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Ethnobotanical Study of Medicinal Plants Used by Local Population of Ilam City on Back Pain, West of Iran

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Abstract

The diverse geographical regions of Iran have tribes with different cultures and customs in the medicinal use of plants in the control, prevention and treatment of diseases, and on this basis, to collect valuable ethnobotanical information in the field of medicinal plants, more studies are needed among different tribes. It is so that in the event of the death of people with this knowledge, their historical and experimental knowledge will not be forgotten. In this ethnobotanical and systematic study in the city of Ilam (western Iran), an attempt has been made to identify and report the use of medicinal plants native to this region in the treatment of back pain. Traditional therapeutic information about medicinal plants effective on back pain is done by ethnobotanical questionnaire. The complete list of herbal druggists in Ilam city was obtained from the Food and Drugs deputy, and the interviewer collected the required information personally by visiting each and every herbal druggists in Ilam city. The questionnaire included personal information and the names of native plants, the organ used, the method of use, and the effect of traditional treatment for back pain. Data analysis shows that 16 medicinal plants from 15 plant families are used in the treatment of back pain in Ilam. Medicinal plants *Pistacia khinjuk*, *Amygdalus communis*, *Achillea biebersteinii*, *Amygdalus arabica*, *Pistacia atlantica*, *Thymbra spicata*, *Capsicum annuum*, *Biebersteinia multifida*, *Nigella sativa*, *Salvia rosmarinus*, *Hypericum helianthemoides*, *Calendula persica*, *Citrullus colocynthis*, *Zingiber officinale*, *Elaeagnus angustifolia*, *Nerium oleander*, *Myrtus communis* and *Ricinus communis* are medicinal plants that are used in Ilam city to treat back pain. Based on the obtained results, it was found that the medicinal plant *Achillea biebersteinii* with usage report index (UR) of 14, relative frequency of citation (RFC) of 0.73 and percentage of frequency of use (PFU) of 53.8% is the most used in the treatment of back pain. Asteraceae plant family is the most used plant family. Leaf with 37% was the most used organ and decoction with 35% was the most traditional way of use. The presence of rich plant flora and medicinal species in Ilam city provides a suitable field for pharmacological research for better use and production of medicines and herbal products against back pain.

Keywords: Herbal plants; Traditional medicine; Back pain; Ilam; Remedy

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Introduction

The human back, like other parts of the body, has a complex structure and includes various components such as bones, muscles, tendons, discs and ligaments. Damage to any of these parts leads to back pain [1]. Most people may experience back pain at some age, but some people are affected more and for a longer period of time. Back pain, which has disrupted people's daily lives, sometimes becomes very debilitating and severe [2]. Back pain is one of the most common types of spinal disorders and one of the problems that many people experience throughout their lives [3]. The most common causes of back pain include herniated disc, muscle cramps, sprains, improper sitting or standing positions, joint inflammation, vertebral fracture or intervertebral disc destruction, gall bladder inflammation, kidney stones, and pancreas inflammation [4,5]. Back pain is divided into two categories, acute and chronic, based on the cause of the pain and its duration. Acute back pain is short-term and usually lasts between a few days and a few weeks. The person does not need any special treatment or medication and will recover only by following the doctor's recommendations and taking necessary care in this field. Acute back pain often occurs for reasons such as falling from a height, back muscle spasms, stretching or cramping, excessive obesity, and women's pregnancy. If back pain continues for a long time, it becomes chronic back pain. In some cases, this type of back pain can be treated with medication and necessary care, but sometimes it requires more serious treatments such as surgery. Chronic back pain occurs due to reasons such as intervertebral discs herniation, tumors, neurological problems and remains with humans for a long time [6]. The treatment of back pain ranges from cold water compresses, massage, rest, physiotherapy, laser therapy, acupuncture and exercise to surgeries such as discectomy, laminectomy, and also the use of anti-inflammatory drugs because of the complication in the inflammatory phase and pressure on the nerves. The most popular medicines in back pain include diclofenac, naproxen, corticosteroids, gabapentin, and pregabalin.

The long-term use of conventional drugs is not recommended due to reported drug side effects [7]. In addition to pain-relieving drugs, there are herbs and teas that can relieve back pain [8].

Since the beginning of human existence, plants have played an important role in providing their lives, and the history of the use of plants by humans is even older than the written history of humans. The approximate time of the use of medicinal plants by humans in Iran reaches 6,000 years [9-11].

Information related to the use of medicinal plants has been passed down from one generation to another over many years and has created a new branch of science called ethnobotany or herbal ethnography [12]. Ethnobotany is a part of indigenous knowledge that deals with the role of plants in the lives of the inhabitants of a region and is the restoration of unwritten traditions that are in danger of being destroyed [13,14]. This science is based on the collection of valid data on the medicinal uses of plants in different cultures, which can be the basis for the discovery of new drugs [15,16].

Since ancient times, mankind has realized the power of healing with medicinal plants, and many studies have been conducted in this regard. Today, pharmaceutical companies use different types of plants to produce medicinal supplements. There are various herbal treatments for back pain, which include the use of herbs in the form of decoctions, tablets or capsules, ointments, or oils. Herbal medicine offers alternatives to drugs for pain management. In traditional Persian medicine, medicinal plants such as red pepper, cardamom, valerian, angelica, citron, willow, chamomile, ginger and turmeric are used to treat back pain [14-16].

Ilam province is located on the western slope of the Zagros Mountain range. A land with varied weather and natural and historical attractions, which is known as the bride of Zagros. According to historical documents, this province was part of the ancient civilization of Elam. Historical monuments and ancient inscriptions in the city are a sign of the antiquity of Ilam. Ilam Province consists of ten cities of Ilam, Dehloran, Abdanan, Ivan, Badreh, Darehshahr, Cherdavol, Malekshahi, Mehran and Sirvan. The city of Ilam is forested and mountainous, and the flora of this province has more than 400 types of medicinal plants. The aim of the current research is descriptive-analytical and ethnobotanical investigation of medicinal plants of Ilam city that are used to treat back pain.

Materials and Methods

Study area

The current study is a cross-sectional ethnobotanical study between April 1402 and November 1402 in Ilam city. Ilam city is the most populated and one of the cities of Ilam province in Iran. Based on the census in 2015, the population of Ilam city was equal to 222,770 people. The main language of the people of this region is Kurdish. Ilam city is bordered by Sirvan city from the north, Chovar city from the northwest, Mehran city from the southwest, Malekshahi city from the south, and Badreh city from the east. This city borders with the provinces of Kermanshah, Lorestan and Khuzestan. Ilam borders with Iraq.

Selection of villages and informants

Collection of traditional therapeutic information about plants effective on back pain was done by ethnobotanical questionnaire. The interviewer personally con-

Figure 1. Map of Ilam city

ducted an interview by referring to each and every herbal druggist in Ilam city. The complete list of herbal druggists in Ilam city was provided by the Food and Drugs deputy of Ilam. The questionnaire include personal information and the names of native plants, the organ used, method of use, and the effect of traditional treatment.

Plant authentication

First, herbarium specimens were taken for the medicinal plants introduced in the questionnaires. Then they were collected based on traditional information. Authentication of plant species was done at the Biotechnology and Medicinal Plants Research Center, Ilam University of Medical Sciences, Iran. Confirmed names of plants were corrected using an online database. The certificate samples were identified and confirmed by two authors (M.B. and N.A.) according to the morphological keys of plant flora of Dr. Valiallah Mozaffarian.

Data processing and statistical analysis

Quantitative methods used in ethnobotanical studies allow researchers to use these formulas to select the most important species of medicinal plants for starting medicinal research during clinical studies.

Usage report index (UR)

In order to analyze the data obtained from the interviews and in line with the objectives of this study, indicators such as the usage report index (UR), the quantitative index of the relative frequency of citation (RFC) and the percentage of frequency of use (PFU) were reported. The UR is the total number of usage reports for any item reported by informants.

Relative Frequency of Citation (RFC)

The quantitative index of RFC was calculated for the relative importance of species for local medicines of the region. The RFC index is obtained by the following formula:

$$RFC = FC/ N$$

The RFC index indicates the number of people who indicated the use of a particular species. In relation to the mentioned FC, the number of informants and interviewees who mentioned a specific species and N is equal to the total number of people who were interviewed. The RFC index varies from zero (when no local knowledgeable person has stated the application for the plant in question) to one (when all local knowledgeable persons have stated the medicinal use for the plant in question).

Ethical considerations

The present study has been approved by Ilam University of Medical Sciences under the ethics code number IR.MEDILAM.REC.1401.069, which deemed that these anonymous surveys, conducted with a questionnaire that does not contain the respondent's identity, did not affect the traditional healers. Approvals were also obtained from the respective department heads of each healthcare structure after reviewing the questionnaire and being informed about the study's objectives. Written consent from interviewees participating in the study were obtained and their personal information was kept confidential.

Results

Demographic characteristics including gender, education levels, age group, age and language are recorded in table 1. After analyzing the data obtained from the questionnaires, the botanical information of medicinal plants effective on back pain in Ilam is specified in table 2. The abundance of plant families, the percentage of organs used and the traditional way of use are given in graph 2-4. Based on the obtained results, it is clear that the Asteraceae family is the most used plant family (Figure 2). Leaf with 37% was the most used organ (Figure 3) and boiled forms with 35% was the most traditional method of use (Figure 4).

Table 1. Demographic profile of the local healers (n = 25)

Characteristics		Abundance	Relative abundance
Gender	Male	13	52%
	Female	12	48%
Education	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%
Age	The youngest		26
	The oldest		55
Language	Kurdish	15	60%
	Luri	5	20%
	Persian	5	20%

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

Persian Name	Scientific name	Plant family	Common name	Organ used	Herbarium code	Traditional method of using	Main compound	Chemical formula
Boumadaran	*Achillea biebersteinii* Afan.	Asteraceae	Common Yarrow	Aerial organs	135	Boiled	1,8-cineole	$C_{10}H_{18}O$
Badam kouhi	*Amygdalus Arabica* Olivier	Rosaceae	Wild almond	Fruit	558	Oil, fresh fruit	Palmitic acid	$C_{16}H_{32}O_2$
Pesteh kouhi	*Amygdalus communis* L. *Pistacia atlantica* Desf. *Pistacia khinjuk* stocks.	Anacardiaceae	Mt. Atlas mastic tree	Fruit	20	Oil, fresh fruit	terpinen-4-ol	$C_{10}H_{18}O$
Avishanak	*Thymbra spicata* L.	Lamiaceae	Mediterranean thyme	Aerial organs	347	Boiled and brewed	Carvacrol	$C_{10}H_{14}O$
Felfele ghermez	*Capsicum annuum* L.	Solanaceae	Red pepper	Fruit	43	Poultice	Capsanthin	$C_{40}H_{56}O_3$
Adamak	*Biebersteinia multifida DC.*	Geraniaceae	Duizendblad	Aerial organs	273	Boiled and brewed	*α-pinene*	$C_{10}H_{16}$
Siah daneh	*Nigella sativa* L.	Ranunculaceae	Black caraway	Seed	545	Oil and decoction	*n-nonane*	C_9H_{20}
Rozmari	*Salvia rosmarinus Spenn.*	Rosemary	Rosemary	Leaves	214	Boiled and brewed	1,8-cineole	$C_{10}H_{18}O$
Gole raei zagrosi	*Hypericum helianthemoides* (Spach) Boiss.	Hypericaceae	St. John's wort	Flowers and Leaf	326	Boiled	*α-pinene*	$C_{10}H_{16}$
Hamishe bahar	*Calendula persica* **C.A.Mey.**	Asteraceae	Pot marigold	Aerial organs	118	Brewed	*Glycosides isoquercitrin*	$C_{21}H_{20}O_{12}$
Hendavaneh abojahl	*Citrullus colocynthis* (L.) Schrad.	Cucurbitaceae	Colocynth	Fruit	236	Infusion and poultice	*2-O-D-glucopyranosyl--cucurbitacin L*	$C_{36}H_{52}O_{12}$
Zangabil	*Zingiber officinale* Roscoe	Zingiberaceae	Ginger	Root	168	Boiled	Zingiberene	$C_{15}H_{24}$
Senjed	*Elaeagnus angustifolia* L.	Elaeagnaceae	Russian olive	Fruit	259	Brewed	Ethyl cinnamate	$C_{11}H_{12}O_2$
Kharzahreh	*Nerium oleander* L.	Apocynaceae	Oleander	Flowers and Leaf	22	Poultice	Calarene	$C_{15}H_{24}$
Mourd	*Myrtus communis* L.	Myrtaceae	Common myrtle	Fruit and Leaf	424	Boiled	1,8-cineole	$C_{10}H_{18}O$
Karchak	*Ricinus communis* L.	Euphorbiaceae	Castor bean	Fruit	268	Poultice	*12-C hydroxyoleic acid*	$C_{18}H_{34}O_3$

Quantitative methods in current ethnobotanical study determine which are the most important medicinal plant species to initiate medicinal research. In table 3, PFU, UR, and RFC of the mentioned plants are calculated (Table 3).

Based on the results of table 3, it was found that *Achillea biebersteinii* medicinal plant with UR of 14, RFC of 0.73 and PFU of 53.8% is the most used in the treatment of back pain. Data analysis shows that 16 medicinal plants from 15 plant families are used in the treatment of back pain in Ilam. Additional information about plant families effective on back pain can be found in figure 2.

Table 3. FUV, RFC, FL of studied plants

The name of the plant	PFU	UR	RFC
Achillea biebersteinii Afan.	53.8 %	0.73	14
Amygdalus Arabica Olivier	46.1 %	0.69	12
Amygdalus communis L.			
Pistacia atlantica Desf.	30.7 %	0.61	8
Pistacia khinjuk stocks.			
Thymbra spicata L.	26.9 %	0.59	7
Capsicum annuum L.	15.3 %	0.54	4
Biebersteinia multifida DC.	19.2 %	0.55	5
Nigella sativa L.	57.6 %	0.77	15
Salvia rosmarinus Spenn.	46.1 %	0.69	12
Hypericum helianthemoides (Spach) Boiss.	42.3 %	0.65	11
Calendula persica C.A.Mey.	23 %	0.58	6
Citrullus colocynthis (L.) Schrad.	34.6 %	0.62	9
Zingiber officinale Roscoe	38.4 %	0.63	10
Elaeagnus angustifolia L.	15.3 %	0.54	4
Nerium oleander L.	34.6 %	0.62	9
Myrtus communis L.	34.6 %	0.62	9
Ricinus communis L.	23 %	0.58	6

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

Some species are used so much that every interviewee mentions them. Our results showed that medicinal species such as *Achillea biebersteinii*, *Amygdalus arabica*, *Amygdalus communis*, *Nigella sativa*, *Hypericum helianthemoides* and *Zingiber officinale* are the most used.

Discussion

In the last decade, the interest towards different types of complementary medicine and herbal therapy among patients and healthcare professionals is increasing all over the world. Medicinal plants are a rich source of bioactive substances that are used to treat various diseases, especially in the treatment of pain [17]. One of the notable aspects of medicinal plants is indigenous knowledge. This knowledge is very broad and includes different aspects including ethnobotany of medicinal plants. Ethnobotany means the knowledge that humans have of botany and plant ecology. Identifying and introducing the local reserves of plants of each region, the forms and traditional uses of these plants, considering the ecological diversity of Iran, can provide useful information in medicine and health [18]. The results of this study showed that herbal medicines are mainly used to treat back pain in local communities and indicate the rich plant diversity of this region. The results of Delfan et al.'s study (2014) showed that medicinal plants such as *Echeveria elegans*, *Alhagi persarum*, *Allium haemanthoides*, *Althaea officinalis*, *Anchusa italica*, *Artemisia annua*, *Cichorium intybus*, *Daphne mucronata*, *Falcaria vulgaris*, *Ferula angulata*, *Matricaria recutita*, *Paliurus spina*, *Papaver rhoeasa*, *Viola tricolor* and *Ziziphus jujuba* are used to treat headache and migraine [19]. The results of Delfan et al.'s study (2015) showed that 17 plant species from 12 plant families are used to treat kidney pain in Lorestan province. These plants include *Anchusa italica, Artemisia annua, Cichorium intybus, Daphne mucronata, Falcaria vulgaris, Ferula angulata,* and *Matricaria recutita* [20]. In another study in Lorestan, Delfan et al. (2014) identified medicinal plants effective on toothache in Lorestan region. In this study, they reported that 14 species of medicinal

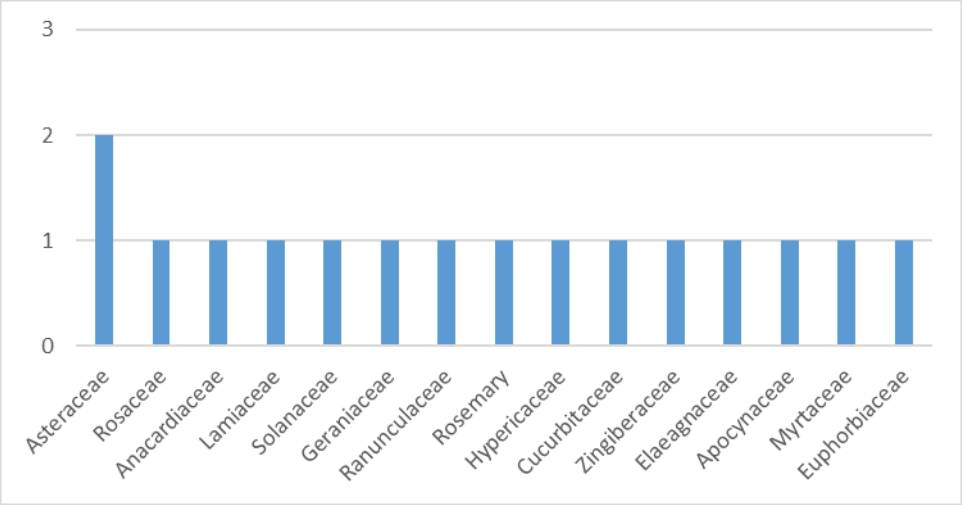

Figure 2. Distribution of plant families affecting back pain in Ilam

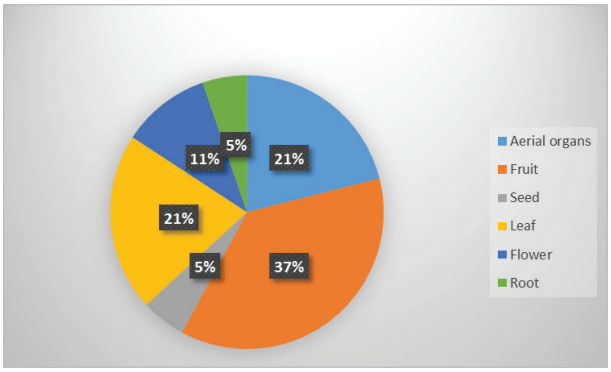

Figure 3. Percentage of use of plant organs effective on back pain in Ilam

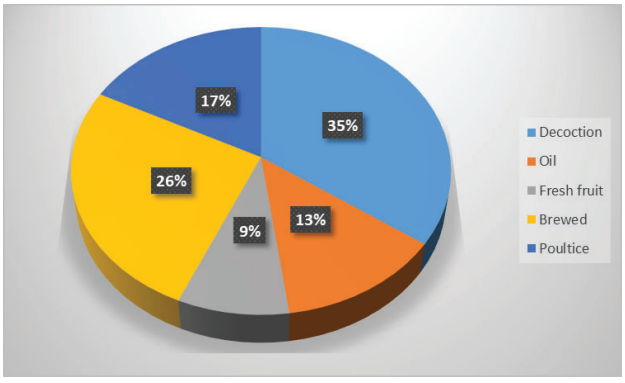

Figure 4. The percentage of the method of use of plant parts effective on back pain in Ilam

plants are used for toothache in Lorestan [20]. The results of the study by Delfan et al. in 2015 investigated the effect of medicinal plants on stomach pain, and the research showed that plants such as *Anchusa italica*, *Heracleum persicum*, *Phleum pratense*, *Quercus brantii*, *Satureja khozistanica*, *Teucrium polium*, *Thymus daenensis*, *Tragapogon caricifolius*, *Viola tricolor* and *Ziziphus spina-christi* are used in cases of stomach pain in Lorestan [21]. Various studies conducted elsewhere have shown that some of the reported medicinal plants have essential compounds that can be used to treat pain [22].

In traditional medicine, yarrow is used to heal wounds, stress, anxiety, insomnia, joint pain, epilepsy, insanity, digestive problems, skin and kidney diseases, menstruation and uterine infection. The chemical compounds of this plant include sabinyl acetate, sabinol, linalool and cineole. Many antioxidants such as flavonoids, rutin, tannin, coumarin, saponin, cineol, lactone, and eugenol are found in yarrow plant [23]. Mountain almonds, containing amygdalin, are used to treat headaches, digestive worms, diarrhea, cough, anti-infection, anti-inflammatory, dandruff and wound healing [24]. In traditional medicine, pistachios are used to treat back pain, infection, diarrhea, premature ejaculation, loss of appetite, mouth ulcers, lowering blood lipids, diabetes and high blood pressure. This plant contains oleic acid, linoleic acid, α-linolenic acid, and palmitic acid [25]. Thyme is used to treat abdominal pain, relieve menstrual pain, increase urination, treat cough and flu, rheumatism, conjunctival pain, prevent miscarriage, treat lung congestion, and cure anemia. The main compounds of thyme species are thymol and carvacrol [26]. Red pepper is used to treat Alzheimer's, weight loss, anemia and intestinal inflammation. Red pepper has analgesic effects. This plant contains tocopherol and phenolic compounds [27]. In traditional medicine, black seed is used as a diuretic, appetite suppressant, diaphoretic, liver and digestive booster, abdominal obesity, strengthening memory, lowering blood pressure, improving joint pain, headaches, improving heart health and controlling diabetes. Black seed is rich in polyphenols and tocopherols and its oil contains linoleic acid, oleic acid, palmitic acid and stearic acid. Thymoquinone,

thymohydroquinone and thymol are the most important components abundantly found in black seed [28]. Rosemary is effective in reducing hair and eyebrow loss, anti-inflammatory, strengthening memory, muscle pain, joint pain and treating migraine headaches. Rosemary contains rosmarinic acid, camphor, caffeic acid, ursolic acid, betulinic acid, carnosic acid, carnosol and camphor [29]. Calendula has exhibited the therapeutic properties such as anti-inflammatory, anticancer, antidepressant, rapid weight loss, and useful in the treatment of sore throat, migraines, anemia, heartburn and gastritis, digestive system ulcers, liver and kidney colic, and meningitis. It is used to treat tetanus, stomach and intestinal worms, strengthen the immune system and heart health. Flavonoids such as flavone glycosides and phloroglucinols and naphthodiantrons such as hypericin, pseudohypericin are identified in this plant [30]. Abu Jahl watermelon is used as antidiabetic, anti-nephrolithiasis, anti-gout, treatment of amenorrhea, headache, temple pain, anti-epileptic, and treatment of itching. Colocyntin, cucurbitacin, saponins, alkaloids, glycosides, and resinous substances are among the components of Abu Jahl watermelon [31]. Ginger poses therapeutic effects such as strengthening the heart, stomach, memory and bladder, reducing pain and joint diseases, back pain and modulating menstruation. Compounds such as α-zingiberene, β-sesquiphellandrene, α-curcumene and trans-γ-cadinene have been identified in ginger [32]. In traditional Persian medicine, the combination of Russian olive and black seed powder is used to treat tooth and gum diseases, diarrhea, stomach ulcers, severe coughs, hiccups, flatulence, colds, viral diseases, fatigue, preventing the complications of intestinal ulcers, improving arthritis and reducing the risk of cancer. Flavonoid compounds, polysaccharides, sitosterols, cardiac glycosides, terpenoids, coumarins, phenol carboxylic acids, amino acids, saponins, carotenoids, vitamins and tannins are present in Russian olive fruit [33]. Oleander plant is an expectorant, diuretic and heart tonic and is also used for shortness of breath. Oleander is used as a poultice for back pain and rheumatism. The chemical composition of this plant includes cardiac glycosides of the cardenolide type, especially oleandrin [34]. Myrtle is used in traditional medicine as a diuretic, cough reliever, antidiarrheal, astringent, stomach and visceral tonic, anti-ulcer, treatment of hemorrhoids, and treatment of tongue and gum ulcers. It is rich in compounds such as various antioxidants, flavonoid compounds such as myristin, quercetin, catechin acid, cineol, myrtenol, pinene, geraniol, linalool, camphene, acyl phloroglucinols, tannin, oleic, linoleic and palmitic fatty acids, various sugars and malic acid [35]. Castor is used to treat constipation and arthritis, strengthen and grow hair, treat acne, moisturize the skin, deep cleanse the face, improve immune function, eliminate wrinkles, reduce swelling and inflammation [36].

The results of a study showed that the *A. bieberstеinii* plant has analgesic and anxiolytic properties in the BALB/c model through interaction with GABAergic systems [37]. The results of a study in a human model showed that the ointment of *Amygdalus communis* var. Amara reduces pain caused by knee osteoarthritis, oleic acid may be responsible for the effects of this plant [38]. A study showed that the aqueous extract of *Pistacia atlantica* showed a high analgesic effect in the contraction test and in the tail immersion test, and anti-inflammatory property in carrageenan-induced paw edema [39]. The results of a study in a mouse model showed that fresh fruit extracts of all four types of bell peppers (200 mg/kg and 400 mg/kg) have anti-inflammatory and pain suppressing activities, which are probably mediated through prostaglandin synthesis [40]. The aqueous extract of *N. sativa* has an anti-inflammatory effect, which is shown by its inhibitory effects on carrageenan-induced paw edema. It also produced a significant increase in hot plate reaction time in mice, indicating an analgesic effect [41]. Studies indicate the effect of ethanolic extract of *Salvia rosmarinus* on pain caused by hot plate test. The results suggested *S. rosmarinus* as an alternative natural compound that has analgesic effects for use in the pharmaceutical industry [42]. The results of a study in male adult Wistar rats confirmed that *Citrullus colocynthis* Schrad. It is a potentially useful drug suitable for further evaluation for rheumatoid arthritis, and its folk medicinal use is valid as an analgesic and anti-inflammatory agent [43]. The anti-inflammatory, analgesic effects of *Zingiber officinale* have been proven in knee osteoarthritis [44]. In the hot plate test, aqueous and ethanolic extracts of *Myrtus communis* L. showed significant analgesic activity, which was inhibited by naloxone. The extracts also showed analgesic activity against acetic acid-induced wrinkling and also showed significant activity against acute inflammation which was dependent on the dose of aqueous extract. Aqueous and ethanolic extracts of aerial parts of *M. communis* showed analgesic effects and this may be mediated by opioid receptors [45]. *R. communis* shows potent anti-inflammatory and analgesic activity possibly by NF-kB, Nrf2, RAF/ERK, Fas receptor, and caspase-mediate apoptosis and Wnt signalling pathways [46]. Clinical studies in animal or human models prove the different analgesic and anti-inflammatory effects of the plants of this study, which are used in the traditional medicine of the region for back pain. Medicinal plants are rich in effective medicinal and active compounds [47-50] such as antioxidants, phenols, polyphenols, flavonoids, and tannins with analgesic

and anti-inflammatory effects [51-57].

Conclusion

This study showed that Ilam is a region with rich plant flora and this situation can provide a suitable ground for better use of medicinal plants of this city to produce promising herbal products for back pain. The results of the research show the richness of herbal medicine culture and ethnobotanical knowledge of Ilam city and the existence of a huge potential to supply raw materials of herbal medicines in this region. It seems necessary to manage, preserve and publish this knowledge, and perform phytochemical and pharmacological tests of species with high use value in order to produce effective natural medicines. Considering the knowledge and experience of the local people regarding the plants of the surrounding environment, further research regarding the collection of the ethnobotanical knowledge and preclinical/clinical evaluation and industrialization of this knowledge is essential.

Conflict of Interests

The authors declare no competing interest.

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