

**STUDY OF CERTAIN *KRUMIGHNA* AYURVEDIC PLANTS & THEIR ANTIMICROBIAL ACTIVITY IN THERAPEUTIC SCIENCE: A LITERATURE REVIEW****Dr. Gopal M. Jadhav<sup>1\*</sup>, Dr. Surekha J. Dewaikar<sup>2</sup> and Dr. Soudamini Choudhari<sup>3</sup>**<sup>1</sup>Ph.D. (Scho) Assistant Professor, Strirog Prasui Tantra Department, Government Ayurved College, Nanded (M.S.).<sup>2</sup>Ph.D. Guide, Ex. Professor and HOD Department of Strirog Prasui Tantra, R.A. Podar Medical College (Ayu) Worli, Mumbai-18 (M.S.).<sup>3</sup>Professor, HOD and Ph.D. Guide, Department of Strirog Prasui Tantra, Government Ayurved College, Nanded (M.S.).**\*Corresponding Author: Dr. Gopal M Jadhav**

Ph.D. (Scho) Assistant Professor, Strirog Prasui Tantra Department, Government Ayurved College, Nanded (M.S.).

Article Received on 05/07/2022

Article Revised on 26/07/2022

Article Accepted on 15/08/2022

**ABSTRACT**

**Introduction:** In *Ayurved* texts *krumi* word used for micro or macro organisms, parasites and germs present inside or outer surface of animal or human body and probably which can be seen by naked eyes. Those microorganisms which cannot be seen by eyes are considered as *Jantu* or *Rakshas*. These are responsible for development of certain diseases. *Krumi* can be cured with various therapeutic methods of Ayurveda like extraction and use of germicidal drugs. Procedures like *vaman*, *virechan* can be used to remove worms from gut. Many *krumighna* drugs described in the texts claim to have germicidal / antimicrobial activities. Majority of the diseases are treated by ayurved therapy on the basis of concept of dosh balancing system. Hence microbiology and antimicrobial therapy is not widely considered in Ayurveda therapy. Antimicrobial drugs described in ancient texts seen beneficial in certain infective clinical conditions depend upon *dosha* system. There must be some relation between concept of *dosha* and microbiological entities. Such studies of ayurved herbs are essential which will establish a new milestone in their antimicrobial properties. **Objectives:** Literary research of major *krumighna* ayurved herbs and their antimicrobial properties in view of their practical implementation in general health system. **Material and Methods:** Literature review has been done from *bhavprakash nighantu*, Indian material medica ancient, various research journals and data interpretation done. **Observations, Conclusion, Result will be presented in full paper.**

**KEYWORDS:** *krumi*, *jantu*, *krumighna*.**INTRODUCTION**

World is facing challenges to fight against microbes with the help of antibiotics which are highly effective. Over use of these drugs is resulting in suppression of immune system and making more prone for more infections. Repeat and prolong use of multiple antibiotics and entire health system is travelling towards a dead end of antibiotic resistance. Traditional systems of medicine like Ayurveda are known for holistic approach and best medicines for pure health. World is in search of best option for antibiotics from Ayurveda field but it equally essential to know the way of their action in infectious conditions. A different type of study stating role of such antimicrobial i.e. *krumighna* drug was essential.

**AIM AND OBJECTIVES**

1. To review ayurved literature regarding *krumighna* properties of ayurved herbal drugs.
2. To review online published research literature related to antimicrobial properties of ayurved herbal drugs.
3. To study relation between antimicrobial properties and ayurved properties of *krumighna* drugs

**MATERIAL AND METHODS:** Literature review has been done from *bhavprakash nighantu*, Indian material medica, ancient ayurved texts, research journals and data interpretation is done.

**Inclusion and exclusion criteria:** Researches published in international journals and original *ayurved sanhita* ie *bhavprakash* references and references from Indian pharmacopeia considered for study while other non-authentic and literature of local languages is excluded from review.

**Discussion on modern and Ayurved literature review**

Many types of microorganisms exist around human beings depends upon area, temperature and other environmental conditions. Human body gets protected<sup>[1]</sup> from micro-organisms with help of skin, various secretions and internal immunity. Any deficit in protective mechanism leads to arrival of infectious illness in human beings and it is known to be major cause of human deaths worldwide.

<sup>[2]</sup>**Concept of krumi:** These are small organisms or parasites seen at different parts of human body out of which some are pathogenic and some are non-pathogenic. Some of them are visible (*Drushya*) and some are non-visible (*Adrushya*). In general also millions of micro and macro organisms exist in universe which may or may not be harmful for human beings rather some of them are useful for human life like microbes present in gut and bacilli present on vaginal mucosa. According to Ayurveda these are classified as external pathogens or parasites, vascular pathogens, mucosal and stool related organisms. It seems to be all organisms are visible by naked eyes. Due to lack of microscopes and technology ayurveda scientist have not described microbes they were well known about it and their existence in blood is explained. Term *Bahya krimi* or *jantu* is used for lice on scalp. These organisms stood responsible for hair fall, itching, pain at scalp which denotes existence of ringworms responsible for tenia capities. These parasites should be extracted from outer part of body and also from GI tract. Causative factors should be avoided and eradication of the factors responsible for their growth and development is to be done.

<sup>[3]</sup>**Raktaj krumi** or microbes in relation with blood are vary minute and round shaped. They destroy nails, vessels, cartilages, tendons, tissues and internal organs which is suggestive of typical systemic infections and pathogenesis. These types of *krumis*/germs are probably similar to microorganisms described in allopath science.

#### **Krumigha drugs: (Germicidal agents)<sup>[4]</sup>**

**1. Pippalimool:** (Root of *Piper longum*): It is appetiser, digestive properties, it relieves abdominal pain, distension, diseases of spleen, asthma and useful in *krumi* (worm) and *kaphaj* diseases.

**2. Yavani:** (*Trachyspermum ammani*) It is appetiser; it relieves abdominal distension, diseases of spleen useful in *krumi* (worm). Extracts from *Trachyspermum ammi* seeds could be used as an effective antibacterial agent since it showed antibacterial activity against a wide range of gram positive and negative bacterial species.

**3. Dhanyak** (*Coriandrum sativum*): Useful in fever, help to increase tasting function, relieves excess thirst, vomiting, heat in body, dyspnoea, cough and *krumi*. Coriander essential oil and its components are known to exhibit wide spared and antimicrobial activity. The results of the methods showed that the essential oil of the seeds and leaves of coriander (*Coriandrum sativum* L) showed antimicrobial activity against all of the bacterial strains used in this study: *Staphylococcus aureus* (Gram-positive), with an inhibitory zone of 12.5 mm and 13.3mm, *Salmonella enterica* (Gram-negative), with an inhibitory zone of 8.16 mm and 10.6mm, *E. coli* (Gram-), with an inhibitory zones of 8.5mm and 11mm, *Vibrio cholera* (Gram-), with an inhibitory zone of 10.16 mm and 12.17 mm and *Yersinia enterocolitica* (Gram+), with an inhibitory zone of 10.33 mm and 11.33mm, respectively.

**4. Vidang** (*Emblca ribes*): It is *krumighna* and *jantunashak*, means anti helminthic as well as antimicrobial also appetiser, and helps to relive abdominal distension and pain, disease of vat and kapha.

**5. Tambaru Phal** (*Zynthophyllum acanthopodium*): It is useful for ophthalmic conditions, disease of ear, lips and cranial disease. It is also useful against *krumi*.

**6. Kutaki** (*Picrorryza kurroa*): Appetizer, laxative, useful in fever, diabetic conditions, respiratory and skin diseases and *krumi* disease. Ethanol rhizome extract of *Picrorhiza kurroa* showed high antibacterial activity against *S. aureus*, *B. cereus*, *E. coli*, *K. pneumoniae*, *S. typhi* and *S. pyogens*. The methanol rhizome extracts showed high antibacterial activity against *S. aureus* and *P. aeruginosa* whereas acetone and hexane extract showed intermediate activity against *S. aureus*, *B. cereus*, *E. coli*, *K. pneumoniae*, *S. typhi*, *P. aeruginosa* and *S. pyogens*.

**7. Kirattikta** (*Swertia chirata*): Useful in respiratory and skin, disease, oedema, fever, ulcers and *krumi*.

**8. Katuparni (Swarnkshiri)**: (*Argimone maxicana*). Is a potent purgative, nauseatic property with useful in itching, *krumi*, poisonous conditions, skin and haemolytic disorders.

**9. Dhataki**: (*Woodfordia floribunda*): It is useful to reduce excess thirst, diarrhoea, haemolytic disorders, poison sun state, *krumi* and skin rashes.

**10. Laksha** (*Laccifer lacca*): Useful in hiccough, respiratory disorders, skin ulcers and rashesh, pulmonary lesions and *krumi*.

**11. Chakramard** (*Cassia tora*): is better for heart, respiratory and skin conditions, *krumi*, itching p-125. Antimicrobial activity of Ethanol extract (0.15mg) and Aqueous extract (0.31mg) against various bacteria but maximum activity is shown by Aqueous Extract against *Staphylococcus aureus*, *Lactobacillus* and show moderate activity against *Pseudomonas aeruginosa*, *P. vulgaris* and *Enterobacter* and show less activity against *Bacillus subtilis* and *Escheria coli* But aqueous extract did not show any activity against *Salmonella typhi*.

**12. Ativisha** (*Aconitum heterophyllum*): useful in diarrhoea, poisonous state, vomiting and *krumi*. p-126 methanolic extract of it is evident from Figures 1 and 2 that extracts of *A. heterophyllum* showed significant ( $P \leq 0.05$ ) antimicrobial activity against both *Aspergillus niger* (*A. niger*) as well as *Alternaria solani* (*A. solani*). While the methanolic extract of *A. heterophyllum* has greater antifungal activity against *A. solani* as compared to *A. niger*. The maximum zone of inhibition for this plant was recorded as 2.3 cm when methanol was used as solvent.

**13. Bhallatak** (*Semecarpus anacardium*): useful in acid peptic disorders, haemorrhoids, oedema, abdominal distention and discomfort, fever and *krumi*. *Semecarpus anacardium* is significantly active against *Salmonella typhi*. The preliminary phytochemical analysis of *Semecarpus anacardium* revealed the presence of Triterpenoids, steroids, Anthraquinones and phenols which have contributed to effective antibacterial activities.

**14. Guggulu** (*Comifera mukul*): It is dyslipidemic, antidiabetic, indigestion, skin disorders, boils and benign growths, oedema, piles, cervical lymphadenopathy and *krumi*.

**15. Jatifal** (*Myristica fragrance*): is used for bad odour of mouth, offensive smell of stool, melena, worms, vomiting and respiratory symptoms.

**16. Twak** (*Cinnamomum cassia*): useful in itching, indigestion, disorders of heart, bladder, allergic rhinitis, vataj arsha and kruminashak

**17. Kunkum** (*Keshar*) (*Crocus sativum*): it is beneficial in cranial diseases, vomiting and is antimicrobial agent

**18. Mustak** (*Cyprus rhotendus*): is useful to reduce excess heat of body, reduces thirst and fever and antimicrobial drug

**19. Karchura** (*Curcuma zedoaria*): is digestive and appetiser drug and gives relief from piles, skin disorders, cough and *krumi*.

**20. Shtouneyak**: (*Clerodendrum infortunatum*): It is antiviral and antimicrobial drug useful in skin disorders.

**21. Elwaluk**: (*Prunus cerasus*): it is useful in itching, ulcers, emesis, thirst, cough, heart pain, angina, skin disease, urinary disorders, and *krumij* conditions.

**22. Guduchi** (*Tinospora cardifolia*): It is rejuvenating, appetiser, burn, diabetes, anemia, jaundice, dermatitis, fever, emesis and *krumighna*.

**23. Shyonak** (*Oroxylum indicum*): Increases taste, appetite and reduces *gulma* i.e. flatulence, piles and *krumi*.

**24. Shaliparni**: (*Desmodium gangeticum*): It improves cachexia, improves body nourishment, cures respiratory and *krumij* conditions.

**25. Arka** (*Calotropus gigantea*): cures skin disorder, itching, poison, ulcers, spleen disease, piles, ascites, worms.

**26. Kalihari/Langali**: (*Gloriosa superba*): cures skin disorder, oedema, piles, ulcers, pain, wormicidal and abortifaciating agent.

**27. Karvir** (*Nerium odorum*): helps to heal ulcers, cures conjunctivitis and skin lesions, it is a poisonous drug and also cures microbes

**28. Nimb** (*Azadirachta indica*): cures skin diseases, ulcers, piles, worms and diabetes.

**29. Paribhadra** (*Erythrina indica*): Reduces oedema, fat, worms, ear disease.

**30. Kanchnar** (*Bouhinia variegata*): Worms, skin disorders, rectal prolapse, cervical lymphadenopathy, ulcers

**31. Shigru**: (*Moringa pterygosperma*): Improves vision, cures abscess, swelling, worms, fat, benign growths, poison, spleen disorders.

**32. Nirgundi** (*Vitex negundo*): Improves hair growth and vision, relieves pain and swelling, cures skin disorders, microbes and fever

**33. Karanj** (*Pongimia pinnata/glabra*): cures diseases of female reproductive system, diabetes, piles, worms, skin diseases. (1) The seed extract completely inhibited the multiplication of HSV-1 at a concentration of 1 mg/ml w/v. Qualitative analysis of HSV-2 showed that an extract concentration of 1 mg/ml w/v could not bring

about complete inhibition and only a concentration of 20 mg/ml completely inhibited replication by HSV-2. (2) There are possibilities of incorporating mature *Karanj* seed methanolic extract in integrated pest management programmes at 5.0% concentration. Repeated application of this extract at different stages of insect development can very well take care of *H. armigera* on crop plants like cotton, etc., where it is a menace. The results demonstrate the potential of *Karanj* seed extracts for further development into a botanical insecticide against *H. armigera* under field conditions considering its effectiveness as well as ease of preparation.

**34. Gunja**: (*Abrus precatorius*): Reduces dryness of mouth, thirst, ophthalmic diseases, aphrodisiac, relieves itching and heals ulcers, cures *krumi*, alopecia, skin disease

**35. Ankot**: (*Alangium lamarckii*): is purgative, wormicidal, analgesic, anti-inflammatory, viral and poisonous conditions, allergic dermatitis, herpes zoster, rat poison

**36. Varahikanda**: (*Dioscoria bulbifera*): Increases sperm count, improves voice, skin lustre, appetite, body strength, rejuvenating agent cures worms, diabetes and skin diseases

**37. Patha** (*Cissampelos pareira*): It is analgesic, antipyretic, antiemetic, antidiarrheal, cures skin disorders, angina, burning pain, itching, poisonous state, ulcers, and antimicrobial.

**38. Danti** (*Boliospermum montanum*): Is rectal polyp, renal colic, itching, dermatitis, burn, ascites, oedema and *krumi*.

**39. Asthisanharak** (*Cissus quadrangularis*): Antimicrobial, haemorrhoids, ophthalmic disease

**40. Bhrangraj** (*Eclipta alba*): useful for hair growth, skin health, antimicrobial, respiratory diseases, inflammation, anaemia, rejuvenating, skin disease and headache. Different extracts from the aerial parts of *Eclipta alba* showed antimicrobial activity against nine microbial species. Most of the antimicrobial compounds of *Eclipta alba* are soluble in butanol and ethyl acetate. The crude methanol extract also showed effective antifungal activity, suggesting a potential use of this plant as an antifungal agent. The antimicrobial compounds present in *Eclipta alba* may serve as an affordable and new source for the treatment of infectious diseases.

**41. Meshshringi** (*Gymnema sylvestre*): Useful in diabetic, respiratory, skin conditions, ulcers, microbes, poison, appetiser disease

**42. Shankpushpi** (*Convolvulus pluricaulis*): it is rejuvenating, memory improver, skin glow, hysteric condition, skin condition, antimicrobial disease

**43. Devdali** (*Luffa echinata*): useful in piles, inflammation, anaemia, tuberculosis, respiratory disease and *krumi*.

**44. Champak** (*Michelia champaca*): It is anti-poisonous, dysuria and antimicrobial

**45. Bakul** (*Mimusops elengi*): It cures leucoderma, poisonous condition, *krumi*, dental disease

**46. Ashok:** (*Saraca indica*): It improves skin health, relieves burning pain, blood disorders, poisonous conditions and antimicrobial

**47. Shal** (*Shorea robusta*): It cures ulcers, reduces perspiration, cures deafness, abscess, female genital diseases, ear diseases.

**48. Shinshapa** (*Dalbergia sissoo*): Is anti lipidemic, cures skin conditions, leucoderma, emesis and germs and causes abortion.

**49. Beejak** (*Pterocarpus marsupium*): cures skin lesions, eryspsles, leucoderma, diabetis, rectal germs/worms

**50. Khadir** (*Acacia catechu*): Anti-lipidemic, anti-diabetic, antipyretic, cures ulcers, leucoderma, reduce edema, anemia. Antibacterial study of *Acacia catechu* shows highest inhibition is found with chloroform extracts against *P. aeruginosa*.

**51. Irimeda** (*Acacia farnesiana*): Cures disorders of oral cavity, dental conditions, cures itching, poison, germs, skin disorders, ulcers due to poisons.

**52. Babul:** (*Acacia Arabica*): cures skin disorders and germs. The methanolic fruit extracts from *Acacia arabica* inhibit the growth of gram-positive bacteria strains. The Over all, the gram-positive bacteria strains were sensitive than the gram-negative bacteria.

**53. Palash:** (*Butea frondosa*) is appetiser, aphrodisiac, ulcer healing, fracture healer, acid peptic disorders, haemorrhoides and germicidal.

**54. Shami** (*Prosopis spicigera*) is regative, cures respiratory diseases, skin disorders, piles, germs.

**56. Saptarn** (*Alstonia scholaris*) is useful in ulcers, skin lesions and microbes.

These are some of the drugs which are having *Jantughna* / *Krumighna* (wormicidal or germicidal) properties. Many of above drugs are working on multiple systems to correct systemic disturbances and for eradication of external as well as internal germs causing pathology. Specific antimicrobial action of some of above drugs has been experimentally ruled out.

1. Extracts<sup>[5]</sup> from *Trachyspermum ammi* seeds could be used as an effective antibacterial agent since it showed antibacterial activity against a wide range of gram positive and negative bacterial species.

2. Essential<sup>[6]</sup> oil of the seeds and leaves of coriander (*Coriandrum sativum* L) showed antimicrobial activity against all of the bacterial strains used in this study: *Staphylococcus aureus* (Gram-positive), with an inhibitory zone of 12.5 mm and 13.3mm, *Salmonella enterica* (Gram-negative), with an inhibitory zone of 8.16 mm and 10.6mm, *E. coli* (Gram-ve), with an inhibitory zones of 8.5mm and 11mm, *Vibrio cholera* (Gram-ve), within inhibitory zone of 10.16 mm and 12.17 mm and *Yersinia enterocolitica* (Gram +ve), with an inhibitory zone of 10.33 mm and 11.33mm respectively.

3. Ethanolic rhizome<sup>[7]</sup> extract of *Picrorhiza kurroa* showed high antibacterial activity against *S. aureus*, *B. cereus*, *E. coli*, *K. pneumoniae*, *S. typhi* and *S. pyogenes*. The methanol rhizome extracts showed high antibacterial activity against *S. aureus* and *P. aeruginosa* whereas acetone and hexane extract showed intermediate activity

against *S. aureus*, *B. cereus*, *E. coli*, *K. pneumoniae*, *S. typhi*, *P. aeruginosa* and *S. pyogenes*.

4. Antimicrobial activity of<sup>[8]</sup> Ethanolic extract (0.15mg) and Aqueous extract (0.31mg) of *Cassia Tora* against various bacteria but maximum activity is shown by Aqueous Extract against *Staphylococcus aureus*, *Lactobacillus* and show moderate activity against *Pseudomonas aeruginosa*, *P. vulgaris* and *Enterobacter* and show less activity against *Bacillus subtilis* and *Escheria coli* But aqueous extract did not show any activity against *Salmonella typhi*.

5. Methanolic extract<sup>[9]</sup> extracts of *Aconytum heterophyllum* showed significant ( $P \leq 0.05$ ) antimicrobial activity against both *Aspergillus niger* (*A. niger*) as well as *Alternaria solani* (*A. solani*). While the methanolic extract of *A. heterophyllum* has greater antifungal activity against *A. solani* as compared to *A. niger*. The maximum zone of inhibition for this plant was recorded as 2.3 cm when methanol was used as solvent.

6. *Semecarpus anacardium*<sup>[10]</sup> is significantly active against *Salmonella typhi*. The preliminary phytochemical analysis of *Semecarpus anacardium* revealed the presence of Triterpenoids, steroids, Anthraquinones and phenols which have contributed to effective antibacterial activities.

7. *Karanj* i.e. *Pongamia Pinnata*<sup>[11]</sup> seed extract is useful in many clinical conditions ulcers, antimicrobial activity, antidiarrheal activity, anti-viral and anti-plasmodia activity.

8. Local<sup>[12]</sup> use of *Neem* i.e. *Azadirachta indica* and *Haridra* i.e. *Curcuma longa* oil in diabetic, leprotic, decubitus and venous ulcers.

9. <sup>[13]</sup> Ayurveda treatment is based more on preventions process. It involves individual care care of seasonal adaptations called *rutucharya* and *dincharya*, practising yoga and diet rules. Treatment part involves use of various medicines and body purification mechanisms but outcome depends upon collective effort of preventive and active aids.

## OBSERVATIONS

- *Krumi* are the micro or macro organisms seen on or inside the human body which may or may not be harmful for body. Some of the micro-organisms which cannot be seen by naked eyes are in relation with blood and responsible for internal systemic pathology.
- Any kind of immune deficiency allows micro-organisms to cause pathology in body and formation of disease.
- *Ayurved krumighna* drugs are useful for management of parasites from gut and also work on other systems to improve their functions which ultimately help to maintain homeostasis of body. Hence they help to restore well immune state of body.
- These drugs definitely have significant antimicrobial properties but may not equally effective as modern antibiotics.

- Local and internal use of ayurvedic *krumighna* drugs in infective pathology shows complete relief from such infection
- Following ayurved lifestyle, guidelines for food, seasonal adaptations, regular exercise, yoga and meditation are having definite role in improvement of health and immune building mechanism.

### CONCLUSION

Many ayurved herbs have antimicrobial properties and their efficacy is proven against specific bacteria. Ayurveda believes use of antimicrobial drugs for strengthening the internal immune system and as well antimicrobial activity. These drugs may not direct kill the pathogens but may enhance immunity to build natural protective mechanism by maintenance of internal homeostasis.

### RESULT

Ayurved *krumighna* or *jantughna* drugs definitely have antibiotic properties but are not as effective as modern antibiotics. These ayurvedic drugs can be used with help of ayurved disease preventive measures like *Dincharya*, *Rutucharya*, *Yoga*, *diet* and good lifestyle adaptations. These concepts can be implemented in health sector to prevent antibiotic resistance like conditions.

### REFERENCES

1. Harsh M0han, Text book of Pathology, Jaypee brother medical publishers, Third edition, 1998; Chapter 6, page 191.
2. Satyanarayan Shastri cha vi 7/9-13, Choukhamba Bharati academy, revised edition, 2004; 725, 26, 27.
3. Satyanarayan Shastri cha vi 7/11, Choukhamba Bharati academy, revised edition, 2004; 726.
4. Dravyaguna vigyan, Dr. AP. Deshpande, Dr. R. R. Jawalgekar, Anamol Publication, rewised edition, 2000.
5. Shailendra Wadhwa and co authers, Antimicrobial activity of essential oils of *Trachyspermum ammani*, International Journal of Pharmaceutical and Biological Archives, 2010; 1(2): 131-133.
6. Shyamapada Mandal and co authers, Phytochemical screening and antimicrobial activity of *Picrorrhiza kurroa*, Arabian Journal of chemistry, Nov 2016; 9(2): S1307–S1313.
7. Deepti Rathi and co authers, Coriander essential oil: chemistry and biological activity, Asian Pacific Journal of Tropical Biomedicine, June 2015; 5,I, 421-428
8. Sarika Sharma and co-authors, Antibacterial activity of *Cassia tora* leaves, International Journal Of Pharmaceutical and Biological Archives, 2010; 1(1): 84-86.
9. Yoirentomba Meetei Sinam and co-authers, Antibacterial properties of *Aconitum heterophyllum* root alkaloid, International Journal of advanced research, 2014; 2(7): 839-844.
10. Zabin K.Bagewadi and co-authers ,Phytochemical screening and evaluation of antimicrobial activity of *semecarpus anacardium* nuts,International journal of Pharmocology and pharmaceutical technology, 2012; 1(2): 277-3436.
11. Pramila Ghumare and co-authers,a riview of *Pongimia pinnata*,Current research in pharmaceutical sciences ISSN 2250-2688, 2014; 04(02): 44-47.
12. Anjali Singh and co authers, effects of Neem oil and Haridra on non healing wounds,International journal in research in Ayurveda, 2014 Oct-Dec; 35(4): 398-403.
13. Ministry of Ayush Government of India website updated on 2<sup>nd</sup> June 2021.