Quantitative Ethnobotany of medicinal plants used by the mountain population of the Kitab Region, Uzbekistan

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Databases and Inventories

Abstract

Background: This article examines the therapeutic use and quantitative ethnobotany

Methods: Data were collected during the 2021 and 2022 surveys as a result of interviews, rapid assessments, and the collection of field materials. Interviews with the local population were conducted in the form of a questionnaire, with the consent of the informants.

Results: One hundred and seventeen species of 73 genera in 20 families, were used by the population of the Kitab district of Kashkadarya region for the treatment of various diseases.

Conclusions: The results of this study showed that the lack of sufficient knowledge of the local population on some diseases led to the lack of recognition of ethnobotanical analysis of plants. The main reason for this is the difficulty of recognizing such diseases in rural areas and the lack of ethnobotanical knowledge. It should be noted that in the remote villages of Kitab district, traditional treatment systems using medicinal plants are preserved.

Keywords: Kashkadarya, Kitab, ethnobotany, diseases, decoction, WHO, JASP, ArcGIS.

Background

The earliest records of medicinal plants are found in the Indian manuscripts of the Rigveda, 4500-1600 BC (Ashgar *et al.* 2018). Today, about 80 percent of the world's population uses medicinal plants, and more than 25 percent of the medicines used are derived from natural plant species (Beyene *et al.* 2016). More than 1300 medicinal plants are used in European countries, 90% of which are collected from natural resources (Budovsky & Fraifeld 2012). The traditional use of natural plants largely depends on socio-economic factors, and not on climatic conditions or the richness of the flora Abbasi *et al.* 2013).. Ethnobotanical research plays a key role in understanding these processes and finding practical solutions (Reyes García *et al.* 2009). Ethnobotanical research is of great importance for identifying species of medicinal plants of local importance and

formalizing popular knowledge that they are in danger of extinction (Sanz-Biset *et al.* 2009). Indeed, ethnobotanical research has been a major source for the discovery of natural and synthetic medicines (Fabricant & Farnsworth 2002). Ethnobotanical knowledge has become a center of research conducted by world scientists in recent years (Ghorbani *et al.* 2011). In particular, the demand in the field of ethnobotany is growing in Uzbekistan in recent years. It should be noted that ethnobotanical knowledge is usually transmitted orally from generation to generation through family members (Nadembega *et al.* 2015) and most of this information is not officially documented (Asase *et al.* 2008). However, in recent years, the declining interest of the younger generation in traditional medical knowledge and methods, the loss of ethnobotanical knowledge in rural areas has led to a steady decline in the development of forests and medicinal plants, and the loss of ethnobotanical knowledge (Kadir *et al.* 2013). This study was conducted in the framework of the project "Creation of an electronic depository of medicinal and endangered plants used in the folk medicine of Uzbekistan" to collect data on medicinal plants used by local residents in mountain villages of Kitob district of Kashkadarya region. The geographical location of the district, including its ancient location on the trade caravan route (Great Silk Road), rich cultural heritage, rich flora, and partial preservation of ethnobotanical knowledge, served as an important factor in the study.

Materials and Methods

Research area

Kitab district is located in the northeast of the Kashkadarya region and includes 12 rural citizens' assemblies (MFY). The district is home to 144,000 people. The average population density is 102 people per 1 km2 (https://stat.uz, 2020). Most of the territory is occupied by the high Gissar and Zarafshan mountains (4000 m), which stretch along the northern and eastern borders. High mountains block the district from the flow of cold air. The Takhtakaracha pass (1788m) connects the territory of the district with the northern regions (http://geografiya.uz).

During the study, interviews were conducted with local residents in 5 villages of the Kitab district of the Kashkadarya region (Figure 2). The main share of medicinal plants was in the villages of Doniyorshaykh (55 / 30.1%), Jovuz (32/41%), and Varganza (31 / 17.4%). According to its use in diseases, digestive diseases in Jovuz, colds and nervous diseases in the villages of Varganza and Doniyorshaikh have a high rate (Fig. 1)

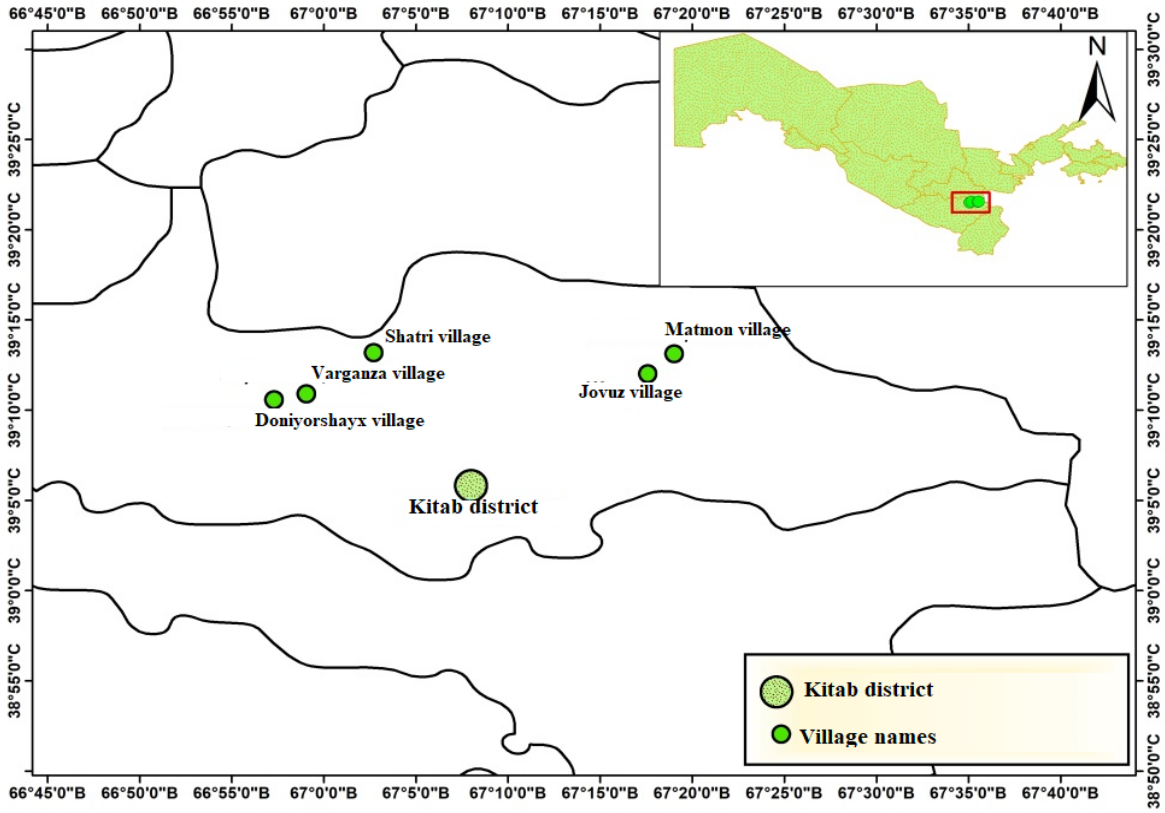

Figure 1. Study area

Collection of ethnobotanical data.

Data were collected during the 2021 and 2022 surveys as a result of interviews, rapid assessments, and the collection of field materials. Interviews with the local population were conducted in the form of a questionnaire, with the consent of the informants. The interviews were conducted in accordance with the rules of the Code of Ethics (ISE Code of Ethics 2006) established by the International Society of Ethnobiology (www.ethnobiology.net). The research was conducted in the villages of Jovuz, Matmon, Shatri, Varganza, Doniyorshaykh in the Kitab district. The remoteness of these villages from the district, the lack of medical facilities, the geographical location of the mountainous areas is suitable for ethnobotanical analysis. The demographic distribution of the local population (gender, age, occupation) was also included in the surveys. Ethnobotanical data were obtained through direct observation, field interviews, group interviews, and interviews using open and semi-structured questioning techniques (Martin 1995). The definition of plant species is given according to the botanical nomenclature (https://powo.science.kew.org/). Voice messages and video recordings were recorded during the interview with prior consent fo the participants. The purpose of the study was explained to each participant, and each participant in the study voluntarily agreed to provide information

Data analysis

JASP version 0.14.1 and MapViewer Demo version 8 were used in the statistical analysis of the collected data and results. Maps of ethnobotanical expeditions and target field research were created in ArcGIS version 10.6.1 (Figure 1). Geographical coordinates reflect the growth points of plants under natural conditions MAPS. Detected using ME (Offline Map & Nav) and Google Earth (Pro 7.1).

Identification and storage of plant specimens

Collected plant specimens were converted to herbarium forms, and taxonomic units were centrally identified using the Asian Plant Identifier (Institute of Botany of the Academy of Sciences of the UzSSR 1968-2016). The collected materials were submitted to the TASH database

Quantitative ethnobotanical concepts

Consensus Factor (ICF)

The data consensus (analytical) factor (Logan 1986), was calculated using the following formula:

$$FIC = Nur - Nt / (Nur - 1)$$

Here, “Light” is the total number of data collected by each disease cluster (informant). “Nt” is the total number of species used for these diseases. This formula has been used in traditional ethnobotany to determine the uniformity of the data of informants (Logan 1986).

Reliability level (FL)

$$FL (\%) = (Np / N) \times 100$$

where Np is the number of people who have reported the use of a plant species to treat a particular disease, N is the number of people who have used plants as a medicine to treat any disease (Friedman *et al.* 1986).

Usage value (Uv)

According to (Friedman *et al.* 1986), FQ was calculated using the following formula:

$$UV = \sum / N$$

Here, “U” indicates the number of data provided by the informants for a particular species, and “N” indicates the total number of respondents. If a tour provides a multi-use indicator, it indicates that there are many useful reports for that type, and a low indicator means a low number of usage reports provided by the providers.

Relative frequency of citation (RFC)

RFC was calculated as follows:

$$RFC = FC / N.$$

The RFC index (Tardío, & Pardo-De-Santayana 2008) is the number of informants that mention a plant species from that species (FC). N is the total number of informants. If there are no users of the plant (RFC) is "0" and "1" when all data providers call it useful.

Family Importance Value

The value of family significance (FIV) is calculated according to the following formula:

$$FIV = FC(Family)/N*100$$

FC – frequency of plant family citations
N – the total number of informants

The storage status of medicinal plants is given in accordance with the IUCN standard (IUCN 2001). FIV helps to characterize families according to the species of a particular plant family used as a drug (Asghar et al. 2018).

Protection status

Based on the parts used, the plants were assessed for their storage status according to IUCN criteria. The conservation status of medicinal plants is listed according to the parts they are used for, their lifespan, and the demand in the local and international market (IUCN 2001).

Results and Discussion

Demographic classification of interviewed participants

A total of 178 local people with different professions were interviewed (Table 2). 42.1% of them were women and 57.9% were men. interviews were conducted mainly with middle-aged and highly educated local seniors who are active in social life (Table 1). Some examples of interviews and plant use are given in Figs. 2-3

Table 1. Participant demographics

Factors	Category	Matmon village community	Jovuz village community	Varganza village community	Doniyorshayx village community	Shatri village community	Percent %
Gender	Male	22	15	21	33	12	57,9
	Female	11	17	10	22	15	42,1
Occupation	Teacher	6	5	6	9	5	17,4
	Farmer	7	4	7	10	6	19,1
	Shepherd	9	6	7	17	5	24,7
	Entrepreneur	4	7	4	8	4	15,2
	Housewife	3	5	4	7	4	12,9
	Temporarily unemployed	4	5	3	4	3	10,7
Age	<30	3	2	4	6	2	9,6
	30-40	5	6	5	9	4	16,3
	40-50	11	8	6	15	8	26,7
	50-70	11	12	9	23	9	35,9
	>70	3	4	7	12	4	16,9

Figure 2. With tabib Hazratkul bobo, (85 age)

Figure 3. Beekeeper and tabib Akmal bobo (75age)

Taxonomic data of medicinal plants

During the interview, 405 ethnobotanical returns of 20 families, 73 genera, and 117 species of medicinal plants were recorded, of which Table 1 shows 61 species of plant specimens (305 records). In particular, the use of some of the introducing plant species listed (Table 2).

Table 2. Species and their uses

Species	Local name	Part used	C	RFC	Uses
Amaryllidaceae					
Allium sativum L.	Sarimsoq	Bulbs, young leaves	3	0.009	It is used in rashes and diseases of the immune system in the human body
Allium stipitatum Regel.	Anzur piyozi	Bulbs, young leaves	2	0.006	It is used by the local population for diseases of the digestive system and vision and hearing
Allium giganteum Regel	Katta piyoz	Bulbs, young leaves	2	0.006	Locals use it to concentrate on swelling and bruising in the body, to improve hearing, memory
Anacaridaceae					
Rhus coriaria L.	Oshlovchi totum	Leaves, fruits	3	0.009	It has been used to treat lung diseases and inflammation
Apiaceae					
Anethum graveolens L.	Ukrop	Aboveground part, seeds	4	0.013	In folk medicine, the plant is consumed in the appetite for its vitamin richness. The locals use it a lot instead of spices
Apium graveolens L.	Xidli qoranafs	Whole plant	3	0.009	In folk medicine, the plant is widely used in painkillers and gastritis. has the property of strengthening immunity in men
Conium maculatum L.	Dog'li zangpoya	Aboveground part	2	0.006	In folk medicine, food is used for digestive diseases and as a cough suppressant and analgesic
Coriandrum sativum L.	Kashnich	Aboveground part, seeds	5	0.016	In folk medicine, coriander fruits are used in diseases of the gastrointestinal tract, and their infusion as an anthelmintic has been used as an appetite suppressant, analgesic, and anti-cold agent.
Cuminum cyminum L.	Sariq zira	Seeds	2	0.006	Regular use of spices in folk medicine has a beneficial effect on the gastrointestinal tract, cardiovascular and nervous systems, and the ability to see.
Elwendia persica (Boiss.) Pimenov & Kljuykov	Fors zirasi	Seeds	3	0.009	The fruits of Zira are used as a diuretic. Abu Ali ibn Sina used cumin seeds to treat splenic tumors and the infusion was obtained from the seeds as a blood-stopping agent. In Tajik folk medicine, cumin seeds are widely used in the treatment of chronic stomach (chronic gastritis), intestinal (colitis), liver (jaundice), chronic cholangitis, tumors, as well as kidney stones.
Ferula foetida (Bunge) Regel	Sassiq kovrak	Roots, gum resin, young leaves	2	0.006	It is used in folk medicine against intestinal diseases and internal poisoning
Ferula tadshikorum Pimenov	Tojik kovragi	Roots, gum resin, young leaves	4	0.013	Ferula is one of the oldest medicinal plants. Abu Ali ibn Sina in his medical practice from ferula in the treatment of skin diseases (vitiligo), tuberculosis,

					joint pain (arthritis), worms, inflammation of the stomach, intestines, as well as salt and food used as a means of cleaning the remains.
Heracleum lehmannianum Bunge	Boldirg'on	Aboveground part	3	0.009	In folk medicine, it is used in the treatment of gastric diseases, asthma, and purulent ulcers
Asteraceae					
Achillea millefolium L.	Oddiy bo'ymadiron	Inflorescence, aerial part	4	0.013	In folk medicine, it is used as an anti-inflammatory, in various diseases of the gastrointestinal tract, and as an appetite suppressant.
Achillea filipendulina Lam.	Dastarbosh	Aboveground part	2	0.006	In folk medicine, it is used in heart, stomach, biliary tract dyskinesia, leukorrhea, malaria, insomnia, urinary incontinence, and in some diseases of the liver, as a means of wound healing and hemostasis during heavy menstruation.
Artemisia absinthium L.	Achchiq ermon	Grass (flowering tops) and leaves	3	0.009	In folk medicine, it is used to stimulate appetite and digestion, chronic diseases of the pancreas and biliary tract
Artemisia dracunculus L.	Sherolg'in	Grass (flowering tops) and leaves	2	0.006	In folk medicine, the aerial part of the plant was used as an antihelminthic, for edema and scurvy.
Bidens tripartita L.	Uch bo'lakli ittikanak	Plant tops and large leaves	3	0.009	It is used in folk medicine for skin diseases and urinary tract diseases
Calendula officinalis L.	Tirnoqgul	Flowers	1	0.003	In folk medicine it is used for colds of the mouth and throat
Helichrysum maracandicum Popov ex Kirp.	O'lmaso't	Inflorescences	2	0.006	In folk medicine, used in diseases of the liver and gallbladder.
Inula helenium L.	Katta andiz	Roots	3	0.009	In folk medicine, lung diseases are used in tuberculosis, and skin rashes
Inula grandis Schrenk	Andiz	Aerial part, root	4	0.013	In folk medicine, lung diseases are used in tuberculosis, and skin rashes
Matricaria chamomilla L.	Dorivor moychechak	Flowers	2	0.006	In folk medicine, it is used as an anti-inflammatory, diaphoretic, sedative, hemostatic, and analgesic agent.
Berberidaceae					
Berberis integerrima Bunge	Qizil zirk	Aboveground part	3	0.009	Used in folk medicine in intestinal diseases and sexually transmitted diseases
Berberis nummularia Bunge	Tangasimon zirk	Aboveground part	3	0.009	Used in folk medicine in intestinal diseases and sexually transmitted diseases
Berberis oblonga (Regel) CK Schneid.	Uzunchoq zirk	Aboveground part	2	0.006	Used in folk medicine in intestinal diseases and sexually transmitted diseases
Brassicaceae					
Armoracia rusticana G.Gaertn., B.Mey. & Scherb.	Yer qalampir	Roots, leaves	2	0.006	In folk medicine, it is used in diseases of the mouth and gastrointestinal tract.

Brassica juncea (L.) Czern.	Xantal	Seeds	5	0.016	In folk medicine, the seeds of Sarepta mustard have been used as an appetite suppressant, stimulating the activity of the gastrointestinal tract, as well as a sedative for malaria, and opium poisoning.
Capsella bursa-pastoris (L.) Medik.	Oddiy jag'-jag'	Aboveground part	6	0.019	In folk medicine, it is used for women's sexually transmitted diseases and bleeding
Lepidium sativum L.	Ekma tarol	Leaves, juice, seeds	2	0.006	In folk medicine, it is used in digestive diseases, hair loss and as a painkiller
Capparaceae					
Capparis spinosa L.	Tikanli kovul	Root bark, flowers, buds, fruits, roots	5	0.016	In folk medicine, capers are used for toothache, gum disease, thyroid, and hemorrhoids.
Caprifoliaceae					
Valeriana officinalis L.	Asarun	Rhizomes	1	0.003	In folk medicine, it is used in cardiovascular diseases, digestive diseases, and insomnia
Ephedraceae					
Ephedra equisetina Bunge	Zog'oza	Shoots, cones	3	0.009	Used in folk medicine for nervous disorders and cough
Equisetaceae					
Equisetum arvense L.	Dala qirqbo'g'imi	Aboveground part	11	0.036	In folk medicine, it is used in heart disease and diseases of the joints
Fabaceae					
Senna alexandrina Mill.	Sano	Leaves	5	0.016	The leaves and extracts of the plant have long been used as a laxative, as well as for diseases of the liver and gallbladder.
Styphnolobium japonicum (L.) Schott	Sofora	Flowers, fruits	4	0.013	In folk medicine, skin diseases are used for rashes and wounds
Quercus robur L.	Eman	Bark, leaves, acorns, galls	3	0.009	In folk medicine, it is used as a painkiller and anti-inflammatory agent.
Vigna unguiculata subsp. *sesquipedalis* (L.) Verdc.	Jandiq	Leaves, beans	2	0.006	In folk medicine, it is used to purify the blood and drive urine, and digest food
Vigna radiata (L.) R.Wilczek	Mosh	Beans	8	0.026	It is used among people with skin diseases and skin burns
Gentianaceae					
Centaurium pulchellum (Sw.) Hayek ex Hand.-Mazz., Stadlm., Janch. & Faltis	Chiroyli mingtillachi	Aboveground part	3	0.009	In folk medicine, it is used to enhance the activity of the stomach and other digestive organs..
Geraniaceae					
Geranium baschkyzylsaicum Nabiev	Yorongul	Aboveground part	3	0.009	In folk medicine, it is used for nasal congestion and cough, as well as in skin tumors

Hypericaceae					
Hypericum perforatum L	Dalachoy	Aboveground part	15	0.049	Used in folk medicine in neurological diseases
Lamiaceae					
Lagochilus inebrians Bunge	Buzulbang	Leaves and flowers	4	0.013	In folk medicine, it is used to stop the deposit
Leonurus turkestanicus V.I. Krecz. & Kuprian.	Arslonquyruq	Tops of grass, with stems no more than 5 mm.	2	0.006	In folk medicine, it is used in the treatment of heart disease and as a sedative, sedative.
Melissa officinalis L.	Limono't	Leaves, flowers	16	0.052	Used in diseases of the nervous system among the population
Mentha longifolia (L.) L.	Yalpiz	Aboveground part	17	0.055	In folk medicine, mint is used for nausea, vomiting and diarrhea associated with inflammation in the gastrointestinal tract, especially accompanied by the formation of painful colic and large amounts of intestinal gas.
Origanum vulgare subsp. *gracile* (K.Koch) Ietsw.	Tog'rayxon	Aboveground part	13	0.042	Among the population, it is used in diseases of the nervous system and digestive tract.
Salvia sclarea L.	Marmarak	Aboveground part	6	0.019	In folk medicine, it has been used in the treatment of sweating (hyperhidrosis), hemoptysis, and heart failure in patients with pulmonary tuberculosis.
Ziziphora pedicellata Pazij & Vved.	Kiyiko't	Aboveground part	20	0.065	In folk medicine, it is used in the nervous system and digestion
Lythraceae					
Punica granatum L.	Anor	Fruit, fruit peel, juice	10	0.032	Pomegranate juice is useful for anemia, a decoction of the peel and membranous partitions - for burns and indigestion.
Malvaceae					
Althaea armeniaca Ten.	Gulxayri	Root, flowers, leaves	6	0.019	In folk medicine, it is used as an anti-inflammatory for diseases of the digestive organs.
Althaea officinalis L.	Dorivor gulxayri	Root, flowers, leaves	5	0.016	Among the population, anti-inflammatory sputum is used in diarrhea and gastric diseases
Ficus carica L.	Anjir	Fruits, leaves	7	0.022	In folk medicine, skin diseases are used in burns and rashes
Polygonaceae					
Persicaria hydropiper (L.) Delarbre (L.) Spach	Suv qaalampir	Aboveground part	4	0.013	used in sexually transmitted diseases and pain relief among the population
Rheum maximowiczii Losinsk.	Ravoch	Roots, rhizomes, petioles, stems and juice from them.	11	0.036	In folk medicine, it is used for anemia, antipyretic and biliary tract diseases
Ranunculaceae					

Nigella sativa L.	Sedana	Seeds, leaves, oil	7	0.022	used in the population for respiratory, gastrointestinal, kidney, liver, and cardiovascular system problems, improving immunity and improving the general condition of the body.
Rosaceae					
Cydonia oblonga Mill.	Bexi	Fruits, seeds and leaves	6	0.019	used in local medicine in diseases of the urinary tract and in the opening of the appetite
Rubus idaeus L.	Buldurg'un	Whole plant	2	0.006	In folk medicine, it is used for colds, flu, and other fevers.
Prunus amygdalus Batsch	Bodom	Fruit	12	0.039	Used in folk medicine for skin diseases and colds
Prunus cerasifera Ehrh.	Tog'olcha	Flowers, leaves, fruits	5	0.016	In folk medicine, it is used in diseases of the liver and kidneys
Moraceae					
Morus alba L.	Oqtut	Whole plant	2	0.006	In folk medicine, it is used for cough, bronchitis, bronchial asthma, expectorant, diuretic, as well as for epilepsy, and hypertension..

C - number of respondents citing the plant; RFC - relative Frequency of citation; FIV - family importance value

In the table in ethnobotany is explained by the fact that the above-mentioned region has long been located on the caravan route and has long cooperated with many countries in trade and culture. According to ethnobotanical records, species belonging to the Lamiaceae family are most commonly used by the local population for medicinal purposes. Species belonging to this family were mentioned 80 times in the survey, which is 19,8% of the total. The next results belong to the families Asteraceae (6,4%) and Apiaceae (6.9%).

Application in diseases

Medicinal plants mentioned in the survey are used in 14 different disease groups. Medicinal plants are widely used by the locals in diseases such as colds, digestive processes, lowering blood pressure and fever, as well as food spices as an appetizer. According to the use of medicinal plants in the diseases mentioned in the interviews, blood pressure-related diseases have a greater advantage of 31 times 17% and diseases related to colds 22 times 12% (Fig. 4).

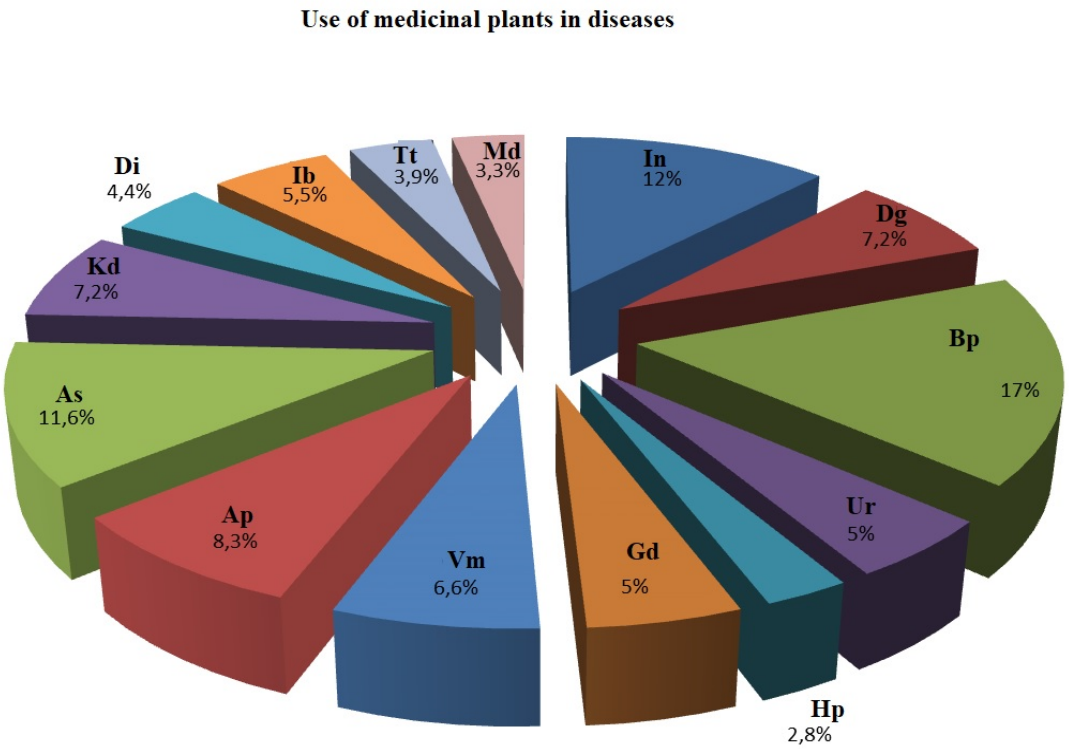

Figure 4. Disease categories medicinal plants were used for. *Sh- Inflammation, OH- Digestion, QB- Blood pressure, PH- Urination, G- Hepatitis, AK- Gynecological diseases, GJ- Vomiting, IO- Appetite, IS- Asthma, BK- Kidney disease, IK - Diarrhea, IO - Immune Booster, Tt -Toothache, EC - Men's Disease.*

According to the analysis, 49% of the medicinal plants recognized by the local population are used in the form of tinctures, the rest in the form of decoctions, ointments, pickles. In use, the leaf parts have 28%, stems and branches 27%, seeds, and fruits 14%, flowers 10% and roots 7%, the rest 14%.

Conclusions

The results of this study showed that the lack of sufficient knowledge of the local population on some diseases led to the lack of recognition of ethnobotanical analysis of plants. The main reason for this is the difficulty of recognizing such diseases in rural areas and the lack of ethnobotanical knowledge. It should be noted that in the remote villages of Kitab district, traditional treatment systems using medicinal plants are preserved. The need to prevent the loss of such ethnobotanical knowledge and to document many processes of conducting similar research in the territory of Uzbekistan, as well as to create a profile of medicinal plants.

Declarations

List of abbreviations: Not applicable.

Ethics approval and consent to participate: All participants provided oral prior informed consent.

Consent for publication: All participants shown in images agreed to have their image taken and published.

Availability of data and materials: All the data are presented in tables in the manuscript and are available with the corresponding authors.

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

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Authors' contributions: ZK, OK collected, analyzed the data and drafted the manuscript. OK, RB and advised, reviewed, and approved the final manuscript

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