Traditionally used Medicinal Plants in the Treatment of Kidney Stone: a Review on Ethnobotanical Studies in Iran

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Key words: Nephrolithiasis, Medicinal plants, Ethnobotany, Traditional culture.

Abstract

Urinary tract stone are considered as the third leading disease of the urinary tract, which is still increasing in prevalence mainly due to ever-changing dietary and lifestyle. Kidney stone removal treatments never give a guarantee against the recurrence of stone and the employed technique may lead to certain side effects. It is thus, necessary to develop a medical prophylactic program to prevent stone recurrence. This review is to identify and report the plants that are used for prevention and treatment of kidney stone in traditional culture from various regions of Iran. We found 56 plants which belong to the 23 floral families are in use as traditional medicine, to specifically treat kidney stone in Iran. Most of the reported plants were from Asteraceae and Rosaceae families with respective 12 and 6 species. Though most of the plants evaluated in this study contain phenolic compounds, their effects in treating nephrolithiasis may be explained antioxidant activities.

Introduction:

Urinary tract stones are considered as one of the prevalent urinary tract diseases with a prevalence of 1%-15% worldwide (Yuvanc et al., 2015). Although the causes of formation of such stones are not fully understood, various complex internal and environmental factors are involved in evolving this disease. Inherited factors, age, and gender are some of the internal factors. Whether, the amount of water its associated minerals, and some specific diet as some of the external factors that may effect in the formation of urinary tract stone are still under debate. The stone is considered to be one of the most common reasons for hematuria, abdominal pain, flank pain, and groin pain which can increase the risk of urinary tract infections (UTIs) and even renal failure (Yuvanc et al., 2015). Currently, adjuvant therapy (over-hydration and analgesic) is considered for treatments in the majority of the cases. For a large stone that does not pass through urinary tract spontaneously, cause severe complications, which required invasive and surgical treatments, including chemical dissolution therapy (to remove stone through urinary tract), percutaneous nephrolithotomy, extracorporeal shock wave lithotripsy, and if needed, surgery (Yuvanc et al., 2015). In addition to imposing heavy costs on patients, surgical treatment or stone crushing may cause several complications including UTI which may lead to infection of all the body and also severe damage to renal tissue (Khan & Thamilselvan, 2000, Yuvanc et al., 2015). In this regard, it is necessary to identify and use nature-based compounds that are able to prevent the formation of a kidney stone or to facilitate removing small stones.

In the recent years, ethnobotanical investigations are growing largely and identifying new medicinal plants used to prevent and treat various diseases through phytotherapy. Ethnobotanical studies conducted in various regions of Iran have reported various traditional uses of many medicinal plants (Bahmani et al., 2016; Jivad et al., 2016a; Jivad et al., 2016b; Parsaei et al., 2016a; Parsaei et al., 2016b; Rouhi-Boroujeni et al., 2016; Asadi-Samani et al., 2016; Samarghandian et al., 2016; Mahmoudian-Sani et al., 2016), leading to developing new study designs to discover medicinal plants (Bahmani et al., 2015; Baradaran et al., 2012; Kooti et al., 2015; Moradi et al., 2012; Moradi et al., 2016b; Moradi et al., 2016c; Moradi et al., 2013a, Moradi et al. 2013b; Nasri et al., 2013; Shahrani et al., 2007; Moradi et al., 2016a; Moradi et al., 2015). In this regard, some modern studies have demonstrated that some medicinal plants used in traditional medicine have useful effects in treating kidney stone (Akanae et al., 2010; Cao et al., 2004;
Jeong et al., 2006; Park et al., 2008; Premgamone et al., 2001). Therefore, we identified here the plants that are used for prevention and treatment of kidney stone in the traditional culture of Iran’s various regions.

In this review article, we used the keywords ethnobotany, ethnomedicine, ethnopharmacology, phytopharmacology, phyto medicine, Iran, and traditional medicine in combination with kidney stone, nephrolithiasis and renal stone to retrieve relevant articles from scientific database. Duplicate articles and the articles without accessible full text were not included in final analysis.

Phytotherapy and Kidney Stone:
Available literature indicates that Iran’s people belonging to various cultures and regions use total 56 medicinal plants from 23 families in the treatment of kidney stone. Most of the identified plants were from Asteraceae and Rosaceae family with respective 12 and 6 species (figure1). Table 1 gives further data on the medicinal plants effective on kidney stone disease.

Figure 1: Family wise representation of medicinal plants effective on kidney stone

Discussion:
Till date, the development and increased use of minimally invasive and non-invasive stone treatments such as percutaneous nephrolithotomy, extracorporeal shock wave lithotripsy, and endoscopy have succeeded to large extent in removing kidney stone; nevertheless, the recurrence rates are still high (10 to 23% per year, which exceeds up to 50% within 5 years’ time period) (Akanae et al., 2010). Furthermore, such mechanical/surgical techniques often resultant to various side-effects such as hemorrhage, tubular necrosis, hypertension, subsequent kidney fibrosis etc. Thus, stone recurrence is a critical issue and requires an effective prophylactic treatment. It is necessary to develop a medical prophylactic program to prevent stone recurrence. The use of natural medicine is a constant aspect of current health care. Although, the modern allopathic medicine is easily available across the world, but many people seem to prefer alternative or complementary therapy, including medicinal herbs (Touhami et al., 2007).

The record of 56 medicinal plants use to treat kidney stones directly indicates the richness of Iran’s traditional medicine, which has long addressed use to prevent and treat the kidney stone. The existence of widely varied approaches to using plants to treat diseases, including kidney stone, in Iranian traditional medicine is compatible with geographical expansion and indicates vegetation diversity of this country.

Most of the identified plants used in kidney treatments were from Asteraceae family and followed by Rosaceae family that contain large amounts of phenolic compounds. In previous experimental studies, flavonoids from plants or herbs were reported to decrease calcium oxalate stone formation in hyperoxaluria-induced stone in rats (Jeong et al., 2006, Park et al., 2008). Further, rosmarinic acid, as a plant flavonoid, found to inhibit several complement-dependent inflammatory processes, acting through stimulating a host antioxidant response (Akanae et al., 2010). Flavonoids interfere with different free radical-producing systems involving the reduction in ischemia–reperfusion injury by interfering with inducible nitric-oxide synthase activity, direct radical scavenging, leukocyte immobilization during ischemia, inflammation conditions, and the xanthine oxidase pathway, which is an important oxidative injury-inducing route inhibited by flavonoids (Nijveldt et al., 2001). The mechanism and sequence of events by which free radicals interfere with cellular functions have not yet been fully understood, but one of the most significant events may be the lipid peroxidation, which leads to cellular membrane damage. Indeed free radicals attract different inflammatory mediators, playing a role in general inflammatory response and tissue damage.

Conclusively, many of plants referred in this study contain phenolic compounds and have antioxidant activity; their effects in treating nephrolithiasis may be completed by their antioxidant activities (Akanae et al., 2010; Amidi et al., 2016; Karimi & Moradi, 2015). Researchers and relevant physicians are advised to investigate the proper roles of the plants referred to this study by clinical trials to develop anti-kidney stone herbal drugs and make them commercially available.

References:
Akanae, W., Tsujihata, M., Yoshioka, I., Nonomura, N. & Okuyama, A. (2010): Orthosiphon grandiflorum has a protective effect in a calcium oxalate stone forming rat model. Urol Res. 38: 89-96


of metformin: Beyond blood glucose regulatory effects. *Iran. J. Kidney Dis.*, 7: 423-428


Table 1: Medicinal plants effective on kidney stone in different subcultures and regions of Iran

<table>
<thead>
<tr>
<th>No.</th>
<th>Scientific name</th>
<th>Family</th>
<th>Local name</th>
<th>Used</th>
<th>Preparation organs</th>
<th>Regions</th>
<th>References*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Biarum straussii Engl.</td>
<td>Araceae</td>
<td>Kardeh</td>
<td>Leaves</td>
<td>Edible</td>
<td>Arjan, Fars P.</td>
<td><em>(Dolatkhahi et al., 2014)</em></td>
</tr>
<tr>
<td>2</td>
<td>Nasturtium officinale R. Br.</td>
<td>Brassicaceae</td>
<td>Bakaloo</td>
<td>Stem, Leaves</td>
<td>Infusion</td>
<td>Arjan, Fars P.</td>
<td><em>(Dolatkhahi et al., 2014)</em></td>
</tr>
<tr>
<td>3</td>
<td>Alhagi camelorum Fisch.</td>
<td>Fabaceae</td>
<td>KharShotor</td>
<td>Toranjabin</td>
<td>Whole Plant</td>
<td>Decoction</td>
<td>Arjan, Fars P.; Mobarakeh, Isfahan P.</td>
</tr>
<tr>
<td>4</td>
<td>Adiantum capillus-Veneris L.</td>
<td>Pteridaceae</td>
<td>Parsiavashoon</td>
<td>Leaves</td>
<td>Infusion</td>
<td>Arjan, Fars P.</td>
<td><em>(Dolatkhahi et al., 2014)</em></td>
</tr>
<tr>
<td>5</td>
<td>Pyrus communis L.</td>
<td>Rosaceae</td>
<td>Anchochak</td>
<td>Seed</td>
<td>Edible</td>
<td>Arjan, Fars P.</td>
<td><em>(Dolatkhahi et al., 2014)</em></td>
</tr>
<tr>
<td>6</td>
<td>Tribulus terrestris L.</td>
<td>Zygophyllaceae</td>
<td>Kharkhasak,</td>
<td>Whole Plant</td>
<td>Infusion, Concentrated</td>
<td>Arjan, Fars P.; Maraveh, Khar Pelangi, Region, North of Iran; Mobarakeh hopancokokok region, Isfahan P.; Turkmen Sahra, north of Iran; Hezar Mountain, SE of Iran; and Kerman, Mashhad, Razavi Khorasan P.</td>
<td><em>(Ghorbani, 2005; Mardaninejad et al., 2013; Dolatkhahi et al., 2014, Mirdeilami et al., 2011; Amiri &amp; Joharchi, 2013; Rajaei &amp; Mohamadi, 2012)</em></td>
</tr>
<tr>
<td>7</td>
<td>Allium iranicum</td>
<td>Alliaceae</td>
<td>sirevahshi</td>
<td>Bulb</td>
<td>Decoction</td>
<td>Hamedan P.</td>
<td><em>(Esmaeili et al., 2014)</em></td>
</tr>
</tbody>
</table>
8  Centaurea solstitialis L.  Asteraceae  Whole Plant  Decoction  Hamedan P.  
   *(Esmaeili et al., 2014)
9  Ceratocephalus falcata (L.)  Ranunculaceae  Aerial Parts  Decoction  Hamedan P.  
   *(Esmaeili et al., 2014)
10  Cicer anatolicum Alef  Fabaceae  Albaloovalshih  Fruit  Decoction  Hamedan P.  
   *(Esmaeili et al., 2014)
11  Citrullus lanatus (Thum.) Matsum & Nakai  Cucurbitaceae  hendev:nedeym  Fruit  Cooked  Hamedan P.  
   *(Esmaeili et al., 2014)
12  Tripleurospermum disciforme (C. A. Mey.) Schultz  Asteraceae  Ryshegaz  Flower  Decoction  Hamedan P.  
   *(Esmaeili et al., 2014)
13  Urtica dioica L.  Urticaceae  Gaz.gaz  Aerial Part  Decoction  Hamedan P., Sardasht, 
   Western Azerbaijan P.  
   *(Esmaeili et al., 2014; Azizi & Keshavarzi, 2015)
14  Salvia sclarea L.  Lamiaceae  -Leaves, Flower, Seed  Infusion  Hezar Mountain, SE of Iran  
   *(Rajaei & Mohamadi, 2012)
15  Adonis aestivalis L.  Ranunculaceae  Teryakoo  Flower  Decoction  Hezar Mountain, SE of Iran  
   *(Rajaei & Mohamadi, 2012)
16  Consolida orientalis (Gay) Schrod.  Ranunculaceae  Flower, Leaves  Poultice, Decoction  Hezar Mountain, SE of Iran  
   *(Rajaei & Mohamadi, 2012)
17  Galium aparine L.  Rubiaceae  Aerial Part  Infusion  Hezar Mountain, SE of Iran  
   *(Rajaei & Mohamadi, 2012)
18  Acanthophyllum squarrosum Caryophyllaceae  Boiss.  Chubakeriz  Root powder  Brew  Hormozgan P.  
   *(Safa et al., 2013)
19  Conyza canadensis (L.) Cronq.  Asteraceae  PirbaharakebaghWhole plant  Brew  Hormozgan P.  
   *(Safa et al., 2013)
20  Desmostachya bipinnata Poaceae  Kertaki, kertah  Root  Fresh organ  Hormozgan P.  
   *(Safa et al., 2013)
21  Heliotropium europaeum L.Boraginaceae  Kolohmu, balghandu  Leaves, flower, seed, twigs  Brew freshorgan  Hormozgan P.  
   *(Safa et al., 2013)
22  Herniaria hirsuta L.  Paranychiaceae  Alafe fatgh  Aerial parts  Decoction brew  Hormozgan P.  
   *(Safa et al., 2013)
23  Amaranthus caudatus L.  Amaranthaceae  Sorkh Maghz  Fruit, seed, flower  Raw seeds  Kerman P.  
   *(Maymand & Mirtajoedin, 2010)
24  Alhagi pseudalhagi (M.Bieb.) Desv  Fabaceae  Adoor, Khare  Aromatic water  Kerman P.  
   *(Mahdavi Maymand & Mirtajoedin, 2010)
25  Eryngium campestre L.  Apiaceae  Zallash  Flower, Stem  Decoction, Edible  Maraveh Tappeh Region, North of Iran  
   *(Mirdeilami et al., 2011)
26  Teucrium polium L.  Lamiaceae  Bakhshiyashen  Leaves, Aerial Part  Demulcent, Infusion  Maraveh Tappeh Region, North of Iran  
   *(Mirdeilami et al., 2011)
27  Anthemis nobilis Boiss.  Asteraceae  Tatbashi  Flower  Decoction, Infusion  Maraveh Tappeh Region, North of Iran  
   *(Mirdeilami et al., 2011)
28  Astragalus hamosus L.  Fabaceae  Nakhonak  Fruit  -  Mashhad, Razavi Khorasan P.  
   *(Amiri & Joharchi, 2013)
29  Nigella sativa L.  Ranunculaceae  Siah Daneh  Seed  Infusion, decoction  Mashhad, Razavi Khorasan P. and Mobarakhe region, Isfahan P.  
   *(Amiri & Joharchi, 2013, Mardaninejad et al., 2013)
30  Cerasus avium (L.) Moench  Rosaceae  Dome Gilas  Pedicel  Mashhad, Razavi Khorasan P.  
   *(Amiri & Joharchi, 2013)
31  Rosa beggeriana Schrenk  Rosaceae  Nastaran  Fruit  Mashhad, Razavi Khorasan P.  
   *(Amiri & Joharchi, 2013)
32  Physalis alkekengi L.  Solanaceae  Arusak Posht  Fruit  Mashhad, Razavi Khorasan P.  
   *(Amiri & Joharchi, 2013)
<table>
<thead>
<tr>
<th>No.</th>
<th>Scientific Name</th>
<th>Family</th>
<th>Part(s)</th>
<th>Use(s)</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
<td>Matricaria chamomilla L</td>
<td>Asteraceae</td>
<td>Flower</td>
<td>-</td>
<td>Mobarakeh region, Isfahan P. <em>(Mardaninejad et al., 2013)</em></td>
</tr>
<tr>
<td>34</td>
<td>Achillea santonicii</td>
<td>Asteraceae</td>
<td>Aerial Part</td>
<td>-</td>
<td>Mobarakeh region, Isfahan P. <em>(Mardaninejad et al., 2013)</em></td>
</tr>
<tr>
<td>35</td>
<td>Raphanus sativus L</td>
<td>Brassicaceae</td>
<td>Root, Leaves, Seed</td>
<td>-</td>
<td>Mobarakeh region, Isfahan P. <em>(Mardaninejad et al., 2013)</em></td>
</tr>
<tr>
<td>36</td>
<td>Rumex crispus L.</td>
<td>Polygonaceae</td>
<td>Root, Leaves, Flower</td>
<td>-</td>
<td>Mobarakeh region, Isfahan P. <em>(Mardaninejad et al., 2013)</em></td>
</tr>
<tr>
<td>37</td>
<td>Prunus cerasus L.</td>
<td>Rosaceae</td>
<td>Peduncle</td>
<td>-</td>
<td>Mobarakeh region, Isfahan P. <em>(Mardaninejad et al., 2013)</em></td>
</tr>
<tr>
<td>38</td>
<td>Polygonum aridum Boiss</td>
<td>Polygonaceae</td>
<td>Aerial parts</td>
<td>-</td>
<td>Mobarakeh region, Isfahan P. <em>(Mardaninejad et al., 2013)</em></td>
</tr>
<tr>
<td>39</td>
<td>Zea mays L.</td>
<td>Poaceae</td>
<td>Stigma, Seed</td>
<td>Decoction</td>
<td>Mobarakeh region, Isfahan P. &amp; Turkmen Sahra, N. Iran <em>(Mardaninejad et al., 2013; Ghorbani, 2005)</em></td>
</tr>
<tr>
<td>40</td>
<td>Allium akaka Gmel.</td>
<td>Aliaceae</td>
<td>Shoots</td>
<td>-</td>
<td>Sardasht, Western Azerbaijan P. <em>(Azizi &amp; Keshavarzi, 2015)</em></td>
</tr>
<tr>
<td>41</td>
<td>Pirus communis L.</td>
<td>Rosaceae</td>
<td>Fruit</td>
<td>-</td>
<td>Sardasht, Western Azerbaijan <em>(Azizi &amp; Keshavarzi, 2015)</em></td>
</tr>
<tr>
<td>42</td>
<td>Anthemis spp.</td>
<td>Asteraceae</td>
<td>Flower</td>
<td>Decoction</td>
<td>Turkmen Sahra, north of Iran <em>(Ghorbani, 2005)</em></td>
</tr>
<tr>
<td>43</td>
<td>Calendula persica C.A.Mey.</td>
<td>Asteraceae</td>
<td>Aerial parts</td>
<td>Decoction, infusion, Juice</td>
<td>Turkmen Sahra, N. Iran; Kohgiluyeh va Boyer Ahmad P &amp; Maraveh Tappeh Region, <em>(Ghorbani, 2005, Mirdeilami et al., 2011, Mosaddegh et al., 2012)</em></td>
</tr>
<tr>
<td>44</td>
<td>Calendula alata Rech. f.</td>
<td>Asteraceae</td>
<td>Aerial parts</td>
<td>Decoction, infusion</td>
<td>Turkmen Sahra, N. Iran <em>(Ghorbani, 2005)</em></td>
</tr>
<tr>
<td>45</td>
<td>Origanum vulgare L.</td>
<td>Lamiaceae</td>
<td>Aerial parts</td>
<td>Flavoring, with yugart</td>
<td>Turkmen Sahra, north of Iran <em>(Ghorbani, 2005)</em></td>
</tr>
<tr>
<td>46</td>
<td>Olea europaea L.</td>
<td>Oleaceae</td>
<td>Flower, Leaves</td>
<td>Infusion, decoction</td>
<td>Turkmen Sahra, N. Iran <em>(Ghorbani, 2005)</em></td>
</tr>
<tr>
<td>47</td>
<td>Polygonum arenasterum Boireau</td>
<td>Polygonaceae</td>
<td>Aerial parts</td>
<td>Decoction</td>
<td>Turkmen Sahra, north of Iran <em>(Ghorbani, 2005)</em></td>
</tr>
<tr>
<td>48</td>
<td>Polygonum hyrcanicum Rech. f.</td>
<td>Polygonaceae</td>
<td>Aerial parts</td>
<td>Decoction</td>
<td>Turkmen Sahra, N. Iran <em>(Ghorbani, 2005)</em></td>
</tr>
<tr>
<td>49</td>
<td>Thymus kotschyanus Boiss.</td>
<td>Lamiaceae</td>
<td>Leaves, nflorescence</td>
<td>Infusion</td>
<td>West Azerbaijan P. <em>(Miraldi et al., 2001)</em></td>
</tr>
<tr>
<td>50</td>
<td>Rosa canina L.</td>
<td>Rosaceae</td>
<td>Flower, Fruits</td>
<td>Infusion</td>
<td>Western Azerbaijan P. <em>(Miraldi et al., 2001; Azizi &amp; Keshavarzi, 2015)</em></td>
</tr>
<tr>
<td>51</td>
<td>Arctium minus Bernh.</td>
<td>Asteraceae</td>
<td>Root/leaf</td>
<td>Infusion</td>
<td>Kohgiluyeh va Boyer Ahmad P <em>(Mosaddegh et al., 2012)</em></td>
</tr>
<tr>
<td>52</td>
<td>Allium jesdianum</td>
<td>Liliaceae</td>
<td>Whole Plant</td>
<td>Infusion</td>
<td>Kohgiluyeh va Boyer Ahmad P <em>(Mosaddegh et al., 2012)</em></td>
</tr>
<tr>
<td>54</td>
<td>Cichorium intybus L.</td>
<td>Asteraceae</td>
<td>Leaves, stem</td>
<td>Aromatic water &amp; cooked</td>
<td>Northeast Latrine Zone of Persian Gulf <em>(Dolatkahi &amp; Nabipour, 2014)</em></td>
</tr>
<tr>
<td>55</td>
<td>Alhagi persarum Boiss. &amp; Buhse</td>
<td>Papilionaceae</td>
<td>Whole Plant</td>
<td>Aromatic water, Decoction</td>
<td>Northeast Latrine Zone of Persian Gulf <em>(Dolatkahi &amp; Nabipour, 2014)</em></td>
</tr>
<tr>
<td>56</td>
<td>Peganum harmala L.</td>
<td>Zygophyllaceae</td>
<td>Aerial parts</td>
<td>Infusion</td>
<td><em>(Dolatkahi &amp; Nabipour, 2014)</em></td>
</tr>
</tbody>
</table>