

Antimicrobial Activity Of Aloe Vera And Opuntia Ficus Extract Against Certain Pathogenic Bacteria

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Abstract: *The aim of current study is detect the activity role of Aloe vera and Opuntia ficus extract against certain pathogenic bacteria and evaluation of Aloe vera and O. ficus extract against certain pathogenic bacteria inhibition in vitro. 100 samples were obtained from patients with different diseases at age 6 Mon. to 65 years from both genders. This study was carried out in Lab. of Biology Dept., Science College/Tikrit University, at the period from 1st of June 2019 to end of January 2020. The antimicrobial activity was performed with the agar well diffusion method. The results show the ability of Aloe vera for inhibition of bacteria according on concentration and the concentrations of 100 was caused in inhibitory effect on E. coli, Acinetobacte, S. aureus, S. epidermidis and S. haemolyticus isolates at diameter 13, 12, 11, 9.8 and 15 mm respectively. While, Opuntia ficus extract at 100% concentration was caused in inhibitory effect bacteria isolates at diameter 10, 9.7, 8.2, 7 and 12 mm respectively. The results also show Aloe vera was found to be able for inhibition of bacteria concentration of 40% was caused in inhibitory effect on E. coli, Acinetobacte, S. aureus, S. epidermidis and S. haemolyticus isolates at diameter 14, 12, 11, 9 and 15 mm respectively. While, Opuntia ficus extract at 40% concentration was caused in inhibitory effect bacteria isolates at diameter 11, 10, 8, 7 and 13 mm respectively, while other concentrations 10%, 20, 30% show less inhibitory effect compare with 100% and 40% concentrations*

Keywords: *Aloe vera; Opuntia ficus; Staphylococcus spp; E. coli; Acinetobacter.*

INTRODUCTION

Aloe vera has been known and utilized to centuries for its health, medicinal activity and skin care properties [1]. It belongs to Asphodelaceae (Liliaceae) family, and is a shrubby or arborescent, perennial, xerophytic, succulent, pea green color plant [2]. The active components of aloe include anthraquinones, chromones, polysaccharides, and enzymes. The anthraquinones and chromones [3-4]. The plant leaves used in emollient, purgative, antimicrobial, anti-inflammatory [5], anti-oxidant, aphrodisiac, anti-helmenthic, antifungal, anti-cancer activity [6], antiseptic [7] and cosmetic values for health care [4]. Cactus plant usually called as prickly pear (family: Cactaceae). *O. ficusindica* synthesis and produces sweet and that nutritionally fruits; its tender cladodes are utilized such as green vegetable [8-9]. The mucilage comprise of D-glucose, glucuronic acids, D-galactose, Larabinose, D-xylose, L-rhamnose and D-galacturonic [10-11]. Other studies reffered that the plants undergo Cactaceae family consist of quercetin with kaempferol and isorhamnetin, the dihydroflavonols, the flavonones and flavanonols. The fruit of cactus pear consist of pigments of the betalain which can use as a good potential for food colorant [12-13-32]. It's used in folk medicine in several counties for several medicinal purposes because of its role in treating different diseases and disorders, anti-inflammatory properties [13], hypoglycemic properties [14], antimicrobial activity [15], anticancer effect [16], inhibition of stomach ulceration [17], antioxidant effects [18], and

neuroprotective effects [19]. So, the aim of this study is elevated the role of Aloe vera and Opuntia ficus extract against certain pathogenic bacteria.

MATERIAL AND METHODS

Preparation of Ethanolic extract

To preparation the ethanol extract, fresh gel was dried by using oven at (85 0C for 48 h) and after that powdered. 20 grams was filtered in (200ml) ethanol through paper called Whatman filter (no. 1) and filtrate was evaporated to dryness. The extract was powdered and after that dissolved by using distilled water. Various concentration of A. vera and Opuntia ficus gel extract was prepared for study the antimicrobial activity.

Preparation of Ethanolic stock solution

0.1 gm of powder was dissolved in (100ml) distilled water to obtained 0.001gm i.e 1mg /1ml concentration that is labeled like solution called stock solution. 1ml was dissolved in (100ml) distilled water to obtained 0.1mg /1ml concentration that was used like stock solution. Several concentrations as 10, 20, 30, and 40 µg were prepared from stock solution [20].

Sample

100 samples were obtained from patients with different diseases at age 6 mon to 65 years from both gender. This study was carried out in Lab. of Biology Dept., Science College/Tikrit University, at the period from 1st of June 2019 to end of January 2020.

The test microorganism

All isolates were collected from private hospital that include *E. coli* from urine, *S. aureus* from Ear, *Staphylococcus epidermidis* from skin , *Staphylococcus haemolyticus* from skin and burns and *Acinetobacter* from wounds has been collected all bacterial isolates were maintenance by culturing on specific media until use.

The test of antimicrobial activity

Activity of antimicrobial was done by using diffusion method on agar [21]. Bacterial strain culture was prepared in a concentration of (1×10⁶ cell per ml) according to standard of McFarland opacity. the plates of Mueller Hinton agar were inoculated by using (0.1 ml) for all bacterial isolates (1×10⁶ cell per ml) using method called spreading method. 10 ml of extract as a control were inoculated wells. Petri dishes kept at 30min. before they were transport to the incubator device. All petri dishes were incubated at 37°C for 24 h. inhibition zones were measured.

Statistical Analysis

The measurements were analyzed according to one way ANOVA test by utilizing SPSS program version 17. All measurements are expressed as mean ± SE. (significant level of P<0.05) [22].

RESULTS

The test of antibiotic sensitivity

Pathogenic bacteria lead to major and dangerous medical disorders. This condition was resulting in hard to select the suitable treatment for patient. The diffusion method by using Muller Hinton medium to determine antibiotic sensitivity versus isolates; it was explained according to CLSI, (2016) to detect the sensitive or antibiotics resistance. The results of bacterial isolates showed different patterns of antibiotic resistance Tables (1).

Table (1): show the effect of antibiotics

Treatment Bacteria type	Polymyxin B	Clindamycin	bacitracin	Doxycycline	dicloxacillin
E. coli	9	31	32	19	16
Acinitobacter	9	13	9	8	11
S. haemolyticus	15	R	17	16	R
S. aureus	20	R	R	R	R
S. epidermidis	25	R	10	20	25

The inhibitory effect of ethanol extracts of Aloe vera and Opuntia ficus

The inhibitory effects of *Aloe vera* and *Opuntia ficus* extract on bacteria at different concentration. The results show ability of *Aloe vera* for bacteria inhibition according to concentration. Concentrations of *Aloe vera* were caused in inhibitory effect on E. coli, Acinetobacte, S. aureus, S. epidermidis and S. haemolyticus isolates at diameter 13, 12, 11, 9.8 and 15 mm respectively. While, *Opuntia ficus* extract at 100% concentration was caused in inhibitory effect bacteria isolates at diameter 10, 9.7, 8.2, 7 and 12 mm respectively as shown in table (2).

Table (2): show the effect of ethanolic extract of *Aloe vera* and *Opuntia ficus* at concentration 100%

Treatment Bacteria type	Aloe vera	Opuntia ficus
E. coli	13.0± 0.9 a	10.0±0.25 a
Acinitobacter	12.0±0.75 b	9.7±0.6 a
S. haemolyticus	11.0± 0.68 ab	8.2±.5 b
S. aureus	9.8± 0.25 c	7.0±0.2 c
S. epidermidis	15.0±0.3 a	12.0±0.38 ab

The results also show *Aloe vera* (40%) was obtained to be able for bacteria inhibition and resulting in inhibitory effect on E. coli, Acinetobacte, S. aureus, S. epidermidis and S. haemolyticus isolates at diameter 14, 12, 11, 9 and 15 mm respectively. While, *Opuntia ficus* extract at 40% concentration was

caused in inhibitory effect bacteria isolates at diameter 11, 10, 8, 7 and 13 mm respectively, while other concentrations 10%, 20, 30% show less inhibitory effect compare with 100% and 40% concentrations as shown in table (3) and figures (1-10).

Table (3): show the effect of ethanolic extract of Aloe vera and Opuntia ficus at different concentration (10%, 20%, 30%, 40%)

Treatment Bacteria type	Diameter of inhibition zone (mm)							
	Aloe vera				Opuntia ficus			
	10%	20%	30%	40%	10%	20%	30%	40%
E. coli	6	8	11	14	5	6	9	11
Acinitobacter	5	7	10	12	–	6	8	10
S. haemolyticus	–	6	9	11	–	5	6	8
S. aureus	–	5	7	9	–	–	5	7
S. epidermidis	7	9	12	15	6	7	10	13

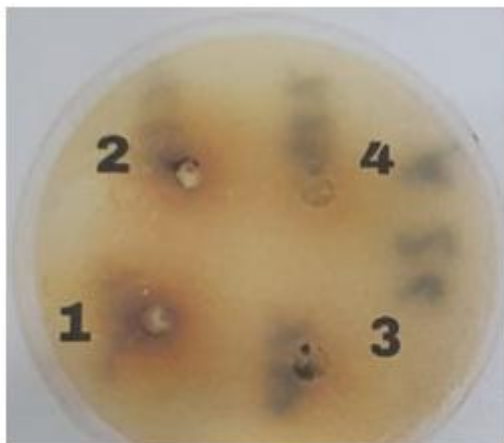


Figure (3): Aloe Vera Effect of on S. haemolyticus midis at different concentrations

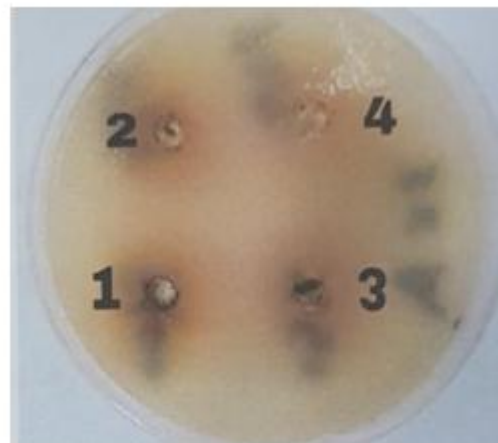


Figure (4): Aloe Vera Effect of on S. aureus midis at different concentrations

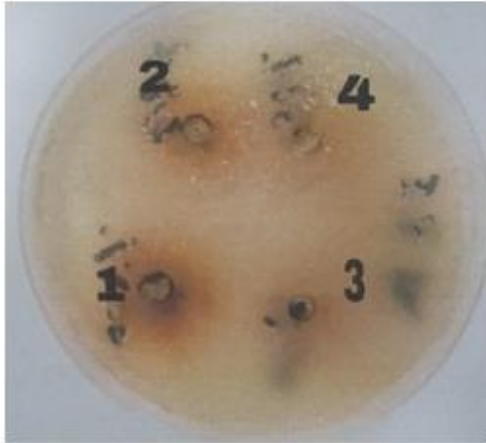


Figure (5): Aloe vera Effect of on *S. epidermidis* midis at different concentrations

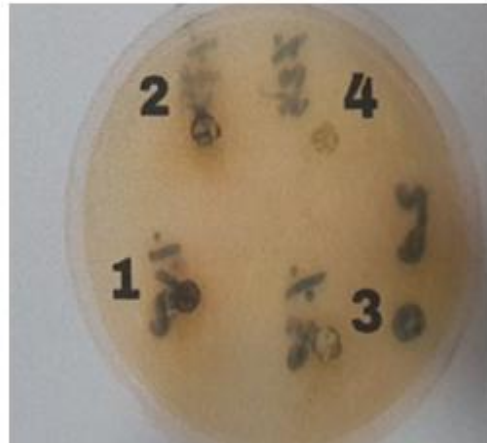


Figure (6): *Opuntia ficus* Effect of on *E. coli* at different concentrations

Note: 1= 10%, 2= 20%, 3= 30% and 4= 40% concentrations

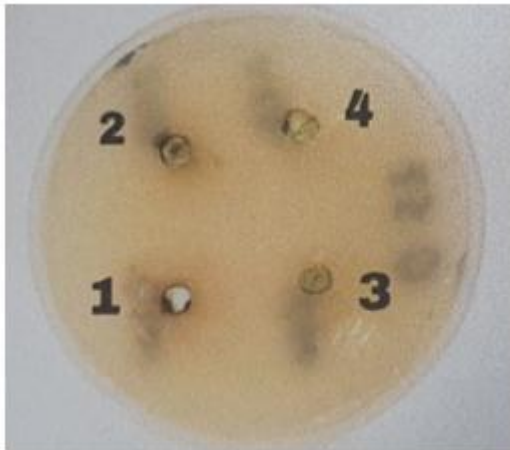


Figure (7): *Opuntia ficus* Effect of on *Acinetobacter* at different concentrations

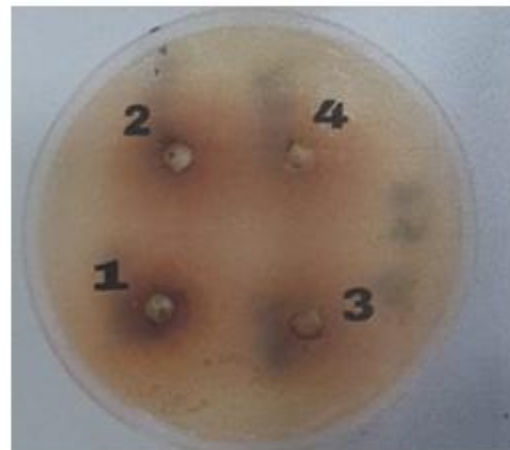


Figure (8): *Opuntia ficus* Effect of on *S. haemolyticus* at different concentrations

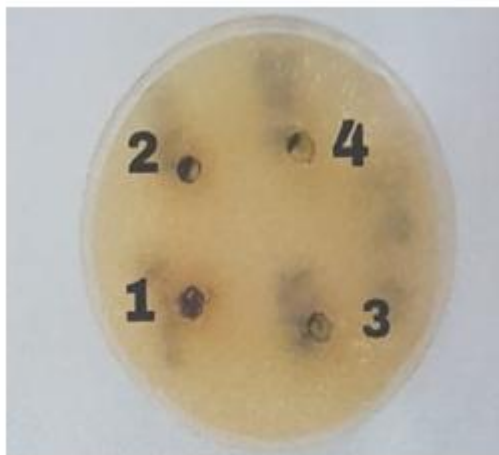


Figure (9): *Opuntia ficus* Effect of on *S. aureus* at different concentrations

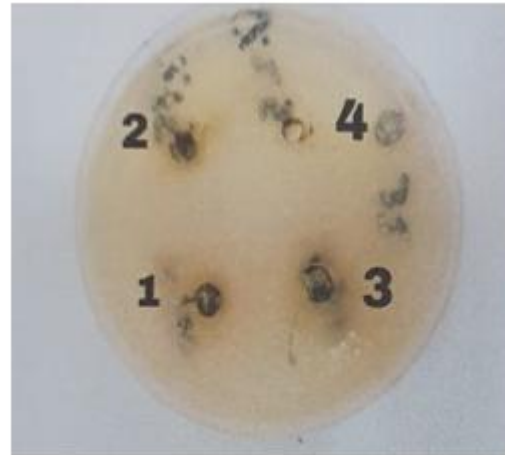


Figure (10): *Opuntia ficus* Effect of on *S. epidermidis* at different concentrations

DISCUSSION

The antimicrobial activity of aloe vera and *Opuntia ficus* was tested against pathogenic bacteria like *S. E. coli*, *Acinetobacte*, *S. aureus*, *S. epidermidis* and *S. haemolyticus* isolates by using cup plate diffusion method. The A. vera extracts were shown to possess compounds which have antimicrobial activity that utilized as antimicrobial agents [23-31]. The results of current study are similar to results of [24] who referred that the methanol and petroleum ether of *Aloe vera* extract at a dose of 20 mg/ml has showed significant activity against *E. coli*. In comparative study to show the antimicrobial activity of Aloe vera gel against bacteria isolates from the fast food [25] demonstrated lower inhibition zones compared to current study, that might be produced from secondary metabolites type which synthesized by Aloe sp. [26]. Antimicrobial activity of *Opuntia ficus* extracts against both gram-positive and gram-negative bacteria. It was clear that *O. ficus* extract is an efficacy extract as antibacterial activity and anti-fungal activity. The most common sensitive bacteria was *Staphylococcus* spp. These findings may be significant to isolate and extract the active compounds, explain the structure and estimate it versus various types of bacteria that describe as antibiotic resistant. Different studies have been demonstrated the efficiency of herbs against many genus and types of bacteria [27-28]. Also, Our findings agree with other works and studies exhibiting inhibitory effect of phenols that extracted from *O. ficus* are more efficient to Gram v+ compared with Gram v- bacteria [29]. Moreover, other authors [30] referred *Opuntia* properties as antimicrobial activity against *E. coli* and *S. aureus*.

REFERENCES

- [1] Surjushe A., Resham V. and Saple, D G. Aloe vera: a short review. *Indian J Dermatol.* 2008; 53(4): 163–166.
- [2] Tyler V. *The honest herbal: A sensible guide to the use of herbs and related remedies.* 3rd ed. Binghamton, New York: Pharmaceutical Products Press; 1993.
- [3] Choi S. W., Son B. W., Son Y. S., Park Y. I., Lee S. K. and Chung M. H., “The Wound-Healing Effect of a Glycoprotein Fraction Isolated from Aloe vera,” *British Journal of Dermatology*, 2001, 145(4): 535-545.
- [4] Sahu, P. K., Deen D. G., Ritu S., Priyanka P., Sharmistha G., Atul K. S., Ajay K. and Kapil D.P. Therapeutic and Medicinal Uses of Aloe vera: A Review. *Pharmacology & Pharmacy*, 2013, 4: 1-12.
- [5] Langmead L., Feakins R.M. and Goldthorpe S., Randomized, Doubled, Placebo-controlled Trial of oral aloe Vera gel for active Ulcerative Colitis , *Alimentary Pharmacology & Therapeutic*, vol,19 No, 7. 2004 pp.739-747.
- [6] Pegu, A. J., Mrs. Ankita S. Review on Aloe Vera. *IJTSRD*, 2019., 3(4): 35-40.
- [7] West DP, Zhu YF. Evaluation of aloe Vera gel gloves in the treatment of dry skin associated with occupational exposure. *Is J Infect Control?* 2003; 31:40–2.
- [8] Pareek OP, Singh RS, Vashishtha BB., Performance of Cactus Pear [*Opuntia ficus-indica* (L.) Mill.] Clones in Hot Arid Region of India. *Journal of the Professional Association for Cactus Development* 2003, 5: 121-130.
- [9] Osuna-Martínez U, Reyes-Esparza J, Rodríguez-Fragoso L (2014) Cactus (*Opuntia ficus-indica*): A Review on its Antioxidants Properties and Potential Pharmacological Use in Chronic Diseases. *Nat Prod Chem Res* 2: 153-161.
- [10] El-Samahy S K, El-Hady EAA, Habiba RA, and Moussa TE. Chemical and Rheological Characteristics of Orange-Yellow Cactus-Pear Pulp from Egypt. *J. PACD.* 2006; 39-51.
- [11] Kaur M., Amandeep K. and Ramica S. Pharmacological actions of *Opuntia ficus indica*: A Review. *J. App. Pharma. Sci.* 02 (07); 2012: 15-18.
- [12] Butera D, Tesoriere L, Gaudio FD, Bongiorno A, Mario A, Pintaudi AM, Kohen R, And Livrea M A. Antioxidant Activities Of Sicilian Prickly Pear (*Opuntia Ficus Indica*) Fruit Extracts And Reducing Properties Of Its Betalains: Betanin And Indicaxanthin. *J. Agric. Food Chem.* 2002; 50: 6895-6901.

- [13] Salim N, Abdelwaheb C, Rabah C and Ahcene B. Chemical composition of *Opuntia ficus-indica* (L.) fruit. *African Journal of Biotechnology*. 2009; 8 (8): 1623-1624.
- [14] Paiz RC, Juarez-flores BI, Aguirre RJR, Chardensa OC, Reyes AJA, Garcia CE et al. Glucose-lowering effect of *xoconostle* (*Opuntia joconostle* A. Web. Cactaceae) in diabetic rats, *J Med plants Res*. 2010; 4:2326-2333.
- [15] Ennouri M, Ammar I, Khema khem B, Attia H. Chemical composition and antibacterial activity of *Opuntia ficus indica* F. *inermis* (cactus pear) Flowers. *J Med. Food*. 2014; 17:908-914.
- [16] Zou DM, Brewer M, Garcia F, Feugang JM, Wang J, Zang R. Cactus pear: a natural product in cancer chemoprevention. *Nutr. J*. 2001; 4:25.
- [17] Kunti JO. Antioxidant compounds from four *Opuntia cactus pear* fruit varieties. *Food chem* 2004; 85:527-533.
- [18] Tilahun, Y. and Gebrekidan W. Pharmacological potential of cactus pear (*Opuntia ficus Indica*): A review. *J. Pharma. Phytochem*. 2018; 7(3): 1360-1363
- [19] Dok-Go H, Lee KH, Kim HJ, Lee EH, Lee J, Song YS et al. Neuroprotective effects of antioxidative flavonoids, quercetin, (+)- Dihydroquercetin and quercetin 3- methyl ether, isolated from *Opuntia ficus indica varsabotan* *Brai Res*. 2003; 965:130-136.
- [20] Gautam, CH. V., Rekha M., Mourya P., Sukanya S., Habeeba U. Evaluation of Antibacterial and Antifungal Activity of Aloe Vera Gel, *Indo Am. J. Pharm. Sci*, 2017; 4(04): 834-839.
- [21] Deans, S.G. and Ritchie, G. (1987) Antibacterial properties of plant essential oils. *International Journal of Food Microbiology*, 5, 165-180.
- [22] Saleh, A. H. Potential Role of Titanium Dioxide (TiO₂) Nanoparticles against the Toxicity of *Leishmania Tropica* in Adult Albino Male Rats. *JGPT* 2019, 11(3): 453-457.
- [23] Subramanian S.; Kumar DS.; Arulselvan P. and Senthilkumar GP. (2006). In vitro antibacterial and antifungal activities of ethanolic extract of *A. vera* leaf gel. *J. Plant Sci.*, 1: 348 -355.
- [24] Kedarnat; Kamble K.; Vishwanath B C. and Patil C S. (2013). Antimicrobial activity of aloe vera leaf extract. *Int. J. App. Bio. Pharma. Tec*. 4(4): 286-290.
- [25] Shireen F., et al. (2015). Anti-fungal activity of Aloe vera: In vitro study". *SRM Journal of Research in Dental Sciences* 6(2): 92-95.
- [26] Gharibi D., et al. (2016). Antibacterial Effects of Aloe Vera Extracts on some Human and Animal Bacterial Pathogens". *Journal of Medicine, Microbiology and Infectious Diseases* 3(1-2): 6-10.
- [27] Wei L, Musa N, Wee W, Musa N, Tse Seng C. 2007. Antimicrobial property of 12 spices and methanol extract of ornamental sea Anemone *Radianthus ritteriy* against *edwardsielliosis* agent and other bacteria. *Advances in Biological Research* 1(5-6), 164- 166.
- [28] Shakeri A, Hazeri N, Vlizabeth J, Ghasemi A, Zaker Tavallaei F. 2012. Phytochemical screening, antimicrobial and antioxidant activities of *anabasis aphyllal.l* extracts *Kragujevac J. Sci*, 34, 71-78
- [29] Delgado Adámez, J.; Gamero Samino, E.; Valdés Sánchez, E.; González-Gómez, D. (2012). In vitro estimation of the antibacterial activity and antioxidant capacity of aqueous extracts from grape seeds (*Vitis vinifera* L.). *Food Control*, 24: 136–141.
- [30] Sánchez, E.; Rivas Morales, C.; Castillo, S.; Leos-Rivas, C.; García-Becerra, L.; Ortiz Martínez, D.M. (2016). Antibacterial and Antibiofilm Activity of Methanolic Plant Extracts against Nosocomial Microorganisms. *Evid. Based Complement. Altern. Med*. 2016: 1–8.
- [31] AL-Samarraie, M. Q., Omar, M. K., Yaseen, A. H., & Mahmood, M. I. (2019). The Wide Spread of the Gene Haeomolysin (Hly) and The Adhesion Factor (Sfa) in The *E. coli* Isolated From UTI. *Journal of Pharmaceutical Sciences and Research*, 11(4), 1298-1303.
- [32] Fadhil, K. B., Majeed, M. A. A., & Mustafa, M. A. (2019). Electronic study of fresh enzyme complexes of antifungal drugs-P450 and *Aspergillus kojic acid* biosynthesis. W: w saccharose flavus: fructose as a substratum. *Annals of Tropical Medicine and Health*, 22, 65-72.