AYUSHDHARA
ISSN: 2393-9583 (P)/ 2393-9591 (O)
An International Journal of Research in AYUSH and Allied Systems

Review Article

BRIDGING AYURVEDA AND MODERN MICROBIOME RESEARCH: THE GUT-EYE AXIS IN VERNAL KERATOCONJUNCTIVITIS

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Article info
Article History:
Received: 12-09-2025
Accepted: 18-10-2025
Published: 30-11-2025
KEYWORDS:
Abhishyanda, Vernal Keratoconjunctivitis (VKC), Gut Microbiome, Dysbiosis, *Langhana.*

ABSTRACT

Vernal Keratoconjunctivitis (VKC) is a chronic, recurrent ocular allergy affecting children and young adults. Traditionally seen as a localized hypersensitivity reaction, recent research highlights a systemic immune component involving gut microbiome dysbiosis and Th2-skewed responses. Ayurveda parallels this understanding through the concept of *Kaphaja-Pittaja Abhishyanda*, linked to *Agnimandya* (digestive fire impairment) and *Ama* (toxin) accumulation. **Objective:** To review and synthesize emerging biomedical evidence on the gut-eye axis in VKC with Ayurvedic principles, particularly the role of *Langhana* therapy in managing systemic immune imbalance. **Materials and Methods:** This study involved a thorough review of a wide range of literature sources, including authoritative ophthalmology textbooks such as A.K. Khurana, Scopus-indexed peer-reviewed journal articles, relevant health publications, and classical Ayurvedic texts like *Charak Samhita*, *Sushruta Samhita*, and *Ashtanga Hridaya*. The analysis integrated modern clinical perspectives with traditional medical knowledge to offer a well-rounded and in-depth understanding of the subject matter. **Discussion:** This narrative review integrates findings from Mendelian randomization studies on gut microbiota and allergic conjunctivitis with classical Ayurvedic texts. The therapeutic rationale and application of *Langhana* modalities- *Pachana*, *Rukshana, Upavasa* are evaluated in the context of gut-immune modulation. **Conclusion:** Gut microbiome composition significantly influences immune responses in VKC. Ayurvedic *Langhana* therapy offers a holistic approach by restoring digestive balance, detoxifying the gut, and modulating immunity. Bridging Ayurveda with modern microbiome science presents a novel, integrative framework for managing VKC and similar allergic eye disorders.

INTRODUCTION

Humans are increasingly exposed to pollution in the modern period, which introduces toxins into the environment, causing instability, chaos, and destruction to the ecosystem. This entire filthy conclusion resulted in a single word- Allergy.

Allergic conjunctivitis (AC) is a common and potentially debilitating ocular surface disease characterized by antigen-specific immunoglobulin E (IgE) and T helper type 2 (Th2) lymphocyte–mediated type I hypersensitivity[1].

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Quick Response Code	
	https://doi.org/10.47070/ayushdhara.v12i5.2273

The primary cause of an allergic response in the body is compromised immunity or hypersensitivity. Allergic conjunctivitis is the most frequent kind of eye allergy and affects a large proportion of the world's population. Having a prevalence rate of 5-22% in general population and a recurrence rate of 41-62%. Allergic conjunctivitis alone has an estimated worldwide prevalence of 6 to 30% in general population and it is estimated to occur upto 30% of children either alone or in association with allergic rhinitis.[2]

Vernal Keratoconjunctivitis (VKC) is a chronic, recurrent allergic eye condition predominantly affecting children and young adults. Its clinical features- itching, mucous discharge, photophobia, and

conjunctival congestion- closely resemble *Kaphaja Abhishyanda.*

Kaphaja Abhishyanda or Vernal Keratoconjunctivitis is a multifactorial condition where both allergic and immunologic pathways are involved. The Ayurvedic concept of *Doshic* imbalance, particularly *Kapha, Pitta*, vitiation, aligns well with the pathogenesis of VKC.

From Systemic Dysbiosis to Ocular Surface Inflammation

Modern immunology increasingly highlights the gut-eye axis, where gut microbiome dysbiosis contributes to systemic immune dysregulation observed in allergic diseases, including conjunctivitis[3].

The gut microbiome influences immune homeostasis- especially the balance between Th1 and Th2 responses[4].

Systemic immune priming/ Th2 skewing: Gut dysbiosis and increased antigenic load from the gut can bias immune responses toward Th2-type, raise systemic eosinophilia, IgE, and mast cell sensitivity- all risk factors for ocular allergy.

Mucosal immune cross-talk: The gut–eye axis, analogous to the gut–lung axis or gut–skin axis, implies that mucosal immune cells in gut-associated lymphoid tissue (GALT) may influence distant mucosal surfaces (conjunctiva-associated lymphoid tissue, CALT).

Evidence Linking Gut Microbiome to Allergic Conjunctivitis

A Mendelian randomization study found that genetic liability toward certain gut microbiota traits (e.g. higher Ruminococcaceae_UCG_002, Holdemanella, Catenibacterium, Senegalimassilia) was associated with *lower* risk of allergic conjunctivitis, while higher Oscillospira was associated with increased risk.

Another two-sample MR study reported a protective association of phylum *Euryarchaeota* against allergic conjunctivitis, and associations of Christensenellaceae R.7 group, Peptostreptococcaceae, Lachnospiraceae FCS020 group with lower risk.

Link to VKC

- Gut dysbiosis may drive Th2 dominance, perpetuating allergic inflammation.
- Metabolic by-products like short-chain fatty acids (SCFAs) (e.g., butyrate) normally suppress inflammation; their reduction leads to unregulated immune responses.

Bridging Ayurveda and Modern Immunology

In Ayurveda, the gut health is closely linked to *Agni* (digestive fire) and *Ama* (toxins) formation. Dysbiosis parallels *Agnimandya* → *Ama* → *Srotorodha* (obstruction) → *Dosha* vitiation, particularly *Kapha* and *Pitta*, which are predominant in VKC *(Abhishyanda).*

***"Rogah Sarve Api Mandagnau"* (*Charaka Samhita, Chikitsasthan 14)*[5]**

Modern Science	**Ayurveda**
Gut Microbiome	*Agni, Pakwashaya sthita doshas*
Dysbiosis	*Mandagni, Ama, Kapha dushti*
SCFAs, Immunomodulation	*Rasa dhatu, Ojas* (immune resilience)
Immune imbalance (Th2 dominant)	*Kapha-Pitta* vitiation, impaired *Ojas*

Ayurvedic Management of VKC *(Abhishyanda)* via *Langhana* in Gut Dysbiosis Context

अक्षिकुक्षिभवा रोगाः प्रतिश्यायव्रणज्वराः।

पञ्चैते पञ्चरात्रेण प्रशमंयान्ति लंघनात्।।[6] (भै.र. नेत्ररोगचि)

emphasizes that diseases originating from the eyes *(Akshi),* abdomen *(Kukshi),* and respiratory tract (such as *Pratishyaya*), including inflammatory conditions like *Vrana* and *Jvara*, can be effectively pacified within five days by the administration of *Langhana* (lightening or fasting therapy).

In the context of Vernal Keratoconjunctivitis (VKC), which parallels *Kaphaja-Pittaja Abhishyanda* in Ayurveda, *Langhana* plays a pivotal role in the initial stages by reducing *Kapha* accumulation, clearing *Ama* (toxins), restoring *Agni* (digestive/metabolic fire), and unblocking *Srotas* (bodily channels), thereby controlling the systemic immune response that underlies allergic eye disorders.

From a modern perspective, VKC is a chronic allergic inflammatory condition with systemic immunological involvement, often linked to gut microbiome dysbiosis, Th2 dominance, and elevated IgE-mediated hypersensitivity[7]. Langhana, by correcting digestive disturbances and detoxifying the gut (the seat of immune regulation), may help reset immune homeostasis and reduce allergic manifestations, thus offering a systemic approach to a localized ocular disorder.

The principle of *Langhana* (including *Pachana*, *Upavasa*, and *Laghu Ahara*) helps in *Ama Shodhana*, *Agni Deepana*, and *Srotoshodhana*- mechanisms that align with the modern understanding of restoring gut–immune balance and reducing systemic inflammation.

This integrative perspective supports *Langhana* as a rational Ayurvedic approach for systemic immune modulation in ocular allergies such as VKC.

DISCUSSION

The growing understanding of the gut-eye axis presents a paradigm shift in the management of allergic ocular diseases like Vernal Keratoconjunctivitis (VKC). Traditionally viewed as a localized hypersensitivity reaction, VKC is now increasingly being understood as a systemic immune disorder, often associated with gut microbiome dysbiosis, skewed Th2 immune responses, and chronic inflammation[8].

The Mendelian Randomization studies cited in recent literature underscore the causal role of specific gut microbial taxa in influencing allergic conjunctivitis risk. For instance, the presence of Ruminococcaceae_UCG_002, Holdemanella, and Catenibacterium has been associated with a protective effect, while Oscillospira correlates with increased risk[9]. This suggests that therapeutic strategies that restore gut microbial balance may provide systemic relief from ocular allergies.

From an Ayurvedic standpoint, this connection between gut dysregulation and ocular pathology has long been articulated through the concept of *Agni* (digestive fire), *Ama* (toxins), and *Dosha* vitiation. Particularly in VKC, which correlates with *Kaphaja-Pittaja Abhishyanda, Kapha* and *Pitta doshas* are considered to be vitiated due to underlying *Mandagni* (weakened digestive fire) and *Ama* accumulation[10].

The Ayurvedic therapeutic strategy of *Langhana* (lightening therapy), particularly in its forms of *Pachana, Rukshana, Upavasa*, and *Shodhana*, appears to offer a comprehensive approach. *Langhana* not only improves digestion and clears Ama but also helps in restoring *Srotas* (channels) patency, aligning well with modern concepts of gut detoxification, reduction of systemic antigenic load, and restoration of immune homeostasis.

Furthermore, SCFAs (short-chain fatty acids) like butyrate, produced by healthy gut microbiota, play a key role in immune modulation by enhancing regulatory T-cell (Treg) development and suppressing proinflammatory cytokines[11]. A reduction in SCFA levels due to dysbiosis contributes to immune dysregulation seen in VKC. Ayurvedic dietary interventions, such as the use of *Mudga Yusha, Takra*, and *Triphala*, have prebiotic and digestive-supporting properties that may support SCFA production and thereby improve immune tolerance[12].

In chronic or recurrent VKC where *Kapha* is predominant, classical Ayurvedic texts recommend *Vamana* (therapeutic emesis) to directly expel the vitiated *Doshas* from the gastrointestinal tract, further reducing systemic allergic load[13]. This aligns with the modern understanding of antigen elimination and immune reset therapies in chronic inflammation.

Thus, integrating Ayurvedic *Langhana* therapy with an understanding of the gut microbiome's role in systemic immune regulation offers a promising preventive and therapeutic framework for VKC. The convergence of traditional insights and modern science provides a compelling rationale for individualized, gut-targeted management of allergic ocular disorders.

CONCLUSION

Vernal Keratoconjunctivitis (VKC), traditionally perceived as a localized ocular hypersensitivity disorder, is now increasingly recognized as a manifestation of systemic immune imbalance rooted in gut dysbiosis. The emerging scientific understanding of the gut–eye axis underscores that ocular health cannot be isolated from the body's internal ecosystem-particularly the microbiome that governs immune homeostasis. Modern immunology's revelation of the Th2-skewed immune response and reduced short-chain fatty acids (SCFAs) in dysbiosis provides a compelling biological basis for Ayurvedic concepts such as *Agnimandya* (weak digestive fire), *Ama* (toxin accumulation), and *Dosha* vitiation (functional imbalance).

Ayurveda, through the time-tested principle of *Langhana*, offers an elegant and systemic approach to correcting the very foundation of this imbalance. By enhancing *Agni*, eliminating *Ama*, and restoring *Srotas* patency, *Langhana* therapies help to reestablish internal equilibrium- a state mirrored in modern terms as immune recalibration and reduction of systemic inflammation. This convergence of traditional Ayurvedic wisdom and contemporary immunological science highlights the transformative potential of integrative approaches in managing chronic allergic diseases like VKC.

Thus, addressing VKC through both the Ayurvedic lens of digestive and *Doshic* balance and the modern understanding of gut–immune modulation opens new avenues for holistic, patient-centered care. Such an integrative paradigm not only alleviates ocular symptoms but also restores systemic harmony, reaffirming that true healing lies in treating the root-the gut- to protect the branch- the eye.

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Cite this article as:
Vikas Kumar, Gunjan Sharma, Neha Negi, Sanjay Singh. Bridging Ayurveda and Modern Microbiome Research: The Gut-Eye Axis in Vernal Keratoconjunctivitis. AYUSHDHARA, 2025;12(5):154-157.
https://doi.org/10.47070/ayushdhara.v12i5.2273
Source of support: Nil, Conflict of interest: None Declared

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