

# Functional Foods in Ayurveda: Concept of Rasayana and Immunity

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## Introduction

The concept of functional foods is foods that provide health benefits beyond basic nutrition has gained significant attention in modern nutrition science. Interestingly, the idea is not new to India. Classical Ayurvedic texts such as the Charaka Samhita and the Sushruta Samhita describe the concept of *Rasayana*, a specialized branch of Ayurveda focused on rejuvenation, longevity, vitality, and disease resistance.

In Ayurveda, food (*Ahara*) is considered one of the three pillars of life (*Trayopastambha*), along with sleep and regulated lifestyle. Functional foods in Ayurveda are those that nourish tissues (*Dhatu*s), strengthen immunity (*Vyadhikshamatva*), enhance mental clarity, and promote overall well-being.

## Understanding the Concept of Rasayana

The term *Rasayana* is derived from two Sanskrit words i.e. *Rasa* (nutritional essence or plasma) and *Ayana* (path or circulation). Thus, *Rasayana* refers to the path through which nourishment reaches body tissues. It aims to optimize the quality of *Rasa Dhatu*, which ultimately supports the formation and strength of all other tissues. Objectives of *Rasayana* Therapy are promotion of longevity (*Dirghayu*), enhancement of memory and intellect (*Medha*), improvement in immunity and disease resistance, maintenance of youthfulness and vitality and prevention of degenerative disorders. Ayurveda emphasizes that a strong digestive fire (*Agni*) and balanced doshas (*Vata*, *Pitta*, *Kapha*) are prerequisites for effective *Rasayana* action.

## Immunity in Ayurveda: Vyadhikshamatva

Immunity in Ayurveda is referred to as *Vyadhikshamatva*, which includes *Vyadhi-bala-virodhitva* i.e. resistance against disease strength and *Vyadhi-utpada-pratibandhakatva* which mean prevention of disease occurrence. The foundation of immunity lies in *Ojas*, considered the essence of all body tissues. When *Ojas* is strong, the body exhibits resilience, strength, mental stability, and vitality.

Modern immunology parallels this concept with innate and adaptive immunity. *Rasayana* foods help in modulating immune responses, reducing oxidative stress, and enhancing host defense mechanisms.

## Functional Rasayana Foods and Scientific Relevance

### 1) Amla (*Emblica officinalis*): A Classical Rasayana with Immunomodulatory Potential

Amla (Indian gooseberry), botanically known as *Emblica officinalis* (syn. *Phyllanthus emblica*), occupies a central

position in Ayurvedic *Rasayana* therapy and is extensively described in classical texts such as the Charaka Samhita. It is a principal ingredient in the renowned polyherbal formulation Chyawanprash, traditionally prescribed to promote longevity, vitality, and immune resilience. From a nutritional perspective, amla is exceptionally rich in natural vitamin C (ascorbic acid), along with an array of polyphenols, including gallic acid, ellagic acid, emblicanin A and B, and flavonoids. These bioactive compounds confer strong antioxidant capacity, enabling effective scavenging of reactive oxygen species and protection against oxidative stress-induced cellular damage.

Functionally, amla demonstrates significant immunomodulatory activity by enhancing the proliferation and activity of immune cells, including lymphocytes and macrophages, thereby strengthening host defense mechanisms. Its anti-inflammatory properties are attributed to the modulation of pro-inflammatory cytokines and inhibition of oxidative pathways. Additionally, the high vitamin C content supports collagen synthesis, contributing to tissue integrity and improved wound healing. Contemporary scientific investigations increasingly validate these traditional claims, positioning amla as a promising functional food ingredient with substantial relevance in preventive nutrition and immune health promotion.



Fig. 1. Amla (Indian gooseberry)

### 2) Turmeric (*Curcuma longa*): A Rasayana with Anti-Inflammatory and Immunoregulatory Potential

Turmeric (*Curcuma longa*), a widely used culinary spice and medicinal herb, is highly revered in Ayurveda as a *Rasayana* and traditionally described as a natural blood purifier (*Rakta Shodhaka*). Classical Ayurvedic literature, including the Charaka Samhita, recognizes turmeric for its role in promoting systemic balance, wound healing, and disease resistance. The principal bioactive compound of turmeric is curcumin, a polyphenolic molecule responsible for its characteristic yellow color and diverse therapeutic properties.

From a functional nutrition perspective, curcumin exhibits potent anti-inflammatory, antioxidant, and antimicrobial activities. It neutralizes reactive oxygen species, enhances endogenous antioxidant enzyme activity, and inhibits lipid peroxidation, thereby protecting cellular structures from oxidative damage. Its anti-inflammatory action is primarily mediated through modulation of molecular signaling pathways, including suppression of pro-inflammatory cytokines and transcription factors such as NF- $\kappa$ B. Furthermore, curcumin plays a significant role in immune regulation by influencing both innate and adaptive immune responses, supporting immune homeostasis rather than excessive immune activation.

Contemporary biomedical research increasingly substantiates the traditional claims associated with turmeric, particularly its capacity to modulate cytokine activity, reduce chronic low-grade inflammation, and contribute to the prevention of inflammatory and metabolic disorders. These validated biofunctional properties position turmeric as a scientifically relevant Rasayana ingredient with considerable potential in the development of evidence-based functional foods and nutraceutical formulations.



Fig. 2. Turmeric (*Curcuma longa*)

### 3) Ashwagandha (*Withania somnifera*): An Adaptogenic Rasayana for Stress Modulation and Immune Support

Ashwagandha (*Withania somnifera*), one of the most extensively documented Rasayana herbs in classical Ayurvedic literature such as the Charaka Samhita, is widely recognized for its adaptogenic properties. Traditionally prescribed to promote vitality (*Balya*), longevity, and resilience, Ashwagandha is categorized as a rejuvenative herb that strengthens both physical and psychological endurance. Its principal bioactive constituents, including withanolides, alkaloids, and sitoindosides, contribute to its multifaceted pharmacological profile.

From a scientific perspective, Ashwagandha has demonstrated significant stress-modulating effects, primarily

through the regulation of the hypothalamic–pituitary–adrenal (HPA) axis and reduction of circulating cortisol levels. By mitigating chronic stress responses, it helps prevent stress-induced immune suppression. Experimental and clinical studies indicate that Ashwagandha enhances immune cell proliferation, improves natural killer (NK) cell activity, and supports overall immune competence. Additionally, its anabolic and restorative properties contribute to improved muscle strength, stamina, and general vitality.

As an adaptogen, Ashwagandha enhances the body's capacity to resist physical, chemical, and psychological stressors while maintaining physiological homeostasis. This stress-buffering action indirectly strengthens immune health, highlighting its relevance as a scientifically validated functional ingredient within the Rasayana framework and its potential application in evidence-based nutraceutical and functional food development.



Fig. 3. Ashwagandha (*Withania somnifera*)

### 4) Guduchi (*Tinospora cordifolia*): An Immunostimulant Rasayana with Hepatoprotective Potential

Guduchi (*Tinospora cordifolia*), revered in Ayurveda as “Amrita” (the nectar of immortality), holds a distinguished position among Rasayana herbs for its rejuvenative and disease-preventive properties. Classical Ayurvedic compendia, including the Charaka Samhita, describe Guduchi as a potent promoter of vitality, longevity, and systemic balance. Its pharmacologically active constituents such as diterpenoid lactones, alkaloids, glycosides, and polysaccharides contribute to its broad spectrum of therapeutic effects.

From a functional nutrition and biomedical perspective, Guduchi exhibits significant immunostimulant activity by enhancing macrophage function, promoting phagocytosis, and improving overall immune surveillance. It supports both innate and adaptive immune responses, thereby strengthening host defense mechanisms. Additionally, Guduchi demonstrates notable antipyretic and anti-inflammatory properties, mediated through modulation of pro-inflammatory cytokines and oxidative stress pathways. Its

hepatoprotective action further underscores its systemic benefits, as it aids in maintaining liver function and detoxification processes essential for metabolic and immune homeostasis.

Contemporary scientific investigations increasingly validate these traditional claims, positioning Guduchi as a promising Rasayana ingredient with substantial relevance in immune-supportive nutraceuticals and evidence-based functional food formulations.



**Fig. 4. Guduchi (*Tinospora cordifolia*)**

### 5) Chyawanprash: A Classical Rasayana Formulation with Immunomodulatory Relevance

Chyawanprash is a traditional polyherbal, jam-like formulation extensively described in the Charaka Samhita as a classical Rasayana preparation intended to promote longevity, vitality, and resistance to disease. Historically formulated to rejuvenate the sage Chyavana, this preparation represents one of the most well-documented examples of functional nutrition within the Ayurvedic system. Its composition is complex and synergistic, typically comprising amla (*Emblia officinalis*) as the primary ingredient, combined with ghee and honey as bioavailability enhancers, along with a group of medicinal plants collectively known as Dashamoola and various adaptogenic herbs.

Amla provides a rich source of vitamin C and polyphenolic antioxidants, while ghee and honey function as carriers that facilitate the absorption of fat-soluble phytoconstituents and enhance metabolic assimilation. The inclusion of adaptogenic and immunomodulatory herbs contributes to systemic resilience and stress adaptation. Traditionally, Chyawanprash is prescribed to strengthen respiratory function, enhance immune competence, and improve stamina and overall vitality. Contemporary scientific investigations have begun to validate its antioxidant, anti-inflammatory, and immunomodulatory properties, supporting its relevance as a culturally rooted yet scientifically significant functional food within the Rasayana framework.

### Mechanism of Rasayana from a Modern Biomedical Perspective

From a contemporary scientific standpoint, Rasayana foods exert their health-promoting effects through multiple interconnected biological pathways that align closely with current concepts in functional nutrition and preventive medicine. One of the primary mechanisms involves potent antioxidant activity, wherein bioactive phytochemicals neutralize reactive oxygen species and reduce oxidative stress, thereby protecting cellular macromolecules from damage. In addition to free radical scavenging, Rasayana herbs demonstrate significant immunomodulatory properties by enhancing both innate and adaptive immune responses. This includes stimulation of macrophage activity, improved lymphocyte proliferation, and balanced immune signaling that promotes defense without excessive immune activation.

Rasayana formulations also exhibit marked anti-inflammatory effects, particularly relevant in the management of chronic low-grade inflammation associated with metabolic and degenerative disorders. These effects are mediated through the modulation of pro-inflammatory mediators and transcription factors. Furthermore, growing evidence highlights the role of Rasayana components in regulating gut microbiota composition, thereby supporting digestive health and contributing to immune homeostasis via the gut-immune axis. Stress reduction represents another critical mechanism, as several Rasayana herbs function as adaptogens, helping to restore neuroendocrine balance and modulate the hypothalamic-pituitary-adrenal (HPA) axis. Emerging molecular studies suggest that many Rasayana ingredients influence key signaling pathways, including NF- $\kappa$ B activation, cytokine regulation, and oxidative stress modulation, providing a mechanistic bridge between traditional Ayurvedic concepts and modern biomedical understanding.

### Rasayana and Preventive Nutrition

Ayurveda fundamentally emphasizes preventive healthcare, advocating the preservation of health (*Swasthasya Swasthya Rakshanam*) alongside disease management. Within this framework, Rasayana therapy represents a structured approach to enhancing physiological resilience, delaying aging, and preventing disease onset rather than merely addressing pathology after its manifestation. Classical Ayurvedic texts, including the Charaka Samhita, classify Rasayana into distinct categories based on purpose and application. *Kanya Rasayana* is administered to promote general health, vitality, cognitive function, and longevity in otherwise healthy individuals. *Naimittika Rasayana* is indicated for targeted disease prevention or as an adjunct in specific clinical conditions to strengthen host defense mechanisms. *Ajasrika Rasayana* refers to daily dietary rejuvenatives such as milk, ghee, and honey that are consumed routinely to maintain tissue nourishment and immune competence.

This stratified approach closely parallels contemporary preventive nutrition strategies that emphasize functional foods, nutraceuticals, and personalized dietary interventions aimed at reducing disease risk and enhancing quality of life. By integrating rejuvenative dietary components into daily regimens, Rasayana provides a culturally rooted yet scientifically adaptable model for sustainable health promotion and functional food development.

### Challenges and Future Directions

Despite the growing scientific interest in Rasayana-based functional foods, several challenges must be addressed to facilitate their evidence-based integration into mainstream nutrition and food systems. Foremost among these is the need for well-designed randomized controlled clinical trials to substantiate traditional claims related to immunomodulation, anti-inflammatory effects, and longevity promotion. Robust clinical evidence is essential to move beyond empirical use toward scientifically validated health applications.

Standardization of active phytoconstituents presents another critical challenge, as variability in cultivation practices, harvesting conditions, and processing methods can significantly influence bioactive compound profiles. Establishing validated markers for quality control, ensuring batch-to-batch consistency, and implementing stringent safety evaluation protocols are imperative to enhance credibility and consumer confidence. Furthermore, the integration of traditional Ayurvedic knowledge with modern biotechnology, advanced analytical tools, and molecular research techniques offers promising avenues for mechanistic elucidation and product innovation.

A clear and harmonized regulatory framework for Ayurvedic functional foods and nutraceuticals is also necessary to ensure safety, efficacy, and global market acceptance. Ultimately, interdisciplinary collaboration among Ayurveda scholars, clinical researchers, nutritionists, food technologists, and regulatory experts will be fundamental to achieving rigorous scientific validation while preserving the philosophical integrity of the Rasayana tradition.

### Conclusion

The concept of Rasayana in Ayurveda offers a holistic framework for understanding functional foods and immunity. By emphasizing tissue nourishment, digestive health, stress management, and immune strength, Rasayana aligns closely with modern concepts of preventive nutrition and functional food science.

Integrating ancient Ayurvedic wisdom with contemporary research can pave the way for innovative, sustainable, and culturally rooted functional food products. The Indian Knowledge System provides not only traditional insights but also a scientific foundation that can contribute significantly to global health and nutrition paradigms.

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