

Indian Knowledge Systems (IKS) and Ayurvedic Applications of Spices: Traditional Knowledge, Therapeutic Perspectives and Modern Scientific Evidence for Well Being

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Abstract—Indian Knowledge Systems (IKS) represent a broad intellectual heritage encompassing philosophy, health sciences, agriculture, mathematics, ecology, architecture, education and cultural practices. The best practice of every window of IKS is the path of well being. Ayurveda, one of India's major traditional systems of health knowledge, developed an extensive framework for maintaining health through diet, lifestyle, preventive practices and therapeutic interventions. Within this framework, spices occupy a particularly important position because many substances used as culinary ingredients have also been described in traditional materia medica.

This review examines the relationship between IKS, Ayurveda and the traditional use of spices. The paper explores Ayurvedic concepts including *rasa, guna, virya, vipaka, agni, ama* and the three *doshas*—*vata, pitta* and *kapha*—and considers how spices have traditionally been incorporated into dietary and therapeutic practices. It also relates the *ponchabhuta* of human body and also its relationship with nature and the three types of human behaviour—*satta, raja* and *tama* according to Gita.

A narrative literature review was undertaken using classical Ayurvedic literature, peer-reviewed scientific publications, PubMed/PMC-indexed studies, systematic reviews and authoritative sources including the World Health Organization (WHO) and also from practices of ayurveda from the ancient India. Contemporary research indicates that several spices contain biologically active compounds with antioxidant, anti-inflammatory, digestive, metabolic and other pharmacological activities. A 2023 scoping review identified 142 relevant clinical studies involving cookery doses of 15 herbs and spices and reported promising evidence for several spices in relation to glycaemic control, blood lipids and inflammatory markers. Evidence is nevertheless heterogeneous, and findings

from concentrated extracts cannot automatically be generalized to ordinary culinary consumption.

The review concludes that spices provide an important bridge between IKS, wellbeing life style, traditional dietary practice and contemporary nutritional research. Their greatest potential may lie in preventive and supportive health practices rather than their uncritical use as replacements for conventional medical treatment. Further standardized clinical trials, pharmacological studies, safety assessments and interdisciplinary research are required to establish the clinical significance of traditional Ayurvedic claims of spices.

Index Terms—Indian Knowledge Systems, philosophical values, Ayurveda, spices, medicinal plants, phytochemicals, traditional medicine, preventive health, diet, *dosha* and *ponchabhuta* and well being.

I. INTRODUCTION

Indian civilization has developed a diverse body of knowledge concerning human life, health, environment, food and social organization from the best practices of Indian traditional culture, philosophy and our ancient knowledge. The contemporary expression Indian Knowledge Systems (IKS) refers to this broad intellectual and cultural heritage. IKS is not limited to one discipline; rather, it encompasses interconnected traditions of philosophy, medicine, mathematics, astronomy, agriculture, architecture, language, arts and ecology. Among India's traditional health traditions, **Ayurveda** occupies a particularly important position and a well known healing method. Ayurveda approaches health through a mental and of bodily adjustment state, appropriate diet, lifestyle, mental well-being and therapeutic practices. The World

Health Organization has developed benchmarks for the practice of Ayurveda covering practitioner competence, quality, safety, regulation and ethical practice.

Food occupies a central position in Ayurvedic thought. The traditional distinction between food and medicine is not always as rigid as it is in modern biomedical systems. Substances used in ordinary cooking may also possess properties considered useful for maintaining physiological balance. Spices are an especially significant example of this overlap. Not only that, foods also occupies the three gunas of human body - satta, raja and tama which controls our behaviour and also our daily life style and knowledge system.

Indian cookery uses a large variety of spices, including turmeric, ginger, black pepper, cumin, coriander, cinnamon, cardamom, fennel, fenugreek, clove and mustard. Apart from providing flavour, aroma and colour, spices contain numerous phytochemicals. Modern nutritional research has therefore increasingly examined whether regular dietary consumption of spices may influence metabolic and inflammatory processes.

The history of spices in India dates back thousands of years. Herbs and spices have been used by Indian tribes for almost as long as the “human civilization of spices. The Rig Veda (about 6000 BC) and Yajurveda, Samaveda, and Atharveda provide the first written record of spices in India. During the Vedic period, information was mostly passed down orally from generation to generation via hymns. Several spices are mentioned in the Rig Veda, and the Yajur Veda also makes mention of black pepper.

In 1498, Vasco da Gama voyaged to India via the southernmost tip of Africa, driven by a desire to plot a direct route to a land where spices were plentiful and cheap. His arrival on India’s Malabar Coast, the centre of the spice trade, marked the start of direct trading between Europe and South East Asia. Conquering tribes ranging from the Assyrians and Babylonians to the Arabians, Romans, Egyptians, Chinese, British, and Portuguese invaded India with the same purpose: to profit from the vast natural resources and origin of spices.

A recent clinical scoping review examined 1,738 initially identified papers and included 142 relevant studies concerning culinary doses of herbs and spices and metabolic health. Cinnamon, fenugreek and

ginger showed promising evidence for glycaemic outcomes; cardamom showed potential regarding inflammatory markers; and cinnamon, ginger and turmeric showed promise regarding blood lipids.

However, a scientific distinction is essential. Traditional Ayurvedic use, laboratory evidence, animal experiments and randomized clinical trials represent different levels of evidence. The existence of a traditional use does not automatically establish clinical efficacy. Similarly, the presence of a bioactive compound does not prove that eating a normal culinary quantity will produce the same effect as a concentrated extract.

Therefore, this research paper examines spices at the intersection of traditional knowledge and modern evidence, rather than attempting to establish that all Ayurvedic claims have already been scientifically proven.

II. CONCEPTUAL FOUNDATION: IKS AND AYURVEDA

Indian Knowledge Systems

IKS may be understood as the body of knowledge traditions that developed within the Indian subcontinent through textual scholarship, observation, practice, oral transmission and community experience. These traditions consistently highlight relationships between human beings, nature, society and the cosmos.

The IKS perspective on health is particularly relevant because food, environment and lifestyle are commonly considered interconnected rather than completely independent domains.

According to the Bhagavad Gita, especially Chapter 14 (the three gunas) and Chapter 17, Verses 8–10 (classification of food), human nature and behaviour are influenced by three fundamental qualities or gunas: Sattva (purity and harmony), Rajas (activity and passion), and Tamas (inertia and ignorance). The Gita teaches that the type of food a person consumes can influence the mind, body, and behaviour.

Sattva (Purity and Harmony)

Sattvic Food

Sattvic foods are fresh, wholesome, nutritious, and easy to digest. They promote health, longevity, mental clarity, and inner peace.

Behaviour of a Sattvic Person

A person who takes the sattvic food, behaved like Calm and peaceful,honest and truthful,compassionate and kind,self-disciplined Spiritually inclined and wise and also emotionally balanced.

Rajas (Activity and Passion)

Rajasic Food

Rajasic foods are excessively spicy, sour, salty, hot, or stimulating. They increase energy and excitement but may also create restlessness and agitation.

Behaviour of a Rajasic Person

- A person who takes the rajasic food, behaved like ambitious and hardworking ,energetic and competitive,restless and impatient, driven by desires and attachment,Easily influenced by anger and ego.

Tamas (Inertia and Ignorance)

Tamasic Food

Tamasic foods are stale, spoiled, over-processed, or unhygienic. According to the Gita, such foods promote dullness and lethargy.

Behaviour of a Tamasic Person

- A person who takes the tamasic food, behaved like Lazy and inactive, Ignorant and careless, Confused and unmotivated,Negligent and irresponsible,Excessively sleepy and lacking enthusiasm.

Relationship Between Food and Behaviour

The Bhagavad Gita explains that:

- Sattvic food promotes purity, mental clarity, peace, and self-control.
- Rajasic food stimulates activity, ambition, and passion but may also increase restlessness and emotional instability.

Relationship between Panchabhuta and Tridosha

Dosha	Panchabhuta combination	Main qualities	Main functions
Vata	Akasha + Vayu	Light, dry, mobile, subtle	Movement, breathing, nerve impulses, circulation
Pitta	Agni/Tejas + Jala	Hot, sharp, light, slightly oily	Digestion, metabolism, body temperature, transformation
Kapha	Prithvi + Jala	Heavy, stable, cool, oily, smooth	Structure, lubrication, strength, stability

Vata is primarily composed of space (Akasha) and air (Vayu).

- Akasha provides space for movement.
- Vayu provides motion and activity.

- Tamasic food leads to laziness, confusion, ignorance, and lack of motivation.

Ayurveda

The word Ayurveda is commonly understood as knowledge or science of life. Classical Ayurvedic literature includes major works such as:

- *Charaka Samhita*
- *Sushruta Samhita*
- *Ashtanga Hridaya*
- *Ashtanga Sangraha*
- later *Nighantus* and materia-medica texts.

Ayurveda traditionally emphasizes prevention as well as treatment. Diet (*ahara*), lifestyle (*vihara*), seasonal adaptation and individualized health practices are important components of this approach.

The three doshas

Ayurvedic physiology traditionally describes three functional principles:

Vata – associated conceptually with movement and functions involving nervous activity, circulation and mobility.

Pitta – associated with transformation, metabolism and digestion.

Kapha – associated with stability, structure, lubrication and cohesion.

Relation with panchabhuta

In Indian philosophy (sankhyo,yoga) and Ayurveda, **the** Panchabhuta (five great elements) are considered the fundamental constituents of the universe and the human body. The three ****Doshas—Vata, Pitta and Kapha—****are formed from combinations of these five elements.

Pitta is associated mainly with fire (Agni/Tejas) **and** water (Jala).

- Agni represents heat and transformation.
- Jala provides the fluid medium necessary for these processes.

Kapha consists primarily of earth (Prithvi) and water (Jala).

- Prithvi provides mass, structure and stability.
 - Jala provides moisture, cohesion and lubrication.
- Thus, according to the Ayurvedic framework within Indian knowledge traditions, the five elements combine in different proportions to produce the three Doshas. The balance of Vata, Pitta and Kapha is considered important for maintaining physiological

equilibrium, well being, while their imbalance is traditionally associated with disease.

Ayurvedic Understanding of Food and Spices

Ayurveda traditionally evaluates substances through concepts such as:

Rasa

The six tastes are traditionally identified as:

Taste	traditionally identified	Related spices
Sweet	(<i>madhura</i>)	Fennel, cinnamon, cardamom
Sour	(<i>amla</i>)	Tamarind, dried mango (amchur), sumac
Salty	(<i>lavana</i>)	Rock salt, sea salt
Pungent	(<i>katu</i>)	Black pepper, ginger, chilli, mustard, long pepper
Bitter	(<i>tikta</i>)	Fenugreek, turmeric, neem
Astringent	(<i>kashaya</i>)	Coriander seed, cumin, certain medicinal herbs

Many spices have a strong pungent, bitter or astringent character.

- Ginger (Śuṇṭhī/Ārdraka) → predominantly Katu (pungent)
- Black pepper (Maricha) → Katu
- Turmeric (Haridrā) → mainly Tikta + Katu
- Cumin (Jiraka) → Katu, with additional Ayurvedic attributes
- Fennel (Śatapušpa/Madhurika) → predominantly Madhura, with other properties depending on the Ayurvedic source.

Guna

Guna refers to qualities or attributes of substances. Ayurveda uses paired qualities such as heavy/light, oily/dry and hot/cold to describe dietary and medicinal substances.

Virya

Virya describes the energetic potency of a substance, commonly classified as heating or cooling.

Vipaka

Vipaka refers to the post-digestive effect traditionally attributed to food or medicinal substances.

Agni

Agni, particularly *jatharagni*, represents the Ayurvedic concept of digestive/metabolic capacity. Spices traditionally associated with supporting digestion are therefore frequently discussed in relation to *agni*.

These concepts provide an important framework for understanding traditional spice use, but they should not be equated directly with modern biochemical mechanisms.

III. LITERATURE REVIEW

Spices and modern nutritional research

Modern research has demonstrated that herbs and spices contain numerous phytochemicals, including polyphenols, terpenoids, alkaloids and volatile compounds. These substances may interact with biochemical pathways related to oxidative stress, inflammation, glucose metabolism and lipid metabolism.

The 2023 scoping review of culinary-dose herbs and spices is particularly relevant because it deliberately distinguished ordinary dietary quantities from

concentrated extracts. It identified clinical research involving black pepper, chilli, cardamom, cinnamon, coriander, cumin, fennel, fenugreek, garlic, ginger, nigella, rosemary, sage and turmeric.

Traditional medicine and evidence-based research
The modern study of traditional medicine increasingly emphasizes standardization, quality, safety and clinical evidence. WHO's benchmarks for Ayurveda explicitly address quality assurance, regulation, safety and ethical practice.

This is important for research on spices because the chemical composition of a plant may vary according to species, cultivar, geographical origin, cultivation conditions, processing and storage.

Consequently, a research framework combining Ayurvedic textual knowledge with pharmacognosy, phytochemistry, nutrition and clinical science can provide a stronger evidence base.

IV. OBJECTIVES OF THE STUDY

The major objectives of this review are:

1. To examine the relationship between Indian Knowledge Systems and Ayurveda.

2. To study the traditional importance of spices in Ayurvedic dietary and therapeutic practices.
3. To examine selected Indian spices from an Ayurvedic perspective.
4. To identify major bioactive constituents of selected spices.
5. To review contemporary scientific research concerning their possible health effects.
6. To compare traditional knowledge with modern scientific evidence.
7. To identify limitations and research gaps.
8. To discuss the potential role of spices in preventive and supportive healthcare.
9. To emphasize safe and evidence-based use of Ayurvedic and herbal preparations.

V. LIMITATIONS

This paper adopts a narrative review methodology. This is a narrative review rather than a registered systematic review. Therefore, it does not claim to have exhaustively identified every publication on Ayurvedic spices.

Comparative Summary of Selected Spices

Spice	Ayurvedic/traditional significance	Major researched constituents	Major modern research areas
Turmeric	Haridra; traditionally used in food and formulations	Curcuminoids, volatile oils	Inflammation, oxidative stress, metabolic health
Ginger	Ardraka/Shunthi; digestive applications	Gingerols, shogaols	Nausea, digestion, inflammation, metabolism
Black pepper	Maricha; culinary and medicinal use	Piperine, volatile oils	Bioavailability, metabolism, antioxidant research
Cumin	Jiraka; digestive dietary use	Cuminaldehyde, terpenes	Digestion, metabolic and antioxidant research
Coriander	Dhanyaka; dietary and digestive use	Linalool, polyphenols	Antioxidant, antimicrobial, metabolic research
Cinnamon	Tvak; culinary and medicinal use	Cinnamaldehyde, polyphenols	Glucose and lipid metabolism
Cardamom	Ela; aromatic and digestive use	Volatile oils	Inflammation, cardiovascular markers
Fennel	Shatapushpa; traditional digestive use	Anethole, volatile compounds	Dysmenorrhea and digestive research

Relationship between Spices, Digestion and Ayurvedic Concepts

Digestion is central to Ayurvedic health theory. The concept of *agni* is used to describe digestive/metabolic capacity, while *ama* is traditionally described as incompletely processed material associated with impaired physiological functioning.

Spices traditionally used in Indian cuisine may have several practical effects relevant to digestion:

- improving palatability of food;
- stimulating appetite;
- contributing aromatic compounds;
- supporting digestive secretions;
- increasing dietary diversity;
- supplying phytochemicals.

Modern physiology can investigate some of these effects through measurable variables such as gastrointestinal motility, gastric secretion, appetite, microbiota and metabolic biomarkers.

Spices, Metabolism and Preventive Health

Modern chronic diseases such as obesity, type 2 diabetes and cardiovascular disease are strongly influenced by dietary and lifestyle factors.

The inclusion of herbs and spices may improve dietary quality by increasing flavour without necessarily requiring large quantities of salt, sugar or highly processed flavouring agents.

The 2023 scoping review found 142 relevant clinical studies examining culinary doses of several spices in metabolic health. It reported promising evidence for cinnamon, fenugreek and ginger regarding glycaemic control; cardamom for inflammatory markers; and cinnamon, ginger and turmeric for blood lipids.

These findings support further research but do not establish spices as stand-alone treatments for metabolic diseases.

Spices and Women's Health

Women's health provides another important area for research into Ayurvedic spices.

Fennel is a particularly interesting example because randomized clinical trials have investigated its role in primary dysmenorrhea. A meta-analysis found a significant reduction in pain compared with placebo but also emphasized methodological limitations in the available studies.

Other spices and medicinal plants have traditionally been used in reproductive-health contexts, but traditional use should not be confused with established clinical efficacy.

Research in this field should pay particular attention to:

- pregnancy safety, lactation, menstrual disorders, drug interactions, dose, preparation, hormonal effects, and reproductive toxicity.

Spices and the Nervous System

Indian dietary traditions repeatedly combine spices with broader lifestyle practices such as yoga, meditation, regulated sleep and disciplined eating.

Modern research has begun investigating whether phytochemicals in spices can influence oxidative stress, inflammatory signaling and neurobiological pathways. However, evidence for specific psychological or neurological outcomes is generally much less established than claims commonly made in popular wellness literature.

This would allow traditional concepts to be studied without making unsupported claims.

VI. DISCUSSION

The evidence reviewed demonstrates three important dimensions of spice research.

First: cultural and historical significance

Spices are not merely ingredients in Indian cuisine. They are embedded within traditional dietary practices and Ayurvedic knowledge. Their continued use illustrates the relationship between food, culture and health in Indian society.

Second: pharmacological potential

Spices contain numerous biologically active compounds. Modern research provides plausible mechanisms for antioxidant, anti-inflammatory, antimicrobial and metabolic effects.

Third: limitations of current evidence

The strongest limitation is the difference between traditional use and modern clinical proof.

For example:

A spice may have been traditionally used for a particular condition, yet this does not establish that the spice alone can treat that condition.

Similarly:

A compound may demonstrate biological activity in laboratory experiments without producing the same effect at ordinary dietary doses in humans.

The distinction between culinary spices and concentrated supplements is therefore fundamental.

- The clinical literature is also characterized by variation in: dose, duration, preparation, species, extraction methods, participant characteristics, outcome measures and study quality.

The 2023 scoping review specifically focused on culinary doses, which is valuable because it provides a more realistic connection between everyday dietary practices and health outcomes.

Safety and Ethical Considerations

The statement that a substance is “natural” does not automatically mean that it is safe for everyone.

Potential concerns include:

1. excessive consumption;
2. contamination or adulteration;
3. interactions with medicines;
4. variable concentration of active compounds;
5. allergic reactions;
6. pregnancy-related concerns;
7. liver or kidney toxicity from certain concentrated preparations;
8. inappropriate substitution of traditional remedies for necessary medical treatment.

VII. RESEARCH GAPS

Several areas require further research.

Standardization

Different varieties of the same spice can contain different concentrations of phytochemicals. Standardized identification and chemical profiling are therefore necessary.

Culinary dose versus therapeutic dose

Research should distinguish clearly between ordinary food quantities and concentrated extracts.

Long-term clinical trials

Many existing studies are relatively short. Long-term randomized controlled trials are needed.

Ayurvedic personalization

Ayurveda traditionally emphasizes individualized treatment. Modern clinical trials often use standardized interventions across populations. Future

research could investigate whether Ayurvedic personalization changes outcomes.

Women’s health

Fennel and other spices deserve carefully designed studies concerning menstrual health, reproductive health and menopause, with particular attention to safety.

Integrative research

IKS scholars, Ayurvedic physicians, pharmacologists, nutritionists, botanists and biomedical researchers should collaborate rather than studying traditional knowledge in isolation.

VIII. CONCLUSION

Indian Knowledge Systems provide an important intellectual and cultural framework for understanding the relationship between human health, food, nature and lifestyle and our well being. Ayurveda represents one of the most significant components of this heritage and gives considerable importance to diet and substances that may simultaneously function as food and traditional remedies.

Spices such as turmeric, ginger, black pepper, cumin, coriander, cinnamon, cardamom and fennel demonstrate this relationship particularly clearly. They have long-standing culinary and traditional significance, while modern science has identified numerous phytochemicals and investigated their possible antioxidant, anti-inflammatory, digestive, metabolic and other biological effects.

Contemporary evidence is encouraging in several areas. Clinical research has produced promising findings for selected spices and metabolic outcomes, while research on fennel has generated evidence relevant to primary dysmenorrhea. Nevertheless, the quality and quantity of evidence differ substantially between spices and health conditions.

The most appropriate conclusion is therefore not that Ayurvedic spices have universally been “scientifically proven,” but that **traditional** Ayurvedic knowledge provides valuable hypotheses and practices that can be investigated through modern scientific methods.

The future of IKS-related spice research should combine textual scholarship, ethnobotany, Ayurveda, phytochemistry, nutrition, pharmacology and clinical medicine. Such an approach can preserve India’s

traditional knowledge while promoting safety, scientific rigor and responsible innovation.

Spices should primarily be understood as components of a healthy dietary pattern and as potential supportive agents. Where a person has a diagnosed disease or takes medication, culinary use should not be presented as a replacement for appropriate medical care.

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