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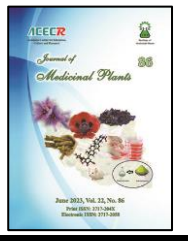

Research Article

Ethnobotanical study of medicinal plants, Fasa County, Iran

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ABSTRACT

Background: Traditional herbal medicine has a long history in the Persian communities of Fars province, especially in Fasa County. Despite the longstanding history and robust culture of traditional medicine in this region, there is no comprehensive study on the ethnobotanical knowledge of this unique region with residents historically dependent on medicinal plants. **Objective:** Hence, the main objective of this study was to identify and record medicine plants and traditional herbal knowledge of the ethnic communities of Fasa County in the Fars province of Iran. **Methods:** Ethnopharmacological data were collected using semi-structured questionnaires, guided walks, and group interviews during a period of two years (2021-2022). 45 local informants were selected and interviewed for data collection. We calculated quantitative factors including informant consensus factors (ICF), and use reports (UR) for each species. Medicinal plant species were identified through standard taxonomic methods by botanists. **Results:** The local communities have documented 62 medicinal plants across 58 genera from 27 families, which are used to treat 12 different categories of ailments. The most common preparation method was infusion, followed by decoction and poultice. Dermatological (ICF = 0.93), neurological (0.92), and digestive (ICF = 0.91) diseases were documented as the most common ailment categories in this area. **Conclusion:** The study results indicated that the traditional herbal knowledge of Fasa County is still rich and it revealed an obvious relationship between the ancient medicinal culture of this region and Iranian Traditional Medicine. Therefore, evaluation of the pharmacological activity of highly utilized medicinal plants could result in new herbal drugs.

1. Introduction

Iran has a long history of traditional medicine and the use of medicinal plants in the treatment of diseases. The first writings about medicinal plants in Iran go back to the Sumerian era (5000 years ago) [1]. Also, the richness of the plant

Abbreviations: ITM, Iranian Traditional Medicine; ICF, Informant Consensus Factors; UR, Use Reports; RFC, Relative Frequency of Citation; FC, Frequency of Citation

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flora of Iran and the great knowledge of Iranians in the use of medicinal plants, and the existence of reliable scientific sources such as Ibn Sina's Canon book (al-Qānūn Fī'l-ṭibb) and other famous scholars such as Abu Rayhan al-Biruni and Razi, who practiced medicine with the popularized medicinal plants among the people of Iran and the interest of Iranians in medicinal plants highlighted the need to pay attention to the Iranian traditional herbal medicine [2]. It is vital to investigate the native knowledge of medicinal plants in various regions of Iran [3]. Around 8000 plant species have been recorded in Iran, 2300 of them identified as medicinal plants, and in the Canon of Medicine (scientist of Iranian traditional medicine), Ibn Sina listed 800 herbal medicines [4]. In this regard, Fars province, which is called the paradise of Iranian medicinal plants, is one of the regions of Iran culturally known as a unique region. It has been the residence of one of the Aryan clans named Pars since the eleventh century BC, and it has been called Pars for this reason. This province was the capital of one of the largest governments in history, the Achaemenids (550-330 BC). Darius I, the emperor of the Achaemenid dynasty, was so interested in medicine that he re-established the school of medicine in Sais, Egypt, which previously had been destroyed, restoring its books and equipment [5]. In Persepolis (the Achaemenid capital), there is a design on a stone that shows a man with a jar of oil in his hand (Fig. 1). The figure depicts the historical use of oils for cosmetic purposes, which were widely utilized in ancient Persia as pacifying agents after bathing [6, 7].

Following the rise of Islam, prominent cultural figures such as Hafez and Saadi lived in this region, and medicinal plants were frequently mentioned in their literary works. For instance, Saadi's writings contain numerous stories about doctors, ophthalmologists, patients, pain, and treatment, highlighting the significance of medicinal plants in traditional Persian medicine [8]. The Fars province encompasses a range of climate zones, including dry and semi-tropical climates, Iran, and Turan (steppe, semi-steppe, dry forests, and high mountains) areas [9]. As a result of these diverse ecological conditions, the region boasts a rich abundance of medicinal plant species, making it one of the most important sources of herbal medicines in Iran [10]. Multivariate statistical bio-climatic classification methods have classified the Fasa region as belonging to a semi-arid, very warm, and dusty Bio-Climatic zone [11].

Fig. 1. Design on stone that shows a man with a jar of oil in his hand in Achaemenid

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Although there has been some identification of medicinal plants in Fars province, it is not sufficient due to the ecological diversity and unique cultural practices of this region. These factors have given rise to a multitude of medicinal plants and traditional herbal knowledge that are original and valuable to this area. Accordingly, Fars province with the 48 tons export of medicinal plants in 2015 ranked as the first exporter in this field in Iran [12]. Out of the approximately 2,300 listed medicinal plant species in Iran [13], 483 species identified and recorded in Fars province that is 21 % of Iran's medicinal plants, which is a very high figure, while this province occupies only 5.7 % of the country's area. Additionally, a significant number of them belong to Fasa County [10].

Fasa is an important region within the Fars province, with a long history that dates back to prehistoric times. While it has lost some of its significance over the years, Fasa remains a prosperous city known for its agricultural output, particularly in wheat production, where it ranks first in Iran and is often referred to as the "city of wheat". According to historical reports, Fasa was considered one of the capitals of the Bakun period, which spanned from 4800 B.C. to 4000/3900 B.C. [14].

The history of this city can be traced back to the Achaemenid period, when it was known as "Pase" or "Pasa" and served as one of the oldest cities in the Pars region. In fact, this city is estimated to be more than seven thousand years old. Based on the discoveries made in the ancient tomb of Tel Dahhak and other historical reports, the age of this city is estimated to be more than seven thousand five hundred years This region is home of diverse cultures and beliefs which could result in different traditional medicine knowledge.

Two Persian reports have reported Fasa medicinal plants [15] that mostly belong to the families of Fabaceae, Asteraceae, and Lamiaceae [16], but evidence suggests that these studies need to be completed and updated, especially in term of quantitative analysis. In addition, it is necessary to look for the relationship between the ancient culture and the traditional uses of the medicinal plants of this region, which have been passed down from generation to generation. For example, Spinach and Sirmoki breads, which contain various types of vegetables and medicinal plants (as shown in Fig. 2), have been a part of the nutritional culture of this region since ancient times and are considered souvenirs of Fasa County. Furthermore, herbal healers in Fasa currently prescribe herbal remedies based on the recommendations of renowned Iranian traditional medicine (ITM) scientists like Avicenna, Aghili Alavi Shirazi, and Rhazes. This is especially true in the case of epidemiological illnesses such as influenza and colds.

Therefore, this research aims to investigate more precisely the traditional medicinal information of this ancient and historical region and explore whether the past and ancient culture of this region is related to their traditional herbal healing knowledge or not.

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Fig. 2. Sirmoki bread as old and well-known medicinal bread in Fasa County

2. Materials and Methods

2.1. Study area

Fasa County is located between 53° 19′ to 54° 15′ east longitude and 28° 31′ to 29° 24′ north latitude (Fig. 3). Its altitude is 1450 meters above sea level. Fasa is one of the cities of Fars province, and has an area of 4303.8 square kilometers. Fasa is located in the east of Fars province and 145 km southeast of Shiraz, and it includes four central districts, Shibkaveh, Sheshdeh - Qarah Bolagh and Now Bandegan. Sahraroud, Jangal, Fadeshkoyeh and Zanganeh are the districts of Fasa city.

Fasa County includes the cities of Fasa, Zahedshahr, Sheshdeh, Qarah Bolagh, and Mianshahr. According to the census of the Statistics Organization in 2015, the population of this city was more than 205 thousand people. According to the census of the Statistics Organization in 2015, the population of Fasa city was more than 205 thousand people. There is no accurate statistics of the ethnic population of Fasa city, but in general, four linguistic ethnicities, Arab, Turk, Fars, and Lor, live in Fasa city, and most of the urban populations are Arabs and Persians, and Turks live mostly in the villages, especially, in Sheshdeh -Qarah Bolagh. The average yearly rainfall is about 285.55 mm and the average temperature is 19.43 ºC. Fasa belongs to the Irano- Turanian region. Species such as *Pistacia atlantica* Desf., *Pistacia khinjuk*, *Onopordum heteracanthum*, *Artemisia sieberi* Besser., *Amygdalus scoparia*, *Astragalus fasciculifolius*, *Polygonum corrigioloides*, *Convolvolus spinosus*, *Hammada salicornica* and *Fagonia* sp. are the most important predominant vegetation species in this region (Fig. 4).

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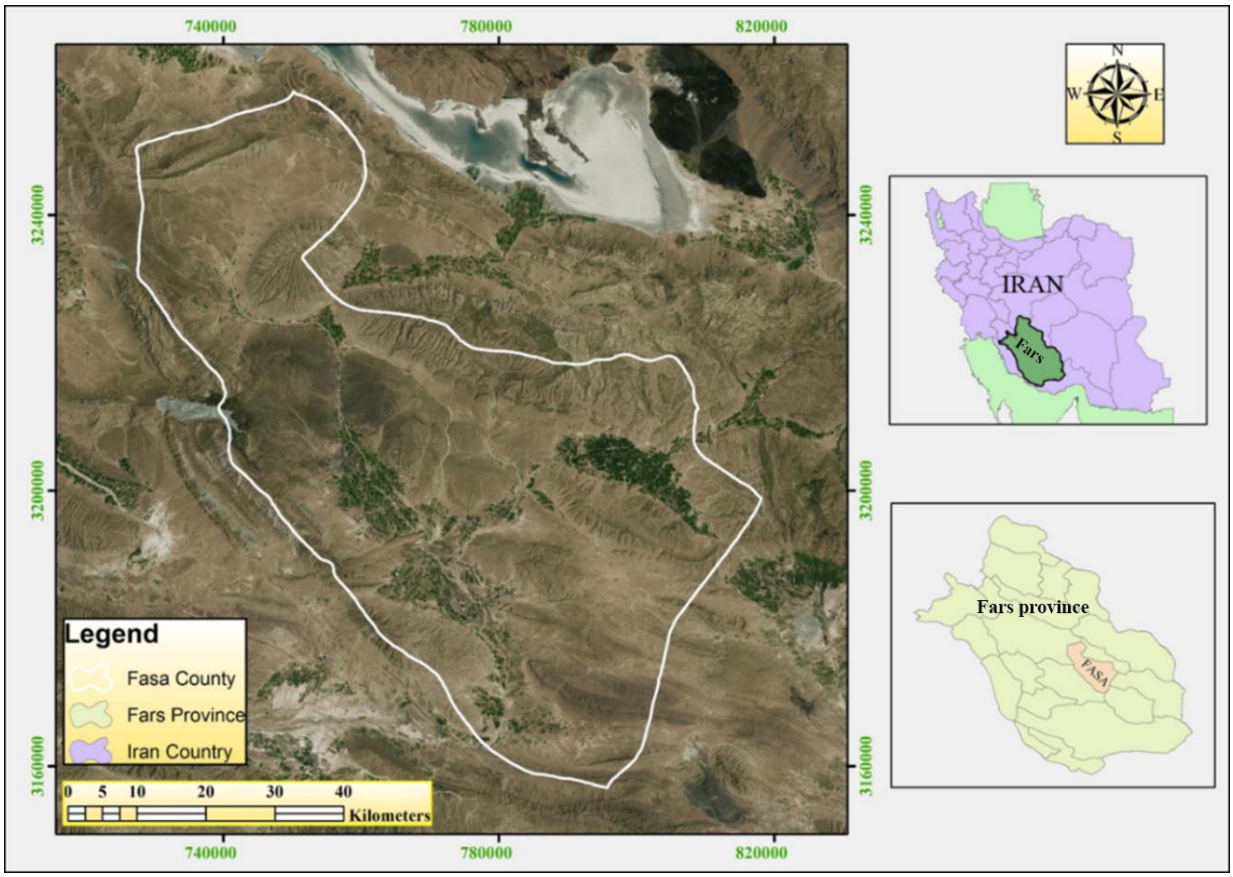

Fig. 3. Study area Fasa County in Fars province, Iran

Fig. 4. Ecosystems and plant species of Fasa County

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2.2. Socio-demographic information

The study involved interviewing 45 local informants, including herbal healers, farmers (both educated and non-educated), and nomadic herders aged between 25 to 82 years old. Socio-demographic details such as gender, educational level, occupation, and age group were recorded (Table 1).

2.3. Data collection, visited villages, and the sampling

The field surveys were carried out in almost all parts of this region from March 2021 to September 2022 under the supervision of the local informants with regards to the climate of the region, growing season, habitats of plants using GPS, and topographic maps focusing on collecting ethnopharmacological information from local people, especially elderly people, farmers, herbalists, and medicinal herb vendors in different parts of the region. The Fasa County is home to four distinct ethnic communities, with Arabic speakers residing primarily in the southern parts, Turks located outside of the city center, and Persians inhabiting the northern and eastern parts of the region. In addition, a small population of the Lor tribe resides in this area. Demographically, the population of this region is approximately 40 % Persian, 30 % Arabic-speaking, and 30 % Turkish-speaking from an ecological point of view, most of the medicinal plants in the Persian settlement district are related to agricultural plants, and in the Turkish and Arab districts, belong to rangeland species, such as Ferula and almond. Also, geographical locations of the studied districts as well as the detailed demographic profile of the local informants are recorded in Table 2.

Semi-structured questionnaires and open-ended questions were utilized during the interviews, which took place at various locations such as homes and medicinal plant stores. In total, 45 questionnaires were completed by local inhabitants. The collected plants were dried and pressed into herbarium specimens, which were then deposited at the Herbarium of Fasa University for future reference and research. Information such as the scientific names, local names, part used, preparation methods, and medicinal effects of each plant were then recorded. To identify the plant specimens to the species level, identification keys in Flora Iranica [17], Flora of Turkey [18] and Flora of Iran [19] were utilized.

Table 1. Demographic profile of the local informants in the study area (n = 45).

Characteristics		Abundance	Relative abundance
Gender	Male	32	71.11
	Female	13	28.89
Education	Primary level	16	35.55
	Secondary level	22	48.89
	Graduate	7	15.56
Age group	25-40	9	20
	41-55	26	57.77
	56-82	10	22.23
Occupation	Nomadic tribe	13	28.88
	Farmer	17	37.78
	Herbal healer	15	33.34

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Table 2. Studied districts in the Fasa County with in-detail demographic profile of the locals

Area	Village-nomadic district	Altitude	Location		Number of informants	Gender	
			Latitude	Longitude		Male	Female
central districts	Sahraroud	1298	763353	3196948	3	2	1
central districts	Jangal	1835	652534	3355366	2	2	-
central districts	Dastjeh	1330	760689	3198963	3	2	1
central districts	Fasa	1389	757073	3205190	5	3	2
Shibkaveh	Mianshahr	1165	779838	3198963	3	2	1
Shibkaveh	Zahedshahr	1193	774222	3182629	4	2	2
Shibkaveh	Nasir Abad	1160	780280	3177339	5	3	2
Sheshdeh - Qarah Bolagh	Qarah Bolagh	1389	212596	3203645	4	3	1
Sheshdeh - Qarah Bolagh	Abas Abad	1769	632609	3235403	4	4	-
Sheshdeh - Qarah Bolagh	Sheshdeh	1384	792128	3205623	5	4	1
Now bandegan	Now bandegan	1271	775550	3195375	4	3	1
Now bandegan	Khorangan	1215	774699	3188768	3	2	1
Total					45	32	13

2.3. Data analysis

The data obtained from the interviews was analyzed using statistical indices, including the use report and informant consensus factors (ICF). The use report was calculated whenever a local informant cited a plant species or part(s) used for a particular illness. This index was used to identify the most commonly used plant species for a specific disease. ICF was calculated by the formula: ICF = (Nur - Nt)/ (Nur - 1). In this index, Nur is the abundance of use citation in each aliments category and Nt is the number of the plant used as medicine for the same category. ICF values ranged from 0 to 1 and employed to determine the homogeneity of the data [20]. In fact, ICF was calculated to evaluate the homogeneity of the obtained data [21].

The RFC (relative frequency of citation) index [22] was calculated using the formula RFC = FC/N, where FC represents the frequency of citation, i.e., the number of informants who mentioned a specific plant species as useful, and N represents the total number of informants surveyed. The RFC index ranges from 0 to 1, with 0 indicating that none of the informants referred to a plant species as useful, and 1 indicating that all the informants mentioned it as useful. This index was used to assess the level of usefulness of each plant species.

The cultural importance index (CI) (Tardío and Pardo-de-Santayana 2008) [22] was also calculated, and the following equation was used:

$$CI = \sum_{u=u_1}^{u_{nc}} . \sum_{i=i_1}^{i_n} UR_{\frac{ui}{N}}$$

One-way ANOVA and post hoc tests were used to compare the use reports between three ethnic communities including (Persians, Arab, and Turks).

2.4. Diseases categories

The International Classification of Primary Care (ICPC-2) was used to categorize all ailments [23]. 12 illness categories were set including (1) Musculoskeletal, (2) Gastrointestinal, (3) Respiratory, (4)

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Neurological, (5) Dermatological, (6) General and Unspecified, (7) Urological, (8) Endocrine/ Metabolic and Nutritional, (9) Female Genitals, (10) Cardiovascular, (11) Pregnancy, Childbearing, Family Planning, and (12) hematological and immune mechanism. However, some minor modifications were made in the classification of treated diseases. Accordingly, some therapeutic and non-therapeutic uses not recorded in the ICPC classification were included in General and Unspecified category.

3. Results

3.1. Medicinal plants diversity

62 medicinal plant species belonging to 27 plant families were recorded. Asteraceae, Fabaceae, and Lamiaceae with 8, 7, and 6 species were the most represented medicinally utilized plant families in this region (Table 3).

Table 3. Medicinal plants used by Locals in the Fasa County, Fars province

Family	Scientific name, Voucher no.	Local name	Use report	Medicinal Uses
Anacardiaceae	*Pistacia atlantica* Desf. FU285	Bane	31	Joint pain (2), Toothache (11), Stomach tonic (17)
	Pistacia khinjuk Stocks FU286	Kolkhong	15	Flatulence (8), Liver tonic (7)
Apiaceae	*Ferula assa-foetida* L. FU324	Angoze	52	Hot temperament (4), Antiseptic (12), Abortion (5), Anti-worm and anti-parasite (25), Reinforcing sexual desire (7)
	Stachys inflate Benth. FU347	Sarbanafshe	38	Relaxing (20), Nervous diseases (8), Diuretic (8), Abortion (2)
	Foeniculum vulgare Mill. FU330	Rajooneh	37	Flatulence (27), Galactagogue (3), Menstrual regulation (7)
Araceae	*Phoenix dactylifera* L. FU384	Khorma	49	Anemia (3), Tonic (15), Blood purifier (6), Cold temperament (10), Reinforcing sexual desire (15)
Asteraceae	*Achillea eriophora* DC. FU407	Gole sarzardoo	15	High blood pressure (1), Hyperlipidemia (2), Blister (8), Female diseases (2), Cramps (1)
	Anthemis tinctoria L. U415	Babooneh	45	Relaxing (18), Nervous tonic (12), Common cold (10), Stomach tonic (5)
	Artemisia sieberi Besser FU428	Dermeneh	32	Hyperlipidemia (10), Pyrosis (6), Flatulence and stomach ache (16)
	Cichorium intybus L. FU434	Kasni	16	Hot temperament (8), Febrifuge (5), Skin disorders (3)
	Echinops aucheri Boiss. FU439	Shekartigal	29	Gastrointestinal disorders (18), Pyrosis (3), Asthma (8)
	Onopordum heteracanthum C.A.Mey. FU442	Kharkolori	36	Cold temperament (10), Sore Throat (8), Liver tonic (18)
	Silybum marianum (L.) Gaertn. FU446	Martigal	21	Chronic liver diseases (16), High blood pressure (2), Galactagogue (4)
	Taraxacum officinale (L.) Weber ex F.H.Wigg. FU449	Gol gasedak	8	Stomach tonic (3), Laxative (5)
Boraginaceae	*Anchusa strigosa* Banks & Sol. FU468	Gavzabon	25	Heart and nervous tonic (18), Common cold (7)
	Solenanthus circinatus Ledeb. FU472	Azar choob	63	Joint pains (2), Bruise (39), Wounds and injuries (22)

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Table 3. Medicinal plants used by Locals in the Fasa County, Fars province (Continued)

Family	Scientific name, Voucher no.	Local name	Use report	Medicinal Uses
Brassicaceae	*Brassica rapa* L. FU475	Shalgam	17	Common cold (9), Cough (8)
	Capsella bursa-pastoris (L.) Medik. FU487	Kise keshis	6	Astringent and bleeding inhibition (6)
	Cardaria draba (L.) Desv. FU491	Sabze	8	Expectorant (5), Anemia (3)
	Descurainia sophia (L.) Webb ex Prantl FU499	Khakshi	33	Heatstroke (12), Constipation (10), Skin disorders (10)
Capparaceae	*Capparis spinosa* L. FU512	Galg	27	Anemia (22), Liver and spleen disorders (5)
Chenopodiaceae	*Bassia aegyptiac*a Turki, El Shayeb & F.Shehata FU527	Maryam goli	7	Flatulence (7)
	Spinacia oleracea L. FU538	Esfenaj	16	Constipation (11), Tonic (5)
Cucurbitaceae	*Citrullus colocynthis* (L.) Schrad. FU567	Hendevane Gorgi	25	Blood sugar (25)
Euphorbiaceae	*Ricinus communis* L. FU586	Kanaton	18	Constipation (8), Kidney stone (10)
Fabaceae	*Alhagi pseudalhagi* (M. Bieb.) Desv. ex B. Keller & Shap. FU604	Kharshotori	23	Kidney stone (20), Blood purifier (3)
	Astragalus fasciculifolius Boiss. FU609	Anzaroot	13	Anti-infective (8), Adhesive production (5)
	Faba vulgaris Moench FU614	Bagale	17	Tooth abscess (3), Blood sugar (6), Diuretic (8)
	Glycyrrhiza glabra L. FU628	Mak	57	Common cold and expectorant (23), Skin patch (7), Body bruises (12), Gastric ulcer (15)
	Medicago sativa L. FU638	Yonje	17	Fattening (2), Tonic (6), Wound healing (9)
	Trigonella foenum-graecum L. FU649	Shomliz	13	Blood sugar (8), Stomach tonic (5)
	Prosopis farcta (Banks & Sol.) J.F.Macbr. FU642	Jagjagak	18	Wound healing (19)
Lamiaceae	*Mentha longifolia* L. FU679	Padaneh	65	Flatulence (25), Anti-anxiety (3), Relaxing (12), Gastrointestinal disorders (25)
	Mentha piperita L. FU680	Nana	34	Stomach tonic (7), Gastrointestinal disorders (22), Relaxing (5)
	Salvia macrosiphon Boiss. FU684	Magas paran	37	Sore throat (3), Blood sugar (4), Insect (fly) repellent (15), anti-infective (15)
	Thymus vulgaris L. FU688	Abshan	85	Flatulence (20), Anti-infective (15), Cough (25), Relaxing (25)
	Teucrium polium L. FU687	Halpe	29	Appetizer (3), Stomach tonic (6), Blood sugar (20)
	Ziziphora tenuior L. FU693	Kakooti	30	Flatulence (10), Relaxing (20)

Table 3. Medicinal plants used by Locals in the Fasa County, Fars province (Continued)

Family	Scientific name, Voucher no.	Local name	Use report	Medicinal Uses
Malvaceae	*Alcea aucheri* (Boiss.) Alef. FU715	Khatmi sefid	19	Pediatric jaundice (5), Common cold and expectorant (12), Hot temperament (2)
	Malva parviflora L. FU721	Khatmi	24	Hot temperament (3), Common cold (15), Constipation (6)
	Malva sylvestris L. FU722	Noole	20	Expectorant (8), Cough (12)
Moraceae	*Ficus carica* L. FU741	Anjir	34	Constipation (14), Body weakness (10), Anemia (10)
	Morus alba L. FU746	Toot sefid	16	Liver tonic (3), Tonic (8), Blood sugar (5)
Myrtaceae	*Eucalyptus camaldulensis* Dehnh.* FU762	Kalitoos	27	Respiratory disorders (5), Air Disinfectant (10), Anti-infective (10)
	Myrtus communis L. FU768	Moord	39	Hair tonic (15), Ant-dandruff (10), Anti-infective (14)
Oleaceae	*Olea europaea* L. FU780	Zeytoon	13	Sunstroke (3), Burn pain relief (2), Constipation (8)
Papaveraceae	*Fumaria parviflora* Lam. FU798	Shatereh	31	Jaundice (5), Skin rash (8), Liver Detoxification (8), Hot temperament (8), Skin itching (7)
Pedaliaceae	*Sesamum indicum* L. FU808	Konjed	15	Tonic (5), Blood sugar (5), Galactagogue (5)
Plantaginaceae	*Plantago lanceolata* L. FU827	Barhang	17	Hemorrhoid (3), Stomach ache (5), Asthma (9)
Poaceae	*Avena sativa* L. FU845	Jew	9	Nervous tonic (3), Anti-infective (4), Acne (2)
	Cynodon dactylon (L.) Pers. FU848	Alafe pamorgi	5	Diuretic (3), Blood purifier (2)
	Hordeum vulgare L. FU856	Jew	2	Liver temperament relief (2)
Portulacaceae	*Portulaca oleracea* L. FU882	Golfeh	35	Blood purifier (5), Constipation (8), Wound healing (12)
Rhamnaceae	*Ziziphus spina-christi* (L.) Desf. FU896	Sedr	37	Preventing of hair loss (15), hair tonic (15), Laxative (5), Gastric ulcer (2)
Rosaceae	*Amygdalus elaeagrifolia* Spach FU903	Arzan	11	Toothache (8), Anti-parasite (3)
	Amygdalus scoparia Spach FU904	Alook	19	Intestinal parasite (12), Preventing of hair loss (7)
	Rosa canina L. FU918	Nastaran	27	Relaxing (15), Palpitation (6), Skin softness (6)
Salicaceae	*Salix aegyptiaca* L. FU946	Beed	14	Jaundice (8), Febrifuge (6)
Solanaceae	*Solanum nigrum* L. FU967	Latrik	10	Pyrosis (5), Constipation (5)
	Datura innoxia Mill. FU978	Tatooreh	9	Rheumatic pains (2), Asthma (7)
Urticaceae	*Urtica dioica* L. FU1013	Gazaneh	5	Hair tonic (2), Menstrual facilitation (3)
Zygophyllaceae	*Peganum harmala* L. FU1038	Esfand	58	Hand and foot cracks (3), Air disinfectant (20), Evil eye (25)

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Table 3. Medicinal plants used by Locals in the Fasa County, Fars province (Continued)

Family	ICPC	Preparation	Part used	Mode of Application
Anacardiaceae	SKE-L, GAS-D, GAS-D	Poultice, Crude	Gum, Fruit	Topical, Oral
	GAS-D, GAS-D	Nuts, Mixed with date	Gum, Fruit	Oral
Apiaceae	OTH-A, OTH-A, PRE-W, GAS-D, OTH-A	Poultice, Infusion	Stem, Fresh Leaf, Gum	Topical, Oral
	NER-N, NER-N, URO-U, PRE-W	Infusion	Flowering branches	Oral
	GAS-D, PRE-W, GYN-X	Infusion, Aromatic water	Seed	Oral
Araceae	Blood-B, OTH-A, OTH-A, OTH-A, OTH-A	Crude, Mixed with food	Fruit	Oral
Asteraceae	CAR-K, OTH-A, DER-S, GYN-X	Poultice, Infusion	Leaf, Flowering branches	Topical, Oral
	NER-N, NER-N, RES-R, GAS-D	Infusion	Leaf, Flowering branches	Oral
	OTH-A, GAS-D, GAS-D	Decoction	Leaf, Flowering branches	Oral
	OTH-A, OTH-A, DER-S	Aromatic water	Aerial parts	Oral
	GAS-D, GAS-D, RES-R	Crude, Infusion	Gum	Oral
	OTH-A, RES-R, GAS-D	Crude, Pickle	Flower	Oral
	GAS-D, CAR-K, PRE-W	Infusion	Flower	Oral
	GAS-D, GAS-D	Decoction, Latex	Root	Oral, Topical
Boraginaceae	NER-N, RES-R	Infusion	Flower	Oral
	SKE-L, DER-S, DER-S	Poultice	Stem bark	Topical
Brassicaceae	RES-R, RES-R	Edible	Root	Oral
	Blood-B	Decoction	Aerial parts	Oral
	RES-R, Blood-B	Boiled in water	Leaf, Young branches	Oral
	OTH-A, GAS-D, DER-S	Maceration	Seed	Oral
Capparaceae	Blood-B, GAS-D	Decoction, Infusion, Pickle	Leaf, Bub, Fruit	Oral
Chenopodiaceae	GAS-D	Crude	Aerial parts	Oral
	GAS-D	Boiled in water	Leaf, Stem	Oral
Cucurbitaceae	MET-T	Tablet, Poultice	Fruit	Oral
Euphorbiaceae	GAS-D, URO-U	Decoction	Seed	Oral
Fabaceae	URO-U, OTH-A	Infusion	Aerial parts	Oral
	OTH-A, OTH-A	Poultice	Gum	Topical
	GAS-D, MET-T, URO-U	Boiled in water	Flowering branches, Fruit, Seed	Oral, Cataplasm
	RES-R, DER-S, DER-S, GAS-D	Infusion, Decoction, Poultice	Root, Rhizome	Oral, Topical
	OTH-A, OTH-A, DER-S	Aromatic water, Poultice	Aerial parts	Oral, Topical
	MET-T, GAS-D	Decoction, Aromatic water	Leaf, Seed	Oral
	DER-S	Poultice	Seed	Topical
Lamiaceae	GAS-D, NER-N, NER-N, GAS-D	Crude, Infusion	Leaf, Flowering branches	Oral, Topical
	GAS-D, GAS-D, NER-N	Crude, Infusion	Leaf, Flowering branches	Topical
	RES-R, OTH-A, OTH-A	Crude, Decoction	Leaf, Flowering branches, Seed	Oral, Topical
	GAS-D, OTH-A, RES-R, NER-N	Infusion, Decoction	Leaf and flower	Oral
	OTH-A, GAS-D, MET-T	Infusion, Decoction	Flowering branches	Oral
	GAS-D, NER-N	Decoction	Leaf, Flowering branches	Oral

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Table 3. Medicinal plants used by Locals in the Fasa County, Fars province (Continued)

Family	ICPC	Preparation	Part used	Mode of Application
Malvaceae	GAS-D, RES-R, OTH-A	Infusion	Flower	Oral
	OTH-A, RES-R, GAS-D	Infusion	Flower	Oral
	RES-R, RES-R		Fruit, Flower	Oral
Moraceae	GAS-D, OTH-A, Blood-B	Crude, Aromatic water	Fruit	Oral
	GAS-D, OTH-A, MET-T	Fresh fruits	Fruit	Oral
Myrtaceae	RES-R, OTH-A, OTH-A	Fumigation, Infusion	Leaf, Fruit	Inhale, Oral
	DER-S, DER-S, OTH-A	Poultice	Leaf, Flowering branches	Topical
Oleaceae	DER-S, DER-S, GAS-D	Crude, Infusion	Leaf, Fruit	Oral, Topical
Papaveraceae	GAS-D, DER-S, GAS-D, OTH-A, DER-S	Poultice, Aromatic water	Leaf, Flowering branches	Topical, Oral
Pedaliaceae	GAS-D, MET-T, PRE-W	Crude	Seed	Oral
Plantaginaceae	GAS-D, GAS-D, RES-R	Infusion, Poultice	Seed	Bath, Oral
Poaceae	NER-N, OTH-A, DER-S	Decoction, Poultice	Seed	Topical, Oral
	URO-U, OTH-A	Infusion	Aerial parts	Oral
	GAS-D	Decoction	Seed	Oral
Portulacaceae	OTH-A, GAS-D, DER-S	Crude	Aerial parts	Topical, Oral
Rhamnaceae	DER-S, DER-S, GAS-D, GAS-D	Decoction	Leaf, Fruit	Topical, Oral
Rosaceae	GAS-D, GAS-D	Poultice, Salted fruit	Fruit, Gum, Young branches	Topical, Oral
	GAS-D, DER-S	Crude, Pickle, Salted	Fruit, Gum	Topical, Oral
	NER-N, CAR-K, DER-S	Infusion, Aromatic water	Flower	Topical, Oral
Salicaceae	GAS-D, OTH-A	Aromatic water	Leaf, Young branches	Oral
Solanaceae	GAS-D, GAS-D	Crude, Infusion	Fruit	Oral
	SKE-L, RES-R	Crude, Infusion	Leaf, Seed	Oral
Urticaceae	DER-S, GYN-X	Decoction	Leaf	Topical, Oral
Zygophyllaceae	DER-S, OTH-A, OTH-A	Poultice, Decoction, Decoration	Seed	Topical, Decoration

3.2. Plant parts

A variety of plant parts were utilized in traditional medicine, including leaves, flowers, terrestrial and aerial parts, fruits, branches, seeds, gum, stem, and bark. Among these, the most commonly used plant parts were leaves, flowers, and fruits, accounting for 19.26%, 18.34%, and 15.59% of the total plant parts used, respectively (Fig. 5).

3.3. Methods of preparation and application

In this study medicinal plants were prepared in 13 distinct forms, including decoction, infusion, poultice, vegetable, aromatic water, pickle, boiled, salted, nuts, maceration, tablet, latex, and fumigation by the local residents. The most common preparation method was infusion (25.53 %), followed by decoction (18.08 %) and poultice (17.02 %) (Fig. 6). The medicinal plants administrated in five ways including oral, topical, bath, cataplasm, and inhale. The most dominant method of administration was oral (67.46 %), followed by topical (27.71 %).

3.4. Informant consensus factor (ICF)

The study findings indicate that the ethnobotanical knowledge of Fasa County is highly diverse and effectively utilized for treating a broad range of ailments. A total of 1386 use reports, referring to 76 diseases across 12 categories, were recorded in this region. Furthermore, two main quantitative factors, including use reports and the ICF, were utilized for data analysis. As results shown in Table 4, the

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ICF values in this study ranged from 00.00 to 93. Dermatological ailment category scored the highest ICF (0.93). This high value of ICF resulted especially in widely used medicinal plant "*Solenanthus circinatus*" which is called Choob Azar in the local language. Based on field visits and interviews with the local informants, the best and most effective treatment for body bruises in this area is *S. circinatus*. In fact, Choob Azar is known as a safe and fast treatment in this region for body bruises. In this way, the bark of the root is powdered and mixed with egg and wood shavings and placed on the bruised area (Fig. 7).

These findings also could be due to high-use reports for plant species such as *Prosopis farcta*, *Portulaca oleracea*, *Ziziphus spina-christi*, and *Myrtus communis* in wound healing, hair tonic, and other skin disorders. Additionally, other reports from this region, such as Ramezanian and Minaee Far (2016) [15], have confirmed the utilization of certain medicinal plant species, such as *Ziziphus spina-christi* and *Myrtus communis*, in the treatment of skin disorders.

Neurological disorders unexpectedly ranked as the second highest ICF (0.92). This high ICF is due to the high use report of some medicinal plants including *Rosa canina*, *Ziziphora tenuior*, *Thymus vulgaris*, *Mentha* spp., *Anthemis tinctoria*, and *Stachys inflate* as relaxing medicine. These findings indicated the relation between past rich traditional knowledge of this ancient region with the present application of some medicinal plant species. For instance, the diversity of used plants in the treatment of stomach diseases such as *Rosa canina*, *Ziziphora tenuior*, *Thymus vulgaris*, *Mentha* spp., and *Anthemis tinctoria* is rooted in the prescription of the Iranian scientist Hakim Bu'ali Sina (980-1037 AD). Contrary to the present study, neurological ailments were ranked second in the use of medicinal plants, in previous studies in this region [15], with less emphasis on the utilization of medicinal plants to treat these diseases. However, some plant species, such as *Rosa canina*, were found to be commonly used in the treatment of nervous disorders in both studies.

The third highest ICF (0.91) was found for gastrointestinal diseases and included the highest values of Nur (460) and Nt. Medicinal plant species such as *Pistacia atlantica*, *Silybum marianum*, *Pistacia khinjuk*, *Foeniculum vulgare*, *Echinops aucheri*, *Onopordum heteracanthum*, *Glycyrrhiza glabra*, *Mentha* spp., *Thymus vulgaris*, and *Teucrium polium* typically were used for treatment of gastrointestinal disorders. Based on the other reports [15] also, *Rumex vesicarius*, *Rheum ribes*, *Citrus aurantium*, and *Teucrium polium* are commonly used for the treatment gastrointestinal disorders in Fasa County.

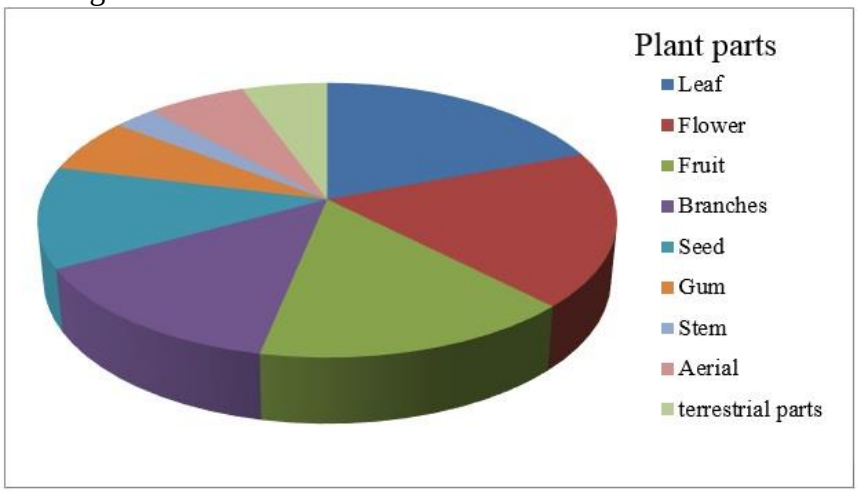

Fig. 5. Plant parts used in traditional medicinal preparation

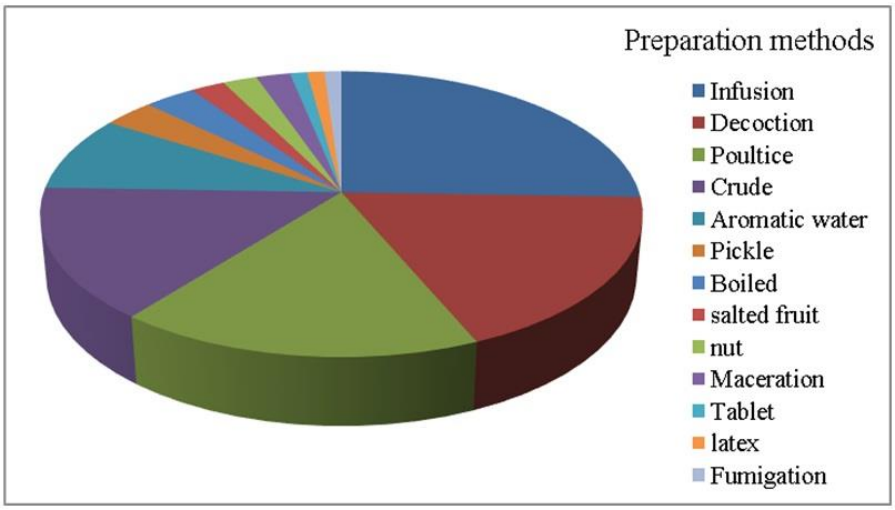

Fig. 6. Preparation methods of the medicinal plants in Fasa County

Table 4. Informant consensus agreement for ailment categories in the Fasa county, Fars province, Iran

ICPC categories	Recorded ailments	ICPC categories	Nt*	Nur**	ICF value***
1	Musculoskeletal (SKE-L)	Joint pains (5), Rheumatic pains (2)	4	5	0.25
2	Digestive (GAS-D)	Toothache (22), Flatulence (112), Liver tonic (28), Anti-parasite (40), Stomach tonic (38), Pyrosis (11), Gastrointestinal disorders (70), liver diseases (30), Laxative (5), Constipation (70), Gastric ulcer (15), Jaundice (18), Hemorrhoid (3)	39	464	0.91
3	Respiratory (RES-R)	Respiratory disorders (5), Common cold (67), Asthma (24), Sore Throat (11), Expectorant (13), Cough (37)	16	157	0.90
4	Neurological (NER-N)	Relaxing (115), Nervous diseases (8), Nervous tonic (33), Anti-anxiety (3), Pain relief (14)	14	173	0.92
5	Skin (DER-S)	Blister (8), Skin disorders (6), Wound healing (42), Hair tonic (32), Ant-dandruff (10), Skin rash (15), Skin itching (7), Acne (2), Preventing of hair loss (22), Skin softness (6), Hand and foot cracks (3), Bruise (51)	15	204	0.93
6	General and Unspecified (OTH-A)	Tonic (32), Hot temperament (17), Antiseptic (12), Reinforcing sexual desire (22), Cold temperament (20), Hyperlipidemia (12), Febrifuge (11), Heatstroke (12), Blood purifier (16), Fattening (2), Anti-infective (42), Appetizer (3), Disinfectant (10), Adhesive production (5), Air disinfectant (20), Evil eye (25)	28	261	0.89
7	Urological (URO-U)	Diuretic (19), Kidney stone (30)	7	49	0.87
8	Endocrine/ Metabolic and Nutritional (MET-T)	Blood sugar (70)	9	70	0.88
9	Female Genital (GYN-X)	Menstrual regulation (7), Female diseases (2), Menstrual facilitation (3)	6	12	0.54
10	Cardiovascular (CAR-K)	High blood pressure (3), Palpitation (1)	4	4	0.00
11	Pregnancy, Childbearing, Family Planning (PRE-W)	Abortion (7), Galactagogue (12)	7	19	0.66
12	Blood, Blood Forming Organs and Immune Mechanism (Blood-B)	Anemia (38), Astringent and bleeding inhibition (6)	9	44	0.81

*Nt: number of the plant used as medicine; **Nur: Number of use reports; ***ICF value: Informant consensus factors

Fig. 7. Treatment of body bruise with the cataplasm of *Solenanthus circinatus*

3.5. Cultural index (CI) and relative frequency of citation

The cultural consensus on the healing properties of remedies and drugs can be helpful in guiding subsequent laboratory studies aimed at evaluating their efficacy and toxicity [24]. Therefore, in this study, besides the local/traditional uses of plants and providing detailed information on their usage and botanical authentication,, an attempt was made to utilize two main quantitative factors, ICF and CI, for data analysis. Among the 62 plant species recorded in Table 3, 20 were found to have high cultural indices (CI) for treating various ailments. (Table 5). The most frequently used plants and species with the highest CI and RFC ranking include *Thymus vulgaris*, *Solenanthus circinatus*, *Mentha longifolia*, *Peganum harmala*, *Glycyrrhiza glabra*, *Ferula assa-foetida*, and *Phoenix dactylifera* that have high phytogeographical diversity, cultural and traditional characteristics. One of highlighted results of this study was that more than 90 percentage of the old informants (> 55 years old) discussed affirmed that their medicinal knowledge was inherited from their ancestors over the time.

The results of the AONOVA and post-hoc tests indicate that in the Fasa County Arab speaking communities, Turks, and Persians had

more knowledge and dependency on the medicinal plants respectively (P = 0.04). Based on the field surveys, it was found that communities such as Arabs and Turks have easier access to and greater reliance on natural resources, but have less access and economic ability to use healthcare facilities. As a result, their utilization of medicinal plants is significantly richer and more diverse compared to people (Persians) with greater access to medical facilities.

3.6. Comparison of indigenous knowledge with other studied neighboring regions

A detailed comparison of this study with previous ethnopharmacological reports from the Fars province revealed the importance of this regional traditional knowledge. The absence-presence matrix for medicinal plants in Fasa County, in comparison with other parts of the Fars province, revealed numerous valuable traditional applications for several medicinal plant species that had not been previously recorded (Table 6). For instance, some plant species like *Echinops aucheri*, *Solenanthus circinatus*, and *Onopordum heteracanthum* were recorded as greatly used medicinal for the first time in this region.

Table 5. Comparison of highly used medicinal plants using indices (RFC and CI) and species ranking based on each index

Family	Scientific name	UR	CI	RFC	CI ranking	RFC ranking
Lamiaceae	*Thymus vulgaris* L.	85	1.89	1.33	1	1
Lamiaceae	*Mentha longifolia* L.	65	1.44	1.06	2	1
Boraginaceae	*Solenanthus circinatus* Ledeb.	63	1.40	1.14	1	1
Zygophyllaceae	*Peganum harmala* L.	58	1.29	0.95	2	2
Fabaceae	*Glycyrrhiza glabra* L.	57	1.27	0.96	2	2
Apiaceae	*Ferula assa-foetida* L.	52	1.16	0.90	2	2
Araceae	*Phoenix dactylifera* L.	49	1.09	0.88	2	2
Asteraceae	*Anthemis tinctoria* L.	45	1.00	0.85	3	2
Myrtaceae	*Myrtus communis* L.	39	0.87	0.79	3	3
Apiaceae	*Stachys inflata* Benth.	38	0.84	0.77	3	3
Apiaceae	*Foeniculum vulgare* Mill.	37	0.82	0.78	3	3
Lamiaceae	*Salvia macrosiphon* Boiss.	37	0.82	0.79	3	3
Rhamnaceae	*Ziziphus spina-christi* (L.) Desf.	37	0.82	0.78	3	3
Portulacaceae	*Portulaca oleracea* L.	35	0.78	0.75	3	3
Asteraceae	*Onopordum heteracanthum* C.A.Mey.	36	0.80	0.77	3	3
Lamiaceae	*Mentha piperita* L.	34	0.76	0.70	3	3
Moraceae	*Ficus carica* L.	34	0.76	0.67	3	3
Brassicaceae	*Descurainia sophia* (L.) Webb ex Prantl	33	0.73	0.62	3	3
Asteraceae	*Artemisia sieberi* Besser	32	0.71	0.59	3	3
Anacardiaceae	*Pistacia atlantica* Desf.	31	0.69	0.53	3	3

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Table 6. Comparative absence-presence matrix for the recorded plant species

Scientific name	Compared				Scientific name	Compared			
	A	B	C	D		A	B	C	D
Pistacia atlantica Desf.		0	0	0	*Prosopis farcta* (Banks &	1	0	1	0
Pistacia khinjuk Stocks	0	0	1	0	*Mentha longifolia* (L.) L.	1	1	1	0
Ferula assa-foetida L.	0	1	0	0	*Mentha piperita* L.	0	0	0	0
Stachys inflata Benth.	0	1	0	0	*Salvia macrosiphon* Boiss.	1	0	1	0
Foeniculum vulgare Mill.	1	0	1	0	*Thymus vulgaris* L.	1	0	0	0
Phoenix dactylifera L.	0	0	0	0	*Teucrium polium* L.	0	1	1	0
Achillea eriophora DC.	1	0	0	1	*Ziziphora tenuior* L.	1	0	0	1
Anthemis tinctoria L.	1	0	0	0	*Alcea aucheri* (Boiss.) Alef.	1	0	1	0
Artemisia sieberi Besser	1	0	0	0	*Malva parviflora* L.	1	0	1	0
Cichorium intybus L.	1	1	1	0	*Malva sylvestris* L.	0	1	0	0
Echinops aucheri Boiss.	0	0	0	0	*Ficus carica* L.	1	0	1	0
Onopordum heteracanthum C.A.Mey.	0	0	0	0	*Morus alba* L.	0	0	1	0
Silybum marianum (L.) Gaertn.	0	0	1	0	*Eucalyptus camaldulensis*	1	0	0	0
Taraxacum officinale (L.) Weber ex	1	0	0	0	*Myrtus communis* L.	1	0	1	0
Anchusa strigosa Banks & Sol.	1	0	0	0	*Olea europaea* L.	1	0	1	0
Solenanthus circinatus Ledeb.	0	0	0	0	*Fumaria parviflora* Lam.	1	0	0	0
Brassica rapa L.	1	0	0	0	*Sesamum indicum* L.	1	0	0	0
Capsella bursa-pastoris (L.) Medik.	1	0	1	0	*Plantago lanceolata* L.	1	1	0	0
Cardaria draba (L.) Desv.	1	0	1	0	*Avena sativa* L.	1	0	0	0
Descurainia sophia (L.) Webb ex Prantl	1	1	1	1	*Cynodon dactylon* (L.) Pers.	1	0	0	0
Capparis spinosa L.	1	0	1	0	*Hordeum vulgare* L.	1	0	0	0
*Bassia aegyptiac*a Turki, El Shayeb &	1	0	0	0	*Portulaca oleracea* L.	1	0	1	0
Spinacia oleracea L.	1	0	0	0	*Ziziphus spina-christi* (L.)	0	0	1	0
Citrullus colocynthis (L.) Schrad.	1	0	1	0	*Amygdalus elaeagrifolia*	1	0	0	0
Ricinus communis L.	1	0	1	0	*Amygdalus scoparia* Spach	1	0	0	1
Alhagi pseudalhagi (M. Bieb.) Desv. ex	1	0	0	0	*Rosa canina* L.	1	0	0	0
Astragalus fasciculifolius Boiss.	1	0	0	0	*Salix aegyptiaca* L.	1	0	0	0
Faba vulgaris Moench	1	0	0	0	*Solanum nigrum* L.	1	0	1	0
Glycyrrhiza glabra L.	1	1	1	1	*Datura innoxia* Mill.	1	0	0	0
Medicago sativa L.	1	0	0	0	*Urtica dioica* L.	1	1	0	0
Trigonella foenum-graecum L.	1	0	0	0	*Peganum harmala* L.	1	0	1	0

A: (Hatami and Zahedifar, 2016); B: (Rahemi Ardakani and Poursakhi, 2020); C: (Dolatkhahi et al., 2014); D: (Sadeghi and Borjian, 2012).

3.7. The necessity of preserving of traditional medicinal knowledge and medicinal herbs in visited villages

To protect traditional and medicinal knowledge in the visited villages of Fasa, the local government should provide a better environment for healers, ensure the legality of their medical practices, and promote their services through appropriate advertisements. It is also important for the local government to pay more attention to training courses for young people. This approach can strongly support sustainable medicinal development in less developed areas and conserve traditional medicinal knowledge. According to demographic investigations, over half of the Fasa

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healers are aged over 60, and some of them are passing away without documenting their traditional medicinal knowledge. Therefore, it is imperative to conduct further surveys and record traditional medicinal knowledge. Publishing books and scientific reports on medicinal plants and traditional medicinal knowledge can also help preserve this valuable information. To increase public understanding, confidence, and safety of traditional medicines, it is important to apply advanced theories and methods of pharmacology, phytochemistry, and molecular pharmacognosy to study traditional medicines and knowledge. Furthermore, to conserve local medicinal plant resources, the local government should encourage individuals to plant preferred or rare medicinal plants in their farmlands. This approach aligns with the strategy of rural revitalization and can contribute to the sustainable development of the region.

4. Discussion

62 medicinal plant species belonging to 27 plant families were recorded in the study area. Asteraceae, Fabaceae, and Lamiaceae with 8, 7, and 6 species were the most represented medicinally utilized plant families in this region. Similar results regarding the dominance of these plant families have been reported in other provinces, such as Kerman [25] and Isfahan [26], and neighboring countries such as Turkey [27]. The common use of some medicinal plant families in a certain district can be due to the proper distribution of those plants in that area [28]. Additionally, the medicinal culture and historical experiences of the local people, which have been passed down from generation to generation, can play a significant role in the utilization of certain plant species. [29].

The most widely plant parts used were leaf (19.26 %), flower (18.34 %), and fruit (15.59 %), respectively. Other studies reported leaves, flowers, and fruit as the common medicinal plant part [30, 31, 32]. During discussions with local informants, it was revealed that the utilization of leaves and other aerial parts of plants by the local communities is due to their awareness of the stability and dynamics of vegetation in the region. Other studies have also indicated that, in addition to conservation, ease of availability, and efficiency of use are other reasons why local residents utilize leaves. [28, 29, 30]. Despite the common use of leaves and other aerial parts, some terrestrial parts of plants are also used as the main medicinal part for therapeutic purposes. For example, the root bark of *Solenanthus circinatus* is frequently used for the treatment of body bruises in the study area. This plant is locally known as a common drug for this purpose.

The most common preparation method was infusion (25.53 %), followed by decoction (18.08 %) and poultice (17.02 %). Other reports have also confirmed that infusion, decoction, and poultice are the main common form of traditional herbal medicine preparation methods [29, 33, 34]. Medicinal plants were administrated in five ways including oral, topical, bath, cataplasm, and inhale. The most dominant method of administration was oral (67.46 %), followed by topical (27.71 %). These findings are consistent with many ethnobotanical reports. [35, 36, 37].

Results showed that the ICF values in this study ranged from 00.00 to 93. The dermatological ailment category scored the highest ICF (0.93). Also, in our previous study in the Kerman province located in the neighboring Fars region, and Bardsir Region studied by Sarhadynejad et al. 2021 [34] *S. circinatus* as a frequently used medicinal plant applied for the treatment of body bruises and pain, respectively [29, 34]. The analgesic activity of *S. circinatus*

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root extract and fractions were evaluated in rat models of pain. Results were comparable with that of diclofenac [11, 38]. It is believed that the analgesic effect of this species is related to the presence of alkaloids, although no further reports of phytochemical studies for this species are available in the literature.

These findings also could be due to high-use reports for plant species such as *Prosopis farcta*, *Portulaca oleracea*, *Ziziphus spina-christi*, and *Myrtus communis* in wound healing, hair tonic, and other skin disorders. Based on similar results of the desert regions like Fasa County [29, 25], the high ICF of skin disorders in this study might be due to high and long-term sunlight exposure, which caused dermatological ailments.

Neurological disorders unexpectedly ranked as the second highest ICF (0.92) in the study. This high ICF is due to the high use report of some medicinal plants including *Rosa canina*, *Ziziphora tenuior*, *Thymus vulgaris*, *Mentha* spp., *Anthemis tinctoria*, and *Stachys inflate* as relaxing medicine. These findings indicate the relationship between the rich traditional knowledge of this ancient region and the present-day application of some medicinal plant species for neurological disorders. For instance, the diversity of used plants in the treatment of stomach diseases such as *Rosa canina*, *Ziziphora tenuior*, *Thymus vulgaris*, *Mentha* spp., and *Anthemis tinctoria* is rooted in the prescription of the Iranian scientist Hakim Bu'ali Sina (980-1037 AD). Bu'ali Sina believed diagnosis of stomach swelling cause (depending on imbalances in Mizaj) is an important and helpful factor in treatment of gastric disorders [39]. He has mentioned different herbs for treating stomach problems in Canon. So, this hypothesis seems to be acceptable that ancient culture and the long history of the Fasa County as an important part of Achaemenids government and also the Bacun period may be played an important role in its current traditional medicinal practices such as medicinal plant practices. Other researchers emphasized that one essential point that must be noticed and investigated is the relationship between the ancient culture and history with the current ethnopharmacological knowledge of each area [40, 41]. Scientific reports indicated that *Mentha* spp. has therapeutic activities such sedative properties. Iranian Traditional Practitioners also believed this genus has analgesic and sedative effects [42].

The third highest ICF (0.91) was found for the treatment gastrointestinal diseases, and it included the highest values of Nur (460) and Nt [34]. These results showed a high value of informant consensus on the abundance of medicinal plant species utilized for the treatment of gastrointestinal diseases. They also suggest the prevalence of this category of ailments among the residents in the studied region [39]. Medicinal plant species such as *Pistacia atlantica*, *Silybum marianum*, *Pistacia khinjuk*, *Foeniculum vulgare*, *Echinops aucheri*, *Onopordum heteracanthum*, *Glycyrrhiza glabra*, *Mentha* spp., *Thymus vulgaris*, and *Teucrium polium* typically were used for treatment of gastrointestinal disorders. Our previous reports [29, 43] confirmed the utilization of species like *Pistacia atlantica*, *Mentha* spp., *Thymus* spp., and *Silybum marianum* for the treatment of gastrointestinal ailments. In this case, *Mentha* spp. is used in Iranian folk medicine for treatment of flatulence and as a carminative drug [44]. Additionally, PDR recommended the utilization of *Mentha* spp. leaves as a remedy for flatulence and as a carminative for gastric diseases [45]. Plants such as mint, which have been prescribed since ancient times in ITM for the treatment of digestive diseases, are still used in the Fasa

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region for the treatment of digestive disorders. Many similarities have been reported between the utilization of medicinal plants for the treatment of gastrointestinal diseases by the locals of the Fasa region with Iranian traditional medicine. For instance, Bu'ali Sina used *Ferula* spp. to relieve toothache, treat inflammation of the stomach and as parasite repellent [46, 47]. Also, based on the other traditional references *Foeniculum vulgare* fruits used in swelling of the stomach, and Phytochemical studies have shown the presence of various valuable constituents, such as volatile compounds, flavonoids, phenolic compounds, fatty acids, and amino acids [48]. *Trigonella foenum-graecum*, *Olea europaea*, *Amygdalus* spp. *Hordeum vulgare*, and *Pistacia atlantica* also was used for gastrointestinal disorders [49]. This matching of the current therapeutic uses of medicinal plants with the context of their use in ITM can confirm the meaningful relationship between the ancient culture and history of the Fasa region and the current therapeutic habits of this region. In other words, today's habits and treatment methods can be largely rooted in the history and therapeutic culture of each region.

The cultural consensus on the healing properties of remedies and drugs can help to inform subsequent laboratory studies that aim at evaluating their efficacy and toxicology [50]. These findings revealed that the locals of this study area historically have distinct perspectives on the medicinal plants that are rooted in their past medicinal culture. In the other words, the cultural tradition of Fasa County has been preserved and enriched for several generations and this interpretation was recognized based on the dynamics of transmission of traditional herbal medicine. Ecological factors and interactions with the human community's conditions can also play a significant role in the traditional herbal culture of this region.. The relationship between local communities and plant species, and consequently their selection for an application, is due to a complex set of interactions of socio-culture [51, 52, 50], ease availability of the medicinal plants, and therapeutic use, resulting in an ecological conditions [53].

Thymus vulgaris, for instance, is one of the most culturally medicinal plants for treatment of flatulence, anti-infective, cough, and relaxing. Biological assays confirmed the potent therapeutic effect of the active ingredient of *T. vulgaris* on the respiratory system through the decreasing of the inflammatory airway hyper responsiveness and particular cellular inflammatory parameters [54]. Also, traditional Iranian physicians, such as Hakim Bu'ali Sina (980–1037 AD) prescribed thymus spp. in the treatment of digestive and respiratory diseases [55].

Study area communities were divided into two categories: rural and nomadic. Compared to rural areas, nomadic communities are thought to have much knowledge and experience regarding medicinal plant use. Among indigenous communities, Rurales use more medicinal herbs or medicinal plants that are within the boundaries of the village or in the agricultural lands. For example, this community uses more plants such as fennel/palm/beans/turnips/olives/figs. The *Cynodon dactylon* is widely distributed in agricultural fields and village areas and is widely used in rural communities. Nomadic communities in the region utilize plant species from natural areas and rocky terrain, including valuable species that are difficult to access. Ferula is a widely used plant among the nomads in the region and is considered a valuable species. It typically grows in highlands and has a limited distribution.

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Other species that are commonly used by nomads include Thymus, Mentha, and Stachys, which typically grow in highlands and mountainous areas. The highest usage of medicinal plants in the studied region is among Arabic-speaking people, who have been using them continuously since ancient times. Local healers among this group have a special status and are highly regarded for their knowledge of medicinal plants.

Ethnically and ecologically, Arabic and Turkish-speaking communities are more dependent on medicinal plants due to their lower economic status, but better access to these resources. Despite the expansion of medical science and numerous hospitals in the study area, the Arab people continue to use medicinal plants. In some cases, they prefer to be treated with medicinal plants rather than visiting a doctor.

Turk and Fars ethnic groups are another biogeographic group in the study area who also use medicinal plants. However, their usage is far less frequent than the Arabs people. Similar to the previous group, Fars ethnic groups also use medicinal plants less frequently. Based on field surveys, communities such as Arabs and Turks have greater access to and dependency on natural resources, but they have less access and economic ability to use healthcare facilities. For these reasons, their utilization of medicinal plants is significantly richer and more diverse than that of people with greater access to medical facilities, such as the Persians. These findings are consistent with those of Soukand and Kalle (2010) [53] in the same field.In Fasa and Gandou region of Sepidan county [56], *Ferula assa-foetida* is commonly used for antiseptic, anti-worm, and anti-parasite properties. *Glycyrrhiza glabra* is mainly used for treating common cold and gastric ulcer, in the study area, but it is also reported to be used for pectoralgia, bone pain, and fatigue in the Anjir region [57].

Salvia macrosiphon is generally used in the study area, for sore throat, anti-infective blood sugar, and particularly for insect (fly) and repellent. However, in the Anjir region, it is used for treating seizures, diarrhea, and as a mouth deodorant. In the Arjan-Parishan region, it is used for respiratory issues and insect bites. [10]. In the study area, *Ziziphora tenuior* is used for Flatulence and Relaxing, but it is used as expectorant and stomach tonic in Anjir and *Ziziphora clinopodioides* for typhus fever, and reducing heat of body in Gando region in Sepidan county [53, 58].

Ziziphus spina-christi is used for preventing of hair loss, hair tonic, laxative, gastric ulcer, but in addition to washing hair it is used for cold in Arjan – Parishan [10]. In the study area, *Mentha longifolia* is used for flatulence, anti-anxiety, relaxing, and gastrointestinal disorders. However, in the Gando region of Sepidan county, it is used for pertussis, gout, hysteria, and as an emmenagogue [56]. It has also been reported to be used for heatstroke and jaundice in the Arjan-Parishan region. [10].

Generally, the Anacardiaceae family is mainly used for the treatment of gastrointestinal disorders, Apiaceae for nervous, digestive, and women diseases, Asteraceae for gastrointestinal, respiratory, and general and unspecified diseases, Boraginaceae for dermatological, and neurological purposes, Brassicaceae for respiratory, and skin ailments, Chenopodiaceae for gastrointestinal problems, Fabaceae for dermatological, and urological diseases, Lamiaceae for neurological, and gastrointestinal problems, and Malvaceae for respiratory, and digestive disorders.

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5. Conclusion

The results of this study revealed that the local residents of Fasa County utilize medicinal plants from 27 botanical families to treat more than 70 human ailments across 12 illness categories. Dermatological disorders such as body bruises were reported to be the most prevalent disorders in this district, followed by neurological and gastrointestinal diseases. The finding reveals that because of the long history and ancient culture of the Fasa Persian communities' area in Fars province, there is rich and valuable traditional herbal knowledge in this region. Therefore, the transmission and preservation of this reliable information seem to be essential, and phytochemical and pharmacological studies of highly used medicinal plants are suggested. Additionally, awareness measures should be taken to preserve such valuable traditional knowledge of medicinal plant, especially knowledge of species mostly used for their roots, such as *Solenanthus circinatus*, and *Glycyrrhiza glabra*.

Author contributions

EJ and SHH designed the work. EJ, SHH, and ZS participated in organization of the ethnobotanical data, SHH conducted the data analysis and participated in all steps. All authors approved the final manuscript.

Conflict of interest

The authors declare that there is no conflict of interest.

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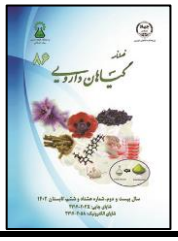

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مقاله تحقیقاتی

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اطلاعات مقاله

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چکیده

مقدمه: طب گیاهی سنتی در جوامع فارسی استان فارس به ویژه شهرستان فسا قدمت طولانی دارد. به‌رغم تاریخ کهن و فرهنگ غنی این منطقه در زمینه طب سنتی، مطالعه جامعی در خصوص دانش اتنوبوتانی این منطقه منحصر به فرد و با وابستگی بالا به گیاهان دارویی انجام نشده است. **هدف:** هدف اصلی این مطالعه شناسایی و ثبت گیاهان دارویی و دانش گیاهی سنتی جوامع قومی شهرستان فسا در استان فارس بود. **روش بررسی:** داده‌های اتنوفارماکولوژیکی با استفاده از پرسشنامه‌های نیمه ساختاریافته و مصاحبه‌های گروهی در یک دوره دو ساله (۲۰۲۲-۲۰۲۱) جمع‌آوری شد. ۴۵ نفر از افراد آگاه محلی برای جمع‌آوری داده‌ها انتخاب و مصاحبه شدند. شاخص‌های کمی از جمله فاکتورهای اجماع مطلعین (ICF) و گزارش استفاده (UR) محاسبه شدند. گونه‌های گیاهی دارویی با روش‌های استاندارد توسط گیاه‌شناسان شناسایی شدند. **نتایج:** ۶۲ گیاه دارویی متعلق به ۵۸ جنس و ۲۷ خانواده برای درمان ۱۲ دسته بیماری توسط جوامع محلی ثبت شد. رایج‌ترین روش تهیه دم کرده و سپس جوشانده و ضماد بود. بیماری‌های پوستی (ICF = 0.93)، عصبی (ICF = 0.92) و گوارشی (ICF = 0.91) به عنوان شایع‌ترین طبقه بیماری در این زمینه ثبت شدند. **نتیجه‌گیری:** نتایج مطالعه نشان داد که دانش گیاهی سنتی شهرستان فسا همچنان غنی است و رابطه آشکاری را بین فرهنگ کهن دارویی این منطقه و طب سنتی ایران نشان می‌دهد. بنابراین ارزیابی فعالیت فارماکولوژیکی گیاهان دارویی پرمصرف می‌تواند منجر به تولید داروهای گیاهی جدید شود.

مخففها: ITM، طب سنتی ایرانی؛ ICF، شاخص اجماع مطلع؛ UR، گزارش استفاده؛ RFC، فراوانی نسبی استناد؛ FC، فراوانی استناد

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