johb.info



Original Article

One Health Bulletin

Ethnomedicinal survey of anti−urolithiatic medicinal plants used in the region of Mascara, Algeria

Safia Lakhdar Toumi[1]✉, Badra Moulei Ali[2]

[1]*Department of Biomedicine, Faculty of Veterinary Sciences, Ibn−Khaldoun University, Tiaret 14000, Algeria*

[2]*Department of Science of Nature and Life, Inb−Khaldoun University, Tiaret 14000, Algeria*

ABSTRACT

Objective: To conduct an ethnomedicinal survey and conserve traditional medicinal practices in the Mascara region of northwestern Algeria. In this region, traditional medicinal knowledge has primarily been transmitted orally, and the study aims to document it in written form for better utilization in the field of pharmacology.

Methods: Purposive sampling with semi-structured questionnaires was adopted with ethnobotanical data obtained from 135 local informants, including 22 herbalists. The study participants were asked about their sociodemographic profiles and ethnomedicinal knowledge about anti-urolithiatic medicinal plants.

Results: Sixty-three anti-urolithiatic species belonging to 59 genera and 32 families were inventoried. All plants are prescribed orally, and decoction presents the most common preparation method (46.0%). Seeds are the most used parts (27.0%). The most frequent botanical families were Apiaceae, Lamiaceae, Fabaceae, and Rosaceae. The predominant anti-urolithiatic plants are *Herniaria hirsute* L., *Hordeum vulgare* L., *Linum usitatissimum* L., *Zea mays* L., *Lavandula angustifolia* Mill., and *Apium graveolens* L.

Conclusions: This study highlights the diversity of the phytotherapeutic practices used against urolithiasis in the region of Mascara. It also suggests that ethnomedicine is well-entrenched in local health practices in this area. However, this knowledge acquired by the local inhabitants over the centuries risks disappearing since it is mainly held by older people and is not documented.

KEYWORDS: Ethnomedicinal survey; Mascara; Algeria; Anti-urolithiasic plants

1. Introduction

Urolithiasis is a prevalent multifactorial disease. It is characterized by the formation of stones from crystalline concretions that grow as a result of an abnormal urinary oversaturation regarding one or more crystalline species, depending on the type of kidney stone[1]. The prevalence of this pathology is increasing worldwide, with an ominous rate of recurrence of 50.0% and severe evolution in some cases that could lead to severe complications and chronic renal failure, which presents a significant public health problem[2]. Moreover, no drug exists for the dissolution of most urolithiasis types[3]. The treatments prescribed, including diuretics, nonsteroidal anti-inflammatory drugs, analgesics, and inhibitors of some metabolites, have a limited effect because they do not treat urolithiasis disease[4,5].

The advancement of techniques for fragmenting and eliminating urolithiasis, such as extracorporeal shock wave lithotripsy and percutaneous extraction, represents significant progress in urological

Significance

This study reveals an important diversity of traditional remedies in Mascara, Algeria by documenting 63 anti-urolithiatic plants belonging to 32 families. Apiaceae, Lamiaceae, Fabaceae, and Rosaceae were the most frequent botanical families. Decoction presents the most common method of preparation, and seeds are the most used parts. These results offer valuable leads for pharmaceutical research for the future integration of traditional knowledge into modern healthcare.

✉To whom correspondence may be addressed. E-mail: safia.lakhdartoumi@univ-tiaret.dz

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-Non Commercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

©2024 *One Health Bulletin* Produced by Wolters Kluwer- Medknow.

How to cite this article: Lakhdar Toumi S, Moulei Ali B. Ethnomedicinal survey of anti-urolithiatic medicinal plants used in the region of Mascara, Algeria. One Health Bull 2024; 4(3): 110-116. doi: 10.4103/ohbl.ohbl_8_24

Article history: Received 31 January 2024 Revision 13 April 2024
Accepted 25 June 2024 Available online 5 July 2024

treatment. However, these methods exhibit limited effectiveness in fragmenting the most prevalent type of stones, such as whewellite, and they can hardly guarantee a comprehensive solution to preventing urolithiasis recurrence. Additionally, it's essential to consider the financial implications associated with these therapeutic interventions[6,7].

Because of modern medical technology failure, the approach to managing this pathology must be based on permanent prevention because of its frequency, recurrent nature, and high treatment costs. Among prophylactic means, traditional medicine could help to expulse lithiasis fragments or even dissolve pre-existing stones and prevent the formation of new ones in the urinary tract. According to the World Health Organization (WHO), traditional and complementary medicine is used by at least 80% of the Member States across all WHO regions, with more than 90% of Member States in the Eastern Mediterranean, Southeast Asia, and Western Pacific regions reporting the use of traditional and complementary medicine[8].

In Algeria, phytotherapy is integral to the local culture[9]. Several ethnobotanical surveys have been conducted in Algeria to identify and document medicinal plants and information on their phytotherapeutic uses practiced by the local population against different pathologies including the following references[9–13]. However, research on anti-urolithiatic medicinal plants and their traditional uses remains was poorly explored. In this context, an ethnobotanical survey was carried out to collect data about the traditional uses of medicinal plants in treating urolithiasis in Mascara, Algeria.

2. Materials and methods

2.1. Study area

The present study was carried out in the region of Mascara located in northwestern Algeria (latitude, 35° 23′ 40N; longitude, 0° 08′ 23E; altitude, 492 m). It covers an area of 5 135 km^2. It is limited on the north by Oran and Mostaganem, on the east by Tiaret and Relizane, on the west by Sidi Bel-Abbes, and on the south by Saïda (Figure 1).

2.2. Ethnomedicinal survey

A survey was carried out from December 2018 to March 2019 using semi-structured questionnaires. Local informants were selected based on their assertion that they knew anti-urolithiatic plants and their uses (most often, people already tried traditional treatments for urolithiasis for themselves or a member of their families) using purposive sampling[14,15]. In total, 135 local people from the study area (including 22 herbalists) were interrogated at their homes or locations (case of herbalists).

Data were obtained in face-to-face interviews; informants were asked about their sociodemographic profiles (sex, age, educational and socioeconomic levels). Ethnomedicinal information about anti-urolithiatic plants was collected including local names, parts used, preparation methods, and administration modes. The survey was done in the Arabic dialect to facilitate understanding, and the agreement of each respondent was obtained orally.

2.3. Botanical identification

The botanical identification was carried out using the following floras[16,17] and then updated with the plant list[18].

2.4. Data analysis

Recorded data were analysed using Excel software, and ethnobotanical information was structured in Use Reports (URs). The relative frequency of citation (RFC) was calculated to highlight the local importance of each species following the formula: RFC= FC/N, where FC is the frequency of citation, and N is the number of informants participating in the survey[19].

Then, the plants were classified into five categories based on their ethnobotanical uses in the treatment and/or the relief of the renal colic caused by the stones' migration. The informant consensus factor (ICF) was calculated to determine the effectiveness of the

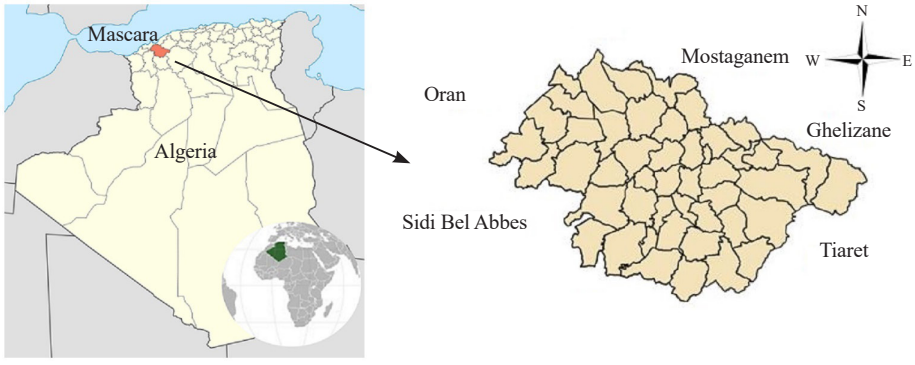


Figure 1. Geographical location of the study area Mascara, Algeria.

medicinal plants in each category. It is calculated with the following formula: ICF= (Nur − Nt)/ (Nur − 1), where Nur refers to the total number of use reports for each category, and Nt is the number of taxa used in that category[20].

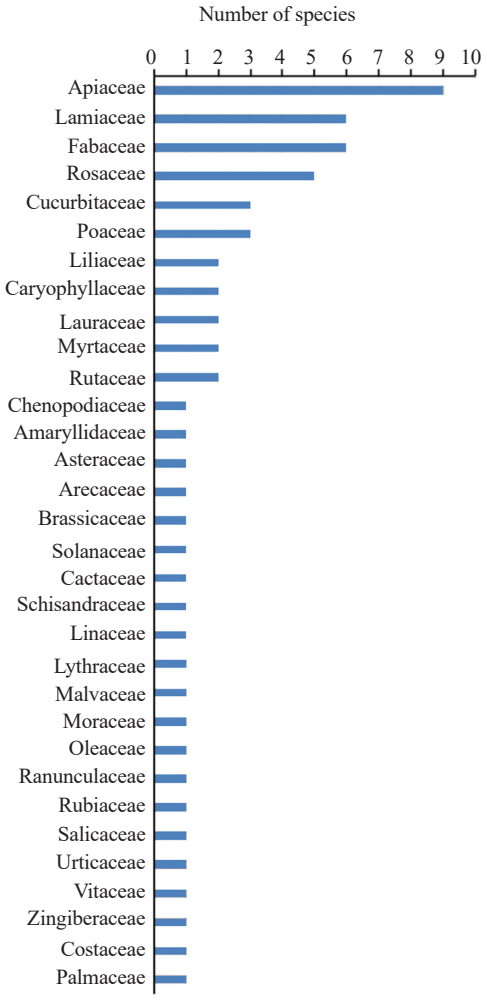


Figure 2. Thirty-two botanical families of anti-urolithiasis plant species.

3. Results

3.1. Informant's sociodemographic profile

The present survey was conducted with 135 participants living in the Mascara region. Of these, 90 individuals were male, and 45 were female. Concerning the interviewees' ages, it was clear that young people need to gain knowledge about the medicinal plants' therapeutic uses. Table 1 shows that the majority of the study population was over 40 years old, with a predominance of the age group (40 to 60) with 48.1% of the total population and 22.2% for the more aged (> 60). However, informants aged between 20 and 40 had the lowest percentage (11.1%) versus 18.5% for the younger (< 20 years old).

Illiterates had the lowest percentage (6.7%). In comparison, most informants had a secondary level with a rate of 48.14%, followed by academics (14.8%), intermediate and primary level (13.3% and 17.0%, respectively). Regarding the socio-economic level, 74.1% have a medium level against 25.9% of the low level (Table 1).

Table 1. Sociodemographic characteristics of informants.

Sociodemographic profile	Categories	Number of informants (%)
Sex	Men	90 (66.7)
	Women	45 (33.3)
Age (Years)	<20	25 (18.5)
	20-40	15 (11.1)
	40-60	65 (48.1)
	>60	30 (22.2)
Educational level	Illiterate	9 (6.7)
	Primary	23 (17.0)
	Secondary	65 (48.1)
	Intermediate	18 (13.3)
	University	20 (14.8)
Socio-economic level	Moderate	100 (74.1)
	Low	35 (25.9)

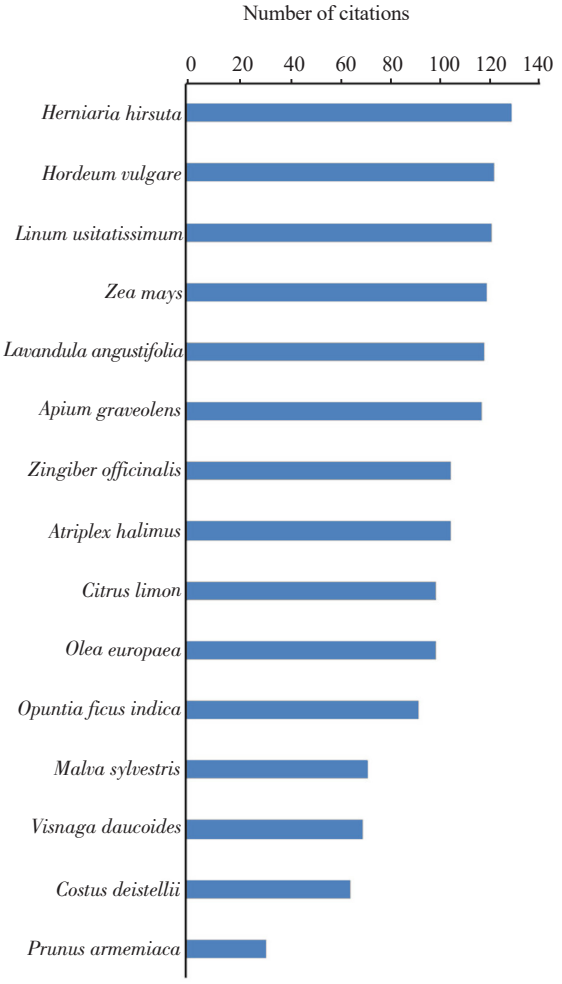


Figure 3. List of the most cited anti-urolithiasis plants.

Table 2. List of anti-urolithiasis plants used by local people of Mascara.

Family name	Botanical name	Local name	Part used	Preparation method	Therapeutic uses	URs	RFC
Apiaceae	*Apium graveolens* L.	Krafes	FS	Decoction	Litholytic	117	0.63
	Petroselinum crispum Mill.	Maadnous	FS	Chopped fresh or decoction	Diuretic	16	0.08
	Carum carvi L.	Carwiya	S	Infusion	Diuretic	6	0.03
	Foeniculum vulgare Mill.	Besbes	S	Maceration	Reduces the colic pain	1	0.005
	Levisticum officinale W.D.J. Koch	Lanjbar	S	Powder with honey	Diuretic	1	0.005
	Pimpinella anisum L.	Habet hlawa	S	Decoction	Diuretic	1	0.005
	Visnaga daucoides L.	Noukha	FS	With milk or yogurt	Litholytic	70	0.37
	Coriandrum sativum L.	Kosbor	FS & S	Infusion	Diuretic; reduces the colic pain	15	0.08
	Daucus carota L.	Zroudia	R	Cooked or raw	Diuretic	1	0.005
Lamiaceae	*Salvia officinalis* L.	Marimiya	L	Infusion	Diuretic	1	0.005
	Lavandula angustifolia Mill.	Khezama	WP	Infusion	Litholytic; reduces the colic pain	118	0.64
	Mentha aquatica L.	Naanaa	WP	Decoction	Diuretic	1	0.005
	Mentha pulegium L.	Fliou	WP	Infusion	Diuretic	1	0.005
	Thymus vulgaris L.	Zaatar	FS	Infusion	Diuretic	1	0.005
	Rosmarinus officinalis L.	Halhal	L & FT	Infusion	Diuretic	1	0.005
Fabaceae	*Vicia faba* L.	Foul	S	Chewed dried	Litholytic; reduces the colic pain	1	0.005
	Cicer arietinum L.	Homos	S	Roasted and ground powder	Diuretic	1	0.005
	Phaseolus vulgaris L.	Loubya	Fr	Cooked	Diuretic	1	0.005
	Glycyrrhiza glabra L.	Ark sous	R	Decoction of powder	Diuretic; reduces the colic pain	1	0.005
	Trigonellafoenum–graecum L.	Helba	S	Decoction	Reduces the colic pain	1	0.005
	Calycotome spinose L.	Guendoul	R	Decoction	Litholytic	1	0.005
Rosaceae	Malus domestica Borkh.	Toufah	Fr	Fresh pulp	Litholytic	1	0.005
	Pyrus communis L.	Baouid	Fr	Fresh pulp	Litholytic	1	0.005
	Prunus domestica L.	Barkouk	Fr	Fresh fruit	Litholytic	1	0.005
	Prunus armeniaca L.	Mechmech	Fr	Dried fruit	Litholytic	31	0.17
	Cydonia oblonga Mill.	Sfarjel	Fr	Decoction or compote or jelly or quince paste	Reduces the colic pain	4	0.02
Cucurbitaceae	*Cucumis melo* L.	Betikh	Fr	Fresh	Diuretic	19	0.1
	Cucumis sativus L.	Khiyar	Fr	Fresh	Diuretic	3	0.01
	Cucurbita maxima Duch.	Kabouya	Fr	Fresh	Diuretic; reduces the colic pain	9	0.04
Poaceae	*Hordeum vulgare* L.	Chaiir	S	Decoction	Diuretic; reduces the colic pain	122	0.06
	Zea mays L.	Dhra	St	Decoction	Reduces the colic pain	119	0.65
	Avena sativa L.	Khortan	S	Decoction	Diuretic & reduces the colic pain	25	0.13
Liliaceae	*Allium cepa* L.	Bsal	B	Decoction	Diuretic	2	0.005
	Asparagus officinalis L.	Sekkoum	WP	Decoction	Reduces the colic pain	10	0.05
Caryophyllaceae	*Herniaria hirsute* L.	Fettetet lehdjar	WP	Decoction	Diuretic	129	0.7
	Ziziphus lotus L.	Sedra-nbeg	L	Decoction	Reduces the colic pain	1	0.005
Lauraceae	*Cinnamomum cassia* Blum.	Karfa	B	Poudre with honey and lemon juice	Litholytic	1	0.005
	Laurus nobilis L.	Rand	L	Decoction	Diuretic	1	0.005
Myrtaceae	*Myrtus communis* L.	Reyhan	L	Infusion	Reduces the colic pain	1	0.005
	Syzygium aromaticum L.	Kronfol	S	Decoction	Litholytic	1	0.005
Rutaceae	*Citrus limon* L.	Lim	Fr	Jus with honey and olive oil	Litholytic	99	0.54
	Citrus sinensis L.	Tchina	L	Decoction	Reduces the colic pain	20	0.1
Chenopodiaceae	*Atriplex halimus* L.	Gtaf	L	Decoction	Litholytic	105	0.57
Amaryllidaceae	*Alium sativum* L.	Thoum	B	Cooked by steaming and mixed with honey	Reduces the colic pain	1	0.005
Asteraceae	*Artemisia herba alba* Asso	Chih	FT	Infusion	Diuretic	1	0.005
Arecaceae	*Chamaerops humilis* L.	Doum	Fr	Fresh	Litholytic	1	0.005
Brassicaceae	*Lepidium sativum* L.	Hab errchad	S	Poudre with honey	Litholytic	1	0.005
Solanaceae	*Solanum lycopersicum* L.	Tomatich	Fr	Decoction	Litholytic	1	0.005
Cactaceae	*Opuntia ficus indica* L.	Hendi	L	Decoction	Litholytic	92	0.5
Schisandraceae	*Illicium verum* Hook. f.	Ennedjma	S	Decoction	Diuretic	1	0.005
Linaceae	*Linum usitatissimum* L.	Zeriat ketan	S	Infusion	Diuretic; reduces the colic pain	121	0.66
Lythraceae	*Lawsonia inermis* L.	Henna	L	Infusion	Litholytic	1	0.005
Malvaceae	*Malva sylvestris* L.	Khobiz	Fl	Infusion	Diuretic	72	0.39
Moraceae	*Ficus carica* L.	Karmous	Fr	Decoction	Diuretic	1	0.005
Oleaceae	*Olea europaea* L.	Zitoun	Fr	Olive oil with honey and lemon juice	Diuretic	99	0.54
Ranunculaceae	*Nigelle sativa* L.	Sanouj	S	Decoction	Diuretic	1	0.005
Rubiaceae	*Coffea arabica* L.	Kahwa khadra	S	Decoction of dried unroasted coffee bean	Diuretic	25	0.13
Salicaceae	*Populus tremula* L.	Safsaf	B	Decoction	Diuretic	1	0.005
Urticaceae	*Urtica pilulifera* L.	Hourig	R	Decoction	Diuretic	1	0.005
Vitaceae	*Vitis vinifera* L.	Zbib	Fr	Decoction (dried grapes)	Litholytic	1	0.005
Zingiberaceae	*Zingiber officinalis* L.	Zanjabil	R	Maceration	Litholytic	105	0.57
Costaceae	*Costus deistellii* K.Schum.	Kast hendi	R	Maceration	Litholytic	65	0.35
Palmaceae	*Phoenix dactylifera* L.	Tmar	S	Decoction	Litholytic	1	0.005

Note: WP: Whole plant; FS: Flaky stem; S: Seeds; L: Leaves; R: Roots; B: Bark; Fr: Fruit; Fl: Flowers; FT: Flowering tops; B: Bulb; St: Stigmata; URs: Use reports.

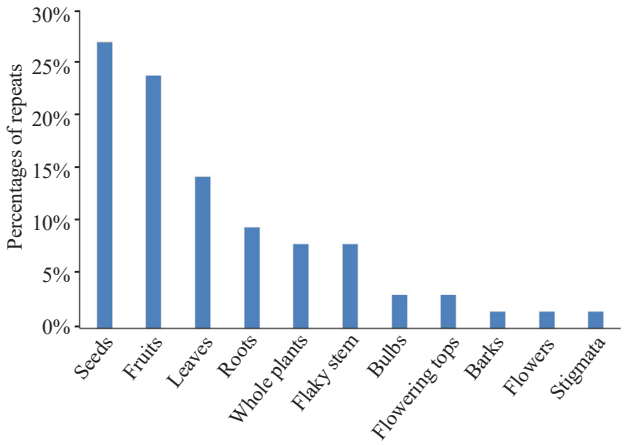


Figure 4. The most common used part of the plants studied.

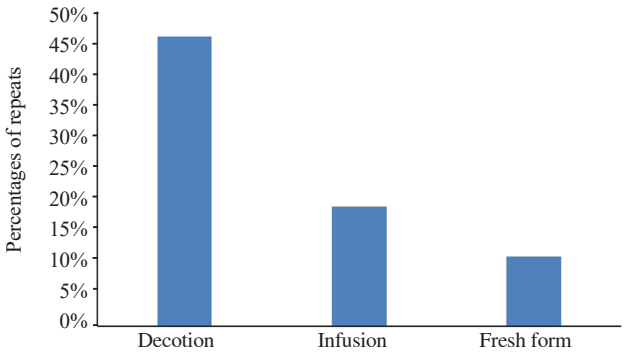


Figure 5. The preparation methods of the medicinal plants.

3.2. Anti–urolithiatic species listed in the region of Mascara

The ethnomedicinal information collected allowed us to inventory 63 anti-lithiasis plant species distributed into 59 genera and 32 botanical families (Table 2). Four families dominate this flora: Apiaceae (nine species), Lamiaceae (six species), Fabaceae (six species), and Rosaceae (five species). They alone account for 26 species, representing 41.3%. Other well-represented families are Cucurbitaceae and Poaceae, with three species each. The remaining families have one or two species (Figure 2). In total, we collected 1 654 use reports (Table 2). The most frequently cited medicinal species are, in descending order of citations number: *Herniaria hirsuta* L. (129 citations), *Hordeum vulgare* L. (122 citations), *Linum usitatissimum* L. (121 citations), *Zea mays* L. (119 citations), *Lavandula angustifolia* Mill. (118 citations), and *Apium graveolens* L. (117 citations). The other well-cited species are *Zingiber officinalis* L. and *Atriplex halimus* L. (105 citations each), *Citrus limon* L. and *Olea europaea* L. (99 citations each), *Opuntia ficus indica* L. (92 citations), *Malva sylvestris* L. (72 citations), *Visnaga daucoides* L. (70 citations), and *Costus deistellii* K.Schum. (65 citations) (Figure 3).

In our study area, the relative frequency of citation ranged from 0.005 to 0.7. *Herniaria hirsute* L., used as a diuretic, was the plant species with the highest degree of RFC (Table 2). The most common plant part used was seeds (27.0%), followed by fruits (23.8%), leaves (14.3%), roots (9.5%), whole plant, and flaky stem (7.9%) each. Bulbs and flowering tops (3.2%) each. Bark, flowers, and Stigmata (1.6%) each (Figure 4). Sometimes, honey and lemon juice are added to medicinal preparations to improve their effectiveness. The decoction using water as solvent was primarily used in this study (46.0%), followed by infusion (19.0%) (Figure 5).

The most often cited therapeutic application category was C (Litholitic) with 696 used reports. The category E (Diuretic) noted the highest number of plants (26 taxa). The informant consensus factor values range from 0.93 to 0.99. The highest ICF value was recorded for the A category (Litholytic and to reduce colic pain) (Table 3).

Table 3. Informant consensus factor.

Therapeutic application category	Number of used reports	Number of taxa	ICF
A (Litholytic and to reduce colic pain)	118	02 (3.2%)	0.99
B (Diuretic and to reduce colic pain)	293	06 (9.5%)	0.98
C (Litholytic)	696	20 (31.7%)	0.97
D (To reduce colic pain)	158	09 (14.3%)	0.94
E (Diuretic)	388	26 (41.3%)	0.93

Note: ICF represents informant consensus factor.

4. Discussion

4.1. Informant's sociodemographic profile

Most of the respondents in this survey were male; this is probably because urolithiasis affects mainly men, with a male/female ratio of 1.5 to 2.5[2]; thus, men should have more knowledge about the traditional treatment of this disease. Male domination in this study can also be explained by the frequency of the interviews conducted with the herbalists, who were all male. The same observation was made by Boudjelal *et al.*[10] and Noman *et al.*[21], who indicated that men dominated in their surveyed population compared to women. Other surveys reported that women were much more familiar with traditional medicine knowledge because of their duties as mothers given that they were responsible for treating themselves and their family members[11,22].

This study reveals that knowledge about anti-urolithiatic medicinal plants is mainly found in the elderly, following their accumulated experience, belief, and confidence in old remedies. Similarly, the distrust towards traditional medicine and the lack of experience of young people (20 and 40 years) can be explained by their disinterest in this medicine, the low transmission of local know-how, the development of medical care offers, and the confidence in conventional medicine. All these factors expose this knowledge to the danger of disappearing. This agrees with several studies in Algeria and worldwide where the average age of people who practice phytotherapy is usually above 50 years[11,23-26].

Contrary to what has been reported in several surveys[11–13], the number of illiterates among the informants had the lowest percentage. The choice of phytotherapy by the medium and low socio-economic level category is mainly linked to the lack of treatment for most urolithiasis types[6] or even the high cost of urinary stone fragmentation and elimination techniques[7]. Thus, the return to popular medicine would be the best alternative for low and modest-income families and individuals.

4.2. Anti–urolithiatic species listed in the region of Mascara

The abundance of Apiaceae during the current survey was also reported in similar studies conducted elsewhere[27–30]. This family is well represented in the flora of Algeria (Apiaceae: 170 taxa)[31]. Some of the widely used species in the study area were reported in ethnobotanical surveys in treating urolithiasis[27–30]. The anti-lithiasis activity of several of these plants was further proven experimentally.

Herniaria hirsuta has a prophylactic effect against forming the most frequent kidney stones (calcium oxalate). *In vitro*, this plant extract has promoted the calcium oxalate crystals nucleation by increasing their numbers and decreasing their sizes[32]. *In vivo*, administering *Herniaria hirsuta* extract to rats appears to reduce the deposition of calcium oxalate crystals in the kidneys[33].

The ethanolic extract of *Hordeum vulgare* seems to have both preventive and curative effects by increasing the urine output, reducing the urinary excretion of calcium, phosphate, uric acid, magnesium, urea, and oxalate and increasing the excretion of citrate[34]. *In vivo* administering of *Hordeum vulgare* and *Avena sativa* seeds decoction to volunteer urolithiasis patients seems to increase diuresis and reduce calciuria and crystalluria[35].

Studies on *Zea mays* effectiveness in preventing urinary stones haven't been clearly determined. Some authors observed a diet-dependent diuretic effect, but it didn't translate to urinary stone risk reduction[36]. Others highlighted its use as an anti-stone agent in traditional medicine, suggesting further research is necessary[37].

Seeds were the most used plant part in the study area. This predominance agrees with the ethnobotanical study of Idm'hand *et al.*[28], while other research indicated that the aerial parts were the most used[38].

The survey showed that all anti-urolithiasis preparations were administered orally, and decoction in water was the primary method used, which agrees with a study conducted in other Algerian locations[9–11] even in neighboring countries[28,29,38]. The highest values of ICF reflect a very high homogeneity of knowledge between the informants.

As a result of this study, it becomes clear that herbal medicine constitutes a still widely accepted practice by the local population of this area. This ethnobotanical survey allowed us to transform oral knowledge into written knowledge by establishing an inventory of 63 anti-urolithiatic species belonging to 59 genera and 32 families. On the other hand, it has been noticed that traditional medicine is attracting much more attention from the elderly. However, a renewed interest in herbal medicine, in general, has been observed in the educated category for anti-urolithiatic plants, particularly in males. These results can be considered a beneficial source of information for scientific research in phytochemistry and pharmacology.

5. Conclusions

This study confirms that herbal medicine remains a widely accepted practice among the local population. The ethnobotanical survey allowed us to transform oral knowledge into written knowledge by establishing an inventory of 63 antiurolithiatic species. All plants are prescribed orally. Decoction is the most common preparation method, and seeds are the most used plant part. The botanical families Apiaceae, Lamiaceae, Fabaceae, and Rosaceae were the most prevalent. On the other hand, it has been noticed that traditional medicine seems to hold more appeal for the elderly population. However, a renewed interest in herbal medicine has been observed in the educated category, particularly in males. These results provide a valuable foundation for further research in the fields of phytochemistry and pharmacology.

Conflict of interest statement

The authors claim there is no conflict of interest.

Funding

This study receives no extramural funding.

Data availability statement

The data supporting the findings of this study are available from the corresponding author upon request.

Authors' contributions

Lakhdar Toumi S conceptualized and designed the study, analyzed data, and interpreted findings. She also wrote and revised the manuscript. Moulei Ali B conducted field interviews and transcribed the data. The authors approved the final draft.

References

[1] Daudon M, Traxer O, Lechevallier E, Saussine C. La lithogenèse. *Prog Urol* 2008; **18**(12): 815-827.

[2] Daudon M, Traxer O, Lechevallier E, Saussine C. Épidémiologie des lithiases urinaires. *Prog Urol* 2008; **18**(12): 802-814.

[3] Tiselius HG. Epidemiology and medical management of stone disease. *BJU Int* 2003; **91**(8): 758-767.

[4] Hollingsworth JM, Rogers MA, Kaufman SR, Bradford TJ, Saint S, Wei JT, et al. Medical therapy to facilitate urinary stone passage: A meta-analysis. *Lancet* 2006; 3**68**(9542): 1171-1179.

[5] Labrecque M, Dostaler LP, Rousselle R, Nguyen T, Poirier S. Efficacy of nonsteroidal anti-inflammatory drugs in the treatment of acute renal colic. *Arch Intern Med* 1994; **154**(12): 1381-1387.

[6] Shafi H, Moazzami B, Pourghasem M, Kasaeian A. An overview of treatment options for urinary stones. *Caspian J Intern Med* 2016; **7**(1): 1-6.

[7] Chandhoke P. When is medical prophylaxis cost-effective for recurrent calcium stones? *J Urol* 2002 ; **168**(3) : 937-940.

[8] World Health Organization. *WHO Global Report on Traditional and Complementary Medicine 2019.* [Online] Available from: https://iris.who.int/handle/10665/312342. [Accessed on 12 March 2023].

[9] Bouasla A, Bouasla I. Ethnobotanical survey of medicinal plants in northeastern of Algeria. *Phytomedicine* 2017; **36**: 68-81.

[10]Boudjelal A, Henchiri C, Sari M, Sarri D, Hendel N, Benkhaled A, et al. Herbalists and wild medicinal plants in M'Sila (North Algeria): An ethnopharmacology survey. *J Ethnopharmacol* 2013; **148**: 395-402.

[11]Miara MD, Bendif H, Ait Hammou M, Teixidor-Toneu I. Ethnobotanical survey of medicinal plants used by nomadic peoples in the Algerian steppe. *J Ethnopharmacol* 2018; **219**: 248-56.

[12]Rebbas K, Bounar R, Gharzouli R, Ramdani M, Djellouli Y, Alatou D. Plantes d'intérêt médicinale et écologique dans la région d'Ouanougha (M'sila, Algérie). *Phytothérapie* 2012; **10**(2): 131-142.

[13]Yasser K, Abdallah M, Abdelmadjid B. Étude ethnobotanique de quelques plantes médicinales dans une région hyper aride du Sud-ouest Algérien "Cas du Touat dans la wilaya d'Adrar ". *J Anim Plant Sci* 2018; **36**(2): 5844-5857.

[14]Albuquerque UP, Lucena RFP, Cunha LVFC, Alve RRN. *Methods and techniques in ethnobiology and ethnoecology*. Springer Protocols Handbooks. New York: Humana Press; **2014.**

[15]Martin GJ. *Ethnobotany: a methods manual*, vol 1. London: Chapman & Hall; **1995.**

[16]Quézel P, Santa S. Nouvelle flore de l'Algérie et des régions désertiques méridionales. Paris : CNRS; **1962 .**

[17]Baba Aïssa F. *Les plantes médicinales en Algérie.* Algérie : Bouchéne; **1990**.

[18]The Plant List. *A working list of all known plant species.*[Online] Available from: http://www.theplantlist.org/. [Accessed on 12 March 2023]

[19]Tardío J, Pardo-De-Santayana M. Cultural importance indices: A comparative analysis based on the useful wild plants of southern Cantabria (northern Spain). *Econ Bot* 2008; **62**(1): 24-39.

[20]Trotter RT, Logan MH. *Informant consensus: A new approach for identifying potentially effective medicinal plants.* In: Etkin NL (Ed.). Bedford Hill, New York: Redgrave Publishing Company; **1986.**

[21]Noman A, Hussain I, Ali Q, Ashraf MA, Haider MZ. Ethnobotanical studies of potential wild medicinal plants of Ormara. *Emir J Food Agric* 2013; **25** (10): 751-759.

[22]Eddouks M, Ajebli M, Hebi M: Ethnopharmacological survey of medicinal plants used in Daraa-Tafilalet region (Province of Errachidia), Morocco. *J Ethnopharmacol* 2017; **198:** 516-530.

[23]Ahmad Jan H, Jan S, Ahmad N, Aysha M. Ethno-medicinal survey of indigenous medicinal plants used by the local population of Goleen Valley, Chitral, Pakistan. *SM J Med Plants Stud* 2017 ; **1**(1):1-8.

[24]Bachar M, Zidane L, Rochdi A. Plantes médicinales et phytothérapie traditionnelle utilisées au niveau du Parc naturel régional de Bouhachem "Rif du Maroc" - cas de la commune rurale de Tazroute. *J Mater Environ Sci* 2016; **7**(11): 4175-4204.

[25]Benítez G, González-Tejero MR, Molero-Mesa J. Pharmaceutical ethnobotany in the western part of Granada province (southern Spain): Ethnopharmacological synthesis. *J Ethnopharmacol.* 2010; **129**: 87-105.

[26]Gnagne AS, Camara D, Fofie NBY, Bene K, Zirihi GN: Étude ethnobotanique des plantes médicinales utilisées dans le traitement du diabète dans le Département de Zouénoula (Côte d'Ivoire). *J Appl Biosci* 2017; **113**: 11257-11266.

[27]Ghourri M, Zidane L. Catalogue des plantes médicinales utilisées dans le traitement de la lithiase rénale dans la province de Tan-Tan (Maroc saharien). *Int J Biol Chem Sci* 2013; **7**(4): 1688-1700.

[28]Idm'hand E, Msanda F, Cherifi K. Ethnobotanical survey of medicinal plants used in treatment of kidney stones in Tarfaya province (Morocco). *Int J Innov Appl Stud* 2019; **26**(3): 711-719.

[29]Ammor K, Mahjoubi F, Bousta D, Chaqroune A. Ethnobotanical survey of medicinal plants used in the treatment of kidney stones in region of Fez-Meknes, Morocco. *Ethnobot Res Applicat* 2020; **19**(50): 1-12.

[30]Abbasi N, Rafieian-Kopaei M, Karami N, Abbaszadeh S, Bahmani M. Medicinal plants for treatment kidney stones, an ethnobotany study in Shahrekord. *Egypt J Vet Sci* 2019; **50**(2); 145-149.

[31]Dobignard A, Chatelain C. *Index synonymique et bibliographique de la flore d'Afrique du Nord.* Volume: 5 (Eds.) Genève: CJB; **2013.**

[32]Atmani F, Khan SR. Effects of an extract from Herniaria hirsuta on calcium oxalate crystallization *in vitro*. *BJU Int* 2000; **85**: 621-625.

[33]Atmani F, Slimani Y, Mimouni M, Aziz M, Hacht B, Ziyyat A. Effect of aqueous extract from *Herniaria hirsuta* L. on experimentally nephrolithiasic rats. *J Ethnopharmacol* 2004; **95**: 87-93.

[34]Shah JG, Patel BG, Patel SB, Patel RK. Anti-urolithiatic and antioxidant activity of *Hordeum vulgare* seeds on ethylene glycol-induced urolithiasis in rats. *Indian J Pharmacol* 2012; **44**(6): 672-677.

[35]Lakhdar-Toumi S, Bereksi-Reguig K. Étude *in vivo* des effets anti-lithiasiques et diurétiques de la décoction de deux céréales: *Hordeum vulgare* et Avena sativa. *Phytotherapie* 2016; **14**(5), 304-308.

[36]Grases F, March JG, Ramis M, Costa-Bauzá A. The influence of *Zea mays* on urinary risk factors for kidney stones in rats. *Phytother Res* 1993; **7**(2): 146-149.

[37]Prachi, Chauhan N, Kumar D, Kasana MS. Medicinal plants of Muzaffarnagar district used in treatment of urinary tract and kidney stones. *IJTK* 2009; **8**(2): 191-195.

[38]Khouchlaa A, Tijane M, Chebat A, Hseini S, Kahouadji A. Ethnopharmacology study of medicinal plants used in the treatment of urolithiasis (Morocco). *Phytotherapie* 2017; **15**(5): 274-287.

Publisher' s note

The Publisher of the *Journal* remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Edited by Liang TC, Qi Y