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Role of Ginger (*Zingiber officinale Roscoe*) in Sustainable Health

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Abstract

Attaining sustainable health involves a comprehensive blend of multiple factors, including structural, physiological, metabolic, and psychological aspects, alongside the cultivation of self-awareness and a sense of fulfillment. The World Health Organization (WHO) underscores in its 2030 Agenda for Sustainable Development that lifestyle-related illnesses, especially non-communicable diseases (NCDs), present considerable hurdles to sustainable progress, stressing the importance of mitigating their risk factors. Nutrition is acknowledged as a cornerstone of health preservation, while individual lifestyle choices play a pivotal role in shaping overall wellness. Nevertheless, dietary supplements, which typically operate on straightforward cause-and-effect principles, provide limited contributions to a holistic approach to health. Panel report of World Cancer Research Fund (WCRF) also recommended meeting the nutritional need through diet alone. In the current context, the ancient concept of a satisfactory diet seems more appropriate to fight against NCDs. Sattva nature of ginger makes it a nature's zesty superfood holding a vishwabhesajam or universal medicine status in Ayurveda and a vital part of sattvic diet. Ginger, known as Adrak and categorized under Harita Varga in Ayurveda, is a vital ingredient in numerous traditional dishes and has been utilized for centuries to address a wide range of health issues. Research studies confirmed the appetizing, digestive stimulant, ergogenic, scavenging and nourishing properties of the ginger which makes it a nature reviving superfood for preventive healthcare management. Understanding the potentiality of ginger in a holistic approach, as considered in Ayurveda, and integrating it modern science, food engineering can play a pivotal role in exploring the more complex nonlinear relationships of food and its implication in sustainable health.

Keywords: Ginger, *harita varga*, holistic, *sattvic*, sustainable health

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INTRODUCTION

Health is crucial for sustainable development, influencing economic growth, social stability, and environmental sustainability. To achieve the Sustainable Development Goals, it is vital to focus on health sustainability and to address health disparities. Ayurveda, the age-old life and health system that originated in India, takes a very holistic approach to food, assigning significant emotional and spiritual value to it, in addition to its physical and biological qualities [1]. Ayurveda's focus is on the prudent use of food products within a holistic framework, considering not only the nutrients that are available but also the health of the individual consuming the food as well as other environmental aspects including time of day, place, and season [2].

Accordingly, food or *ahar* has been classified in 12 categories or *ahar varga* according to its

morphological characteristics and the physiological effects it performs in the human body [3]. Versatility of *Adrak* or Ginger (*Zingiber officinale* Roscoe) makes it a special food commodity and has been placed at the top of the foods under *Harita Varga.* This spice is widely used as a seasoning and plays an important role in numerous traditional healing practices. Its use can be traced back to ancient civilizations, where it was incorporated into Ayurvedic, Chinese, Unani-Tibb, Sri Lankan, Arabic, and African medicine to treat various unrelated health issues [4]. The numerous therapeutic properties are linked to its abundant bioactive compounds, including gingerols, shogaols, and paradols. This review explores the health benefits of ginger and its potential contributions to sustainable health practices.

DIET VS DIETARY SUPPLEMENTS

Experts in science and medicine concur that dietary supplements may be advantageous to human health in specific situations, but they shouldn't take the place of full, well-balanced meals that include all the foods required for a nutritious diet [5]. The American Institute for Cancer Research and the World Cancer Research Fund panel study from 2007 suggested that diet be the only way to achieve nutritional needs [6].

Reductionist methodology typically applies to linear cause-effect correlations that might be used for therapeutic purposes and that describe how one nutrient interacts with one particular result. But in addition to linear cause-and-effect interactions, food must also play a multifaceted role in the body's more intricate nonlinear relationships. From a holistic perspective, food is viewed as a complex matrix that influences health outcomes through its capacity to satisfy hunger, the varying rates at which nutrients are released into the body, and potential synergistic interactions between various substances within the body. Specific physico-chemical characteristics of each food matrix, such as its ability to hold water, dissolve, permeability, ferment, bind, viscosity, and abrasiveness, result in different physiological impacts during digestion and absorption [7].

As the relationship between diet and health becomes more apparent, new research strategies like transdisciplinary research and another epistemological approach like holism are required. These are due to the realization that the whole is greater than the sum of its parts, the limitations of the reductionist approach's applicability, and the growing knowledge about the components of diet [3]. Ayurveda, an ancient life science system, offers a well-developed knowledge base in food science, unique principles, and practices. Its proactive nature, combined with holistic considerations that consider the interconnectedness of body, mind, and environment, along with personalized dietary planning tailored to individual needs, could significantly enrich contemporary food science and nutrition [8]. As per Ayurveda, proper food selection and dietary schedule helps to control the mind and consequently maintain holistic health and happiness [9].

GINGER IN *SATTVIC* DIET

Food is classified as *sattvic*, *rajasic*, or *tamasic* in the *Srimad Bhagavad Gita*. Of these, "*Sattvic* food" refers to foods that promote health, happiness, and love; they also stay stable; strengthen the heart; and are naturally juicy and smooth [10]. It is also believed that eating *sattvic* meals offers several health advantages. It is claimed to improve energy levels, boost immunity, facilitate better digestion, and support stable emotions and mental clarity. Furthermore, it could help to reduce the risk of developing long-term illnesses like cancer, diabetes, and cardiovascular disease [11].The idea of a *sattvic* diet is more pertinent now since poor dietary habits are a major contributor to non-communicable diseases.

Appetizing, digestive stimulant, ergogenic, scavenging and nourishing properties of ginger makes it a special food commodity of *sattvic* diet and accordingly it is treated as universal medicine in *Ayurveda*. Since ancient times, ginger has been used as a herb and medicine and is a staple ingredient in cuisine all over the world [12].

BIOACTIVE COMPONENTS IN GINGER

The existence of several bioactive compounds in ginger is strongly linked to its nutritional and medicinal value. More than a hundred pharmacologically active chemicals in ginger have been identified by prior research; these can be broadly categorized into three groups: volatile oils, gingerol, and diarylheptanoids. Volatile oil yields ranged from 1 to 3%. The "pungent principles" of gingerols (4.7–7.5%) are a homologous group of phenols that are distinguished by the length of their unbranched alkyl chains; in the fresh rhizome, 6-gingerol is the most prevalent, followed by 8- and 10-gingerol [13].

HEALTH PROMOTING QUALITIES OF GINGER

Ginger's key active compound, 6-gingerol, is renowned for its diverse health benefits, showcasing remarkable anti-inflammatory, antibacterial, and anti-carcinogenic properties. This potent substance possesses a distinctively pungent flavor, which is characteristic of ginger itself. Extensive research has documented a wide array of health-promoting effects attributed to 6-gingerol, including its ability to combat cancer cell proliferation (anti-carcinogenic), neutralize harmful free radicals (antioxidant), reduce inflammation (anti-inflammatory), support heart health (cardiotonic), lower blood pressure (hypotensive), alleviate nausea (anti-emetic), reduce fever (anti-pyretic), relieve joint pain associated with rheumatism (anti-rheumatic), prevent the formation of ulcers (anti-ulcer), and inhibit the production of inflammatory compounds (anti-prostaglandin) [14]. These multifaceted benefits highlight 6-gingerol's significant role in promoting overall health and well-being. Table 1 presents a summary of studies examining the health efficacies of ginger.

FOOD APPLICATIONS OF GINGER

Food products that are healthier and more useful are becoming more and more popular as people become more aware of leading healthy lives and making smart dietary choices. The growing recognition and interest in functional food items has expanded the possibility for investigating, characterizing, and perhaps using bioactive chemicals and functional food ingredients. Ginger is a great source of bioactive compounds and a useful functional ingredient that is used in many different culinary products. Table 2 presents some significant research on the use of ginger and its derivatives in different food items.

Table 1. Health Promoting Properties of Ginger [3].

Derivative	Compound	Efficacy
Ginger extract	6-shogaol	Weakens diabetes neuropathy
Ginger extract	Phenolic compounds	Prevention of necrotizing enterocolitis
Ginger essential oil	Monoterpenes; sesquiterpenes	Antimicrobial *Mycobacterium* spp.
Ginger extract	Shogaol	Inhibits oxidative stress and anticlastogenic
Ginger volatile oil	B-phellandrene; camphene; linalool; geranial; zingiberene; β-sesquiphellandrene; neral; αbisabolene; α-curcumene; α-farnesene and murolene	Modulate the function of lymphocytes and the cellular immune response
Fresh ginger extract	Phenolic compounds	Antivirus human respiratory syncytial virus (HRSV)
Ginger extract	6-gingerol, 6-shogaol, terpenoids citral and β- phellandrene	Anti-inflammatory
Ginger rhizome ethanol extract	Total polyphenols	Anticancer (against malignant melanoma)
Ginger extract	6-paradol; 6-shogaol; methyl 6-gingerol; 1- dehydro-6-gingerol; 5-, 6-, 8-, and 10- gingerol	Anti-inflammatory
Ginger essential oil	Total polyphenols	Inactivation of Caprine alphaherpesvirus 1

Table 2. Some Significant Research on the Use of Ginger and its Derivatives [13].

Derivative	Product	Positive Effect
Ginger Powder	Wheat Bread	Increase in antioxidant activity, minerals, total phenolics, textural properties, shelf life and sensorial characteristics Decrease in microbial growth
Ginger Juice	Wheat Flour Muffin	Increase in total phenolics, antioxidants, and sensorial characteristics No change in textural attributes
Ginger Powder	Peda	Increase in functionality and shelf Life Decrease in microbial growth and cost
Ginger Juice	Yogurt	Increase in total phenolic contents, antioxidant, total solids and viscosity, decrease in coagulation time and pH
Ginger Juice	Ice Cream	Increase in antioxidant activity, phenolic content, sensorial characteristics and melting resistance
Ginger Essential Oil	Soft Cheese	Increase in total phenolics, antioxidants, and sensorial characteristics Decrease in microbial growth
Ginger Powder	Cocoa Beverage	Increase in total phenolics, antioxidants, and viscosity
Ginger Extract	Robusta Coffee	Increase in antioxidant activity and phenolic contents No change in sensorial properties
Ginger Extract	Chitosan-Based Edible Coating (Walnut)	Increase in antioxidant activity, shelf life and oxidative stability Reduction in fungal spoilage

CONCLUSIONS

Health is a vital component of sustainable development, intricately linked to economic, social, and environmental factors. Good health enhances individual well-being, boosts productivity, and stimulates economic growth. It fosters social stability by strengthening communities and reducing healthcare costs.

Additionally, investing in health encourages environmentally sustainable practices, creating a cycle where sustainable health contributes to broader developmental goals and benefits society. *Sattva* nature of ginger plays a significant role in promoting sustainable health through its diverse therapeutic properties. The bioactive compounds present in ginger confer a multitude of health benefits, including potent antioxidants and anti-inflammatory properties, as well as significant antimicrobial and anticancer activities. Integrating ginger into daily health regimes may not only enhance overall well-being but also serve as a proactive measure in the prevention of chronic diseases, underscoring its potential role in promoting long-term health.

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