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Panchavalkala as a Potential Microbiome-preserving Agent for Recurrent Vulvovaginal Candidiasis: A Narrative Review

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Abstract

Background: Vulvovaginal candidiasis, described in *Ayurveda* as *Slaishmiki Yoni Vyapat*, has been a frequent health issue worldwide due to recurrent *Candida albicans* infections and rising resistance to antifungal agents. *Panchavalkala* is a classical five-bark preparation (*Nyagrodha, Udumbara, Ashvatha, Parisha,* and *Plaksha*) that has been traditionally used as a wound-cleansing (*Vrana Shodhana*), wound-healing (*Vrana Ropana*), and antimicrobial (*Krimighna*) agent. **Aim:** To critically review *in vitro*, preclinical, clinical, and classical *Ayurvedic* evidence to determine the antifungal capabilities, safety profile, and the mechanism of *Panchavalkala* in the treatment of vulvovaginal candidiasis and to evaluate its translational implications and gaps in existing evidence. **Methods:** This narrative review combines experimental, clinical, and classical *Ayurvedic* data on *Panchavalkala* for vulvovaginal candidiasis, as well as *in vitro* antifungal research and descriptions of *Yoni Vyapada*. A structured narrative search of PubMed, Scopus, AYUSH Research Portal, and Google Scholar (2000-2025) was conducted with the following keywords: *Panchavalkala*, *Candida albicans*, vulvovaginal candidiasis, antifungal activity, *Yoni Vyapada* and *Shwetapradara*. The studies were chosen for their relevance and methodological credibility across *in vitro*, preclinical, clinical, and classical sources, while results were interpreted based on *Ayurvedic* principles, such as *Kashaya Rasa, Kapha-Pitta Shamaka*, and *Vrana Shodhana/Ropana*. **Results:** *Panchavalkala* exhibits dose-dependent antifungal effects against *C. albicans* (13-25 mm inhibition zones) in *in vitro* research. There is limited clinical evidence, mainly case reports and small series, indicating that it is associated with symptomatic improvement and minimal adverse effects. Phytochemicals, such as tannins and flavonoids, could play a role in antifungal and anti-inflammatory effects. **Conclusion:** *Panchavalkala* shows promising antifungal activity and may serve as a potential microbiome-preserving agent; however, current evidence is largely preclinical and lacks clinical validation. Well-designed randomised controlled trials are required to confirm efficacy, safety, and microbiome-specific effects before routine clinical application.

Major Finding: *Panchavalkala* demonstrates promising synergistic antifungal activity against *C. albicans* (13-25 mm ZOI) versus individual barks, with potential microbiome-preserving effects on the vaginal microbiome for recurrent vulvovaginal candidiasis treatment.

Keywords: Antifungal Activity, *Ayurvedic* Pharmacology, *Candida albicans*, Herbal Antimicrobials, Vaginal Infections, *Vrana Ropana, Yoni Vyapada*

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1. Introduction

Vulvovaginal candidiasis, described in *Ayurveda* as *Slaishmiki Yoni Vyapat* (*kapha*-dominant vaginal disorder), is one of the most prevalent gynaecological infections worldwide and affects approximately 75% of women at least once during their childbearing age. About 40–45% experience two or more episodes, while 5–8%

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develop recurrent infections[1]. The primary pathogen, *Candida albicans*, favours growth when the vaginal flora becomes imbalanced due to antibiotic use, endocrine imbalance, diabetes, pregnancy, or immunosuppression[2]. These factors relate to the *Ayurvedic* principles of hormonal imbalance (*dosha vaishamya*), disturbed vaginal environment (*yoni gata agni vikriti*), and obstruction of microchannels (*srotorodha*)[3]. While there has been significant progress in antifungal pharmaceuticals in modern medicine, the emergence of high recurrence rates and azole resistance, as well as side effects, necessitates alternative or complementary approaches that integrate traditional therapeutics with state-of-the-art microbiological perspectives[4].

Vaginal infections as part of the wider diagnoses of *Yoni Vyapada* (gynaecological disorders) are treated in *Ayurveda* with formulations that suggest a more gynaecological-based approach to female health than may be treated under collaborative vaginal infections in the West under vulvovaginal candidiasis or bacterial vaginosis[5]. In *Ayurveda*, causation occurs through a *Kapha dosha* imbalance, which is further aggravated by excess moisture and a lack of local immunity. *Shwetapradara* excess *shweta* (whitevaginal discharge) is the condition (symptomology, thick discharge, itching, inflammation and pain) connected with vulvovaginal candidiasis[6]. Therefore, classical authorities who are interested in formulation development based on long-term empirical observation have determined that these formulations are more likely to restore *dosha* homeostasis, cleanse specific tissues, and reduce pathogen overgrowth without impacting physiological flora. This therapeutic interest is highly relevant to modern microbiome-safe interventions[7].

The comparative uniqueness of *Panchavalkala* is that it is a 5-bark formulation. The other formulations presented have been used and proven, for generations, to be effective treatments for female reproductive issues[8]. The formulation includes *Nyagrodha, Udumbara, Ashvatha, Parisha and Plaksha*. It has been used as a strong *kashaya rasa* (astringent) and medicinal food for female-based issues since it acts upon both *Kapha* and *Pitta doshas*[9]. In addition, it is cited as a wound cleanser and a restorative cleanser with anti-inflammatory and antiseptic properties, as well as palliative effects on discharge, itch, burning, and inflammation associated with wounds, urogenital issues, and general swelling[10].

Panchavalkala has been used for centuries to treat inflammatory infections, but only recently have studies and explorations examined its response to contemporary findings, such as vulvovaginal candidiasis[11]. For example, one study reports that *Panchavalkala* is effective in treating *C. albicans* (vulvovaginal candidiasis), with inhibition zones ranging from 13 to 25 mm depending on the concentration of *Panchavalkala*[12]. It also notes that *Panchavalkala* might be effective in inhibiting the harmful fungus while leaving the beneficial bacteria of the female vaginal microbiome alone, an important consideration, as modern findings support *Ayurvedic* observations with *prakritisthapana* and *dhatu avarana nivritti*, since many antifungal medications eliminate both beneficial and harmful bacteria, which can increase recurrence[13].

The mechanism by which this occurs is also relevant through the assessment of *Panchavalkala* and its constituent active agents. *Panchavalkala* is high in tannins, saponins, flavonoids, phenols, and triterpenoids[14]. Tannins exert a tightening effect on tissues, thus supporting a *stambhana* approach. Tannic flavonoids also deter fungal adhesion/biofilm formation, supporting proper dosha balance. Anti-inflammatory properties support the credibility of *shothahara*. Antioxidants confer *rasayana* properties, enabling agents to maintain tissue strength and elasticity/wilfulness with age. In contrast, tannins and saponins reduce fungal growth through their antifungal activity and minimise pro-inflammatory and devastating effects by promoting local immunity[15]. Not many agents provide such a range of constituents working harmoniously together, save for the *Panchavalkala* here[16].

Biomedical findings reported so far are reassuring, even as larger clinical data become available. For example, women who suffer from or commonly experience itching, discharge, burning, and discomfort oftentimes report favourable supportive efforts with *Panchavalkala praśālan* or decoction creation with little systemic adverse events/toxicity as noted[17]. This aligns with clinically documented applications of *Ayurveda*, where conditions such as *Shwetapradara*, *Kaphaja Yoni Vyapada, vrana*, and inflammation have been noted. The fact that it comes from bibliographic and clinical reports only further solidifies the reliability of *Panchavalkala* for clinically applicable purposes[18].

Most active constituents have one action, and *Panchavalkala* possesses two: antimicrobial function and *vrana ropana*/tissue remodelling (healing and protection). The more studies that emerge on *panchavala* and *Ayurveda's* recommendations for *yoni shuddhi* and *yoni swasthya*, the more reasonable it becomes to embrace them as a viable intervention to reduce recurrent candidiasis[19]. With its antimicrobial and immune-modulating properties, *Ayurvedic* treatment offers a synergistic effect that few other allopathic interventions can match. *Vrana ropana* properties support it as it creates a tissue-moulded functional advantage against chronic problems[20].

Finally, a note on antifungal resistance is warranted. As azole (fluconazole) resistance increases worldwide, sustainable treatment options become more needed. Since *Panchavalkala* has independent active constituents and varied action mechanisms, it can serve as a possible adjunct or alternative when intolerance or resistance to other treatments is present[21]. Thus, this reflects *Ayurveda's* ancient understanding of formulations as *yoga dravya samyoga*, since *Panchavalkala* is composed of multiple parts that serve different purposes, something the modern mind is increasingly struggling to comprehend[22]. Finally, the potential adjunctive use of *Panchavalkala* topical application, or its use in conjunction with antifungals, creates cumulative benefits by allowing for de-escalated doses and fewer adverse events[23]. This is because the adjunctive use of gel-based formulations can reduce the need for them. The presence of tannins creates the potential for subsequent pharmaceutical-based formulations (gel, ovules, wash, irrigation solution) that appear modern but stem from *Ayurvedic kwatha, lepana*, and *yoni prakshalana*, gynaecological-specific findings[24].

However, many more gaps remain. For example, dosage, standardisation of use, safety in pregnant populations, systemic metabolism and efficacy of *Panchavalkala*, limited data regarding time-based targets. Furthermore, the mechanism of action remains questionable. For example, what is responsible for the bioactive components of *Panchavalkala*? Ergosterol pathway inhibition, anti-persistence, morphological changes, obstruction, and immune response?

Furthermore, how does this relate to *Ayurveda* through *gunas, virya*, and *vipaka*? How does this impact interdisciplinary research down the line? Such questions could reveal novel pharmacological avenues. Thus, this review integrates therapeutic *Ayurvedic* knowledge, laboratory studies, and clinical findings across all levels to identify where current research surpasses what should make *Panchakarma* a microbiome-friendly, dynamic treatment for female health. Thus, this study aims to demonstrate that ancient and modern medicine are not in conflict, but rather act symbiotically to support patient care and translational medicine across cultures and interdisciplinary fields, thereby fostering safe advancements.

2. Literature Search

Sharma and Chaturvedi provided an early clinical overview of *Panchavalkala*, demonstrating its wound healing (*Vrana Ropana*), anti-inflammatory (*Shothahara*), and antimicrobial (*Krimighna*) properties across dermatological and gynaecological conditions. However, the study was largely descriptive and lacked specific antifungal evaluation, highlighting the need for focused antifungal research[25]. Experimental results indicated dose-dependent antimicrobial activity of *Panchavalkala* preparations against *C. albicans, E. coli*, and *S. aureus*, with higher concentrations exhibiting greater inhibitory effects and uniform antifungal activity despite small compositional changes Ranjan *et al*[26].

Later, Gupta *et al*., tested an *Ayurvedic* antimicrobial vaginal suspension in animals and found that it had acceptable acute and chronic toxicity profiles with minimal vaginal irritation, further supporting the safety of polyherbal strategies for mucosal use[27]. Dhurve and Dudhamal highlighted the classical *Ayurvedic* use of *Panchavalkala* in wound cleansing (*Vrana Shodhana*) and healing (*Vrana Ropana*), especially in diseases involving mucous membranes, which require a gentle yet effective therapeutic action[28]. Jadhav *et al*., also put *Panchavalkala* into context with the *Ayurvedic* concept of *Slaishmiki Yoni Vyapat*, comparing it to vulvovaginal candidiasis and determining it as a potentially effective antifungal formulation based on its traditional indications[29]. Most recently, Agrawal and Khatri performed *in vitro* culture-sensitivity experiments on *Panchavalkala* decoction (*kwath*) for leucorrhoeal samples, where antimicrobial activity was uniform, and

the five-bark formulation exhibited better activity than its constituent parts[30].

Together, the available literature indicates the potential of *Panchavalkala* for antifungal and antimicrobial use. However, evidence is mostly restricted to *in vitro* studies, preclinical models, and smaller-scale or descriptive clinical reports. There is still a need for robust randomised controlled trials and standardised clinical trials to determine its efficacy and safety, as depicted in Table 1.

3. Materials and Methods

This narrative review critically integrates experimental, clinical and classical *Ayurvedic* data on antifungal and antimicrobial activity of *Panchavalkala* in the treatment of vulvovaginal candidiasis.

3.1 Data Collection

The relevant literature was identified through a systematic search of peer-reviewed articles, clinical reports, and classical *Ayurvedic* texts across major databases, including PubMed, Scopus, the AYUSH Research Portal, and Google Scholar. The search cutoff included 2014-2023, covering both the background and recent evidence.

The search strategy involved predefined keywords and Boolean operators, such as: *Panchavalkala* AND *Candida albicans*, vulvovaginal candidiasis AND antifungal activity, herbal antifungal AND *Ayurveda, Yoni Vyapada* or *Shwetapradara* and *Ficus* species AND antimicrobial. These terms were used both separately and in combination to ensure that as many relevant studies as possible were retrieved. Reference lists were also manually screened to ensure that all relevant literature was included.

3.2 Selection Criteria

3.2.1 Inclusion Criteria

Studies comparing antifungal or antimicrobial effects of *Panchavalkala* or its components against *C. albicans* or vaginal pathogens; preclinical and clinical safety/toxicity reports of *Ayurvedic* formulations with potential vaginal application; literature about *Ayurvedic* traditional use, and pharmacological effects of *Panchavalkala* on vaginal conditions.

Table 1. Summary of key literature on *Panchavalkala* in antimicrobial and gynaecological research[25-30]

Key Findings	Focus Area	Limitations	Future Scope	Article Type	References
Demonstrated wound healing (*vrana ropana*), anti-inflammatory (*shothahara*), and antimicrobial (*krimi hara*) actions across dermatological and gynaecological disorders.	Clinical overview of *Panchavalkala* applications.	Broad narrative; no specific antifungal data.	Focused antifungal trials.	Review	25
Dose-dependent inhibition (13–30 mm) against *C. albicans*, *E. coli*, and *S. aureus*; similar to griseofulvin.	*In vitro* testing of two *Panchavalkala* variants.	Methanolic extracts only; lacks clinical correlation.	Aqueous extracts and clinical studies.	Original Research	26
Ayurvedic vaginal formulation is safe in acute/chronic toxicity, with minimal irritation.	Safety assessment of polyherbal antimicrobial formulation.	Animal-only evaluation; indirect link to *Panchavalkala*.	Human safety trials; formulation refinement.	Original Research	27
Documented *Panchavalkala* formulations are effective for wound cleansing (*vrana shodhana*) and healing (*vrana ropana*).	Classical formulations and dosage forms.	Limited experimental evidence.	Clinical testing for vaginal use.	Review	28
Correlated *Slaishmiki yoni vyapat* with candidiasis; listed *Panchavalkala* as a therapeutic option.	Review of *Ayurvedic* remedies for vaginal candidiasis.	Indirect reference; no specific evaluation.	*Panchavalkala*-specific antifungal validation.	Review	29
Panchavalkala kwath showed the most potent inhibition (≈21 mm) on *Shwetapradara* vaginal swabs, superior to individual barks.	*In vitro* culture-sensitivity on leucorrhoea samples.	*In vitro* only; needs clinical confirmation.	RCTs on *yonipra kshalana* for candidiasis.	Original Research	30

Note: Evidence on antimicrobial, antifungal, and gynaecological applications of *Panchavalkala*, showing a trend from classical reviews to *in vitro* validation for vulvovaginal candidiasis.

3.2.2 Exclusion Criteria

Non-peer-reviewed articles, anecdotal articles that were not scientifically verified, articles that were not related to the topic of vulvovaginal candidiasis, and articles whose methodology was not well described or were unavailable in full text.

3.3 Data Extraction and Synthesis

Data on antifungal efficacy (zone of inhibition, dose–response), phytochemical composition, safety profiles, and clinical outcomes were systematically extracted and qualitatively synthesised. Findings were interpreted through an integrative framework correlating phytochemical mechanisms with *Ayurvedic* pharmacodynamics, including *dosha* modulation and *Vrana Shodhana/Ropana*.

3.4 Limitations

As a narrative review, formal systematic protocols and meta-analytical methods were not applied, limiting quantitative generalisability. Heterogeneity in study design, extraction methods, and dosage regimens further limits direct comparability.

4. Results

4.1 Classical Indications for *Yoni Vyapada* Gynaecological Disorders

The *Ayurvedic* classics outline *Panchavalkala* as a primary intervention for *yoni vyapada*, targeting *kapha-dominant* pathologies through its quintet of astringent barks unified by *kashaya rasa and ruksha guna*. *Bhavaprakasha Nighantu* places this formulation within the *Vatadi varga* for *stambhana* and *grahi*, hence serving as the drug of choice for *shwetapradara* (leucorrhoea), wherein the *kapha avarana* gives rise to *visrishta* and *yonikandu*[31]. Furthermore, the *Sharangadhara Samhita* recommends its *kwatha* for *yoniprakshalana* to restore *artava margashuddhi*. At the same time, Sushruta prescribes *lepa* in *aticharana yoni vyapada*, or chronic or recurrent infections that act against *daha* through *vrana shodhana*[32].

In the management of *kaphaja yoni vyapada*, excessive mala *strava* or secretory discharge shares symptoms of vulvovaginal candidiasis. *Pichu* or tampon therapy has been recommended for *karnini yoni vyapada* or cervical pathology with discharge by *Vagbhata* in *Ashtanga Hridaya*, using *raktaprasadana* or blood purification to balance the yoni dhatu or vaginal tissues[33]. This selective pacification of *kaphapitta* dosha prevents dysbiosis and allows endogenous healing, distinctly differentiating *Panchavalkala* from an indiscriminate purgative. Its *sheetala virya* or cooling potency addresses the recurrent *slaishmiki yoni vyapada* or fungal vaginal disorders uniquely by way of precision therapeutics based on restoration of *prakriti* rather than mere symptom suppression[34].

4.2 *In vitro* Antifungal Activity Against *Candida albicans*

Agar well diffusion assays demonstrate the effectiveness of *Panchavalkala* against *Candida* when tested with methanolic extracts. Clear, expanding zones of inhibition are observed as the active biodynamic agents permeate the fungal medium and exert their effect at increasing concentrations[35]. This is a dose-dependent relationship, not only to manifestation at low doses but also to nearly 100% realized inhibition, akin to pharmaceuticals. This occurs as a result of the polyphenol gradation of the bark decoction. As far as aqueous *kwath*, it exceeds expectations more so than its individual constituent herbs, meaning that when compounded, it works as a single treatment; it is the strongest synergy[36]. Furthermore, it is a selective agent. Where synthetic azoles typically act on a single enzyme at a time, *Panchavalkala* targets *Candida* on multiple fronts: it inhibits hyphal and biofilm growth, and hydrolyzable tannins bind the glycoproteins of the cell wall, precipitating the membrane fluidity sought via flavonoids. This does not rely on ergosterol[37].

Furthermore, compounding this attack only makes it harder for the fungus to gain resistance - it is not aimed at one means, but instead, attacked from all directions. This is also true for *Lactobacilli*. This is important, as the *Ayurvedic* tenets state that *krimi hara* action: the villain must die, but the good ones must live[38]. This means that the acid produced by *Lactobacillus* proliferation can continue as intended, maintaining a healthy vaginal niche. Where broad-spectrum options kill everything and exacerbate the chances of complications later, *Panchavalkala* does not - as long as no one is dually infected with either microbe, as shown in Table 2.

Table 2. Antifungal activity of *Panchavalkala* and related extracts against *Candida albicans*[35-39]

Extract Type	Concentration (mg/mL)	Zone of Inhibition (mm)	Standard Drug (ZOI mm)	Study Type / Key Findings	References
Panchavalkala Arka	Undiluted (~80 g/500 mL decoction)	Zone of resistance; clearance on smear	Not applicable (wet smear assessment)	Case report: pseudohyphae positive → negative after 7-day vaginal wash; vaginal pH improved to 4.6	35
Guduchyadi Kashaya (*Panchavalkala*-based)	Fresh (~25 g/500 mL)	Clinical smear clearance	Clotrimazole (reference control)	Case series (n = 3); all patients smear-negative post-treatment, symptomatic relief documented	36
Panchavalkala solvent extracts	1000 (maximum tested)	8.0 mm (against *C. albicans*); 6.7–17.4 mm (seaweed comparators)	Clotrimazole 13–18; Fluconazole (variable)	Review of antimicrobial activity: tannins and glycosides inhibit biofilm formation	37
Panchavalkala extract (gel base)	400 (gel formulation)	Significant inhibition (better than individual barks)	*Streptomycin*	*In vitro* study; superior activity against *S. aureus* and *C. albicans* compared to single-bark extracts	38

Note: This review investigated comparative findings of formulations based on *Panchavalkala* and their antifungal properties against *Candida albicans*. Zones of inhibition and concentrations were measured to determine relative efficacy compared with other antifungal pharmaceuticals, compiled from clinical notes, experiments, and review articles.

4.3 Selective Antimicrobial Spectrum in Vaginal Pathogens

Panchavalkala is renowned for its specific, localised antimicrobial activity against intravaginal pathogens. It targets *Candida* explicitly, to a greater extent than bacteria or protozoa[39]. It can be observed through larger zones of inhibition against fungi, and generally may allow preservation of *Lactobacillus* species, a type of good bacteria[40]. However, this is more than just a fun observation; it complements *Ayurvedic* methods for achieving better *prakriti samyak*. Ideally, broad-spectrum drugs kill off the entire microbiome, thereby downregulating the balance and preventing dysbiosis. However, the *kashaya* of *Panchavalkala* means that it binds to fungal glycoproteins while leaving acid-producing bacteria alone[41]. The latter are critical for vaginal pH homeostasis to prevent recurring infections, and this is the absolute problem with leveraging the conventional broad-spectrum approach. Inappropriately eliminating pathogens and good microbes creates resistance and chronic biofilms[42]. The *kapha-shamaka* attenuates the mucoadherence of the fungal hyphae, yet leaves the beneficial flora adherent to the epithelium, allowing these naturally occurring bacteria to reacclimatize in their own time following a retentive application. There is no reason for a healer to destroy everything when they need to remove the harmful fungi and leave the beneficial bacteria alone. Such a transfigurative perspective on the stewardship of the microbiome creates a gap in vulvovaginal candidiasis treatment that has persisted far too long[43], as shown in Table 3.

4.4 Phytochemical Basis of Antifungal Efficacy

Panchavalkala exhibits antifungal potency through the synergistic action of phytochemicals across five barks, which are dominated by hydrolysable tannins, flavonoids, and triterpenoids, thereby conferring multi-target candidacidal mechanisms[44]. Condensed tannins of *Nyagrodha* and *Udumbara* precipitate fungal cell wall mannoproteins, disrupting adhesion and hyphal invasion critical for mucosal persistence, while flavonol glycosides inhibit ergosterol-independent membrane permeability[45]. Triterpenoid saponins permeabilise the fungal plasma membrane by means of cholesterol-complexation, thereby enhancing tannin penetration and creating a cascading lysis effect that is absent

Table 3. Antifungal properties of *Ficus* species[39-43]

Mechanistic Insight	Microbial Target	Spectrum Characteristics	Clinical/Functional Relevance	References
Flavonoids, tannins, and saponins disrupt membranes and cell walls	*Candida*, *Aspergillus*, *Trichophyton*, *Fusarium*	Broad activity against yeasts, moulds, and dermatophytes	Effective in animal models; supports topical/nanoformulations	39
Rhizosphere-driven enhancement of phytochemicals; indirect antifungal modulation	Indirect (via microbial–plant interaction)	Polyphenol-rich extracts suggest ecosystem-level antifungal potential	Enhances plant resilience; relevance for optimised herbal extracts	40
Phenolics/flavonoids inhibit fungal enzymes; endophytes produce antifungal metabolites.	*Candida* spp., dermatophytes	Synergistic action with endophytic compounds	Supports use in skin infections and wound healing	41
Quercetin/saponins cause membrane damage; tannins induce ROS; enzyme inhibition.	*Candida*, *Aspergillus*, *Trichophyton*	Vigorous activity (10–30 mm ZOI) across systemic and superficial fungi	*In vivo* reduction of fungal burden; useful for resistant infections	42
Flavonoids inhibit lipid biosynthesis enzymes, potentially exhibiting antifungal properties.	Dermatophytes, yeasts (crude extracts)	Moderate activity in multi-species screening	Supports traditional use; basis for future antifungal development	43

Note: Primary antifungal mechanisms, microbial targets, spectrum profiles, and clinical implications of prominent *Ficus* species, attributed to their phytochemical composition and validated by *in vitro* and preclinical research.

in single-compound antifungals[46]. This polyphenol matrix embodies *Ayurvedic krimi hara*, or pathogen destruction, through *rasa-samya*, or taste harmony, in which *kashaya*, or astringency, traps macromolecular fungal components. The cooling potency of the formulation is consistent with its antioxidant quenching of *Candida*-induced reactive oxygen species, thereby reducing host inflammatory cascades without disrupting the epithelium[47]. In contrast to the susceptibility of azole monotherapies to efflux pump resistance, this phytochemical variety employs parallel pathways: quorum-sensing disruption, biofilm dispersal, ABC transporter-mediated inhibition of efflux, and interference with ergosterol biosynthesis, suggesting a potential multi-target effect against the emergence of resistance. This biochemical sensitivity substantiates the classical *rasayana* properties of *Panchavalkala* as a second-generation antifungal scaffold for recurrent vulvovaginal candidiasis resistant to the conventional synthetic arsenal[48].

4.5 Safety Profile and Formulation Tolerability

Panchavalkala demonstrates remarkable safety efficacy in preclinical investigations, an expected advantage. There is virtually no acute/chronic oral toxicity in animal subjects; it does not irritate vaginal mucosa under investigational conditions observed, and it contains no heavy metals or synthetic contaminants, avoiding liver and kidney burden attributable to long-termazole use[49]. Blood values remain within normal limits, even with higher doses. Upon intravaginal application, blood readings indicate the tissue is in excellent condition, with no peeling or irritation, unlike polyene antifungals, which can be rough, irritating, and anoxic, hindering penetration. Thus, *Panchavalkala* is safe for long-term use on sensitive mucosal tissue surfaces[50].

This gentle approach aligns with the *Ayurvedic yogavahi* principles of avoiding dosha aggravation through a balanced formula and achieving deep-tissue penetration, yet not systemic, with *rasayana dravya*. *Panchavalkala* does not induce genetic damage, allergic responses, or hormonal disturbances, which differentiate it from treatment, which may exacerbate candidiasis, especially those associated with hormonal birth control[51]. Its clean pharmacology supports *yoniprakshalana* (vaginal douching) differently for recurrence of *kapha*-related problems, and it is a safety option for pregnant, lactating or otherwise immunocompromised individuals (generally unable to take conventional anti-fungals), which enhances

Table 4. Synergistic antifungal effects of *Panchavalkala vs.* individual barks[53-57]

Synergistic Mechanism	Key Phytochemicals	Combination *vs.* Individual Efficacy	Implication	References
Additive flavonoid–tannin synergy enhances membrane disruption	Flavonoids, phenolics, tannins	Combo 93% activity; larger inhibition zones than single barks	Supports superior antifungal action	53
Multi-extract synergy enhances cell wall inhibition.	Tannins, flavonoids, saponins	Combo ZI 15–25 mm *vs.* 10–20 mm singles	Better efficacy for dermatophytes	54
Polyphenol synergy induces fungal apoptosis.	Quercetin, tannic acid, leucocyanidins	Combo IC_{50} 20–50 µg/ml *vs.* higher in singles	Useful for resistant *Candida*	55
Synergy boosts oxidative stress-mediated fungal lysis.	Total phenols, flavonoids, terpenoids	Combo 80–93% scavenging *vs.* 60–81% singles	Strong anti-*Candida* potential	56
Combined flavonoids block ergosterol and chitin pathways.	Lupeol, β-sitosterol, tannins	Combo 75–100% inhibition *vs.* 40–70% singles	Broad-spectrum antifungal benefit	57

Note: Table 4 shows how polyherbal synergy makes *Panchavalkala* more powerful fungicidal efficiency - supported by larger zones of inhibition, decreased MICs and greater clinical significance.

clinical integrity of the formula by integrating *Ayurvedic* principles with modern gynaecological concepts[52].

4.6 Synergistic Effects of Combination *vs.* Individual Barks

No single bark acts alone. The true strength of *Panchavalkala* lies in how these barks function together. This is clear in laboratory tests: the complete formula clears fungal growth zones 15-30% more effectively than any individual extract. This is more than simple addition; it is synergy[53]. Each bark offers something distinct. Tannins from *Nyagrodha stabilise* the matrix, flavonoids in *Ashvatha* enhance membrane penetration, and triterpenoids from *Plaksha* inhibit fungal efflux—the outcome: A chain reaction that eliminates fungi in ways a single-bark cannot[54]. For the first time, it is evident how these barks rely on one another, producing candidacidal effects greater than the sum of their parts. This captures the essence of *Mishraka Gana* and has clear implications for strengthening *Rasayana Dravya*. The blend's *kapha-pitta*-balancing effect is especially apparent in its ability to prevent the regrowth of fungal biofilms. The bark used alone gives a temporal response; it inhibits hyphae but cannot maintain it[55].

However, together, *Panchavalkala* disrupts biofilms for a long time. It hyperinhibits fungal adhesion, growth, and survival, thereby simultaneously reflecting the complex process of *vrana ropana* healing described in classical texts. By themselves, each bark reduces only part of this, but the whole re-establishes the balance of the entire system[56]. Thus, the cooperative action of their constituents makes the formulation stronger against even more fungal strains. Standardised *Panchavalkala kwatha* is not just another herbal remedy; it is a traditionally formulated antifungal that may offer advantages over what a single herb can accomplish. It stands as supportive evidence that *Ayurveda's* practice of combining herbs is not only insightful but also highly relevant to modern challenges, particularly in the face of increasing drug resistance[57] as shown in Table 4.

5. Discussion

This narrative review correlates the translational significance with the *Ayurvedic* rationale for the progression of *Panchavalkala* as a *vrana shodhana* and *vrana ropana* compound, and its modern phytopharmacological quality. These findings are predominantly based on *in vitro* evidence. *In vivo* findings from case-report investigations and clinical results from Ranjan *et al.*, and Agrawal and Khatri *et al.*, note that a polyherbal formulation of *Panchavalkala* showed antifungal activity. *In vitro* findings indicate 15-30% higher than single bark decoctions (which suggests potential synergistic effects, meaning an actual additive reaction as opposed to just an additive reaction), which suggests possible multi-target effects championed by network pharmacology based upon synergistic phytochemical interaction. This applies to women's health from an integrative standpoint because

Panchavalkala may be considered as a potential adjunct, relatively potentially accessible treatment for azole-intolerant, hormonally fluctuating, diabetic, recurrent episode or idiopathic vaginal dysbiosis patients[58]. As a naturally occurring adjunctive treatment, the noted *sheetala virya* (cooling potency), upon any adjusted dose, where applicable, along with such an acidogenic environment and *stambhana* (astringent property), may help reduce symptoms such as pruritus, burning, inflammation, and excessive vaginal discharge[59]. This applies to clinically relevant patient-derived findings and *Ayurvedic sthanika chikitsa* (localised intervention) through topically applied formulations, such as vaginal washes, pessaries, ovules, or gel-like options. Such localised means of formulated intervention may reduce symptoms without compromising alternative systemic formulations[60]. Such positive findings, however, can contrarily pose risks to overuse and excessive use. Differences in active and inactive chemical components, the chosen barks, plant age, time of year of acquisition, and the means of extraction[61] do not simplify the standardisation of *Panchavalkala*. Higher-order analytical techniques (HPLC, LC-MS/MS, metabolomics) are needed to standardise the assessed blended formulations, and homogeneous profiles need to be established and maintained to ensure credibility and to ensure the phytochemical makeup remains the same over time in populations receiving treatment[62].

At the molecular level, future suggestions would focus on select antifungal mechanisms of action, including localisation and gene differentiation[63]. Transcriptomic and proteomic studies may help clarify the accessibility of *Panchavalkala,* which may inhibit biofilms and destabilise fungal membranes, in line with well-established research on the *Candida albicans*-derived genes EFG1, HWP1, and ALS3, which are responsible for hyphal transformation. Furthermore, co-cultures with *Lactobacillus* species may further elucidate how *Panchavalkala* spares the vaginal microbiome, unlike allopathic antifungals, which destroy beneficial flora[64].

This further relates to *Ayurvedic* concepts of *prakriti* classification value of person-centred approach to intervention; such clinical data assessments would not just be valued for pragmatic results but also include *prakriti*-based stratification whereby subpopulations would be evaluated through biostatistical analysis, which would help divide who would benefit most from *Panchavalkala* therapy for a more pointed trial design down the line[65]. This supports Ayuromics, where gynaecological women's health interventions can be constitution-based (therapeutic based on constitution), which would include nanoparticles of polyphenol- or tannin-rich formulations or controlled-release vaginal film options[66].

However, this narrative review has many limitations. Much translational efficacy derives from *in vitro* findings with solvent extractions, which do not necessarily conform to classical *Ayurvedic* formulations. Clinical findings are mostly based on case studies and small case series, making it difficult to identify correlations or determine optimal effect sizes. Furthermore, heterogeneity of findings, lack of powerful controlled studies, and publication bias complicate interpretation.

Ultimately, this narrative review provides empirically integrative and holistic findings where classical *Ayurvedic* formulations and modern phytochemistry and gynaecology meet in the middle. The specific relative nature of *Panchavalkala* as a selective, potential antifungal candidate highlights the need for further investigation, well-designed randomised controlled trials comparing standardised *Panchavalkala* with conventional antifungal offerings with respect to clinical efficacy, recurrence rates, and microbiome preservation, to achieve evidence-based integration into women's health clinical applications. Overall, while *Panchavalkala* demonstrates promising antifungal activity, the current evidence base is insufficient to draw definitive clinical conclusions.

6. Conclusion

Ultimately, *Panchavalkala* is the potential microbiome-conscious antifungal agent for VVC according to this narrative review. Here is why *Panchavalkala* shows relatively clear zones of inhibition (13-25 mm) against *C. albicans*, with dose-dependent activity, while maintaining lactic acid bacteria of the vaginal biota. This is due to the tannins, flavonoids, and triterpenoids in the formulation - all actionable via *Kashaya Rasa*, with a *Kapha Pitta dosha* balance. *In vitro*, this is evidenced by hyphal disruption within the biofilm, with a 80% significant reduction.

Moreover, clinically observed findings showed symptom alleviation with *yoni prakshalana*, and no adverse events were noted. This is critical in an environment of increased secondary findings relative to azole susceptibility and natural recurrence (5-8% of the population at baseline). In addition, *Panchavalkala* has the potential to be a top contender, especially because much of the evidence presented in this narrative review is preclinical, owing to ease of application, variable means of application and preparation, and actionability within the pathogen-host environment intended for integrative gynaecological purposes. Thus, it compiles the *Vrana Shodhana* from *Sushruta* of millennia ago with modern-day CLSI standards, alluding to polyherbal regulated applications. This is particularly important given the increasing prevalence of antifungal-resistant infections; further research should be promoted, with clinical trials featuring more exploratory phases to address *Panchavalkala's* established antifungal stewardship role and women's health goals, ensuring specificity and cultural applicability.

Panchavalkala is an important herbal agent for VVC due to its antifungal activity against *C. albicans*, with inhibition zones reaching 13-25 mm. This is due to its comparative action from all barks in the formula versus one specific composition. *Panchavalkala* spares vaginal microbiota, unlike azoles, which is an important consideration. This aligns with the *Ayurvedic* approach to *Slaishmiki Yoni Vyapada* as it pacifies *Kapha* and *Pitta*. Phytochemicals, such as tannins and flavonoids, possess multifaceted actions, precipitating cell walls, inhibiting hyphal formation, and neutralising ROS. Thus, this integrated approach reduces the likelihood of resistance.

Clinical findings support significant symptom alleviation without adverse events via *yoni prakshalana* for recurrent vulvovaginal candidiasis. More studies should be conducted, including nanoparticle formulations and randomised controlled trials with dosha balancing. This incorporation of microbiome stewardship represents a new perspective on treatment in this realm, at a moment when Phase II studies should be supported to integrate into women's health endeavours burdened by this condition.

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Author Contribution

Dr Shilpa Koranne designed the study and helped to prepare the manuscript; Dr Sheetal Asutkar made critical revisions and helped in the research direction. Both authors have read and agreed to the published version of the manuscript.