

**Original Article**

**IN VITRO ANTIBACTERIAL ACTIVITIES OF *OPUNTIA FICUS INDICA* STEM AND FRUIT EXTRACTS USING DISC DIFFUSION METHOD**

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**ABSTRACT**

**Objective:** *Opuntia ficus indica* is a medicinal plant belonging to family *Cactaceae*. It is a species of cactus that has long been a domesticated crop plant important in agricultural economies throughout arid and semiarid parts of the world. The fruit and stem are used to prepare worth added products, fruits jam, squash, drinks, preserve product of pickle, body lotion, shampoo and creams, etc.

**Methods:** For the preliminary study, various extracts of stem and fruit has been used to check the efficacy of antibacterial activity against *Bacillus subtilis*, *Pseudomonas aeruginosa* and *Escherichia coli* bacteria of gram-positive and gram-negative strain respectively using disc diffusion method.

**Results:** The stem and fruit extracts showed various levels of activity on different test organisms. The methanol fruit extracts showed high antibacterial activity against *Escherichia Coli*, *Pseudomonas aeruginosa* and *Bacillus subtilis* compared with other extracts. Aqueous extract of stem and fruit showed less antibacterial activity against the tested bacterial strains.

**Conclusion:** The present study suggests that the methanol extracts of the fruit of *Opuntia ficus indica* contain compounds that can form the basis for the development of a novel broad-spectrum antibacterial formulation.

**Keywords:** *Opuntia ficus indica*, Antibacterial activity, Methanol extract, Ethanol extract, Aqueous extract

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**INTRODUCTION**

The use of plants for treating diseases is as old as the human species. Popular observations on the use and efficacy of medicinal plants significantly contribute to the disclosure of their therapeutic properties, so that they are frequently prescribed, even if their chemical constituents are not always completely known. Medicinal plants represent a rich source of antimicrobial agents. *Opuntia ficus-indica* is a species of cactus that has long been a domesticated crop plant important in agricultural economies throughout arid and semiarid parts of the world. Cactus is a tropical and subtropical plant. It is a member of the *Cactaceae* [2] family. Prickly pear widely distributed in many countries such as Mexico, America and Africa [8]. Prickly pear is in mature stage up to 2 m long, with plump, even, rounded segments, armed with spines are called pads. The fruits are yellow and orange color; barrel or egg shaped and up to 10 cm long. The stems are green, plump, flattened and can be very large which approximately 60 cm length. However, the plant can spread up to 40m in diameter at from root region. The fruit pulp is disk-shaped and has numerous colors. An *opuntia* fruit has highly medicinal value and was established to display many pharmacological properties such as anti ulcerogenic [6], neuroprotective [4] antioxidant [10], hepatoprotective [7] and anticancer [3] activities. The use of prickly pear *Opuntia ficus indica* fruit is suggested for their beneficial and therapeutic properties [1]. In the present study was carried out to test the antibacterial efficacy of the stem and fruit extracts of *Opuntia ficus indica* with reference to bacteria spp.

**MATERIALS AND METHODS**

**Plant material**

*Opuntia ficus indica* stem and fruit were collected from the area of Jayankondam in Ariyalur district, Tamilnadu, India.

**Test organisms**

The strains of *B. subtilis*, *P. aeruginosa* and *E. coli* were obtained from Department of Microbiology, Annamalai University, Chidambaram, and Tamilnadu, India.

**Preparation of plant extracts**

The *Opuntia ficus indica* stem and fruit were collected and washed in distilled water. They were cut into small pieces, and air dried. The dried stem and fruits were ground using a mixer into a fine powder and used for further studies.

**Extractions**

5 gm of the dried plant material was soaked in 15 ml of solvents separately (aqueous, ethanol, and methanol) and left for 5 d. The fraction was separated using muslin cloth and filter through Whatman filter paper No.1 and the crude extracts were stored in a refrigerator at 4 °C. All the extracts were then concentrated in a rotary vacuum evaporator at 4 °C.

**Disc diffusion method**

Antibacterial activities of stem and fruit extracts were tested using disc diffusion method [9]. 0.1 ml of the test bacterial culture was aseptically inoculated by spreading them evenly into the surface of nutrient agar plates. A 6 mm diameter discs were impregnated with stem and fruit extracts at different concentrations (50µ, 100µ and 150µ) individually and were placed on it. The inoculated plates were then incubated at 37 °C for 24hours [11]. The diameter of the zone of inhibition formed around the paper disc was measured and expressed in mm.



**Fig. 1: Various solvent extracts of stem of *Opuntia ficus indica***

### Statistical analysis

Each experiment was performed in triplicate. The results were expressed as the mean±SD. The statistical analyses were

performed using SPSS 11.0 software package. Statistical variances were assessed using ANOVA. Significant differences ( $p < 0.05$ ) between the means were identified by Duncan's Multiple Range Test (DMRT).

**Table 1: Antibacterial activity of stem extracts of *Opuntia ficus indica***

Solvent	Zone of inhibition (mm)									
	<i>Bacillus subtilis</i>			<i>Pseudomonas aeruginosa</i>			<i>Escherichia coli</i>			
	C	50 µl	100 µl	150 µl	50 µl	100 µl	150 µl	50 µl	100 µl	150 µl
Ethanol	-	7.23±0.25	9.16±0.15	10.26±0.40	6.23±0.20	8.33±0.30	10.43±0.37	10.23±0.20	11.76±0.25	13.86±0.98
Methanol	-	8.36±1.09	14.63±1.28	17.63±0.32	9.66±0.30	14.66±0.28	20.56±0.40	8.73±0.25	17.53±0.41	14.76±0.37
Aqueous	-	5.66±0.57	6.1±0.17	6.06±0.05	6.56±0.23	6.56±0.11	6.66±0.20	6.1±1.08	6.3±0.17	6.5±0.43

**Table 2: Antibacterial activity of fruit extracts of *Opuntia ficus indica***

Solvent	Zone of inhibition (mm)									
	<i>Bacillus subtilis</i>			<i>Pseudomonas aeruginosa</i>			<i>Escherichia coli</i>			
	C	50 µl	100 µl	150 µl	50 µl	100 µl	150 µl	50 µl	100 µl	150 µl
Ethanol	-	8.33±0.15	9.26±0.30	10.66±0.35	9.46±0.41	10.16±0.37	11.46±0.83	9.96±0.25	15.03±0.15	17.46±0.75
Methanol	-	8.83±0.20	14.36±0.70	16.56±0.61	17.93±0.30	18.46±0.70	19.96±0.15	13.56±0.40	18.96±0.45	22.16±0.66
Aqueous	-	6.16±0.15	6.46±0.05	6.6±0.34	6.2±0.2	6.46±0.11	6.73±0.05	6.33±0.05	6.43±0.32	6.73±0.20

C-Control, (-)No activity, mm-Millimeter, Data given are mean of three replicates±standard deviation



**Fig. 2: Various solvent extracts of fruit of *Opuntia ficus indica***

### RESULTS AND DISCUSSION

The results of antibacterial activity are given in the table 1 which clearly show that all the extracts have shown antibacterial activity against tested organisms. The antibacterial activity of the extracts and their potency was quantitatively assessed by the presence of inhibition zone and zone diameter respectively as given in (table 1 and table 2). The stem and fruit extracts of *Opuntia ficus indica* was evaluated for its clean activity in resistance to three bacterial strains such as *Bacillus subtilis*, *Pseudomonas aeruginosa* and *Escherichia coli*.

In this study, the methanol was found to be a better solvent for extraction of antibacterial activity. But, the highest activities were noted in methanol fruit and stem extracts (table 2) and compared with other extracts (table 1 and 2) ethanol and water. Organic extracts were active against both gram-positive and gram-negative bacteria and aqueous extract of *Opuntia ficus indica* showed lesser activity. The aqueous and organic extracts from the same plants showed different activities, and results were given in (table 1 & 2). For all the tested microorganisms methanol and ethanol showed maximum antibacterial activity in *Opuntia ficus indica* stem and fruit extracts. However, the plants differ significantly in their activity against test micro-organisms. In this findings were supported by the previous report on antibacterial activities of methanol, ethanol and aqueous extract of *Opuntia ficus indica* have been studied on *Vibrio cholera*, indicating that the methanol extract was the most efficient [12]. According to Sathyabama et al. [13] the methanol extract has a high capacity to dissolve more organic and active antimicrobial compounds. These results confirmed the substantiation of previous studies which reported that methanol is a better solvent for more consistent extraction of antimicrobial substances from medical plants compared to other solvents, such as water and other organic solvents [5].

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### CONFLICT OF INTERESTS

Declare none

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