

An Investigation of Antimicrobial Activity of Celery (*Apium graveolensis* L.)

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In this study, the antimicrobial activity of celery (*Apium graveolensis* L.) has been reported. The extract of celery were prepared in diethyl ether and tested against *P. aeruginosa* ATCC 27853, *E. coli* ATCC 25922, *K. pneumoniae* FML 5, *S. aureus* ATCC 25923, *M. smegmatis* CCM 2067, *M. luteus* A 2971 ve *C. albicans* ATCC 60192 with the disc diffusion method. Celery had inhibitory activity on *K. pneumoniae* FML 5, *M. smegmatis* CCM 2067, *M. luteus* A 2971, *S. aureus* ATCC 25923 and *C. albicans* ATCC 60192 but has no inhibitory activity against other bacteria strains.

Key Words: *Apium graveolens* L., Antimicrobial activity, Disc diffusion method.

INTRODUCTION

Many of the plants used today were known to the people of ancient cultures throughout the world. They were valued their preservative and medicinal powers. Scientific experiments on the antimicrobial properties of plants and their components have been documented in the late 19th century¹.

Celery is a herb which belongs to *Apium graveolensis* L. type of Apiaceae family. From Switzerland to the Mediterranean countries, Abyssinia, Caucasia, Bulicistan and with high lands of India, New Zealand and California are shown as the motherland of it. In Turkey, celery plant grow up is common in different regions. Erect glabrous biennial, stem angled, deeply sulcate, 30-100 cm. Leaflets (3-)5-7 per leaf, petiolulate, deltate-rhombic, sometimes cuneate, 10-30 × 7-35 mm, usually lobed and serrate to crenate, glabrous. Umbels usually leaf-opposed, short peduncled to sessile; rays 4-12, unequal, 1-25 cm; bracts and bracteoles absent; flowers up to 20 per umbellule. Mericaps 1.5-2 × 1 mm. Fl. 5 × 8. Coastal plains, marshy ground, s.l.-c. 200 m; also cultivated².

Leafy vegetables, including those used as seasoning, highly valued mainly on account of the biologically active compounds present in such vegetables³.

Celery bulbs contains etheric oils. Vitamins A, B₁, B₂ and niacin are not present while carotin, calcium, vitamin C, phosphorus, iron exist. These are flavanoids, ascorbin acid, vitamin B₁ and B₂, canatrium, P and asparagin at the stems of them. Furthermore, celery carries a compound named as apiin, volatile oil and fixed oil. The fresh leaf of celery is beneficial for the stomach and the livers which caught cold^{4,5}. This study was made to determine whether celery (*Apium graveolensis* L.) has inhibitory activity on some bacteria.

EXPERIMENTAL

Pseudomonas aeruginosa ATCC 25353, *Escherichia coli* ATCC 25922, *Klebsiella pneumonia* FML 5, *Staphylococcus aureus* ATCC 125923, *Mycobacterium smegmatis* CCM 2067, *Micrococcus luteus* A 2971 and *Candida albicans* ATCC 60192 strains were obtained from culture collection of Microbiology Laboratory of Medical Faculty, Yuzuncu Yil University.

In addition, Trypticase Soy Broth (TSB, Fluka 22092) and Sabouroud 2 % Glucose Bouillon (Merck 108339) were used for activation of micro-organism cultures. Antibacterial activity assays were carried out using Mueller-Hinton Agar (MHA, Fluka 70191).

Apium graveolensis L. which was used in the search with the help of systematic sources, which was diagnosed in the Yuzuncu Yil University Herbarium. The celery leaves were washed with distilled water, dried in aseptical conditions and frozen with liquid nitrogen gases. They were homogenized in a breaker until they became dust and were grounded until they would pass in a 1 mm sifter. Samples were preserved in cloth bags in the laboratory until extraction procedure⁶.

Preparation of model extracts: The method suggested by Holopainen *et al.*⁷ was applied to prepare model extracts. For this purpose 25 g herb sample were ground and added 250 mL diethyl ether, shaken for every 15 min to homogenize and was held for 12 h. They were then filtered and diethyl ether was evaporated using a evaporator (50°C) (Bibby-Rotary evaporator RE 100). The dark green extracts were preserved in a refrigerator (4°C) until the end of the analysis.

Test of antimicrobial activity: In the present study, disc diffusion technique as described by Hanafy and Hatem⁸ was applied. The diethyl ether extracts of celery leaves, were transferred into sterile bottles containing filter paper (Whatmann No:1; 6 mm diameter). Bottles were then placed into a water bath (50°C) for complete removal of diethyl ether with periodical shakings to allow an even distribution of extract between disc.

Bacterium strains used in the study were inoculated to TSB agar and incubated at 35°C for 24 h and were allowed to grow until they reach 10^8 - 10^9 cfu/mL. The 0.1 mL of inoculum from the prepared culture was transferred to MHA medium. The inoculum was spraded on the surface of plates with a sterile swab and the inoculated plate were air-dried at room temperature. Paper discs embedded within a plant extract were placed on previously inoculated plates and were incubated for 24 h at 35°C. After incubation the zones of growth inhibition around discs were measured the mm. Three replicates were used for each test strain and the mean value of each measurement were calculated.

RESULTS AND DISCUSSION

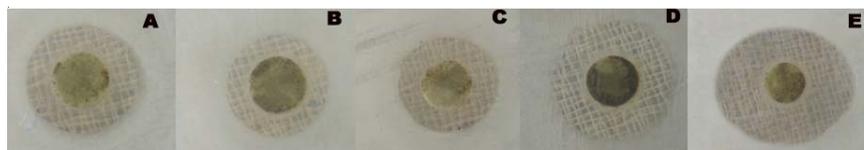
The antimicrobial activity of celery leaf is in Table-1 and the inhibition zone diameters are shown in Fig. 1.

TABLE-1
RESULTS OF ANTIMICROBIAL ACTIVITY OF CELERY

Bacterium strains	Inhibition zone (mm) (30 µg/disk)
<i>P. aeruginosa</i> ATCC 25353	–
<i>E. coli</i> ATCC 25922	–
<i>K. pneumoniae</i> FML 5	11
<i>S. aureus</i> ATCC 25923	16
<i>M. luteus</i> A 2971	15
<i>M. smegmatis</i> CCM 2067	13
<i>C. albicans</i> ATCC 60192	18

No zone (–); Inhibition zone diameter (mm).

Celery had inhibitory activity on *C. albicans*, *S. aureus*, *M. luteus*, *M. smegmatis* and *K. pneumoniae*, but had no inhibitory activity at the proliferation of other bacteria strains. The effect of celery on *C. albicans* was the greatest one and celery made a wide inhibition zone on *S. aureus*, which is an important pathogen for food poisoning. Little inhibitory effect was observed on *K. pneumoniae*.



(A) *M. luteus* (B) *M. smegmatis* (C) *K. pneumoniae* (D) *S. aureus* (E) *C. albicans*

Fig. 1. The inhibition zones of celery extract, which were determined with standard bacteria strains.

Celery is widely used in food industry in many countries. In Turkey, too, in some regions it is consumed pretty much in traditional meals as the main substantial element. Long use of some antibiotics are cause, in the course of time, to the resistancy of antibiotic. For this reason, the search of new antibiotics especially the ones which are natural against the microorganisms presents importance.

Spices and herbs are used in foods primarily because they impart desirable flavours and aromas, but they may fulfill more than one function in foods to which they are added. Thus, cloves, mustard, garlic, onion, oregano and others, in addition to imparting flavour, exhibit antimicrobial activity and may help to preserve the food⁹. Studies have been reported on antimicrobial properties of different plant parts and their extracts used as spices or aromatic herbs including garlic, onion, cinnamon, nutmeg, curry, mustard, black pepper, thyme, oregano, sage, rosemary, Jamaican pepper, aniseed, basil, paprika, turmeric, bay, cardamom, cassia, Cayenne pepper, celery, chives, clover, coriander, dill, ginger, savory and marjoram¹⁰⁻²⁴.

Vegetable extracts examined for their suitability to support the growth of *V. parahaemolyticus*, eggplant, tomato, carrot, parsley, celery and onion were shown to be inhibitory²⁵.

Moore and Atkins²⁶ reported that 22 active pathogenic isolates of *C. albicans* were all inhibited by the garlic extract. *C. albicans* were all inhibited by plant extracts²⁷. The highest effect was obtained on celery which inhibited the growth of tested yeast.

Tegos *et al.*²⁸ stated in their study that antimicrobial agents, which were originated from herbs, had an inhibition activity on *S. aureus* and *B. megaterium*, which were mostly gram positive pathogens. Some investigators noted that sensitivity of microorganisms to chemotherapeutics differs according to type of strain^{29,30}. The difference between inhibition zone diameters on test strains, which were used in this study shows that celery affects bacteria on different levels. This finding is similar to the findings of other investigators. Since there are side effects of many drugs, studies to identify natural products are important.

Conclusion

Besides the main chemical elements which functions in the pharmacology area, the usage of plant pithy and as some of these plants do not have side effects, the usage of plant pithy drugs have come to a position in which it may be preferred. From this point of view, the complete biological usage of the natural products presents importance for human health.

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