Review Article

Apium Graveoleons - A Health Boon

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ABSTRACT

Celery, botanically known as *Apium graveolens* is belongs to the family of apiaceae, an annual or bionomical herbaceous plant that is native of Mediterranean regions like Asia, Africa and Europe. *Apium graveolens* is an important plant with great Ayurvedic medicinal properties. The medicinal properties of celery includes antioxidant, anti-inflammatory, antispasmodic, antibacterial, antifungal, anticancer, diuretic and sedative activities. Celery is used as a salt and in salads for its good culinary tastes. Celery requires comparatively high humidity, but does not needhigh temperature. Therefore its best product comes in cool weather and te mperate regions. The present paper reviews the geographical distribution, history, cultivation, uses, side effects, synonyms, botanical description, taxonomical classification, phytochemical constituents and pharmacological activities.

Keywords: *Apium graveolens*, antioxidant, antispasmodic, antibacterial.

INTRODUCTION

An 'APIACEAE family' member- *Apium graveolens*, well known as celery, is an antiquity Mediterranean plant. Celery is the herbaceous plant, usually 60-120 cm high. It is a hardy biennial, occasionally annual, widely cultivated for its fleshy leaf stalks. The term celeria**c** is used for a specially selected cultivar group (*Apium graveolens* Rapaceum Group) of celery that is grown as a root vegetable for its large taproot, rather than the stem or leaves. The plant provides a number of values for the ecosystem and human beings, including as a source of food for animals, such as rabbits and Lepidoptera, and a nutritious food for humans. There are two types of celery stalk varieties, self-blanching or yellow and green or pascal celery. It is used as a vegetable and seeds which contains 2–3% essential oil and 17–18% fatty oil. The essential oil has d-selenene, sedlanolide and sedanoic acid anhydride contributing to its flavor and 60% of d-limonene.

The word "celery" comes from frenchceleri, which in turn derived from the Italian word seleri. According to WHO, more than 80% of developing country's population depends on plant based medicines for their health care needs. From the time immemorial, the whole celery plant is used as a traditional medicine. *Apium graveolens* is used as an Indian Ayurvedic medicine to treat colds, flu, fluid retention, indigestion and different types of arthritis. It contains secondary metabolites, which have biological activity, kindling scientific interest.

History

Celery is believed to be originally from the Mediterranean basin. Ancient literature documents that celery has been cultivated in the Mediterranean regions of Europe for at least 3000 years). During ancient times Ayurvedic physician used celery seeds to treat the following conditions: colds, flu, water retention, and liver and spleen ailments. Woven garlands of wild celery are reported to have been found in early Egyptian tombs.

Celery was considered a holy plant in the classical period of Greece and was worn by the winners of the Nemean Games, similar to the use of bay leaves at the Olympic Games. The Nemean Games were conducted every second year, starting in 573, in the small city of Nemea in southern Greece. The Italians domesticated celery as a vegetable in 17th century.

Geographical Distribution [1,2]

Celery is native to Mediterranean regions. Celery was first cultivated in Italy and France. From here, the plant spreads to Central and Northern Europe.

World Scenario

A. graveolens is cultivated in Italy, France, Sweden, Algeria, Egypt, Ethiopia, Kingdom of Saudi Arabia and India.

Indian Scenario

A. graveolens is cultivated in north –western Himalayas, Punjab, Haryana and western utter Pradesh.

Cultivation

The range of cultivation and consumption of celery is very extensive.[3] Celery requires comparatively high humidity, but does not need high temperature. Therefore its best products comes in cool weather and temperate regions.[4] Celery is a shade oriented vegetable and high light intensity decreased its quality and growth.

Climate

Celery can be grown in all but extreme climates, although it prefers cool temperature weather, of between 58^0F (15^0C-26^0AC).

Soil

It grows best in average to moist soil that is light and sandy with a neutral pH of 6.6 to 7.5, and hardy to zone 6, though they can be damaged by hard frosts. It can adapt to a variety of soil types and conditions, but has waterlogging intolerance. *A. graveolns* flowers are hermaphrodite (have both male and female organs) and are pollinated by Flies.[5]

Propagation

The easy and cost effective method of propagation of celery is by sowing seeds. Seed – sow spring or autumn in situ. If seed is in short supply it can be sown in a cold frame in spring. The seed can harbor certain diseases of celery, it is usually treated by seed companies before being sold but if you save your own seed you should make sure that only seed from healthy plants is used. Soaking of seed in water for 24 hours improves germination.[5]

Uses

Traditional Uses

- It is used as heart tonic to lower the blood pressure in African traditional medicine in Trinidad and Tobago.[6]
- Celery has been used in the traditional system of medi cine to treat spasm and stomach problems and as diur etic, laxative and sedative.
- There is also a report to the use of celery in joint probl ems.[7]
- The celery seed is well known as libido stimulant in th e traditional system of medicine due to its protective role against the sodium valproate in testes and amplification of the sperm profile.[8,9]
- It also increases the secretion of breast milk.[10]

Medicinal Uses

Hepatoprotective

The methanolic extract of celery seed was found to be effective paracetamol-induced[11] and carbon tetra chloride-induced[12] liver damage. It was noticed that celery has the protective activity against thioacetamide drugs.[13]

Anti-diabetic

The aqueous extract of the celery stimulate pancreas to secrete insulin to reduce blood glucose levels, so that it can used to reduce or treat diabetes complications.[14,15]

Pain and Inflammation

Some of the compounds in its seed show anti-inflammatory and analgesic effects.[16, 17]

The juice extracted from the petioles can be used for ede ma, rheumatic tendencies, gout, flatulence, chronic pulmonary catarrh, tendencies toward overweight and lack of appetite.[18]

Diuretic

It is a strong diuretic, and is used as a urinary antiseptic, mainly because of the volatile oil apiol.[19]

In the study by Ashburn MA et al, it was shown that essen tial oil obtained from celery is reported to have a calming effect on the central nervous system. Moreover, some of its constituents showed antispasmodic, sedative and anticonvulsant actions[20]

Anti-hysteric

Wild celery is said to be useful in cases of hysteria, promoting restfulness and sleep, and diffusing through the system a mild sustaining influence.[21]

Anti-cancer

These have anti-cancer properties due to anti-cancer chemicals like polyacetylens and phthalide. These can detoxify carcinogens present in cigarette.[22]

In animal studies, it was shown that perillyl alcohol in celery causes regression of tumors of the pancreas, liver, and breast.[23]

Celery has a protective effect on the gastric mucosa and it Isanti - gastric ulcer,[24] also a diuretic plant[28] with antioxidant properties.[25] It is also used to treat stomach pain.[26] This plant increases the secretion of breast milk.[26] It also reduces jaundice.[27]

Anti-microbial Activity

The ethanolic extract of celery was found to be exhibit antibacterial activity against Escherichia coli.[29]

Culinary Uses

Celery recipes are famous for their aromatic flavor. Celery leaves are typically used as a salad ingredient. Its seeds are used as a seasoning or dry spice in many celery dishes. Even a spice called 'celery salt' is also prepared by mixing salt and grounded celery seeds.

This spice is widely used as a flavoring in savory dishes as well as cocktails, namely 'Bloody Mary', Along with onion and carrot; celery makes some of the most flavorful celery recipes. Celery stalk and leaves are also considered a base ingredient in many soups and stew dishes. An additional use of celery is to extract 'volatile oil' from its seeds.

Contraindications

Due to the irritating effect of the volatile oils, is contraindicated in acute kidney conditions. The volatile oils have an empirical emmenogogue and possible abortifacient effect and should be avoided during pregnancy. Empirical evidence also suggests increased photosensitivity due to the furanocoumarins.

Side-Effects

The plant is generally safe for the common use. Excessive use of celery may cause kidney inflammation. High dose of celery seeds can stimulate the uterus in pregnant women.[30] High intake of celery during the last four weeks of pregnancy may increase the complications.[31]

Table 1: International Synonyms of *Apiumgraveolens*[22, 32]

Name	Language	Country/Region
Karafs-e-hindi	Unani	Greece
Celeri	French	France
Zeller	Hungarian	Hungary
Apio	Spanish	Spain
Seller	Swedish	Sweden, Finland, Estonia
Soilire	Irish	Ireland
Seller	Danish	Denmark, Greenland
Seledri	Indonesian	Indonesia

Table 2: Indian Synonyms of *Apiumgraveolen*[22, 32]

Name	Language	State/Region
Ajamoda, Ayamoda, Ajmoja, Dipyaka	Sanskrit	Uttarakhand
Ajmuda, Ajmod	Hindi	India
Oma, Ajavana, Omakki	Kannada	Karnataka
Randhuni, Banyamani	Bengali	West Bengal
Omam	Malayalam	Kerala, Lakshadweep and Puducherry
Omam	Tamil	Tamilnadu
Naranjivamu	Telugu	Puducherry
Oova, Ajmoda	Marathi	Maharashtra
Banajuani	Oriya	Eastern India
Bodiajamo, Ajamo	Gujarati	Gujarat
Fakhazur, Banjuan	Kashmiri	Kashmir
Valjawain, Ajmod	Punjabi	North India
Ajmod	Urdu	North India
Bonjamani, Yamani, Ajowan	Assamese	Assam, Nagaland and Arunachal Pradesh

Table 3: Botanical Description of *Apium graveolens*

Leaves	Shiny pinnate, toothed leaflets
Flowers	White
Petals	Small and entire
Fruits	Small and slightly compressed
Stems	Branched, angular, green
Seeds	Small
Flowering period	June to august
Root	Succulent, well developed

Table 4: Taxonomical Classification of *Apiumgraveolens*[22, 33]

Kingdom	Plantae
Subkingdom	Tracheobionta
Superdivision	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Apiales
Family	Apiaceae
Genus	Apium
Species	Graveolens

Table 5: Nutritional value of *Apiumgraveolens*[34, 35]

Nutrients	Units	Value per 100 grams
Water	G	5.1
Energy	Cal.	450
Carbohydrate	G	40.9
Dietary Fiber	G	2.9
Fat	G	22.8
Protein	G	18.1
Minerals		
Calcium	Mg	1.8
Iron	Mg	0.45
Fatty oil	Ml	17
Mineral matter	Mg	2.0
Phosphorus	Mg	0.55
Potassium	Mg	1.4
Sodium	Mg	0.17
Vitamins		
Vitamin B1	Mg	0.42
Vitamin B2	Mg	0.49
Niacin	Mg	4.4
Vitamin C	Mg	17.2
Vitamin A	Mg	65

CONCLUSION

Celery is a fragrant plant with multifaceted medicinal properties like antioxidant, antibacterial, antifungal, anticancer, hypoglycemic, antimalarial, antiepileptic, cytotoxic, analgesic, anti-inflammatory, antispasmodic, antipyretic and immunomodulatery effect. In addition celery is also used for stomach pain, jaundice and to increase the breast milk secretion. Further research work and clinical trials need to be done to establish the above mentioned effects in human beings.

Table 6: Phytoconstituent of ApiumGraveolens[33]

Phytoconstituent		Pharmacological Activity
Glycosides	Apigenin	Antitumor, Antioxidant, Antiviral
Organic Acid	Caffeic acid	Antioxidant, antitumor
Organic acid ester	Chlorogenic acid	Anticancer, antioxidants, anti-inflammatory, analgesic
Furanocoumarins	Bergapten Isopimpinellin	Anti-psoriatic, anticancer Anticancer
Fatty Acids	Myristic acid Octadecanoic acid Palmitic acid Linoleic acid Stearic acid	Bioavailability enhancer Antimicrobial, Immunomodulatery Antioxidant, anti-cholesterol Anticancer Antitumor, anti-cholesterol
Essential Oil	d-limonene d-selinene Sedanolide Terpineol Santalol Selinene beta pinene d-carvone beta myrcene	Aromatherapy, anticancer Antimicrobial Antioxidant, Antimicrobial, anticancer Anticonvulsant, Antioxidant, antimicrobial Antitumor Antimicrobial, antioxidant Antibacterial, antifungal, antioxidant Acaricidal, Spasmolytic, antifungal Antioxidant, antiulcer, anticancer

REFERENCES

1. Migahid AM. Flora of Saudi Arabia. Riyadh: Riyadh University Publication; 1978.
2. Al-Asmari AK, Al-Elaiwi AM, Athar MT, et al. A review of hepatoprotective plants used in Saudi traditional medicine. Evid Based Complementary Alter n Med 2014, 2014, 1-23.
3. Ghahraman A. Iranian Chormofits. Tehran: Academic Publication Centre; 1, 1994, 671.
4. Kolarovice J, Popovic M,Mikov M, et al. Protective effects of celery juice in treatments with Doxorubicin. Molecules. 14(4), 2009, 1627-38.
5. *Apium graveolens*. (n.d.). In "Plants for a future". Retrieved from http://pfaf.org/user/Plant.aspx?LatinName=Apium+graveolens.
6. Lans CA. Ethnomedicines used in Trinidad and Tobago for urinary problems and diabetes mellitus, J EtnobiolEthnomed 2006; 2:45.
7. Fazal SS, Singla RK. Review onn the pharmacological and pharmacognostical characterization of Apiumgraveolens Linn. Indo Glob Pharm Sci 2, 2012, 36-42.
8. Kerishchi P, NasriS, Amim G, et al. The effects of Apiumgraveolens extract on sperm parameters and HG Hormonal axis in mice. In Proceedings of the 20th Iranian Congress of Physiology and Pharmacology, 2011.
9. Hamza AA, Amin A. Apiumgraveolens modulates sodium valproate-induced reproductive toxixity in rats. J ExpZool A Ecol Genet Physiol 307, 2007; 199-206.
10. Hardani A, Afzalzadeh MR, Amirzargar A, et al. Effects of aqueous extract of celery leaves on spermatogenesis in healthy male rats. Avicenna J phytomed 5, 2015, 113-9.
11. Singh A, Handa SS. Hepatoprotective activity of ApiumGraveolens and Hygrophilaauriculata against paracetamol and thioacetamideintoxication in rats. J Ethnopharmacol 49, 1995, 119-26.
12. Ahmed B, Alam T, Varshney M, Khan SA. Hepatoprotective activity of two plants belonging to the Apiaceae and the Euphorbiaceae family. J Ethnopharmacol 79, 2002, 313-316.
13. Hamza AA, Amin A. Apiumgraveolens modulates sodium valproate-induced reproductive toxicity in rats. J ExpZool A Ecol Genet Physiol. 307(4), 2007, 199-206.
14. Roghani M, Baluchnejadmojarad T, Amin A, Amirtouri R. The effect of administration of Apiumgraveolens aqueous extract on the serum levels of glucose and lipids of diabetic rats. Iran J Endocrinol M etab 9, 2007, 177-181
15. Thimn JC, Burritt DJ, Sims IM, et al. Celery parenchyma cell walls: cell walls with minimal xyloglucan. Physiol Plant. 116(2), 2002, 164-71.
16. Atta A. Anti-nociceptive and anti-inflammatory effects of some Jordanian medicinal plant extracts. J Ethnopharmacol. 60(2),1998, 117-24
17. Tsi D, Tan BK. The mechanism underlying the hypocholesterolaemic activity of aqueous celery extract, its butanol and aqueous fractions in genetically hypercholesterolaemic RICO rats. Life Sci. 66(8), 2000, 55-67
18. Harrison's Principles of internal medicine. 15th ed. 1998
19. Saini N, Singh GK, Nagori BP. Spasmolytic potential of some medicinal plants belonging to family umbelliferae: A Review. Int J Res Ayurveda Pharm. 5(1), 2014, 74-83
20. Ko FN, Huang TF, Teng CM. Vasodilatory action mechanisms of apigenin isolated from Apiumgraveolens in rat thoracic aorta. BiochemBiophysActa. 1115(1), 1991, 69-74
21. Naema NF, Dawood B, Hassan S. A study of some Iraqi medicinal plants for their spasmolytic and antibacterial activities. J Basrah Res. 36(60), 2010, 67-73
22. The Bhavpraka shnighantu with elaborated Hindi commentary by Padmashri prof. K.C. Chunekar, edited by Dr. G.S. Pandey: edition of verse 53-54, 1998, page no- 26-27
23. Till BJ, Burtner C, Comai L, Henikoff S. Mismatch cleavage by single-strand specific nucleases. Nucleic Acids Res. 32(8), 2004, 2632-41.
24. Belanger JT. Perillyl alcohol: applications in oncology. Altern Med Rev. 3(6), 1998, 448-57.
25. Zidorn C, Johrer K, ganzera M, Schubert B, Sigmund EM, Mader J, et al. Polyacetylenes from the apiaceae vegetables carrot, celery, fennel, parsley, and parsnip and their cytotoxic activities. J Agric Food chem. 53(7), 2005, 2518-23.
26. Yarnell E. Botanical medicines for the urinary tract. World J Urol. 20(5), 2002, 285-93.
27. Fluke H. Herb. Trans Tavakoli-Saberi H. 6th ed. Tehran: Gulsh an publicathion, 2005, 201.
28. Al-Howiriny T, Alsheikh A, Alqasoumi S, et al. Gastric antiulcer, ant secretory and cytoprotective properties of celery I rats. Pharm Biol. 48(7), 2010, 786-93.
29. Naema NF, Dawood B, Hassan S. A study of some Iraqi medicinal plants for their spasmolytic and antibacterial activities. J Basrah Res (Sci) 36, 2010, 67-8.
30. Kolarovic J, Popovic M, Mikov M, Mitic R, Gvozdenovic L. Protective effects of celery juice in treatments with Doxorubicin. Molecules, 14(4), 2009, 1627-38.
31. Jones AF. Perforation of small intestine by a fragment of celery. Can Med Assoc J. 63(3), 1950, 291-2.
32. Spice Pages. Celery. (n.d.). Retrieved from http://gernot-katzers-spice-pages.com/engl/Apiu_gra.html
33. Al-Asmari AK, Athar MT, Kadasah SG. An updated phytopharmacologocal review on medicinal plant of arab region: Apiumgraveolens Linn. Phcog Rev 11, 2017, 13-8.
34. SELF NutritionData. (n.d.). Retrieved from http://nutritiondata.self.com/facts/vegetables-and-vegetable-products/2396/2
35. Livesciences.com. (n.d.). Retrived from http://www.livescience.com/50640-celery-nutrition.html
36. Celery History. (n.d.). In "FoodRefrence.com". Retrieved from http://www.foodreference.com/html/celery-history.html

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