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Unveiling the Gut-Eye Axis: The Role of the Microbiome in Ocular Health

Navya R[1], Sharanprasad Kolliyavar[2]

[1]PG Scholar, [2]Associate Professor
[1, 2]Department of Shalakya Tantra Shri Dharmasthala Manjunatheshwara Institute of Ayurveda and Hospital Bengaluru, Karnataka, India

Abstract

The gut microbiome (GM) is a diverse ecosystem of microorganisms that regulate digestion, immune function, and systemic inflammation. Recent research has uncovered its critical role in ocular health through the gut-eye axis, where microbial dysbiosis influences eye diseases such as uveitis, dry eye syndrome, and age-related macular degeneration (AMD). Disruptions in the gut microbiota lead to increased production of pro-inflammatory cytokines, altered immune responses, and compromised intestinal and ocular barriers, contributing to disease pathogenesis.

Ayurveda, an ancient system of medicine, recognizes the gut's influence on vision and emphasizes balanced digestion (*Agni*) for maintaining eye health. Ayurvedic treatments such as *Virechana* (purgation therapy) and *Basti* (medicated enema) are traditionally used to detoxify the body and restore microbial homeostasis. Herbal formulations, dietary modifications, and seasonal regimens further support gut integrity, reducing inflammation and enhancing ocular function. Scientific studies align with Ayurvedic principles, demonstrating that various therapies mentioned in ayurveda can positively influence gut microbiota and, consequently, ocular health.

This review bridges the gap between modern microbiome research and Ayurvedic perspectives, proposing an integrative approach to managing ocular diseases through gut-targeted interventions. Understanding the gut-eye connection opens new avenues for preventive and therapeutic strategies, reinforcing the importance of holistic health in vision care.

Keywords: Gut, microbiome, Mandagni, ocular diseases

Introduction

The phrase "we are what we eat" highlights the deep interconnection between diet, gut microbiota, and overall health. The gut microbiome, an ecosystem of bacteria, viruses, archaea, and eukaryotic microorganisms, regulates digestion, immune responses, and systemic inflammation. Emerging research suggests that disturbances in gut microbiota can influence diseases beyond the gastrointestinal tract, including ocular conditions[1]. The concept of the gut- eye axis posits that gut-derived metabolites and inflammatory mediators can affect eye health, contributing to conditions such as uveitis, dry eye syndrome, and AMD.

The gut microbiome is a dynamic and diverse community of microorganisms that interact with the host in

multiple ways. It helps in nutrient absorption, production of essential vitamins, and the modulation of immune function. The symbiotic relationship between the gut microbiota and the host ensures homeostasis; however, factors such as poor diet, antibiotic use, and stress can disrupt this balance, leading to dysbiosis. This imbalance not only affects gut health but

also has systemic implications, including ocular diseases. Scientific evidence suggests that gut- derived metabolites such as short-chain fatty acids (SCFAs) and pro-inflammatory cytokines can travel through the bloodstream and influence the health of distant organs, including the eyes.[2]

Ayurveda, the ancient Indian system of medicine, has long emphasized the importance of gut health in maintaining overall well-being, including vision. Ayurvedic practices such as detoxification therapies, dietary modifications, aim to restore gut balance and promote ocular health.

This paper aims to examine the relationship between gut microbiota and ocular health by reviewing modern biomedical research and Ayurvedic insights. By understanding the mechanisms linking gut dysbiosis to eye diseases, we can develop holistic approaches that integrate scientific advancements with traditional wisdom to maintain optimal eye health.

Methods

A literature review was conducted using peer-reviewed articles, clinical studies, and Ayurvedic texts. Key sources included research on gut dysbiosis, ocular diseases, microbial metabolites, and Ayurvedic therapies. Comparative analysis was performed to evaluate traditional and modern approaches to managing ocular health through gut microbiota modulation.

Results

The Impact of Gut Dysbiosis on Ocular Diseases

Dysbiosis is associated with systemic inflammation, largely mediated by pro-inflammatory cytokines and altered B- and T-cell populations. This systemic inflammation can contribute to ocular diseases by disrupting immune homeostasis.

- **Uveitis:** Studies indicate that systemic microbial infections, particularly those linked to gut dysbiosis, may be a key factor in uveitis pathogenesis. Researchers such as Horai et al. (2015) and Huang et al. (2018) have identified microbial signatures associated with inflammatory eye conditions.
- **Dry Eye Syndrome:** Research by Cano-Ortiz et al. suggests that dry eye patients have reduced gut microbiome diversity, with increased Bacteroidetes and Proteobacteria and decreased Firmicutes and Actinobacteria.[4]
- **Age-Related Macular Degeneration (AMD):** A comparative study between AMD patients and healthy controls revealed an increase in pro-inflammatory bacteria (Escherichia-Shigella) and a reduction in beneficial short-chain fatty acid (SCFA)- producing bacteria (Blautia and Anaerostipes).
- **The Gut-Retina Axis and Microbial Metabolites**

The gut-retina axis explains how gut microbiota influences retinal health. One critical factor is the

disruption of the blood-retinal barrier (BRB), leading to increased permeability and translocation of microbial metabolites. SCFAs, produced by beneficial gut bacteria, have been shown to cross the BRB and regulate immune responses in the retina[5].

Discussion

Ayurvedic Perspective on Gut-Ocular Health

The connection between gut health and ocular health has gained increasing attention in modern research, aligning with Ayurvedic principles that emphasize the role of digestion (Agni) in maintaining overall well-being. Ayurveda recognizes that gut imbalance (Agnimandya) leads to the formation of Ama (toxins), contributing to systemic inflammation and ocular diseases. Understanding this connection through the lens of Ayurveda and modern microbiome research can provide a holistic approach to maintaining eye health.

Instances highlighting relation between gut and ocular health.

According to Acharya Vaghbata *vata vega dharana* causes *drushti vadha.*[6] According to Acharya Sushruta *Virechana* provides *indriya bala.*[7] Before performing procedures like *Anjana* and *Tarpana Kaya Shodhana* is indicated that includes *Vamana/Virechana*[8]. Acharya Sushruta refers to *Basti Chikitsa* as "चक्षु: प्रीणयति,[9]" implying that *Basti* is effective in reaching eyes. Acharya Charaka mentions *timira* as one of the symptoms of *Vaataja grahani roga*[10]

Gut Microbiome and Agni: A Seasonal Perspective

Recent studies have revealed a strong relationship between gut microbiota and environmental factors such as changing seasons and dietary habits. Research by Davenport et al. (2014) on native communities, including the Hutterites and Hadza hunter-gatherers[11], demonstrates that the diversity of the human gut microbiome fluctuates throughout the year. This seasonal variation correlates with the Ayurvedic concept of Agni, which also changes with seasonal transitions.

By understanding Agni in terms of gut microbiome fluctuations, we find support for the gut- eye relationship described in Ayurvedic texts. For instance, in Grahani Roga (a disorder associated with digestive dysfunction), Timira (early-stage vision impairment) is mentioned as a symptom. This suggests a direct link between digestive health and ocular function.

Inflammatory Ocular Disorders and Gut Imbalance

Ayurveda describes *Saama Netra Roga* as an inflammatory stage of eye disorder characterized by symptoms such as severe pain and a foreign body sensation. Treatments recommended for bringing this state to *Nirama Avastha* include *Langana* (fasting and purification therapies) and *Tikta Dravya Sevana* (consumption of bitter herbs)[12].

Langana encompasses various therapeutic modalities such as *Shodhana* (purification), *Upavasa* (fasting), and *Deepana-Pachana* (digestive stimulants). Studies have shown that procedures like *Virechana*[8] (purgation therapy) and fasting significantly influence gut microbiome restoration by reducing dysbiosis-induced inflammatory metabolites (Zuo et al., 2018)[13]. This aligns with Ayurvedic principles that consider digestive health essential for reducing systemic inflammation, including ocular inflammation.

Ayurvedic Therapeutic Approaches

Acharya Sushruta emphasizes the role of *Basti* (medicated enema) in promoting ocular health, referring to it as "चक्षुः प्रीणयति," which means it nourishes and strengthens vision. This underscores the Ayurvedic view that a healthy gut positively influences ocular function and there is a definitive relationship between the gut and the ocular health.

Also, before ocular treatments such as *Netra Tarpana* (eye nourishment therapy) and *Anjana* (collyrium application), *Koshta Shuddhi* has been advised. This preparatory step highlights the importance of gut in enhancing ocular health. Here the *Saama Netra Roga* lakshanas are in par with the inflammatory changes taking place, various treatment modalities mentioned in *Saama Avastha* mainly aim at bringing this condition to *Nirama Avastha* and influence gut microbiome restoration by reducing dysbiosis-induced inflammatory metabolites.

Conclusion

The Ayurvedic perspective on gut-ocular health underscores the fundamental principle that treating the gut is crucial for overall well-being, including vision. The adage that "all diseases originate from *Mandagni* (impaired digestion)" reinforces the necessity of maintaining balanced Agni. Since Netra (eyes) are predominantly governed by the *Agni-Pitta* principle, their health is directly influenced by digestive balance. Modern research on gut microbiota supports these ancient Ayurvedic insights, demonstrating the systemic impact of gut health on inflammation and disease. By integrating Ayurvedic practices such as *Langana, Virechana,* and *Basti,* alongside dietary modifications, we can enhance both gut and ocular health, offering a holistic approach to vision care.

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References

1. Napolitano, P., Filippelli, M., Davinelli, S., Bartollino, S., dell'Omo, R., & Costagliola, C. (2021). Influence of gut microbiota on eye diseases: an overview. *Annalsofmedicine*, *53*(1),750–761. https://doi.org/10.1080/07853890.2021.1925150
2. **Zysset-Burri DC, Zinkernagel MS, Morandi S, Herzog EL.** The role of the gut microbiome in eye diseases. *Prog Retin Eye Res.* 2023;92:101117.
3. Zhao, Yue BSca; Qiu, Peijin MDb; Shen, Ting MDb,*. Gut microbiota and eye diseases: A review. Medicine 103(39):p e39866, September 27, 2024. | DOI: 10.1097/MD.0000000000039866
4. Song, J., Dong, H., Wang, T. *et al.* What is the impact of microbiota on dry eye: a literature review of the gut-eye axis. *BMC Ophthalmol* **24**, 262 (2024). https://doi.org/10.1186/s12886-024-03526-2
5. Scuderi, G., Troiani, E., & Minnella, A. M. (2022). Gut microbiome in retina health: the crucial role of the gut-retina axis. *Frontiers in Microbiology*, *12*, 726792.
6. Pandit Hari Sadashiva Shastri Paradkara, editor. Ashtanga Hridaya with Sarvangasundara and Ayurvedarasayana commentary. sutrasthana. Chapter 4, verses12. Varanasi: Chaukhamba Krishnadas Academy; 2017. P56.
7. Effect of Virechan Karma in the management of Oligoasthenozoospermia (Shukradushti): A Case Report Akshata L. Tare, Tanuja Gaikwad Ayurlog: National Journal of Research in Ayurved

Science- 2019; (7)(3): 1 to 6

8. Vaidya Yadavaji Trikamji Acharya, editor. Sushruta Samhita with Nibandhasangraha commentary. Uttaratantra Chapter 7, verse. 8 Varanasi: Chaukhamba Surbharati Prakashan; 2017. p. 606.
9. Virkar, Sanika & Jagtap, Pallavi & Shiralkar, Mayur & Rahinj[4], Santosh & Kale, Anand & Madhukar, Madhav. (2024). Basti: Gateway to Retinal Disorders Managemen:Journal of chemical health risks:p155,JCHR(2024)14(2),ISSN:2251-6727
10. Vaidya Yadavaji Trikamji Acharya, editor. Agnivesha. Charaka Samhita. Ayurveda-Dipika commentary by Chakrapanidutta revised ed. Nidanastana Chapter 6, verse . Varanasi: Chaukhamba Surbharati Prakashan; 2005. p.352.
11. Davenport, E. R., Mizrahi-Man, O., Michelini, K., Barreiro, L. B., Ober, C., & Gilad, Y. (2014). Seasonal variation in human gut microbiome composition. *PLoS ONE, 9*(3), e90731.
12. Bai J, Zhu Y, Dong Y. Modulation of gut microbiota and gut-generated metabolites by bitter melon results in improvement in the metabolic status in high fat diet-induced obese rats. *J Funct Foods*. 2018;41:127-34.
13. Zuo, T., Ng, S. C. (2018). The role of the gut microbiota in the pathogenesis of inflammatory diseases: Current status and future perspectives. *Journal of Inflammation Research, 11*, 263-271.