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A Comprehensive Review of Therapeutic and Pharmacological Potential of Karafs (*Apium graveolens*)

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Abstract

The history of the medicinal properties of plants and their use in various ailments is as old as the history of mankind. Karafs (Apium graveolens) is one of the important plants among them, belonging to the family Apiaceae/Umbelliferae. Its use in various ailments has been documented in Unani classical literature in detail. Every part of Karafs possesses wonderful medicinal properties. A series of studies conducted to evaluate its medicinal uses have also proved that it strengthens the heart, lowers blood pressure, and decreases blood glucose and serum lipid levels. Karafs also possess anti-inflammatory, cytotoxic, anti-bacterial, anti-fungal, and powerful antioxidant properties. It is a good source of organic compounds i.e protein, vitamins (vit-A and vit-C), amino acids (alanine, glutamine, and asparagine) carbohydrates, flavonoids, coumarins, alkaloids, saponins, B-carotene, terpenoids, steroids, glycosides, and flavonoid. In this paper, the traditional uses, medicinal properties, and therapeutic and pharmacological actions of Karafs will be discussed thoroughly considering classical Unani and modern literature.

Keywords: Karafs, Apium graveolens, Unani Medicine, Nephroprotective, Hepetoprotective

INTRODUCTION

Plants have played a versatile role in the management of different ailments for thousands of millennia as evidenced by much written evidence, like clay slabs (5000 years BC), Books (2500 BC), and Ebres Pyperus (1550 BC). These sources also highlight the use and preparation of various drugs [1]. Karafs (*Apium graveolens)* belongs to the family *Apiaceae/Umbelleferae* [2–6]. Its various parts and forms, like fresh herbs, stalks, seeds, oil, and oleoresin are used for flavoring foods and various medicinal purposes [7–17].

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DESCRIPTION OF THE PLANT

Karafs is a biennial, glabrous, erect plant with a height of about 100 cm, having a fleshy taproot and grooved stem. Leaves are present in two manners. The lower ones are arranged alternately, and the upper ones are as trifids. Leaflets are shiny, trilobed, cuneate at the base; deltoid to rhomboid in shape; flowers are sessile, bisexual, and shortly pedunculated, opposite to leaves and arranged in umbellate fashion, fruits are schizocarp with two mericarp ovoid to elliptical and seeds propagate epigeally [18–20].

Habitat and Distribution

Karafs love to grow in sandy-loam soil having a pH between 6 to 7, low humidity cool weather with moderate rainfall. It is native to Europe, India, North& South Africa, Afghanistan, Southern

Western Asia North Africa USA. It grows in the base of the northwestern Himalayas, in silhouette of the hills of Punjab, hills of Uttar Pradesh, Himachal Pradesh, and Southern India. It grows wild in all temperate regions [21–26].

Varities of Karafs

Krafs has been classified based on place of origin and parts consumed. It has been grouped into three distinct forms based on the consumption of the botanical parts as follows [5, 18–19]:

1. *Apium graveolens var. dulce (Mill.) (Celery):* They are luscious, solid leafstalks. It is the most popular among all types of karafs and is cultivated all over the world. People have been using its aromatic leaves in salad as an appetizer for decades in their daily cuisine [18].
2. *Apium graveolens var. rapaceum (Mill):* Celeriac or root celery, Its roots are mainly used as stews and soups.
3. *Apium graveolens var. silvestre (smallage)*: Its leaves are used for seasoning, garnishing, and medicinal purposes [5, 19]. This variety of karafs grows as a wild plant in Europe [18].
4. *Apium graveolens var. graveolens* L: Common celery, wild celery [18].

Based on Place of Origin

According to their place of origin, karafs have been classified into 5 different types by Ancient Greek and Arab scholars [10, 20]. These are as follows.

1. *Karafs jabli:* Also known as asalinoon, Saliyun, KohiMaqdun is hot and dry in the third degree of temperament. It grows on hills and mountainous regions. It is extremely effective among all varieties [10].
2. *Karafs nabti:* Also known as *aqusaliyun*, Karafs e Mashriqi, Karaf se Areez, Karafs e Shatwi. Its branches are long, and its leaves are red in color and strong odour. This variety of Karafs grows in sheltered places [10, 20].
3. *Karafs Bustani:* Also known as Saalibiyun this variety is cultivated too [10].
4. Karafs Sakhuri*:* Also known as Fitursaliyun, grows on a stony surface [10].
5. *Tari (Maiee):* Also called as Samarniyun, Anusaliyun, Qurratulain. This variety of karafs grows in dump areas near rivers, ponds, and canals [10].

As shown in Table 1, the vernacular names of the species vary across regions, The taxonomic classification is detailed in Table 2, Various parts of the plant used for medicinal purposes are listed in Table 3.

Table 1. Vernacular names.

Vernacular Names [9–10, 18, 25–32]	
Language	**Name**
Unani	Karafsa, Saliyun
Siryani	Krafsha
Romi	Batirakhyun
Shami	Sard
Persian	Karafsh, Karasb
Latin	Salahari [1]
Hindi	Ajmud, karafs, Ajmod
English	Celery
Marathi	Ajmuda
Tamil	Celery-keerai
Bangali	Ajmud, chann
Urdu	Tukhmekarafs, Ajmod
Arabic	Krafs [2] Phitrasaleyaun
Folk	Ajmuda
Sindhi	Diljan
Sanskrit	Mayauri, Ajmoda
Kanada	Selerina
Gujarati	Bodiajmuda

Table 2. Taxonomic classification.

Taxonomic Classification [16, 19, 24]	
Domain	Eukaryota
Kingdom	Plantae
Phylum	Spermatophyta
Subphylum	Angiospermae
Class	Dicotyledonae
Order	Apiales
Family	Apiaceae
Genus	Apium
Species	*Apium graveolens*

Table 3. Parts used.

Parts Used [7–13, 15, 25–30, 33–37]	
Parts used	Seeds, leaves and roots [30].
Temperament	Hot 2 and dry 2 [1, 3–5]. Hot 3 and dry 3 [1].
Taste	The seeds have a pungent hot and sharp taste [1, 2, 6–9].
Dose	Seed 3–5 gm [3, 10–11]. Root 5–7 gm [1, 6].
Toxicity	Harmful for hot temperament [1], Lungs [3]. Causes severe photodermatitis, it is also reported that in high doses it also causes, calcium deficiency, potassium deficiency, drowsiness, and anaphylactic reaction. It should not be used in pregnancy [1]. [4] [5] [6] [7] and kidney diseases [8].
Correctives	*Mastagi* [9] [4], *Anisoon* [9] [4] [10] [3].
Substitutes	*Saunf, Ajwain khurasani* [9] and *Zeera* [10].
Unani compound formulations	*Jawarish falafili, Majoone hajrul yahood, Majoone jograj gugal, Majoone nankhwah, Jawarishe zarooni sada, Sikanjabeen bazoori motadiol, Majoon dabeedul ward, Zimade sumbulutteeb, Banadiqul buzoor, Sufoofe mohazzil* [11].

Pharmacological Actions [2, 7–12, 25–27, 30–32, 34, 38–40]

It is described in detail in ethnobotanical and classical Unani literature and various actions of the drug have been reported, such as De-obstruent [1] [4] [12] [10] [13] [14] resolvent [13], laxative [10] [6] [2] [15] [1] [4], carminative [1] [4] [16] [7] [17] [13] [18] [2], antiseptic [18], appetizer [4] [5] [10] [7] [15], diaphoretic [4] [5] [6] [2] [15], sedative [18] [14], tranquilizer [18] antifungal [18], lithotripter, diuretic [13] [1] [19] [14] [4] [12] [10] [3] [17] [2] [20] antiemetic [18] [1], abortifacient [1] [2], antispasmodic [2] [13], astringent [2], anti-inflammatory [1] [20] [7] [2], antidote [2] [1], emmenagogue [1] [19] [3] [17] [2] [20] [18] [13] [14], digestive [10] [2] [1] [4] [12], aphrodisiac [1] [3] [4] [10], Mosakkin [1], Mudamil, brochodilator [1].

Therapeutic Uses [2, 7, 9–10, 13, 16, 26–27, 40–45]

According to the literature whole plant has been used for medicinal purposes and in some texts, only part of the plant has been described for the diseases. some of the uses of karfs are in diseases, like ascites [9] [1], flatulence [9] [1] [19], hiccup [10], mastitis [1], cough, pleurisy [9] [4] [3] [2] [1], phlegmatic fever and jaundice [19], nausea [1], stomach-ache, gastritis, gastric ulcer [1], kidney and other phlegmatic diseases [9] [1], renal and bladder calculi [1] [20] [21] [1], renal colic [19], obstruction in urinary passages [19], dysuria [9] [1], dribbling of urine [1], inflammation [13], rheumatic disorder [22], gout [13], obstructive disease of liver and spleen [1], nausea [1], pruritus, itching [1], chronic wound [9] [1], asthma [1], backache [19], gout [9] [4] [10] anasarca, amenorrhhea [2] [1], colic [2] [13] [1]. [15], [1], ophthalmia, bronchitis, asthma [1] [18] [13] [2], vomiting [2], toothache [2], tumor [2], fever with cough [23] [2], constipation [2], rheumatism [2] chest pain, catarrh [2] scabies, purities psoriasis [18] [2].

Chemical Composition and Active Ingredients [24]

Leaves, stalks, and seeds of karafs are rich in volatile oils. There are also some differences in their constituents according to age, geographical region, harvesting stage, and method of obtaining volatile oil [8]. Many bioactive components have been reported in different extracts (aqueous, methanolic, phenolic, and ethyl acetate) of this plant. Some are given in Table 4.

Table 4. Major Bio-Active Components of *A. Graveolens*.

Major Bio-Active Components of *A. Graveolens* [42–50]	
Organic	Protein, vitamins (vit-A and vit-C), amino acids (alanine, glutamine, and asparagine) [4, 15, 24, 26], carbohydrates, flavonoids, coumarins, alkaloids, saponins, B-carotene, terpenoids, steroids and glycosides, flavonoids, steroids [25] [26] [27].
Seeds (fruit)	*Volatile oil (1–3%):* Major components of volatile oil include limonene (70–80%), selinene (20%), β-pinene, camphene, cumene, α-thuyene, α-pinene, β-phellendrene, p-cymene, γ-terpinene, sabinene, and terpinolene. [28] [29] Aromatic components of karafs *(A.graveolens)* are3-n-butyl-4-5-dihydrophthalide (sedanenolide), 3-n-butyl phthalide, sedanolide, and sedanonic anhydride. *Fatty acids (15%):* Petroselenic (64.3%), oleic (8.1%), linoleic (18%), linolenic (0.6%), and palmitic acids [51, 52]
Leaves	The major components from seeds and leaves are 3-hydroxymethyl-6-methoxy-2,3-dihydro-1H-indol-2-ol , [31] 4-chloro-4,4-dimethyl-3-(1-imidazolyl)-valerophenone (19.90%), 1-dodecanol (16.55%), 9-octadecen-12-ynoic acid, methyl ester (4.93%), ethyl 4,4-D2-*N*-hexyl ether (4.11%), 3-(hydroxymethyl)-1-phenyl-1-heptadecyn-3-ol (3.28%), 1,4-methano-1*H*-indene, octahydro-4-methyl-8-methylene-7-(1-methylethyl)-, (1*S*-(1α,3αα,4α,7α,7αα))- (2.99%), 3,4-dihydro-2*H*-1,5-(3″-*t*-butyl)benzodioxepine (2.56%), *Z*-10-tetradecen-1-ol acetate (2.53%), 9*H*-pyrrolo(3′,4′:3,4)pyrrolo(2,1-α)phthalazine-9, 11(10*H*)-dione, 10-ethyl-8-phenyl (2.07%) [53, 54].
Fresh celery leaves	Three new triterpenoids were also identified from whole plant of fresh Karafs (*Apium graveolens*) (1)11,21-dioxo-2β,3β,15α-trihydroxyurs-12-ene-2-O-β-d-glucopyranoside (2) 11,21-dioxo-3β,15α,24-trihydroxyurs-12-ene-24-O-β-d-glucopyranoside and (3)11,21-dioxo-3β,15α,24-trihydroxyolean-12-ene-24-O-β-d-glucopyranoside.And they also revealed two new flavonoids along with 10 other known flavonoids, i.e., (1) apigenin-7-O-(2″-O-(5‴-O-feruloyl)-β-d-apiofuranosyl)-β-d-glucopyranoside and (2) chrysoeriol-7-O-(2″-O-(5‴-O-feruloyl)-β-d-apiofuranosyl)-β-d-glucopyranoside [33].
In-organic	Na, P, K, Ca, Mg, Fe, C, Mn, Zn, Ni, Pb, Pt, Cd, Se, C [27, 53]

PHARMACOLOGICAL STUDIES

Anti-Inflammatory and Cytotoxic Effects

To evaluate these activities of karafs (*Apium graveolens*) a study was conducted by T. Mencherini et al. In this study, they used ethanolic and aqueous extract of A. *graveolens* var. Dulce leaves and observed dose-dependent anti-inflammatory and cytotoxic effects of it [42–47].

Organ Protective Effect

Many studies have been carried out for this purpose. Studies conducted by Haider Ridha Salman et al., Anubha Singh, and S. S. Handa et al. have revealed its protective effects on the liver and heart in doxorubicin [an anti-tumor drug] induced toxicity in rabbits [52]. In this study, they also reported a significant rise in RBC, WBC, Hb, and neutrophile levels [53]. In another study conducted by G. C. Jain et al., the hepatoprotective effect of methanolic extract of *Apium graveolens* L. (celery) seeds was tested against Di-[2- ethylhexyl] phthalate (DEHP) induced hepatotoxicity in rats [48–49].

Diuretic and Nephroprotective Effect

Faruk H. Al Jawad et al. had planned a study to evaluate the diuretic and nephroprotective activity of Karafs in 2013. For this purpose, nephrotoxicity was induced in rabbits by giving a single large dose (333 mg/kg) of oxalic acid. After inducing oxalic acid, BUN and serum creatinine levels were significantly elevated. To reveal its effects on the kidney test group was given fresh celery at 8 g/kg and a significant difference in BUN and serum creatinine between and control and test groups was found, thus revealing its nephroprotective and diuretic effects [50–52].

Antimicrobial Effects

Several studies have been conducted on different parts [seed, root, leaves] of karafs (*Apium graveolens*) to evaluate their antimicrobial activity. Studies conducted by Sameh Baananou et al. revealed the anti-bacterial activity of *Apium graveolens* extract. In the first study Essential oil and aqueous extract of both the arial part and seed was used. It was found that the essential oil of the *Apium graveolens* possesses strong inhibitory against *Escherichia coli* and moderately inhibitory action against *Pseudomonas aeruginosa and Staphylococcus aureus* [53]. In the second study it was revealed that crude methanolic, ethanolic, methylated spirit and hexane fraction of *Apium graveolens* possesses antibacterial activity against *Staphylococcus aureus, Escherichia coli, Psteropseda aeruginosa, Salmonella typhi, and Bacillus subtilis* [54–55] and antifungal activity against *Trchophytonlongifusus, Candida albicans, Candida glaberata, Fusarium solani, and Aspergillus flavus*. It was also reported that among all fractions, ethanolic extract possesses strong antimicrobial activity and methanolic fraction possesses antibacterial action against *S. typhi and B. subtilis* [54–55].

Mosquitocidal, Nematicidal, and Antifungal Effects

These activities of Karafs were reported by Rafikali A. Momin and Muraleedharan, G. Nair for the first time. In their study, they reported that bioactive compounds from Karafs seeds, i.e., sedanolide, senkyunolide-N, and senkyunolide-J have 100% mortality at 50 μg mL^{-1} on nematode, mosquito larvae, Aedes aegyptii, and it also inhibited the growth of Candida albicans and Candida parapsilasis at 100 μg mL^{-1} [56–57].

Antiulcerogenic Effect

Antiulcerogenic property of Karafs *A. graveolens* was reported by Sameh Baananou et al. In their study, they used aqueous and methanolic extracts of leaves and seeds and observed highly significant dose-dependent inhibition of gastric ulcers [58–59].

Antioxidant Effect

Antioxidant activity of karafs (*Apium graveolens*) has been reported in different fractions (methanolic, ethanolic, phenolic, ethyl acetate, and aquous) by many researchers, using different parts of the plant and has been found that methanolic extract possesses significant scavenging activity. They also revealed the presence of higher phenolic content responsible for the higher scavenging activity. Free radical scavenging activity of the karafs (*Apium graveolens*) was determined by ABTS, DPPH, and FRAP, methods [60–65]. Another study conducted by Jabbar A., et al. revealed the antioxidant activity of the n-butanol extract of *Apium graveolens* seed in streptozotocin-induced diabetic male rats.

Hypolipidemic Effect

Several studies have been conducted to evaluate the hypolipidemic activity of Karafas. A study was conducted by Mansi Kamal et al. using ethanol extract of *Apium graveolens* seed in male albino rats to investigate the hypolipidemic effect. In this study, rats were treated on different doses, i.e., 30, 40, 50, 60, 70, 80, 85, 90, 95, and 100 mg/20 g. It was noted that the rate of mortality was high after giving 85mg/20g. So, in this study, oral doses of 425 and 213 mg/kg were selected. The result showed a significant body weight loss, an increase in HDL, and a decrease in the concentration of total cholesterol, triglycerides, and LDL cholesterol in the treated group. Another study was conducted by D. Tsi et al. in which they revealed the hypolipidemic property of aqueous extract of karafs in rats. In another study hypolipidemic property of the hydro-alcoholic extract of karafs leaves showing a significant reduction in cholesterol and LDL levels was reported.

CONCLUSIONS

Karafs (*Apium graveolens*) has been extensively studied through physicochemical analyses and experimental investigations. Research has demonstrated its wide range of pharmacological properties, including antioxidant, antibacterial, antifungal, anti-inflammatory, antihyperlipidemic, cytoprotective, antidiuretic, nephroprotective, and gastric anti-ulcer effects. This plant holds significant medicinal value due to the presence of numerous bioactive compounds, such as volatile oils, amino acids (e.g., alanine,

glutamine, and asparagine), carbohydrates, flavonoids, coumarins, alkaloids, saponins, β-carotene, terpenoids, glycosides, and steroids. Given its therapeutic potential, further research is needed, including detailed experimental and clinical trials, to comprehensively explore its medicinal properties and establish Karafs as a standard drug in modern medicine.

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