



Review Article

HUMAN GUT MICROBIOME IN HEALTH AND DISEASE-AN AYURVEDIC PERSPECTIVE

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ABSTRACT

The human gut microbiome refers to the complex collection of trillions of microorganisms residing in the gastrointestinal tract, which play a crucial role in homeostasis and disease. Over the past few years, our understanding of the microbiome has evolved significantly, highlighting its impact on a wide range of physiological and pathological processes. This emerging knowledge has transformed health sciences, revealing the gut microbiome's essential role in maintaining metabolic, immune and neurological health. In this context, Ayurveda, a traditional system of medicine originating in India, has long emphasized the importance of gut health. Ayurveda's integrative approach of dietary guidelines, lifestyle modifications, treatments, and practices aimed at restoring balance within the body. The "Agni" (digestive fire) in Ayurvedic terms, is considered a central element of health. Ayurveda teaches that proper digestion is essential not only for physical well-being but also for mental clarity and emotional stability. Ayurveda offers supportive view into modern microbiome science by focusing on the balance of bodily humours (*Doshas*) and recommending specific herbs, probiotics, and prebiotics that can support gut health. In-depth analysis of Ayurvedic concepts and practices in line with the theory of microbiome proves that they are aimed at maintaining a balanced gut flora. As microbiome research continues to evolve, Ayurveda's emphasis on individualized care, nurturing the gut microbiome and enhancing overall health.

INTRODUCTION

The human gut microbiome refers to the complex and dynamic population of microorganisms, including bacteria, viruses, fungi, and archaea, that reside within the gastrointestinal tract. These microbes play a major role in maintaining human health by supporting digestion, metabolism, synthesizing vitamins, regulating the immune system, and even influencing mental health. The gut microbiome is composed of over 100 trillion microbes, with each individual having a unique microbial community influenced by factors such as genetics, diet, environment, and lifestyle. Current research has significantly advanced our understanding of the gut microbiome's importance in disease prevention and maintenance of health.

A balanced microbiome is essential for proper nutrient absorption, immune system function, and protection against harmful pathogens<sup>[1]</sup>. Dysbiosis, an imbalance in the microbial community, has been linked to a variety of conditions, including gastrointestinal disorders metabolic diseases, autoimmune diseases, and even neurological disorders<sup>[2]</sup>. Furthermore, the gut-brain axis, a bidirectional communication network between the gut and the brain, has become a key area of research. Studies explains that the gut microbiome influences brain function and behaviour through signalling molecules like neurotransmitters<sup>[3]</sup>. Emerging therapies, such as probiotics, prebiotics, and faecal microbiota transplants, aim to restore microbial balance and improve health. Overall, the human gut microbiome is a complex and dynamic ecosystem that impacts physical and mental well-being. Ongoing research continues to explore influence of microbiome in human health, leading to more targeted and personalized approaches in medicine.

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## MATERIALS AND METHODS

### The basic concept of *Agni*

Ayurveda has long emphasized the importance of gut health and its multidimensional approach includes dietary guidelines, lifestyle modifications, treatments, and practices aimed at restoring balance within the body. The "*Agni*" (digestive fire) in Ayurvedic terms, is considered a central element of health. Ayurveda believes that proper digestion is essential not only for physical well-being but also for mental clarity and emotional stability<sup>[4]</sup>. Ayurveda offers contribution into knowledge of modern microbiome science by focusing on the balance of bodily humours (*Doshas*) and recommending specific herbs, probiotics, and prebiotics that can support gut health. The Ayurvedic view of digestion, or *Agni*, is closely related to the health of the gut microbiome. According to Ayurveda, *Agni* is responsible for transforming food into nutrients and eliminating waste, and its strength directly influences on health. The concept of *Agni* is a major key to the understanding of gut health in Ayurveda. A strong, balanced *Agni* leads to proper digestion, absorption of nutrients, and the prevention of toxins (*Ama*) that can accumulate when digestion is weak<sup>[5]</sup>. But when *Agni* is weak, digestion becomes impaired, leading to the production of *Ama*, which can contribute to several health issues, including gut dysbiosis, inflammation, and disease. Ayurveda have great role on maintaining balanced *Agni* through dietary factors, lifestyle practices, and herbal remedies.

### Physiological balance of the gut

As per Ayurvedic principles, *Agni* is considered as the seat of health, where the digestive system (*Koshta*) plays a crucial role in maintaining the body's overall balance. The term *Koshta* refers to the entire digestive tract, encompassing the stomach, intestines, and associated organs that facilitate digestion and absorption. Ayurveda emphasizes that a healthy *Koshta* is vital for the proper functioning of the body and mind<sup>[6]</sup>. The *Doshas* govern different physiological functions, including those of the digestive system. *Vata*, associated with movement, regulates the motility of the gut and elimination of waste. *Pitta*, associated with heat and transformation, governs the digestive processes and the balance of enzymes. *Kapha*, linked to structure and lubrication, maintains the mucosal lining of the intestines and facilitates the absorption of nutrients. Imbalances in the *Doshas* can disturb the gut microbiome, leading to conditions such as bloating, constipation, or inflammation<sup>[7]</sup>. A well-balanced *Agni* helps in proper transformation of *Dhathus* and thus in maintaining health and this leads to the formation of proper *Ojas*, which in turn strengthens the body's natural defence mechanisms, including those within the gut<sup>[8]</sup>. Since a large portion of the immune system is

housed in the gut (through structures like the gut associated lymphoid tissue, or GALT), a healthy microbiome is essential for immune function and resilience against infections<sup>[9]</sup>. Ayurveda sees the gut as a dynamic ecosystem that interacts with both internal (*Dosha* balance) and external factors (diet, lifestyle etc.). For example, *Prakriti* (individual constitution) influences the gut flora's composition, while factors such as diet, stress, and environment can alter the gut's microbial balance. Ayurvedic approaches aim to maintain this balance by prescribing individualized treatments that consider both the *Doshic* imbalances and the health of the microbiome.

A balanced *Agni* ensures that food is properly digested, nutrients are absorbed efficiently, and waste products are eliminated efficiently. The state of *Agni* directly impacts the health of the gut microbiome. When *Agni* is strong, the digestive process is proper, leading to the creation of beneficial gut flora and the prevention of toxins (*Ama*). But a weak *Agni* results in improper digestion, leading to an imbalance in the microbiome, accumulation of *Ama*, and digestive disturbances.

### Gut and the Mind

In Ayurveda, mental factors are closely connected to the health of the gut and the microbiome, emphasizing the integrative nature of mind-body balance. The relationship between mental and digestive health is significant in the context of *Koshta* and *Agni*. Ayurveda says that the mind and emotions have a profound impact on digestion, which in turn affects the gut microbiome. Psychological stress, anxiety, and negative emotions such as anger, fear, and sadness can disrupt the balance of *Agni*. When the mind is disturbed, it impairs the digestive fire, leading to weakened digestion and the formation of *Ama*<sup>[10]</sup>. This results in an unhealthy gut microbiome, which can manifest as digestive issues like bloating, constipation, or diarrhoea. Chronic stress can also increase *Vata Dosha*, disrupting gut motility and further contributing to digestive disturbances. According to Ayurveda, mental clarity and focus are essential for strong *Agni*. When the mind is calm and balanced, digestion is more efficient, leading to better nutrient absorption and a balanced gut flora. Practices such as meditation, mindfulness, and relaxation techniques help pacify the mind, supporting the digestive process and overall gut health<sup>[11]</sup>. Ayurveda recognizes the deep connection between the gut and the brain, a concept supported by modern science through the gut-brain axis. A balanced mind promotes a healthy gut, while gut imbalances can influence mood and cognition. Ayurvedic practices aim to maintain mental health, thus supporting digestive health and the microbiome.

## RESULTS AND DISCUSSIONS

### Gut as a generating centre for diseases

The balance and strength of *Koshta* and *Agni* directly influence digestion, absorption, detoxification, and immune function, all of which are crucial for maintaining good health. According to Ayurveda, when *Agni* (digestive fire) is strong and balanced, it ensures that food is properly digested and absorbed, contributing to the creation of healthy tissues (*Dhatus*) and the elimination of waste products (*Malas*)<sup>[12]</sup>. However, when *Agni* is weak (a condition known as *Mandagni*), digestion becomes impaired, leading to incomplete digestion of food. This results in the formation of *Ama*-undigested or improperly processed food particles that accumulate in the body as toxins. *Ama* is considered the root cause of many diseases in Ayurveda, as it can spread through the circulatory system and settle in tissues, joints, and organs, causing inflammation, infection, and degeneration. The integrity and health of the *Koshta*, which includes the stomach, small intestine, large intestine, and the associated organs of digestion are essential for overall well-being. When the digestive tract is compromised due to poor *Agni*, irregular food habits, or emotional stress, the microbiome within the gut can become imbalanced<sup>[13]</sup>. Dysbiosis, or microbial imbalance, is seen as a contributor to digestive disturbances, metabolic disorders, and immune dysfunction. For example, an overgrowth of harmful bacteria or yeast in the gut can lead to conditions like irritable bowel syndrome (IBS), leaky gut syndrome, and even systemic inflammation<sup>[14]</sup>.

### Treatments to re-establish gut health

Ayurvedic treatment for most diseases revolves around restoring the balance of *Agni*. The base line treatments like *Pachana* and *Deepana* aims at strengthening the *Agni*. *Shamanoushadhas* contain drugs that maintains *Pachana* and *Deepana*. The *Panchakarma* treatments that eliminate toxins from the body, in turn helps to maintain the balance of *Agni*. *Samsarjana krama*, which is suggested after *Dosha shodhana* is really intended for the balance of *Agni*<sup>[15]</sup>.

Ayurveda focus a great emphasis on the type of food consumed to maintain a healthy *Koshta* and *Agni*. According to Ayurvedic principles, foods should be chosen based on an individual's *Dosha*, the season, and digestive capacity. Eating freshly prepared, warm, and easily digestible foods helps stimulate *Agni* and avoid the formation of *Ama*<sup>[16]</sup>. It is advised to avoid heavy, cold, and greasy foods, as they can weaken digestion and disturb the gut microbiome. Certain Ayurvedic *Dravya*, like *Shundi* (*Zingiber officinale*), *Haridra* (*Curcuma longa*), *Jeeraka* (*Cuminum cyminum*), *Sarshapa* (*Brassica juncea*), *Kaidarya* (*Murraya koenigii*), *Triphala* (consisting of *Terminalia chebula*, *Terminalia bellerica* and *Emblica officinalis*) etc., play a

vital role in supporting *Agni* and maintaining a balanced microbiome, thus a proper gut health. These *Dravya* can aid in reducing inflammation, fighting infections, and promoting the growth of beneficial bacteria in the gut<sup>[17]</sup>. In addition to dietary considerations, Ayurveda emphasizes the importance of proper lifestyle habits in maintaining *Koshta* and *Agni*. Practices like *Abhyanga* (oil massage), regular physical activity, and mindful eating (eating in a calm environment and chewing food properly) are essential for digestive health. Reducing stress through practices like yoga, meditation, and adequate sleep is also crucial, as mental and emotional balance directly affects digestive function and microbiome health<sup>[17]</sup>.

## CONCLUSION

Ayurveda provides a comprehensive and integrative approach to understanding the health of the human gut, emphasizing the crucial roles of *Koshta* and *Agni* in overall well-being. A strong and balanced *Agni* ensures proper digestion, absorption of nutrients, and elimination of waste, while a healthy *Koshta* supports the body's immune system, metabolism, and gut microbiome. When *Agni* is weak, it leads to improper digestion and the accumulation of *Ama*, which can disrupt the gut microbiome and contribute to various health issues. Ayurvedic treatments, including dietary regulations, herbal remedies, and detoxification therapies like *Panchakarma*, aim to restore *Agni*, eliminate *Ama*, and support a balanced gut microbiome. Furthermore, Ayurveda emphasizes the importance of mindful eating, proper meal timing, and stress management to maintain optimal digestive health. As microbiome research continues to evolve, Ayurveda's emphasis on individualized, multi-dimensional care provides valuable perspectives for nurturing the gut microbiome and enhancing overall health.

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