

A Review – Recent Advances in Nutrition of Health Benefits and their Significance of Indian Spices in Foods

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ABSTRACT

Herbs and spices could be regarded as the first real “functional foods” and have a long history of medicinal use. Spices can come from almost any part of a plant including seeds, leaves, barks, rhizomes, latex, stigmas, floral buds and modified stems. India has been recognized all over the world for spices and medicinal plants. Both exhibit a wide range of physiological and pharmacological properties. Modern-day researchers are beginning to prove that these culinary treasures can help consumers eat healthier diets by adding flavor without calories, fat or sugar and by providing healthful phytonutrient rich antioxidants. Spices and food herbs are only slightly different, and for the purposes of this chapter no distinction will be made. While many spices have health benefits, the nutritional rather than medicinal uses of herbs in foods and dietary supplements will be discussed rather than prescribed herbal medicines. Recently several molecular targets have been identified for therapeutic / preventive effects of turmeric. Fenugreek seeds, a rich source of soluble fiber used in Indian cuisine reduces blood glucose and lipids and can be used as a food adjuvant in diabetes. Similarly garlic, onions, and ginger have been found to modulate favorably the process of carcinogenesis.

Keywords: Spices, Herbs, Antioxidants, Dietary supplements, Nutrition, Pharmaceuticals and Carcinogenesis.

INTRODUCTION

Spices are used for flavour, colour, aroma and preservation of food or beverages. Spices may be derived from many parts of the plant: bark, buds, flowers, fruits, leaves, rhizomes, roots, seeds, stigmas and styles or the entire plant tops. The term ‘herb’ is used as a subset of spice and refers to plants with aromatic leaves. Spices are often dried and used in a processed but complete state. While many spices have health benefits, the nutritional rather than medicinal uses of herbs in foods and dietary supplements will be discussed rather than prescribed herbal medicines. A food herb is generally defined as the leaf of a plant when used in cooking, but any other part of the plant, often dried, can be a spice. Spices can be the buds (cloves), bark (cinnamon), roots (ginger), berries (peppercorns), aromatic seeds (cumin) and even the stigma of a flower (saffron). Many of the aromatic seeds known as spices are actually gathered from plants when they have finished flowering. A familiar example would be coriander, with the leaves being referred to as an herb, and the dried seeds as a spice. When referring to the stem and roots of coriander, which are used in cooking, and to onions, garlic and the bulb of fennel, these parts of these plants tend to be classified along with herbs, as they are often used fresh and applied in a similar way to cooking. Another option is to prepare extracts such as essential oils by distilling the raw spice material (wet or dry), or to use solvents to extract oleoresins and other standardized products. There are many texts which provide an overview of the industry in general^{1,2,3} or for specific crops^{4,5,6}.

The major exceptions to this group are the capsicums (chilli peppers, paprika), and coriander which are grown over a much wider range of tropical and nontropical environments. Production of spices and essential oils in these wet and humid environments brings special difficulties for crop and product

management. Drying the crop to ensure a stable stored product is of particular importance, and in wet humid environments this creates the need for efficient and effective drying systems. In Asian countries; particularly, India, China, Japan and Korea; there is a longstanding tradition and culture of attributing healing properties to foods and plant materials. They have an extra-ordinary place in the realm of traditional cures as medicines Valiathan⁷. There is a treasure house of knowledge, which needs to be explored to establish the scientific basis of its benefits.

Phytochemicals in spices, which primarily serve in plant protection, are considered vitamins of the 21st Century. They are also less toxic compared to drugs. This article captures some recent scientific findings on turmeric, fenugreek, mustard, ginger, onions and garlic, which are common spices and have a distinct place in folk medicine in several of Asian countries. Spices and food herbs are only slightly different, and for the purposes of this chapter no distinction will be made.

Various Studies on Indian Spices

Ginger

Ginger or **ginger root** is the rhizome of the plant *Zingiber officinale*, consumed as a delicacy, medicine, or spice. It lends its name to its genus and family (Zingiberaceae). The characteristic odor and flavor of ginger is caused by a mixture of zingerone, shogaols and gingerols, volatile oils that compose one to three percent of the weight of fresh ginger. Gingerols increase the motility of the gastrointestinal tract and have analgesic, sedative, antipyretic and antibacterial properties Hara et al.⁸. A study at the University of Michigan demonstrated that gingerols can inhibit growth of ovarian cancer cells *in vitro* Rhode et al.⁹, Kim et al.¹⁰, Choudhury et al.¹¹. [6]-gingerol (1-[4-hydroxy-3-methoxyphenyl]-5-hydroxy-3-decanone) is the major pungent principle of ginger. Ginger contains up to three percent of a fragrant essential oil whose main constituents are sesquiterpenoids, with (-)-zingiberene as the main component. Zingerone is also produced from gingerols during this process; this compound is less pungent and has a spicy-sweet aroma. McGee and Harold¹², Ginger is also a minor chemical irritant, and because of this was used as a horse suppository by pre-World War I mounted regiments for feaguing. Ginger has a sialagogue action, stimulating the production of saliva, which makes swallowing easier.

Nutritional information of Ginger

Ginger	
Parameters	Value
Moisture	80.900 gm
Protein	2.300 gm
Fat	0.900 gm
Minerals	1.200 gm
Fibre	2.400 gm
Carbohydrates	12.300 gm
Energy	67.000 K cal
Calcium	20.000 mg
Phosphorus	60.000 mg
Iron	3.500 mg
Vitamins	
Carotene	40.000 µg
Thiamine	0.060 mg
Riboflavin	0.030 mg
Niacin	0.600 mg
Vitamin C	6.000 mg
Minerals & Trace Elements	
Magnesium	405.000 mg
Copper	0.740 mg
Manganese	5.560 mg
Zinc	1.930 mg
Chromium	0.057 mg

Turmeric

Turmeric is a rhizomatous herbaceous perennial plant of the ginger family, Zingiberaceae Chan *et al.*, (2009). It is native to tropical Indian Subcontinent and needs temperatures between 20 °C and 30 °C (68 °F and 86 °F) and a considerable amount of annual rainfall to thrive¹³. Its active ingredient is curcumin and it has a distinctly earthy, slightly bitter, slightly hot peppery flavor and a mustardy smell. Curcumin has been a centre of attraction for potential treatment of an array of diseases, including cancer, Alzheimer's disease, diabetes, allergies, arthritis and other chronic illnesses¹⁴. India and Pakistan are significant producers of turmeric which has regional names based on language and country. The name appears to derive from the Latin, *terra merita* (merited earth) or *turmerite*¹⁵. The name of the genus, *Curcuma* is from an Arabic name of both saffron and turmeric.

The most important chemical components of turmeric are a group of compounds called curcuminoids, which include curcumin (diferuloylmethane), demethoxycurcumin, and bisdemethoxycurcumin. Nagpal and Sood¹⁴, there are other important volatile oils such as turmerone, atlantone, and zingiberene. Some general constituents are sugars, proteins, and resins.

According to National Center for Complementary and Alternative Medicine, "there is little reliable evidence to support the use of turmeric for any health condition because few clinical trials have been conducted." Although trials are ongoing for the use of turmeric to treat cancer, large doses would need to take for any effect. It is not known what, in any, positive effect turmeric has for human beings with cancer.

Mishra and Palanivelu¹⁶ are being investigated in relation to Alzheimer's disease, arthritis, diabetes, and other clinical disorders. As an example of such basic research, turmeric reduced the severity of pancreatitis-associated lung injury in mice¹⁷. A laboratory study of Liu *et al.*¹⁸ found that created hybrid molecules with the anti-nausea drug thalidomide and turmeric killed myeloma cancer cells. Ragasa *et al.*¹⁹ studies shows compounds in turmeric to have anti-fungal and anti-bacterial properties; however, curcumin is not one of them.

Nutrition Information of Turmeric

TURMERIC	
Parameters	Value
Moisture	13.100 gm
Protein	6.300 gm
Fat	5.100 gm
Minerals	3.500 gm
Fibre	2.600 gm
Carbohydrates	69.400 gm
Energy	349.000 K cal
Calcium	150.000 mg
Phosphorus	282.000 mg
Iron	67.800 mg
Vitamins	
Carotene	30.000 µg
Thiamine	0.030 mg
Niacin	2.300 mg
Folic Acid (Free)	10.000 µg
Folic Acid (Total)	18.000 µg
Minerals & Trace Elements	
Magnesium	278.000 mg
Copper	0.390 mg
Manganese	8.380 mg
Zinc	2.720 mg
Chromium	0.069 mg
Phytin Phosphorus	97.000 mg

Fenugreek

Fenugreek, *Trigonella Foenum-groecum* Linne, is an annual herb indigenous to the countries bordering on the eastern shores of the Mediterranean and largely cultivated in India, Egypt, and Morocco.

Fenugreek has strong flavor and aroma. The plants leaves and seeds are widely consumed in Indo-Pak subcontinent as well as in other oriental countries as a spice in food preparations, and as an ingredient in traditional medicine²⁰. Medicinally it was used for the treatment of wounds, abscesses, arthritis, bronchitis, ulcer and digestive problems. Traditional Chinese herbalists used it for kidney problems and conditions affecting the male reproductive tract. Fenugreek was, and re-mains, a food and a spice commonly eaten in many parts of the world. Fenugreek Seeds are aromatic, bitter, carminative, galactogouge, antibacterial and may be eaten raw or cooked. Bulk of the seed is dietary fiber (50%) and protein (30%) both of which have no taste or flavor.

The chemical components of fenugreek seeds include a large carbohydrate fraction (mucilaginous fiber, galactomannan); 20-30% proteins high in tryptophan and lysine; pyridine-type alkaloids; flavonoids; free amino acids (4-hydroxyisoleucine, arginine, lysine, histidine); saponins; glycosides; vitamins, minerals, (28%) mucilage, (22 %) proteids, 5 % of a stronger-smelling, bitter fixed oil. volatile oils. Bitterness is mainly due to the oil, steroidal saponins and alkaloids.

Fenugreek or Methi has been found to provide the following health benefits:

- Fenugreek in recent research has been found to have anti-carcinogenic properties and effectively control liver cancer.
- Fenugreek has been proven to protect against gamma radiation. It controls lipid peroxidation when subjects are exposed to radiation.
- Fenugreek leaves helps in cure of a number of digestive ailments that include indigestion, flatulence, liver disorders, colic, dysentery, peptic ulcers and inflammation of the digestive tract. It also helps to clean out the bowels and kidneys of excess mucous while depositing a mucilaginous layer on ulcers while passing through the system.
- In early stages of respiratory infections such as bronchitis, influenza, and pneumonia, the tea made of fenugreek leaves help excrete toxins through sweat.

Nutrition information of Fenugreek

Parameters	Value
Moisture	13.700 gm
Protein	26.200 gm
Fat	5.800 gm
Minerals	3.000 gm
Fibre	7.200 gm
Carbohydrates	44.100 gm
Energy	333.000 K cal
Calcium	160.000 mg
Phosphorus	370.000 mg
Iron	6.500 mg
Vitamins	
Carotene	96.000 µg
Thiamine	0.340 mg
Riboflavin	0.290 mg
Niacin	1.100 mg
Folic Acid (Free)	14.500 µg
Folic Acid (Total)	84.000 µg
Choline	1161.000 mg
Minerals & Trace Elements	
Magnesium	124.000 mg
Sodium	19.000 mg
Potassium	530.000 mg
Copper	0.710 mg
Manganese	1.030 mg
Zinc	3.080 mg
Chromium	0.064 mg
Phytin Phosphorus	151.000 mg

Mustard

Mustard is a condiment made from the seeds of a mustard plant (white or yellow mustard, *Sinapis hirta*; brown or Indian mustard, *Brassica juncea*; or black mustard, *B. nigra*). The whole, ground, cracked, or bruised mustard seeds are mixed with water, salt, lemon juice, or other liquids, and sometimes other flavorings and spices, to create a paste or sauce ranging in color from bright yellow to dark brown.

Mustard has been used medicinally since the time of the Greek physician Hippocrates (c. 460—375 BC). The Romans ate the whole seed as a spice during meals, but mustard was not milled for use at table until the eighteenth century. Today, mustard is number one in the world spice trade in terms of volume. That is perhaps a little-known fact, as most people think of spices in terms of nutmeg, mace, cinnamon, ginger and the other tropical spices and condiments. The action of mustard as a condiment is due to three qualities. These are its ability to stimulate appetite and salivation and so hasten the first stage of digestion, its ability to break down indigestible fats and meat fibers, and its ability to stimulate digestive juices to complete the digestive process.

Many people find the taste itself adds to their enjoyment, so aiding good digestion. Mustard contains an essential oil (allyl isothiocyanate) which, when applied to the outside of the body, increases the circulation and so helps the elimination of poisons. Two or three tablespoons of mustard powder can be used in the bath to ease chills, relax tired muscles and promote sleep.

Nutrition information of Mustard

Mustard	
Parameters	Value
Moisture	8.500 gm
Protein	20.000 gm
Fat	39.700 gm
Minerals	4.200 gm
Fibre	1.800 gm
Carbohydrates	23.800 gm
Energy	541.000 K cal
Calcium	490.000 mg
Phosphorus	700.000 mg
Iron	7.900 mg
Vitamins	
Carotene	162.000 µg
Thiamine	0.650 mg
Riboflavin	0.260 mg
Niacin	4.000 mg
Choline	211.000 mg
Minerals & Trace Elements	
Copper	0.830 mg
Manganese	2.560 mg
Molybdenum	0.089 mg
Zinc	4.800 mg
Chromium	0.063 mg

Garlic

Allium sativum, commonly known as garlic, is a species in the onion genus, *Allium*. Its close relatives include the onion, shallot, leek, chive²¹ and rakkyo. With a history of human use of over 7,000 years, garlic is native to central Asia²² and has long been a staple in the Mediterranean region, as well as a frequent seasoning in Asia, Africa, and Europe. Garlic has a long tradition as a food and as a medicinal plant. Therapeutic effects, routes of application and modes of preparation of garlic are very varied. In order to be able to assess which mode of preparation is suitable for which application, it is necessary to explain certain substance characteristics of garlic. The garlic bulb contains cysteine sulphoxides belonging to the secondary plant components.

Epidemiological studies prove that the risk for different malignant diseases, especially of the gastrointestinal tract is significantly reduced by regular consumption of large amount of garlic. In numerous investigations it was possible to demonstrate different pharmacological properties, for some cysteine sulphoxides, like antimicrobial, anticancer, and antioxidant activity. The antioxidant potential of garlic is

of great interest in connection with the antiatherosclerotic and cardioprotective effects observed epidemiologically and clinically. Durak *et al.*²³ showed the supplementation with garlic extract inhibited vascular calcification in human patients with high blood cholesterol.

Garlic is also alleged to help regulate blood sugar levels. Regular and prolonged use of therapeutic amounts of aged garlic extracts lower blood homocysteine levels and has been shown to prevent some complications of diabetes mellitus. People taking insulin should not consume medicinal amounts of garlic without consulting a physician. Fareed *et al.*,²⁴ garlic has been used reasonably successfully in AIDS patients to treat *Cryptosporidium* in an uncontrolled study in China. John²⁵ has also been used by at least one AIDS patient to treat toxoplasmosis, another protozoal disease.

Nutrition information of Garlic

Garlic	
Parameters	Value
Moisture	62.000 gm
Protein	6.300 gm
Fat	0.100 gm
Minerals	1.000 gm
Fibre	0.800 gm
Carbohydrates	29.800 gm
Energy	145.000 K cal
Calcium	30.000 mg
Phosphorus	310.000 mg
Iron	1.200 mg
Vitamins	
Thiamine	0.060 mg
Riboflavin	0.230 mg
Niacin	0.400 mg
Vitamin C	13.000 mg
Minerals & Trace Elements	
Magnesium	71.000 mg
Copper	0.630 mg
Manganese	0.860 mg
Zinc	1.930 mg
Chromium	0.020 mg

Cardamom

Cardamom is known as the “Queen of Spices”. It is one of the most highly priced and exotic spices in the world. It is a perennial tropical herb plant belonging to the ginger family (Zingiberaceae) and grows from a thick rootstalk up to around 6-10 feet. It is indigenously grown in the evergreen forests of the Western Ghats in South India.

It is a perennial herb and grown under mixed forest tree in Eastern Himalayas. In India, it was used as early as the 6th century BC in Ayurvedic preparations, as mentioned by Susrata²⁶.

Cardamom contributes a lot to the human being for good health. It contains many compounds that are known to have antioxidant, disease preventing and health promoting properties. The seeds of large cardamom are good source of minerals like potassium, calcium, magnesium, manganese and iron. Potassium is an important component of cell and body fluids that help to control heart rate and blood pressure. The therapeutic properties of large cardamom oil has found application in many traditional medicines as antiseptic, antispasmodic, carminative, digestive, diuretic, expectorant, stimulative, stomachic and tonic to heat and liver.

An anti-wrinkle cream containing *A. subulatum* was evaluated in the treatment of facial skin wrinkles and thus shows antioxidant activity (Ravinchandran *et al.*²⁷). Large cardamom is also one of the popular ingredients in ancient Indian remedies and ayurveda. The seeds are also useful as antidote to scorpion sting and snake bite²⁸. Seeds and fruits were found to be useful in prevention of hyperlipidaemia²⁹. Essential oil, oleoresin, encapsulated flavour, flavoured biscuits and flavoured liquors are some of the products developed for diversifying the uses of large cardamom.

Nutrition information of Cardamom

Cardamom	
Parameters	Value
Moisture	20.000 gm
Protein	10.200 gm
Fat	2.200 gm
Minerals	5.400 gm
Fibre	20.100 gm
Carbohydrates	42.100 gm
Energy	229.000 K cal
Calcium	130.000 mg
Phosphorus	160.000 mg
Iron	4.600 mg
Vitamins	
Thiamine	0.220 mg
Riboflavin	0.170 mg
Niacin	0.800 mg
Choline	1550.000 mg
Minerals & Trace Elements	
Magnesium	173.000 mg
Copper	0.470 mg
Manganese	8.920 mg
Zinc	2.810 mg
Chromium	0.031 mg

Herbs and Spices as Integral Part of both Culinary and Medicinal Preparations:

Herbs and spices have a long history of both culinary and medicinal uses³⁰. Herbs and spices are integral part of the daily diet. Herbs and spices could be regarded as one of the first real 'functional foods' but have largely become forgotten foods in the modern westernized diet. Herbs and spices can add variety, flavour, colour and aroma to the everyday diets whilst contributing a wide range of both nutrients³¹ and bioactives that may contribute to improved health³². Herbs and spices may act synergistically to enhance the health-related properties of other foods³³. Herbs and spices are added to traditional dishes and snacks to beneficially improve the health status of the consumer without detrimental effect on the flavour and taste. Flavours and seasonings are important considerations for snacks³⁴ and herbs could be used as both flavouring^{34,35} and functional ingredients³⁶ in snack products. Moreover, the pharmacological properties of traditional herbs have been well documented^{37,38}. Herbs and spices, as plant products, can add substantial variety to the nutrients and bioactives available in the diet. Herbs have been widely used as culinary herbs and have been known as medicinal plants in traditional medicine. Dietary spices influence various systems in the body such as gastrointestinal, cardiovascular, and reproductive and nervous systems resulting in diverse metabolic and physiologic actions³⁹.

CONCLUSION

The relevance of the innumerable actions of spices shown in vitro, have to be demonstrated in vivo. The diversity of their cellular actions supports their possible beneficial effects on various chronic diseases. Turmeric, through its kaleidoscopic effects, appears to be truly a spice of life. Food based approaches for enhancing the intake of spices and phytochemicals can offer an avenue to greatly impact the onset and progression of chronic diseases, oxidant stress and ageing. Although the chemopreventive approach is a recognized strategy, public health actions should be directed at increases in the consumption of foods / herbs / spices / beverages, which possess a package of protective phytonutrients. Spices such as turmeric, fenugreek, mustard, ginger, onion and garlic have a wide variety of bio functions and their additive or synergistic actions are likely to protect the human body against a variety of insults. Traditionally spices, as part of the diets, have holistic effects on human health.

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