

Traditional botanical flora of medicinal plants in the treatment of kidney stones in Iran

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Abstract

Medicinal plants have long been considered for the treatment of many diseases among Iranians and in recent years the use of medicinal plants has increased. In traditional Iranian medicine, many plants have been described to eliminate kidney stones, dissolve kidney stones or prevent stone formation. Based on the results Medicinal plants *Cichorium intybus* L., *Biarum straussii* Engl., *Tribulus terrestris* L., *Nasturtium officinale* R. Br., *Alhagi camelorum* Fisch., *Adiantum Capillus-Veneris* L., *Anchusa italic*, *Alhagi maurorum*, *Achila mellifolium*, *Capsella bursa-pastoris* (L.) Medicus., *Adiantum capillus- Veneris* L., *Pistacia khinjuk*, *Acanthophyllum khuzistanicum* Rech. F., *Malva parviflora* L., *Allium iranicum* (Wendelbo Wendelbo), *Centaurea solstitialis* L., *Cerasus vulgaris* Miller, and etc. are medicinal plants that are used in different parts of Iran used to treat kidney stones. It was found that plant families including Fabaceae (10 plants), Asteraceae (10 plants), Brassicaceae (6 plants) and Zygophyllaceae (6 plants) have the most medicinal plants in the discussion of medicinal plants affecting kidney stones and parts such as leaf (27%), fruit (15%), aerial parts (15%) and flower (14%) are the most plant organs that are used in this area for the treatment of kidney stones. The great tendency of people in the knowledge of ethno-botany and plant

flora in traditional medicine is evident in the use of medicinal plants and the historical history of the use of medicinal plants. Iranian ethno-botanical knowledge can play a good role in presenting pure ideas of traditional medicine for modern medicine.

Introduction

The kidneys are one of the most important organs in the body, located in the back of the abdomen, in the lumbar region. The main parts of each kidney include the cortex and the medulla. Kidney function includes the reabsorption of glucose, amino acids, and other small molecules, the regulation of sodium, potassium, and other electrolytes, the regulation of fluid balance, the maintenance of acid-base balance, and the production of hormones and vitamin D activation.^{1,2} Nephrons are the basic functional part of any kidney, which removes waste products from the blood by receiving and purifying it. Each nephron consists of a Bowman capsule, a Henle tube, a round tube, and a collecting duct.³⁻⁵

Kidney disorders and diseases are divided into congenital diseases and adult diseases. Congenital diseases include congenital hydronephrosis, congenital obstruction of the urinary tract, duplicated ureter, horseshoe kidney, polycystic kidney disease (renal dysplasia, and unilateral small kidney). Adult diseases include: diabetic nephropathy, glomerulonephritis, hydronephrosis, interstitial nephritis, kidney stones, kidney tumors, lupus nephritis, minimal change disease, nephrotic syndrome, and pyelonephritis.⁶⁻⁸ It has been made clear that sedimentation of compounds (in high concentrations) in the urine causes the formation of kidney stones. Most kidney stones are caused by genetic factors, diet and some underlying diseases.⁹ Most kidney stones are composed of compounds such as calcium oxalate, uric acid, steroid and cysteine.¹⁰ Usually, in order to eliminate these stones are used various treatment methods such as consumption of fluids, acidic and alkaline solvents and surgical methods, including: removal of obstruction, extracorporeal stone crushing, stone crushing, and crushing.^{10,11} If not treated properly, the side effects of stones are significant and sometimes lead to kidney loss. Therefore, early diagnosis and treatment of kidney stones reduces side effects and treatment costs. Nowadays, due to the side effects and severe harmful effects of chemical drugs, the use of various herbal and natural medicines in the treatment of kidney stones has been considered by researchers.¹²⁻¹⁴ Kidney stone disease is a well-known disease in both traditional and modern medicine. In the authoritative books of traditional medicine, the etiology, symptoms and traditional herbal treatments for this disease are stated. Therefore, the aim of current systematic study was ethno-botany in the treatment of kidney stones in Iranian ethno-botanical documents.

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Materials and Methods

The aim of this study was to review articles in Iranian ethnobotanical medicine sources. For this purpose, keywords such as “kidney stones”, “medicinal plants”, “herbs”, “ethno-botany”, “identification of medicinal plants”, “region” and “Iran” were used. Databases such as ISI Web of Science, PubMed, Scopus, ISC, Magiran, and Google Scholar were used to find articles and resources (articles of 2001 to 2020). Forty-nine (49) articles were found. Three articles lacked full text, and there were 3 duplicate articles that were deleted. Finally, 46 articles were identified for this review. Out of 46 articles, only 20 articles contained ethnobotanical information on the treatment of kidney stones. The flow-chart of the search strategy and the inclusion and exclusion criteria of the articles are specified in Figure 1. The data collected in this study were analyzed using Excel program.

Results

Medicinal plants *Cichorium intybus* L., *Biarum straussii* Engl., *Tribulus terrestris* L., *Nasturtium officinale* R. Br., *Alhagi camelorum* Fisch., *Adiantum Capillus-Veneris* L., *Anchusa italic*, *Alhagi maurorum*, *Achila mellifolium*, *Capsella bursa-pastoris* (L.) Medicus., *Adiantum capillus-Veneris* L., *Pistacia khinjuk*, *Acanthophyllum khuzistanicum* Rech. F., *Malva parviflora* L., *Allium iranicum* (Wendelbo Wendelbo), *Centaurea solstitialis* L., *Cerasus vulgaris* Miller, *Ceratocephalus falcata* (L.) Pers , *Cicer anatolicum* Alef., *Citrullus lanatus* (Thumb.) Matsum & Nakai, *Urtica dioica* L., *Adonis aestivalis* L., *Allium akaka* Gmelin., *Amygdalus arabica* Olivier., *Raphanus niger* Mill., etc. are medicinal plants that are used in different parts of Iran used to treat kid-

ney stones. Additional information in this regard, medicinal plants, scientific name, plant family name, area used, organ used and its main active ingredients are specified in Table 1.¹⁵⁻³³

Based on the results obtained from the analysis of the items in Table 1, it was found that plant families including Fabaceae, Asteraceae, Brassicaceae and Zygophyllaceae have the most medicinal plants in the discussion of medicinal plants affecting kidney stones in this study (Figure 2).

As it is known, fruit, asteraceae, leaf, aerial parts and flower are the most plant organs that are used in this area for the treatment of kidney stones (Figure 3).

Discussion

Today, with the advancement of technology and the availability of various types of stone crushers that have undergone a great change in the treatment of urinary tract stones, effective and safe drug treatment that without surgical intervention leads to complete or incurable treatment of the stone. In the knowledge of ethnobotany and traditional medicine of different societies, medicinal plants have been used to treat diseases. Today, in addition to the use of chemical drugs, medicinal plants are used to treat kidney stones due to the proof of the effect of various herbal medicines.^{12,34,35} In traditional medicine of Iran and many parts of the world, medicinal plants are used to treat kidney stones. In traditional medicine, these herbs are effective treatments for this disease. Comparison of medicinal plants that are traditionally known as anti-kidney stones is more effective if these plants are proven in animal and human models in scientific and pharmacological experiments. The results of some studies confirm the effect of medicinal plants that have been mentioned in traditional medicine and have been effective in modern medicine studies.

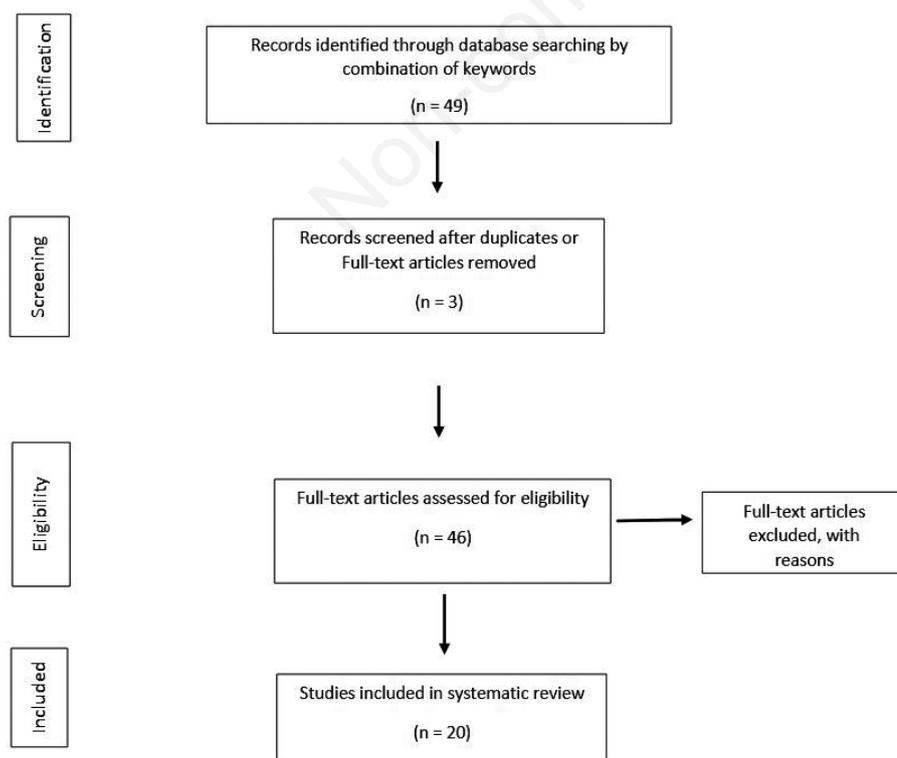


Figure 1. The criteria and the number of entry and exit articles.

Table 1. Scientific name, plant family name, local name, organ used and area of use of medicinal plants affecting kidney stones.

Scientific name	Herbal family	Common name	Used part(s)	Region	Compound	Molecular formula
<i>Biarum straussii</i> Engl.	Araceae	Kardeh	Aerial parts	Arzhan of fars ¹⁵	Phenol	C ₆ H ₆ O
<i>Tribulus terrestris</i> L.	Zygophyllaceae	Khar Pelangi	Aerial parts	Arzhan of fars ¹⁵	furostanol	C ₂₇ H ₄₆ O ₂
<i>Nasturtium officinale</i> R. Br.	Brassicaceae	Bakaloo	Aerial parts	Arzhan of fars ¹⁵	myristicin	C ₁₁ H ₁₂ O ₃
<i>Alhagi camelorum</i> Fisch.	Fabaceae	Kharshotore	Aerial parts	Arzhan of fars ¹⁵	Drimenol	C ₁₅ H ₂₆ O
<i>Alhagi camelorum</i> Fisch.	Papilionaceae	Khar Shotor	Aerial parts	Arzhan of fars ¹⁵	Drimenol	C ₁₅ H ₂₆ O
<i>Adiantum Capillus-Veneris</i> L.	Pteridaceae	Parsiavashoon	Aerial parts	Arzhan of fars ¹⁵	adiantoxide	C ₃₀ H ₅₀ O
<i>Anchusa italica</i>	Boraginaceae	Boragon	Aerial parts	Alamout ¹⁶	Diisobutyl phthalate	C ₆ H ₄
<i>Alhagi maurorum</i>	Fabaceae	<i>Dava gharni</i>	Leaf	Ahar va arasbaran ¹⁷	Drimenol	C ₁₅ H ₂₆ O
<i>Achila mellifolium</i>	Asteraceae	Boumadaran	Leaf, Flowering branch	Abadeh of fars ¹⁸	1,8-Cineole	C ₁₀ H ₁₈ O
<i>Capsella bursa-pastoris</i> (L.) Medicus.	Brassicaceae	Kise keshish	Leaf	Bushehr ¹⁹	kaempferol-3-O-rutinoside	C ₂₇ H ₃₀ O ₁₅
<i>Adiantum capillus-Veneris</i> L.	Adiantaceae	Pare siavashan	Aerial parts	Behbahan ²⁰	adiantoxide	C ₃₀ H ₅₀ O
<i>Anthriscus cerefolium</i> L. (Hoffm.)	Apiaceae	Jafari	Aerial parts	Behbahan ²⁰	estragole	C ₁₀ H ₁₂ O
<i>Alhagi mannifera</i> Deaf.	Fabaceae	Khar shotor	Aerial parts	Behbahan ²⁰	kaempferol	C ₁₅ H ₁₀ O ₆
<i>Pistacia khinjuk</i>	Anacardiaceae	Kolkhonak	Fruit, Leaf	Tange balangestan ²¹	myrcene	C ₁₀ H ₁₆
<i>Acanthophyllum khuzistanicum</i> Rech. F.	Caryophyllaceae	Khobak khuzistani	Aerial parts	Tange balangestan ²¹	quillaic acid	C ₃₀ H ₄₆ O ₅
<i>Malva parviflora</i> L.	Malvaceae	Panirak	Flower, Leaf	Tange balangestan ²¹	β- amyrin	C ₃₀ H ₅₀ O
<i>Allium iranicum</i> (Wendelbo Wendelbo)	Alliaceae	Sire vahshi	Bulb, Leaf	Toisekan ²²	dibutylphthalate-1'2-benzenedicarboxylic acid	C ₁₆ H ₂₂ O ₄
<i>Centaurea solstitialis</i> L.	Asteraceae	yellow star	Whole plant	Toisekan ²²	hexadecanoic acid	C ₁₆ H ₃₂ O ₂
<i>Cerasus vulgaris</i> Miller	Rosaceae	Manase	Vegetative part	Toisekan ²²	α-Pinene	C ₁₀ H ₁₆
<i>Ceratocephalus falcata</i> (L.) Pers	Ranunculaceae	-	Spine, Aerial Part	Toisekan ²²	α-Pinene	C ₁₀ H ₁₆
<i>Cicer anatolicum</i> Alef.	Fabaceae	-	Whole plant, Fruit	Toisekan ²²	isoflavonoid	C ₁₅ H ₁₀ O ₂
<i>Cichorium intybus</i> L.	Asteraceae	Cichout	Aerial Part, Root	Toisekan ²²	esculetin	C ₉ H ₆ O ₄
<i>Citrullus lanatus</i> (Thumb.) Matsum & Nakai	Cucurbitaceae	-	Fruit	Toisekan ²²	Phenol	C ₆ H ₅ OH
<i>Tripleurospermum disciforme</i> (C. A. Mey.) Schultz	Asteraceae	tripaloe	Flower	Toisekan ²²	β-farnesene	C ₁₅ H ₂₄
<i>Urtica dioica</i> L.	Urticaceae	-	Leaf	Toisekan ²²	Hexa hydrofarnesyl acetone	C ₁₈ H ₃₆ O
<i>Adonis aestivalis</i> L.	Ranunculaceae	Cheshm khruş tabestani	Aerial parts	Dastena ²³	hexaglycoside	C ₃₀ H ₃₂ O ₂₀
<i>Centaurea depressa</i> M.B.	Astraceae	Gole gandom	Flower	Dastena ²³	Piperitone	C ₁₀ H ₁₆ O
<i>Centaurea persica</i> Boiss.	Astraceae	Gole gandome farsi	Flower	Dastena ²³	Quercetin	C ₁₅ H ₁₀ O ₇
<i>Cnicus benedictus</i> L.	Astraceae	Kharmoghadas	Leaf	Dastena ²³	cnicin	C ₂₀ H ₂₆ O ₇
<i>Equisetum arvensis</i> L.	Equisetaceae	Horsetil	Leaf	Dastena ²³	Hexahydrofarnesyl acetone	C ₁₈ H ₃₆ O
<i>Alhagi persarum</i> Boiss. & Buhse.	Fabaceae	Toranjabin	Stems, Leaf	Dehloran and Abdanan ²⁴	kaempferol	C ₁₅ H ₁₀ O ₆
<i>Adiantum capillus-veneris</i> L.	Polypodiaceae	Kamar Avizeh	Flower, Leaf	Dehloran and Abdanan ²⁴	α-D-Glucopyranoside	C ₇ H ₁₄ O ₆
<i>Allium akaka</i> Gmelin.	Aliaceae	Aneshk	Leaf, Bulb	Dehloran and Abdanan ²⁴	1-Butene,1-(methylthio)-(Z)	C ₅ H ₁₀ S
<i>Allium ampeloprasum</i> L. subsp. <i>iranicum</i> Wendelbo	Aliaceae	Tareh Koochi	Leaf, Bulb	Dehloran and Abdanan ²⁴	linoleic acid	C ₁₈ H ₃₂ O ₂
<i>Amygdalus arabica</i> Olivier.	Rosaceae	Badam-e-Koochi	Fruits	Dehloran and Abdanan ²⁴	Amigdalinal	C ₂₀ H ₂₇ NO ₁₁
<i>Cerasus mahaleb</i> (L.) Miller.	Rosaceae	Beralik	Fruits	Dehloran and Abdanan ²⁴	Coumarin	C ₉ H ₆ O ₂
<i>Gundelia tournefortii</i> L.	Asteraceae	Kenyer	Leaf, Stem	Dehloran and Abdanan ²⁴	Amyrin	C ₃₀ H ₅₀ O

To be continued on next page

Table 1. Continued from previous page.

Scientific name	Herbal family	Common name	Used part(s)	Region	Compound	Molecular formula
<i>Noaea mucronata</i> (Forssk.) Asch & Schweinf.	Chenopodiaceae	Khargo	Leaf, Flower	Dehloran and Abdanan ²⁴	rhamnase	C ₆ H ₁₂ O ₅
<i>Onobrychis elymaitica</i> Boiss. & Hausskn. Ex Boiss.	Fabaceae	Pieh kol	Leaf, Flower	Dehloran and Abdanan ²⁴	methyl 6-O-p-trans- coumaroyl-beta-D- glucopyranoside	C ₄₂ H ₄₆ O ₂₃
<i>Consolida orientalis</i> (Gay) Schrod.	Ranunculaceae	Zaban-pas-ghafa	Whole plant	Dehlolo of kerman ²⁵	delcosine	C ₂₄ H ₃₉ NO ₇
<i>Tribullus terrestris</i> L.	Zygophyllaceae	Khar-khesak	Leaf, Root, Fruit	Dehlolo of kerman ²⁵	kaempferol	C ₁₅ H ₁₀ O ₆
<i>Raphanus niger</i> Mill.	Brassicaceae	Torbe siah	Leaf, Bulb	Zarivar ²⁶	3-(E)-(methylthio) methylene-2- pyrrolidinethione	
<i>Alhagi persarum</i> Boiss. & Buhse.	Fabaceae	Dava yandakhi	Root, Flower	Zanjan ²⁷	kaempferol	C ₁₅ H ₁₀ O ₆
<i>Carthamus oxyacantha</i> M.Bieb.	Asteraceae	Sari tikan	Shoot	Zanjan ²⁷	phenol	C ₆ H ₆ O
<i>Rosa canina</i> L.	Rosaceae	Gul burnu	Fruit, Flower, Shoot	Zanjan ²⁷	hyperoside	C ₂₁ H ₂₀ O ₁₂
<i>Tribulus terrestris</i> L.	Zygophyllaceae	Damir tikan	Whole plant	Zanjan ²⁷	kaempferol	C ₁₅ H ₁₀ O ₆
<i>Amaranthus caudatus</i> L.	Amarantaceae	Sorkh Maghz	Fruit, Seed, Flower	Sirjan ²⁸	phenol	C ₆ H ₆ O
<i>Alhagi pseudalhagi</i> (M. Bieb.) Desv.exB.	Fabaceae	Adoor	Aerial parts	Sirjan ²⁸	3-O-Methyl-d-glucose	C ₇ H ₁₄ O ₆
<i>Tribulus terrestris</i> L.	Zygophyllaceae	Khar- Khorsak	Fruit	Sirjan ²⁸	saponin	C ₅₈ H ₉₄ O ₂₇
<i>Alhagi persarum</i> Boiss. & Buhse.	Fabaceae	Kharshotor	Stem, Leaf, Flower	Sirjan ²⁸	kaempferol	C ₁₅ H ₁₀ O ₆
<i>Rubia tinctorum</i> L.	Rubiaceae	Ronas	Seed	Sirjan ²⁸	3-O-Methyl-d-glucose	C ₇ H ₁₄ O ₆
<i>Cichorium intybus</i> L.	Asteraceae	Kasni	Leaf, Stem	East Persian Gulf ²⁹	esculetin	C ₉ H ₆ O ₄
<i>Alhagi persaru</i> Boiss. & Buhse	Papilionaceae	Kharshotor	Aerial parts	East Persian Gulf ²⁹	kaempferol	C ₁₅ H ₁₀ O ₆
<i>Peganum harmala</i> L.	Zygophyllaceae	Esfand	Aerial parts	East Persian Gulf ²⁹	harmine	C ₁₃ H ₁₂ N ₂ O
<i>Allium cepa</i> L.	Amaryllidaceae	Piaz	Bulb	East of khuzistan ³⁰	Quercetin	C ₁₅ H ₁₀ O ₇
<i>Petroselinum crispum</i>	Apiaceae	Jafari	Fruit, Leaf	East of khuzistan ³⁰	apigenin	C ₁₅ H ₁₀ O ₅
<i>Helianthus annus</i> L.	Asteraceae	Aftabgardan	Seed	East of khuzistan ³⁰	<i>alpha</i> -Pinene	C ₁₀ H ₁₆
<i>Descurainia sophia</i>	Brassicaceae	Khakeshir	Seed	East of khuzistan ³⁰	palmitic acid	C ₁₆ H ₃₂ O ₂
<i>Raphanus sativus</i> L.	Brassicaceae	Torb	Bulb	East of khuzistan ³⁰	3-(E)-(methylthio) methylene-2- pyrrolidinethione	-
<i>Linum usitatissimum</i> L.	Linaceae	Katan	Seed	East of khuzistan ³⁰	phenol	C ₆ H ₆ O
<i>Alhagi pseudalhagi</i>	Papilionacea	Toranjabin	Flower, Leaf	East of khuzistan ³⁰	3-O-Methyl-d-glucose	C ₇ H ₁₄ O ₆
<i>Astragalus hamosus</i> L.	Papilionacea	Nakhonak	Fruit	East of khuzistan ³⁰	9,12-Octadecadienoic acid	C ₁₈ H ₃₂ O ₂
<i>Faba vulgaris</i> Moenchris.	Papilionacea	Baghela	Seed, Leaf	East of khuzistan ³⁰	Palmitic acid	C ₁₆ H ₃₂ O ₂
<i>Amygdalus communis</i> L.	Rosaceae	Badamtalkh	Seed	East of khuzistan ³⁰	<i>alpha</i> -Pinene	C ₁₀ H ₁₆
<i>Rubia tinctorum</i> L.	Rubiaceae	Ronas	Root	East of khuzistan ³⁰	lucidin	C ₁₅ H ₁₀ O ₅
<i>Tribulus terrestris</i> L.	Zygophyllaceae	Kharkhasak	Fruit	East of khuzistan ³⁰	dioscin	C ₄₅ H ₇₂ O ₁₆
<i>Nasturtium officinale</i> (L.) R. Br.	Brassicaceae	Alafeh cheshmeh	Flower, Leaf	Kazeroun ³¹	myristicin	C ₁₁ H ₁₂ O ₃
<i>Alhagi persarum</i> Boiss. & Buhse	Papilionaceae	Kharshotor	Aerial parts	Kazeroun ³¹	kaempferol	C ₁₅ H ₁₀ O ₆
<i>Tribulus terrestris</i> L.	Zygophyllaceae	Kharkhasak	Fruit	Kazeroun ³¹	dioscin	C ₄₅ H ₇₂ O ₁₆
<i>Achillea millefolium</i>	Asteraceae	Boomadaran	Leaf	Mashhad ³²	1,8-Cineole	C ₁₀ H ₁₈ O
<i>Alhagi camelorum</i>	Fabaceae	Kharshotor	Bark, Stem, Fruit	Mashhad ³²	Drimenol	C ₁₅ H ₂₆ O
<i>Tribulus terrestris</i> L.	Zygophyllaceae	<i>Tribulus terrestris</i>	Leaf, Fruit	Mashhad ³²	dioscin	C ₄₅ H ₇₂ O ₁₆
<i>Cyndon dactylon</i>	Poaceae	Biid giyah	Leaf, Fruit	Mashhad ³²	glycerin	C ₃ H ₈ O ₃
<i>Borago officinalis</i>	Boraginaceae	Gav zaban	Leaf, Fruit	Mashhad ³²	linoleic acid	C ₁₈ H ₃₂ O ₂
<i>Cousinia alexeenkoana</i> Bornm.	Asteraceae	Boumadaran	Flower, Leaf	Natanz of kashan ³³	<i>alpha</i> -Pinene	C ₁₀ H ₁₆

In a clinical trial study, the effect of *Smyrniun cordifolium* Boiss on the prevention of kidney stones from ethylene glycol-induced calcium oxalate in rats was evaluated and it was found that ethylene glycol significantly increased serum urea, uric acid and creatinine compared to the normal control group ($p < 0.01$). While serum urea, uric acid and creatinine levels decreased in groups III and IV compared to ethylene glycol group, but this decrease was not significant ($p > 0.05$). Urine parameters showed

that the extract significantly increased urine volume compared to ethylene glycol group and urinary oxalate level decreased significantly ($p < 0.05$).³⁶ In a clinical trial study, the effect of hydroalcoholic extract of *Nigella Sativa* seeds on ethylene glycol-induced kidney stones in rats was investigated. The results showed that the amount of calcium oxalate deposition in the treatment group was significantly reduced compared to the ethylene glycol group and the level of urinary oxalate was similar to the study in the treat-

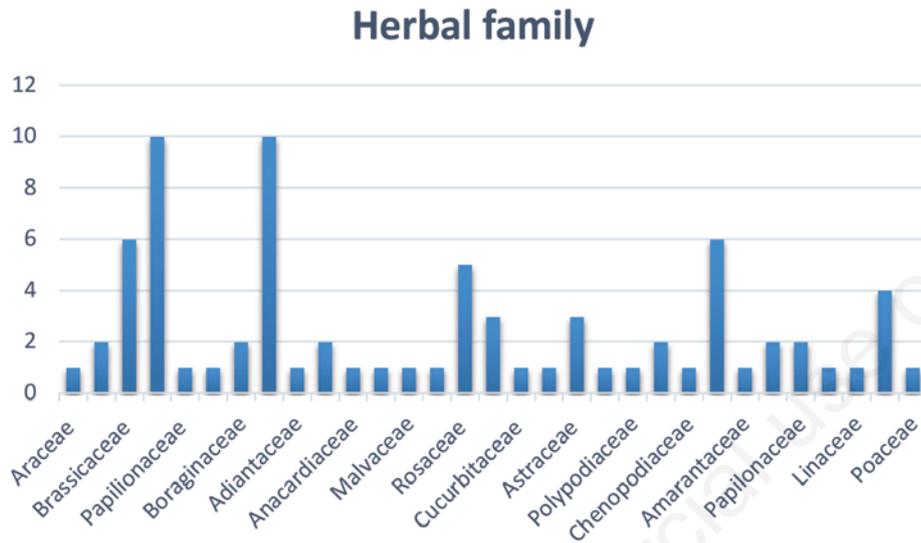


Figure 2. Herbal families affecting kidney stones.

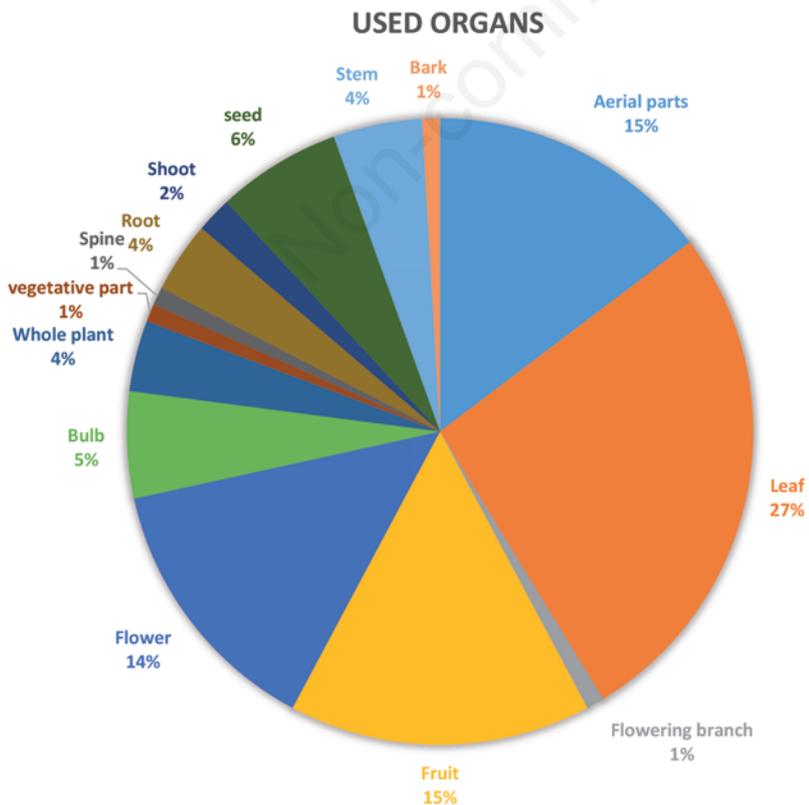


Figure 3. Details of the percentage of herbal used organs.

ment group.³⁷ In a clinical trial study, the effects of alcoholic extract of *nigella sativa* seeds on kidney stones induced by ethylene glycol in rats were investigated. In this study, 32 male Wistar rats were divided into 4 groups: group (A) healthy control, group (B) negative control, group (C) prevention and group (D) treatment for 30 days of 1% ethylene glycol added.

The results showed that in group B, the number of accumulation of kidney stones (55.05 ± 9.988) increased significantly compared to group A ($p < 0.001$). In groups C (19.75 ± 7.75) and D (97.8 ± 24.14), the number of rock accumulations significantly decreased ($p < 0.05$) compared to group B, but did not differ significantly compared to group A. Biochemical evaluation of urine showed a significant increase in urinary calcium oxalate in group B (15.57, 15, 1.26 mg/dL) in comparison with groups A (8.43, 1, 1) and C (8.1, 0, 0.7) ($p < 0.001$) and in comparison with group D (10.64 ± 1.2; $p > 0.05$). The findings of this study showed that the alcoholic extract of *nigella sativa* seeds is effective in preventing the accumulation of calcium oxalate crystals and in crushing kidney stones.³⁸ In a clinical trial study, the effect of aqueous extract of *Zolanga* plant in preventing pathological changes caused by ethylene glycol-induced calcium oxalate crystals in rat cortex and renal medullary tissues was shown and the results showed that the number of calcium oxalate crystals in healthy There was a significant difference in negative control ($p < 0.05$). However, despite a decrease in the number of crystals compared to the negative control group, no significant difference was found in the 100 mg/kg dose group ($p < 0.05$). Also, there was a significant difference between the prevention group with a dose of 200 mg/kg compared to the negative control group in terms of reducing the number of crystals ($p < 0.05$). But there was no significant difference between the prevention group with 400 mg/kg and the negative control group ($p < 0.05$).³⁹ In a clinical trial study examining the effect of hydrophilic extract of *alhari maurorum* on ethylene glycol-induced renal stone in male Wistar rats, the results showed there was no significant difference between the accumulations of calcium oxalate crystals in the studied groups ($p > 0.2$). Urine was lower and this difference was significant in this regard ($p < 0.3$). As a result, we can conclude that hydrophilic extract of *alhari maurorum* is effective in preventing calcium oxalate stones in rats by reducing the amount of oxalate and increasing urinary citrate.⁴⁰ The results of study in Shiraz city (Iran) shown 19 botanical families are used to treat kidney stone in Shiraz. *Alhari maurorum*, *Tribulus terrestris*, *Nigella Sativa*, *Mangifera indica*, *Prunus cerasus*, *Prangos acaulis* (DC.) Bornm.^{41,42} Studies have shown that medicinal plants due to their active ingredients and medicinal and antioxidant compounds have beneficial effects on human health and have a therapeutic effect on various organs of the body and various diseases.⁴³⁻⁵² Herbs can be used to treat kidney stones. The results of a study in Muzaffarnagar district show that 15 medicinal plants from 13 plant families are traditionally used in this region for kidney stones in humans. Currently in Iran, SANKOL[®] herbal drops are prescribed to remove kidney stones and facilitate the removal of pebbles after using a crusher. SANKOL drug is a mixture of medicinal plants such as fennel, cumin, fragrant leaves, cherries (tail), corn cob, prickly pear and melon seeds. The components of this herbal medicine include plants such as *Cucurbita pepo*, *Populus nigra* and *Solidago canadensis*. Commercial teas including green tea, dandelion plant, a mixture of milk and mangosteen and borage are also produced and available in the market for human consumption. Numerous studies have reported the side effects of chemical drugs. Also, the high tendency of people to use medicinal plants and the historical history of using medicinal plants is obvious. The kidneys can play a good role in the treatment of kidney stones.

References

1. von Websky K, Reichetzeder C, Hoher B. Physiology and pathophysiology of incretins in the kidney. *Curr Opin Nephrol Hypertens* 2014;23:54-60.
2. Stowasser M, Gordon RD. Primary aldosteronism: changing definitions and new concepts of physiology and pathophysiology both inside and outside the kidney. *Physiol Rev* 2016;96:1327-84.
3. Kohan DE. Endothelins in the kidney: physiology and pathophysiology. *Am J Kidney Dis* 1993;22:493-510.
4. Lindeman RD. Overview: renal physiology and pathophysiology of aging. *Am J Kidney Dis* 1990;16:275-82.
5. Hoenig MP, Zeidel ML. Homeostasis, the milieu interieur, and the wisdom of the nephron. *Clin J Am Soc Nephrol* 2014;9:1272-81.
6. Webster AC, Nagler EV, Morton RL, Masson P. Chronic kidney disease. *Lancet* 2017;389:1238-52.
7. Vize PD, Woolf AS, Bard JB. The kidney: from normal development to congenital disease. Elsevier; 2003.
8. Hildebrandt F. Genetic kidney diseases. *Lancet* 2010;375:1287-95.
9. Coe FL, Evan A, Worcester E. Kidney stone disease. *J Clin Invest* 2005;115:2598-608.
10. Khan S, Thamilselvan S. Nephrolithiasis: a consequence of renal epithelial cell exposure to oxalate and calcium oxalate crystals. *Molecular Urol* 2000;4:305-11.
11. Grases F, Prieto RM, Gomila I, et al. Phytotherapy and renal stones: the role of antioxidants. A pilot study in Wistar rats. *Urol Res* 2009;37:35.
12. Bahmani M, Baharvand-Ahmadi B, et al. Identification of medicinal plants for the treatment of kidney and urinary stones. *J Renal Injury Prev* 2016;5:129.
13. Kasote DM, Jagtap SD, Thapa D, et al. Herbal remedies for urinary stones used in India and China: A review. *J Ethnopharmacol* 2017;203:55-68.
14. Dinesh V, Bembekar SK, Sharma P. Herbal formulations used in treatment of kidney stone by native folklore of Nizamabad District, Andhra Pradesh, India. *Biosci Discov* 2013;4:250-3.
15. Dolatkahi M, Dolatkahi A, Bagher Nejad J. Ethnobotanical study of medicinal plants used in Arjan –Parishan protected area in Fars Province of Iran. *Avicenna J Phytomed* 2014;4:402-412.
16. Ahvazi M, Khalighi-Sigaroodi F, Charkhchiyan MM, et al. Introduction of medicinal plants species with the most traditional usage in Alamut Region. *Iranian J Pharmaceut Res* 2012;11:185-94.
17. Ebadi M, Eftekharian R. Ethnobotanical study of medicinal plants used in Ahar-Arasbaran (protected area in East Azerbaijan Province of Iran). *Mediterranean Botany* 2019;40:209-14.
18. Razmjoui D, Zarei Z, Akbari M. Ethnobotanical study of some medicinal plants of Abadeh city located in Fars province. *J Crop Ecol* 2014;7:222-34.
19. Dolatkahi M, Nabipour I. Systematic study of medicinal plants in Bushehr. *J Herbal Drugs* 2013;3:209-21.
20. Razmjoue D, Zarei Z, Armand R. Ethnobotanical study (identification, medical properties and how to use) of some medicinal plants of Behbahan city of Khuzestan Province, Iran. *J Medicinal Plants* 2017;16:33-50.
21. Ghavam M, Dehdari S, Hosseinpour Sh. Introduced flora, life forms and geographical distribution of plants tight

- Balangesan. *J Plant Res* 2019;31:1-7.
22. Mosaddegh M, Esmacili S, Hassanpour A, et al. Ethnobotanical study in the highland of Alvand and Tuysarkan, Iran. *Res J Pharmacognosy* 2016;3:7-17.
 23. Arefatabad M, Jalilian N. Ethnobotanical study of medicinal plants in Zarivar region of Marivan city. *J Med Plants* 2015;14:55-76.
 24. Ghasemi Pirbalouti A, Momeni M, Bahmani M. Ethnobotanical study of medicinal plants used by Kurd tribe in Dehloran and Abdanan Districts, Ilam Province, Iran. *Afr J Tradit Complement Altern Med* 2013;10:368.
 25. Vakili Shahrababaki SMA. The Ethnobotanical Study of Medicinal Plants in (Dehe-lolo-vameghabadbidoieh) Village. Kerman, Iran. *J Med Plants By-products* 2016;1:105-111.
 26. Conversion, Jalilian N. Ethnobotanical study of medicinal plants in Zarivar region of Marivan city. *J Medicinal Plants* 2012;14:55-75.
 27. Moghanloo L, Ghahremaninejad F, Vafadar M. Ethnobotanical study of medicinal plants in the central district of the Zanjan county, Zanjan province, Iran. *J Herbal Drugs* 2019;9:121-31.
 28. Khajoei Nasab F, Khosravi AR. Ethnobotanical study of medicinal plants of Sirjan in Kerman Province, Iran. *J Ethnopharmacol* 2014;154:190-7.
 29. Dolatkahi M, Nabipour I. Ethnobotanical study of medicinal plants in the northeastern watershed of the Persian Gulf. *Med Plants Quart* 2019;13:129-143.
 30. Khodayari H, Amani SH, Amiri H. Ethnobotany of medicinal plants in the northeast of Khuzestan province. *J Ecophytochem Med Plants* 2014;8:12-16.
 31. Dolatkahi M, Ghorbani Nohooji M, Mehrafarin A, Amini Nejad GHR. Ethnobotanical study of medicinal plants in Kazerun city: Identification, distribution and traditional uses. *J Med Plants* 2011;11:163-78.
 32. Amiri MS, Joharchi MR. Ethnobotanical investigation of traditional medicinal plants commercialized in the markets of Mashhad, Iran. *Avicenna J Phytomed* 2013;3:254-71.
 33. Abbasi SH, Afsharzadeh S, Mohajeri AR. Introduction of plant species with medicinal properties in Nazanz region (Kashan). *J Herbal Drugs* 2014;3:147-56.
 34. Ernst E. The efficacy of herbal medicine—an overview. *Fundamental Clin Pharmacol* 2005;19:405-9.
 35. Alelign T, Petros B. Kidney stone disease: an update on current concepts. *Adv Urol* 2018;2018: 3068365.
 36. Adhamian esfehani M, Rouhi L, Azizi S. The effect of alcoholic extract of *smyrnium cordifolium* boiss root on prevention of ethylene glycol-induced kidney calculi in rats. *Sjimu* 2016;24:130-8.
 37. Khajavi Rad A, Hadjzadeh M, Monavvar N, Ayathollahi H. The preventive effects of ethyl acetate fractions from aqueous and ethanolic extract of *Nigella sativa* L. seeds on calcium oxalate stones in Wistar rat. *Koomesh* 2008;9:123-30.
 38. Hadjzadeh M, Khoei A, Parizadeh M, Hajzadeh Z. The effects of ethanolic extract of *Nigella Sativa* seeds on ethylene glycol induced kidney stones in rat. *Urol J* 2007;4:86-90.
 39. Esmacili S, Falahpour Amiry M, Taene A, et al. Effect of aqueous extract of “*eryngium campestre*” on the prevention of pathologic alterations caused by calcium oxalate crystals induced by ethylene glycol in the cortex and medulla of rats’ kidneys. *J Birjand Univ Med Sci* 2017;24:84-92.
 40. Shafaeifar A, Mehrabi S, Malekzadeh J, Jannesar R, Sadeghi H, Vahdani R et al . Effect of hydrophilic extract of *alhagi maurorum* on ethylene glycol-induced renal stone in male Wistar rats. *Armaghane danesh* 2012;17:129-138.
 41. Bahmani M, Baharvand-Ahmadi B, Tajeddini P, et al. Identification of medicinal plants for the treatment of kidney and urinary stones. *J Renal Inj Prev* 2016;5:129-33.
 42. Prachi, Chauhan N, Kumar D, Kasana MS. Medicinal plants of Muzaffarnagar district used in treatment of urinary tract and kidney stones. *Indian J Trad Knowledge* 2009;8:191-5.
 43. Ghaneialvar H, Abbasi N, Sancei S, Zangeneh A, Zangeneh M M, Pooyanmehr M, et al . An ethno medicinal plant: Antibacterial activities of *Stachys lavandulifolia* Vahl aqueous extract against common pathogens. *Plant Biotechnol Persa* 2021;3:2.
 44. Manouchehri A, Shakib P, Biglaryan F, et al. The most important medicinal plants affecting bee stings: A systematic review study. *Uludag Arıcılık Dergisi* 2012;21:91-103.
 45. Zhang Y, Mahdavi B, Mohammadhosseini M, et al. Green synthesis of NiO nanoparticles using *Calendula officinalis* extract: Chemical characterization, antioxidant, cytotoxicity, and anti-esophageal carcinoma properties. *Arabian J Chem* 2021;14:103105.
 46. Ma D, Han T, Karimian M, et al. Immobilized Ag NPs on chitosan-biguanidine coated magnetic nanoparticles for synthesis of propargylamines and treatment of human lung cancer. *Int J Biol Macromolec* 2020;165:767-75.
 47. Solati K, Karimi M, Rafieian-Kopaei M, et al. Phytotherapy for wound healing: The most important herbal plants in wound healing based on iranian ethnobotanical documents. *Mini-Rev Med Chem* 2021;21:500-19.
 48. Abbasi N, Khalighi Z, Eftekhari Z, Bahmani M. Extraction and phytoanalysis of chemical compounds of *Eucalyptus globulus* leaf native to Dehloran, Ilam province, Iran by HS-SPME and GC-MS. *Adv Animal Veterinary Sci* 2020;8:647-652.
 49. Aidy A, Karimi E, Ghaneialvar H, et al. Protective effect of *Nectaroscordum tripedale* extract and its bioactive component tetramethylpyrazine against acetaminophen-induced hepatotoxicity in rats. *Adv Trad Med* 2020;20:471-7.
 50. Abbaszadeh S, Rashidipour M, Khosravi P, et al. Biocompatibility, cytotoxicity, antimicrobial and epigenetic effects of novel chitosan-based quercetin nanohydrogel in human cancer cells. *Int J Nanomed* 2020;15:5963-75.
 51. Karimi E, Abbasi S, Abbasi N. Thymol polymeric nanoparticle synthesis and its effects on the toxicity of high glucose on OEC cells: Involvement of growth factors and integrin-linked kinase. *Drug Design Devel Ther* 2019;13:2513-32.
 52. Abbaszadeh S, Andevvari AN, Koohpayeh A, et al. Folklore medicinal plants used in liver disease: A review. *Int J Green Pharmacy* 2018;12:463-72.