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ANTIMICROBIAL AND WOUND HEALING ACTIVITY OF JASMINUM GRANDIFLORUM LINN: A REVIEW

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ABSTRACT

Wound is defined as a breach in the continuity of skin & thus no human being can escape from it in their lifetime. Patients with chronic wounds require prolonged periods of dressing & this can cause a significant financial burden to the healthcare system. Moreover, wound infections delays the process of wound healing & may cause serious health problems including disability & death. The clinical efficacy of the currently available antimicrobial drugs is being threatened by the emergence of multi drug resistant microbes as well as the toxic effects of these drugs to the host cells. Therefore, the demand for natural & herbal medications is increasing globally due to the easy availability of raw materials, cost effectiveness & paucity of reported adverse reaction. Plants used in traditional medicines that are claimed to have antimicrobial & wound healing potential should be investigated to substantiate their potential healing effect & to better understand their properties, safety & efficacy. *Jasminum grandiflorum* is one such plant that has been used in *Ayurveda* for the treatment of wounds. In this research paper an effort was made to review the research conducted on *Jasminum grandiflorum* to better understand its antimicrobial & wound healing potential. It was found that Jasminum grandiflorum has significant antimicrobial & wound healing potential.

KEYWORDS: *Jati, Jasminum grandiflorum,* antimicrobial, wound healing.

INTRODUCTION

Wounds are defined as breach in the continuity of living tissues. Thus, humans cannot escape from an event of injury in their lifetime.[1] Infection of the wound delays the process of

wound healing and has a potential for serious bacterial wound infections including gas gangrene and tetanus, and these in turn may lead to long term disabilities, chronic wound and bone infection and death.[2] The clinical efficacy of the existing antimicrobials used in the treatment of wound infections is being threatened by the emergence of multi drug resistant microbes. Moreover, many of the newly developed antimicrobials produce toxic reactions.[3] Patients with chronic wounds require prolonged period of dressings & this can cause a significant financial burden to the healthcare system.[4] Hence it is the need of the time to look for safe & effective *Ayurvedic* treatment for treating wounds & wound infection. Plant extracts have a novel mechanism of action and have the ability to promote blood clotting, fight infections & accelerate the healing of wounds simultaneously.[1][5] In the *Ayurvedic* classics, many plants have been described that are claimed to have *krimighna* (antimicrobial) & wound healing properties. *Jati (Jasminum granadiflorum)* is one such plant described in *Ayurvedic* texts in the treatment of wounds. *Jati (Jasminum grandiflorum Linn.) (Family-Oleaceae)*; is a large climbing shrub with dark green twigs and pinnate leaves with fragrant flowers.[6] It is native to Asia & the numerous parts of this plant such as leaves, flowers, stem & roots are very beneficial & significant in pharmaceutical industry & have been reported to possess antimicrobial, cytoprotective, chemopreventive, anti-acne, anti-inflammatory, anthelmintic, antiseptic, antioxidant, antiulcer & wound healing activities.[7][8] Hence the current study was undertaken to review the research conducted on *Jasminum grandiflorum* to better understand its antimicrobial & wound healing potential.

Table 1: Review of Research Work on Antimicrobial Activity of *Jasminum Grandiflorum.*

Sr. no.	Title of study	Extract Used	Method of in-vitro study	Microbes	Proved activity
1.	Chemical Composition, Olfactory Evaluation and Antimicrobial Activities of *Jasminum grandiflorum* L. Absolute from India (2007)[9]	*Jasminum grandiflora-um* L. Absolute	agar diffusion disc and the agar serial tube dilution methods	*Staphylococcus aureus, Enterococcus faecalis, Escherichia coli, Pseudomonas aeruginosa, Proteus vulgaris, Klebsiella pneumoniae, Salmonella* sp., *Candida albicans.*	The jasmine absolute showed medium to high activity (reference compounds: eugenol and three synthetic antibiotics) against the Gram-positive bacterium *Enterococcus faecalis*, against the Gram-negative bacteria *Escherichia coli, Pseudomonas aeruginosa, Klebsiella pneumoniae* and

					Salmonella sp., as well as against the yeast *Candida albicans*.
2.	Antimicrobial activity of *Jasminum grandiflorum & Jasminum sambac* (2008)[10]	ethanolic extract of J. grandiflorum callus	disc diffusion method	*Proteus mirabilis, staphylococcus aureus & salmonella typhii*	J. *grandiflorum* exhibited highest antibacterial activity against salmonella typhi & lowest against proteus mirabilis. The results of this study suggest that the extract of *J. grandiflorum* is effective against the tested pathogens.
3.	Antimicrobial Activity of Extracts of some Plants Collected from the Kingdom of Saudi Arabia (2008) [11]	Methanolic extract	agar-diffusion method	*Escherichia coli, Proteus vulgaris, Pseudomonas aeruginosa, Staphylococcus aureus, Sarcina lutea, Bacillus subtilis, Mycobacterium phlei, Candida albicans*	J. grandiflorum showed significant antimicrobial activity against all tested microorganisms.
4.	Screening of some selected medicinal plants extracts for in-vitro antimicrobial activity. (2009)[12]	n-hexane, chloroform, acetone, methanol and water extracts of jasminum grandiflorum leaves.	MIC by macro broth dilution method.	*Aspergillus flavus, Aspergillus fumigatus, Aspergillus nigar, Candida albicans, Saccnaromyces creveaceae, Escherichia coli, Enterobacter aerogenes, Klebsiella pneumoniae, Pseudomonas aeruginosa, Proteus vulgaris, Staphylococcus aureus, Salmonella typhi*	In *J. grandiflorum*, chloroform extract was found to be active against all seven bacterial strains in the range of 1.56-6.25 mg/ml; while n-hexane, acetone, ethanol and water extract shows activity against one or more strains.
5.	Antibacterial activity of Jasminum grandiflorum Linn. Leaves. (2009) [8]	Petroleum ether, chloroform, acetone, methanol and aqueous extract of leaves *of j. grandiflorum.*	Disc diffusion method	*Staphylococcus aureus, Bacillus subtilis, Escherichia coli, Pseudomonas aeruginosa*	Petroleum ether, methanol and aqueous extracts of J.grandiflorum showed better activity than the standard (penicillin) against all the four microorganisms. Chloroform extract was only effective against *Bacillus subtilis* and *Pseudomonas aeruginosa.* Acetone extract was most effective against *Pseudomonas*

					aeruginosa and *Escherichia coli*.
6.	Screening of some plant extracts against *Alternaria Sp.* isolated from foot infections in cancer patients. (2010)[13]	Methanolic extract of *Jasminum grandiflorum* leaves	Agar well diffusion method.	*Alternaria sp.*	Out of all the plant Extracts tested in this study, *Jasminum grandiflorum* showed maximum antifungal activity. *Jasminum grandiflorum* showed antimycotic effect and significantly retarded the growth of fungi Alternaria sp.
7.	Phytochemical, cytotoxic & antibacterial activity of two medicinal plants of Bangladesh. (2014)[3]	Ethanolic extract	Disc diffusion method. Minimum inhibitory concentration was determined by broth macro dilution assay with some modifications	*Enterococcus faecalis, Hafnia alvei, Pseudomonas aeruginosa, Proteus vulgaris, Plesiomonas shigelloides, Staphylococcus pidermidis, Staphylococcus aureus, Staphylococcuss aprophyticus, Salmonella typhi, Staphylococcus pyogenes, Shigella boydii, Shigella flexneri, Shigella sonnie, Shigella dysenteriae*	The extract showed moderate zone of inhibition against most of the tested bacteria. *J.grandiflorum* showed highest zone of inhibition against *Proteus vulgaris*. *J.grandiflorum* was inactive against *E.faecalis, H.alvei, P.vulgaris, P.shigelloides, S.typhi*. The obtained MICs were between 250 and 500 µg/ml.
8.	Comparative study between percolation & ultra-sonication for the extraction of Hibiscus & Jasmine flowers utilizing antibacterial bioassay. (2014)[14]	Ethanolic extract of *Jasminum grandiflorum* flowers.	Disc diffusion method	*E. coli, S. aureus*	Ultrasonic extraction technique extracted more active compounds from jasmine flower responsible for the inhibition of *S. aureus* compared to the soxhlet extraction technique, but both extraction techniques failed to produce active compounds for the inhibition of *E. coli*.
9.	Anti-candidal activity of Piper betle (L.), Vitex negundo (L.) &	Water extract & ethanolic extract of *Jasminum*	Agar well diffusion method. MIC was	*Candida albicans, Candida glabrata, Candida krusei, Candida*	Water & ethanolic extracts of *Jasminum grandiflorum* leaves did not show a significant

	Jasminum grandiflorum (L). (2014)[15]	*grandiflorum* leaves	determined using both the Andrews (2001) method and the British Society for Antimicrobial Chemotherapy (BSAC) (Andrews, 2005) method.	*parapsilosis, Candida tropicalis*	anti-candidal activity.
10.	Antimicrobial effect of *Jasminum grandiflorum L. & Hibiscus rosa-sinensis L.* extracts against pathogenic oral microorganisms-an in-vitro comparative study. (2015)[16]	Aqueous and ethanol (cold and hot) extracts prepared from leaves of *Jasminum grandiflorum*	Agar well diffusion method. MIC using	*Streptococcus mutans and Lactobacil-lus acidophilus*	At lower concentrations, hot ethanol *Jasminum grandiflorum* (10 µg/ml) extract was found to have statistically significant (P < 0.05) antimicrobial activity against S. mutans and L. acidophilus with MIC values of 6.25 µg/ml and 25 µg/ml, respectively.
11.	Evaluation of antimicrobial activity of Jasminum species using solvent extracts against clinical pathogens. (2015)[17]	Ethanol, Methanol, Propanol, Chloroform, Diethyl ether, Hexane and aqueous extracts of leaves of J. grandiflorum	Agar well diffusion method	*E.coli, Bacillus sp., Streptococcus sp., Salmonella sp., Pseudomonas sp., Serratia marcescens, Klebsiella pneumonia, Staphylococcus aureus*	All the extracts of J.*grandiflorum* showed appreciable antimicrobial activity. The highest zone of inhibition was exhibited by the Chloroform extract against *Bacillus subtilis* and the second most effective extract was Ethanol which showed zone of inhibition against *E. coli*. The lower activity was exhibited by Diethyl ether extract (*Streptococcus sp.*), Ethanol extract (*Pseudomonas aeruginosa* and *Klebsiella pneumonia*).
12.	Antibacterial activity of methanolic extracts from some selected medicinal	Methanolic extract of Jasminum grandiflorum leaves	Disc diffusion method	**Gram Positive** *Bacillus anthracis Bacillus pumilus Bacillus subtilis Corynebacterium diphtheriae*	*Jasminum grandiflorum* extract showed strong activity against six Gram-positive and one Gram-negative bacteria. (Gram positive:

	plants. (2017)[7]			*Corynebacterium hoffmanii* *Corynebacterium xerosis* *Staphylococcus aureus* *Staphylococcus citreus* *Staphylococcus epidermidis* *Staphylococcus faecalis* *Staphylococcus lactis* *Streptococcus pyogenes* **Gram Negative** *Branhamella catarrhalis* *Enterobacter aerogenes* *Escherichia coli* *Klebsiella ozaenae* *Klebsiella pneumoniae* *Proteus vulgaris* *Pseudomonas aeruginosa* *Pseudomonas fluorescens* *Salmonella schottmuelleri* *Salmonella typhi* *Salmonella typhimurium* *Salmonella paratyphi A* *Serratia marcescens* *Shigella boydii* *Shigella dysenteriae* *Shigella flexneri* *Shigella sonnei* *Vibrio cholerae*	*Bacillus anthracis*, *Bacillus pumilus*, *Corynebacterium Diphtheriae*, *Corynebacterium Hoffmanii*, *Corynebacterium Xerosis*, *Staphylococcus citreus*, Gram negative: *Branhamella catarrhalis*)

Table 2: Review of research work on wound healing activity of Jasminum grandiflorum.

Sr. no.	Title of study	Extract used	Animal model & wound model	Route of administration / dose /duration	Proved activity
1.	Influence of ethanolic extract of *jasminum grandiflorum* Linn. Flower on wound healing activity in rats. (2007)[18]	Ethanolic extract of *jasminum grandiflorum* flowers	Excision wound & dead space wound models in male albino rats of Wistar Strain	Topical application for excision wound models & oral for dead space wound models 250 mg/kg/day	Ethanol extract of *J. grandiflorum* flower has properties of promoting wound healing activity compared with controls. Wound contraction and increased hydroxyproline

					content support the *J. grandiflorum* in the topical treatment and management of wounds.
2.	Wound healing activity of the aqueous alcoholic extract of *Jasminum grandiflorum Linn*. Leaves. (2010)[1]	Aqueous alcoholic extract of leaves of *J. grandiflorum*	Excision and dead space wound models in male albino rats of dr strain	Oral 250 mg/kg body weight.	Extract treated rats exhibited 65% reduction in the wound area when compared to controls (54%). The wet and dry granulation tissue weight, and hydroxyproline content in a dead space wound model increased significantly compared to controls. Thus from this study it is concluded that the *J. grandiflorum* leaf extract has a reproducible wound healing potential.
3.	Efficacy of *Jasminum grandiflorum L.* leaf extract on dermal wound healing in rats. (2012)[19]	Ointment, prepared by methanolic extract of *Jasminum grandiflorum L.* leaves	Excision wound & incision wound models in male albino rats.	Topical application, twice daily for 12 days.	Ointment from the methanolic extract of J. *grandiflorum* leaf improved the rate of wound healing by enhancing the rate of collagen synthesis and also by improving the antioxidant status in the newly synthesized healing wound tissue.
4.	Experimental study of *Jati patra (Jasminum* grandiflorum Linn.) W.S.R. to its vrana ropana (wound healing activity). (2013) [20]	Extract & crude paste of *J. grandiflorum* leaves	Excision wound model in albino rats.	Local application once a day for 21 days.	*Jati* extract and crude drug paste of leaf promotes wound contraction and epithelization. The extract of *Jati patra* and *kalka* application showed equipotent effect with control group (Betadine ointment). *Jati patra* extract and paste is effective, safe and well tolerated in the treatment of excision wound.
5.	Evaluation of the wound healing effect of *Jasminum grandiflorum* by wound contraction studies & wound breaking strength. (2014)[21]	*Jasminum grandiflorum* leaf paste	Excision and incision wound models in albino rats	Local application twice a day	*J. grandiflorum* leaves promoted wound healing by improving the early inflammatory process, by enhancing wound contraction and by promoting an early epithelisation when compared with control. The wound breaking strength was more in the drug treated group compared to normal.
6.	Evaluation of	*J.*	Excision & re-	Local application	*Jasminum grandiflorum*

	wound healing effect of *Jasminum grandiflorum* in albino rats by histopathological studies. (2014)[22]	*grandiflorum* leaves paste	sutured incision wound models in albino rats.	Twice daily Duration of treatment varied as per wound model.	leaves promoted wound healing by improving the early inflammatory process, by enhancing wound contraction through increased fibroblast proliferation, and by promoting an early epithelisation and increased collagen formation when compared with control in albino rats.
7.	Experimental wound healing aspects of *Jasminum grandiflorum Linn:* A preclinical study. (2015)[23]	Successive ethanolic extract ointment of leaves of *J. grandiflorum*	Excision wound & incision wound models in albino rats.	Local application once a day starting from the wound induction till complete healing.	Successive ethanolic extract of the leaves exhibited promising wound healing, antioxidant and antimicrobial properties.
8.	Effects of ethanolic extract of *Jasminum grandiflorum Linn*. flowers on wound healing in diabetic wistar albino rats. (2017)[24]	Ethanolic extract of *Jasminum grandiflorum Linn*. flowers	Excision wound, incision wound & dead space wound models in Streptozotocin-induced diabetic *Wistar* albino rats	Oral 250 mg/kg daily till complete healing of the excision wounds.	This study demonstrated that *J. grandiflorum* Linn. flowers significantly enhances wound contraction, granulation tissue formation and neo-angiogenesis in diabetic wounds.
9.	Effects of oil extract of *Jasminum grandiflorum* leaves on wound healing activity in albino rats. (2017)[25]	Oil extract of *Jasminum grandiflorum* fresh leaves	Excision wound & burn wound models in albino rats.	Local application	Test groups showed significant decrease in periods of epithelialization & significant increase in wound contraction rate when compared to control and vehicle control groups in excision wound and burn wound models. Oil extract of *J. grandiflorum* leaves has shown wound healing effects in burn wounds and excision wounds.
10.	Phytochemical investigation & wound healing activity of *Jasminum grandiflorum*. (2018)[26]	Ethanolic extracts of leaves & roots of *J. grandiflorum*	Excision wound model in albino rats.	Local application once a day till complete epithelisation	The leaf extract treated wounds were found to epithelise faster as compared to control group. Leaf extract treated rats exhibited 61.346% reduction in the wound area when compared to control 55.72%.

DISCUSSION AND CONCLUSION

On reviewing the available research papers on antimicrobial & wound healing activities of *Jasminum grandiflorum*, it was found that it is the leaves of this plant that exhibit the most significant antimicrobial & wound healing potential as compared to the rest of the plant parts.

Jasminum grandiflorum has significant antimicrobial activity against a wide range of microbes including many gram positive & gram negative bacteria as well as fungi. It is effective against most of the microbes responsible for wound infections such as- staphylococcus aureus, pseudomonas aeruginosa, E. coli, candida albicans, Aspergillus species, Corynebacterium species, streptococcus sp., proteus vulgaris, etc.[27][28][29][30][31] The antimicrobial activity may be due to the presence of various phytochemicals such as flavonoids, alkaloids, tannins, saponins, glycosides, salicylic acid, etc.[7][8]

Wound healing and tissue repair are complex processes that involve a dynamic series of events including clotting, inflammation, granulation tissue formation, epithelization, collagen synthesis and tissue remodeling.[1] *Jasminum grandiflorum* promotes wound healing by-

- Increasing the rate of wound contraction
- Increasing hydroxyproline content
- Enhancing granulation tissue formation
- Enhancing the rate of collagen synthesis
- Improving the antioxidant status in newly synthesized healing wound tissue
- Improving the early inflammatory process
- Promoting an early epithelization
- Enhancing wound contraction through increased fibroblast proliferation
- Antimicrobial action
- Enhancing neo-angiogenesis (in diabetic wounds).

Probable mode of action of *Jati (Ayurvedic* point of view)

Jati is having tikta, kashaya rasa, laghu guna, ushna virya and katu vipaka. Acharya Vagbhata while explaining functions of rasa, mentioned tikta rasa act as lekhana (scraping), shoshana of kleda, meda, vasa, majja and lasika (decreases/ absorbs muscle fat, bone marrow, adipose and body fluids) i.e. it act as shothahara, (decreases the exudation from the wound), vrana shodhana (wound cleansing/ purification). Kashaya rasa act as both Vrana shodhana and

Vrana ropana (wound purification & healing). Thus jati helps in healing of wounds by its vrana shodhana & vrana ropana properties.[20] [32]

Thus it can be concluded that the leaf extracts of *jasminum grandiflorum* has antimicrobial & wound healing potential.

REFERENCES

1. Mishra SB, Mukerjee A, Vijayakumar M. Wound Healing Activity Of The Aqueous Alcoholic Extract of Jasminum Grandiflorum Linn Leaves. Pharmacologyonline, 2010; 3: 35-40.
2. Prevention and management of wound infection. Guidance from WHO's department of violence & injury prevention & disability & the department of essential technologies. http://www.WHO.int/hac/techguidance/tools/guidelines_prevention_and_management_wound_infection.pdf
3. MahmudurRahman, Amina Khatun, S Khan, F Hossain, A AKhan. Phytochemical, cytotoxic and antibacterial activity of two medicinal plants of Bangladesh. Pharmacologyonline, 2014; 1: 3-10.
4. Amanda A. Dorai, Wound care with traditional, complementary & alternative medicine; Indian Journal of plastic surgery, May-Aug, 2012; 45(2): 418-424.
5. R. Thakur, N. Jain, R. Pathak, S. Sandhu. Practices in wound healing studies of plants. Hindawi Publishing Corporation, Evidence – based complementary & alternative medicine, 2011; article ID- 438056, 17.
6. The Ayurvedic Pharmacopoeia of India. Government of India Ministry of Health and Family Welfare Department of Ayush. Part-I, III: 111-113.
7. Ali ST, Ayub A, Ali SN, Begum S, Siddiqui BS, Mahmood N, Khan KA. Antibacterial Activity of Methanolic Extracts from Some Selected Medicinal Plants. *FUUAST J. BIOL*., 2017; 7(1): 123-125.
8. Sandeep, Padmaa. M. Paarakh, Usha Gavani. Antibacterial activity of *Jasminum grandiflorum* Linn leaves. Journal of Pharmacy Research, 2009; 2(7): 1206-1207.
9. Jirovetza L, Buchbauera G, Schweigera T, Denkovab Z, Slavchevb A, Stoyanovac A, Schmidtd E, Geisslere M. Chemical Composition, Olfactory Evaluation and Antimicrobial Activities of *Jasminum grandiflorum* L. Absolute from India. Natural Product Communications, 2007; 2(4): 407-412.

10. Priya Joy, Dr. D. Patric Raja. Anti-Bacterial Activity Studies of *Jasminum grandiflorum* and *Jasminum sambac.* Ethnobotanical Leaflets, *2008; 12: 481-483.*
11. Essam Abdel-Sattar, Fathalla M. Harraz, Sabah H. El Gayed. Antimicrobial Activity of Extracts of some Plants Collected from the Kingdom of Saudi Arabia. JKAU: Med. Sci., 2008; 15(1): 25-33.
12. Mangesh Khond, J.D. Bhosale, Tasleem Arif, T.K. Mandal, M.M. Padhi and Rajesh Dabur. Screening of Some Selected Medicinal Plants Extracts for *In-vitro* Antimicrobial Activity. Middle-East Journal of Scientific Research, 2009; 4(4): 271-278.
13. Mishra Alka, Shrivastava A., Jain S.K. Screening of Some Plant Extracts against Alternaria sp. Isolated from Foot Infections in Cancer Patients. International Journal of Pharm Tech Research, 2010; 2(2): 1165-1170.
14. Rasha Saad, Gayathiry Murugiah, Junainah Abdulhamid, Eddy Yusuf, Mohd Fadli. Comparative Study between Percolation and Ultrasonication for the Extraction of Hibiscus and Jasmine Flowers Utilizing Antibacterial Bioassay. International Journal of Pharmacognosy and Phytochemical Research, 2014; 6(3): 472-476.
15. Buddhie Samanmalie Nanayakkara, Charmalie Lilanthi Abayasekara, Gehan J. Panagoda, H. M. Dinusha Kumari Kanatiwela, M. R. Dammantha M. Senanayake. Anti-candidal activity of *Piper betle* (L.), *Vitex negundo* (L.) and *Jasminum grandiflorum* (L.). African Journal of Microbiology Research, June, 2014; 8(23): 2307-2314.
16. Nagarajappa, Ramesh; Batra, Mehak; Sharda, Archana J.; Asawa, Kailash; Sanadhya, Sudhanshu; Daryani, Hemasha; Ramesh, Gayathri. Antimicrobial Effect of Jasminum grandiflorum L. and Hibiscus rosa-sinensis L. Extracts against Pathogenic Oral Microorganisms -- An In Vitro Comparative Study. Oral Health & Preventive Dentistry, 2015; 13(4): 341-348.
17. Sushant Shekhar and Prasad M.P. Evaluation of Antimicrobial Activity Of *Jasminum* Species Using Solvent Extracts Against Clinical Pathogens. World Journal of Pharmacy and Pharmaceutical Sciences, 2015; 4(05): 1247-1256.
18. B. S. Nayak, Krishna Mohan. Influence of Ethanolic Extract of *Jasminum Grandflorum* Linn Flower on Wound Healing Activity in Rats. Indian J Physiol Pharmacol, 2007; 51(2): 189–194.
19. Chaturvedi AP, Kumar M, Tripathi YB. Efficacy of Jasminum grandiflorum L. leaf extract on dermal wound healing in rats. Int Wound J., 2013; 10: 675–682.

20. Mehatre Dhulappa, Wali G Ashok. Experimental Study Of Jati Patra (Jasminum Grandiflorum Linn) W. S. R. To Its Vrana Ropana (Wound Healing Activity). IAMJ, 2013; 1(6): 77-84.
21. Ravishankar M, Jagadeesh K, Shreenivas P. Revankar. Evaluation of the wound healing effect of *Jasminum grandiflorum* by wound contraction studies and wound breaking strength. Int J Basic Clin Pharmacol, Feb, 2014; 3(1): 66-69.
22. Ravishankar M, Shreenivas P. Revankar, Jagadeesh K. Evaluation of wound healing effect of *Jasminum grandiflorum* in albino rats by histopathological studies. Int J Res Med Sci., Feb, 2014; 2(1): 206-209.
23. Mittal Arun, Sardana Satish, Pandey Anima. Experimental Wound Healing Aspects of *Jasminum Grandiflorum* Linn: A Preclinical Study. Afr J Tradit Complement Altern Med., 2015; 12(3): 135-142.
24. Hirapara H, Ghori V, Anovadiya A, Baxi S, Tripathi C. Effects of ethanolic Extract of Jasminum grandiflorum Linn. Flowers on Wound Healing in Diabetic Wistar Albino Rats. Avicenna J Phytomed, 2017; 7(5): 401-408.
25. Almeida PMD, Mandal T, Laxminarayana Bairy K, Adiga S. Effect of oil extract of Jasminum grandiflorum leaves on wound healing activity in albino rats. Advanced Science Letters, Mar 1, 2017; 23(3): 1957-1959.
26. B. S. Hunasagi, M. Somashekhar, N. V. Kalyane, E. N Gaviraj. Phyto Chemical Investigation And Wound Healing Activity Of *Jasminum Grandiflorum.* IJP, 2018; 5(6): 364-368.
27. P. G. Bowler, B. I. Duerden, D. G. Armstrong. Wound Microbiology and Associated Approaches to Wound Management. Clinical Microbiology Reviews, 2001; 14(2): 244-269.
28. Lucinda J Bessa, Paolo Fazii, Mara Di Giulio, Luigina Cellini. Bacterial isolates from infected wounds and their antibiotic susceptibility pattern: some remarks about wound infection. Int. wound J., feb., 2015; 12(1): 47-52.
29. A. Giacometti, O. Cirioni, A. M. Schimizzi, M. S. Del Prete, F. Barchiesi, M. M. D'errico, E. Petrelli, And G. Scalise. Epidemiology and Microbiology of Surgical Wound Infections. JOURNAL OF CLINICAL MICROBIOLOGY, Feb., 2000; 38(2): 918–922.
30. R. S. Howell-Jones, M. J. Wilson, K. E. Hill, A. J. Howard, P. E. Price and D. W. Thomas. A review of the microbiology, antibiotic usage and resistance in chronic skin wounds. Journal of Antimicrobial Chemotherapy, 2005; 55: 143–149.

31. Giandoni MB, Grabski WJ. Cutaneous candidiasis as a cause of delayed surgical wound healing. J Am Acad Dermatol, Jun, 1994; 30(6): 981-4.
32. Deshpande AP, Javalgekar RR, Ranade S. Dravyagunavigyana. Reprint 2011, Pune, Proficient publishing house, 2011.