Review Article

www.ijrap.net

(ISSN Online:2229–3566, ISSN Print:2277–4343)

EXPLORING AYURVEDIC ALTERNATIVES TO MODERN ANTIBIOTICS: A CLASSICAL REVIEW

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Received on: 24/10/25 Accepted on: 25/11/25

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DOI: 10.7897/2277-4343.166219

ABSTRACT

The advent of antimicrobial resistance (AMR) has presented a historic challenge to modern medicine, exposing the flaws of universal antibiotic-driven strategies and calling for comprehensive and long-term infection control measures. This article explores the concept of infectious disease in ancient Ayurveda and evaluates traditional therapeutic approaches for treating fever, pathogenic agents, with Prakṛti Vighāta Cikitsā (Host environment modification). This narrative review examines Ayurvedic pathology, therapeutics, and lead-herb applications by triangulating classical texts, contemporary pharmacological studies, and clinical accounts. Using current biomedical concepts as an interpretive medium, we analysed host-focused strategies—host rectification (Agni restoration, Āma clearance, Ojas support), immune modulation, anti-biofilm actions, and phytochemical synergy. Across historical prescriptions and modern reports of use and efficacy, Ayurveda presents a multi-layered therapeutic model that engages the host–pathogen interface via Agni dīpana, Āma pācana, Doṣa śamana, and Ojas nourishment. Lead medicines commonly display antibacterial, anti-inflammatory, and immunomodulatory effects. Crucially, many act by reshaping the internal terrain and attenuating virulence rather than relying solely on direct microbicidal pressure—plausibly lowering selection for resistance. Case reports showing effective treatment of viral fevers, antibiotic-resistant infections, and challenging wounds in outpatient and surgical settings are practical rather than merely theoretical. Ayurveda provides antimicrobial therapy with a personalised, reliable holistic approach in a time of rapidly increasing AMR. Its host-specific techniques could strengthen to prevent and control infection and promote global stewardship if carefully included into standard care. To truly achieve that goal, we'll need carefully planned clinical research and genuine teamwork across different fields.

Keywords: Ayurveda, antimicrobial resistance, Krimi, Jvara, Prakriti Vighata Chikitsa, herbal antimicrobials, immune modulation, Ojas, Agni, Rasayana, and Ayurvedic infection management.

INTRODUCTION

Antimicrobial resistance is a global problem—and an urgent one—pressing us to explore and integrate traditional, whole-systems therapeutics alongside standard care.[1,2] The antibiotic development pipeline tells a hard story: more than $1 billion USD, 10–15 years of R & D, and the labour of multidisciplinary teams for a single new drug.[3] Yet efficacy can fade fast. Even newly launched agents may weaken within a few years by rapidly emerging resistance[4]; in fact, many pathogens evolve evasion mechanisms two to five years after clinical introduction through ordinary genetic adaptation.[5] The result is costly innovation followed by quick obsolescence—overburdened health systems and, worldwide, a worsening infectious-disease landscape.[5] No surprise, then, that interest is rising in sustainable, holistic mindful infection-control strategies.

Ayurveda, the classical "science of life," offers a structured, comprehensive lens for understanding and managing infections. It frames disease as a disturbance in the dynamic balance among Doṣa (Bio-energies), Dhātu (Body Tissues), Mala (Waste Products), and Agni (Digestive Fire), and health as the continual re-equilibration of those functions.[6] Within this equilibrium, Krimi describes pathogenic organisms—macro and micro—that destabilize that balance. Infectious presentations are organized under Jvara (fever), Vraṇa (wounds), Vidradhi (abscesses), and Prameha Piḍakā (diabetic carbuncles), among others.[7]

The main goal of Prakṛti Vighāta Cikitsā (Host environment modification) described in treatment of Krimi chikitsa, is to strengthen the host (the patient's body) first, rather than immediately attacking the pathogen. This involves several steps: boosting the digestive fire (Agni), clearing accumulated toxins (Āma), and fortifying the vital essence (Ojas) to enhance the body's natural immunity. Once the body's internal environment, or 'inner homeostasis,' is restored and its defences are active, the pathogen can easily deal with as necessary. This approach is seen as a rational and sustainable way to complement (or sometimes replace) treatments like antibiotics that primarily focus on killing the microbes.

The present article is a review of classical literature on the Ayurvedic viewpoint of microbial control. This has been largely collected through the understanding from the Bṛhattrayī—Charaka Samhita, Sushruta Samhita, Ashtanga Samgraha, and Ashtanga Hridaya—combined with their Sanskrit and Hindi commentaries. This material has also been supplemented with pertinent recent research articles available on the internet. Results have been rearranged and critically examined to present an in-depth discussion and draw meaningful inferences. Analysis is largely based on the use of various herbs and classical drugs in the control of various types of microbial infections. Their antitoxic and antimicrobial action as narrated in classical literature has been examined and justified. Significantly enough, these classical fundamental principles and therapy have also been noted and commented upon in real-time clinical practice by the

authors in the outpatient department (OPD), an indication of their practical applicability.

RESULT

Ayurvedic Understanding of Infectious Diseases

In Ayurveda, infectious diseases are mainly comprehended within the related understanding of Jvara (fever) and Krimi (pathogenic organisms). Jvara is not simply a sign/symptom but an independent disease entity characterized by the presence of an elevated body temperature, body pain (Angamarda), weakness, anorexia, and imbalances of Doshas—mainly Pitta vitiation, usually complicated by the accompaniment of Ama (undigested/incremental metabo-toxic waste) resulting from imbalanced Agni (digestive/metabolic fire).[9] This classical picture resembles the clinical presentation of new-world infections—viral, bacterial, or septic—where fever and systemic discomfort are typical manifestations.[10,11] Management of Jvara, therefore, in Ayurveda lays equal importance on Agni Deepana (stimulation of digestion), Ama Pachana (digestion of toxins), Dosha Shamana (alleviation of vitiated Doshas), and Ojas Vriddhi (strengthening of vital essence).[11]

Alongside this, the concept of Krimi provides a more certain description of microbial causality of infections. Ayurveda categorizes Krimi as being both microscopic and macroscopic organisms and Āgantuka Hetu (external causative agents) that possess the capacity of surviving and growing within the body where the inner conditions incline towards them. This occurs particularly in the presence of Kleda—a wet, dirty inner environment—and Ama, and these tend to accumulate as an outcome of chronic impropriety in dietary (Ahāra) and lifestyle (Vihāra) intake.[12] Krimi breeds on this pathologic substratum, specifically within the Rakta, Kapha, and Māṃsa Dhātus, and initiates an auto sustaining cycle of disease propagation: Nidāna (causative agents) produce Kleda, on which Krimi grows luxuriantly; Krimi also impairs the Doshas and increases Kleda—create an auto sustaining pathologic cycle.[12]

The application of the concept of Krimi within the Ayurvedic framework of Jvara immensely enriches the Ayurvedic concept of infectious disease pathogenesis. It highlights the point that chronic or recurrent infection tends to persist not only through external pathogenetic agencies but also through an inner pathologic field of Ama buildup, dominance of Kleda, and compromised Agni.[12] In such an instance, pacification of generalized Doshas (Sāmānya Upakrama) is ineffectual unless the inner ground is rectified and pathogenic organisms (Krimi) are targeted specifically.[13]

Ayurveda explains infectious manifestations such as Jvara (fever), Vrana (wounds), Vidradhi (abscesses), and Prameha Piḍaka (diabetic carbuncles) as secondary to an interaction between Dosha disturbance and microbial overgrowth, more specifically with Pitta vitiation and Ama formation.[14,15] These dual causality conditions support a multifactorial pathophysiological model in which inner predisposition and microbial persistence perpetuate disease.[14,15] In response, the Ayurvedic treatment emphasizes restoring systemic equilibrium through digestive correction (Deepana–Pachana), selective eradication of Krimi through specific Krimighnas, and Adhisthana (site of disease) correction with Prakṛti Vighāta Cikitsā. Rejuvenative therapy (Rasāyana), like Gudūci, also enhances Ojas and promotes tissue recovery.[13]

To maintain these phenomena and avoid relapse, strengthening Bala (immunity) has been strongly recommended by Ayurveda, and it is graded as Sahaja (innate), Kālaja (time-dependent), and Yuktikṛta (through proper lifestyle and dietary regimen and Rasāyana).[16] Preventive therapies such as Dinacharya (daily regimen) and Rutucharya (seasonal adaptation) are important in maintaining Agni, cleansing of Srotas (channels of the body), and long-term host protection—all compatible with Ayurveda's overall immunological framework emphasizing pathogen control and host strengthening.[17]

Key Ayurvedic Agents for Infection Management

Ayurvedic care for infections draws on a wide bench of medicines—single herbs and polyherbal (Kaṣṭhauṣadhi) as well as Herbo-mineral preparations (Rasauṣadhi). Together they're described as acting on pathogens while improving host defences—a two-track strategy that clinicians will recognize.[18]

General properties. Drugs with Katu (pungent), Tikta (bitter), Kaṣāya (astringent), Kṣāra (alkaline), and Uṣṇa (hot) qualities are traditionally favoured for microbial illnesses.[13] Of these, Tikta rasa shows dominant action. Formulations having Tikta rasa are used to subsides Pitta and Kapha and are indicated for Krimi (parasitic/ microbial states), Visha Doṣa (toxicity), Jvara (fever), Utkleśa (nausea), and Daha (burning)—a symptom cluster that maps neatly onto many infectious presentations. Formulations having Tikta rasa are also considered helpful in Prameha (diabetes) and its associated infections by subsiding disturbed Doṣas, reducing excess tissue fluid, rekindling Agni, and "detoxifying" channels (srotas sodhana).[19]

The Role of Prakriti Vighata Chikitsa in Infectious Diseases

In the Vyādhitarūpīya Vimāna of the Caraka Saṃhitā, Ācārya Caraka outlines a disease-specific therapeutic approach known as Prakṛti Vighāta Cikitsā—a treatment method aimed at countering the very nature or constitution of the disease itself.[13] In the context of Krimija Vikāra (disorders caused by pathogenic organisms) and related infectious conditions, the underlying pathological framework is described in detail. These diseases arise from excessive Kleda (moisture and fluidity), the buildup of Āma (toxic metabolic residue) resulting from weakened digestive fire (Agni Māndya), and the recurrent interaction of Kapha dominance with intermittent Vāta aggravation. This state of internal environment is suitable for various krimis for proliferation. Once the infection happened than these krimis also further aggravated doshas and weakened digestive fire leads to more Kelda and Ama formation; leading to a vicious cycle of pathogenesis. Clinically, such conditions tend to showing patterns of persistence and relapse, making them challenging to eradicate completely.[12]

Prakṛti Vighāt therapy, therefore, requires a stepwise intervention model:

Alter the Environment: Employ Rukṣaṇa (desiccation) and Lekhana (scraping) therapies to reduce Kleda and initiate Deepana–Pachana to restore Agni and digest Ama.[20]

Eliminate the agent by breaking the pathological cycle: It is achieved using substances that are bitter (Tikta), pungent (Kaṭu), astringent (Kaṣāya), alkaline (Kṣāra), and hot (Uṣṇa) in potency.[13]

Reinforce host defence: Rasāyana therapies, such as Gudūci, Āmalakī, and Yaṣṭimadhu is used to strengthen Ojas, restore Dhātu integrity, and prevent recurrence of diseases. This phase is consolidated through Samsarjana Krama, ensuring a stable metabolic baseline.[21]

Thus, Prakṛti Vighāta Cikitsā represents a holistic treatment strategy that focuses on removing the root cause of disease rather than just controlling its symptoms. By changing the internal environment that supports the growth of Krimi (pathogens) and strengthening the body's natural defence system, this approach

helps to stop the cycle of infection and relapse. It restores balance in digestion, metabolism, and tissue strength, leading to long-term recovery and prevention of recurrence. In essence, it reflects the Ayurvedic goal of achieving complete healing through purification, correction, and rejuvenation of the body.

The Role of Tikta Rasa in Infectious Diseases

Out of the six classical tastes (Shad Rasa), Tikta (bitter) rasa is of great importance in treating infectious and inflammatory diseases.[19] Tikta rasa consists mainly of ether (Akasha) and air (Vayu) Maha Bhutas and therefore has light (Laghu), drying (Ruksha), and cooling (Sheeta) characters. These characters render Tikta rasa very useful in suppressing Pitta as well as Kapha doshas, which predominantly get vitiated in infections.[19]

Ancient Ayurvedic literature describes an extensive list of activities to Tikta rasa. It pacifies Krimi (parasitic infestations), Trishna (pathologic thirst), Visha Dosha (toxicity), Kustha (cutaneous disorders), Murchha (delirium), Jvara (fevers), Utklesha (nausea and toxin surge), and Daha (burning), as well as Kapha and Pitta imbalances. These symptoms almost parallel the pathophysiology of most infectious diseases, where toxin buildup, inflammation, fever, and immune disarray dominate.[19]

A significant clinical commentary is that Prameha (an ancient term comprehensively embracing diabetes mellitus) patients have increased vulnerability towards infections because of compromised tissue immunity as well as sluggish healing responses.[22] Tikta rasa not only finds an indication in infectious and febrile conditions but also is extremely useful in Prameha. Due to its effect of soothing Kapha and Pitta doshas, checking tissue fluid formation, rectifying metabolic fire (Agni), and clearing toxin channels (Srotoshodhana), it becomes one of the pivotal therapeutic rasas while managing diabetes and infectious complications thereof.[23]

Thus, Tikta rasa has a central role in Ayurvedic therapy of infective conditions and offers an integrated therapy that is aimed at managing not just the causative doshic disorder but also the clinical manifestation of infective conditions.

Specific Examples and Reported Activities

Haridra (Turmeric): With Ruksha (dry), Laghu (light), Tikta (bitter), and Katu (pungent) virtues, Ushna Virya (hot potency), and Katu Vipaka (pungent follow-action), Haridra (*Curcuma longa*) is characteristically indicated in the Ayurvedic management of Krimi (parasitic/microbial infestations).[24] These virtues effectively neutralize the Kleda-abundant and Ama-rich inner environment predisposing for proliferation of Krimi. Tikta-Katu Rasa and Ushna Virya induce Agni Deepana (rising of digestive/metabolic fire) and Pachana of Ama (elimination of toxins), respectively, and these are preliminary steps toward the disruption of the life and habitat of the Krimi. Furthermore, the Ruksha and Laghu virtues of Haridra serve to dry up excessive secretions and minimize the gelatinous biofilm-like state (Kleda) where the Krimi flourish. The potential of curcumin as an antimicrobial, anti-inflammatory, and detoxifying agent further serves toward eliminating the microbes and restoring doshic balance and supporting Dhatu Shuddhi (elimination of tissue toxins). In this way, Haridra serves the dual purpose of a Krimighna Dravya (anti-Krimi agent) and a Rasayana (imbuing tissue agent), achieving a dual mandate in the Ayurvedic therapy of infections.[25]

Curcumin, an ingredient of turmeric, has exhibited antiviral activity against enveloped viruses such as Zika, chikungunya, dengue, hepatitis C, and vesicular stomatitis in in vitro experiments. Curcumin decreases infectivity of enveloped viruses through cell-binding inhibition and does so early in the infection process. Curcumin analogues also possess antiviral action against enveloped viruses.[26]

Tested to have antibacterial activity against *Helicobacter pylori, Staphylococcus aureus, Escherichia coli,* and *Pseudomonas aeruginosa.*[27,28] May have the potential to prevent bacterial cell proliferation via FtsZ assembly inhibition.[29] Curcumin may prevent the development of biofilm and regulate virulence factor production of P. aeruginosa.[30]

Furthermore, it has an antifungal property against *Candida species, Paracoccidioides brasiliensis*, and various microorganisms, ostensibly as an inhibitor of ergosterol biosynthesis.[31] Curcumin could even have a synergistic action on conventional antifungal agents. Others cite it as potentially inhibiting the antibacterial property of some antibiotics and potentially boosting the pathogenicity of Salmonella in some cases.[32]

Tulsi (Holy Basil): Tulsi (*Ocimum sanctum*), or Holy Basil, is classically described as having predominantly Katu (pungent) and Tikta (bitter) Rasa, with Laghu (light), Ruksha (dry), and Teekshna (piercing) Guna, Ushna (hot) Virya, and Katu Vipaka.[33] In practice, those traits let Tulsi settle aggravated Vata and Kapha. Its light, penetrating, and frankly trenchant nature helps loosen stubborn, deep-seated morbid factors and move them out.[33] In Krimi Chikitsa, the same Tikta–Katu palette and Teekshna–Ushna energy work together to digest Ama, dry excess Kleda, and rekindle Agni—precisely the terrain where Krimi tend to thrive. Add its antimicrobial effects and gentle immunomodulation, and Tulsi functions both as a Krimighna Dravya for Shodhana (clearing pathogens) and as a Rasayana that supports host recovery (Bala).[33]

Contemporary use echoes the classics. Tulsi is a key ingredient in AYUSH Kwath, a polyherbal blend promoted for immune support; studies report immunomodulatory, antistress, antimicrobial, and anti-inflammatory actions.[34] The essential oil of *O. sanctum* shows broad antibacterial, antifungal, and antiviral activity.[35] Traditionally, clinicians and households alike turn to Tulsi for bronchitis, coughs and colds, and febrile illnesses—nothing new there, just enduring practice.

Its pharmacology is tied to a cluster of bio actives: eugenol, methyl eugenol, carvacrol, sesquiterpenes, flavonoids, and triterpenes.[35] Eugenol (and the essential oils more generally) can modulate immune responses, while flavonoids contribute meaningfully to that same immunomodulatory profile.[35] Notably, eugenol displays antiviral effects against poliovirus, herpes simplex virus, and hepatitis B virus; Tulsi leaf extracts have inhibited poliovirus type 3 replication *in vit*ro, and several phytoconstituents show broad-spectrum antiviral potential.[35]

Antibacterial activity extends to notable pathogens as well: laboratory studies report efficacy against *Staphylococcus aureus*—including MRSA—and *Escherichia coli*.[36] Results vary by extract, method, and strain (as they do), yet the signal is consistent enough to matter.

Ginger (*Zingiber officinale*): Śuṇṭhī (dry ginger), a key herb in AYUSH Kwath, is praised in Ayurveda as Vishwabheshaja, the "universal medicine," and as Mahāuṣadha, a kind of supreme remedy. It carries Katu (pungent) Rasa; Laghu (light), Rukṣa (dry), and Tikṣṇa (sharp) Guṇa; Uṣṇa (hot) Vīrya; and Madhura (sweet) Vipāka—an energetic profile long used against Krimi (microbial/parasitic states) and Jvara (fever).[37]

In Krimi Chikitsā, those properties work on the usual suspects: they digest Āma, check Kleda, and correct Mandāgni. The Tikṣṇa–Uṣṇa edge helps the drug penetrate tissues, cut through viscid, biofilm-like mucus, and unsettle entrenched pathogens; its Agni-dīpana and Āma-pācana actions help clear the slate metabolically. In Sāma Jvara, Śuṇṭhī behaves as a Jvaraghna by rekindling Jatharāgni, settling Kapha–Vāta, and encouraging diaphoresis and toxin elimination—simple, but clinically useful.[37] In practice, clinicians reach for it in cough, coryza, colic, nausea, asthma, and fever, among other day-to-day complaints.[38]

Chemistry gives the rationale: gingerols, shogaols, and sesquiterpenes map to Kapha–Vāta suppression, antipyretic effects, and notable antiviral activity; a few constituents even inhibit HCV replication in experimental models.[39] Antimicrobial work points the same way—an ethanolic extract has shown activity against tough, drug-resistant bugs such as *Pseudomonas aeruginosa, Escherichia coli,* and *Staphylococcus aureus*.[40]

Black Pepper (*Piper nigrum*): Included both in AYUSH Kwath and the classical Trikatu blend, black pepper brings a concentrated pharmacology—chiefly piperine and piperidine—as its calling card.[41] Beyond culinary heat, it shows antioxidant, antifungal, antibacterial, and immunomodulatory activity.[42] Piperine, in particular, can nudge both cellular and humoral immunity, modulate T-helper cytokines, and dampen IgM secretion and LPS-driven lymphocyte proliferation.[41] Just as important, it behaves as a bioavailability enhancer and efflux-pump inhibitor, which means other herbs and drugs often work better in its company.[43]

Triphala: The classic trio—Haritaki, Bibhitaki, and Amalaki—acts as a gentle systemic cleanser that steadies digestion and helps correct metabolic drift.[44] Externally, Triphala's decoctions or washes serve as practical wound cleansers.[45] On the chemistry side, Haritaki contributes chebulagic and chebulinic acids; extracts have been shown to enhance antibody production and exert immunostimulant effects.[46] Broad antimicrobial activity has been reported against *S. aureus, MRSA, P. aeruginosa, Klebsiella pneumoniae,* and *E. coli,* with generally stronger effects on Gram-positive organisms and supportive evidence for improved healing in infected dermal wounds.[47]

Guduchi (*Tinospora cordifolia*): The principal ingredient in Sanshamani Vati, Guduchi is treated as a core Rasayana and Tridoṣahara remedy—used for fevers, wound repair, and immune support in infectious and febrile states.[48] Clinical reports include platelet count increases in dengue, alongside enhanced phagocytic activity and consistent immunomodulatory behaviour. Safety looks favourable: no significant toxic effects have been reported for this drug at customary doses.[48]

AYUSH Kwath: This four-herb formula—Tulsi, Dalchini, Śuṇṭhī, and Marich—aims to bolster host defences and ease viral-syndrome symptoms via combined antiviral, antioxidant, anti-inflammatory, and immunomodulatory effects. At recommended doses, the ingredients are generally regarded as safe.[49]

Sanshamani Vati: Sanshamani Vati. An archetypal Guduchi-based formulation, Sanshamani is classically positioned as a Rasayana for febrile states and immune support. More recently, it was officially included in the AYURAKSHA kit for COVID-19 prophylaxis—an unusual meeting point of tradition and policy.[48]

AYUSH-64: Originally designed with malaria in mind, this polyherbal was later pulled into collaborative studies as part of Ayurvedic interventions for COVID-19. Old tool, new context, cautiously explored.[50]

Shallaki (*Boswellia serrata*): Long used as an anti-inflammatory—also for complaints like diarrhoea—Shallaki's actives (terpenes and boswellic acids) show antibacterial and anti-biofilm effects. The proposed mechanisms are concrete enough: terpenes can disrupt bacterial membranes and dampen virulence, a pattern especially noted in Gram-negative organisms such as *E. coli*, which frequently present with resistance. On that basis, some authors argue it could offer a cost-effective, safer alternative to standard antibiotics in select scenarios.[51-53]

Jeeraka (*Cuminum cyminum*): Familiar in kitchens and decoctions alike, Jeeraka is credited with antioxidant, antimicrobial, and carminative-digestive actions and finds use in fever and certain skin disorders. Key bio actives include cumin aldehyde, cymene, and other terpenoids. The essential oil has shown notable antibacterial and anti-biofilm activity; phenolics likely underwrite part of the anti-inflammatory profile.[54]

Neem (*Azadirachta indica*): A classical Tikta Dravya with well-known Krimighna and Kuṣṭhaghna actions, neem is used topically as an antiseptic—especially for non-healing wounds and in postoperative care—without systemic adverse effects being a common feature. Nimbidin is often cited for anti-inflammatory and antibacterial properties. Dentistry and oral hygiene add another use case: efficacy has been reported against *Streptococcus mutans* and *Candida albicans*; traditionally, it's also invoked in the prevention of viral fevers.[55]

Punarnava (*Boerhaavia diffusa*): Counted among respected Rasayanas, Punarnava is described as immunomodulatory and antimicrobial with broad, system-level healing effects—a quiet multitasker in many formulations.[56]

Pippalī (*Piper longum*): Another classical Rasayana, prominent in Agastya Haritaki and elsewhere. Piperine is again the headliner, associated with immunomodulation and better bioavailability of co-administered agents. Pippalī Rasayana has been observed to stimulate macrophage function and raise WBC counts in reports.[57,58]

Chandrakala Rasa: A Herbo-mineral preparation used by practitioners for difficult viral fevers—especially where conventional antivirals underperform. It's positioned as enhancing systemic immune defence and speeding recovery, with applications mentioned in herpes zoster, UTIs, and Mutrakṛcchā. Evidence is still patchy, but the traditional use case is consistent.[59,60]

Aśvagandhā (*Withania somnifera*): A heavyweight Rasayana with adaptogenic credentials, it featured in AYUSH-led collaborative research during COVID-19 for high-risk cohorts, largely on the strength of immune-enhancing and stress-buffering effects.[61,62]

Yaṣṭimadhu (*Glycyrrhiza glabra*): Another Rasayana with broad antiviral notes. Glycyrrhizin—the signature constituent—has been reported to inhibit SARS-CoV replication; there are also data suggesting improved resistance to HSV-1 and anti-HIV activity in experimental settings. Modest claims, but intriguing all the same.[63,64]

Punarnavadi Maṇḍūra: An iron-based formulation commonly prescribed for anaemia, oedema, chronic inflammatory states, and infections marked by "impure" blood and undernourished tissues. Classical guidance—and a fair amount of clinical observation—supports iron-containing preparations here to foster tissue repair, shore up immune resilience, and aid convalescence during infectious illness.[65]

Mechanisms of Action

Ayurvedic agents often work through overlapping—but not identical—pathways compared with modern antibiotics, sometimes complementing them rather than competing.

Direct antimicrobial action: Certain constituents act directly on microbes; curcumin is the stock example, with reported antibacterial, antiviral, and antifungal effects.[26-30]

Anti-biofilm activity: Many plant derivatives interfere with biofilm formation or help break established films; a big reason organisms resist therapy. Terpenes and cumin aldehyde are repeatedly flagged for this role.[38-40]

Efflux-pump inhibition: Some compounds, notably piperine, can block bacterial efflux pumps that eject antibiotics—functionally restoring drug sensitivity in strains that had learned to shrug therapy off.[41-43]

Virulence attenuation (anti-QS). Instead of killing bacteria, certain extracts blunt their weapons to control them. Eugenol—the major constituent of Tulsi (*Ocimum sanctum*) oil—can inhibit quorum sensing in *Pseudomonas aeruginosa*, cutting pyocyanin output and disrupting biofilm formation without direct bactericidal action.[35,36]

Immune modulation: Rasayana-class herbs tend to "tune" the host response: they enhance cellular and humoral arms, reshape cytokine profiles, boost phagocytosis, and shift lymphocyte subsets; macrophage activation sits squarely in this picture as well.[48,49,57,58,61,62]

Antioxidant and anti-inflammatory effects: By limiting oxidative damage and tempering inflammation, several herbs help protect tissues during infection and its aftermath.[41-43]

Improved bioavailability: Again, with piperine, it can enhance absorption and curb efflux, raising the effective exposure of co-administered drugs and botanicals.[41-43]

Multi-component synergy: Polyherbal formulas aim at multiple targets at once. The combined effect can exceed the sum of parts—and by hitting parallel pathways, may make resistance harder to evolve; synergy has been observed both between natural products and with synthetics.[44-46,49]

Ayurveda as an Alternative and Complementary Approach

The antibiotic era is wobbling—costly pipelines, faster-than-ever resistance, and side effects that are hard to ignore. Considering this, Ayurveda is gaining attention again as a comprehensive, reasonably priced, and environmentally responsible supplement. Its centre of gravity is the host: strengthening immunity and resilience rather than waging a single-molecule war. That emphasis overlaps with emerging "non-biotics," agents that modulate host–pathogen dynamics without directly killing microbes. Through Agni promotion, Āma elimination, Ojas fortification, and Dosha balancing, Ayurvedic interventions aim to restore systemic harmony and infection hardiness—an ethos that dovetails with antimicrobial stewardship goals.[66]

Ayurveda's environmental hygiene ideas don't feel quite so quaint anymore. Medicinal smoke from select herbs can depress airborne microbial counts for hours, suggesting a practical role in air sterilization—old ritual, new rationale.[67] Likewise, the classic advice to store water in copper vessels has empirical teeth: diarrheagenic bacteria such as Vibrio cholerae and Escherichia coli are inactivated, while copper ions stay within WHO limits.[68]

Clinical applications in outpatient settings

In the OPD, these principles translate into quite concrete outcomes, both in published observations and in the author's own case series.[69] non-healing surgical wounds that had outlasted prolonged antibiotic courses responded to Guduchi Taila dressings combined with systemic Rasaūṣadhi, with rapid granulation and closure reported.[70] In viral illnesses such as herpes zoster, Chandrakala Rasa alongside supportive Tikta dravyas has been associated with quicker lesion resolution and fewer post-herpetic sequelae; severe urinary tract infections with striking leucocytosis have shown brisk improvement on Suvarna-containing formulations, including normalization of counts within short windows.[59,60] Chronic, stubborn ulcers in rheumatic patients—often a clinical grind—have healed under combined herbal–mineral regimens, sidestepping the complications of extended antibiotic exposure. Dengue cases treated with Guduchi-based formulations have demonstrated notable rises in platelet counts, curbing transfusion needs and shortening stays.[71] Reports also include parasite clearance without recurrence in malignant malaria (*Plasmodium falciparum*) on Ayurvedic management verified by follow-up testing.[72] And in insulin-dependent diabetes, structured programs cantered on Ojas support and Agni restoration have, over time, enabled tapering and even cessation of insulin with improved glycaemic control and HbA1c—careful work, but not rare in these series.[73]

Application in surgical settings

Perioperative protocols likewise adapt classical methods. Pre-op skin preparation with Triphalā Kwātha washes has provided reliable microbial control without leaning on chemical antiseptics.[74] Post-op, Nimba Taila and Guduchi Taila dressings have been used to encourage tissue repair, reduce infection, and support orderly regeneration.[75] In anorectal procedures requiring dilatation and lubrication, medicated oils such as Nimba Taila have substituted for glycerine-based products, protecting mucosa and easing technique without adverse reactions. Across these practices, a series reports an absence of postoperative infections—reassuring for both safety and practicality in everyday theaters.[76]

DISCUSSION

The accelerating crisis of antimicrobial resistance (AMR) forces a rethink: we need infection strategies that are effective, sustainable, and kinder to ecosystems. Ayurveda—often treated as a historical footnote—actually maps closely onto modern views of immunology, microbial ecology, and host–pathogen give-and-take.

Its distinctive move is Host before target. According to Ayurveda, the primary cause of vulnerability and persistence is the internal environment, specifically Agni (digestive/metabolic fire), Āma (metabolic residues), and Ojas (vital immunity). It layers therapies rather than focusing solely on microbial kill: restore systemic dynamics (Doṣa Śamana), strengthen resilience (Ojas Vṛddhi), eliminate toxic build-up (Āma Pācana), and spark poor digestion (Agni Dīpana). Framed through Prakṛti Vighāta Cikitsā, the point is to disrupt the pathological "soil" that lets microbes take root and hang on.

Ayurveda's Krimi concept—which explicitly includes microscopic life—and its ties to Kleda and Āma sound, today, like early microbial ecology with a host slant. Therapies using Rukṣaṇa, Lekhana, and Krimighna dravyas don't just strip away pathogen-friendly substrates; they also deliver targeted antimicrobial effects. Familiar exemplars—Gudūcī, Haridrā, Tulsi, and Triphalā, among others—show antimicrobial, immunomodulatory, anti-inflammatory, and anti-biofilm actions

across classical descriptions and contemporary studies. Not magic; method.

Tikta Rasa (bitterness) is a good illustration. Long tagged as "infection-clearing," it now aligns with data on metabolic regulation, immune activation, and detox pathways. In infections tangled up with chronic metabolic disease (e.g., Prameha), Tikta-forward care can work on two fronts: mend the terrain and lighten the microbial load.

Clinic floors add texture to theory. Outpatient and surgical observations describe stubborn wounds that finally granulate, viral fevers that resolve faster, and inflammatory parameters that normalize—sometimes with Ayurveda alone, sometimes alongside conventional care, especially when cases are recurrent or antibiotic-resistant.

This is more than just "herbal antibiotics" in terms of mechanism. Phytochemicals interact synergistically, polyherbal formulations have multiple targets, and the host-centric, terrain-modifying strategy is presumably less likely to cause resistance. This puts Ayurveda in a position to be a supplementary, ethical, and ecological arm of antimicrobial stewardship rather than a competitor.

CONCLUSION

An experienced, integrative alternative to traditional antibiotic management is provided by the Ayurvedic approach to infection care, which is based on a whole-system interpretation of host–pathogen dynamics. Rebuilding immunological tone, correcting the host homeostasis, and adding pathogen-specific measures as necessary are all examples of how it works the ground rather than chasing individual targets. The outcome is a tenable, holistically approach to infection control in an era plagued by AMR.

Classical agents—Gudūcī, Haridrā, Tulsi, and Triphalā, among others—show up here not as folklore cameos but as working tools. Texts back them; an uneven yet growing empirical record does too. Clinically, what counts is the day-to-day: outpatient and surgical use suggest they're practicable and, by and large, safe.

As resistance keeps dulling standard antibiotics, folding Ayurvedic principles into mainstream care looks less exotic and more sensible—a complementary path to infection resilience, with old methods and contemporary evidence trying to meet in the middle. Next steps aren't mysterious: tighter interdisciplinary work, trials with teeth, and policy that scales what proves out. Not everything will; enough might.

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Cite this article as:

Subhyendu Maity and Subhas Chandra Dutta. Exploring Ayurvedic Alternatives to Modern Antibiotics: A Classical Review. Int. J. Res. Ayurveda Pharm. 2025;16(6):88-96
DOI: http://dx.doi.org/10.7897/2277-4343.166219

Source of support: Nil, Conflict of interest: None Declared