



Review Article

AYURVEDIC PERSPECTIVES ON THE GUT MICROBIOME: CONCEPTUAL INSIGHTS INTO
AGNI-AMA AND GUT HEALTH

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ABSTRACT

In Ayurveda, the principles of *Agni* (digestive fire), *Ama* (metabolic toxins), and *Grahani* (functional integrity of the gastrointestinal tract) are considered fundamental determinants of health and disease. These concepts emphasize the importance of efficient digestion, proper assimilation, and the prevention of toxic by-products within the body. The objective of this review is to explore the similarities between Ayurvedic principles of digestion, particularly *Agni*, *Ama*, and *Grahani* and the modern scientific understanding of the gut microbiome, highlighting their shared relevance in maintaining gastrointestinal and systemic health. **Materials and Methods:** A comparative narrative approach examined *Agni* and *Ama* in relation to gut microbiota, dysbiosis, and related disorders, highlighting similarities with *Grahani Dosha* and the role of Ayurvedic interventions in restoring gut health. **Result and Discussion:** Ayurveda says strong *Agni* keeps the gut healthy like a balanced microbiome. Weak digestion forms *Ama*, similar to toxins and harmful bacteria causing inflammation. *Grahani* disorders resemble issues like IBS, and Ayurvedic herbs help restore gut balance. **Conclusion:** The analysis demonstrates significant conceptual convergence between Ayurvedic digestive theory and modern microbiome science. Balanced *Agni* (*Samagni*) indicates proper digestion and healthy microbial balance, whereas disturbed *Agni* (*Vishmagni*) may be compared with dysbiosis. Integrating Ayurvedic principles with modern research may help develop more personalized, preventive, and holistic approaches for improving gut and overall health.

INTRODUCTION

The human digestive system (also called the gastrointestinal tract) is home to a huge variety of tiny living things, called microorganisms. Together, they are known as the gut microbiome. This community is made up of trillions of organisms like bacteria, viruses, fungi, and some others. If we compare all the genes of these microorganisms with human genes, the gut microbiome has about 150 times more genes than the human body. [1] The microbiome has been increasingly recognized as a “meta-organ” that participates in essential physiological processes, including digestion of complex polysaccharides, biosynthesis of vitamins and amino acids, modulation of host immunity,

maintenance of intestinal barrier integrity, and regulation of neuroendocrine pathways via the gut-brain axis.[2,3] This balance of the gut microbiome is very important for keeping us healthy. When it is disturbed, the condition is called dysbiosis. Such imbalance can cause many health problems, including obesity, type 2 diabetes, and metabolic disorders. It may also lead to autoimmune diseases, where the body’s defense system mistakenly attacks its own cells. In addition, loss of this balance can affect the brain and nervous system, increasing the risk of depression, anxiety, and other mental health issues. [4,5]

Interestingly, the ancient Indian system of medicine, Ayurveda, which was written more than two thousand years ago, already explained ideas similar to what modern science is now discovering. In Ayurveda, *Agni*, or the “digestive fire,” is considered the key to good health and long life. It is responsible for digesting food and turning it into energy and nutrition for the body. When *Agni* works properly, the body stays healthy and strong. But if *Agni* becomes weak or

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disturbed, digestion does not happen completely. This leads to the formation of *Ama*, which is like a toxic, half-digested substance. *Ama* is believed to block normal body functions and is considered the root cause of many diseases. In this way, Ayurveda explains that keeping *Agni* strong and preventing *Ama* is essential for maintaining health.^[6,7] The classical Ayurvedic text *Charaka Samhita* unequivocally asserts: "Life, vitality, strength, complexion, nourishment, luster, immunity, energy, and memory-all depend upon the state of *Agni*. When *Agni* is extinguished, life ceases; when *Agni* functions properly, life is sustained" (*Chikitsasthana* 15/3-4).^[6] This statement shows that Ayurveda considers digestion and metabolism as the main controllers of overall health. Modern microbiome science is now also proving the same idea. The objective of this article is to compare *Agni* and *Ama* from Ayurveda with the modern concepts of the gut microbiome and dysbiosis. By finding these similarities, we can see how ancient wisdom and modern science can work together and support each other to improve our understanding of gut health.

MATERIALS AND METHODS

A comparative review approach is utilized to analyze the functional role of *Agni* as the core regulator of health and *Ama* as a pathological by-product of impaired digestion. These traditional frameworks are systematically evaluated against today's perspective on the gut microbiome to establish areas of conceptual convergence and to assess the therapeutic relevance of Ayurvedic interventions.

Data Source: Information is drawn from classical Ayurvedic literature (like *Charaka Samhita*, *Shusruta Samhita*, and *Vagbhata Astanga Hridaya*) detailing *Agni* (digestive fire), *Ama* (metabolic toxins), and *Grahani* (the anatomical seat of *Agni*), alongside modern peer-reviewed journals and scientific databases focusing on gut microbiome composition, function, and modern gastrointestinal pathology.

RESULT & DISCUSSION

The analysis of classical Ayurvedic literature and contemporary biomedical research revealed significant conceptual parallels between traditional digestive physiology and modern gut microbiome science. The findings are presented under the following sections

Agni as the Core Regulator of Health in Ayurvedic Thought

In Ayurveda, *Agni* is not just a symbol but a full physiological concept that includes digestion, metabolism, and the absorption of nutrients into the body. There are thirteen types of *Agni* described.^[6] The most important, *Jatharagni*, is found in the stomach and upper small intestine and controls the main digestion of food. The *Bhutagnis*, or five elemental fires, change digested food into basic elemental forms,

while the *Dhatvagnis*, or seven tissue-level fires, manage metabolism at the cellular level and help nutrients reach different body tissues. This detailed system shows that Ayurveda understood digestion and metabolism as connected processes happening at multiple levels, from the whole digestive system down to individual cells, similar to what modern science calls systems biology.^[7]

Ayurveda classifies the functional state of *Agni* into four types. *Samagni*, or balanced *Agni*, means that digestion and metabolism are working properly, keeping the body healthy. *Mandagni*, or weak *Agni*, leads to slow digestion, buildup of undigested food, and can increase the risk of chronic diseases. *Tiksnagni*, or strong *Agni*, means digestion is too fast or intense, which can exhaust the body's tissues and cause inflammation. *Vishmagni*, or irregular *Agni*, refers to unstable digestion, often causing bloating, discomfort, or other digestive problems. Understanding these types helps Ayurveda explain why people respond differently to food and why digestive balance is so important for overall health.^[6,7] *Charaka* affirms the primacy of *Agni* by declaring, "All diseases arise due to impaired *Agni*; hence all therapeutic interventions aim fundamentally at restoring *Agni*".^[19]

Ama: The Pathological By-Product of Impaired Digestion

In Ayurveda, *Ama* is the toxic, undigested substance that forms when *Jatharagni* (the main digestive fire) is weak or not working properly. *Ama* is described as heavy, sticky, and foul-smelling, and it can block the body's channels (*Srotas*) and disturb the balance of energies in the body (*Doshas*). Classical texts explain that *Ama* can cause early warning signs like loss of appetite, indigestion, stomach heaviness, coated tongue, joint stiffness, fatigue, and general discomfort. As *Charaka* explains: "When the digestive fire is weak, the primary nutrient essence (*Rasa*) is not fully formed; this incompletely transformed product is called *Ama*, which affects all *Doshas*."^[8]

From a modern science perspective, *Ama* is similar to the harmful substances that form in the body when the gut microbiome is unbalanced. These include toxic by-products and molecules that can cause inflammation and other health problems. Scientists sometimes call this condition metabolic endotoxemia, which shows how an imbalanced gut can affect overall health.^[9] These include lipopolysaccharides (LPS), advanced glycation end products, putrefactive metabolites (indoles, p-cresol), and other pro-inflammatory intermediates that are known to disrupt intestinal permeability, activate immune responses, and contribute to systemic low-grade inflammation.^[10,11] *Ama* is an ancient way of describing what happens in the body when digestion is weak or

the gut is out of balance. Ayurveda recognized that poor digestion leads to the buildup of harmful, toxic substances, which can block the body's channels and disturb the natural energies (*Doshas*). This idea is very similar to modern science, which shows that an imbalanced gut microbiome can produce toxic by-products and cause inflammation, metabolic problems, and other diseases. In this way, *Ama* can be seen as an early description of the harmful effects of microbial imbalance and maldigestion, showing that ancient and modern medicine share similar insights about gut health.

Grahani: The Anatomical and Functional Seat of Agni

In Ayurveda, *Grahani* is considered to be the duodenum and the upper part of the small intestine. It is seen as the main place where *Jatharagni* (the digestive fire) works.^[6] When the body is healthy, *Grahani* holds the food until it is fully digested and then moves it forward so the nutrients can be absorbed. If *Agni* is weak or impaired, *Grahani* cannot work properly. This condition is called *Grahani-dosha*, which can cause problems like long-lasting diarrhea, poor absorption of nutrients, weight loss, and general weakness in the body.^[7] This Ayurvedic description is similar to what modern science understands about certain digestive problems. Conditions like irritable bowel syndrome, celiac disease, and "leaky gut syndrome" happen when the small intestine does not work properly. This can lead to poor absorption of nutrients, weakening of the intestinal barrier, and inflammation throughout the body. Just like *Grahani-dosha* in Ayurveda, these modern conditions show how important the small intestine and proper digestion are for overall health.^[10,12]

The Gut Microbiome: Today's Perspective

Advances in metagenomics and high-throughput sequencing have illuminated the composition and functional significance of the gut microbiome. The dominant bacterial phyla include firmicutes, bacteroidetes, actinobacteria, and proteobacteria.^[1,2] These tiny organisms in the gut perform many important jobs that keep the body healthy. They break down dietary fibres from food into small molecules called short-chain fatty acids (SCFAs), such as butyrate, propionate, and acetate, which provide energy and support the cells lining the intestines. They also make essential vitamins, including B vitamins and vitamin K, which are important for energy, blood clotting, and overall health. The gut microbes help process bile acids, which are needed for fat digestion, and they also control the immune system by keeping a balance between fighting harmful microbes and preventing unnecessary inflammation.^[2,3,13]

If the microbiome becomes unbalanced, it is called dysbiosis. In this state, there are fewer types of healthy microbes, harmful microbes (opportunistic pathogens) may increase, beneficial microbes decrease, and the substances they produce (metabolites) are changed. This imbalance can affect digestion, immunity, and overall health.^[4,5] This dysregulated state has been implicated in the pathogenesis of obesity, insulin resistance, type 2 diabetes, inflammatory bowel diseases, allergies, autoimmune disorders, cardiovascular disease, and neuropsychiatric illnesses.^[10,13,14] When the gut microbiome is imbalanced (dysbiosis), it can make the intestines more permeable, a condition often called "leaky gut." This allows harmful substances, such as LPS (lipopolysaccharides) and other microbial products, to pass from the gut into the bloodstream. Once in the circulation, these substances can trigger chronic low-level inflammation and disrupt normal metabolism, which may contribute to various health problems like obesity, diabetes, and other metabolic disorders.^[11,13]

Agni-Ama and the Microbiome: Conceptual Convergence

Ayurveda and modern science may seem different, but when we compare them, we find many similarities. In Ayurveda, *Agni* is considered the power of digestion, and it closely matches what modern science calls the gut microbiome- the community of tiny microbes living in our intestines. When *Agni* is balanced, called *Samagni*, digestion works smoothly, just like when the gut microbes are healthy and balanced. If *Agni* becomes weak, known as *Mandagni*, digestion slows down, which is similar to an unhealthy gut condition called dysbiosis, where harmful microbes grow and cause gas, bloating, and toxins. On the other hand, when *Agni* is too strong, called *Tiksnagni*, digestion becomes too quick and harsh, which is like an overactive gut leading to irritation and diarrhea. Lastly, when *Agni* is irregular, called *Vishmagni*, digestion becomes unpredictable, just like when the gut microbes are unstable, causing irregular bowel movements and discomfort. Thus, both Ayurveda and modern science explain digestion in their own way, but the core ideas are very similar.^[6,9] In Ayurveda, the concept of *Ama* refers to undigested or harmful substances formed when digestion is weak. Modern science describes something very similar in the gut, called endotoxins and harmful metabolites produced during dysbiosis (imbalance of gut microbes). Just like *Ama*, these substances can stick to tissues, block normal body functions, and cause inflammation. This shows how ancient Ayurvedic ideas and modern microbiology are closely connected in explaining the effects of poor digestion on health.^[10,11] In Ayurveda, *Grahani-dosha* is a disorder that occurs when the digestive fire (*Agni*) becomes weak or irregular,

leading to poor digestion and absorption of food. Modern science explains similar conditions through problems like impaired gut barrier function (leaky gut), malabsorption syndromes (where nutrients are not absorbed properly), and irritable bowel disorders (IBS), which cause irregular bowel habits and abdominal discomfort. Thus, *Grahani-dosha* described in Ayurveda closely matches these modern digestive disorders, showing how both systems highlight the importance of healthy digestion for overall well-being.^[12,13]

Thus, Ayurveda and microbiome science converge on a unified principle: the quality of digestion and the integrity of gut microbial ecology are pivotal determinants of systemic health and disease.

Ayurvedic Interventions and Their Microbiome Relevance

According to Ayurveda, keeping digestion (*Agni*) healthy is important to prevent the build-up of harmful substances (*Ama*). For this, food should be freshly cooked, warm, and easy to digest, so that the body can absorb nutrients properly. Ayurveda also advises changing diet with the seasons (*Ritucarya*), because our body's metabolism and energy needs vary in summer, winter, and rainy season. *Trikatu* is a traditional Ayurvedic mixture made from *Pippali* (long pepper), *Maricha* (black pepper), and *Shunthi* (dry ginger). It is known to improve digestion and help the body absorb nutrients better. When combined with synbiotics (a mixture of probiotics- good bacteria- and prebiotics- the food that supports these bacteria), it can support a healthy gut by improving digestion, balancing gut microbes, and promoting overall health.^[17] In a similar line *Triphala*, traditionally used in Ayurvedic medicine, is being scientifically validated for numerous therapeutic effects beyond its laxative action. Its polyphenols positively influence the gut microbiome by promoting beneficial bacteria (bifidobacteria and lactobacillus) and suppressing harmful microbes, with gut microbiota mediating the production of anti-inflammatory compounds.^[13,15]

Lifestyle practices (*Vihara*) such as regular daily routines (*Dinacharya*), yoga, pranayama, and meditation support digestive efficiency and stress resilience.^[7] Ayurveda advises not to eat when you are upset, at odd times, or in excess. Modern science also shows that such habits can disturb digestion, upset the balance of gut bacteria, and disturb the body's natural clock (circadian rhythm).^[13,16]

Trikatu churna is considered very effective in treating *Ama* (toxins formed from improperly digested or metabolized food, including harmful free radicals). It is also regarded as the main remedy for *Agnimandya* (weak digestion caused by a faulty digestive process).^[18] Detoxification procedures (*Sodhana*), including *Panchakarma* therapies like *Vamana*

(therapeutic emesis), *Virechana* (purgation), and *Basti* (enema), aim to reset digestive function and restore microbial balance.^[15] Following detoxification, gradual dietary rehabilitation through *Samsarjana-krama* is recommended, which parallels modern dietary re-feeding strategies that promote microbiome reassembly. Rejuvenative (*Rasayana*) therapies are further prescribed to restore tissue health, mucosal integrity, and immunity, analogous to microbiome-supportive interventions such as probiotics and prebiotics.^[16]

Bridging Ayurveda with microbiome science offers new research opportunities. Future studies may explore whether *Mandagni* is linked with reduced microbial diversity and inflammation.^[9] The concept of *Ama* may correspond to biomarkers such as LPS and harmful metabolites seen in dysbiosis.^[11] Ayurvedic therapies like *Triphala*, *Takra*, and *Panchakarma* may help improve gut microbial balance.^[15] Differences in *Prakrti* may also relate to distinct microbiome patterns.^[16]

CONCLUSION

Recent studies show that gut health is very important for controlling body functions, immunity, and the risk of chronic diseases. Both Ayurveda and microbiome science agree that digestion and metabolism are the main regulators of health. In Ayurveda, *Agni* means the body's ability to digest, absorb, and convert food into energy, while *Ama* refers to harmful substances produced when digestion is weak or gut microbes are imbalanced. These ideas are similar to modern concepts of gut health. A balanced gut microbiome (eubiosis) supports health, while an imbalance (dysbiosis) can lead to disease. Beneficial compounds like short-chain fatty acids (SCFAs) support gut function, whereas harmful substances such as lipopolysaccharides (LPS) may cause inflammation. Combining Ayurvedic knowledge with microbiome research may help develop a more holistic, preventive, and personalized approach to healthcare. This integration allows traditional ideas to be studied with modern scientific tools and may help improve nutrition, develop new treatments, and support better disease prevention.

Authors' contribution statement

KS designed and drafted the manuscript. While SC critically reviewed and refined the manuscript. Both authors approved the final version

Data availability statement

All information generated or examined in this study is fully presented within this manuscript. No separate or additional datasets were developed or utilized.

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