



Research Article

Ayurveda Dietetics and Food Technology: Modern Correlations

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Abstract

This paper examines how Ayurveda dietetics and the food technology of the present times are intertwined and how ancient knowledge and the modern body of knowledge are interrelated. It examines the fundamental Ayurvedic principles of food, nutrition and their role in health and also examines the potential application of current food technologies to enhance the effectiveness and accessibility of Ayurvedic dietary principles. The paper will discuss the meaning of *Prakriti* (body constitution), *Tridosha* theory and the importance of diet per individual in Ayurveda. It also looks at what part can be played by modern food processing techniques, food preservation and fortification to be adapted to Ayurvedic principles and produce the optimum health effects and overall well-being. In addition, the paper explains the synergies possible between the traditional Ayurvedic formulations and the new technologies such as nanoencapsulation, non-thermal processing, and artificial intelligence, and how they can lead to increased nutrient bioavailability and provision of individualised dieting solutions. These correlations can be used by the study to provide a comprehensive framework of the formulation of the functional foods according to Ayurvedic principles but with the imprint of the modern science.

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1. INTRODUCTION

This paper presents a conceptual review aimed at exploring correlations between traditional Ayurvedic dietary principles and modern food technology innovations. It outlines theoretical intersections and does not include primary data collection.

Ayurveda is an ancient Indian system of health that presents a comprehensive perspective of health and the interconnection of the body, mind, and spirit (Sen *et al.*, 2024) [21]. The Ayurvedic philosophy is mostly founded on the concept of food as medicine and the personalised diet to the distinct *Prakriti* or constitution of a person (Satyamoorthy *et al.*, 2014) [20]. Ayurveda considers numerous elements, which are related to health and well-being, such as a good life, sustainable happiness, and longevity (Payyappallimana & Venkatasubramanian, 2016) [15]. This integrative process contrasts with the existing mode of allopathic medicine that is more inclined towards treating diseases than focusing on the general well-being (Arnold, 2022) [2]. Ayurveda concentrates on prevention therapy by modifying the lifestyles including daily routine, seasonal adjustments, and conscious life to attain a balance. The key to comprehending the principles of Ayurveda is interpreting ancient principles into the vocabulary of modern biology and medicine (Hankey, 2010) [6]. An important part of Ayurveda is the focus on preserving health with proper diet and lifestyle (Sarkar *et al.*, 2011) [19]. The system emphasises the need to customise dietary prescriptions, lifestyle habits and treatment methods to personal constitutions and imbalances. The importance of preventive care is also discussed in Ayurveda, and it is noted that such daily routines and seasonal changes as well as mindful living contribute to the preservation of the balance (Sen *et al.*, 2024; Sharma *et al.*, 2007) [21, 22].

The comprehensive approach of Ayurveda addresses the existing trend of lifestyle medicine to cure chronic diseases (Cohen, 2014) [4]. Ayurvedic diet philosophy aims at achieving balance between three fundamental forces or *Doshas*—*Vata*, *Pitta*, and *Kapha* which are the factors that define physiological and psychological functions (Motilal, 2012) [13]. A unique mixture of these *Doshas* is what forms the *Prakriti* of a particular individual and predisposes them to diseases and the response to various foods and other environmental factors (Rastogi & Chiappelli, 2017) [16]. Ayurveda has proposed a series of measures which involve health education, self-awareness and bringing spirituality and morals in the health care system. It also combines different fields such as Yoga, meditation and mindful activities, therefore, the significance of self-awareness and mental health in health management. Ayurvedic dietetics is the science of knowing the qualities of various foodstuffs, their impact on the *Doshas* and their overall impact on the body. The new technology in food offers fresh methods of processing, preserving and nutritive values of food. Ayurveda and modern food technology have a huge potential of coming up with functional foods and dietary interventions that are personalised to the needs of individuals and which promote their overall well-being. The integration of Ayurvedic principles and contemporary food technology can lead to the creation of personalised and functional foods and dietary

interventions that promote general well-being. Modern food technology can complement Ayurveda by promoting individualised nutrition and providing new opportunities to develop individual diet solutions. Ayurveda principles can be used in the creation of new food products; they will satisfy certain dietary requirements and support general wellness.

Ayurvedic Principles of Dietetics

Ayurveda categorises food substances according to their *Rasa* (taste), *Guna* (qualities), *Virya* (potency), and *Vipaka* (post-digestive effect). *Rasa* is the taste of something, *Guna* is its attributes, *Virya* is its strength (heating or cooling), and *Vipaka* is its after-taste. These properties dictate the effects that a given food will have on the *Doshas* and the health of the person. A healthy diet is vital to ensure the optimal health, and certain dietary prescriptions are given based on *Dosha* constitution and the health status of an individual (Verma *et al.*, 2024) [25]. Ayurvedic diet is also determined by time of the day, season and geographical location. Classical Ayurvedic treatises such as *Charaka Samhita* and *Sushruta Samhita* extensively discuss these dietary principles, offering foundational insights into *Rasa*, *Guna*, *Virya*, and *Vipaka*. Ayurvedic dietetics is all about comprehending the *Doshas*—*Vata*, *Pitta* and *Kapha*. These three *Doshas* are made up of five elements, which include earth, air, fire, water and space, where *Vata* is the element of air and space and *Pitta* is the element of fire and water. Some people may have one *Dosha* that is dominant, others might have two or three, and they will determine physical and behavioural characteristics of people (Dunlap *et al.*, 2017) [5]. As an example, persons with a dominant *Vata Dosha* should eat warm, moist, and grounding food cooked grains, root vegetables, healthy fats and minimise cold, dry, and light foods. The Ayurvedic dietary advice is to balance the *Doshas* through foods that have specific qualities and which help balance the *Doshas*. The Ayurveda holistic approach is also consistent with the “One Health” concept that appreciates the relationship between human, animal, and environmental health (Sen *et al.*, 2024) [21]. This integrated view highlights the significance of looking at the whole ecosystem to deal with health issues, which is the strong point of Ayurveda as it is highly aware of the impact of the environment on the human health. Further research on reliability and validity is also necessary since the questionnaires can influence the long-term diagnosis and treatment (Dunlap *et al.*, 2017) [5]. Ayurvedic dietetics is based on the detailed knowledge and use of the six *Rasas* (sweet, sour, salty, pungent, bitter, and astringent). The *Rasa* also has certain influences on the *Doshas*; e.g. The sweet taste enhances *Kapha*, decreases *Vata* and *Pitta*, and the pungent taste enhances *Pitta*, decreases *Kapha*, and its effect on *Vata* is variable. With wise integration of these tastes in a meal, the *Doshas* can be harmonised and the best digestion and assimilation can be ensured. Ayurvedic food incorporates spices that aid digestion, enhances flavours and also has a medical purpose. A table that will summarise the six *Rasas*, their properties, how they affect *Doshas* and the examples of foods that illustrate each *Rasa*.

Table 1: The Six Rasas in Ayurveda and Their Effects

| Rasa (Taste) | Qualities | Effect on Doshas | Food Examples |
|--------------|----------------|---|----------------------------|
| Sweet | Cooling, Heavy | Increases Kapha, Decreases Vata & Pitta | Milk, Rice, Wheat |
| Sour | Hot, Light | Increases Pitta & Kapha, Decreases Vata | Citrus fruits, Yogurt |
| Salty | Heavy, Moist | Increases Kapha & Pitta, Decreases Vata | Salt, Seaweed |
| Pungent | Hot, Light | Increases Pitta & Vata, Decreases Kapha | Chili, Garlic |
| Bitter | Cooling, Light | Increases Vata, Decreases Pitta & Kapha | Bitter gourd, Leafy greens |
| Astringent | Dry, Light | Increases Vata, Decreases Kapha & Pitta | Green bananas, Tea |

Modern Food Technology: An Overview

Modern food technology refers to various methods and processes that are used to enhance the safety, quality and nutritional value of food. These are food processing, preservation, packaging and fortification technologies, each of which is critical in the provision of safe and nutritious food products. Food technology has considerably increased the shelf life of perishable foods, minimised food wastage as well as increased the convenience of food products.

There are numerous processes in food processing which include heating, cooling, drying, fermentation and irradiation to convert the raw materials into final products. These procedures have the capacity to change the texture, taste and nutritional values of food. Canning, freezing, drying and chemical preservation are the methods used to prevent growth of microorganisms and enzyme activity and increase the shelf life of food.

Some of the packaging technologies deployed to maintain the quality and safety of food during transportation and storage are modification atmosphere packaging and aseptic packaging. Food fortification refers to the process of adding additional nutrients to foodstuffs to alleviate any nutrient shortage and promote the health of the population.

The use of non-thermal food processing has risen to prominence because it allows the food to preserve its sensory properties and nutritional value as well as safety and shelf life (Chacha *et al.*, 2021) [3]. Such techniques as high-pressure processing, pulsed electric fields, and cold plasma provide alternatives to conventional thermal processing, which may denature thermal-sensitive nutrients and change the taste of food.

The use of various methods is a combination of hurdles, which expose the microorganisms to unfavorable conditions, disrupt homeostasis of microorganisms in food, either temporarily or permanently (Aaliya *et al.*, 2021) [1].

High-Pressure Processing: HPP is the method that inactivates microorganisms and enzymes with high pressure to extend the shelf life of food, but it does not affect the natural flavor, colour, or nutritional value of food (Chacha *et al.*, 2021) [3].

Pulsed Electric Fields: PEF technology uses short pulses of electricity to treat food and disrupt microbial cell membranes causing inactivation.

Cold Plasma: CP utilises ionised gas to produce reactive species that kill microorganisms on the surface of food products (Woldemariam & Emire, 2019) [26]. The emerging technologies overcome the drawbacks of thermal processing that usually leads to the loss of nutrients and unpleasant changes in flavor (-Jambrak *et al.*, 2019) [9]. Other preservation technologies of foods such as irradiation and high pressure are very commonly used because of their flexibility with solid foods and liquid foods (Lado & Yousef, 2002) [11]. These techniques are effective in killing dangerous microorganisms, which is particularly beneficial when it comes to sensitive products such as fruits and vegetables (Temiz & Ayhan, 2017) [24]. Non-thermal technologies may be applied to treat any type of food such as fruits, vegetables, pulses, spices, meat, and fish (Jadhav *et al.*, 2021) [8].

Such developments resonate with the worldwide demand of sustainable food production and minimisation of food waste, providing creative solutions to the food security challenges.

In order to get a clearer picture of the technological sequence of food production in the modern world, the given flowchart gives a graphic illustration of stages of food processing, starting with raw materials and ending with finished products.

This chart is a clear summary of transformation processes and technologies used throughout the food production chain, and it shows the importance of every stage in maintaining nutrition and food safety.

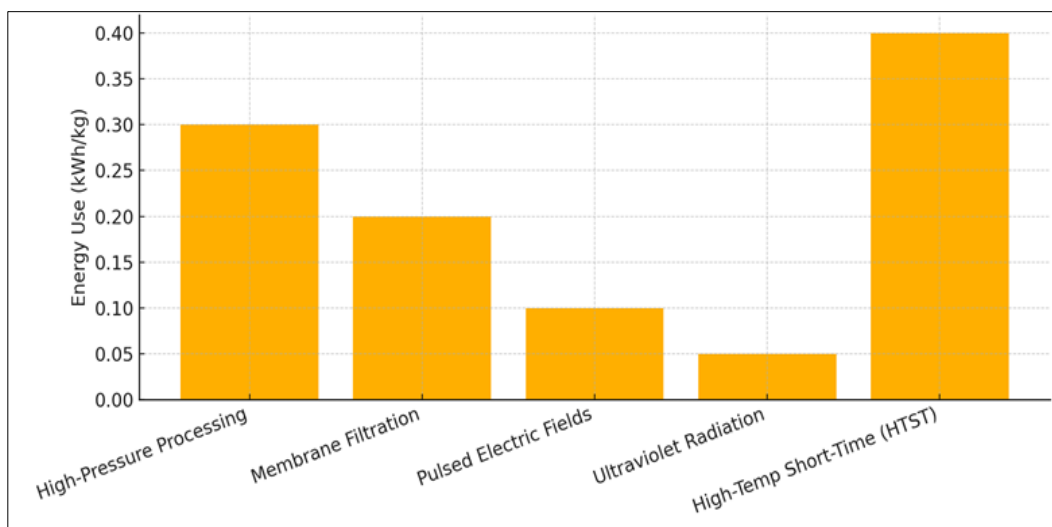


Fig 1: Energy Use in Various Food Processing Techniques

The graph below shows the comparative energy use of the major food processing technologies and provides information about their sustainability and the efficiency of operation. Through the assessment of energy needs, stakeholders will know how to make appropriate decisions on the use of food

technologies in terms of cost-effectiveness and environmental effects.

A comparison table of various food preservation methods (thermal vs. non-thermal) in terms of their effect on nutrient retention, sensory properties, and shelf life.

Table 2: Thermal vs Non-Thermal Food Preservation Techniques

| Technique | Methods | Nutrient Retention | Impact on Sensory Attributes | Shelf Life |
|-------------|-------------------------------|--------------------|------------------------------|------------------|
| Thermal | Pasteurisation, Sterilisation | Lower | Altered | Moderate to High |
| Non-Thermal | HPP, PEF, Cold Plasma | Higher | Preserved | High |

Correlations between Ayurvedic Dietetics and Modern Food Technology

Bridging these paradigms requires not only scientific translation but cultural sensitivity to ancient health wisdom.

Ayurvedic dietetics and modern food technology, while rooted in different paradigms, share common goals of promoting health, ensuring food safety, and optimising nutritional value.

The focus of Ayurveda on personalised dietary suggestions, depending on *Doshas*, is also similar to the contemporary understanding of personalised nutrition, whereby dietary advice is provided based on individual genetic, metabolic, and lifestyle considerations.

The Ayurvedic food combining that particular foods are to be consumed along with other foods in order to facilitate digestion and assimilation of nutrients has been verified in modern studies of enzyme action and digestive physiology.

The contemporary food technology may become a breaking point into the transformation of the Ayurvedic food concepts into the available and convenient food products (Tappi *et al.*, 2020) [23]. An example is that the ready to eat food may be

prepared with the help of food processing methods to suit a specific *Doshas*, with appropriate *Rasas* and spices to induce health and harmony.

The new technologies of fruits and vegetables processing are supposed to retain the bioactive compounds as much as possible and not to influence the sensory quality of the food chain and improve the quality control and safety of the food chain (Hribar *et al.*, 2018) [7].

Additionally, the new food preservation technologies assist in the storage of Ayurvedic formulations and ingredients, and, therefore, to make them more available to the consumers (Mandal *et al.*, 2018) [12].

Such innovative technologies as nanoencapsulation can contribute to making Ayurvedic herbs and nutrients well-absorbed and utilized by the organism due to their increased bioavailability (Pateiro *et al.*, 2021) [14].

To make a basis of a synergy between Ayurveda and modern food practices, the Venn diagram below demonstrates principles that they share and compare their areas of strengths.

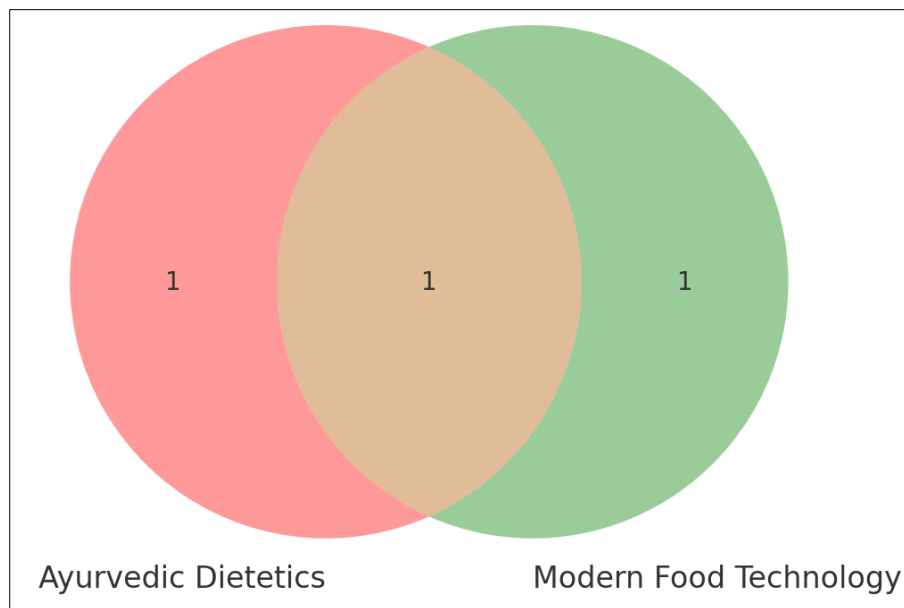


Fig 2: Overlap of Ayurveda and Modern Food Technology

The figure illustrates that the interdependence of the two divergent systems may lead to a more broad and individualised knowledge of health and nutrition.

Early examples of this synergy in the marketplace are products like nutraceutical capsules based on Chyawanprash, or Prakriti specific meal kits. Comparison of nutrient value and the bioavailability of the Ayurvedic formulations prepared in the

modern method of food processing with the traditional method of food processing.

In the table below, the comparative analysis of the traditional and modern techniques of formulation of Ayurveda, in particular, on their nutrient bioavailability and functionality benefits is provided.

| Formulation Method | Absorption Rate | Stability | Advantages |
|-----------------------|-----------------|-----------|---|
| Traditional | Low to Moderate | Variable | Culturally rooted, time-tested |
| Modern (Encapsulated) | High | Stable | Improved shelf life and absorption |
| Modern (Non-Thermal) | High | Stable | Preserves nutrients and sensory quality |

This analogy shows that the traditional Ayurvedic products can be conserved and improved by making contemporary adaptations to offer therapeutic potential.

The growing demand of healthier food products on a global scale is pushing innovation and development (Kumar *et al.*, 2016) [10].

As people become increasingly aware of the connection between the diet and health, companies invest more in the development of nutrient-rich foods that meet specific dietary needs.

The food industry is also shifting towards plant-based diets and lately, an increasing number of plant-based products that substitute meat and dairy products are being released to the market.

The holistic view of health in Ayurveda that takes into account the interrelated nature of the mind, body and spirit has much to teach the modern food technologist.

Incorporating Ayurvedic concepts in the development of food products, the manufacturers will be able to produce foods that will not only have a nourishing effect on the body but will also contribute to mental and emotional health (Rattan & Kaur, 2022) [17].

CONCLUSION

Future research may explore the development of AI-powered diet platforms based on Prakriti analysis, regulatory frameworks for Ayurvedic-functional foods, and real-world trials of techno-Ayurvedic food formulations to validate efficacy and consumer acceptance.

Ayurvedic dietetics and food technology are different but complementary methods of the optimisation of human health and well-being using food.

The combination of ancient wisdom of Ayurveda and modern scientific developments will enable us to establish a healthy and sustainable food system.

Due to technological innovation, changing consumer tastes, and increasing health awareness, the food industry is rapidly changing.

The contemporary food technology will provide the tools to convert the Ayurvedic principles of diet into practical and convenient food products and Ayurveda has a comprehensive model of viewing the effects of food on the health and well-being.

The combination of these two methods has the potential to be huge in making a food system that is both sustainable and health-promoting.

One of the main trends of the technological development is the technological development through the combination of different raw materials to obtain a certain ratio of nutrients, micro- and macro-elements, vitamins and fatty acids (Stepanova & Akrashie, 2021)^[28].

Based on artificial intelligence, it will be possible to develop new functional foods that will have some health effects (Zhu & Wang, 2023)^[27].

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