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Gall stone dissolving plants: A concise review

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Abstract
Medicinal plants have been known for thousands of years and are highly esteemed throughout the world as a rich source of therapeutic agents for the prevention and cure of diseases. Nowadays, large number of population suffers from gall stone. Gall stones problem is now being increased significantly due to changes in living style and conditions *i.e.* industrialization and malnutrition. Medicinal plants are used from centuries due to its, cultural acceptability, efficacy, safety and lesser side effects as compared to synthetic drugs. The aim of the review is to gather the information of the plants utilized in various parts and societies of the world against gallstones. The information not only useful for common people but also for the scientific community to carry out further phytochemical, pharmacological and toxicological studies for the discovery of new, effective and safer molecules against gallstones.

Keywords: Gall stone, anticholelithiatic plants, ethnomedicine

Introduction
Gallstone is a worldwide problem. Its pervasiveness gives off an impression of being higher in Western countries (>10%) than in Asian countries (3 – 10%). Female sex, older age, higher body mass index (BMI), hyperlipidemia, alcohol consumption, and diabetes mellitus have been accounted for as danger factors for gallstone problem [1-3]. Cholelithiasis (gallstone formation) is generally found in adults as compared to children. The frequency of gall stones among children is 1.9%. About 10 - 20% adult population of Western countries suffers from gall stones and its predominance in India is 3 - 6 % [4].
The gallbladder is a sac situated under the liver. It stores and concentrates bile produced in the liver. Bile acids play an important role in the assimilation of fats and are delivered from the gallbladder into the upper small digestive tract (duodenum) in response to food, especially fats. Development of stones inside the gall bladder is known as cholelithiasis. In this condition, hard stones composed of cholesterol or bile pigments are formed in the gallbladder. If stones are present in the common bile duct, the condition is called choledocholithiasis. Most of the stones are composed of cholesterol [5].
Bile is composed of bile salts, cholesterol, and lecithin, is present in solution by a delicate harmony. The proportion between bile salts to cholesterol is the most significant, in light of the fact that the bile salts are acid, and without this acid the cholesterol would form crystals and stones. In other words, sufficient bile acids are needed to keep the cholesterol from forming stones in the gallbladder. In bile, cholesterol is in equilibrium with bile salts and with phosphatidylcholine. When the cholesterol in the bile becomes too concentrated, it saturates the bile acids and begins to form crystals. Then a sludge containing cholesterol, mucin, calcium salts and bilirubin is formed and ultimately stones are developed [6].
Cholesterol stones are mainly causes due to difference in the production of cholesterol or the secretion of bile. The most ideal approach to forestall and eliminate gallstones is to bring down the body's general cholesterol level, which lessens the cholesterol in the gallbladder, and in this way makes a healthy bile-to-cholesterol proportion. When this proportion is restored, the bile acids can disintegrate the cholesterol crystals and stones and reestablish the healthy gallbladder. Pigmented stones are chiefly made out of bilirubin, which is an element formed because of the ordinary breakdown of red blood cells [7]. Among various variants of gall stones about 70% patients have cholesterol stones and 30% have pigmented gall bladder stones. The prevalence of Bilirubin or brown pigment stones is highest in East Asia and Africa [4]. In Western countries, gallstones are composed mainly of cholesterol as cholesterol monohydrate crystals in 75–80% of the cases. The staying 20% are pigment stones, comprised basically of calcium bilirubinate [8, 9].

The significant reasons for gallstones are elevated cholesterol diet, low bile salt levels, decreased gall bladder motility etc. Obesity, female gender, family history, rapid weight loss sharp, and vitamin B_{12} or folic acid deficiency are considered as significant danger factors in the advancement of gall stones. Gallstones can cause intense pain in the upper right part of the abdomen. This pain may radiate to back and up to the shoulder blade. Other symptoms include nausea, vomiting, light-colored or gray stool, and diarrhea. The clinical presentations include acute cholecystitis and febrile illness with pain and tenderness in the right upper quadrant (Murphy sign: In this condition gallbladder is inflamed, the patient will hastily stop inhaling due to the pain). This torment may emanate to back and up to the shoulder bone. Different manifestations incorporate queasiness, spewing, light-shaded or dim stool, and looseness of the bowels. The clinical introductions incorporate intense cholecystitis and febrile sickness with torment and delicacy in the correct upper quadrant (Murphy sign: In this condition gallbladder is excited, the patient will quickly quit breathing in because of the agony). Generalized body weakness and weight reduction are considered as most common symptoms of gallstones. The complications incorporate cholangitis, empyema of gall bladder, pancreatitis, abscess formation, porcelain gall bladder and gall bladder perforation [4].

External shock wave lithotripsy (ESWL) can be used in the treatment of gall stones [6]. When surgery is to be avoided, extracorporeal shock wave lithotripsy is a noninvasive therapeutic alternative for symptomatic patients. Although serious adverse effects (e.g., biliary pancreatitis, liver hematoma) are rare, limitations of the procedure include stone recurrence [10] ESWL is safer but inferior to laparoscopic cholecystectomy with respect to recurrence rate [11]. The most widely used conventional treatment for symptomatic gallstones is cholecystectomy (gallbladder removal). Most patients experience a resolution of symptoms after cholecystectomy, but about 10-15% of patients suffer from postcholecystectomy syndrome, which is characterized by biliary colic or persistent right upper quadrant (RUQ) abdominal pain with or without dyspepsia [12].

Non-surgical treatment for gall stones is oral dissolution therapy. The oral administration of a naturally occurring bile acid (Ursodeoxycholic acid or Chenodeoxycholic acid), may promote gradual dissolution of radiolucent gallstones over a time of a half year to two years [9]. Methyl tert-butyl ether and monooctanoin (Moctanin) are solvents that are infused directly into the bile duct or the gallbladder to dissolve stones [13]. However, these treatments can cause various gastrointestinal symptoms and other adverse effects. In addition, recurrences are seen in up to 50 % of patients after treatment is discontinued [9].

Anticholelithiatic plants are utilized since old periods before imagining current medicines for treating (dissolution or elimination) gallstones and to avoid their recurrence [14]. Various plants are utilized to fix and forestall cholelithiasis. Although medicinal plants produce slow recovery, these are affordable and less expensive, evidence based traditionally proven dissolution or elimination of gallstones, less relapse of cholelithiasis, their successful prophylactic use, less side effects, not only revealing their therapeutic potential but encourages patient's belief and increasing their interest in traditional practices to find an herbal cure for gallstones. The use of anticholelithiatic plants in the form of decoction, infusion, juice, powder taken along with water, raw eaten are less expensive than current medication and procedures [15].

Expanding interest for restorative plants become as one of the main territories of exploration. Nonetheless, closer consideration is required for bioactivity-safety evaluation, phytochemical analysis and plant conservation. Extraction and isolation along with clinical trials may develop proactive anticholelithiatic compounds. This could be helpful in creating mass awareness about conservation of such plants to promote ethno-medicobotany knowledge within the region, besides contributing to the preservation of such medicinally important species before they are extinct [16].

This review gives a brief look at herbal remedies against gallstone with significant data with respect to their strategy of preparation. However, for testing the scientific validity of these herbal preparations clinical studies are required, to establish their safe therapeutic use. The present review won't just be helpful for the overall population yet in addition pull in the scientific world for anticholelithiatic drug discovery. This significant ethno pharmacological data may lead towards disclosure of new anticholelithiatic compounds.

Table 1: Medicinal plants for dissolving gall stones in different countries and cultures

Plants	Part / Mode of preparation
Achillea millefolium L.	Leaves decoction - Azerbaijan [17]
Agrimonia eupatoria L.	Whole plant [18]
Aloe vera (L.) Burm. f.	Leaves juice [19]
Apium graveolens L.	Roots [20]
Arctostaphylos uva-ursi (L.) Spreng.	Leaves infusion [21]
Bauhinia cumanensis Kunth.	Whole plant [22]
Bauhinia excelsa (Miq.) Prain.	Whole plant [23]
Berberis aquifolium Pursh.	Roots [24]
Berberis aristata DC.	Roots [25]
Bidens tripartita L.	Roots [26]
Boerhavia diffusa L.	Roots decoction - Saudi Arabia [27] and Brazil [28]
Borreria articularis (L.f.) F.N. Williams.	Leaves – Bangladesh [29]
Borreria hispida Spruce ex K. Schum.	Leaves [30]
Brassica napus L.	Seed oil [31].
Bryonia dioica Jacq.	Roots [21]
Bryophyllum pinnatum (Lam.) Oken. or *Kalanchoe pinnata* (Lam.) Pers.	Leaves decoction - India [32, 33].
Capraria biflora L.	Leaves [23]
Caulophyllum robustum Maxim.	Roots decoction [26]
Chamaesyce hirta (L.) Millsp.	Whole plant [23]
Chelone glabra L.	Whole plant decoction [34]
Chionanthus virginicus L.	Root bark [34]

Cichorium intybus L.	Flowers [35]
Cissus verticillata (L.) Nicolson & C.E. Jarvis.	Leaves decoction [22]
Citrus × *aurantium* L.	Essential oil from fruit peel [36]
Citrus limon (L.) Osbeck.	Fruit juice [37]
Citrus sinensis (L.) Osbeck.	Fruit juice – China [38]
Cocos nucifera L.	Fruit oil [23]
Costus scaber Ruiz & Pav.	Whole plant [23]
Curcuma longa L.	Roots - Saudi Arabia [27]
Eutrochium purpureum (L.) E.E. Lamont.	Roots decoction [19]
Galium triflorum Michx.	Plant infusion [26]
Gomphrena globosa L.	Flowers [23]
Haloxylon salicornicum (Moq.) Bunge ex Boiss.	Aerial parts - Saudi Arabia [27]
Herniaria hirsuta L.	Whole plant [37]
Hordeum vulgare L.	Seeds - Nepal [39]
Hydrangea arborescens L.	Roots [40]
Juniperus communis L.	Berries [41]
Lycopersicon esculentum Mill.	Fruits [42]
Macrotyloma uniflorum (Lam.) Verdc.	Seeds [43]
Magnolia officinalis Rehder & E.H. Wilson.	Bark [44]
Malva sylvestris L.	Leaves infusion – Algeria [45]
Matricaria chamomilla L.	Flowers decoction [19, 46]
Mentha × *piperita* L.	Leaves decoction – Azerbaijan [47]
Menyanthes trifoliata L.	Leaves infusion – Azerbaijan [47]
Nepeta cataria var. *citriodora* (Dumort.) Lej.	Aerial parts [48]
Orthosiphon aristatus (Blume) Miq.	Leaves – Philippine [49]
Petroselinum crispum (Mill.) Fuss.	Roots [50]
Phyllanthus amarus Schumach. & Thonn.	Leaves [51]
Pinus sylvestris L.	Needles (Leaves) oil - Germany, Slovenia and Poland [52]
Plantago major L. / *Plantago asiatica* L.	Seeds [53]
Portulaca oleracea L.	Leaves [23]
Raphanus sativus var. niger (Mill.) J. Kern.	Root juice [54]
Rhamnus purshiana DC.	Bark [55]
Rubia cordifolia L.	Roots [56]
Ruscus aculeatus L.	Roots [57]
Scutellaria baicalensis Georgi.	Roots [58]
Sorbus americana Marshall.	Fruits without seeds [21].
Trianthema monogyna L.	Leaves [42]
Taraxacum officinale (L.) Weber ex F.H. Wigg.	Roots decoction [59, 60].
Vaccinium macrocarpon Aiton.	Berry juice [61]
Vitis vinifera L.	Fruits [42]
Zea mays L.	Cobs and corn silk [62]
Zingiber officinale Roscoe.	Rhizome [53]

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