



A REVIEW ON APIUM GRAVOLENS: PHYTOCHEMISTRY AND PHARMACOLOGICAL ACTIVITIES

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Abstract: This article analyzes the phytochemical composition of different parts of celery (*Apium graveolens*) and their pharmacological activities. Flavonoids, organic acids, hydrocinnamic acid, essential oil terpenes, tannins, vitamins and trace elements are the biological substances (BAS) of *A. graveolens*. Rich BAS content enables herbal products to have many biological and chemical properties, especially antioxidant activity. Additionally, the extract has neuroprotective, anti-inflammatory, hypolipidemic, antihypertensive and antibacterial effects. *A. graveolens* has a wide range of medicinal properties and is a non-toxic plant. Drugs based on *A. graveolens* will have high safety. The results provided an opportunity to prepare celery-based herbal medicine and introduce them into medical studies.

Index Terms - Medicinal plants, Celery, Apiaceae family, Biological substances, Herbal medicine, Antioxidant activity, Medicinal properties.

I. INTRODUCTION

Medicines derived from medicinal plants are widely used in cultures around the world and are becoming popular today as alternatives to synthetic drugs. Most people in the world still use medicinal products for daily health purposes. "A medicinal plant is a plant that can be used for treatment purposes in one or more organs or can be useful as an effective drug combination (Daniel M. 2006 and Chopra et al., 1932)

Celery is a dried vegetable from plants in the Apiaceae family. This is often called karnaulli or ajmod.. There are four known horticultural type of celery: - *Apium graveolens*, *Apium rapaceum*, *Apium secalinum*, *Apium smallage*. Commercially celery is available as celery seed, celery flaks, vegetable, celery seed, and celery seed oleoresin. Celery seed is one of the rare herbs in Western medicine. has been used for thousands of years (Ghani et al 2003)

Celery (*Apium graveolens* L.) is a perennial or perennial herb belonging to the Apiaceae or Umbelliferae family. All parts of this plant have been used as flavoring agents in various home remedies and in the food industry for thousands of years. The genus Apiaceae includes approximately 20 species of plants belonging to the Apiaceae family (Ambrose et al 2016)

It grows only in coastal areas due to better peace. Celery is widely grown in temperate regions as an important garden crop and has become a popular vegetable due to its leaf stem bleaching (G. Satyavati et

al 1976) The plant's stems, leaves, and flowers differ in morphology and chemical composition. Celery is susceptible to cross-pollination but is inconsistent with self-pollination. No other plant has the name "celery". Celery has many names in different parts of the world (R. Rastogi et al 1990)

II. BOTANICAL CLASSIFICATION

Scientific Name: - *Apium graveolens*

Kingdom: - Plantae

Division: Spermatophyta

Family: - Apiaceae

Genus: - *Apium*

Order: -Apiales

Species: - *A. graveolens*

Class: - Dicotyledonae

1. Phytochemical

Phytochemical analysis showed that the methanolic extract of celery seeds contains flavonoids, glycosides, steroids, alkaloids and carbohydrates. Celery contains phenolic compounds and furanocoumarins. Furanocoumarins include apigenin, apigenin, bergamoten, apigenol, apigenin, isoimperatorine, apigenin, isopargenin, apigenin, 5-hydroxymethoxypsoralen, and 8-Hydroxymethoxypsoralen. Phenolics include isoquercitrin, apigenin, tannins, apigenin, Graurobioside A, Graurobioside B, and phytic acid. The leaves, stems and oil of celery seeds contain fatty acids, alcohol sesquiterpenes and essential oils, isolated compounds such as camphene, limonene, terpinene, cymene, selenic acid, sabinene, alpha-pinene, alpha-tin β -phellandrene, β . - Pinene, γ -terpinene, p-cymene, stearic acid, palmitic acid, linoleic acid, petroleum cellulose, myristic acid, oleic acid, myristic acid, carnitine Myristoleic acid, palmitoleic acid, alpha-cineol, mulberry alcohol, cedanenolide, phthalite and 3. -n-butylphthalide. Celery tuber contains 5-methoxypsoralen, methoxysalen (8-methoxypsoralen), and anti-allergy (Baananou S et al 2013 and Roper R et al 2017)

2. Pharmacology study

1.1. Antimicrobial activity

Ethanol extracts of celery leaves and roots have antibacterial activity against many bacteria such as *Enterococcus faecalis*, *Escherichia coli*, *Enterobacter aerogenes*, *Salmonella typhimurium*, *Bacillus cereus*, *Citrobacter freundii*, *Proteus vulgaris*, *Monocytobacter Listeria hilogenes* and so on. Also, the ethanol extract of celery leaves is stronger and better than the ethanol extract of dried celery root. Higher doses of ethanol extracts of celery leaves and roots have more antibacterial properties. Celery extract also inhibits the growth of *Citrobacter freundii* and *Proteus vulgaris* (Sipailiene A et al 2005)

1.2. Antifungal activity

The methanolic extract of celery at a concentration of 200 $\mu\text{g/mL}$ is antifungal against many fungi such as *Aspergillus flavus*, *Fusarium solani*, *Trichophyton villosa*, *Microsporum canis*, *Candida glabrata* and *Candida albicans*. Antiparasitic activity Celery seed oil has antiparasitic (larvicidal and anthelmintic)

activity and is effective against *Aedes aegypti* larvae, which are vectors of dengue fever. In another study, celery oil (with 5% vanillin) was better at killing mosquitoes than pesticides (Tuetun B et al 2005)

1.3. Anti-inflammatory activity

The anti-inflammatory properties of celery in ear infections caused by celery oil were evaluated in a mouse model. The findings showed that celery oil-induced mice had seven times fewer anti-inflammatory drugs than indomethacin. This process may occur due to the inhibitory effect of apigenin compounds on the production of inducible nitric oxide (NO) and nitric oxide synthase (iNOS). Celery, a polysaccharide found in celery, can increase interleukin 10 (IL-10) production, decrease IL-1 β , and increase immunity by reducing neutrophil migration. In addition, the aqueous extracts of celery stalks contain polar compounds with anti-inflammatory activity (Ovodova RG et al 2009)

1.4. Anti-cancer activity

Celery oil contains important compounds called phthalides that can prevent cancer, Cholesterol and high blood pressure. The active phthalide compound is sedum lactone, which can kill cancer cell in cancer patients. Celery seed oil contains two main compounds, sedum lactone and 3-n-butylphthalide, which can activate the detoxifying enzyme called glutathione S- transferase (GST) in cancer cells. Celery can also reduce the conversion of cancer cells by fighting free radicals in damaged cells, thereby reducing the likelihood of cells turning into cancer cells. Other active compounds of celery, which are coumarins, also show these effects. Celery can be used as a powerful electrolyte substitute in juice because of its high potassium and sodium content. Celery also controls cholesterol and cancer levels after increasing detoxification(Sowbhagya H et al 2014)

1.5. Antiulcer activity

Ethanol extract of celery seed was effective against gastroenteritis induced by indomethacin and cell disruptor (0.2 M NaOH, 80% ethanol and 25% NaCl) in rats. Results were evaluated using histopathological and biochemical analyses of treat and control samples. The ethanol extract of celery seed protected the guava mucosa and inhibited gastric fundus secretion in mice, probably due to the antioxidant capacity available from the presence of the ethanol extract of celery seed (Al-Howiriny T et al 2010)

1.6. Antioxidant activity

Celery contains many phenolic compounds and is a good source of antioxidants. The antioxidant activity of celery leaves has been studied by inhibiting the free radical activity of 1,1-diphenyl trinitrophenylhydrazine and is considered a natural antioxidant by inhibiting the oxidation process. It is associated with other antioxidants, including L-tryptophan and methoxyphenylchromone derivatives. In another study, celery extract was examined and found to have good 2,2-diphenyl-1 picrylhydrazine and hydroxyl radicals scavenging activity. In vivo experiments with CC14- induced toxicity also showed significant antioxidant activity (Popovic M et al 2006)

1.7. Antidiabetic activity

In the study, n- butanol extract from celery seeds was used to investigate the antioxidant and anti-inflammatory effects of streptozotocin to improve lipid peroxidation in male rats. These finding suggest that celery seeds n-butanol extract (60 mg/kg BW) or insulin therapy as a standard drug can alter the

activities of a II antioxidant enzymes, increase weight gain, improve diabetes associated anxiety high blood pressure and good blood sugar control (Al-Kurdy MJJ et al 2016)

1.8. Anti-infertility activity

Experiments have shown that celery extract is protective against testicular toxicity caused by sodium valproate in rats. The results of this experiment were supported by histopathological analysis. Apigenin, one of the main components of celery, may play a role in this process. In addition, another experiment showed that celery extract has activity of mouse testicles against injury of testicles (Madkour NK et al 2014)

1.9. Antiplatelet activity

Celery extract has strong antiplatelet activity because celery extract contains apigenin compound, which can inhibit platelet aggregation induced by adenosine diphosphate, collagen and arachidonic acid. In addition, apigenin can inhibit collagen-adenosine diphosphate induced aggregation in blood (Teng C et al 1988)

1.10. Anti-spasmodic activity

The ethanol extract of celery has strong antispasmodic activity, because the ethanol extract of celery can inhibit the ileal concentration at a certain dose. The active ingredients apigenin and flavonoids in the ethanol extract of celery may play a role in this activity (Gharib Naseri MK et al 2007)

III. RESULTS AND DISCUSSION

For eras, celery - an Apiaceae family part - has been utilized as a therapeutic plant or as a component in other manufactured drugs. The celery plant contains various compounds, counting flavonoids, glycosides, steroids, alkaloids, that are contributory to its recuperating properties. Examination of its pharmacological properties has uncovered a noteworthy extend of helpful impacts, counting antibacterial, anti-inflammatory, anti-cancer, antioxidant, anti-diabetic and more. In expansion, compounds from celery can offer assistance hinder cancer, as well as authorization of cholesterol control. Besides, celery's antioxidant capacities and antidiabetic character have been famous, whereas moreover illustrating antispasmodic and antiplatelet movement. It's in general helpful potential is underscoring the centrality of assist investigating its restorative capacities.

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