethnobotanical Insights into Medicinal Plants Used for Joint Pain Management by the Indigenous Population of Ilam Province, West of Iran

Naser Abbasi[1], Alireza Pourrahim[2]*, Damoun Razmjoue[3,4], Mahmoud Bahmani[1]*

[1]Biotechnology and Medicinal Plants Research Center, Ilam University of Medical Sciences, Ilam, Iran
[2]Student Research Committee, Faculty of Medicine, Ilam University of Medical Sciences, Ilam, Iran
[3]Medicinal Plants Research Center, Yasuj University of Medical Sciences, Yasuj, Iran
[4]Department of Pharmacognosy, Faculty of Pharmacy, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

Received: 1 Mar 2025 **Accepted:** 30 Aug 2025

Abstract

Joint pain is a prevalent symptom affecting millions worldwide, often resulting from inflammatory or non-inflammatory conditions such as arthritis and arthralgia. Conventional treatments, such as nonsteroidal anti-inflammatory drugs (NSAIDs) and corticosteroids, often lead to adverse effects, increasing the demand for alternative therapies. Ethnobotanical studies provide valuable insights into traditional medicinal practices, helping to bridge the gap between folk medicine and modern pharmacology. This study aimed to document medicinal plants used by the indigenous population of Ilam Province, Iran, for joint pain management. A cross-sectional ethnobotanical survey was conducted in Ilam City between April and November 2024. Data were collected through face-to-face interviews and structured questionnaires administered to 25 traditional healers, selected based on their expertise and long-standing practice in herbal medicine. Herbarium specimens of the cited plants were collected and authenticated at the Biotechnology and Medicinal Plants Research Center, Ilam University of Medical Sciences. Quantitative analyses, including the Usage Report Index (UR) and Relative Frequency of Citation (RFC), were employed to evaluate the cultural significance and therapeutic relevance of the identified species. The results revealed 20 medicinal plant species across 15 botanical families used in joint pain management. The Asteraceae family emerged as the most frequently utilized, with aerial plant parts being predominantly employed (29%) and decoction (35%) as the primary method of preparation. Notable species include *Syzygium aromaticum* (L.) Merr. & L.M.Perry, *Olea europaea* L., *Nigella sativa* L., and *Salvia Rosmarinus* Spenn., each recognized for their anti-inflammatory, analgesic, and antioxidant properties. This study documented the rich ethnobotanical heritage of Ilam Province, highlighting its potential as a source of effective, natural treatments for joint pain. The findings underscore the urgent need for conservation of traditional knowledge and further phytochemical and pharmacological investigations to validate and potentially commercialize these herbal remedies, bridging traditional practices with modern evidence-based medicine.

Keywords: Joint pain; Arthralgia; Arthritis; Ethnobotany; Medicinal plants; Traditional medicine; Iran

http://doi.org/10.18502/tim.v10i4.20728

Citation: Abbasi N, Pourrahim A, Razmjoue D, Bahmani M. **Ethnobotanical Insights into Medicinal Plants Used for Joint Pain Management by the Indigenous Population of Ilam Province, West of Iran**. Trad Integr Med 2025;10(4): 404-412. http://doi.org/10.18502/tim.v10i4.20728

*Corresponding Authors:Mahmoud Bahmani
Biotechnology and Medicinal Plants Research Center, Ilam University of Medical Sciences, Ilam, Iran
Email: mahmood.bahmani@gmail.com
Alireza Pourrahim
Biotechnology and Medicinal Plants Research Center, Ilam University of Medical Sciences, Ilam, Iran
Email: alirpourrahim2003@gmail.com

Introduction

Joint pain is a prevalent condition characterized by discomfort, stiffness, inflammation or functional limitation in one or more joints [1,2]. It is not classified as a disease, but rather a symptom which can be broadly categorized into inflammatory (arthritis) and non-inflammatory (arthralgia) forms, arising from diverse etiologies such as autoimmune disorders, degenerative diseases, metabolic conditions, infections, trauma, or degenerative diseases like osteoarthritis [3]. Epidemiological studies highlight the growing prevalence of joint pain, particularly in aging populations and individuals with physically demanding lifestyles [4,5]. Osteoarthritis, the most common cause of joint pain, affects approximately 10% of men and 18% of women over 60 globally, as reported by the World Health Organization (WHO) [6-8]. Inflammatory joint diseases, such as rheumatoid arthritis and gout, also contribute significantly to the burden of joint disorders [9]. Risk factors include advanced age, obesity, genetic predisposition, repetitive joint use, and comorbidities such as diabetes or cardiovascular diseases [10,11]. This condition poses a significant socioeconomic burden, affecting patients' quality of life, productivity, and mobility [12,13]. The management of joint pain often includes lifestyle modification, physical therapy, and pharmacological interventions [14,15]. However, given its chronic nature, the demand for effective and sustainable treatment options is rising, emphasizing the importance of exploring alternative approaches such as herbal medicine [16].

The prolonged use of conventional pharmacological treatments, including NSAIDs and corticosteroids, can lead to adverse effects such as gastrointestinal bleeding, kidney dysfunction, and cardiovascular complications, underscoring the need for safer therapeutic alternatives [17].

The use of medicinal plants for treating various ailments, including joint pain, dates back thousands of years. Traditional medicine systems, such as Ayurveda, Traditional Chinese Medicine, and Persian Medicine, have documented numerous herbal formulations and their efficacy [18-23]. These remedies often leverage plant-derived bioactive compounds with anti-inflammatory, analgesic, and regenerative properties [24].

Ethnobotany, the study of the relationships between people and plants, plays a pivotal role in preserving traditional knowledge about medicinal plants [25,26]. Herbal ethnography delves deeper into understanding how specific communities have developed, maintained, and transmitted this knowledge over generations. This field not only highlights the cultural and ecological significance of medicinal plants but also serves as a foundation for discovering novel bioactive compounds [27,28].

Throughout history, medicinal plants have been employed to alleviate joint pain and inflammation. Numerous herbs, such as *Zingiber officinale* Roscoe (ginger) and *Boswellia serrata* Roxb. (Indian frankincense), have demonstrated anti-inflammatory and analgesic effects in traditional medicine [29,30]. In Iran, Persian Medicine has a rich history of utilizing herbal remedies for musculoskeletal disorders, including joint pain [17]. Ancient Persian texts, such as "Canon of Medicine" by Avicenna, describe several plants for arthralgia treatment. Such practices remain embedded in modern ethnomedicinal traditions, highlighting their relevance as complementary therapies [31].

Ilam Province, located in the western part of Iran, is renowned for its rich biodiversity and unique climatic conditions, making it a hotspot for medicinal plant species [32]. The province's mountainous terrain and semi-arid climate foster the growth of various endemic and medicinal plants, many of which are integral to the local population's traditional practices [33,34]. Ethnobotanical studies in this region offer invaluable insights into the sustainable use of plant resources for therapeutic purposes.

This study aims to document and analyze the medicinal plants used by the local population of Ilam Province for the treatment of joint pain. By identifying the scientific and traditional knowledge surrounding these plants, the research seeks to bridge the gap between traditional practices and modern pharmacology, contributing to the development of safer, plant-based therapeutic options for joint pain management.

Materials and Methods

Study area

The present ethnobotanical study was conducted in Ilam City, the capital and most populous city of Ilam Province, located in western Iran. Ilam Province encompasses an area of 20,133.11 km² and is situated between 34°04′ N, 45°42′ E and 32°07′ N, 47°09′ E. The province shares a 425-kilometer border with Iraq to the west and is bordered by Kermanshah Province to the north, Lorestan Province to the east, and Khuzestan Province to the south (Figure 1). Ilam City is geographically positioned in the Zagros Mountain range, characterized by rugged mountains, valleys, and seasonal rivers.

According to the 2024 census conducted by the Iran Statistics Center, Ilam Province has a population of 646,026, with Ilam City accounting for 261,836 residents. The predominant language spoken in the region is Feyli Kurdish, and the population primarily consists of Kurdish communities with a strong cultural and historical connection to traditional medicine.

This cross-sectional study was conducted between April 2024 and November 2024, aiming to document

and analyze medicinal plants used by the local communities. Ilam City was selected as the study area due to its diverse plant life, strong ethnobotanical traditions, and the ongoing practice of herbal medicine in musculoskeletal health management.

Selection of villages and information

The selection of villages and informants for this ethnobotanical study was carried out using a structured approach to document traditional knowledge regarding medicinal plants used for joint pain management. Data collection was conducted through face-to-face interviews and ethnobotanical questionnaires with 25 traditional healers and herbal practitioners in Ilam City. The informants were selected based on their expertise in herbal medicine, years of experience, and recognition within the local community.

To ensure a comprehensive dataset, a complete list of traditional healers in Ilam City was obtained from the Food and Drug Deputy of Ilam, allowing researchers to systematically approach knowledgeable individuals. The questionnaire included sections on personal and demographic information, the local and scientific names of medicinal plants, the plant parts used, traditional preparation methods, routes of administration, and perceived therapeutic effects.

The interviews were conducted in Kurdish, Persian and Luri to facilitate clear communication and accurate documentation of ethnobotanical knowledge. Each informant's responses were carefully recorded, and oral consent was obtained before participation. This systematic methodology ensured that the study captured authentic and culturally significant data on the use of medicinal plants for musculoskeletal health.

Plant authentication

For the authentication of medicinal plants reported in the ethnobotanical survey, herbarium specimens were collected based on the plants introduced in the questionnaires. The authentication of plant species was performed at the Biotechnology and Medicinal Plants Research Center, Ilam University of Medical Sciences, Iran. The scientific names of the collected plant specimens were verified and cross-checked using reliable online databases to ensure taxonomic accuracy. To confirm the botanical identification, the plant specimens were examined and validated by two authors (N.A. and M.B.) according to the morphological keys of plant flora described by Dr. Valiallah Mozaffarian. The confirmed specimens were then deposited in a herbarium collection, and herbarium codes were assigned for reference in future studies.

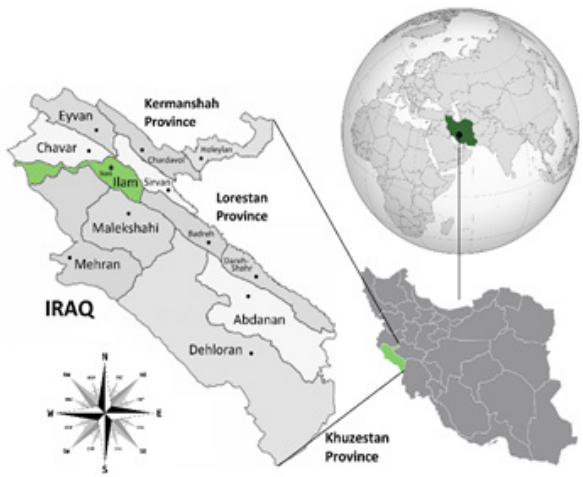

Figure 1. Location of Ilam city within Ilam province and Iran.

Data processing and statistical analysis

To analyze the collected ethnobotanical data, quantitative methods were applied to identify the most significant medicinal plants used for joint pain management. These statistical approaches allowed for the systematic evaluation of plant species reported by traditional healers, providing a basis for potential pharmacological and clinical research. The data from the questionnaires were entered into a spreadsheet database, and descriptive statistical analyses were conducted. The relative importance of each species was assessed using ethnobotanical indices to determine their frequency of use and cultural significance among the local population.

Usage Report Index (UR) and Relative Frequency of Citation (RFC)

To quantify the significance of medicinal plants cited by informants, the Usage Report Index (UR) and the Relative Frequency of Citation (RFC) were calculated. The UR represents the total number of usage reports for each plant species documented during the study. The RFC was used to assess the relative importance of each medicinal species among local practitioners [35]. It was calculated using the following formula:

$$RFC = \frac{FC}{N}$$

FC = Number of informants who cited a particular plant species.

N = Total number of interviewed informants (25).

The RFC index ranges from 0 to 1, with 0 indicating no citation of a plant species and 1 indicating that all informants cited the medicinal use of a given species. These indices provide insight into the cultural significance and popularity of medicinal plants used for joint pain treatment.

Ethical Considerations

This study was approved by Ilam University of Medical Sciences under the ethics code IR.MEDILAM.REC.1401.069. The ethical review confirmed that the survey was conducted anonymously, ensuring that no

Table 1. Socio-Demographic Characteristics of Local Healers (n = 25)

Characteristics		Frequency	Percentage
Gender	Male	13	52%
	female	12	48%
Education level	Diploma	5	20%
	Associate degree	2	8%
	Bachelor's degree	15	60%
	Master's degree	3	12%
Age Group	20-40	17	68%
	41-60	8	32%
	Minimum age	26	
	Maximum age	55	
Language	Kurdish	15	60%
	Lori	5	20%
	Persian	5	20%

personally identifiable information was collected from the informants. Additionally, approvals were obtained from the relevant authorities, including local health offices and traditional medicine representatives. Each participant provided written informed consent, acknowledging their voluntary participation and understanding of the study's objectives. Confidentiality was strictly maintained, and informants retained the right to withdraw from the study at any stage.

Results

The demographic characteristics of the study participants, including gender, education level, age, and language, are presented in Table 1, offering insights into the socio-cultural background of informants and their role in preserving ethnobotanical knowledge. Analysis of the collected data identified 20 medicinal plant species from 15 botanical families traditionally used for joint pain management in Ilam Province, with detailed botanical information provided in Table 2. Among these, the Asteraceae family emerged as the most frequently utilized (Figure 2), while aerial plant organs (29%) were the most commonly used (Figure 3), and decoction (35%) was the predominant method of preparation (Figure 4).

To assess the cultural significance of these plants, quantitative ethnobotanical indices, including UR, RFC, and PFU, were calculated and presented in table 3. *Syzygium aromaticum* was identified as the most frequently cited medicinal plant for joint pain relief, with a UR of 14, RFC of 0.56, and PFU of 53.8%. Additionally, several plant species, including *Bieberstеinia multifida*, *Isatis raphanifolia*, *Rhus coriaria*, and *Anchusa italica* were consistently mentioned by all interviewed traditional healers, emphasizing their widespread use and therapeutic importance in the region.

Discussion

In recent years, there has been a growing global interest in complementary and alternative medicine (CAM), particularly in the use of herbal therapies for managing various health conditions, including pain. The growing dependence on medicinal plants can be attributed to their diverse pharmacological characteristics, cost-effectiveness, and ethnobotanical origin, establishing them as an indispensable part of traditional and alternative medicine [36-38]. Among the diverse applications of herbal medicine, pain management—especially for chronic conditions such as joint pain—has garnered significant attention due to the limitations and side effects associated with conventional

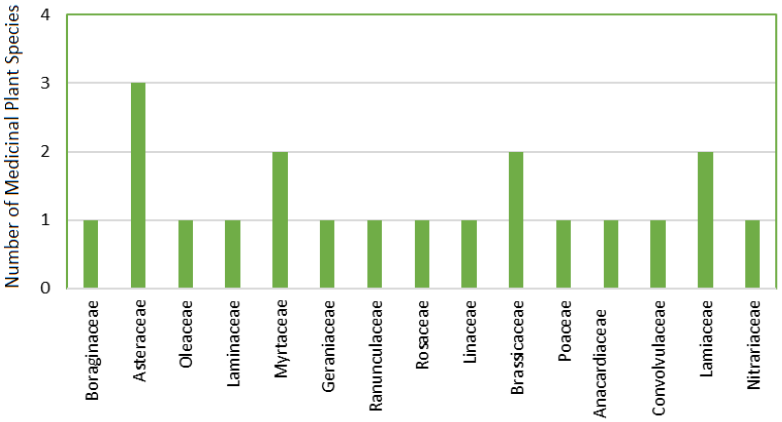

Figure 2. Distribution of plant families used for joint pain in Ilam city

Table 2. Medicinal plants effective on joint pain in Ilam city

Persian Name	Scientific name	Plant family	Common name	Organ used	Traditional method of using	Main compounds
Goleh Gavzaban	*Anchusa italica* Retz	Boraginaceae	Italian Bugloss	Flower	Decoction & infusion	Rosmarinic acid, Allantoin
Goleh Gandom Taq Bostani	*Centaurea irritans* Wagenitz	Asteraceae	Centaurea	Flower	Decoction & infusion	Flavonoids, Sesquiterpene lactones
Zeytoun	*Olea europaea* L.	Oleaceae	Olive	Fruit, Oil	Fresh fruit & oil	Oleuropein, Hydroxytyrosol
Moureh Talkh	*Teucrium orientale* L.	Laminaceae	Eastern Germander	Aerial organs	Decoction	Diterpenoids, Flavonoids
Mikhak	*Syzygium aromaticum* (L.) Merr. & L.M.Perry	Myrtaceae	Clove	Wood, Oil	Poultice	Eugenol
Adamak	*Biebersteinia multifida* DC.	Geraniaceae	Biebersteinia	Aerial organs	Decoction & infusion	Alkaloids, Flavonoids
Siah Daneh	*Nigella sativa* L.	Ranunculaceae	Black Cumin	Seed	Oil & decoction	Thymoquinone
Rozmari	*Salvia Rosmarinus* Spenn.	Lamiaceae	Rosemary	Leaf	Decoction & infusion	Carnosic acid, Rosmarinic acid
Hamisheh Bahar	*Calendula persica* C.A.Mey.	Asteraceae	Persian Marigold	Flower	Infusion	Triterpenoids, Flavonoids
Badam Kouhi	*Amygdalus arabica* Olivier *Amygdalus communis* L.	Rosaceae	Wild Almond	Fruit	Oil & fresh fruit	Amygdalin, Vitamin E, Oleic acid
Katan	*Linum usitatissimum* L.	Linaceae	Flaxseed	Seed	Oil & infusion	Omega 3, Lignans
Vasmeh	*Isatis raphanifolia* Boiss.	Brassicaceae	Isatis	Aerial organs	Poultice & decoction	Indirubin, Flavonoids
Jarou Alafi Harz	*Bromus danthoniae* Trin.	Poaceae	Bromus	Aerial organs	Decoction	Phenolic compounds
Okaliptus	*Eucalyptus camaldulensis* Dehnh.	Myrtaceae	Red River Gum	Leaf	Decoction	Eucalyptol, Tannins
Somagh	*Rhus coriaria* L.	Anacardiaceae	Sumac	Aerial organs, Fruit	Infusion & fresh fruit	Tannins, Flavonoids
Ghodoumeh	*Alyssum homalocarpum* (Fisch. & C.A.Mey.)	Brassicaceae	Alyssum	Aerial organs	Infusion	Glucosinolates
Shangeh Asbi	*Leontodon lanatus* (L.) Fisch	Asteraceae	Woolly Hawkbit	Aerial organs	Infusion	Sesquiterpene lactones
Pichakeh Sahraei	*Convolvulus arvensis* L.	Convolvulaceae	Field Bindweed	Flower, Leaf	Infusion	Alkaloids, Flavonoids
Kakouti Sarsan	*Ziziphora capitata* L.	Lamiaceae	Ziziphora	Aerial organs	Decoction	Pulegone, Flavonoids
Espand	*Peganum harmala* L.	Nitrariaceae	Syrian Rue	Seed, Leaf	Poultice & decoction	Harmaline, Harmine

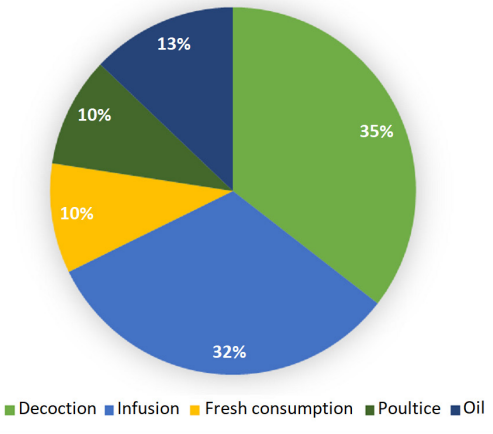

Figure 3. Percentage Distribution of Plant Organs Used for Joint Pain Treatment in Ilam City.

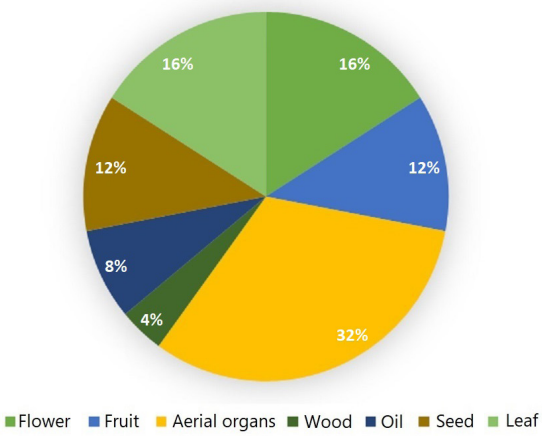

Figure 4. Percentage Distribution of Traditional Methods for Using Medicinal Plants in Joint Pain Treatment in Ilam City.

Table 3. Quantitative ethnobotanical indices of medicinal plants used for joint pain in Ilam city.

The name of the plant	PFU	UR	RFC
Anchusa italica Retz	34.6%	9	0.36
Centaurea irritans Wagenitz	15.3%	4	0.16
Olea europaea L.	23.0%	6	0.24
Teucrium orientale L.	23.0%	6	0.24
Syzygium aromaticum (L.) Merr. & L.M.Perry	53.8%	14	0.56
Biebersteinia multifida DC.	46.1%	12	0.48
Nigella sativa L.	30.7%	8	0.32
Salvia Rosmarinus Spenn.	19.2%	5	0.20
Calendula persica C.A.Mey.	23.0%	6	0.24
Amygdalus arabica Olivier	15.3%	4	0.16
Amygdalus communis L.			
Linum usitatissimum L.	19.2%	5	0.20
Isatis raphanifolia Boiss.	42.3%	11	0.44
Bromus danthoniae Trin.	23.0%	6	0.24
Eucalyptus camaldulensis Dehnh.	34.6%	9	0.36
Rhus coriaria L.	38.4%	10	0.40
Alyssum homalocarpum (Fisch. & C.A.Mey.)	23.0%	6	0.24
Leontodon lanatus (L.) Fisch	19.2%	5	0.20
Convolvulus arvensis L.	26.9%	7	0.28
Ziziphora capitata L.	15.3%	4	0.16
Peganum harmala L.	19.2%	5	0.20

Abbreviations: PFU: percentage of frequency of use, UR: usage report index, RFC: relative frequency of citation

pharmaceutical treatments [39,40]. Ethnobotanical knowledge serves as an integral aspect of cultural heritage and provides a wealth of information about plant-derived therapies that have been employed for millennia [41,42]. Traditional healing practices provide a foundation for scientific research, helping to identify bioactive compounds with potential therapeutic applications. Documenting and validating these traditional remedies not only safeguard indigenous knowledge, but also contribute to the development of novel pharmacological interventions for pain-related disorders [43,44]. The results of this study highlight the diverse range of medicinal plants used for joint pain management in Ilam Province, reflecting the region's rich ecological and cultural heritage. Many of these plants exhibit potential analgesic and anti-inflammatory properties, emphasizing the need for further pharmacological validation.

The findings of this research align with other ethnobotanical studies conducted both in Iran and internationally, underscoring the importance of medicinal plants for pain management in general and joint pain relief in particular. In Iran, Ziaei et al. (2016) reported the use of various species such as *Acorus calamus* L., *Allium sativum* L., *Althaea officinalis* L., *Brassica nigra* (L.) W.D.J.Koch, *Calendula officinalis*, and *Cichorium intybus* L. for joint pain treatment in Iranian Traditional Medicine (ITM) [17]. Although *Calendula officinalis* was cited in their study and *Calendula persica* C.A.Mey. emerged in the present

research, the prominence of the *Calendula* genus in both studies suggests shared therapeutic potential for inflammatory conditions. Similar findings have been noted outside of Iran as well. Anadka et al. (2024) in Karnataka, India, documented a large repertoire of 82 medicinal plants used for joint pain, suggesting that traditional herbal knowledge for musculoskeletal ailments is both extensive and deeply rooted in South Asian communities [45]. Beyond the Indian subcontinent, Teng et al. (2011) in Shaanxi Province, China, reported several plants with known anti-inflammatory effects, such as *Eucommia ulmoides* Oliv. and *Rubia cordifolia* L. [46]. Likewise, Wambugu et al. (2011) in Kenya documented species like *Carissa spinarum* L., *Schkuhria pinnata* (Lam.) Kuntze ex Thell., and *Tithonia diversifolia* (Hemsl.) A.Gray for chronic joint pain, highlighting once again that diverse flora can converge on similar therapeutic goals worldwide [47]. In Southeast Asia, Widyowati et al. (2024) identified 32 plant species and 25 herbal formulations in Solo City, Indonesia, frequently employed by traditional healers for joint pain relief, including *Piper retrofractum* Vahl., *Zingiber officinale*, *Curcuma xanthorrhiza* Roxb., and *Curcuma longa* L. [48].

S. aromaticum (clove) is a potent analgesic and anti-inflammatory properties from eugenol, a phenolic compound. Traditionally used for toothaches, digestive disorders, and respiratory ailments, its efficacy in pain relief is well-documented [49,50]. *O. europaea* (olive), especially its oil, is valued for anti-inflammatory effects aiding joint pain, driven by oleuropein and hydroxytyrosol, with additional uses in cardiovascular health and skin conditions [51, 52]. *N. sativa* (black cumin) offers anti-inflammatory and immunomodulatory benefits for joint pain, respiratory issues, and digestion, primarily due to thymoquinone [53,54]. *Salvia rosmarinus* (rosemary), with rosmarinic acid and carnosic acid, provides anti-inflammatory and antioxidant effects, used for joint pain, cognitive enhancement, and digestive health [55,56]. *C. persica* (marigold), akin to *C. officinalis*, is applied topically for inflammation and wound healing, indirectly aiding joint pain, with flavonoids and triterpenoids as key compounds [57-59]. *L. usitatissimum* (flaxseed) reduces inflammation via alpha-linolenic acid (ALA), an omega-3 fatty acid, supporting cardiovascular health, and digestion [60]. *Eucalyptus camaldulensis* (eucalyptus) is known for respiratory benefits, but its anti-inflammatory eucalyptol (1,8-cineole) aids topical joint pain relief [61]. *Rhus coriaria* (sumac), which is rich in gallic acid and tannins, has been documented to exhibit antioxidant and anti-inflammatory activities. In traditional medicine, it is employed to manage a range of conditions, including liver diseases, diarrhea, urinary tract disorders, and ulcerations [62,63]. *Peganum harmala* (Syrian rue) offers analgesic and anti-inflammatory properties from beta-carboline alkaloids like harmine and harmaline, also used for digestion and as an antimicrobial [64,65]. Other notable species include *Anchusa italica* (flavonoids, phenolic acids) for inflammation [66], *Biebersteinia multifida* (alkaloids, flavonoids) for pain relief [67], *Isatis raphanifolia* (indirubin, flavonoids) for anti-inflammatory effects [68-70], *Teucrium orientale* (diterpenoids, flavonoids) for digestive and respiratory issues [71,72], *Amygdalus arabica/ A. communis* (amygdalin, fatty acids, vitamins) for mild anti-inflammatory benefits [73,74], *Convolvulus arvensis* (alkaloids, flavonoids) as an anti-inflammatory [75], and Ziziphora (essential oils, flavonoids) for digestive and respiratory conditions [76,77]. In Iran, seventy-four *Centaurea* species have been recorded, which 38 are endemic. Numerous species within this genus exhibit a range of bioactivities, including anti-inflammatory, antimicrobial, diuretic, mild astringent, antihepatotoxic, antioxidant, and cytotoxic effects [78].

Conclusion

This study highlights Ilam Province, Iran, as a vital repository of plant biodiversity with significant potential for herbal medicine, particularly for joint pain. Through ethnobotanical research, 20 species of medicinal plants belonging to 15 families were found, some of which include *S. aromaticum*, *O. europaea*, *N. sativa*, and *S. rosmarinus* based on their medicinal applications and pharmacological properties. These findings render Ilam as a potential source of raw material for traditional medicine, provided that its ethnobotanical heritage is conserved. Modernization threatens this traditional heritage, and thus immediate conservation and documentation are necessary. Further phytochemical and pharmacological studies are required to confirm the efficacy and safety of these species for application in evidence-based practice. Clinical and preclinical trials will be central to the transition from traditional practice to industrialized herbal medicines. In conclusion, not only does this research document Ilam's medicinal plants, but it underscores the necessity of ongoing conservation, scientific validation, and commercialization. By synthesizing local wisdom with rigorous research, Ilam's plant resources could yield effective, natural treatments for joint pain, to the benefit of both the region and the broader herbal medicine sector.

Conflict of Interests

None.

Acknowledgements

None.

References

[1] Ekediegwu EC, Akpaenyi CE, Nwosu IB, Onyeso OK. Demographic and disease characteristics associated with pain intensity, kinesiophobia, balance, and fall self-efficacy among people with osteoarthritis: a cross-sectional study. BMC Musculoskelet Disord 2022;23:544.

[2] Gates LS, Cherry L, Grønne DT, Roos EM, Skou ST. The prevalence of foot pain and association with baseline characteristics in people participating in education and supervised exercise for knee or hip osteoarthritis: a cross-sectional study of 26,003 participants from the GLA: D® registry. J Foot Ankle Res 2023;16:83.

[3] Heidari B. Knee osteoarthritis prevalence, risk factors, pathogenesis and features: Part I. Casp J Intern Med 2011;2:205-210.

[4] Fan Z, Yan L, Liu H, Li X, Fan K, et al. The prevalence of hip osteoarthritis: a systematic review and meta-analysis. Arthritis Res Ther 2023;25:51.

[5] Gabriel SE, Michaud K. Epidemiological studies in incidence, prevalence, mortality, and comorbidity of the rheumatic diseases. Arthritis Res Ther 2009;11:1-16.

[6] World Health Organization. Osteoarthritis. 2023 [cited 2025 Jan 24]. Available from: https://www.who.int/news-room/fact-sheets/detail/osteoarthritis.

[7] World Health Organization. Musculoskeletal Health. 2022 [cited 2025 Jan 24]. Available from: https://www.who.int/news-room/fact-sheets/detail/musculoskeletal-conditions.

[8] Long H, Liu Q, Yin H, Wang K, Diao N, et al. Prevalence trends of site-specific osteoarthritis from 1990 to 2019: findings from the global burden of disease study 2019. Arthritis Rheumatol 2022;74:1172-1183.

[9] Asghari KM, Zahmatyar M, Seyedi F, Motamedi A, Zolfi M, et al. Gout: global epidemiology, risk factors, comorbidities and complications: a narrative review. BMC Musculoskelet Disord 2024;25:1047.

[10] Adamson J, Ebrahim S, Dieppe P, Hunt K. Prevalence and risk factors for joint pain among men and women in the West of Scotland Twenty-07 study. Ann Rheum Dis 2006;65:520-524.

[11] Kidd BL. Osteoarthritis and joint pain. Pain 2006;123:6-9.

[12] Kawai K, Kawai AT, Wollan P, Yawn BP. Adverse impacts of chronic pain on health-related quality of life, work productivity, depression and anxiety in a community-based study. Fam Pract 2017;34:656-661.

[13] Agaliotis M, Fransen M, Bridgett L, Nairn L, Votrubec M, et al. Risk factors associated with reduced work productivity among people with chronic knee pain. Osteoarthritis Cartilage 2013;21:1160-1169.

[14] Conduah AH, Baker III CL, Baker Jr CL. Managing joint pain in osteoarthritis: safety and efficacy of hylan GF 20. J Pain Res 2009;2:87-98.

[15] Palmer T, Toombs JD. Managing joint pain in primary care. J Am Board Fam Pract 2004;17(Suppl 1):S32-S42.

[16] Lindler BN, Long KE, Taylor NA, Lei W. Use of herbal medications for treatment of osteoarthritis and rheumatoid arthritis. Medicines 2020;7:67.

[17] Ziaei A, Sahranavard S, Faizi M. Topical herbal remedies for treatment of joint pain according to Iranian Traditional Medicine. 2016.

[18] Joshi K, Harjpal L, Singh S. Ayurvedic approach to managing Joint Disorders: Case Studies. J Ayurveda Integr Med Sci 2024;9:239-246.

[19] Banga P, Sarodea S, Bhosalea M. Ayurvedic approaches to joint pain management: a Kayachikitsa perspective.

[20] Arnold MD, Thornbrough LM. Treatment of musculoskeletal pain with traditional Chinese herbal medicine. Phys Med Rehabil Clin N Am 1999;10:663-671.

[21] Chen W-h, Liu X-x, Tong P-j, Zhan H-s. Diagnosis and management of knee osteoarthritis: Chinese medicine expert consensus (2015). Chin J Integr Med 2016;22:150-153.

[22] Wang M, Liu L, Zhang CS, Liao Z, et al. Mechanism of traditional Chinese medicine in treating knee osteoarthritis. J Pain Res 2020;13:1421-1429.

[23] Abolhassanzadeh Z, Aflaki E, Yousefi G, Mohagheghzadeh A. Medicinal plants for joint pain in traditional Persian medicine. Trends Pharm Sci 2016;2:2.

[24] Wang Z, Efferth T, Hua X, Zhang X. Medicinal plants and their secondary metabolites in alleviating knee osteoarthritis: a systematic review. Phytomedicine 2022;105:154347.

[25] Hooshmand Garehbagh L. An ethnobotanical review of medicinal plants traditionally used for diabetes management in southern Iran. J Biochem Phytomed 2025; 4:23-30.

[26] J Alkhatib A, Abdi F. ethnobotanical study of medicinal plants used by traditional therapists for headache treatment in the Tafila Region, Jordan. Plant Biotechnol Persa 2026;8.

[27] Baharvand-Ahmadi B, Bahmani M, Naghdi N, Saki K, Baharvand A, et al. Medicinal plants used to treat infectious and non-infectious diseases of skin and skin appendages in city of Urmia, northwest Iran. Der Pharmacia Lettre 2015;7:189-196.

[28] Patel V, Acharya S. In vitro anti-urolithiatic activity of aqueous extract of macrotyloma uniflorum. Plant Biotechnol Persa 2025;7:140-149.

[29] Kravchenko I, Eberle L, Nesterkina M, Kobernik A. Anti-inflammatory and analgesic activity of ointment based on dense ginger extract (Zingiber officinale). J Herbmed Pharmacol 2019;8:126-132.

[30] Siddiqui MZ. Boswellia serrata, a potential antiinflammatory agent: an overview. Indian J Pharm Sci 2011;73:255.

[31] Afshar A. Concepts of orthopedic disorders in Avicenna's Canon of Medicine. Arch Iran Med 2011;14.

[32] Ghasemi PA, Momeni M, Bahmani M. Ethnobotanical study of medicinal plants used by Kurd tribe in Dehloran and Abdanan districts, Ilam province, Iran. Afr J Tradit Complement Altern Med 2013;10:368-385.

[33] Mirhashemi H, Pourbabaei H, Mezbani A. The effect of altitude on diversity and Species Importance Value (SIV) of herbaceous species in forests of Kabirkouh, Ilam. J Plant Res (Iran J Biol) 2020;33:1025-1036.

[34] Poorbabaei H, Heydari M, Najafifar A. The relationship between plant diversity and physiographic factors in Ghalarang protected area, Ilam, Western Iran. In: Proc Global Conf Global Warming (GCGW). 2008.

[35] Razmjoue D, Ezati M, Abbasi N, Pirhadi M, Shojaei B, et al. Ethnobotanical study of medicinal plants used by local population of Ilam city on back pain, West of Iran. Trad Integr Med 2024;9:289-297.

[36] Ekor M. The growing use of herbal medicines: issues relating to adverse reactions and challenges in monitoring safety. Front Pharmacol 2014;4:177.

[37] Mosavat SH, Pasalar M, Joulaei H, Ameli V. Complementary and alternative medicine use among people living with HIV in Shiraz, Southern Iran. Front Public Health 2023;11:1206665.

[38] Nahin RL, Straus SE. Research into complementary and alternative medicine: problems and potential. BMJ 2001;322:161-164.

[39] Jahromi B, Pirvulescu I, Candido KD, Knezevic NN. Herbal medicine for pain management: efficacy and drug interactions. Pharmaceutics 2021;13:251.

[40] Hasan MK, Zanzabil KZ, Ara I, Rahman T, Kieu A. Herbal therapies for pain management: a scoping review of the current evidence.

Phytochem Rev 2024;1-52.
[41] Ishtiaq M, Sardar T, Hussain I, Maqbool M, Waqas Mazhar M, et al. Traditional ethnobotanical knowledge of important local plants in Sudhnoti, Azad Kashmir, Pakistan. Sci Rep 2024;14:22165.
[42] Gentile C, Spampinato G, Patti M, Laface VLA. Contribution to the ethnobotanical knowledge of Serre Calabre (Southern Italy). Res J Ecol Environ Sci 2022;35:35-55.
[43] Balkrishna A, Sharma N, Srivastava D, Kukreti A, et al. Exploring the safety, efficacy, and bioactivity of herbal medicines: bridging traditional wisdom and modern science in healthcare. Future Integr Med 2024;3:35-49.
[44] Dasgupta SC. Bioactive compounds from medicinal plants and its therapeutic uses in the traditional healthcare system. In: Medicinal Plants: Biodiversity, Biotechnology and Conservation. Springer; 2023. pp. 525-537.
[45] Anadka Y, Gulimane K. Ethnobotanical investigation on herbal remedies for musculoskeletal disorders in Dakshina Kannada district, Karnataka, India. Ethnobot Res Appl 2024;29:1-48.
[46] Teng Y, Guo H, Liang Z, Shu Z. Ethnobotanical survey of medicinal plants and their utilization in Shaanxi Province, China. J Med Plants Res 2011;5:1762-1778.
[47] Wambugu SN, Mathiu PM, Gakuya DW, Kanui TI, Kabasa JD, et al. Medicinal plants used in the management of chronic joint pains in Machakos and Makueni counties, Kenya. J Ethnopharmacol 2011;137:945-955.
[48] Widyowati R, Purwitasari N, Ekasari W, Agil M, Sahu RK, et al. An ethnomedicinal study; joint pain therapy by traditional healers of Solo City. Trad Integr Med 2024;3:3-12.
[49] Cortés-Rojas DF, de Souza CRF, Oliveira WP. Clove (Syzygium aromaticum): a precious spice. Asian Pac J Trop Biomed 2014;4:90-96.
[50] Pramod K, Ansari SH, Ali J. Eugenol: a natural compound with versatile pharmacological actions. Nat Prod Commun 2010;5:1934578X1000501236.
[51] Frumuzachi O, Gavrilaș LI, Vodnar DC, Rohn S, Mocan A, et al. Systemic health effects of oleuropein and hydroxytyrosol supplementation: a systematic review of randomized controlled trials. Antioxidants 2024;13:1040.
[52] Bulotta S, Celano M, Lepore SM, Montalcini T, Pujia A, et al. Beneficial effects of the olive oil phenolic components oleuropein and hydroxytyrosol: focus on protection against cardiovascular and metabolic diseases. J Transl Med 2014;12:1-9.
[53] Zielińska M, Dereń K, Polak-Szczybyło E, Stępień AE. The role of bioactive compounds of Nigella sativa in rheumatoid arthritis therapy—current reports. Nutrients 2021;13:3369.
[54] Shaterzadeh-Yazdi H, Noorbakhsh M-F, Hayati F, Samarghandian S, Farkhondeh T, et al. Immunomodulatory and anti-inflammatory effects of thymoquinone. Cardiovasc Haematol Disord Drug Targets 2018;18:52-60.
[55] Oresanya IO, Orhan IE. Deciphering neuroprotective effect of Rosmarinus officinalis L. (syn. Salvia rosmarinus Spenn.) through preclinical and clinical studies. Curr Drug Targets 2024;25:330-352.
[56] Brindisi M, Bouzidi C, Frattaruolo L, Loizzo MR, Tundis R, et al. Chemical profile, antioxidant, anti-inflammatory, and anti-cancer effects of Italian Salvia rosmarinus Spenn. methanol leaves extracts. Antioxidants 2020;9:826.
[57] Patil K, Sanjay C, Doggalli N, Devi KR. A review of Calendula officinalis—magic in science. J Clin Diagn Res 2022;16:2.
[58] Olennikov DN, Kashchenko NI. Marigold metabolites: diversity and separation methods of Calendula genus phytochemicals from 1891 to 2022. Molecules 2022;27:8626.
[59] Ukiya M, Akihisa T, Yasukawa K, Tokuda H, Suzuki T, et al. Anti-inflammatory, anti-tumor-promoting, and cytotoxic activities of constituents of marigold (Calendula officinalis) flowers. J Nat Prod 2006;69:1692-1696.
[60] Noreen S, Tufail T, Ul Ain HB, Awuchi CG. Pharmacological, nutraceutical, and nutritional properties of flaxseed (Linum usitatissimum): an insight into its functionality and disease mitigation. Food Sci Nutr 2023;11:6820-6829.
[61] Shiekh RAE, Atwa AM, Elgindy AM, Mustafa AM, Magdy Senna M, et al. Therapeutic applications of eucalyptus essential oils. Inflammopharmacology 2025;33:163-182.
[62] Alsamri H, Athamneh K, Pintus G, Eid AH, Iratni R. Pharmacological and antioxidant activities of Rhus coriaria L. (Sumac). Antioxidants 2021;10:73.
[63] Kosar M, Bozan B, Temelli F, Baser K. Antioxidant activity and phenolic composition of sumac (Rhus coriaria L.) extracts. Food Chem 2007;103:952-959.
[64] Akhtar MF, Raza SA, Saleem A, Hamid I, Ashraf Baig MMF, et al. Appraisal of anti-arthritic and anti-inflammatory potential of folkloric medicinal plant Peganum harmala. Endocr Metab Immune Disord Drug Targets 2022;22:49-63.
[65] Moloudizargari M, Mikaili P, Aghajanshakeri S, Asghari MH, Shayegh J. Pharmacological and therapeutic effects of Peganum harmala and its main alkaloids. Pharmacogn Rev 2013;7:199-212.
[66] El Khomsi M, Hmamou A, El Oubbadi R, El Houda Tahiri N, Kara M, et al. HPLC analysis and anti-inflammatory, antinociceptive, healing and antidepressant properties of Anchusa italica Retz extracts. Phytomed Plus 2024;4:100518.
[67] Farsam H, Amanlou M, Dehpour AR, Jahaniani F. Anti-inflammatory and analgesic activity of Biebersteinia multifida DC. root extract. J Ethnopharmacol 2000;71:443-447.
[68] Caliskan H, Argon M, Sabudak T. The genus Isatis L.: a review on its flavonoid and phenolic compound profile. Rec Agric Food Chem 2023;2:75-83.
[69] Serafini M, Peluso I, Raguzzini A. Flavonoids as anti-inflammatory agents. Proc Nutr Soc 2010;69:273-278.
[70] Yang LY, Li X, Huang W, Rao X, Lai Y. Pharmacological properties of indirubin and its derivatives. Biomed Pharmacother 2022;151:113112.
[71] Alviri M, Bahadori MB, Bahadori S. Flavonoid and diterpenoid components from Teucrium orientale subsp. orientale and their radical scavenging activity. Biointerface Res Appl Chem 2022;12:682-689.
[72] Jarić S, Mitrović M, Pavlović P. Ethnobotanical features of Teucrium species. Teucrium Species: Biology and Applications. 2020;111-142.
[73] Saati S, Dehghan P, Azizi-Soleiman F, Mobasseri M. The effect of bitter almond (Amygdalus communis L. var. Amara) gum as a functional food on metabolic profile, inflammatory markers, and mental health in type 2 diabetes women: a blinded randomized controlled trial protocol. Trials 2023;24:35.
[74] Browicz K, Zohary D. The genus Amygdalus L. (Rosaceae): species relationships, distribution and evolution under domestication. Genet Resour Crop Evol 1996;43:229-247.
[75] Kaur M, Kalia A. Convolvulus arvensis: a useful weed. Int J Pharm Pharm Sci 2012;4:38-40.
[76] Pirbalouti AG, Amirkhosravi A, Bordbar F, Hamedi B. Diversity in the chemical composition of essential oils of Ziziphora tenuior as a potential source of pulegone. Chemija 2013;24:234-239.
[77] Šmejkal K, Malaník M, Zhaparkulova K, Sakipova Z, Ibragimova L, et al. Kazakh Ziziphora species as sources of bioactive substances. Molecules 2016;21:826.
[78] Ayromlou A, Masoudi S, Mirzaie A. Chemical composition, antioxidant, antibacterial, and anticancer activities of Scorzonera calyculata Boiss. and Centaurea irritans Wagen. J Rep Pharmaceutical Sci 2020;9:118-127.