



# Documentation of medicinal plant use in Karaj, Iran: An urban ethnobotanical study of herbal markets and shops

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## Research

### Abstract

**Background:** Urban ethnobotany provides critical insights into how traditional plant knowledge adapts within modern societies. Despite Iran's rich ethnomedicinal heritage, little attention has been paid to cities such as Karaj, where traditional and modern herbal markets coexist.

**Methods:** Between 2018 and 2024, we surveyed 25 herbal outlets across 12 districts of Karaj. A total of 186 medicinal plant samples were collected, identified, and deposited as herbarium vouchers. Semi-structured interviews were conducted with herbalists and customers to document vernacular names, plant parts used, preparation forms, and therapeutic applications. Quantitative indices, including frequency and relative frequency of citation, were calculated to reveal use patterns.

**Results:** The study recorded 186 species belonging to 144 genera and 68 families. The most represented families were Asteraceae (10%), Lamiaceae (9%), Apiaceae (8%), and Fabaceae (7%). Fruits (24.9%) and seeds (16.9%) were the most frequently traded parts. The dominant therapeutic categories included digestive (21.4%), immune/general tonic (17.7%), respiratory (10.1%), and nervous system (8.1%) uses. Native species constituted 57% of the recorded flora, while 33% were cultivated or imported.

**Conclusions:** The herbal markets of Karaj demonstrate both continuity and transformation of traditional medicinal plant knowledge in an urban context. While long-established attari shops preserve vernacular expertise, modern outlets introduce packaged and imported products, reflecting shifts in consumer behavior and trade networks. These findings contribute to understanding urban ethnobotanical systems and emphasize the importance of documenting and safeguarding traditional medicinal knowledge within rapidly changing metropolitan environments.

**Keywords.** Ethnobotany; medicinal plants; urban markets; Iran; Karaj; traditional knowledge

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## Background

Medicinal plants continue to play a fundamental role in primary healthcare systems worldwide, particularly in regions where traditional knowledge remains embedded in everyday life and complements formal medical infrastructures (Bussmann & Sharon 2006, WHO 2013). Ethnobotanical research has demonstrated that plant-based remedies are not only culturally significant but also economically important, especially in low- and middle-income countries where access to modern healthcare may be limited or uneven (Hamilton 2004, Heinrich *et al.* 2009). In recent decades, ethnobotany has increasingly emphasized the need to document how traditional medicinal knowledge adapts under conditions of urbanization, globalization, and market integration, as cities have become key nodes for the transmission, transformation, and commercialization of herbal knowledge (Albuquerque *et al.* 2014, Vandebroek & Voeks 2019).

Iran represents one of the most important centers of plant diversity and ethnomedicinal knowledge in Southwest Asia. Owing to its climatic heterogeneity, complex topography, and biogeographic position, the country harbors more than 8,000 vascular plant species, of which approximately 2,300 are used medicinally (Mozaffarian 2013, Ghahremaninejad & Hoseini 2015). A substantial proportion of this flora is endemic, with over 2,500 angiosperm species occurring exclusively within Iran (Ghahremaninejad *et al.* 2025). Iranian traditional medicine has been shaped by centuries of scholarship and practice, most notably through Persian medical texts such as Avicenna's Canon of Medicine and continues to influence contemporary herbal use and trade (Amin 1991; Zargari 1990). Numerous ethnobotanical studies across Iran have documented medicinal plant use in rural communities, mountainous regions, and tribal societies, consistently highlighting families such as Lamiaceae, Asteraceae, Apiaceae, and Fabaceae, and showing that digestive, respiratory, and dermatological disorders dominate traditional treatments (Ghorbani 2005, Rajaei *et al.* 2012, Mosaddegh *et al.* 2012, Shahraki *et al.* 2020).

While rural and indigenous ethnobotany in Iran has been relatively well studied, urban ethnobotany remains underrepresented, despite the fact that cities play a central role in shaping contemporary herbal markets and consumer behavior. Urban markets function as interfaces between rural supply systems, long-standing traditional knowledge, modern commercial practices, and increasingly globalized trade networks (Cunningham 2001, Albuquerque *et al.* 2014). Studies from Iran and elsewhere have shown that urban herbal markets often maintain a stable "core" of widely used medicinal species, while simultaneously incorporating imported plants, packaged products, and standardized preparations that reflect changing lifestyles and health perceptions (Bussmann 2002; Amiri & Joharchi 2013; Motahhari *et al.* 2022). Comparative research from Latin America, the Caucasus, and the Middle East further demonstrates that urbanization can both conserve ethnomedicinal knowledge and drive its homogenization, potentially leading to erosion of local specificity and vernacular taxonomy (Bussmann & Sharon 2006, Vandebroek & Voeks 2019).

Karaj, the capital of Alborz Province, provides a particularly relevant case study for examining these dynamics. As a rapidly expanding, multicultural city adjacent to Tehran, Karaj has experienced intense migration, urban growth, and socio-economic transformation over recent decades. Unlike historically prominent cities such as Mashhad or Isfahan, whose herbal markets have been studied in detail, Karaj combines long-established attari shops with modern commercial outlets selling packaged herbal products, offering a unique opportunity to investigate how traditional ethnobotanical knowledge is maintained, adapted, or transformed within an urban setting. Despite its demographic and economic importance, Karaj has so far received little attention in ethnobotanical research, leaving a significant gap in our understanding of medicinal plant trade and knowledge transmission in Iranian metropolitan environments.

Against this background, the present study aims to document and analyze the diversity of medicinal plants sold in herbal markets across Karaj between 2018 and 2024. Specifically, the study records medicinal plant species through herbarium voucher specimens, documents vernacular names, plant parts used, preparation methods, and therapeutic applications, and applies quantitative ethnobotanical indices to assess patterns of use and agreement among informants. By integrating qualitative market observations with quantitative measures, this research situates Karaj within both national and global discussions on urban ethnobotany.

Based on previous ethnobotanical studies in Iran and other urban contexts, we formulated the following testable hypotheses:

- Medicinal plants used for digestive system disorders will exhibit the highest informant consensus, reflecting a stable and widely shared core of ethnomedicinal knowledge in urban markets.
- A limited number of plant families (particularly Asteraceae, Lamiaceae, Apiaceae, and Fabaceae) will account for a disproportionately large share of medicinal species and use reports.

- Native Iranian species will dominate the urban herbal market of Karaj, but a substantial proportion of cultivated and imported species will reflect market integration and changing consumer preferences.
- Quantitative indices such as relative frequency of citation and informant consensus factor will reveal structured, non-random patterns of medicinal plant use, indicating that urban herbal knowledge remains coherent rather than fragmented.

By testing these hypotheses, the study contributes robust quantitative evidence to Iranian ethnobotany and provides a framework for comparing urban herbal markets across regions and cultural contexts. Ultimately, documenting medicinal plant use in Karaj enhances our understanding of how traditional knowledge persists and adapts within rapidly changing urban environments.

## Materials and Methods

### Study area

This study was conducted in Karaj, the capital of Alborz Province, located approximately 20 km west of Tehran, Iran, at an elevation of about 1,350 m above sea level (Fig. 1). Karaj lies on the southern foothills of the Alborz Mountains and experiences a semi-arid climate with cold winters and hot, dry summers. According to the national census, Karaj hosts more than 1.9 million inhabitants and is characterized by rapid urban expansion and pronounced cultural diversity resulting from internal migration. The city hosts a heterogeneous network of traditional herbal stalls, long-established attari shops, and modern commercial outlets selling medicinal plant products.

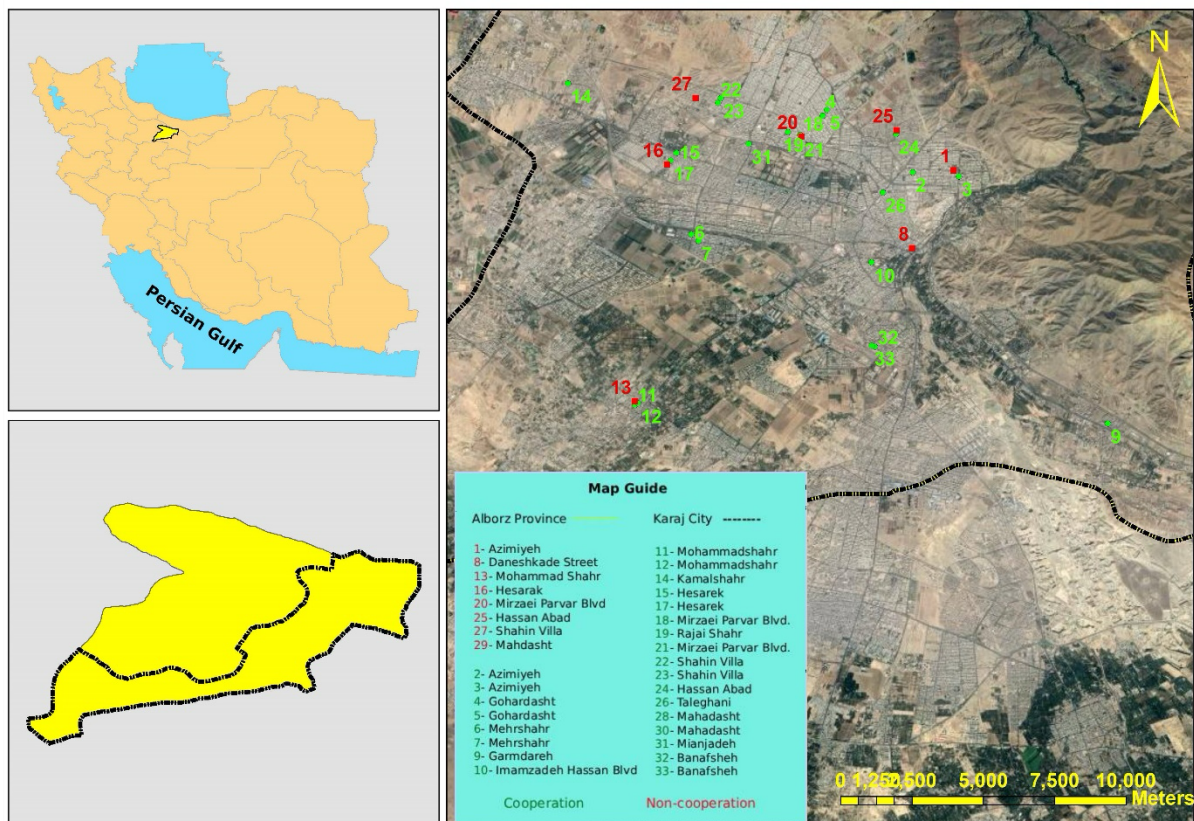


Figure 1. Location of Karaj city and the stores where the survey was conducted.

### Selection of participants

Participants were selected using a purposive sampling strategy, a standard approach in ethnobotanical research aimed at identifying individuals with relevant knowledge (Albuquerque *et al.* 2014). Herbal shop owners (attars), vendors, and experienced sellers were initially approached in each surveyed district. In addition, a snowball sampling method was applied, whereby interviewed participants recommended other knowledgeable individuals active in the herbal trade.

**Selection criteria included:**

- (i) Active involvement in the sale or preparation of medicinal plants,
- (ii) A minimum of three years of professional experience, and
- (iii) Willingness to participate voluntarily in the study.

Both herbalists and informed customers were included to capture perspectives from suppliers and users of medicinal plants in urban markets.

**Demographic characteristics of participants**

A total of 25 participants were interviewed during the study period. Of these, 23 were male and 2 were female. Participant ages ranged from 30 to 65 years, with a mean age of 50 years. Most herbalists reported long-term engagement in herbal trade, often exceeding ten years of experience. All participants provided prior informed consent, and interviews were conducted in accordance with ethical standards for ethnobotanical research.

**Data collection**

Fieldwork was conducted between 2018 and 2024 in 25 herbal outlets across 12 districts of Karaj. Semi-structured interviews were carried out using open-ended questions focusing on vernacular plant names, plant parts used, preparation methods, therapeutic applications, and patterns of demand. Interviews were conducted in Persian and recorded in written form. Market samples were purchased or donated by vendors specifically for botanical identification.

**Plant identification and voucher specimens**

A total of 186 medicinal plant samples were collected during the survey. For each taxon, voucher specimens were prepared, labeled, and assigned unique voucher numbers. Voucher specimens were deposited in the Herbarium of Tehran (Herbarium code: T), Kharazmi University, Tehran, Iran, where they are permanently stored and accessible for future reference. Voucher numbers corresponding to each taxon are provided in Table 1.

Plant identification was conducted using Flora Iranica (Rechinger 1963–2015), Flora of Iran (Assadi 1988–2024), and standard taxonomic keys (Mozaffarian 2013). Scientific names were verified and updated according to World Flora Online (WFO). Voucher numbers corresponding to each species are provided in Table 1.

**Data analysis**

Medicinal uses were classified into therapeutic categories following the Economic Botany Data Collection Standard (Cook 1995). Quantitative ethnobotanical indices, including frequency of citation (FC), relative frequency of citation (RFC), use reports (UR), and informant consensus factor (ICF), were calculated to evaluate patterns of medicinal plant use and agreement among informants. Data analysis was performed using Microsoft Excel and R software.

**Quantitative ethnobotanical analysis**

To evaluate the degree of agreement among informants and the relative importance of recorded medicinal plant species, quantitative ethnobotanical indices were applied, including the Informant Consensus Factor (ICF) and the Relative Frequency of Citation (RFC).

**Informant Consensus Factor (ICF)**

The Informant Consensus Factor (ICF) was calculated for each therapeutic category in order to assess the level of homogeneity in medicinal plant knowledge among informants. ICF values were computed using the following formula:

$$\frac{tN_{ur} - N}{N_{ur} - 1} = ICF$$

where:

$N_{ur}$  represents the total number of use reports for a given therapeutic category, and

$N_t$  denotes the number of taxa used for that category.

ICF values range from 0 to 1, with values approaching 1 indicating a high level of agreement among informants and a limited number of taxa used for treating a particular ailment, whereas lower values reflect a greater diversity of taxa and more heterogeneous treatment practices.

In the present study, ICF values varied considerably across therapeutic categories (Table 2). The highest ICF values were recorded for categories such as gastrointestinal disorders, respiratory ailments, and metabolic conditions, indicating strong consensus among informants and suggesting that a relatively small number of plant species are preferentially used for these health problems. In contrast, lower ICF values were observed in categories characterized by a broader spectrum of species and a higher diversity of reported uses, reflecting more individualized or less standardized treatment approaches.

Overall, high ICF values highlight culturally well-established medicinal uses, while lower values may point to experimental, supplementary, or less widely shared ethnomedicinal knowledge within the urban context of Karaj.

### Relative Frequency of Citation (RFC)

The relative importance of individual medicinal plant species was assessed using the Relative Frequency of Citation (RFC) index, calculated as:

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

where

FC is the number of informants who mentioned the use of a given species, and

N is the total number of informants participating in the survey.

RFC values range from 0 to 1, with higher values indicating species that are more frequently cited and therefore considered more important within local ethnomedicinal practices.

Several medicinal plant species exhibited notably higher RFC values compared to others (Table 1), reflecting their prominence in herbal markets of Karaj. These species are characterized by widespread availability, frequent recommendation by herbalists, and broad therapeutic applications. Conversely, species with lower RFC values were generally associated with more specialized uses or were cited by fewer informants.

The RFC analysis highlights a subset of key medicinal plants that play a central role in the urban herbal trade and may represent priority taxa for further pharmacological and conservation-oriented studies.

All taxa included in the quantitative analyses are supported by voucher specimens, with voucher numbers provided in Table 1, ensuring taxonomic reliability and reproducibility of the results.

### Visualizations

The visualizations were created using R version 4.3.1 with the ggplot2 package. Data visualization was performed using the tidyverse collection of packages for data manipulation and graphical representation.

## Results

### Species diversity

The study identified 186 species across 144 genera and 68 families. The most prevalent families were Asteraceae (10%), Lamiaceae (9%), Apiaceae (8%), and Fabaceae (7%). Fruits (24.9%) and seeds (16.9%) were the most commonly traded plant parts. The primary therapeutic uses were for digestive ailments (21.4%), immune support/general tonics (17.7%), respiratory issues (10.1%), and nervous system disorders (8.1%). Native species comprised 57% of the flora, with cultivated or imported species accounting for 33%.

Table 1. List of medicinal plant species documented in herbal markets of Karaj, with scientific name, vernacular name, family, plant part used, preparation method, and therapeutic application.

Family	Species	English name	Persian name	Voucher numbers	Useful part	RFC	Preparation	Uses
Acoraceae	<i>Acorus calamus</i> L.	Calamus	اگیر ترکی (Agir-e torki)	26455J	Roots	0.6	Decoction	Stomach tonic, anti-flatulent, cures rheumatic diseases
Amaryllidaceae	<i>Allium paradoxum</i> (M.Bieb.) G.Don	Leek	تره وحشی (Tareh Vahshi)	26580J	Aerial parts	0.4	Seasoning	Treating asthma, bronchitis and abdominal pain
Amaryllidaceae	<i>Allium stipitatum</i> Regel	Willd garlic	موسیر (Musir)	26590J	Bulbs	0.92	Seasonings and spices	Relieves indigestion, stimulates appetite and is antiseptic
Anacardiaceae	<i>Anacardium occidentale</i> L.	Cashew	بادام هندی (Badam-e Hendi)	26503J	Fruits	0.88	Snack	Astringent, tonic, digestive and anti-bilious
Anacardiaceae	<i>Mangifera indica</i> L.	Mango	انبه (Anbe)	26473J	Leaves	0.56	Herbal tea or powdered in water	Treating diabetes and regulating blood pressure
Anacardiaceae	<i>Pistacia atlantica</i> Desf.	Mount atlas pistachio	بنه (Bane)	26533J	Fruits	0.48	It is pounded for food and its oil used as a burn poultice.	Laxative, tonic and treatment of anemia
Anacardiaceae	<i>Pistacia vera</i> L.	Common pistachio	پسته (Peste)	26440J	Bark, fruits	0.82	Snack	Tonic, sedative and antidiarrheal
Anacardiaceae	<i>Rhus coriaria</i> L.	Sicilian sumac	سماق (Somagh)	26579J	Fruits	0.96	Seasoning	Cholesterol-lowering, anti-diabetic, anti-hypertensive, anti-diarrheal
Anacardiaceae	<i>Semecarpus anacardium</i> L.f.	Cashew nut	بلادر (Belador)	26459J	Fruits	0.32	Poultice	Tonic, eliminates bad foot odor
Apiaceae	<i>Anethum graveolens</i> L.	Dill	تخم شوید (Tokhm-e Shevid)	26470J	Fruits	0.88	Herbal tea and seasoning	Anti-lipidemic, analgesic, anti-inflammatory
Apiaceae	<i>Apium graveolens</i> L.	Celery	تخم کرفس (Tokhm-e Karafs)	26439J	Seeds	0.72	Herbal tea	Painkiller and diuretic
Apiaceae	<i>Coriandrum sativum</i> L.	Coriander	گشنیز (Geshniz)	26541J	Fruits	0.84	Herbal tea and seasoning	Appetizer, sedative, antiseptic and aromatic
Apiaceae	<i>Cuminum cyminum</i> L.	Cumin	زیره سبز (Zireh-e Sabz)	26500J	Fruits	0.8	Herbal tea	Anti-aging

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Apiaceae	<i>Elwendia persica</i> (Boiss.) Pimenov & Kljuykov	Caraway	زیره سیاه (Zireh-e Siyah)	26456J	Fruits	0.72	Tea and seasoning	Anti-obesity, anti-flatulence and indigestion, food flavoring
Apiaceae	<i>Eryngium billardierei</i> F.Delaroche	Eryngium	بوقناق (Bughnagh)	26543J	Fruits and roots	0.32	Decoction	Treatment of anemia, edema and kidney stones, constipation and anxiety
Apiaceae	<i>Falcaria vulgaris</i> Bernh.	Common falcaria	غازیاغی (Ghazyaghi)	26434J	Leaves and fruits	0.4	Decoction	Treatment of scars, cuts and wounds
Apiaceae	<i>Ferula ammoniacum</i> (D.Don) Spalik	Gum amoniacum	کندل (وشا) (Vasha)	26610J	Gum and root	0.64	Decoction	Appetizer, expectorant, anti-inflammatory of the bladder
Apiaceae	<i>Foeniculum vulgare</i> Mill.	Fennel	رازیانه (Razianeh)	26488J	Seeds or fruits	0.8	Herbal tea and decoction	Stimulant and tonic, antiparasitic, anti-cough, asthma and sore throat
Apiaceae	<i>Levisticum officinale</i> W.D.J.Koch	Lovage	انجدان رومی (Angedane Roomi)	26450J	Fruits	0.4	Herbal tea	Treatment of nervous diseases, heart tonic and indigestion
Apiaceae	<i>Oliveria decumbens</i> Vent.	Moshkoorak	تیغنگ (Tighonak)	26582J	Leaves and flowers	0.52	Extract	Relieves stomach discomfort, antimicrobial effects
Apiaceae	<i>Pimpinella anisum</i> L.	Anise	انیسون (Anison)	26482J	Fruits	0.64	Herbal tea	Treatment of flatulence, treatment of colic, anti-diarrhea
Apiaceae	<i>Trachyspermum ammi</i> Sprague	Bishop's weed	زنیان (Zenyan)	26567J	Fruits	0.6	Herbal tea	Strengthens the brain and spinal cord, relieves migraines and dizziness, treats diarrhea, and fights asthma.
Araliaceae	<i>Panax ginseng</i> C.A.Mey.	Jinseng	جنسینگ (Jinsing)	26479J	Roots	0.36	Decoction	Nerve tonic and indigestion treatment
Arecaceae	<i>Areca catechu</i> L.	Betel nut	فوفل (Fufel)	26576J	Seeds	0.44	Herbal tea	Antidiarrheal and stomach tonic
Aristolochiaceae	<i>Aristolochia rotunda</i> L.	Snakeroot	زراوند (Zaravand)	26449J	Tuber	0.48	Decoction and poultice	Diuretic, tonic and rheumatism treatment
Asparagaceae	<i>Drimia maritima</i> (L.) Stearn	Shore sea onion	عنصل (Onsol)	26544J	Bulbs	0.36	Poultice	Anti-arthritis, hair growth stimulant

Asphodelaceae	<i>Aloe vera</i> (L.) Burm.f.	Aloe vera	الوئه ورا (Aloe Vera)	26612J	Leaves	0.68	Poultice or food	Anti-obesity, anti-hemorrhoids, burn treatment
Asphodelaceae	<i>Eremurus spectabilis</i> M.Bieb.	Foxtail lily	سريش (Serish)	26445J	Roots	0.48	Decoction or powder	Treatment of skin infections and anti-lipidemia
Asteraceae	<i>Arctium lappa</i> L.	Burdock	بابا آدم (Baba Adam)	26574J	Roots and leaves	0.68	Decoction, ointment	Relieves gout, rheumatism and skin diseases, diuretic, lowers blood sugar and purifies the blood
Asteraceae	<i>Achillea millefolium</i> L.	Yarrow	بومادران (Bumadaran)	26489J	Aerial parts	0.88	Herbal tea	Anti-hemorrhoids, anti-diarrhea, lowers blood sugar, anti-inflammation of the intestines and indigestion, nerve
Asteraceae	<i>Anacyclus pyrethrum</i> (L.) Lag.	Pellitory	عاققرها (Aghergherha)	26552J	Roots	0.6	Herbal tea	Sciatica treatment and stuttering treatment
Asteraceae	<i>Anthemis cotula</i> L.	Stinking Chamomile	بابونه بدل (Babune Badal)	26611J	Flowers	0.8	Herbal tea	Anti-migraine, parasite removal, stomach and intestinal upset, anti-cough and hair strengthening
Asteraceae	<i>Artemisia dracunculus</i> L.	Tarragon	ترخون (Tarkhun)	26536J	Leaves	0.92	Herbal tea and seasoning	Appetizer, relieves body weakness, bloating, indigestion, gout, rheumatism, arthritis
Asteraceae	<i>Artemisia vulgaris</i> L.	Erio yarrow	برنجاسف (Baranjasef)	26573J	Flowers	0.44	Herbal tea and decoction	Nerve tonic
Asteraceae	<i>Calendula officinalis</i> L.	Calendula	همیشه بهار (Hamishe Bahar)	26512J	Flowers	0.88	Herbal tea and extract	Anti-eczema, treatment of skin disorders
Asteraceae	<i>Carthamus tinctorius</i> L.	Safflower	گرننگ (Golrang)	26469J	Flowers and seeds	0.84	Herbal tea and seasoning	Aphrodisiac, laxative and treatment of rheumatism
Asteraceae	<i>Centaurea behen</i> L.	Behen	بهمن سفید (Bahmane Sefid)	26487J	Roots	0.48	Decoction	Anti-kidney stone

Asteraceae	<i>Centaurea depressa</i> M.Bieb.	Cornflower	گل گندم (Gol-e Gandom)	26505J	Aerial parts	0.8	Decoction	Anti-cough and bronchitis, liver strengthening, anti-diabetic, antipyretic
Asteraceae	<i>Cichorium intybus</i> L.	Chicory	کاسنی (Kasni)	26563J	Aerial parts	0.76	Decoction	Digestive stimulant, diuretic, anthelmintic, liver disorder, treatment of palpitations, and anti-allergic
Asteraceae	<i>Cynara cardunculus</i> L.	Artichoke	کنگرفرنجی (Kangar Farangi)	26514J	Aerial parts	0.6	Herbal tea and decoction	Liver tonic, digestive, anti-jaundice and hepatitis
Asteraceae	<i>Gundelia tournefortii</i> L.	Gunera	کنگر (Kangar)	26471J	Young aerial parts	0.68	Cooked	Lung tonic and hepatitis treatment
Asteraceae	<i>Helichrysum graveolens</i> (M.Bieb.) Sweet	Everlasting	گل پی مرگ (Gol-e Bimarg)	26435J	Aerial parts	0.4	Herbal tea	Deworming, digestive and appetite stimulant
Asteraceae	<i>Lactuca sativa</i> L.	Lettuce	کاهو (Kahu)	26530J	Seeds	0.8	Raw	Anti-asthma, anxiety, palpitations, sleep aid
Asteraceae	<i>Matricaria chamomilla</i> L.	Willd chamomile	بابونه دشتی (Babooneh-e Dashti)	26600J	Flowers	0.76	Herbal tea	Cough and fever treatment
Asteraceae	<i>Stevia rebaudiana</i> (Bertoni) Bertoni	Stevia	شیرین برگ (Shirin Barg)	26460J	Leaves	0.56	Powder	Sugar and tonic treatment
Asteraceae	<i>Tagetes erecta</i> L.	Marigold	گل جعفری (Gol-e Jafari)	26551J	Flowers	0.4	Herbal tea	Fever reducer, treatment of wounds and cuts
Asteraceae	<i>Taraxacum spp.</i>	Dandelion	قاصدک (Ghasedak)	26604J	Flowers	0.64	Herbal tea and decoction	Lowering blood pressure, anti-cancer and treating digestive problems
Berberidaceae	<i>Berberis integerrima</i> Bunge	Barberry	زرشک کوهی (Zereshke Kuhi)	26497J	Fruits	0.24	Raw or cooked	Lowers blood sugar, antihypertensive, cleanses blood and liver, jaundice, reduces fever and is antifungal.
Betulaceae	<i>Corylus avellana</i> L.	Hazelnut	فندق (Fandogh)	26432J	Fruits	0.76	Raw	Treatment of anemia and appetite stimulant
Boraginaceae	<i>Cordia myxa</i> L.	Sebesten	سه پستان (Sepestan)	26477J	Fruits	0.68	Herbal tea	Antipharyngitis, antitussive, antipyretic, laxative

Boraginaceae	<i>Echium amoenum</i> Fisch. & C.A.Mey.	Oxtongue	گاوزبان ایرانی (Gavzaban-e Irani)	26496J	Flowers	0.76	Herbal tea	Antihypertensive, nervine, diuretic, anti-stress
Brassicaceae	<i>Alyssum spp.</i>	Sweet alyssum	قدومه شیرازی (Ghodum-e Shirazi)	26500J	Seeds	0.56	Soaked in water	Antitussive, antipyretic, laxative and hoarseness treatment
Brassicaceae	<i>Brassica napus</i> L.	Winter rape	شلغم (Shalgham)	26521J	Seeds	0.72	Oil	Antiseptic, cold treatment and tonic
Brassicaceae	<i>Descurainia sophia</i> (L.) Webb ex Prantl	Flixweed	خاکشیر (Khakshir)	26572J	Seeds	0.76	Soaked in water	Blood and liver cleanser, jaundice, fever reducer, itching treatment and laxative
Brassicaceae	<i>Eruca vesicaria</i> (L.) Cav.	Arugula	منداب (Mandab)	26491J	Seeds	0.36	Raw or flavored	Sedative, diuretic, laxative and stomach tonic
Brassicaceae	<i>Lepidium perfoliatum</i> L.	Madwort	قدومه شهری (Ghodume Shahri)	26504J	Seeds	0.4	Soaked in water	Antitussive, tonic and kidney stone breaker
Brassicaceae	<i>Lepidium sativum</i> L.	Cress	شاهی (Shahi)	26486J	Seeds	0.8	Soaked in water	Appetizer, antiparasitic, laxative and sore throat treatment
Brassicaceae	<i>Mutarda nigra</i> (L.) Benth.	Black mustard	خردل سیاه (Khardal-e Siyah)	26493J	Seeds	0.2	Powder or decoction	Laxative, seasoning, and as a poultice to relieve muscle pain
Brassicaceae	<i>Nasturtium officinale</i> W.T.Aiton	Watercress	علف چشمه (Alaf-e Cheshmeh)	26601J	Arial parts	0.64	Raw	Anti-diabetic and indigestion
Burseraceae	<i>Boswellia sacra</i> Fluek.	Oliban	کندر (Kondor)	26510J	Gum	0.56	Chewable	Memory booster
Burseraceae	<i>Commiphora myrrha</i> (T.Nees) Engl.	Guggul gum	مقل ازرق (Moghle Azragh)	26557J	Gum	0.2	Mix with water, drink and gargle	Anti-obesity, anti-flatulence, laxative and anti-gastric pain
Cannabaceae	<i>Cannabis sativa</i> L.	Hemp	شاهدانه (Shahdaneh)	26462J	Seeds	0.8	Raw	Sedative, tonic, arthritis treatment and earache treatment
Cannabaceae	<i>Humulus lupulus</i> L.	Hop	رازک (Razak)	26457J	Leaves	0.48	Herbal tea	Diuretic, insomnia treatment, kidney tonic, sedative and digestive

Capparaceae	<i>Capparis spinosa</i> L.	Caper	کور (Kavar)	26540J	Fruits and roots	0.24	Decoction	Liver tonic, anti-hepatitis, appetite stimulant, stomach tonic and anti-gout
Caprifoliaceae	<i>Nardostachys jatamansi</i> (D.Don) DC.	Indian valerian	سنبل الطيب (Sonbol-o Teyb)	26599J	Roots	0.72	Herbal tea	Treats insomnia, soothes, relieves headaches and heart palpitations
Colchicaceae	<i>Colchicum autumnale</i> L.	Colchicum	سورنجان (Suranjan)	26526J	Roots	0.68	Decoction	Sedative and anti-gout
Combretaceae	<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Belleric myrobalan	بلیله (Balileh)	26539J	Fruits	0.44	Decoction or powder	Blood purifier, appetite stimulant and laxative
Combretaceae	<i>Terminalia chebula</i> Retz.	Myrobalan	هليلة سیاہ (Halileh-e Siah)	26466J	Fruits	0.64	Decoction or powder	Treats constipation, strengthens the liver and fights hemorrhoids
Combretaceae	<i>Terminalia citrina</i> (Gaertn.) Roxb.	Double myrobalan	هليلة زرد (Halileh-e Zard)	26585J	Fruits	0.6	Decoction or powder	Anti-diarrheal and digestive
Convolvonaceae	<i>Cuscuta epithymum</i> (L.) L.	Small-Dodder	افتمون (Aftimun)	26531J	Aerial parts	0.42	Spice	Laxative and anti-hemorrhoid
Cucurbitaceae	<i>Citrullus colocynthis</i> (L.) Schrad.	Bitter apple	هندوانه ابوچهل (حنظل) (Hanzal)	26451J	Fruits and seeds	0.64	Powder	Painkiller, anti-constipation and laxative, and blood sugar reduction
Cupressaceae	<i>Juniperus sabina</i> L.	Sabine	ابهل (Abhal)	26586J	Fruits	0.44	Decoction	Diuretic, digestive and antiseptic
Cyperaceae	<i>Cyperus rotundus</i> L.	Nutgrass	سعد کوفی (Soade Kufi)	26615J	Roots	0.36	Decoction	Memory enhancement
Elaeagnaceae	<i>Elaeagnus angustifolia</i> L.	Russian Olive	سنجد (Senjed)	26537J	Fruits	0.76	Raw or powder	Treatment of rheumatism, anti-diarrhea
Ephedraceae	<i>Ephedra foeminea</i> Forssk.	Jointfir	خاکسترکشتار (Khakestar Koshtar)	26578J	Aerial parts	0.28	Decoction	Joint pain treatment
Equisetaceae	<i>Equisetum arvense</i> L.	Horsetail	دم اسب (Domeasb)	26453J	Aerial parts	0.42	Decoction	Treatment of obesity, antihypertensive, prostate and kidney disorders
Euphorbiaceae	<i>Ricinus communis</i> L.	Castor bean	کرچک (Karchak)	26444J	Seeds	0.48	Oil	Laxative, anti-constipation

Fabaceae	<i>Alhagi maurorum</i> Medik	Camel thorn	خارشتر (Khar Shotor)	26575J	Aerial parts	0.68	Oral and topical	Appetite suppressant, diuretic, anti-jaundice and antipyretic
Fabaceae	<i>Astragalus fasciculifolius</i> Boiss.	Sarcocola	انزروت (Anzerut)	26515J	Gum	0.64	Chewable	Antitussive, laxative
Fabaceae	<i>Astragalus hamosus</i> L.	Milk vetch	ناخنک (Nakhonak)	26548J	Fruits	0.68	Fruits	Painkiller, kidney stone removal, diuretic
Fabaceae	<i>Cassia fistula</i> L.	Purging cassia	فلوس (Folus)	26441J	Fruits	0.6	Decoction	Laxative and laxative
Fabaceae	<i>Ceratonia siliqua</i> L.	Carob	خرنوب (Kharnub)	26516J	Fruits	0.56	Herbal tea	Treats shortness of breath, allergies, eliminates lung swelling
Fabaceae	<i>Chamaecrista absus</i> (L.) H.S.Irwin & Barneby	Paternoster	چشوم، چیشام (Cheshom)	26475J	Seeds	0.4	Poultice, seed husk powder	Anti-cough, anti-obesity and analgesic
Fabaceae	<i>Cicer arietinum</i> L.	Chickpea	نخود (Nokhod)	26542J	Fruits	0.96	Powder	Diuretic, aphrodisiac, anthelmintic
Fabaceae	<i>Glycine max</i> (L.) Merr.	Soybean	سویا (Soya)	26589J	Seeds	0.92	Snacks and powder	Treatment of rheumatism and gout
Fabaceae	<i>Glycyrrhiza glabra</i> L.	Licorice	شیرین بیان (Shirin Bayan)	26437J	Roots	0.6	Decoction and extract	Antitussive, tonic, treatment of stomach ulcers, treatment of hypotension and anemia
Fabaceae	<i>Medicago sativa</i> L.	Alfalfa	تخم یونجه (Yunjeh)	26591J	Aerial parts	0.68	Herbal tea and decoction	Appetizer, tonic, anti-osteoporosis
Fabaceae	<i>Melilotus officinalis</i> Pall.	Yellow sweet clover	اکلیل الملک (Aklil Almolk)	26583J	Aerial parts and seeds	0.56	Decoction	Analgesic, anti-inflammatory, diuretic, anti-flatulent and antispasmodic
Fabaceae	<i>Robinia pseudoacacia</i> L.	Black locust	اقاقیا (Aghaghia)	26502J	Flowers, bark and leaves	0.56	Herbal tea	Diuretic, astringent, sedative and antispasmodic
Fabaceae	<i>Senegalia senegal</i> (L.) Britton	Gum Arabic	صمغ عربی (Samgh-e Arabi)	26452J	Gum	0.4	Edamame and syrup, water soluble	Anti-cough, stomach ulcer, anti-inflammatory
Fabaceae	<i>Senna alexandrina</i> Mill.	Senna	سنا (Sena)	26587J	Leaves	0.6	Herbal tea	Anti-obesity and hemorrhoid treatment
Fabaceae	<i>Tamarindus indica</i> L.	Tamarind	تمرهندی (Tamr-e Hendi)	26569J	Fruits	0.76	Seasoning	Jaundice, depression and anti-acne

Fabaceae	<i>Trigonella foenum-graecum</i> L.	Fenugreek	شنبليله (هلبه) (Shanbalileh, Holbeh)	26519J	Seeds	0.8	Herbal tea and decoction	Treatment of diabetes, bronchitis, osteoporosis, anti-lipidemia, tonic and treatment of anemia
Fagaceae	<i>Quercia</i> spp.	Oak	بلوط (مازو) (Balut)	26507J	Fruits	0.6	Raw or cooked	Antidiarrheal
Fagaceae	<i>Quercus infectoria</i> Oliv.	Green Oak	مازوسبز (Mazuye sabz)	26474J	Flowers	0.4	Raw or cooked	Treatment of mouth ulcers, hemorrhoids. Stops bleeding, relieves diarrhea and treats cracked skin.
Grossulariaceae	<i>Ribes</i> spp.	Currant	غرقات (ترشک) (Ghareh Ghat)	26613J	Fruits	0.32	Raw or decoction	Antihypertensive, diabetic and blood purifier
Hypericaceae	<i>Hypericum scabrum</i> L.	Goatweed	هوفاریقون (Hofarighun)	26517J	Flowers	0.64	Herbal tea	Anti-migraine, stomach ulcer, headache treatment
Iridaceae	<i>Crocus sativus</i> L.	Saffron	زعفران (Zaafaran)	26581J	Stigma	0.88	Herbal tea and seasoning	Tonic, treatment of menstrual pain, neuropathic, treatment of stomach ulcers
Iridaceae	<i>Iris spuria</i> L.	Iris	زنبق (Zanbagh)	26570J	Roots	0.48	Herbal tea	Joint pain relief and diuretic
Juglandaceae	<i>Juglans regia</i> L.	Walnut	گردو (Gerdu)	26549J	Bark and leaves	0.92	Herbal tea and decoction	Blood purifier, tonic, anti- hair loss, wound, anti- diarrhea
Lamiaceae	<i>Lallemantia royleana</i> Benth.	Dragonhead	بالنگوی شیرازی (Balanguy_e Shirazi)	26602J	Seeds	0.6	Soaked in water	Stomach ulcers, cough suppressant, laxative, hoarseness
Lamiaceae	<i>Lavandula angustifolia</i> Mill.	English lavender	اسطوخودوس (Ostokhodus)	26476J	Aerial parts	0.76	Herbal tea	Treatment of insomnia, treatment of colds, tonic for nerves and heart
Lamiaceae	<i>Lavandula stoechas</i> L.	Spanish lavender	چای کوهی (Chai Kuhi)	26520J	Flowers	0.68	Herbal tea	Nerve tonic, cold treatment
Lamiaceae	<i>Marrubium vulgare</i> L.	Horehound	فراسیون (Ferasion)	26522J	Aerial parts	0.6	Extract	Liver tonic and anti-cough
Lamiaceae	<i>Melissa officinalis</i> L.	Madwort	بادرنجبویه (Badranjbuyeh)	26468J	Leaves	0.72	Herbal tea	Strengthens the heart, anti- stress, headache, depression, asthma, cough

Lamiaceae	<i>Mentha × piperita</i> L.	Peppermint	نعناع فلفلی (Naana)	26547J	Aerial parts	0.6	Herbal tea	Relieves diarrhea, gastritis, nausea, relieves seizures, stomach tonic, diuretic, flatulence, stomach ulcers, asthma, bronchitis, nervous weakness, insomnia, tremors and anxiety
Lamiaceae	<i>Mentha longifolia</i> (L.) L.	Willd mint	پونه (Puneh)	26565J	Aerial parts	0.8	Herbal tea	Antiparasitic, analgesic, antidiarrheal and digestive
Lamiaceae	<i>Nepeta</i> sp.	Mountain sage	گل ارونه (Arvane)	26535J	Aerial parts	0.64	Herbal tea	Anti-flatulent and anti-rheumatic
Lamiaceae	<i>Ocimum basilicum</i> L.	Basil	ریحان، تخم شربتی (Reyhan)	26562J	Seeds	0.68	Herbal tea and syrup	Cough treatment, aphthous ulcers, antiseptic, antidiarrheal, analgesic, laxative, digestive
Lamiaceae	<i>Origanum vulgare</i> L.	Oregano	مرزنجوش (مرزنگوش) (Marzanjush)	26596J	Aerial parts	0.56	Herbal tea	Treatment of sinusitis, sedative, cardiogenic and nervine, and treatment of shortness of breath
Lamiaceae	<i>Salvia macrosiphon</i> Boiss.	Wild sage	کنوچه، مروه (Kenocheh)	26595J	Seeds	0.52	Raw or decoction	Anti-cough, fever, stomach ulcers, sore throat and laxative
Lamiaceae	<i>Salvia officinalis</i> L.	Sage	مریم گی (Maryam goli)	26501J	Aerial parts	0.68	Herbal tea and decoction	Sedative, anti-flatulent and blood sugar lowering
Lamiaceae	<i>Salvia rosmarinus</i> Schleid.	Rosemary	رزماری (Rozmari)	26597J	Leaves and flowers	0.76	Herbal tea	Treatment of joint pain, hair loss, antidepressant, nervine, appetite stimulant and hypnotic
Lamiaceae	<i>Stachys inflata</i> subsp. <i>caucasica</i> (Stschegl.) Takht.	Poulk	پولک (Pulk)	26481J	Area; parts	0.52	Herbal tea	Against lung infections, sinusitis, asthma and rheumatism
Lamiaceae	<i>Stachys lavandulifolia</i> Vahl	Wood betony	چای کوهی (Chay-e Kuhi)	26553J	Flowers	0.64	Herbal tea	Nerve and heart tonic, treatment for colds
Lamiaceae	<i>Teucrium polium</i> L.	Poley Gamander	مریم نخودی (کلیپوره) (Kalpure)	26532J	Aerial parts	0.8	Herbal tea	Treats indigestion, diabetes, and anti-diarrhea

Lamiaceae	<i>Thymus kotschyanus</i> Boiss. & Hohen.	Kotschyan Thyme	آویشن (Avishan)	26545J	Flowering branches	0.88	Herbal tea and decoction	Antitussive, anticonvulsant, disinfectant
Lamiaceae	<i>Vitex agnus-castus</i> L.	Caste tree	فلفل سفید (بری، پنج انگشت) (Felfel sefid)	26438J	Fruits	0.6	Decoction	Remedy for menstrual problems
Lamiaceae	<i>Zataria multiflora</i> Boiss.	Zaatar	آویشن شیرازی (Avishan-E Shirazi)	26560J	Aerial parts	0.8	Herbal tea and decoction	Cold and cough, sinusitis treatment, anti-asthma and shortness of breath
Lamiaceae	<i>Ziziphora tenuior</i> L.	Ziziphora	کاکوتی (Kakuti)	26614J	Aerial parts	0.68	Herbal tea	Digestive, antiseptic
Lauraceae	<i>Cinnamomum verum</i> J.Presl	Cinnamon	دارچین (Darchin)	26461J	Bark	0.96		Headache treatment, sedative, flavoring, blood sugar lowering
Lauraceae	<i>Laurus nobilis</i> L.	Bay	برگ بو (Barg-e Boo)	26483J	Leaves	0.84	Herbal tea and decoction	Soothing, appetizing, flavorful
Liliaceae	<i>Polygonatum orientale</i> Desf.	Shakakul	شقاقل ایرانی، مهرسلیمان شرقی (Shaghaghhol-e irani)	26577J	Roots	0.32	Herbal tea	Blood vessel opener
Lythraceae	<i>Lawsonia inermis</i> L.	Henna	حنا (Hana)	26454J	Leaves	0.8	Herbal tea and poultice	Treats headaches, strengthens hair, is antifungal and antiseptic
Lythraceae	<i>Punica granatum</i> L.	Pomegranate	گنار (Golnar)	26558J	Flowers, roots and Bark	0.76	Herbal tea	Antihypertensive
Malvaceae	<i>Helicteres isora</i> L.	Screwtree	بهمن پیچ (Bahman pich)	26458J	Fruits	0.36	Decoction	Astringent and anti-flatulent
Malvaceae	<i>Hibiscus syriacus</i> L.	Hollyhock	ختمی (Khatmi)	26538J	Flowers and roots	0.84	Herbal tea	Diuretic, antiseptic, heals skin injuries and wounds
Malvaceae	<i>Malva sylvestris</i> L.	Common mallow	پنیرک (Panirak)	26556J	Fruits and leaves	0.76	Herbal tea	Anti-pest, antipyretic, anti-cough, laxative, anti-ulcer and wound healing
Moraceae	<i>Ficus benghalensis</i> L.	Gomme-e laque	لاک مغسول (Lak-e Maghsool)	26484J	Gum	0.32	Powder	Tonic, astringent

Myristicaceae	<i>Myristica fragrans</i> Houtt.	Nutmeg	جوز بویا (Joz-e Buya)	26464J	Seeds	0.6	Decoction	Tonic and appetizing
Myrtaceae	<i>Eucalyptus spp.</i>	Eucalyptus	اکالیپتوس (Okaliptus)	26523J	Fruits and leaves	0.68	Incense	Sinusitis treatment, cold and headache treatment
Myrtaceae	<i>Myrtus communis</i> L.	Myrtle	مورد (Murd)	26495J	Fruits and leaves	0.68	Decoction	Psoriasis treatment, sinusitis treatment, mouth ulcers, antifungal
Myrtaceae	<i>Syzygium aromaticum</i> (L.) Merr. & L.M.Perry.	Clove	میخک (Mikhak)	26534J	Flowers	0.76	Herbal tea	Disinfectant, digestive, anti-herpes
Nitrariaceae	<i>Peganum harmala</i> L.	Harmel	اسپند (Espand)	26546J	Seeds	0.84	Smoking	Soothing, disinfectant
Nymphaeaceae	<i>Nymphaea alba</i> L.	Water lily	نیلوفر آبی (Nilufar-e Abi)	26564J	Flowers	0.6	Decoction and extract	Expectorant, hypnotic, antitussive and sedative
Oleaceae	<i>Olea europaea</i> L.	Olive	زیتون (Zeytun)	26605J	Fruits and leaves	0.8	Decoction	Lowers blood pressure and sugar, laxative and tonic
Orchidaceae	<i>Anacamptis morio</i> (L.) R.M.Bateman, Pridgeon & M.W.Chase	Hypnotic root	ثعلب قلوه (Saalab-e Gholvei)	26528J	Roots	0.6	Herbal tea	Strengthens the heart, joints and bones, induces sleep
Orchidaceae	<i>Dactylorhiza incarnata</i> subsp. <i>cilicica</i> (Klinge) H.Sund.	Salp Orientale	ثعلب پنجه (Saalab-e Panjei)	26472J	Roots	0.36	Herbal tea and powder	Tonic
Papaveraceae	<i>Chelidonium majus</i> L.	Celandine	مامیران (Mamiran)	26518J	Aerial parts	0.52	Herbal tea and decoction	Lowers blood pressure, purifies blood, expels worms, diuretic and laxative
Papaveraceae	<i>Fumaria vaillantii</i> Loisel.	Willd fumitory	شاتره (Shatare)	26448J	Seeds, fruits and aerial parts	0.76	Decoction	Blood purifier, relieves skin itching
Papaveraceae	<i>Papaver rhoeas</i> L.	Corn poppy	شقایق (Shaghayegh)	26499J	Flowers	0.72	Herbal tea	Sedative, anti-insomnia, anti-cough and anti-asthma
Papaveraceae	<i>Papaver somniferum</i> L.	Opium poppy	خشخاش (Khashkhash)	26524J	Seeds	0.72	Powder	Analgesic, laxative, tonic and hypnotic
Pedaliaceae	<i>Sesamum indicum</i> L.	Sesame	کنجد (Konjed)	26509J	Seeds	0.88	Raw or oil	Anti-hair loss, memory enhancement, treatment of cracked skin and laxative
Phyllanthaceae	<i>Phyllanthus emblica</i> L.	Myrobalan	آمله (عاقله) (Agheleh)	26508J	Fruits	0.52	Powder or decoction	Appetizer, heart tonic and hair strengthening

Piperaceae	<i>Piper cubeba</i> L.f.	Cubebs	كبابه (Kababe)	26467J	Fruits	0.48	Spice	Appetizer, tonic and sedative
Piperaceae	<i>Piper nigrum</i> L.	Black pepper	فلفل سیاه (Felfel-e Siah)	26568J	Fruits	1	Spice	Stimulant, tonic, appetizing and flavorful
Plantaginaceae	<i>Plantago ovata</i> Forssk.	Great plantain	بارهنگ، اسفرزه (Barhang)	26433J	Seeds and leaves	0.86	Herbal tea and syrup	Anti-eczema, anti-allergy, fever, jaundice, anti-cough, anti-diarrhea and stomach ulcers
Poaceae	<i>Cymbopogon citratus</i> (DC.) Stapf	Lemon grass	علف لیمو (Alaf-e Limoo)	26480J	Aerial parts	0.24	Herbal tea	Treating fever, cough, cold, stress and strengthening the immune system
Poaceae	<i>Cynodon dactylon</i> (L.) Pers.	Bermuda grass	مرغ (Margh)	26550J	Rhizome	0.56	Decoction	Diuretic, hemorrhoid treatment, blood purifier, kidney stones and obstruction of liver and spleen ducts
Poaceae	<i>Oryza sativa</i> L.	Rice bran	سبوس برنج (Sabus-e Berenj)	26559J	Seed cover	0.64	Herbal tea and flavorings	Hair strengthener, anemia treatment, anti-diarrhea
Poaceae	<i>Panicum miliaceum</i> L.	Millet	ارزن (Arzan)	26443J	Seeds	0.8	Powder	Diuretic, astringent, rheumatism treatment
Poaceae	<i>Zea mays</i> L.	Corn	ذرت (Zorrat)	26566J	Cobs	0.84	Herbal tea	Anti-cystic, rheumatism, obesity, anti-inflammatory, kidney disorders, and diuretic
Polygonaceae	<i>Polygonum aviculare</i> L.	Knotgrass	علف هفت بند (Alaf-e Haftband)	26442J	Aerial parts	0.6	Decoction	Anti-diabetic, anti-diarrheal
Polygonaceae	<i>Rheum palmatum</i> L.	Rhubarb	ریوند چینی (Rivand-e Chini)	26588J	Roots	0.4	Raw or cooked	Liver diseases, heart tonic, kidney problems, back pain, appetite stimulant
Polygonaceae	<i>Rheum ribes</i> L.	Conglomer dock	ریواس (Rivas)	26555J	Fruits and leaflets	0.44	Raw or cooked	Cardiotonic, relieves mouth ulcers, and is an antidepressant.
Polypodiaceae	<i>Polypodium vulgare</i> L.	Common polypody	بسپایک (Baspayak)	26592J	Roots	.016	Decoction, powder and ointment	Relieves indigestion, is expectorant and anti-jaundice

Primulaceae	<i>Embelia ribes</i> Burm.f.	Mugwort	برنگ کابلی (Berang-e kaboli)	26598J	Fruits	0.12	Powder	Antiparasitic and laxative
Pteridaceae	<i>Adiantum capillus-veneris</i> L.	Maidenhair	پرسیاوشان (Parsiavashan)	26603J	Aerial parts	0.68	Herbal tea	Anti-cough, anti-hemorrhoid, sore throat treatment, antipyretic, laxative
Ranunculaceae	<i>Nigella sativa</i> L.	Black cumin	سیاه دانه (Siahdaneh)	26529J	Seeds	0.96	Spices and flavorings	Anti-kidney stones, anti-acid, digestion, anti-cough, preventing gray hair
Rhamnaceae	<i>Ziziphus jujuba</i> Mill.	Jujube	عنانب (Annab)	26607J	Fruits	0.92	Decoction	Blood purifier, antipyretic, laxative, antitussive
Rosaceae	<i>Cydonia oblonga</i> Mill.	Quince	به دانه (Behdaneh)	26463J	Seeds and leaves	0.8	Herbal tea and decoction	Treatment of burns, frostbite, softening of the airways and cough
Rosaceae	<i>Prunus avium</i> (L.) L.	Bird cherrt	گیلاس (Gilas)	26485J	Fruit's stem	0.8	Herbal tea	Treatment of urinary tract and kidney disorders
Rosaceae	<i>Rosa × damascena</i> Mill.	Damask rose	گل سرخ (گل محمدی) (Gol-e Sorkh)	26431J	Flowers	1	Decoction and syrup	Anti-sore throat, runny nose, digestive tract swelling, anti-hemorrhoid, laxative and sedative
Rosaceae	<i>Rosa beggeriana</i> Schrenk ex Fisch. & C.A.Mey.	Dog rose	نسترن (Nastaran)	26594J	Fruits	0.88	Decoction	Antihypertensive, diuretic and anti-kidney stone
Rosaceae	<i>Rosa foetida</i> Herrm.	Persian yellow rose	گل زرد (Gol-e Zard)	26554J	Flowers	0.76	Herbal tea	Tonic
Rubiaceae	<i>Cinchona officinalis</i> L.	Cinchona	گنه گنه (Gane Gane)	26525J	Leaves	0.6	Decoction and powder	Treating joint pain, reducing fever
Rubiaceae	<i>Coffea arabica</i> L.	Coffee	قهوه (Ghahve)	26593J	Seeds	0.88	Herbal tea	Obesity treatment, anti-diarrhea
Rubiaceae	<i>Rubia tinctorum</i> L.	Madder	روناس (Ronas)	26478J	Roots	0.76	Herbal tea and decoction	Diuretic and tonic
Rutaceae	<i>Citrus × aurantium</i> L.	Bitter orange	بهار نارنج (Bahar Narenj)	26527J	Flowers	0.8	Herbal tea	Anti-stress, heart tonic, digestion and high blood pressure
Rutaceae	<i>Citrus medica</i> L.	Citron	بالنگ (Balang)	26571J	Seeds	0.84	Raw or in the form of jam	Disinfectant and bile reducer

Rutaceae	<i>Ruta graveolens</i> L.	Rue	سداب (Sodab)	26446J	Aerial parts	0.76	Decoction	Soporific
Salicaceae	<i>Salix aegyptiaca</i> L.	Aegyptian willow	بیدمشک (Bidmeshk)	26498J	Flowers	0.72	Herbal tea	Sedative, heart tonic
Santalaceae	<i>Santalum album</i> L.	Santalum	صندل (Sandal)	26492J	Woods	0.68	Herbal tea and decoction	Diuretic, antipyretic, treats diarrhea and relieves headaches
Scrophulariaceae	<i>Digitalis purpurea</i> L.	Lady's glove	گل انگشتانه (Gol-e Angoshtane)	26447J	Flowers	0.4	Herbal tea	Heart tonic
Scrophulariaceae	<i>Scrophularia striata</i> Boiss.	Striata	مخلصة (Mokhalasse)	26584J	Flowers	0.32	Herbal tea and extract	Strengthening the immune system, improving digestion, treating migraines, relieving menstrual pain, and treating anemia
Solanaceae	<i>Alkekengi officinarum</i> Moench.	Winter cherry	عروسک پشت پرده (Aroosak-e Poshte Pardeh)	26490J	Fruits	0.6	Raw	Kidney stone treatment, blood purification
Solanaceae	<i>Capsicum annuum</i> L.	Chilli pepper	فلفل قرمز (Felfel Ghermez)	26609J	Fruits	1	Herbal tea and spices	Appetizer, spice, treatment of osteoporosis, tonic
Solanaceae	<i>Datura stramonium</i> L.	Thorn apple	تاتوره (Tature)	26561J	Seeds	0.76	Raw	Sedative
Solanaceae	<i>Hyoscyamus niger</i> L.	Henbane	بنگ دانه (Bang Daneh)	26494J	Seeds	0.64	Herbal tea and powder	Sedative, toothache treatment, headache treatment and anti-gout
Solanaceae	<i>Solanum americanum</i> Mill.	Wonderberry	تاج ریزی (Tajrizi)	26436J	Fruits	0.36	Decoction	Arthritis treatment, sleeping pills, sedatives and gastritis treatment
Theaceae	<i>Camellia sinensis</i> (L.) Kuntze	Green Herbal tea	چای سبز (Chai-e Sabz)	26513J	Leaves	0.92	Herbal tea and ointment	Anti-hypertensive, hepatitis, anti-lipidemic
Urticaceae	<i>Urtica dioica</i> L.	Nettle	گزنه (Gazaneh)	26465J	Flowers	0.84	Herbal tea	Antidiarrheal, tonic and antiseptic, reduces blood sugar, anemia, anti-inflammatory and digestive
Violaceae	<i>Viola odorata</i> L.	Violet	بنفشه (Banafsheh)	26506J	Flowers	0.76	Herbal tea and syrup	Anti-constipation, eczema, antipyretic, anti-allergic,

								blood purifier, jaundice, cold treatment and expectorant
Zingiberaceae	<i>Alpinia officinarum</i> Hance.	Galangal	قولنجان، خولنجان (Kholanjan)	26511J	Roots	0.76	Decoction	Rheumatism treatment, tonic, sedative, digestive
Zingiberaceae	<i>Amomum subulatum</i> Roxb	Nepal cardamom	هل باد (Hele Bad)	26606J	Fruits	0.8	Herbal tea	Painkiller, flavoring

Asteraceae (10%) and Lamiaceae (9%) are the most represented families among the medicinal species sold in Karaj markets, followed by Apiaceae (8%), and Fabaceae (7%). Together these four families account for roughly one-third of the documented medicinal flora, reflecting a common pattern in Iranian and regional ethnobotanical studies where herbaceous and aromatic families dominate traditional remedies. Several other families (Brassicaceae, Anacardiaceae, Poaceae, Solanaceae, Rosaceae, and Papaveraceae) contribute smaller but notable shares. Figure 2 shows the percentage of each family's contribution. The relatively high representation of Asteraceae and Lamiaceae likely reflects both ecological abundance and the pharmacological versatility of these families (digestive, respiratory, and nervous system uses), while Fabaceae and Apiaceae contribute many species used as tonics, digestive aids, and spices. Remaining families are represented by a few specialist taxa, including cultivated or imported species, underscoring the mixed origin (wild and cultivated) of urban herbal supplies.

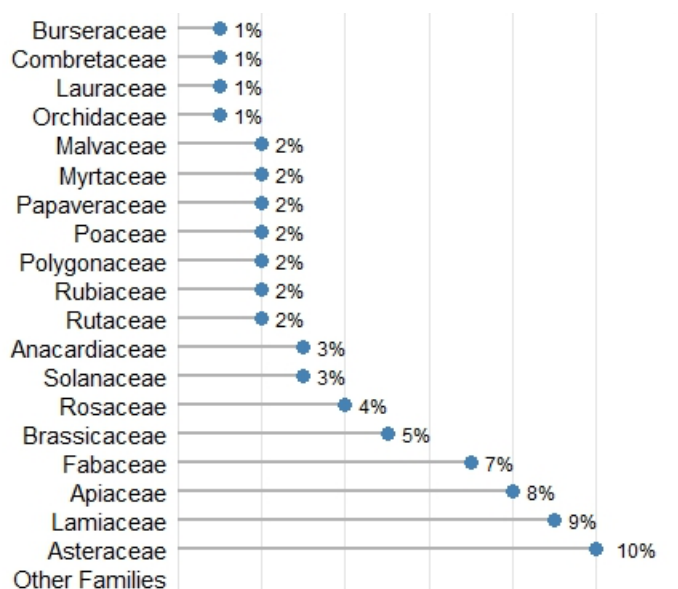


Figure 2. Percentage distribution of medicinal plant species by botanical family recorded in herbal markets of Karaj, Iran (n = total unique species). Families are ordered left to right by descending percentage; minor families (singletons) are combined under "Other" in the figure for clarity.

Medicinal uses reported by herbalists and shopkeepers were classified according to the principal therapeutic system affected. Following Cook (1995) and widely used ethnobotanical standards, each reported use was grouped into one of ten categories representing major physiological systems or general health functions. This classification provides an overview of the primary health concerns addressed by medicinal plants in Karaj and facilitates comparison with other regional and international ethnobotanical studies (Table 2).

Table 2. Therapeutic categories of medicinal plants marketed in Karaj, Iran, with corresponding codes and representative examples of health indications (Some species are counted in two or more codes).

Code	Therapeutic Category	Count	ICF	Example
DIG	Digestive system	74	0.33	Stomachache, bloating, dyspepsia, diarrhea, constipation, bile regulation
RES	Respiratory system	35	0.17	Cough, asthma, bronchitis, sore throat, cold
DER	Dermatological	24	0.15	Wound healing, burns, skin diseases, eczema
URIN	Urinary / Reproductive	17	0.16	Diuretic, kidney, bladder, menstruation, fertility
CAR	Cardiovascular	26	0.19	Heart, blood pressure, cholesterol
NER	Nervous system / Mental health	28	0.21	Sedative, relaxant, sleep aid, memory
MET	Metabolic / Endocrine	23	0.21	Diabetes, blood sugar, obesity, metabolism
IMM	Immune / General tonic	61	0.19	Tonic, strengthener, immune booster
ANT	Antimicrobial / Antiparasitic	17	0.20	Antiseptic, antibacterial, antifungal, febrifuge
OTH	Other / Undefined	40	0.28	Anti-inflammatory, analgesic, cancer, general use

The frequency distribution of therapeutic categories (Figure 3) shows that plants used for digestive system disorders were the most prevalent, accounting for over one-fifth (21.4%) of all therapeutic use-mentions. This was followed by remedies for immune function and general tonics (17.7%), and those for nervous system/mental health (8.1%) and cardiovascular conditions (7.5%). Respiratory (10.1%), dermatological (7.0%), metabolic/endocrine (6.7%), and urinary/reproductive (4.9%) applications were also significant. Categories related to antimicrobial/antiparasitic use (4.9%) and other undefined purposes (11.6%) completed the profile. These results indicate that gastrointestinal ailments and general wellness tonics remain central to urban herbal medicine in Karaj, reflecting patterns observed across Iran.

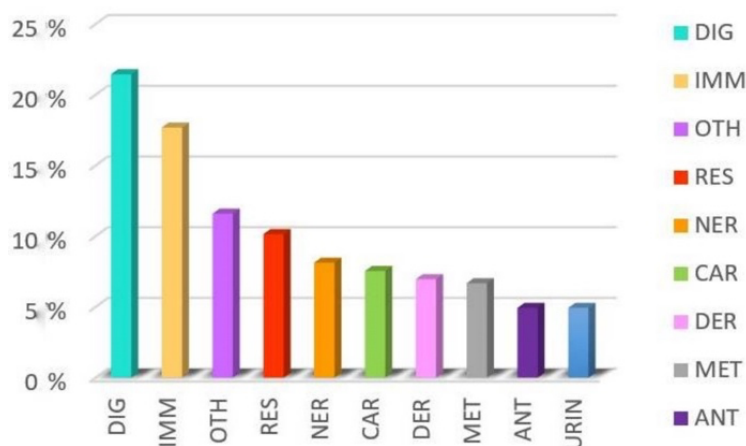


Figure 3. Proportional representation (%) of therapeutic categories of medicinal plants documented in the herbal markets of Karaj, Iran.

#### Plant parts used

Among the recorded medicinal plants, fruits represented the most frequently used plant parts (24.9%), followed by seeds (16.9%), aerial parts (15.3%), leaves (10.1%), roots (9.5%), and flowers (5.5%). Gums and resins together accounted for about 3% of all recorded uses. A few preparations involved combinations of parts such as fruits and leaves. These findings indicate that reproductive and above-ground organs dominate the herbal trade in Karaj, reflecting practical preferences for plant materials that are easier to harvest, store, and process. Figure 4 illustrates the proportional distribution of plant parts used in medicinal preparations sold in the city's herbal markets, emphasizing the predominance of fruits and seeds in local ethnomedical practices.

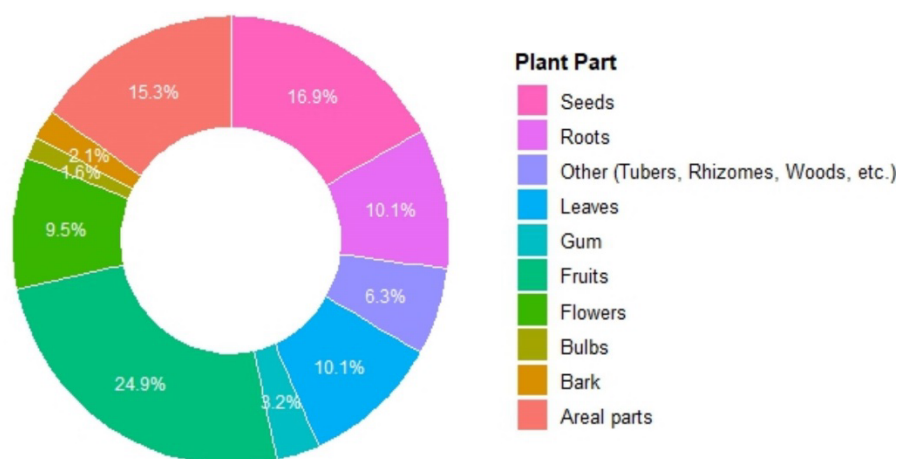


Figure 4. Percentage distribution of plant parts used in medicinal plant preparations sold in herbal markets of Karaj, Iran.

Of the 186 medicinal plant species documented in Karaj markets, the majority (57%) are native to Iran. A significant portion (33%) are imported or cultivated within the country, while a smaller proportion (10%) are classified as introduced species. This distribution underscores the substantial reliance on Iran's indigenous flora, complemented by a considerable volume of non-native plants supplied through trade and cultivation to meet market demands. Figure 5 shows the percentage of geographical origin of the studied species.

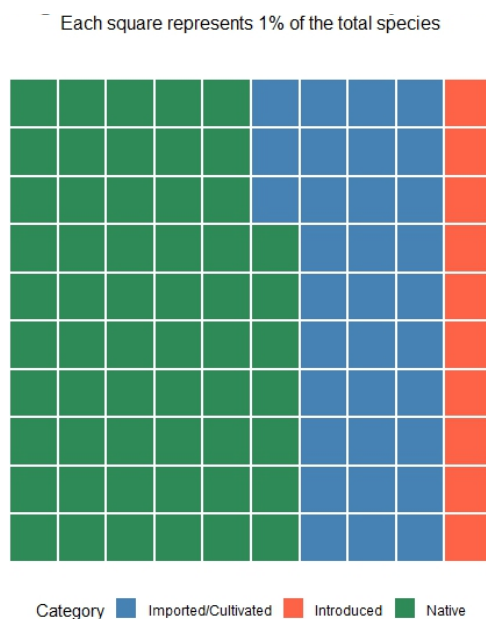


Figure 5. Distribution of 186 medicinal plant species by geographical origin. Data reflects market inventory in Karaj, Iran.

### Market types

Medicinal plants were marketed through three main types of establishments:

- Traditional stalls in local bazaars, offering small assortments of common species.
- Long-established herbal shops (attari), carrying a broader selection, often with specialized knowledge transmitted across generations.
- Modern outlets, where packaged products, herbal teas, and essential waters were predominant.

While overlap in species was considerable, some plants and preparations were specific to certain market types. Traditional stalls focused on a core set of widely used species, whereas modern outlets introduced packaged blends and imported herbal items.

### Discussion

This study documents a high diversity of medicinal plants traded in the urban herbal markets of Karaj and provides a quantitative evaluation of ethnomedicinal knowledge using informant-based indices. By combining species richness data with Informant Consensus Factor (ICF) and Relative Frequency of Citation (RFC) analyses, the present work contributes to a growing body of urban ethnobotanical research emphasizing the persistence and transformation of traditional medicinal knowledge in rapidly urbanizing contexts.

#### Informant consensus and therapeutic reliability

The observed variation in ICF values among therapeutic categories reflects differing levels of shared knowledge and agreement among informants. High ICF values recorded for gastrointestinal, respiratory, and metabolic disorders indicate a strong consensus on the use of a limited number of plant taxa for these ailments. Similar patterns have been reported in ethnobotanical studies from other Iranian urban and peri-urban markets, including Mashhad and Isfahan, where digestive and respiratory complaints consistently show high consensus values (Motahhari *et al.* 2022; Mohammadi *et al.* 2021). High ICF values are generally interpreted as indicators of culturally well-established remedies and may also suggest a higher likelihood of pharmacological efficacy, as repeated independent citations reduce the probability of random plant selection (Heinrich *et al.* 2009; Albuquerque *et al.* 2014). In contrast, lower ICF values observed in categories with a broader spectrum of taxa likely reflect greater experimentation, individualized treatment strategies, or the availability of multiple therapeutic alternatives within urban markets.

Comparable trends have been documented in ethnobotanical surveys across the Middle East and other regions, where urbanization has not eliminated traditional medicinal practices but has instead reshaped them through commercialization and selective knowledge retention (Bussmann & Sharon 2006; Vandebroek & Voeks 2019).

### Relative importance of species in urban herbal markets

RFC analysis highlights a subset of medicinal plant species that play a central role in the herbal markets of Karaj. Species with high RFC values are not only widely known among informants but are also readily available and frequently recommended by herbalists. These taxa often correspond to plants with well-documented ethnomedicinal histories and established roles in Iranian traditional medicine, as reported in regional ethnobotanical surveys (Mosaddegh *et al.* 2012; Motahhari *et al.* 2022). High RFC values have been interpreted as proxies for cultural salience and commercial importance, particularly in urban market-based studies where availability and consumer demand strongly influence citation frequency (Bussmann 2002; Cunningham 2001). In contrast, species with low RFC values tend to be associated with specialized uses or niche applications and may reflect localized or declining knowledge.

The identification of highly cited species provides a useful framework for prioritizing taxa for future pharmacological investigations, conservation planning, and sustainable trade assessments, particularly in rapidly expanding metropolitan areas such as Karaj.

### Urban ethnobotany and knowledge persistence

The results of this study underscore the role of urban herbal markets as dynamic spaces where traditional ethnomedicinal knowledge is maintained, adapted, and transmitted. Despite increased access to biomedical healthcare, herbal medicine continues to address common health concerns, particularly chronic and non-life-threatening conditions such as digestive and respiratory disorders. Similar observations have been made in urban ethnobotanical studies worldwide, where market systems act as hubs for knowledge exchange between rural suppliers, urban vendors, and consumers (Hamilton 2004; Vandebroek & Voeks 2019). The persistence of high-consensus remedies in Karaj suggests that urbanization does not necessarily lead to the erosion of ethnobotanical knowledge but may instead promote selective retention of effective and culturally salient practices.

### Comparison with regional ethnobotanical studies

The patterns of informant consensus and species importance observed in Karaj show strong similarities with ethnobotanical studies conducted in other regions of Iran and the broader Middle East. High ICF values for gastrointestinal and respiratory disorders have been repeatedly reported from herbal markets and urban or peri-urban settings in Mashhad, Isfahan, Birjand, and southern Iran, where digestive complaints consistently represent the most frequently treated ailments using medicinal plants (Mosaddegh *et al.* 2012; Motahhari *et al.* 2022; Amiri & Joharchi 2013; Ghorbani 2005). These recurrent patterns suggest a shared core of ethnomedicinal knowledge across Iranian urban centers, likely shaped by common cultural traditions, historical medical texts, and overlapping plant availability. Similarly, studies from neighboring regions, including Turkey and the eastern Mediterranean, report comparable trends in informant consensus, with high agreement for a limited number of widely used taxa addressing common health problems (Ertuğ 2004; Polat *et al.* 2015). The consistency of high-consensus categories across these regions supports the interpretation that plants associated with elevated ICF values in Karaj represent culturally entrenched remedies rather than opportunistic or idiosyncratic market choices.

### Comparison with global urban ethnobotanical literature

At the global scale, the results from Karaj align with findings from urban ethnobotanical studies conducted in Latin America, Africa, and Europe, where herbal markets function as focal points for the preservation and transformation of traditional medicinal knowledge. Studies from urban centers such as Lima, La Paz, Johannesburg, and New York have shown that a relatively small subset of medicinal plant species typically accounts for a large proportion of use reports and citations, resulting in high consensus values for specific ailment categories (Bussmann & Sharon 2006; Williams *et al.* 2013; Vandebroek *et al.* 2010). High RFC values reported for commercially important taxa in Karaj mirror global observations that market availability, consumer demand, and perceived efficacy strongly influence citation frequency in urban contexts (Cunningham 2001; Hamilton 2004). Rather than reflecting random plant selection, these patterns indicate selective retention of culturally salient and therapeutically trusted species within urban herbal economies. The convergence of results across geographically and culturally distinct urban markets suggests that similar socio-economic drivers shape ethnomedicinal knowledge systems worldwide, reinforcing the relevance of the Karaj case study within the broader framework of global urban ethnobotany.

### Implications and limitations

The combined use of ICF and RFC provides a robust yet conservative quantitative framework for assessing ethnomedicinal knowledge without overextending the available data. While these indices do not replace pharmacological validation, they offer valuable insights into culturally important and potentially effective remedies. It should be noted that the present study is based on market surveys and reported uses rather than clinical outcomes. Future research integrating phytochemical

analyses, pharmacological testing, and longitudinal monitoring of market dynamics would further strengthen the understanding of medicinal plant use in urban Iran.

## Conclusion

This study documents the diversity and uses of medicinal plants marketed in Karaj, an expanding urban center in central Iran. Field surveys across 25 herbal outlets yielded 186 samples representing a broad taxonomic spectrum, with Asteraceae, Lamiaceae, and Fabaceae as the dominant families. Our results are consistent with a similar study conducted in Mashhad (Amiri & Joharchi 2013), where the four families Asteraceae, Lamiaceae, Apiaceae, and Fabaceae have the highest number of species. Seeds, leaves, and aerial parts were the most common materials traded, a pattern that shows regional variation, as in Kerman, fruits and flowers are the most widely offered products (Mehrabani *et al.* 2014). Gastrointestinal, respiratory, and dermatological disorders were the most frequently treated categories.

Comparison with ethnobotanical data from other Iranian regions, such as Mashhad (Amiri & Joharchi 2013, Motahhari *et al.* 2022), Birjand (Mohammadi *et al.* 2023), and Isfahan (Abbasi *et al.* 2025), indicates that a consistent core of medicinal plant use persists across ecological and cultural zones, while market composition and preparation forms vary with urbanization and consumer demand. This indicates that the combination of plant uses has gradually become more uniform and has reduced the differences resulting from local uses. Most herbal markets across Iran offer a high percentage of similar products. This trend toward uniformity is contrasted by findings from more isolated communities; for instance, a study of plants used by a Bakhtiari tribe, an ancient Iranian people known for preserving traditional knowledge, revealed a unique family composition (Amiri-Ardekani *et al.* 2021). Lamiaceae was the most common, followed by Fabaceae and Apiaceae. Asteraceae, typically the most prevalent, ranked fourth. Aerial parts were the most frequently used, followed by seeds and fruits, reflecting the tribe's reliance on local plants and vegetables for sustenance. The prominence of well-known pharmacologically supported species such as *Achillea eriophora* (Mohammadi *et al.* 2021) demonstrates the continuity between traditional practice and validated phytotherapy.

Karaj's herbal markets illustrate how urban environments can simultaneously conserve and transform ethnobotanical traditions. Traditional attari shops sustain oral knowledge transmission, while modern outlets introduce new packaging, marketing, and access routes. However, this commercial system faces significant challenges, as some of the medicinal plants available in the Iranian market have ambiguous identification along with adulteration and contamination (Joharchi & Amiri 2012). Together, these factors shape a living, yet vulnerable, adaptive ethnomedicinal system that continues to play a role in community health.

To safeguard this cultural and biological heritage, policies supporting sustainable harvesting, quality control, and knowledge documentation are urgently needed. Future research should include quantitative monitoring of market dynamics, ecological assessment of traded species, and phytochemical studies to validate widely used remedies. Integrating these approaches will strengthen the link between traditional knowledge and modern health care, ensuring that Iran's rich ethnobotanical heritage remains a vital part of its sustainable future.

## Declarations

**Ethics approval and consent to participate:** All participants involved in the interview process gave their prior informed oral consent.

**Consent for publication:** Not applicable.

**Competing interests:** The authors declare that they have no competing interests.

**Funding:** Not applicable.

**Availability of data and materials:** The data was not deposited in public repositories but is available from the corresponding author upon request.

**Author contributions:** Sahar Jalali, Farrokh Ghahremaninejad, Hamid Nazari collected and analyzed the data, drafted, and developed the manuscript. Rainer W Bussmann substantially rewrote and revised the manuscript draft. All authors approved the final manuscript.

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