



RESEARCH ARTICLE

Ethnobotanical study of medicinal plants used by iraqi herbalists in the management of Nephrolithiasis: A cross-sectional survey conducted in Southern Iraq “Karbala”

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ARTICLE HISTORY

Received: 06 August 2023
Accepted: 30 November 2023
Available online
Version 1.0 : 29 March 2024



Additional information

Peer review: Publisher thanks Sectional Editor and the other anonymous reviewers for their contribution to the peer review of this work.

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Indexing: Plant Science Today, published by Horizon e-Publishing Group, is covered by Scopus, Web of Science, BIOSIS Previews, Clarivate Analytics, NAAS, UGC Care, etc See https://horizonepublishing.com/journals/index.php/PST/indexing_abstracting

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CITE THIS ARTICLE

Humadi SS. Ethnobotanical study of medicinal plants used by iraqi herbalists in the management of Nephrolithiasis: A cross-sectional survey conducted in Southern Iraq “Karbala.”. Plant Science Today (Early Access). <https://doi.org/10.14719/pst.2848>

Abstract

Nephrolithiasis is one of the most significant urinary tract diseases, with an enormous socio-economic impact. Numerous research studies have been conducted to assess the potential of herbal medicine in managing kidney stones; however, further study is required in Iraq. The objective was to document the ethno-botanical uses of medicinal plants in managing nephrolithiasis in southern Iraq and analyse the herbalists' diagnostic method. A cross-sectional survey was performed through face-to-face interviews with 48 herbalists practicing in Karbala. The results indicated the use of 19 species from 10 botanical families. *Zea mays*, *Trigonella foenum-graecum* and *Tribulus terrestris* exhibited the highest frequency of mentions, accounting for 81.25%, 56.25%, and 52.0%, respectively. The botanical plant families Apiaceae and Fabaceae were predominantly utilized, accounting for usage rates of 31.5% and 15.7%, respectively. Furthermore, the data indicated that seeds were the most utilized plant parts, and decoction was the predominant preparation technique. Moreover, the data showed that although a significant proportion of herbalists possessed a high level of education, most of these herbalists (72.9%) relied on patient symptoms rather than physician diagnosis when identifying nephrolithiasis, irrespective of their experience or education level. Herbalists commonly suggest cures for nephrolithiasis without considering the specific type and location of the stone. This study concluded that medicinal plants are significant for future research endeavors to treat and manage nephrolithiasis.

Keywords

nephrolithiasis; kidney stones; climate circumstances; traditional medicine; herbalists

Introduction

Nephrolithiasis, commonly known as kidney stones, is characterized by calculi in the urinary system resulting from deviations in the typical crystallization parameters of urine (1-3). This condition ranks as the third most prevalent urological ailment, following urinary tract infections and prostate disorders (4). It affects approximately 10–12% of the population in industrialized countries and is estimated to impact 1-5% of individuals in Asia, 5-9% in Europe, and 13% in North America (5). The variation in kidney stones across different countries can be attributed to genetic and environmental factors, including dietary patterns, climatic circumstances, and

socio-economic position (4, 6). Multiple research projects have demonstrated that the prevalence of this phenomenon is more significant in warm regions than in colder regions (4, 7). Additionally, research has indicated that excessive intake of sodium, animal-derived protein, calcium, fatty acids, and sugar is associated with an increased susceptibility to the formation of kidney stones (7). Urolithiasis is infrequently observed in select geographic regions, such as Greenland and the coastal parts of Japan (8, 9). Like other warm countries, Iraq lies within the stone belt area, where patients with kidney stones represent the bulk of all urological patients (10-12). According to recent studies, they constitute more than half of all urological patients in Iraqi hospitals (13).

The significance of traditional systems of medicine has gained global recognition (14). Herbal medicines have a long history in Iraq, dating back to the early stages of human civilization, notably during the Sumerian era (3000-1970 B.C.) and the subsequent periods of Babylonian and Assyrian civilizations (1970-589 B.C.) (15). Research conducted in Iraq has revealed a prevalence ranging from 71.6% to 76.4% in the utilization of herbal products among individuals suffering from various medical conditions (16-18). Patients turn to herbal therapy as an alternative due to the perceived lack of effective pharmaceutical interventions for treating and preventing kidney stone recurrences (19). Multiple research studies were undertaken in Iraq to examine kidney stones and various classifications (13, 20). However, limited studies have been performed to identify medicinal plants used in the southern areas of Iraq. This study was designed to document the ethnobotanical uses of medicinal plants by local herbalists for the management of nephrolithiasis in Karbala. The aim of the study further extends to discussing herbalists' methods of diagnosis and whether they are related to their education and practice skills.

Materials and Methods

Study Design

An ethnobotanical survey, conducted as a questionnaire-based cross-sectional descriptive study, was performed between October 2022 and March 2023 through face-to-face interviews with local herbalists practicing in Karbala. Semi-structured questionnaires were utilized to conduct interviews with herbalists within the premises of their herbal stores. Plant samples were collected with the completed questionnaires from each herbalist.

Studied Area

Karbala is a geographical region located on the Mesopotamian plain, approximately 92 km southwest of Baghdad, Iraq. The area covers approximately 30 square km and falls within the Eastern Longitude range of 44° 25' 00" to 43° 45' 00" and the Northern Latitude range of 32° 40' 00" to 32° 20' 00" (Fig. 1). Karbala and its surrounding suburbs are positioned on the transitional boundary between the stable platform known as the Al-Salman sub-zone and the unstable platform referred to as the Mesopotamia sub-zone (21).

The climate in the area exhibits characteristics consistent with a western desert climate, as determined by climatological factors. The climate within the study area is classified as continental, characterised by aridity and relatively high temperatures during the summer season, along with cold temperatures and limited precipitation during the winter. Additionally, it is hypothesized that the climate in the study area is influenced by the Mediterranean Sea (21, 22).

Questionnaire

The form used in this investigation was developed after a thorough review of relevant literature and subsequently adapted to align with the objectives of this study (15, 25-28). The survey comprised eight closed-ended questions, categorized into three sections.

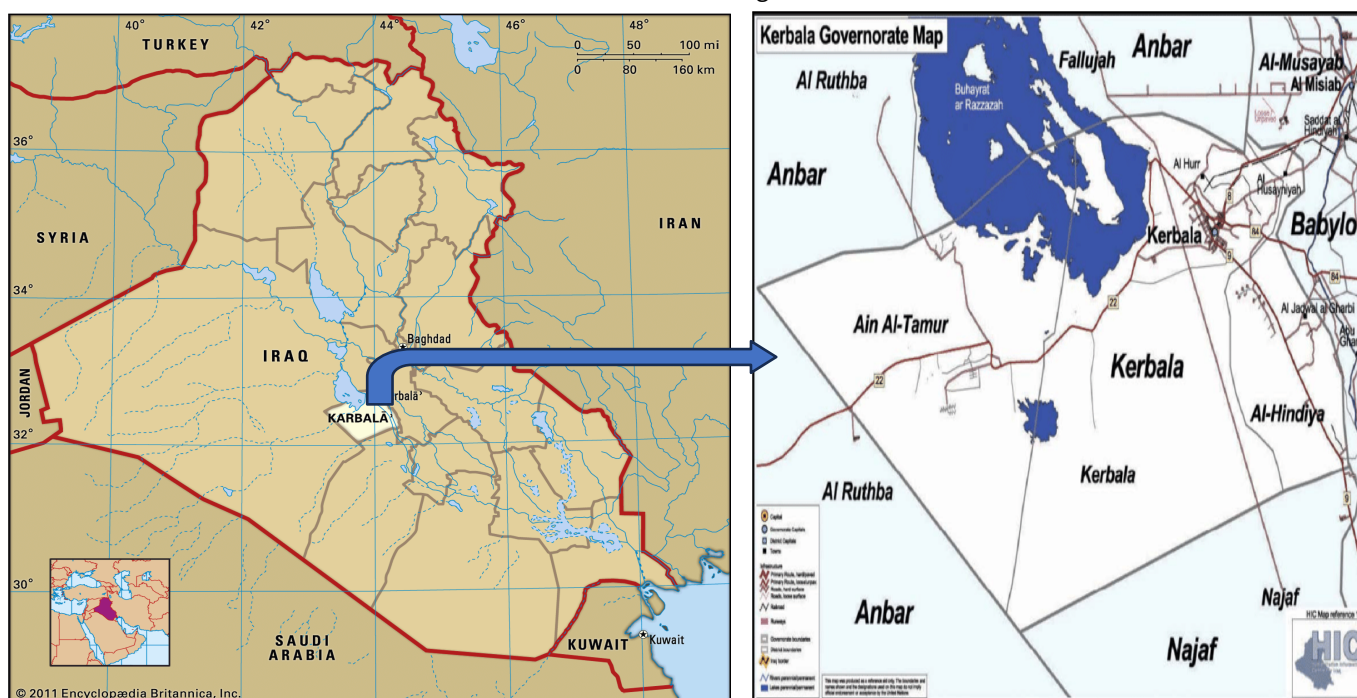


Fig. 1. Map of the studied area, Karbala

The first section includes a series of six inquiries about demographic information: individual's name, gender, age, educational attainment, and years of professional experience. The subsequent section comprised two inquiries about herbal practitioners' diagnostic approaches.

The concluding section of the study involved compiling a list of herbal products used by the participants to manage kidney stones. The provided documentation included essential details about each medicinal plant, such as its scientific nomenclature, commonly used name, the specific plant portion utilized for medicinal purposes, and the prescribed mode of administration. Data were considered authentic when a plant received recommendations from at least two herbalists.

Data collection

The data were gathered from a specific sample of herbalist stores using face-to-face interviews with the herbalists. Each interview lasted approximately 25 to 30 min, and participants' consent was inferred from their agreement to complete the questionnaire. The Research Ethical Board of Al Zahrawi College University approved the study (REBZ Ref No. 08/10/2022).

Plant Identification

Each individual plant specimen collected from the informants' store was assigned a unique numerical identifier, and the gathered samples were securely stored within the premises of the pharmacognosy laboratory at the Pharmacy Department of Al-Zahrawi College University. Subsequently, these samples underwent taxonomic evaluation, confirmation, and identification by Associate Prof. Sukeyna Abbas Aliwy/Baghdad University Herbarium/College of Science, Ref No. (1121, 28/05/2023).

Statistical Analysis

The data analysis in this study utilized SPSS Version 26, a statistical software commonly employed in the social sciences field and developed in Chicago, United States. Demographic characteristics and components of the practice questions were determined through descriptive statistics. Simultaneously, the Chi-square test was employed to assess the statistical significance of the correlation between specific variables, with a significance level set at $P < 0.05$.

Furthermore, the UV index (use value) was employed to assess plant citations during the interviews. The calculation is performed as follows: $UVc = \sum U / ns$, where U represents the cumulative count of use citations for a particular species across all informants and ns is the total number of informants. This methodology assesses the relative significance of each medicinal species by considering its relative utilization among informants (29).

Results

A total of 60 herbalists were invited to participate in the survey. However, the number of respondents who agreed to participate amounted to 48, resulting in a participation

rate of 80%. The demographic features of the herbalists are presented in Table 1.

Table 1. Demographic characteristics of herbalists

Variants	Type	f	%	M	Sd
Age	20-39	17	35.4		
	40-59	25	52.1	1.7708	0.66010
	60-79	6	12.5		
Total		48	100.0		
Level of Education	Primary school	5	10.4		
	Secondary school	21	43.8	3.35	0.668
	University	22	45.8		
Total		48	100.0		
Year of experience	<5 years	2	4.2		
	5-9 years	9	18.8		
	10-19 years	18	37.5	3.4583	1.25407
	20-29 years	3	6.3		
	>30 years	16	33.3		
Total		48	100.0		

The collected data in this area revealed a predominant presence of male practitioners in herbalism, with a notable absence of female participation.

The study included participants aged between 20 and 79, with 52.1% falling within the 40-59 age groups. Additionally, 35.4% of herbalists were between 20 and 39, while just 12.5% were 60 or older. The data revealed a notable finding indicating that a significant proportion of herbalists possessed a high level of education, with 45.8% holding a university degree and 43.8% possessing a secondary certification.

In contrast, only 10.4% of herbalists had completed primary education, and none were found to be illiterate.

Additional examination of the demographic data revealed that the majority of herbalists, specifically 37.5%, had work experience ranging from 10 to 19 years. Furthermore, a significant percentage of herbalists, accounting for 33.3%, had accumulated over 30 years of professional experience. A minority of participants (18.8%) possessed professional experience ranging from 5 to 9 years. A small fraction (4.2%) of the participants reported having less than five years of work experience.

Proceeding to the subsequent data analysis phase, the findings revealed that only 27.1% of herbalists rely on the diagnosis provided by physicians, while the majority (72.9%) base their diagnostic process on the symptoms reported by the patients. A significant number of herbalists (66.7%) advocate using herbal treatments to address stones, irrespective of their nature or location. However, a smaller proportion (33.3%) of herbalists make a distinction between kidney stones and other types of stones found in the urinary tract.

The data revealed a lack of substantial correlation between these factors when examining the association

between practice, educational attainment, and years of experience, with a P value >0.05.

This finding is supported by the results presented in Tables 2 and 3

Table 2. Relation between herbalists' practice and level of education.

Type	Primary school		Secondary school		University		Total		Chi-Square	p-value
	Count	%	Count	%	Count	%	Count	%		
I depend on the patient's symptoms to diagnose a kidney stone rather than the physicians										
Yes	3	60%	14	66.7%	18	81.8%	35	72.9%	1.721	0.423
No	2	40%	7	33.3%	4	18.2%	13	27.1%		
Total	5	100%	21	100%	22	100%	48	100%		
I give my recommendation for the specific kidney stone location and nature										
Yes	0	0%	9	42.9%	7	31.8%	16	33.3%	3.380	0.185
No	5	100%	12	57.1%	15	68.2%	32	66.7%		
Total	5	100%	21	100%	22	100%	48	100%		

Table 3. Correlating herbalist's practice to years of experience.

Type	<5 years		5-9 years		10-19 years		20-29 years		>30 years		Total		Chi-Square	p-value
	n	%	n	%	n	%	n	%	n	%	n	%		
I depend on the patient's symptoms to diagnose a kidney stone rather than the physicians														
Yes	2	100%	7	77.8%	14	77.8%	1	33.3%	11	68.8%	35	72.9%	3.587	0.465
No	0	0%	2	22.2%	4	22.2%	2	66.7%	5	31.2%	13	27.1%		
Total	2	100%	9	100%	18	100%	3	100%	16	100%	48	100%		
I give my recommendation for the specific kidney stone location and nature.														
Yes	2	100%	2	22.2%	7	38.9%	0	0%	5	31.2%	16	33.3%	6.281	0.179
No	0	0%	7	77.8%	11	61.1%	3	100%	11	68.8%	32	66.7%		
Total	2	100%	9	100%	18	100%	3	100%	16	100%	48	100%		

The results of the ethnobotanical survey indicated that herbalists suggested a total of 19 distinct species from 10 different medicinal plant families for treating nephrolithiasis.

Table 4 presents a comprehensive compilation of medicinal plants, including their scientific and common names, specific parts utilized, and corresponding administration methods. Furthermore, the utilization percentage of these herbs and the Frequency of citation (FC) are illustrated in Fig. 2.

The data analysis revealed that *Zea mays*, *Trigonella foenum-graecum*, and *Tribulus terrestris* were the plant species with the highest citations from herba-lists, garnering 81.25%, 56.25%, and 52.0% respectively, surpassing other plants in terms of recognition and usage. *Adiantum capillus-veneris* and *Arabic gum* were commonly employed by many herbalists, with utilization rates of 43.75% and 41.66%, respectively. The remaining plant species exhibited varying utilization percentages, ranging from 6.25% to 22.91%. Additionally, it was demonstrated that the primary mode of administration employed was predominantly through decoctions.

The predominant plant components utilized were the seeds of medicinal plants, as depicted in Fig. 3. Additionally, *Apiaceae* and *Fabaceae* were the two most frequently used families, as illustrated in Fig. 4.

Discussion

Throughout history, various civilizations worldwide have employed herbal treatments to address or prevent a diverse range of ailments, including those related to

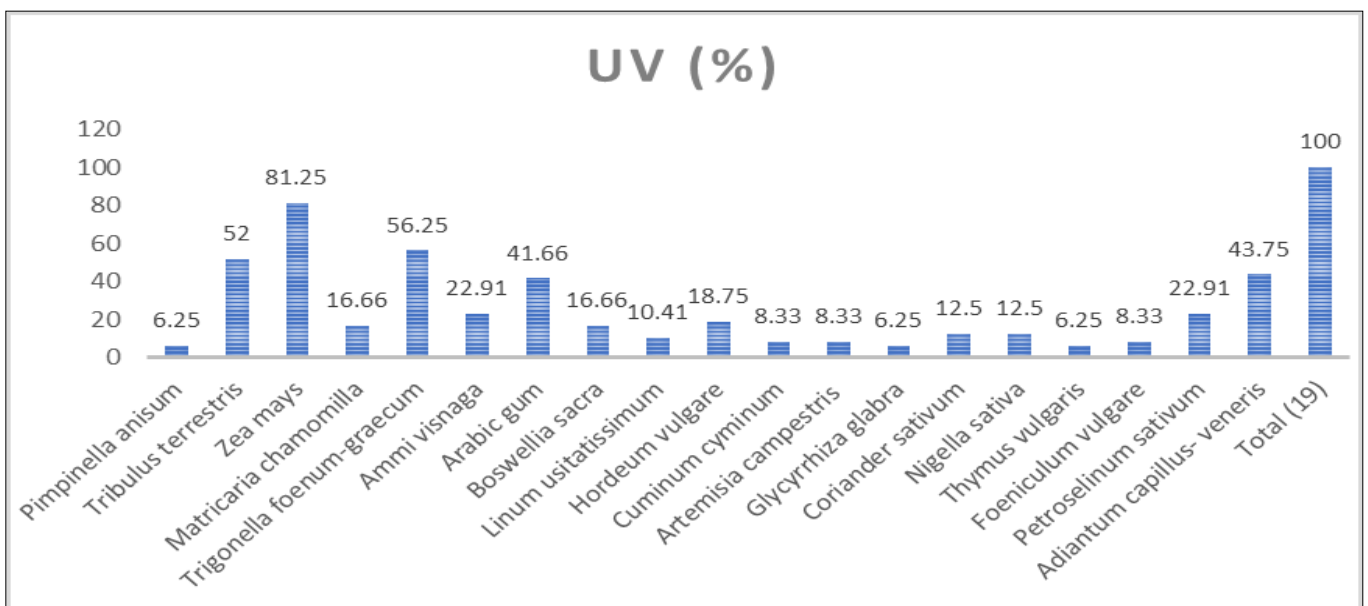
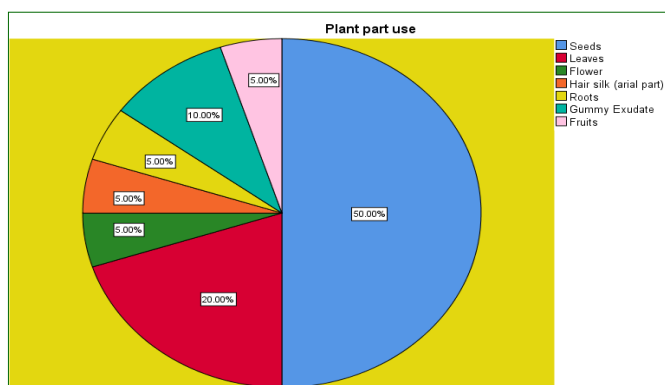
urological health (29). Folk medicine continues to play a significant role within the official health systems of numerous Arabic countries, with some similarities in the flora of these populations and traditional uses of medicinal plants (28, 35). The wealth of information about medicinal plants within the Iraqi population is derived from centuries of cultural practices, empirical observations, and deeply ingrained beliefs. The transmission of this information has persisted across successive generations throughout historical periods (27), and its application has been traditionally upheld by herbal medicine practitioners known as Attar in Iraq.

Several ethnobotanical investigations have been conducted in the northern region of Iraq, exploring the overall utilization of herbal medicine for various ailments (15, 32, 36). Additionally, a limited number of studies have been undertaken in Baghdad (27). However, there is a lack of clear research on treating kidney stones in southern Iraq. Therefore, this study holds significant value in documenting the utilization of medicinal plants to manage kidney stones in Karbala. Furthermore, the study also examined the diagnostic approach employed by herbalists to prescribe treatments to their clientele.

This study recruited 48 male herbalists who willingly consented to participate in our survey. Historically, the discipline of herbalism has been predominantly occupied by male practitioners, with a notable absence of

Table 4. List of medicinal plants Iraqi herbalists use to treat nephrolithiasis in Karbala.

Scientific Name (Voucher number)	Family	Common Name	Part of the plant used	Method of administration	Evidence from literature proving its use in nephrolithiasis
(A-01) <i>Pimpinella anisum</i>	Apiaceae	Anise, Yansoon	Seeds	Decoction	26,31
(A-02) <i>Tribulus terrestris</i>	Zygophyllaceae	Al-Gutub	Leaves and Fruits	Decoction	26,31-33
(A-03) <i>Zea mays</i>	Poaceae	Corn hair	Silk	Decoction	30, 31
(A-04) <i>Matricaria chamomilla</i>	Asteraceae	Chamomile, (Babonage)	Flower	Decoction	33
(A-05) <i>Trigonella foenum-graecum</i>	Fabaceae	Fenugreek, Helba	Seeds	Decoction	32, 34
(A-06) <i>Ammi visnaga</i>	Apiaceae	Khella	Seeds	Decoction	28, 29
(A-07) <i>Senegalia senegal</i>	Fabaceae	Arabic gum, al-samgh al-'arabi	Gummy exudate	Decoction	28
(A-08) <i>Boswellia sacra</i>	Burseraceae	Frankincense ,Luban	Gummy exudate	Decoction	31
(A-09) <i>Linum usitatissimum</i>	Linaceae	Flax or linseeds, Ketan	Seeds	Decoction	31
(A-10) <i>Hordeum vulgare</i>	Poaceae	Barley	Seeds	Decoction	31
(A-11) <i>Cuminum cyminum</i>	Apiaceae	Cumin	Seeds	Decoction	31
(A-12) <i>Artemisia campestris</i>	Asteraceae	Al-sheeh	leaves	Decoction	31
(A-13) <i>Glycyrrhiza glabra</i>	Fabaceae	Licorice, Erkssoos	Root	Decoction	28, 31, 33
(A-14) <i>Coriander sativum</i>	Apiaceae	Coriander, Kozbara	Seeds	Decoction	31, 32, 34
(A-15) <i>Nigella sativa</i>	Ranunculaceae	Black seeds, Habat Soda'a	Seeds	Decoction	26, 31
(A-16) <i>Thymus vulgaris</i>	Laminaceae	Zaetar	Leaves	Decoction	31, 32
(A-17) <i>Foeniculum vulgare</i>	Apiaceae	Habit Helwa	Seeds	Decoction	34
(A-18) <i>Petroselinum sativum</i>	Apiaceae	Parsley, Ma'adanos	Seeds	Decoction	31
(A-19) <i>Adiantum capillus-veneris</i>	Pteridaceae	kuzburat –elber, Kraf al-bir	Leaves	Decoction	26, 31

**Fig. 2.** Distribution of herbal usage by herbalists.**Fig. 3.** Plant part used by herbalists.

female participation, as observed in similar recent studies conducted in the same area (30).

The collected data indicated that the majority of participants were individuals in the older adult age group with a university-level education. The study's findings suggest that approximately 37.5% of the participants reported applying and cultivating their skills and knowledge for 10-19 years, while 33.3% reported engaging in such activities for a period exceeding 30 years. Despite their knowledge and practical experience, most herbalists primarily relied on the patient's symptoms for diagnostic purposes. Upon analysing the relationship between

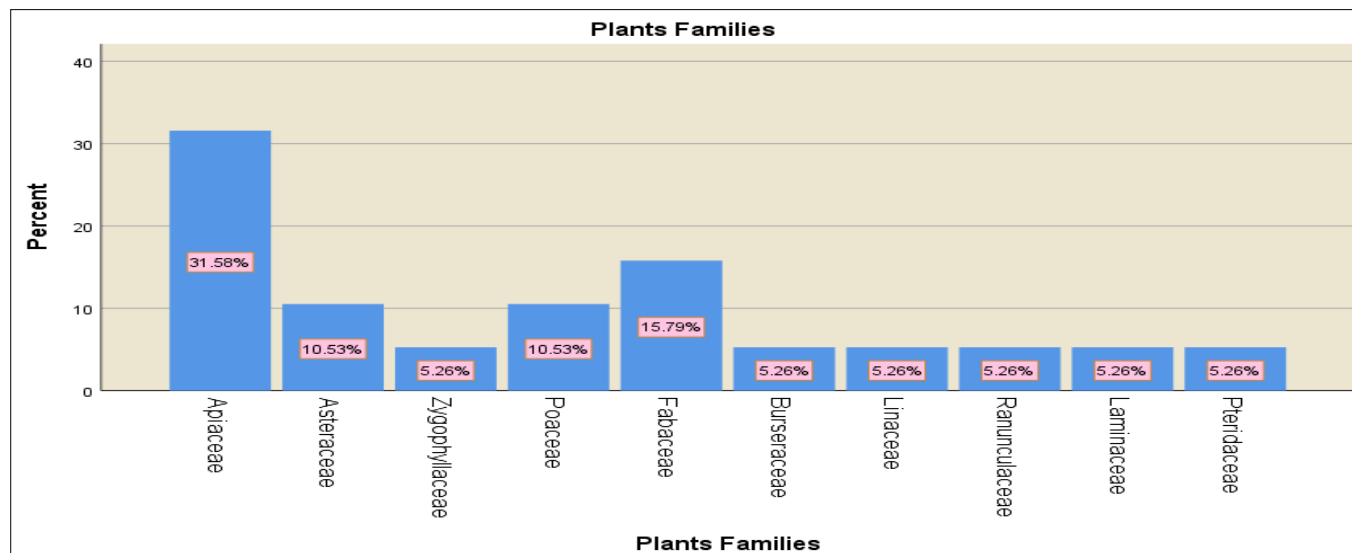


Fig. 4. Plant Families most used by herbalists.

practice, level of education, and work experience, the results revealed a lack of a substantial link between these factors. This practice raises concern about patient safety in the timely identification and management of urological conditions. Utilizing herbal treatments without a comprehensive diagnosis by a healthcare provider may pose risks to patients' well-being. Furthermore, in certain instances, it may obscure the manifestation of symptoms associated with a potentially hazardous ailment (30, 37).

Another significant discovery in this investigation was the identified need for greater differentiation among herbalists concerning various classifications of urinary tract stones. Many herbalists tended to prescribe the same therapies regardless of the specific type or location of the stone.

The findings of the ethnobotanical survey on medicinal plants utilized in treating nephrolithiasis indicated that herbalists practicing in the Karbala region endorsed a total of 19 species, classified under ten distinct botanical families. The most prescribed medical herbs included *Zea mays*, *Trigonella foenum-graecum*, and *Tribulus terrestris*. The utilization of these plants has garnered significant support due to their widespread usage in several nations (32-34, 38).

Notably, the study above revealed a significant overlap between the antilithiatic medicinal plants identified and those documented in ethnobotanical studies conducted in Iran, a neighboring country to the east of Iraq. The botanical species referenced in the survey include *Cuminum cyminum*, *Nigella sativa*, *Zea mays*, *Linum usitatissimum*, *Tribulus terrestris*, *Foeniculum vulgare*, *Glycyrrhiza glabra* (39, 42), *Adiantum capillus veneris* (41) and *Pimpinella anisum* (42) were also cited. Additionally, it has been discovered that Iranian herbalists employed *Tribulus terrestris* at a rate of 51.58%, which closely aligns with the suggestion of Iraqi herbalists. The most frequently applied botanical plant family among these practitioners was Apiaceae (26). This phenomenon might be linked to the strong cultural ties between the neighbouring countries, particularly the significant number of Iranian pilgrims who visit the city of Karbala annually for religious and cultural reasons.

The predominant mode of delivery for most of the aforementioned medicinal plants involved preparing a concentrated liquid extract known as a decoction. This extract was obtained by boiling the relevant plant component with water and was subsequently administered orally to patients. Additionally, herbalists commonly prescribe a combination of herbal medicines to optimize the therapeutic effects of the remedies.

Conclusion

Preserving and safeguarding the diverse range of therapeutic plant species and the associated indigenous knowledge is imperative for the local population. This data integrates traditional knowledge with the current and future evolution of herbal medicine. The study identifies 19 medicinal plants, along with their common names, used by local herbalists in the city of Karbala to manage nephrolithiasis. The three most commonly used herbs are *Zea mays*, *Trigonella foenum-graecum*, and *Tribulus terrestris*. Other nations have publicly accepted the use of these medicinal plants to control kidney stones. This underscores the potential for developing and evaluating novel herbal medicines that incorporate specific combinations of these species. Further research should focus on the identification and isolation of phytochemicals, as well as the development and assessment of herbal formulations for effective nephrolithiasis treatment. The study also identified gaps in the practice of herbalists, emphasizing the need for a thorough evaluation of existing practice guidelines, the establishment of nationally standardized guidelines by the Ministry of Health, and the implementation of a system to monitor herbalist practices for public safety.

Acknowledgements

I would like to appreciate the help and assistance of Associate Prof. Sukeyna Abbas, Baghdad University Herbarium, for her effort in analyzing the collected plant samples.

Compliance with ethical standards

Conflict of interest: Author do not have any conflict of interests to declare.

Ethical issues: : No ethical issue was involved in this work and the study was approved by The Research Ethical Board of Al Zahrawi College University (REBZ Ref No. 08/10/2022).

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