JOURNAL OF NATURAL REMEDIES
DOI: 10.18311/jnr/2024/35148

SHORT COMMUNICATION

Exploring the Antimicrobial Efficacy of *Panchavalkala Kwatha* and *Arka*: A Comprehensive Study

G. Harikrishnan, Shara Mohan, Arunmohanan, N. V. Ramesh and E. N. Prajeesh Nath*

Department of Rasashastra and Bhaishajya Kalpana (Pharmaceuticals), Amrita School of Ayurveda, Amrita Vishwa Vidyapeetham, Amritapuri, Kollam - 690525, Kerala, India; drprajeeshnath@gmail.com

Abstract

Panchavalkala, a combination of five tree barks, is significant in *Ayurvedic* formulations as an individual ingredient and in composite preparations. These five barks are *Vata* (*Ficus bengalensis* L.), *Udumbara* (*Ficus glomerata* Roxb.), *Ashwatha* (*Ficus religiosa* L.), *Parisha* (*Thespesia populanea* Soland. *ex-Correa.*), and *Plaksha* (*Ficus lacor* Buch-Ham.). As per *Ayurveda*, *Panchavalkala Kwatha* has *vrana ropana* (wound healing) properties and is also known for its diverse properties encompassing antiseptic, anti-inflammatory, antioxidant, antibacterial, and antimicrobial attributes, rendering it valuable for wound purification and healing. This study aims to investigate the antimicrobial potential of *Panchavalkala Kwatha* (PVK) while validating its ancient *Ayurvedic* significance in wound healing. The study involves meticulously preparing *Panchavalkala Kwatha* and *Panchavalkala Arka*. *Panchavalkala Kwatha* is meticulously prepared by the guidelines stipulated in *Sharangadhara Samhita*, while *Panchavalkala Arka* (PVA) follows the principles outlined in *Arka Prakasha*. The antimicrobial activity of *Panchavalkala Kwatha* and *Panchavalkala Arka* was assessed using *Escherichia coli* and *Staphylococcus aureus* through the well-diffusion assay. *Panchavalkala Kwatha* exhibits a substantial zone of inhibition measuring 25 mm against *E. coli* and 28 mm against *S. aureus*. This antimicrobial efficacy is comparable to Ciprofloxacin's, signifying potent antimicrobial activity. In contrast, *Panchavalkala Arka* shows no inhibitory effect on microbial growth. These results underscore the robust antibacterial activity of *Panchavalkala Kwatha* against both *E. coli* and *S. aureus*, while *Panchavalkala Arka* remains inert. This research furnishes primary evidence supporting the antibacterial properties of *Panchavalkala Kwatha* against *E. coli* and *S. aureus*. These findings suggest the potential utility of this *Ayurvedic* formulation in expediting wound healing processes.

Keywords: Antimicrobial Activity, *Arka, Kwatha, Panchavalkala*

1. Introduction

In the realm of *Ayurvedic* pharmaceutics, the foundation of medicinal formulations lies in *Panchavidha Kashaya Kalpana*. These formulations, encompassing diverse preparations like *Avaleha*, *Sneha*, and *Sandhana*, were ingeniously devised by ancient scholars or *Acharyas* to address various ailments. *Kwatha Kalpana*, a pivotal component of this pharmacological tradition, is the cornerstone for creating these *Ayurvedic* remedies. The fundamental concept underlying the production of *Kwatha* lies in the recognition that a plant, in its entirety or its various constituents, may not necessarily possess the therapeutic efficacy sought for a particular ailment. Instead, it is often the case that only specific components within a plant possess medicinal value. To harness these active compounds for medicinal purposes, a medium is employed to extract them from the plant material, typically employing water as an inert universal solvent.

Among the various dosage forms within *Panchavidha Kashaya Kalpana*, *Kwatha* stands out as an efficacious and easily digestible option. Due to their intended immediate use, *Panchavidha Kashaya*

*Author for correspondence

Article Received on: 20.09.2023 Revised on: 29.11.2023 Accepted on: 13.01.2024

Kalpana formulations are often fortified with chemical preservatives such as sodium benzoate, methylparaben, and propylparaben to extend their shelf life, albeit at the risk of their known carcinogenic potential with prolonged use.

Arka Prakasha categorizes these preparations into *Kalka, Churna, Rasa, Taila,* and *Arka*, with *Arka* being esteemed as one of the most potent among them. However, using *Arka Kalpana* in *Ayurvedic* medicine remains unconventional and exceptionally rare. Some assert that it aligns more with the Unani School of Medicine than *Ayurveda*, as neither the *Vedas, Samhitas,* nor *Nighantus* mention it. Nevertheless, *Arka* finds its roots in antiquity, with *Ravana,* a figure from the *Dwaparayuga* era, providing an extensive account of *Arka* in his book, "*Arka Prakasha*". This historical context suggests that *Arka* preparations enjoyed prominence during that era. *Arka* represents a unique approach to herbal medicine, involving distilling water-soluble active ingredients and essential oils from medicinal herbs. As a water distillate, *Arka* exhibits resistance to spoilage and boasts a storage life of approximately one year. Medications in *Arka* form enhance palatability and extend their shelf life, ultimately promoting better patient compliance.

In contemporary times, the indiscriminate use of antimicrobial drugs has led to the development of resistance among microorganisms, while the associated side effects of antibiotics remain a concern. *Panchavalkala* is a compelling alternative, offering broad-spectrum antibiotic properties. Comprising five potent botanicals, namely *Vata* (*Ficus bengalensis* L.), *Udumbara* (*Ficus glomerata* Roxb.), *Ashwatha* (*Ficus religiosa* L.), *Parisha* (*Thespesia populanea* Soland. ex-Correa.), and *Plaksha* (*Ficus lacor* Buch-Ham), and as per *Ayurveda*, *Panchavalkala* K*watha* has *vrana ropana* (wound healing) properties. *Panchavalkala* embodies properties such as antiseptic, anti-inflammatory, immune-modulatory, antioxidant, antibacterial, and antimicrobial wound purification, and healing, as well as astringent characteristics[1]. This study endeavours to substantiate the scientific validity of ancient *Ayurvedic* literature and further assess the antimicrobial activity of *Panchavalkala Kwatha* (PVK) and *Panchavalkala Arka* (PVA) through agar well diffusion assays.

2. Materials and Methods

1.1 Plant Collection

The botanical components required to prepare *Panchavalkala Kwatha* and *Panchavalkala Arka* were sourced from the GMP-certified pharmacy, Amrita Life, a division of the Amrita School of *Ayurveda* situated in Kollam.

2.2 Preparation of *Panchavalkala Kwatha* (PVK)

The production of *Panchavalkala Kwatha* (PVK) followed the established protocol detailed in the *Sharangadhara Samhita*[2]. The barks of *Panchavalkala* were meticulously gathered, dried, and then pulverized to yield a coarse powder. As outlined, all the specified ingredients were carefully placed into a stainless-steel vessel. Subsequently, 200 ml (approximately 6.76 oz) of water, sufficient for soaking the herbal components for three hours, was added to the vessel. Following this initial step, an additional 1600 ml (about 54.1 oz) of water (equivalent to 16 parts) was introduced, and the mixture was gently heated while continuously stirring without covering the vessel's mouth. The reduction process continued until the volume decreased to 1/8 of its original quantity (200 ml). The contents were meticulously filtered through a clean cotton cloth at this juncture. The resulting *Panchavalkala Kwatha* (PVK) was then carefully transferred to a stainless-steel container and stored in a clean, airtight receptacle while the residue was appropriately disposed of (Figure 1) (Table 1).

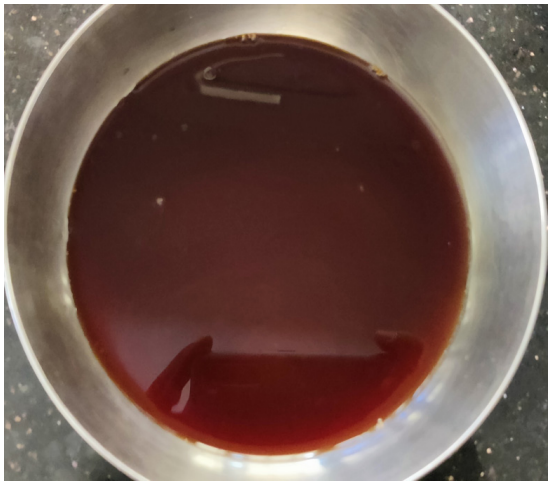

Figure 1. An image of *Panchavalkala Kwatha* (PVK).

Table 1. Ingredients of *Panchavalkala Kwatha* (PVK) and *Panchavalkala Arka* (PVA)

S. No.	Ingredients	Latin name	Parts used	Uses	*Panchavalkala Kwatha*	*Panchavalkala Arka*
1	*Vata*	*Ficus bengalensis* L.	Bark	Antidiabetic activity Antioxidant activity Antibacterial activity	20g	20g
2	*Udumbara*	*Ficus glomerata* Roxb.	Bark	Immunomodulatory activity Hypoglycemic activity Antimitotic activity Gastroprotective activity	20g	20g
3	*Ashwatha*	*Ficus religiosa* L.	Bark	Anti-viral activity Antioxidant activity Anti-inflammatory activity Analgesic activity Antibacterial activity Antifungal activity	20g	20g
4	*Parisha*	*Thespesia populanea* Soland. Ex Correa.	Bark	Anti-inflammatory activity Analgesic activity Antipyretic activity	20g	20g
5	*Plaksha*	*Ficus lacor* Buch-Ham	Bark	Antidiabetic activity Anti-inflammatory activity	20g	20g

2.3 Preparation of Panchavalkala Arka (PVA)

The preparation of *Panchavalkala Arka* (PVA) was conducted following the general method outlined in the *Arka Prakasha*[3]. Raw materials were meticulously placed within a stainless-steel container, adhering to the quantities specified. Subsequently, ten times the volume of water required for soaking was added, and the mixture was allowed to soak overnight (Table 1).

The following day, the preparation was transferred to the distillation apparatus, where a condenser was connected, and the system was heated using a heating mantle. The heating process commenced with an initial temperature of 80°C, causing the contents to reach a boiling point. Once this was achieved, the temperature was lowered to a consistent 60°C, which was maintained throughout the distillation process. Approximately 80 minutes into the process, *Panchavalkala Arka* (PVA) began accumulating in the apparatus's receiver part. The initial 20 ml (about 0.68 oz) were discarded, as they might not have contained any volatile material. The heating was discontinued after collecting the second-third of the distillate, equivalent to 600 ml (about 20.29 oz). The resulting *Panchavalkala Arka* (PVA) was then carefully transferred into a fresh glass bottle for storage (Figure 2).

Figure 2. An image of *Panchavalkala Arka* (PVA).

2.4 Analytical Study

The pharmaceutical preparation and organoleptic characteristics of the prepared *Panchavalkala Kwatha* (PVK) and *Panchavalkala Arka* (PVA) were evaluated. The results of the study are shown in (Table 2 and Table 3).

Table 2. Pharmaceutical study

S. No.	Observations	*Panchavalkala Kwatha* (PVK)	*Panchavalkala Arka* (PVA)
1	Total quantity of drugs taken	100 g	100 g
2	Quantity of water added	1600ml	1000 ml
3	Quantity obtained	200ml	600 ml
4	Quantity of reduction	1400ml	400ml
5	Total time taken	2.23 hours	4.05 hours
6	Total yield	12.5 %	60%

Table 3. Organoleptic characters of *Panchavalkala Kwatha* (PVK) and *Panchavalkala Arka* (PVA)

S. No.	Organoleptic characters	*Panchavalkala Kwatha* (PVK)	*Panchavalkala Arka* (PVA)
1	Colour	Deep brown	Colourless
2	Taste	Bitter	Slightly bitter
3	Odor	Aromatic	Aromatic
4	State	Liquid	Clear liquid

2.5 Antimicrobial Study

2.5.1 Microorganisms

The antibacterial activity of the sample was assessed against the specified organisms listed below.

Escherichia coli (Gram-negative)

Staphylococcus aureus (Gram-positive)

2.5.2 Culture Medium

Mueller Hinton agar was employed as the culture medium, with the following composition.

Beef infusion (300g/lit)

Casein acid hydrolysate (17.5g/lit)

Starch (1.5g/lit)

Agar (17g/lit)

The final pH was adjusted to 7.3±0.1 at 25°C.

Culture Conditions: To conduct the antibacterial tests, 24-hour-old cultures of the specified organisms were first inoculated onto sterile nutrient agar media plates. Using the spread plate method, the plates were then inoculated with the test microorganisms (bacteria). Agar wells, approximately 10mm (about 0.39 in) in diameter, were created in the plates. The sample under test was introduced into the respective wells.

2.5.3 Antimicrobial Assay

Prepare nutrient agar media plates and inoculate plates with the test microorganism (bacteria) by spread plate method. Make agar wells of approximately 10mm (about 0.39 in) in diameter and fill them by adding the sample under test to the concerned wells. Each well should be placed so that the added drug's antibacterial zone is easily visible on the agar surface and distributed evenly so that they are no closer than 24 mm (about 0.94 in) from each other, centre to centre. Add the *Panchavalkala Kwatha* (PVK), *Panchavalkala Arka* (PVA) and ciprofloxacin samples to the respective wells and mark them properly. Incubate the plates under test for 24 hours at 37°C inside a bacteriological incubator. After incubation, examine all plates under test. The resulting inhibition zones will be uniformly circular with a confluent growth lawn. Measure the diameters of the zones of complete inhibition, including the control zone's diameter. The experiment was not repeated (the experiment was not done in triplicate).

3. Results and Discussion

In the antimicrobial assay conducted on samples of *Panchavalkala Kwatha* (PVK) and *Panchavalkala Arka* (PVA) using the good diffusion method on Mueller Hinton agar, with ciprofloxacin serving as the positive control, the following results were obtained and against *E. coli*, *Panchavalkala Kwatha* (PVK) exhibited a substantial zone of inhibition measuring 25 mm (about 0.98 in), which is on par with the antimicrobial efficacy of ciprofloxacin - against *S. aureus*, *Panchavalkala Kwatha* (PVK) displayed an impressive zone of inhibition measuring 28 mm (about 1.1 in), akin to the potency observed with ciprofloxacin. In contrast, *Panchavalkala Arka* (PVA) showed no discernible antimicrobial effect against either *E. coli* or *S. aureus* (Figure 3 and Figure 4) (Table 4).

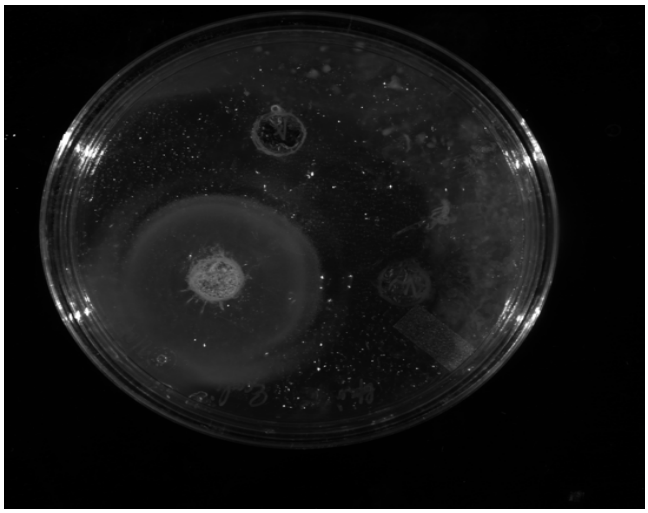

Figure 3. Antibacterial activity of *Panchavalkala Kwatha* (PVK), *Panchavalkala Arka* (PVA), and Ciprofloxacin against *E. coli*.

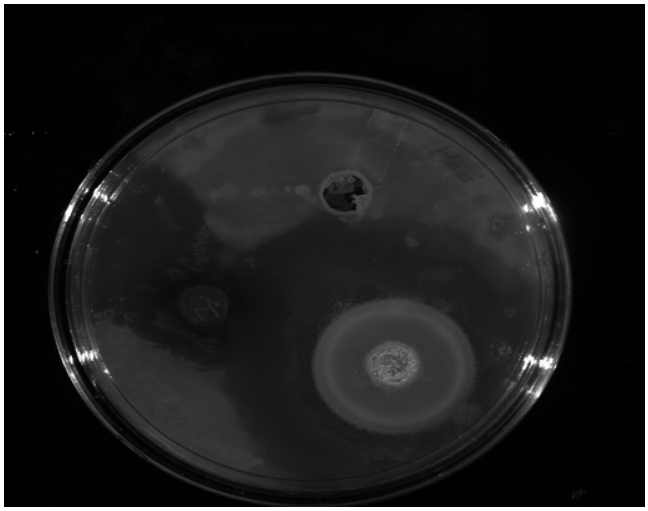

Figure 4. Antibacterial activity of *Panchavalkala Kwatha* (PVK), *Panchavalkala Arka* (PVA), and Ciprofloxacin against *S. aureus*.

These results collectively highlight the robust antibacterial activity of *Panchavalkala Kwatha* (PVK) against both gram-negative and gram-positive bacteria, underscoring its potential as a potent antimicrobial agent. Conversely, *Panchavalkala Arka* (PVA) demonstrated no such effect, emphasizing the distinct contrast in efficacy between the two formulations (Table 4).

Considering the results obtained, several key aspects emerge in the discussion of Panchavalkala Kwatha (PVK) and its potential therapeutic applications.

Table 4. Antimicrobial activity of *Panchavalkala Kwatha* (PVK) and *Panchavalkala Arka* (PVA) against *S. aureus* and *E. coli*

Organisms	*Panchavalkala Kwatha* (PVK)	*Panchavalkala Arka* (PVA)	Ciprofloxacin
S. Aureus	28mm	zero	41mm
E. coli	25mm	zero	34mm

3.1 Alternative to Iodine-based Antiseptics

Given the intolerance of some patients to iodine-containing antiseptics like Betadine (Povidone Iodine), *Panchavalkala Kwatha* (PVK) can serve as a viable alternative. *Panchavalkala* cream has demonstrated its ability to efficiently reduce microbial load, clinically manage infections, expedite wound debridement, and can be recommended to treat chronic nonhealing wounds[1].

3.2 Plant-based Medicine for Antibiotic Alternatives

As concerns about drug resistance and side effects of conventional antibiotics continue growing, plant-based medicines are gaining prominence as an alternative therapeutic approach. *Panchavalkala Kwatha* (PVK) stands as a representative example of this new avenue in therapy.

3.3 Anti-inflammatory Properties

Panchavalkala Kwatha (PVK) is believed to possess potent anti-inflammatory properties. This makes it a valuable option for managing various inflammatory conditions, including arthritis, joint pain, and swelling. The synergistic combination of the five herbs within *Panchavalkala Kwatha* (PVK) works together to mitigate inflammation and alleviate associated discomfort[4,5].

3.4 Antioxidant Activity

Many Ficus species, including those present in *Panchavalkala*, have been studied for their antioxidant potential. These plants contain various bioactive compounds, such as flavonoids, phenolic compounds, carotenoids, and vitamins, which exhibit antioxidant properties. This ability to neutralize harmful free radicals can safeguard cells from oxidative damage[6-8].

3.5 Enhanced Wound Healing

Panchavalkala ointment, being herbal-based and effective as an antimicrobial agent, enhances wound healing[9]. Its application can lead to clinical benefits in the context of wound management.

3.6 Immune Support

Some of the herbs found in *Panchavalkala Kwatha* (PVK) are believed to boost the immune system, aiding the body in fighting infections and promoting overall health[10].

3.7 Efficacy and Safety

Panchavalkala Kwatha (PVK), combined with five barks, has demonstrated its efficiency in healing properties, substantiated by research. Notably, it presents itself as a safe and easily prepared herbal remedy. In a landscape where traditional antibiotics face challenges like resistance and side effects, *Panchavalkala Kwatha* (PVK) is a noteworthy traditional *Ayurvedic* medicinal formulation[11,12]. This study underscores the substantial antimicrobial effect of *Panchavalkala Kwatha* (PVK), further supporting its potential as a valuable therapeutic option in various medical scenarios.

3.8 Discussion of Panchavalkala Arka (PVA) and its Potential Therapeutic Applications

Panchavalkala Arka, a colourless and odourless liquid derived from five specific trees, contains natural compounds with properties described in *Ayurvedic* texts. Its *Katu* (pungent), *Tikta* (bitter), *Kashaya* (astringent) tastes, along with *Laghu* (light), *Ruksha* (dry), *Teekshna* (sharp), and *Ushna* (hot) qualities are believed to have wound healing (*Vranashodhana*), tissue restoration (*Ropana*), and anti-itching (*Kandughna*) properties, among others - these attributes, along with identified phytochemicals in. *Panchavalkala Arka* (PVA), suggest its potential for therapeutic applications in maintaining vaginal health. *Panchavalkala Arka* (PVA) holds promise as a potential natural remedy for addressing vaginal discomfort and abnormal discharge associated with Candida albicans. Its observed inhibitory effects on fungal growth, along with its natural composition and traditional therapeutic properties, make it an appealing alternative to chemically prepared vaginal washes[13]. However, further research, including clinical studies, would be beneficial to validate its efficacy and safety for practical applications in addressing vaginal health concerns.

4. Conclusion

Based on the study's results, it can be inferred that *Panchavalkala Kwatha* (PVK) exhibits substantial antimicrobial efficacy against both gram-positive and gram-negative bacteria. This highlights its potential as an effective antimicrobial agent. *Panchavalkala Arka* (PVA) was found to lack antimicrobial activity against the tested bacteria. These findings suggest that *Panchavalkala Kwatha* (PVK) may hold promise for wound healing. It can be an alternative to iodine-containing antiseptics like Betadine, which can trigger hypersensitivity reactions in certain patients. *Panchavalkala Kwatha* (PVK) may find utility in wound irrigation. It's important to recognize that this study serves as a preliminary investigation. To substantiate *Panchavalkala Kwatha's* (PVK) efficacy in wound healing, further research, including *in vivo* and clinical studies, is imperative[14].

In conclusion, this study contributes to our comprehension of *Ayurvedic* remedies within the context of wound healing. It serves as a foundational step, offering insights for future research and the potential development of innovative therapeutic approaches. The study underscores the significance of exploring traditional medicinal systems, such as *Ayurveda,* in contemporary healthcare practices.

5. Acknowledgement

The authors would like to thank Sailaja M. for providing valuable guidance throughout our study.

6. References

1. Bhat K, Vishwesh BN, Sahu M, Shukla VK. A clinical study on the efficacy of *Panchavalkala* cream in *Vrana Shodhana* w.s.r to its action on microbial load and wound infection. Ayu. 2014; 35(2):135. https://doi.org/10.4103/0974-8520.146216 PMid:25558157 PMCid: PMC4279318
2. Srivastava S, Sharngadhara Samhita. Ch. 2. Varanasi: Chaukhambha Orientalia;. Madhayam Khand. Reprint edition. 2009. p. 135.

3. Ravana, Indradev Tripathy. Arkaprakasha.2nded. Varanasi: Chowkamba Sanskrit, Series, 2006. Chaturpada 34-35.
4. Patil V, Pimprikar R, Patil V. Pharmacognostical studies and evaluation of the anti-inflammatory activity of *Ficus bengalensis* Linn. Journal of Young Pharmacists. 2009; 1(1):49. https://doi.org/10.4103/0975-1483.51879
5. Vasudevan M, Gunnam KK, Parle M. Antinociceptive and anti-inflammatory effects of *Thespesia populnea* bark extract. Journal of Ethnopharmacology. 2007; 109(2):264–70. https://doi.org/10.1016/j.jep.2006.07.025 PMid:16949778
6. Manian R, Anusuya N, Siddhuraju P, Manian S. The antioxidant activity and free radical scavenging potential of two different solvent extracts of *Camellia sinensis* (L.), *O. Kuntz*, *Ficus bengalensis* L. and *Ficus racemosa* L. Food Chemistry. 2008; 107(3):1000–7. https://doi.org/10.1016/j.foodchem.2007.09.008
7. Preethi RC, Devanathan V, Loganathan M. Antimicrobial, and antioxidant efficacy of some medicinal plants against foodborne pathogens. 2010.
8. Sharma RK, Chatterji S, Rai DK, Mehta S, Rai PK, Singh RK, *et al*. Antioxidant activities and phenolic contents of the aqueous extracts of some Indian medicinal plants. Journal of Medicinal Plants Research. 2009; 3(11):944-8.
9. Kulkarni AM. Comparative clinical study of *Panchavalkal* ointment and Framycetin Sulfate cream (local application) in the management of infected wound wrt *Dushta Vrana*. Journal of Advanced Research in *Ayurveda*, Yoga, Unani, Siddha and Homeopathy. 2020; 6(3 and 4):17–24. https://doi.org/10.24321/2394.6547.201910
10. Dhiman K. *Leucorrhoea* in *Ayurvedic* literature review. Ayurpharm Int J Ayur Alli Sci. 2014; 3(3):73–8.
11. Shri Bhavamishra, Bhavaprakasha. Ch. 5. Varanasi: Chaukambha Sanskrit Bhawan; 2013. Madhya Khanda. Part II. Reprint; p. 66.
12. Shastri SN. Ch. 47. Varanasi: Chaukhambha Sanskrita Sansthan; 2009. Bhaishjya Ratnavali. Reprint edition; p. 819, 822.
13. Deepthi GB, Bhat NVG. Management of *Kaphaja Yoni Vyapat* by *Panchavalkala Arka* w.s.r to vulvovaginal candidiasis - A case report. Ayushdhara. 2021. p. 3261–9. https://doi.org/10.47070/ayushdhara.v8i3.708
14. Pareek A. A Study of anti-microbial activity of *Panchvalkal Kwath*. International Journal of *Ayurveda* and Pharma Research. 2022. p. 55–7. https://doi.org/10.47070/ijapr.v10i5.2380