



Ethnomedicinal plants of Farouj district, North Khorasan province, Iran

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ARTICLE INFO

Type: Original Research

Topic: Medicinal Plants

Received January 5th 2015

Accepted February 22th 2015

Key words:

✓ Ethnobotany

✓ Farouj

✓ Iran

✓ North Khorasan

✓ Medicinal plants

ABSTRACT

Background & Aim: Medicinal plants are one of the most valuable resources in Iran, having a scientific knowledge and proper use; they can play an important role in community health. Some of the significant aims of ethnobotany project are to indicate the most common medicinal species, finding out the exact application of the plant species from various population of the area, and proving the knowledge of ethnobotany among human beings.

Experimental: To achieve these goals, the project has been conducted in Farouj, North Khorasan province, Iran in 2014-2015. To acquire ethnobotanical data of the studied area, several steps were taken such as the accumulation of plants, interviews with native people, and distribution of the questionnaires. Some important indices such as the relative frequency of citation (RFC), informant agreement ratio (IAR), and cultural important index (CI) were estimated. Furthermore, a traditional null hypothesis testing was adopted.

Results & Discussion: A total of 91 taxa belonging to 29 families were identified, 73 of which are grown naturally in the studied area. Asteraceae and Brassicaceae were the most detected families with 16 and 9 genera, respectively. Other diseases and digestive ones are the most curable ailments in Farouj County. Most of the parts of the plants that were collected consist of leaves (22%), whole plants (18%) and seeds (14%), orderly. *Vitis vinifera* L. has the maximum relative frequency of citation and cultural importance indices. Farouj area has a great potential in the growing of pharmaceutical plants. This research has been done for the first time in this area.

Industrial and practical recommendations: Plant extracts can be used as cure for many diseases and some extracts might have new beneficial effects on illness.

1. Introduction

Human indigenous knowledge about medicinal herbs is dynamic and complex (Reyes-Garcia *et al.*, 2013). Contemporary and historical documents allow the use of medicinal plants in different times (Ameri *et al.*, 2015; Hamedi *et al.*, 2013). Gathering medical information lead to recall many experiences and

combining it with the past, present and future knowledge (Breitbach *et al.*, 2013; Giorgetti *et al.*, 2011; Medeiros & Albuquerque, 2014). Due to increasing industrialization and human need to find a suitable replacement for treating diseases safely and without any side effects, many researchers have an especial tendency on medical plants (Turner *et al.*, 2011). However, such enthusiasm have been more seen

in Asian countries (Kim & Song, 2013; Song *et al.*, 2013).

According to World Health Organization (WHO), around 80% of the population in developing countries rely on traditional healing herbs to treat diseases, maintaining and improving the lives of their generation (Calixto, 2005; WHO, 2002). Based on several studies, around 442000 flowering plants were identified, of which just 50000 of them are applied for medicinal purposes and only 5000 of these plants have been scrutinized in terms of phytochemistry (Mahmood & Tabassum, 2011).

Since the beginning of human civilization, plants were used as medicinal resources for many body disorders (Chung *et al.*, 2013). Increasing the price of synthetic drugs not only multiplied the interests of people to utilize these plants, but also the number of researchers who are following them are intensified (Ahmad *et al.*, 2014; Bibi *et al.*, 2014; Mann *et al.*, 2008; Shrivastava & Kanungo, 2013; Sulaiman *et al.*, 2011).

On the basis of broad sense, ethnobotany means the study of complex relationships between people and plants (Hurrell & Albuquerque, 2012). This science is deal with the past and current knowledge of medicinal herbs (Pochettino & Lema, 2008), and for the first time; it was used by the American botanist (Harsh Berger) in 1896. Ethnobotany is composed of two words including ethno (people) and botany (plant). Rate of infectious diseases have been increased with growing technology in the world (Carballo *et al.*, 2002). Interestingly, using herbal medicines for treatment of various diseases have considerable economic benefits. About 74% of herbal medicines have been detected by botanists in field studies (Azaizh, 2003). It can be considered that the traditional knowledge plays an important role in defining the use of plants in large human communities.

Identifying and analyzing the characteristics of the natural environment and plants of each area is one of the fundamental steps in investigation of health of indigenous people and traditional customs. However, ethnobotany attracts the attention of many scientists through time, for instance; Abel & Busia (2005) had an exploratory ethnobotanical study of the practice of herbal medicine by the Akan people of Ghana. Manjula & Mamidala (2013) concerned about an ethnobotanical survey of medical plants used by

traditional healers of Thadvai, Warangal district, Andhra Pradesh, India. Safa *et al.*, (2012) have studied Hormozgan Province in Iran, Abbasi *et al.*, (2012) concerned about the ethnobotanical study of medicinal plants in Natanz region (Kashan), Iran.

North Khorasan Province with an area of 28179 square kilometers comprise seven cities is located in North East of Iran including Farouj, Shirvan, Esfarayen, Jajarm, Garmeh, Maneh and Semelghan. Farouj city is the gate of North Khorasan province from holy Mashhad and terminated to some other cities such as Bajgiran (North), Esfarayen (South), Shirvan (from West) and Quchan (East). This city with an area of 1736 square kilometers has 2 cities, 2 districts, 5 subdistricts and 77 villages by latitude: 37 °13'N and longitude: 58 ° 13'E, 1182 meter above sea level (Fig. 1). Moreover, it has a pleasant climate, fertile soil and appropriate position because of Atrak River, Shah-e jahan (South) and Hezar masjed (North) Mountains. Because of water resources, including Atrak River, Agriculture has flourished and become an important center of oilseeds and nuts. Some meteorological data of the studied region (from 1977 to 2015) are as follow: average maximum and minimum temperature are 6.9 and 19.8 °C; Average maximum and minimum humidity are 80 and 40 in percent, respectively.

The main aims of this study are as follow: 1. To dedicate most common medicinal species in Farouj (Faruj or Faroj) district (North Khorasan, Iran); 2. Find out the exact application of the species from local population of the area; 3. How the people use these plants and where are the most important part of these species to cure diseases; 4. Maintain the correct usage of wild, cultivated plants, and 5. Prove the knowledge of ethnobotany among human beings.

2. Material and Methods

To acquire ethnobotanical data of studied area, several steps have done such as accumulation of plants, interviews with native people (experienced people like herbal therapists; local people, especially elderly ones), and distribution a questionnaire. This project was lasted from April 2014 to November 2015.

The questions which utilized are as follow: what is your name, how old are you, do you know any medicinal plants in Farouj, what is the local name of these plants, which part of the plant, how and what

diseases can be used for treatment. The participants have selected randomly (amateurs) and intentionally (professionals) in various locations such as villages, farmlands, streets, homes and spicy stores. Totally, 53 informants were participated with an approximate average of 61 years old (28-95 years), among which 37 were women and 16 men. Of these, 53 are belonging to elderly people or a medical traditional therapist whom has enough knowledge about herb healings.

Personally, during the interviews, several places (gardens, orchards, agriculture fields) were cautiously checked out. Careful observation and collection of samples were taken place using different methods (random-stratified, transect tape, and etc) through determined time. The size of plots was $1.5 \times 1.5 \text{ m}^2$. Normally, a transect line set up across the studied area where there were transparent environmental gradients. Each species which touch the line or occurred in plots were accumulated. After gathering information from amateur and professional people of Farouj, a field walk was done along some transects; in order to distinguish environmental properties of collected samples. Unknown species were transported to Lorestan University Herbarium for more detailed studies using authoritative floras including Flora Iranica (Rechinger, 1963-2013).

2.1. Data analysis

The final information was obtained from questionnaires and other collected data. In addition some indices (relative frequency of citation (RFC), index of informant agreement ratio (IAR), Cultural importance index (CI) were measured using some variables like i , u and s . s is a species which the informant (i) put it in an especial category like u .

RFC is estimated with separating frequency of citation (FC) (the number of informants who mention the use of the species) to total number of informants in the research (N). This value alters from zero (nobody refers to the plants as useful) to one when all informants prove the beneficial of species (Tardio & Pardo-de Santayana, 2008).

$$1. \text{ RFC} = \frac{\text{FC}}{N}$$

Following formula is considered to measure the index of informant agreement ratio (IAR). It dedicate the range of agreement about usefulness of medicinal

plants among informants (Trotter & Logan, 1986). IAR transparent the relationship between n_t (number of taxa) and n_{ur} (number of citation in each use category) (Collins *et al.*, 2006). More IAR shows higher agreements among participants.

$$2. \text{ IAR} = \frac{n_{ur} - n_t}{n_{ur} - 1}$$

The last index is cultural importance index (CI) (Tardio & Pardo-de Santayana 2008) which calculated the proportion of informants. Vividly, it sums the number of informants that noticed the use of each species divided by total number of informants (N). This index concerned about the number of participants whom use medicinal plants.

$$3. \text{ CI} = \sum_{u=u_1}^{u_{NC}} \sum_{i=i_1}^{i_N} \frac{\text{UR}_{ui}}{N}$$

To investigate the relationship between medical usage and participant recovery from ailment, a traditional null hypothesis test was prepared using IBM SPSS Statistics 22 x86/x64. In null hypothesis (H_0) the researcher tries to accept or reject a concept. As a result, the hypothesis of this project was determined as follow:

H_0 : People who use medical plants for disease therapy do not show serious symptoms of it than people who do not.

3. Results and discussion

A total of 91 species belonging to 80 genera and 29 families were identified, 73 of which grow naturally in the studied area and classified as wild edible plants (*Artemisia siberi* Bessr, *Carthamustinctorius* L., *Centaurea solstitialis* L., *Echinopsritrodes* Bunge, *Gundelia tournefortii* L., etc), but other species are cultivated (*Ficus carica* L., *Juglansregia* L., *Helianthustuberosus* L., *Vitisvinifera* L., etc). The scientific names, plant families, local names, medical applications, part uses, frequency of citation (FC), number of use reports (UR), number of uses (NU) are available in Table 1. Based on Figure 2 Asteraceae family with 15 species (20%), Brassicaceae and Lamiaceae each with 9 species (12%) were the most described families. The preference of these two families is mainly due to some especial properties such as secondary metabolites.

Table 1. Ethnopharmacology of plants in Farouj area. FC, frequency of citation; UR, use reports and NU, number of use.

Family name	Scientific name	Local name	Parts used	medicinal uses	F C	U R	N U
Amaranthaceae	<i>Amaranthus caudatus</i> L.	Tajkhorous domgorbeie, baroutak	whole plant	Treatment of hemorrhoids, Blood purification, Painful and slow urination	2	1	1
Apiaceae	<i>Ferula latisecta</i> Rech. f. Aell.	Anghouzeh	whole plant	Analgesic, Anti-tumor, Cure digestive diseases, Carminative, Fungicides, Reduction of blood pressure	9	10	7
Aspleniaceae	<i>Asplenium Ruta-muraria</i> L.	Sarakhs panjeie	whole plant	Pain relief, Astringent, Treatment of lung infection, Bactericidal, Antipyretic, Anti-inflammatory, Urinary tract antiseptic, Pain relief, Insecticide, Lowering fat and sugar, Cold treatment	1	-	-
Asteraceae	<i>Anthemis cotula</i> L.	Babouneh bahari	flowers, leaves	Antiepileptic, Headaches treatment, Diarrhea, Dysentery, Increased sleeping, Shortness of breath	8	9	5
Asteraceae	<i>Artemisia siberi</i> Bessr	Dermaneh	whole plant	Treatment of burns, Earache	4	2	2
Asteraceae	<i>Calendula officinalis</i> L.	Hamisheh bahar	flowers, leaves	Blood purification, Anticancer, Wound treatment, Analgesic, Vermifuge, Antibacterial, Anti-retroviral, Heart tonic,	1	1	1
Asteraceae	<i>Carthamus tinctorius</i> L.	kajireh	flowers, leaves	Analgesic, Anti-plot adhesion, Antipyretic, Anti-tumor, Heart tonic, Eye problems, Sedative, Rheumatism treatment	5	4	2
Asteraceae	<i>Centaurea behen</i> L.	Gol gandome talaei	flowers, roots	Strengthening, Jaundice treatment, Heart diseases, Antidote, Relief impotence, Palpitations, Increase sperm volume, Heart strengthen, Refreshing, Jaundice, improve memory loss	2	2	2
Asteraceae	<i>Centaurea depressa</i> M. B.	Gole gandom	whole plant	Neurasthenia treatment	3	1	1
Asteraceae	<i>Centaurea solstitialis</i> L.	Gole gandome zard	flower, roots	Refrigerant, Stomach tonic	9	6	4
Asteraceae	<i>Cichorium intybus</i> L.	Kasni	leaves, roots	Anti-bacterial, Carminative, Heart tonic, Liver protection, Nerves reinforcing, Lowering blood sugar, Anti-anemia, Skin disorders, Digestive, Jaundice treatment, Stomach ache	3	1	1
Asteraceae	<i>Echinops ritrodes</i> Bunge	Shekar tighal	whole plant	Treatment of skin diseases, Prevention of cough	2	2	2
Asteraceae	<i>Gundelia tournefortii</i> L.	Kangar	leaves	Sedative, Eaten with rice	8	7	7
Asteraceae	<i>Helianthus annus</i> L.	Aftabgardan	flower, seeds, leaves, roots	Refrigerant, Disposal of lung diseases, Diuretic and mucosa creative, Hypoglycemia, Stomach pain	6	5	5
Asteraceae	<i>Helianthus tuberosus</i> L.	Sibzamini torshi	glands	Lowering blood sugar and blood urea	5	5	3
Asteraceae	<i>Lactuca sativa</i> L.	Kahoo	stems, leaves, seeds	Cool agent, Blood purifier, Analgesic, Appetizer, Hypnotic, Anti-cough, Hypoglycemic, Liver cleaning, Treatment of neuritis, Mental weakness, Iron deficiency, Treatment of whooping	1	1	1

Asteraceae	<i>Onopordon acanthium</i> L.	Khar panbeh	flowers, stems, roots	cough, Nervous cough treatment, Asthma, Diabetes, Hyperemia, Gout, Constipation Cancer treatment, Skin wounds, Stomach tonic, Appetizer, treat baldness	1	1	1
Asteraceae	<i>Silybum marianum</i> (L.) Gaertn	Khar maryam	seeds	Hypoallergenic, Anti-cancer, Anti-depressant, Anti-oxidants, Resistant prostate diseases, Anti-virus, Laxative, Expellant, Digesting food, Fat blockers, Treatment of chronic hepatitis	1	2	1
Brassicaceae	<i>Brassica rapa</i> L.	Shalgham	fruits, roots, leaves	Rheumatic muscle treatment, Bronchitis treatment, Inhibition the growth of bacteria and fungi, Anti-cancer, Anti-microbial, Anti-virus, Diuretic, Treatment of kidney stones, Uric acid reduction, Gout treating, Soothing breathing problems	2	1	1
Brassicaceae	<i>Brassica oleracea</i> L.	Kalame mamouli	leaves, seeds	Laxative, Stomach tonic, Appetizer, Vermifuge, Gout treating, Rheumatism, Pus draining, Contusion, Adolescent pimples, Vascular disorders, Eyelid inflammation, Heart disease	1	1	1
Brassicaceae	<i>Eruca sativa</i> Miller	Mandab	whole plant	Stimulant and tonic for the digestive system, Sexual motivation	1	1	1
Brassicaceae	<i>Erysimum repandum</i> L.	Khakshir	seeds	Fever reduction, Relieve abdominal pain	1	-	-
Brassicaceae	<i>Lepidium sativum</i> L.	Tartizak, Shahi	roots, seeds, leaves	Treatment of Asthma, Anti-cough and stomach ache, Carminative, Decreasing the stimulation of intestinal mucous layer, Back pain and rheumatism, Fix hiccups, Appetizer, Eaten with rice.	3	2	2
Brassicaceae	<i>Raphanus raphanistrum</i> L.	Torob vahshi	whole plant	Eliminating redness of the skin, Stimulant, Appetizer	4	4	3
Brassicaceae	<i>Raphanus sativus</i> L.	Torobche noghli	roots, leaves, seeds	treatment of Urinary and gastrointestinal pain, Laxative, Digestion stimulating, Strengthen the digestive system, Curing headaches and insomnia	4	3	3
Brassicaceae	<i>Sinapis arvensis</i> L.	Khardal biabani	seeds	Gastric mucosa stimulation, Anti-rheumatism, Hypnotic, Analgesic, Antibacterial, Carminative, Digestive, Fungicides, Anti-cancer	1	-	-
Brassicaceae	<i>Sisymbrium altissimum</i> L.	Khakshir laghzan	flowers, leaves	Mucosa, Nourishing, Antipyretic, Relieving cough and asthma	5	1	1
Chenopodiaceae	<i>Spinacia oleracea</i> L.	Esfanaj	whole plant	Decrease blood sugar, Treatment of anemia, Vermifuge, Expellant, Antipyretic	2	4	4
Convolvulaceae	<i>Convolvulus arvensis</i> L.	Pichake sahraei	whole plant	Very toxic and causing gastro-intestinal sensitivity, Expellant	1	2	2
Cucurbitaceae	<i>Benincasa hispida</i> (Thunb. Ex Murray) Cogn.	Kadouye moumi	fruits, seeds,	Vermifuge, Treatment of wound, Anti-cough, dermatology diseases, Anti-wrinkle, Prevent sunburn	1	1	1
Cucurbitaceae	<i>Citrullus lanatus</i> (Thunb.) Matsum. & Nakai	Hendevaneh	fruits	Cool agent, Sedative, Fortifying, Vermifuge	2	1	1
Cucurbitaceae	<i>Cucumis melo</i> L.	Kharbozeh	fruits, roots, seeds	Expellant, Nutritious, Remove freckles, Sedative, Relieve indigestion, Fix eczema, Cool agent, Urinary tract	1	2	2

Cucurbitaceae	<i>Cucumis melo</i> L. var. <i>flexuosus</i>	Khiar chanbar	fruits	infection and painful urination, Treatment of gastro-intestinal disorders, Anti-fungal, Treatment of urinary disorders Cooling and cleaning the skin, Treatment of burns and scratches, Fortifying, Refrigerant, Anti-cough, Strong digestive, Vermifuge, Expellant	4	4	3
Cucurbitaceae	<i>Cucumis melo</i> L. var. <i>reticulatus</i>	Talebi	fruits	Strong digestive, Treatment of burns and scratches, Fortifying, Cooling and cleaning the skin, Refrigerant, Stomach tonic, Anti-cough, Vermifuge, Expellant, Sedative, Remove freckles, Relieve indigestion, Fix eczema, Cool agent, Treat urinary tract infection, Anti-fungal, Treatment of biliary disorders	1	1	1
Cucurbitaceae	<i>Cucurbita moschata</i> Duchesne	Kadou halvaei	Seeds, fruits	Vermifuge, Relieve abdominal cramps, Improving inflation	1	1	1
Elaeagnaceae	<i>Elaeagnus angustifolia</i> L.	Senjed	leaves, fruits	Stomach disorders, Diarrhea, Asthma, Anti-fever, Anti-cancer	1	2	2
Euphorbiaceae	<i>Ricinus communis</i> L.	Bid anjir	leaves, roots, seeds	Expellant, Antibacterial, Analgesic, Fungicides, Treatment of constipation Anti-tumor, Anti-cough, Lowering blood sugar, Jaundice treatment, Stomach pain, Blister treatment, Joint pain relief	1	-	-
Fumariaceae	<i>Fumaria officinalis</i> L.	Shahtareh	whole plant	Fortifying, Blood purification, Liver regularity, Treatment of vascular disorders, Anti-hyperemia, Vermifuge, Jaundice, Anti-histamines, Disinfectants, Appetizer, Fortifying	1	-	-
Geraniaceae	<i>Erodium moschatum</i> L' Her. ex Aiton	Noklaklaki	whole plant	Stop internal bleeding, Wound healing, Diarrhea, Astringent	2	3	3
Juglandaceae	<i>Juglans regia</i> L.	Gerdou	flowers, leaves, barks	Pancreas stimulation, Blood purification, Anemia, Diabetes, Gout, Vermifuge, Anti-cancer, Anti-tumor, Antifungal, Anti-virus, Appetizer	1	1	1
Lamiaceae	<i>Lavandula angustifolia</i> Miller subsp. <i>angustifolia</i>	Ostokhoddo us	whole plant	Analgesic, Nerve and Heart paregoric, Blood pressure decreasing	1	1	1
Lamiaceae	<i>Mentha longifolia</i> (L.) Hudson	Pouneh	leaves, flowers	Anti-asthma, Carminative, Stimulant, Refrigerant, Headache, Treatment of digestive disorders	1	2	1
Lamiaceae	<i>Ocimum basilicum</i> L.	Reihan	flowers	Fortifying, Anti-spasm, Asthma, Pertussis, Paralysis, Migraine, Gout, Epilepsy, Treatment of neurasthenia, Treatment of anorexia, Alzheimer's prevention, Fortifying, Anti-arthritis, Anti-cancer, Anti-fungal	1	1	1
Lamiaceae	<i>Rosmarinus officinalis</i> L.	Rozmari	leaves	Stimulating the adrenal glands, Blood pressure increasing, Anti-cough, Anti-diarrhea, Heart fortifying, Anti-rheumatism pains, Pertussis, Common cold, Prevention from obstruction of the bile ducts, Stomach disorders, Epilepsy, Paralysis, Healing of wounds and scalds	1	1	1
Lamiaceae	<i>Calamintha officinalis</i> Moench	Nana ziba	whole plant	Carminative, Causing hiccups, Fever lowering, Cough improvement, Common cold	1	1	1

Lamiaceae	<i>Dracocephalum moldavica</i> L.	Badranjbooyeh	seeds, leaves, stem	Fever lowering, Food digestion, Wound healing, Paregoric Sedative	2	2	2
Lamiaceae	<i>Satureja laxiflora</i> C. Koch	Marzeh	leaves	Analgesic, Anti-arthritis, Anti-herpes virus, Disinfectant, Food digestion, Carminative, Vermifuge, Anti-cancer, Expellant, Anti-diarrhea	1	1	1
Lamiaceae	<i>Thymus serpyllum</i> L.	Avishane vagheei	whole plant	Improving visual impairment, Curing toothache, Carminative, Nervous headache treatment, Pertussis, Angina treating	1	1	1
Lamiaceae	<i>Ziziphora persica</i> Bunge	Kakouti Irani	stems, leaves	Decreasing fever, Mucosa creative, Carminative, Improving digestive system, Heart fortifying, Bloody diarrhea	8	8	6
Liliaceae	<i>Allium cepa</i> L.	Piaze khoraki	bulbs	Arthritis, Disinfectant, Common cold, Indigestion, Decrease fat, Prevention of premature aging, Analgesic, Lowering blood sugar, Rheumatism	7	9	5
Liliaceae	<i>Allium hirtifolium</i> Boiss.	Mousir	bulbs	Lowering blood pressure	5	5	5
Liliaceae	<i>Allium sativum</i> L.	Seer	bulbs	Lowering blood pressure and heart beat, Appetizer, Common cold, Lowering blood fat, Anti-gout, Pertussis, Disinfection, Prevention of premature aging, Asthma, Anti-cough, Rheumatism, Antipyretic, Anti-amoeba, Sudoriferous	7	6	4
Malvaceae	<i>Alcea fasciculiflora</i> Zohary	Khatmi	flowers,	Anti-cough, Common cold	1	1	1
Malvaceae	<i>Malva sylvestris</i> L.	Panirake ghermez	leaves, flowers	Laxative, Mucosa creative, Constipation treatment, Common cold, Improve tongue inflammation, Paregoric	1	1	1
Moraceae	<i>Morus alba</i> L.	Toote sefid	Leaves, barks, roots, fruits	Sudoriferous, Expellant, diarrhea, Many stings, Stimulant, Stomach fortifying, Mucosa creative, Laxative, Vermifuge, Sore throat treatment, Relief thirst and fever, Reduce depression, Headache, Dizziness, Indigestion	2	2	1
Moraceae	<i>Morus nigra</i> L.	Shahtoot	leaves, fruits, barks, roots	Refrigerant, Diuretic, Mucosa creative, Blood pressure reduction, Tapeworm, Pest and Sore throat treatment, Anti-depressant, Vermifuge, Decrease blood pressure, Lowering blood sugar, Analgesic, Inflammation of oral mucosa, Antipyretic	1	1	2
Moraceae	<i>Ficus carica</i> L.	Anjir	fruits, roots, barks	Sedative, Anemia treatment, Vermifuge, Constipation, Wart removing, Laxative, Expellant	1	1	1
Nyctaginaceae	<i>Mirabilis jalapa</i> L.	Laleh abbasi	roots, leaves, glands	Laxative, Mucosa creative, Jaundice, Refrigerant, Treatment of anemia, Blain disinflation, Sputum reduction, Asthma, Vermifuge, Diarrhea, Stomach fortifying	1	1	1
Papaveraceae	<i>Papaver bracteatum</i> Lindl.	Khashkhash e kabir	flowers, leaves, seeds	Anti-addiction, Strong hypnotic, Paregoric, Lung infections, Bronchitis, Pneumonia, Treatment of sore throat, Food digestion, Eyelid inflammation, Anti-cough, Sedative, Rheumatism pains, Paregoric, Analgesic, Anti-spasm, Asthma	1	1	1
Papilionaceae	<i>Alhagi</i>	Kharshotor	whole	Sudoriferous, Laxative, Mucosa creative	1	1	1

	<i>mannifera</i> Desf.		plant				
Papilionaceae	<i>Cicer arietinum</i> L.	Nokhode abgoushti	seeds, leaves	Vermifuge, Renal colic, Opening and healing the festering wounds, Treatment of sprained joints, Thirst resolving, Burns treatment	1	1	1
Papilionaceae	<i>Coronilla varia</i> L.	Yonjeh baghi	whole plant	Expellant	1	1	1
Papilionaceae	<i>Glycyrrhiza glabra</i> L.	Shirin bayan, Choub shirin	roots	Antihistamines, Mucosa creative, Anti-inflammatory, Nervous cough treatment, Anti-ulcer, Anti-depressant, Expellant, Anti-tumor	1	1	1
Papilionaceae	<i>Medicago sativa</i> L.	Yonjeh	whole plant	Antimicrobial, Carminative, Cholesterol lowering, Arthritis therapy, Anti-anemia	6	3	3
Papilionaceae	<i>Pisum sativum</i> L.	Nokhod farangi, Nokhod sabz	fruits	Lowering blood sugar, Meningitis treatment, Nervous system problems, Cramp, Tremor, Walking problems, Paralysis	5	4	2
Papilionaceae	<i>Psoralea drupacea</i> Bunge	Loubiaye Khorasani	whole plant	Antimicrobial, Antibacterial	1	1	1
Papilionaceae	<i>Trigonella foenum-graecum</i> L.	Shanbelileh	whole plant	Treatment of small-pox, Heart fortifying, Disinfectant, Carminative, Rheumatism Lowering blood pressure, Small pox treatment	1	1	1
Poaceae	<i>Cynodon dactylon</i> (L.) Pers.	Margh	whole plant	Epilepsy treatment, Skin disorders, Cool agent, Nosebleed prevention, Improvement of fresh wounds, Treatment of inflamed glands and Sedative, Stop bleeding, Appetizer, Inflammation, Gout, Liver diseases, Delusion, Rheumatism, Reduce burn feeling, Vomiting	1	1	2
Poaceae	<i>Panicum miliaceum</i> L.	Arzan	whole plant	Recover wounds	1	1	1
Poaceae	<i>Hordeum vulgare</i> L.	Jo		Antipyretic, Digestive, Diuretic, Stomach fortifying, Mucosa creative, Stimulate blood circulation	1	1	1
Poaceae	<i>Triticum aestivum</i> L.	Gandom	seeds	Appetizer, Disinfectant, Anti-jaundice, Anti effects of alcohol, Lowering blood fat, Intestine stimulating, Expellant, Remove thirst, Antipyretic	1	1	1
Poaceae	<i>Zea mays</i> L.	Zorrat, Balal	whole plant	Rheumatism, Losing weight, Analgesic, Burn treatment, Sedative, Inflation and Wound, Fortifying, Expellant	1	1	1
Polygonaceae	<i>Polygonum aviculare</i> L.	Alafe haftband	roots	Vermifuge, Astringent, Reduce intestinal secretion, Anti-diabetic, Blood purification, Treatment of gallstones and urinary	6	6	4
Polygonaceae	<i>Rheum ribes</i> L.	Rivas	stems	Joyful and Cooling	6	4	4
Polygonaceae	<i>Rumex crispus</i> L.	Torshake mavvaj	roots	Fortifying, Anti-anemia, Diabetes treatment, Tuberculosis and liver diseases, Disinfectant, Sore throat treatment, Anti-tumor, Blister and Scorch, Vermifuge, Laxative, Anti-cancer	5	3	1
portulacaceae	<i>Portulaca oleraceae</i> L.	Khorfeh	leaves	Diarrhea, Appetizer, Headache, toothache, Anti-spasm, Asthma, Vermifuge, Recover rash, Snake bite, Jaundice	1	1	1
Rosaceae	<i>Amygdalus commnuiis</i> L.	Badame talkh	leaves, flowers, barks	Paregoric, Vermifuge, Pain relief, Gum revival	1	1	1

Rosaceae	<i>Armeniaca vulgaris</i> Lam.	Zardalou	fruits	Anti-cough, Mucosa creative, Anti-cramp, Asthma therapy, Analgesic, Liver diseases, Earache	1	1	1
Rosaceae	<i>Cerasus avium</i> (L.) Moench	Gilas	stems, fruits	Treatment of cystitis, Arthritis, Laxative	1	1	1
Rosaceae	<i>Cerasus vulgaris</i> Miller	Albalou	flowers	Liver diseases, Kidney swelling, Chronic inflammation of the digestive system	3	3	3
Rosaceae	<i>Cotoneaster nummularioides</i> Pojark.	Shirkheshtesekkehei	whole plant	Expellant, Refrigerant, Mucosa creative, Recover chest and throat discomfort, Laxative, Anti-cough	1	1	1
Rosaceae	<i>Cydonia oblonga</i> Miller	Beh, Shal beh	fruits, seeds	Stomach tonic, Anti-cough, Refrigerant, Mucosa creative, Inflammation reduction, Heart Fortifying	1	1	1
Solanaceae	<i>Capsicum annum</i> L.	Felfel dolmeei	fruits	Stomach tonic, Indigestion, Nausea, Paralysis, Analgesic, Anti-platelet adhesion, Insecticide, Enhancing capillaries diarrhea, Rheumatism	1	1	1
Solanaceae	<i>Datura innoxia</i> Miller	Datoureh	leaves, seeds	Highly toxic, Anti-spasm, Analgesic, Hypnotic, Anti-anxiety, Anti-Asthma, Pupil dilation, Blister and Ulcer treatment, Earache Sedative	1	1	1
Solanaceae	<i>Ipomoea purpurea</i> (L.) Roth.	Niloufar	roots	Expellant	1	1	1
Solanaceae	<i>Nicotiana tabacum</i> L.	Tanbakou	leaves	Laxative, Narcotic, Vermifuge, Carminative, Bronchitis treatment, Fortifying, Relief muscle pain, Skin disorders, Healing wound, Pain treatment, Asthma, Anti-cancer, Paregoric, Nerves strengthen	1	1	1
Solanaceae	<i>Solanum melongena</i> L.	Bademjan	roots, leaves, fruits, seeds	Asthma, Anti-spasm, Stimulant, Therapy, Nasal ulcer treatment, Narcotic, Cholesterol-lowering	1	1	1
Solanaceae	<i>Solanum tuberosum</i> L.	Sibzamini	leaves, glands	Analgesic, Antibacterial, Heart strengthen, Blood pressure, Scorch healing, Appetizer, decreasing, Treatment of gingivitis	1	1	1
Urticaceae	<i>Urtica dioica</i> L.	Gazaneh	leaves	Rheumatism, Joints improvement, Blood pressure decreasing, Anti-dandruff, Asthma, Anti-histamines, Antiepileptic, Disinflation, Blood pressure decreasing, Analgesic, Anti-cancer	1	1	1
Vitaceae	<i>Vitis vinifera</i> L.	Angour	fruits, leaves, stem	Sedative, Laxative, Heart diseases, Anti-fever, Relieve sore throat, Jaundice, Thirst removing, Skin disorders, Constipation, Cold treatment, Slimming.	9	9	8
Violaceae	<i>viola tricolor</i> L.	Banafsheh sehrang	whole plant	Laxative, Mucosa creative, Treatment of kidney inflammation, Rheumatism, Skin disorders, Muscle relaxants, Detoxification, Diarrhea	1	-	-

Table 2. Comparison of significant medicinal plants utilizing indices and species ranking according to each index in Farouj area.

Family	Scientific name	CI	RFC	CI ranking	RFC ranking
Vitaceae	<i>Vitis vinifera</i>	0.5112	0.3953	1	1
Apiaceae	<i>Ferula latisecta</i>	0.5112	0.3523	1	2
Lamiaceae	<i>Ziziphora persica</i>	0.4832	0.2932	2	3
Asteraceae	<i>Gundelia tournefortii</i>	0.4612	0.2932	3	3

Liliaceae	<i>Allium cepa</i>	0.4476	0.2932	4	3
Liliaceae	<i>Allium sativum</i>	0.4332	0.2429	5	4
Asteraceae	<i>Centaurea solstitialis</i>	0.3712	0.2340	6	5
Asteraceae	<i>Anthemis cotula</i>	0.3732	0.2340	6	5
Asteraceae	<i>Helianthus annuus</i>	0.3511	0.1834	7	6
Brassicaceae	<i>Sisymbrium altissimum</i>	0.3382	0.1713	8	7
Cucurbitaceae	<i>Cucumis melo</i>	0.2919	0.1713	9	7
Asteraceae	<i>Helianthus tuberosus</i>	0.2637	0.1552	10	8
Asteraceae	<i>Carthamus tinctorius</i>	0.2110	0.1101	11	9

RFC: relative frequency of citation CI: index of cultural importance.

Table 3. Informant's agreement factor for different use categories in Farouj area.

IAR	n _t	n _{ur}	Use category
0.562	15	33	Other diseases
0.518	14	28	Digestive diseases
0.409	14	23	Sugar and Fat reduction
0.375	11	17	Respiratory disease
0.285	6	8	Urinary tract
0.2	5	6	Skin disease
0.0	4	4	Eye disease
0.0	2	2	Oral disease

n_t: number of taxa; n_{ur}: number of citation in each use category. IAR: informant agreement ratio.

Other pharmaceutical dominant families are Papilionaceae, Cucurbitaceae, Rosaceae, and Solanaceae (Table 1). Asteraceae was the most abundant families in many previous projects like Ghasemi Pirbalouti *et al.*, (2012).

In Figures 3 and 4, the usages of medicinal plants are described. According to Figure 3, other diseases (23%), digestive diseases (22%), sugar and fat reduction (17%), respiratory disease (15%), skin diseases (11%) are the most ailments which treated with healing herbs. Moreover, as illustrated in Figure 4 the most collected plant parts belonging to leaves (22%), whole plants (18%) and seeds (14%), orderly. As mentioned leaves are allocated the most part for drugs consumption, that probably due to the ease of access and being fresher than the other parts of plants (Bonet & Valles, 2002). The highest and the lowest part of the plant used as medicinal purposes are the leaves and bulbs. Obviously, many diseases can be cured (from common to complicated sickness) using these medicinal plants and most of these plants can treat a variety of current diseases (Figures 3 and 4). Leaves is one of the most usable parts in medical purposes as Mosaddegh *et al.*, (2012) research. Nevertheless, roots are the most abundant applicable

medical part in Traditional Chinese Medicine (Weckerle *et al.*, 2009).

3.1. Medicinal and non-medicinal uses

Of 91 species discovered in Farouj district, some species have two properties (medicinal and non-medicinal). *Ferula latisecta* Rech. f. Aell., is using for making kind of broth. *Gundelia tournefortii* L. and *Allium cepa* L. have been eaten with rice. *Brassica* species using in salads. Some species use as vegetables such as *Lepidium sativum* L., *Cucumis melo* L., *Mentha longifolia* (L.) Hudson, *Satureja laxiflora* C. Koch, and *Spinacia oleracea* L., *Ziziphora persica* Bunge have been drink with tea. *Morus alba* L., *Morus nigra* L., *Ficus carica* L., *Cerasus avium* (L.) Moench, *Cerasus vulgaris* Miller, *Cydonia oblonga* Miller, *Vitis vinifera* L. applied as fruits. Additionally, animals are feeding with *Medicago sativa* L. and *Amygdalus conmmuis* L. utilize for making baskets.

3.2. Compare estimated indices

Ferula latisecta has the highest number of informants. It shows that it is the most distinguished species in the studied area. *Vitis vinifera* and *Carthamus tinctorius* have the maximum and

minimum number of use-reports with 10 and 4 use-reports, orderly. The position of *Ferula latisecta* and *Vitis vinifera* are changed in Figures 6 and 7 due to the independence of CI index to the number of informants, in contrast with RFC.

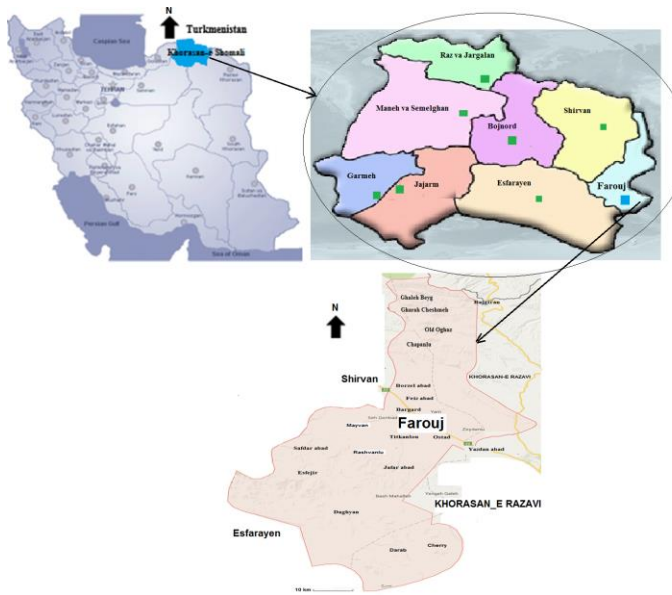


Fig. 1. The position of the studied area (Farouj district), in North Khorasan province, Iran.

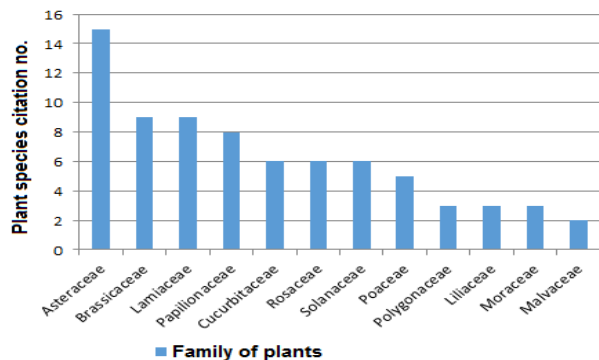


Fig. 2. Plants families with the highest number of cited species in Farouj area.

Based on Table 2, the ranking indices are different among species. Obviously, informant agreement factor (IAR) have displayed in Table 3. IAR (informant agreement ratio) estimated using n_t (number of taxa) and n_{ur} (number of citation in each use category). IAR is zero for two categories (eye and oral diseases) because of the same number of plants and citation for each species. It shows lack of agreement among informants on species usage. The disagreement is

probably due to the long history of mankind and lack of attention on using medical plants. Similar results with present research have reported in Kohghiluyeh and Boyer Ahmad, (Mosaddegh *et al.*, 2012) and china (Ghorbani *et al.*, 2011).

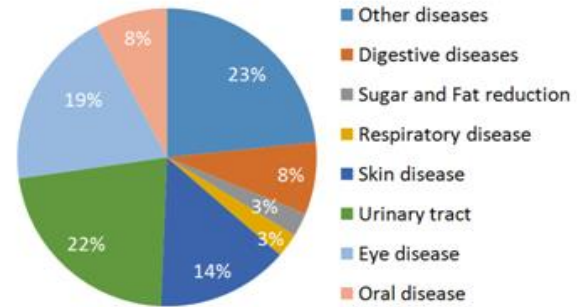


Fig. 3. Chart abundance of medicinal plants in treatment of various diseases in Farouj area.

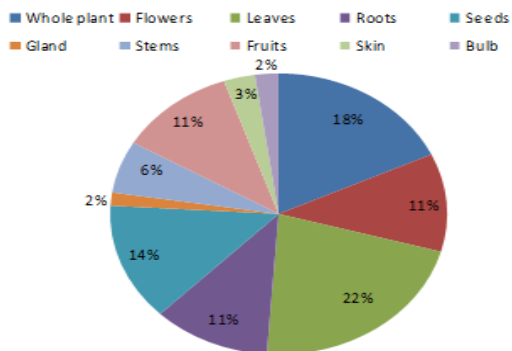


Fig. 4. The most frequently used part of the plants in the studied area, Farouj area.

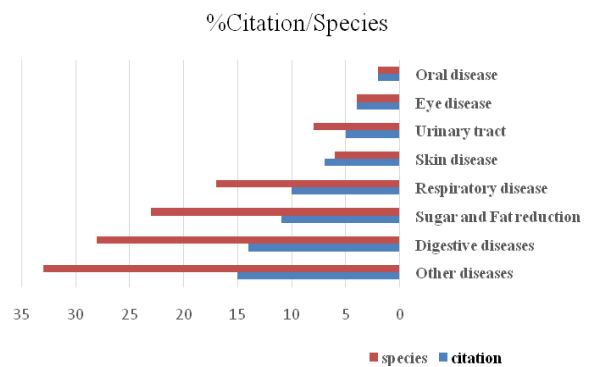


Fig. 5. Percentage of species and citation in each use category in Farouj area.

The maximum IAR indices are mainly pertain to other diseases and digestive disorders, respectively. More IAR value is mostly because of high rate of these ailments over successive generations and as a result more frequent applications of these medicinal plants. High IAR values are also reported from Indian Mexicans (Heinrich *et al.*, 1998), Thailand and China (Inta *et al.*, 2008), SW of Iran (Mosaddegh *et al.*, 2012).

Statistic results fit the null hypothesis because the significance tests generate 95% or 99% likelihood, then the hypothesis is accepted. It means that people who use medical plants for disease therapy will soon recover their health than people who do not.

3.3. Most cited plants and some pictures of the studied area, farouj area

Vitis vinifera L., *Ferula latisecta* Rech. f. Aell., and *Ziziphora persica* Bunge are the most prevalent plants which introduced by people. Some important properties are as follow sedative, laxative, heart diseases, anti-fever; relieve sore throat, jaundice, thirst removing, skin disorders, constipation, cold treatment, slimming.

3.4. Importance of medicinal plants usage in urban and rural regions

Many researchers interested in ethnobotany field. The results of some researchers are accordance with many prior projects. For instance; leaves were the most frequent plant part for curing diseases in some parts of Colombia (Cadena-Gonzalez *et al.*, 2013).

Choudhary and his counterparts (2008) studied medicinal plants in India. They noted "that 2500 plant species have medicinal value". Other scientists like Mesfin *et al.*, (2013) had a research on Northern Ethiopia. They concluded "that a total of 31 medicinal species are grown there (less species than present study)". Moreover, Jeruto *et al.*, (2008) dedicated that around 40 medicinal plants are present in Nandi Forests in Kenya. Some other scientists like Lagos (2005) and Neves with his colleagues studied Imbituba, Santa Catarina, Brazil Zank, and Hanazaki. They agreed that digestive disorders such as stomach pains are one of the most illnesses which can be treated in the studied areas (Zank & Hanazaki 2011). Rajaei & Mohammadi (2012) were look over SE of Iran (Hezar Mountain). Similar to present research, they have

recorded "about 92 species; the most common remedy was related to digestive disorders". Amiri & Joharchi (2013) investigate traditional medicinal plants in Mashhad. Approximately, 269 species were discovered. In this research, plants are mostly used for curing digestive disorders that is in accordance with our research.

In contrast with existent experiment, Bahmani *et al.*, (2014) evaluate 30 medicinal plants in Uremia which Lamiaceae family was the most abundant family (in accordance with Amiri & Joharchi). Similarly, leaves were the most part used in disease remedy. They also considered that many of mentioned species have active potential to improve diabetes. Abbasi *et al.*, (2012) examined Natanz region (Kashan). In total, 65 medicinal plants were identified. They mentioned "that because of livestock grazing and inappropriate climate, most species are supposed to be endangered".

Compare with the present research, a total of 122 genera was investigated in Dehloran and Abadan districts, Ilam Province. Asteraceae was the most abundant family correspondingly to present project. Digestive pains and leaves are the main disease and plant part, respectively (Ghasemi Pirbalouti *et al.*, 2012). In contrast with our study the fruits of these species are used most often and the region is ample with Lamiaceae family (Khajoei Nasab & Khosravi, 2014). In another research a notable amount of medical plants (around 45 species) have conducted. Asteraceae and Fabaceae were dominant families in Hamedan. The most treated disorders (similar to our results) were digestive pains (Naghbi *et al.*, 2014). Additionally, Khodayari *et al.*, (2014) investigated the medical plants of South East of Khuzestan Province. They detected about 174 species owing to 65 families. Asteraceae family had the most value in medicinal treatments especially digestive disorders which are correspond positively with our results.

Some more researches from Iranian projects which involved in ethnobotany are as follow: Ghelichnia (2005) studied the East of Khuzestan province. He considered "more than 86 medical species in that area that is less than the detected species in Farouj". Lamiaceae, Rosaceae, and Asteraceae were the most abundant families there. Traditionally, Kohkilouyeh and Boyerahmad had 138 used plants. Similar to our research Asteraceae was dominant (Mosaddegh *et al.*, 2012), Ghasemi Pirbalouti (2009)

discloses 61 species in Chaharmahale Bakhtiari. Lamiaceae, Asteraceae, and Fabaceae were the most common families, in another research, 91 species were investigated in Kazeroun. Lamiaceae and Asteraceae were commonly used in this region (Dolatkhahi *et al.*, 2014), in Boushehr city, 63 species belonging to 55 genera and 36 families have recognized. Asteraceae family was the largest taxon with nine species (Dolatkhahi & Nabipour 2013), 227 medical plant were found out in Markazi Province. Asteraceae, Lamiaceae and Brassicaceae conclude more usable taxa (Mirdavoodi, 2008), some other ethnobotanists studied Kordestan, and discovers 144 medical plant species (Hooshidari 2009). Ilam has about 122 plants that can be used as ailment therapy. Asteraceae and Lamiaceae were claimed to be the most taxa which contain these plants (Ghasemi Pirbalouti *et al.*, 2012), 394 species of medicinal plants is also grown in Hamedan Province among which the most common family is Asteraceae (Kalvandi, 2007).

It should be noticed that, based upon excessive use of some medicinal plants, they might be unprotected and vulnerable in near future. These species can be conserved by domestication and revival techniques. Obviously, there are some more phenomena that abrogate medicinal plants such as fire, browsing, grazing, grass cutting, lopping, climatic factors, wild animals and insects, agriculture, and etc. Generally, depend on the type of diseases that people meet, different plants might be exposed to danger, for example Njoroge *et al.*, (2010) reported that "*Crassia edulis* is threatened by overuse to cure many disorders such as stomach problems in Ethiopia" (CRAF-PROSEA network). As a result, overutilization of plants can be a parameter to detect threatened species.

4. Conclusion

Farouj district has a great potential in the growing of pharmaceutical plants. This research has been done for the first time in this area. Some striking knowledge has been accumulated about traditional medical plants which will be in use in near future.

Entirely, more plants belonging to angiosperms (except Aspleniaceae). Two families (Liliaceae and Poaceae) fit to monocotyledons, the rest belong to dicotyledonous.

Transparently, women (69%) have more knowledge about medicinal herbs than men (31%), and a more number of questionnaires were completed by them, which is probably due to the fundamental role of women in maintaining family health. Most people in the studied area claimed that they had used these medicinal plants a long time ago, when they were very young, and the plants which are now used only for food consumption not pharmaceutical ones.

Iran with great experience in traditional medical plants is one of the most appropriate countries in this field and has a growing potential in preparation, production, and export of pharmaceutical plants. On the other hand, collecting medicinal plants in their natural habitat need enough knowledge and experience. Great efforts made in this paper have highlighted the drug habits of Farouj city from past to present.

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