# Neutraceutical Potential of Indian Spices: A Review

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**Abstract**

Spices are important natural sources that benefit human health by phytochemicals and micronutrients present in them. Dietary consumables have been different dietary cultures all over the world. In which spices play a major role. Spices are defined as "a strongly flavoured or aromatic substance of vegetative origin, obtained from tropical plants". Spices are a traditional source of medication and since last few years there has been an exponential growth in the field of herbal medicine and these drugs are gaining popularity both in developing and developed countries because of their natural origin and less side effects. Against deal of research has been done on medicinally and commercially available spices. The World Health Organization (WHO) has listed 21,000 plants, which are used for medicinal purposes around the world. Among these 2500 species are in India, out of which 150 species are used commercially on a fairly large scale. This current review focuses on the use of various spices for treatment of different diseases thus exploring their antimicrobial potential in the world. The use of Ayurvedic medicines is common in both adults and children and is increasing in many areas of the world. This paper will discuss the benefits of the use of herbal medicines.

**Keywords -** Herbs, Spices, Antimicrobial agents.

## Introduction

India is the largest producer of the medicinal herbs and spices. It is historically known as a land of spices and aromatic plants, and it continues to be one of the leading producers of spices and medicinal plants in the world (Prajapati *et al*., 2005). They are obtained from dried seeds, fruits, roots, bark or leaves. They are the aromatic substances which are basically used as additives to flavour, colour or preserve food. In India many of these spices are used in everyday cooking and significant quantities may be consumed in a single meal. It is estimated that an adult in India can consume 80-200 mg/day of curcumin the bioactive component of turmeric. Some Indians have been reported to consume up to 50 g of garlic in a week (Tapsell *et al.*, 2006). This data suggests that therapeutic doses of the active ingredients in spices can be taken by dietary consumption alone. However, for many patients, treatment with nutraceuticals present in food with enhanced concentrations of the active ingredients of the spices can be done. There is a widespread effort in India to define the potential health benefits of herbal medicines, including spices, and identify the active ingredients, especially compounds with anti-oxidant and anti-inflammatory properties (Vaidya and Devasagayam, 2007).

Antibiotics resistance is an emerging global problem and has serious negative effects in designing the treatment strategies (Levy and Marshall, 2004; Gould, 2009). The 'superbugs' which are multidrug resistance strains are emerging at a faster rate and can lead to an increase in morbidity and mortality. The emergence and spread of antimicrobial resistance is a big problem caused by various interconnected factors, many of which are related to misuse and overuse of antibiotics. Other factors leading to the need for novel anti-infective agents are their cost and the toxicity related with antibiotic use. All these factors emphasize the need for development of novel antimicrobials. Due to an increasing antimicrobial resistance, the future development of new anti-microbial agents is required for research in this field. Many researchers showed that most of the spices and herbs have great pharmaceutical value and have been traditionally used in home based medicines (Arora and Kaur, 1999; Shukla and Gardner, 2006). Huge arrays of bacterial agents have been introduced and antibiotics can be used effectively to treat major infectious diseases (Wood, 1990). However, the usage of antibiotics and antibacterial chemotherapeutics is becoming more and more restricted, because: (i) due to the developing resistance to antibiotics soon after their introduction (ii) and their side effects. Therefore, it becomes essential to search for newer drugs with lesser resistance development and lesser toxicity (Eman, 2009). Around 60% of the world's population depends on herbal medicine, a broad term including spices, for primary healthcare (Modak *et al*., 2007).

There are 2600 plant species of which more than 700 are noted for their use as medicinal herbs (Ali-Shtayeh, and Abu Ghdeib, 1999). A survey of literature reveals that there are many essential oils which possess antifungal activity (Dutta *et al*., 2007). Today, many ethnic cuisines are recognized for their reliance on "signature" herbs and spices. Turmeric in Indian cuisine; basil, garlic, and oregano in Italian and Greek cuisines; and lemongrass, ginger, cilantro, and chilli peppers in Thai food represent some of the cultural diversity in the use of herbs and spices. Satia-Abouta *et al.*, 2002 report that the cuisines of Asia, Southeast Asia, and the Mediterranean are perceived by many to be healthier than the typical Western diet. Results from a case-control study involving over 1200 gastric cancer patients and more than 1100 controls from seven areas, grouped into high and low risk areas, pointed to several categories of foods associated with gastric cancer risk (Buiatti *et al*., 1989). In Asian countries, the consumption of curcumin, a component of curry powders, turmeric, and mustard, along with low meat intake, have been reported to be factors linked to a lower incidence of colon cancer (Mohandes and Desai, 1999).

Kitchen spices can thus play a major role in healthy digestion and can be used in medication. Food can be medicine by adding delicious herbs. Following are a few common kitchen spices with their medicinal affects. Anise (*Pimpinella anisum*) – treats flatulence, Bay (*Laurus nobilis*) – prevents gas and indigestion, Caraway (*Carum carvi*) – prevents gas, colic, indigestion, and nervous conditions, Cardamom (*Elettaria cardamomum*) – treats indigestion, gas, colic, and diarrhea, Cayenne (*Capsicum anuum*) – aids circulation, indigestion, calms gas, Cinnamon (*Cinnamomum zeylanicum*) – treats diarrhea, cramps, abdominal pains, indigestion, and gas, Cloves (*Syzygium aromaticum*) – improves digestion, calms flatulence, stops vomiting and nausea, Cumin (Cuminum cyminum) – relieves gas ,Fennel (*Foeniculum vulgare*) – carminative, and antispasmodic, Fenugreek (*Trigonella foenumgraecum*) – soothes ulcers and inflammations of the stomach and intestines, Garlic (*Allium sativum*) – antibiotic, relieves gas, Ginger (*Zingiber officinale*) - aids digestion, prevents nausea, aids intestines in detoxification, Marjoram (*Origanum majorana*) – aids upset stomach, and colic, Rosemary (*Rosmarinus officinalis*) – aids indigestion, colic, nausea, and gas, Sage (*Salvia officinalis*) – relieves diarrhea, Thyme (*Thymus Vulgaris*) – treats intestinal worms, gas, and diarrhea. Therefore this review has been undertaken. The spices chosen are as follows:

Cuminum cyminum (*Zeera*), Curcuma longa (*Haldi*), Coriandrum sativum (*Dhania*), Trigonella

foenumgraecum (*Methi*), Foeniculum vulgare (*Saunf*), Piper nigrum (*Kali Mirch*), Elettaria cardamomum (*Choti Elaichi*), Cinnamomum zeylanicum (*Dalchini*), Cinnamomum tamala (*Tejpat*), Syzygium aromaticum (*Laung*), Ferula asafoetida (*Hing*), Trachyspermum ammi (*Ajwain*), Brassica juncea (*Rai*), Allium sativum (*Garlic*), Murraya Koenigii (*Curry leaf*)

***Foeniculum vulgare* (Sounf)**

The name is derived from a Latin word 'foenum' which means 'hay', perhaps because smell of fennel resembles that of hay (Singh and Panda, 2005). Fennel is a native of Mediterranean region and Europe but is commonly cultivated throughout India especially in Assam, Maharashtra, Punjab and Gujarat. Fennel is chiefly known as culinary herb but it is a commonly used household remedy for various medicinal purposes (Sandhu and Heinrich, 2005). Fruits of fennel are used as spice and condiment; they are also employed as flavouring agent in culinary preparations, confectionary etc. Water extracts are given as a digestive tonic to infants and children. In a study carried out on rats, *Foeniculum vulgare* has shown a protective effect against ethanol induced gastric mucosal lesions (Birdane *et al*., 2007). Fennel has shown anticancer (Celik and Isik, 2008; Singh and Kale, 2008); antidementia (Joshi and Parle, 2006); antihirsutism (Javidnia *et al*., 2003); anti-inflammatory (Choi and Hwang, 2004); antioxidant (Barros *et al*., 2009; Nickavar and Abolhasani, 2009); antiplatelet and antithrombotic (Tognolini *et al*., 2006, 2007); antispasmodic activities (Ostad *et al*., 2001) and as curative in infantile colic (Savino *et al*., 2005).

Essential oil of fennel have antifungal activities and have also shown antimycobacterial and anticandidal activity. They can also be used as possible bio fungicides, alternative to synthetic fungicides against phytopathogenic fungi as it has been reported to reduce the mycelia growth and germination of *Sclerotinia sclerotiorum* (Soylu *et al*., 2007). Fennel essential oils showed antibacterial effect against foodborne pathogens such as *Escherichia coli* and *Bacillus megaterium* (Lo-Cantore *et al*., 2004); *E. coli* and *S. aureus* (Mohsenzadeh, 2007); *E. coli* O157:H7, *L. monocytogenes, Salmonella typhimurium* and *S. aureu* (Dadalioglu and Evrendilek, 2004). Aqueous and organic extracts of fennel have demonstrated moderate antibacterial activity (Kaur and Arora, 2010). Hydroethanol extract of *F. vulgare* has shown inhibition of *Campylobacter jejuni* and *H. pylori* (Mahady *et al*., 2005; Cwikla *et al*., 2009).

***Trachyspermum ammi* (Ajwain)**

It is characterised as a small, erect, annual, herbaceous plant with branched leafy stems, feather like leaves (2.5 cm long), and 4-12 ray flower heads bearing 6 - 16 flowers. Its fruits are very small, greyish-brown coloured and egg shaped. It is widely used in curries due to its aromatic smell and pungent taste. It is basically used in small quantities for flavouring numerous foods, as preservatives, in medicine and for the manufacture of essential oil for ultimate use in perfumery (Pruthi, 1992). In India it is administered as a household remedy for stomach disorders, a paste of crushed fruits is applied externally for relieving colic pains; and a hot and dry fomentation of the fruits applied on chest is used as a common remedy for asthma (Anonymous, 1995). *T. ammi* has been shown to possess anti-aggregatory effects (Srivastava, 1988); anthelmintic (Lateef *et al*., 2006); antihyperlipidaemic (Javed *et al*., 2006); antifilarial (Mathew *et al*., 2008); insecticidal (Chaubey, 2008); kidney stone inhibitory (Kaur *et al*., 2009); molluscicidal (Singh and Singh, 2000); mosquito repellent (Pandey *et al*., 2009); and nematicidal activities (Park *et al*., 2007). Its seed extract at 1:20 dilution was reported to possess fungicidal action against *Rhizoctonia solani*, a causative agent of sheath blight of rice (Ansari, 1995). Omum oil has exhibited a remarkable antibacterial activity against *Staphylococcus aureus, Escherichia coli, Salmonella typhi, Shigella dysenteriae* and *Vibrio cholera*. The essential oils extracted from the seeds of *T. ammi* showed antibacterial activity against *E. coli, P. aeruginosa, S. typhi* and *S. aureus* (Patel *et al*., 2008), They are therefore used for the treatment of gastrointestinal disorders. Since centuries they are used to cure various gastrointestinal

disorders has also been scientifically proved in another study carried out by Kaur and Arora (2009). Moreover aqueous and organic extracts of omum seeds have also shown their antibacterial effect. Methanol extracts of *T. ammi* showed significant *in vitro* inhibitory effect on hepatitis C virus (HCV) protease at a concentration 100 µg/ml (Hussein *et al*., 2000).

***Curcuma longa* (Haldi)**

*Curcuma longa* is a plant of great medicinal importance & known to belong to the Zingiberaceae family. *C. longa*, commonly known as 'turmeric', is widely used as a spice and colouring agent, and is well known for its chemotherapeutic properties. The major component of turmeric is curcuminoids, which include mainly curcumin (diferuloyl methane), demethoxycurcumin, and bisdemethoxycurcumin. Curcumin is the most important fraction which is responsible for the biological activities of turmeric. Curcumin 95%, a potent antioxidant is believed to be the most bioactive and soothing portion of the herb turmeric and posses the properties like antioxidant, anti-inflammatory, anti-platelet, cholesterol lowering, antibacterial and anti-fungal effects. *C. longa* oil was tested against cultures of *Staphylococcus albus*, *S. aureus* and *Bacillus typhosus*, inhibiting the growth of *S. albus* and *S. aureus* in concentrations up to 1 to 5,000 (Chopra *et al*., 1941). Turmeric cultivation in India occupies 60% of the total area. It is not only an ancient but also a highly cultivated Asian spice and used in countries like India, China, Malaysia, Pakistan, Bangladesh, Indonesia, Taiwan, Haiti, Jamaica and El-Salvador. Traditionally turmeric is used in many ways as a tonic, stimulant, and cosmetic and for the treatment of coughs, colds, sore throats, asthma and dyspepsia including peptic ulcers. It is also used as a deworming agent and as a paste for some viral diseases such as chicken pox, small pox and measles. Its traditional use in arthritis and wound healing is a reflection of its pleiotropic effects. Current literature supports its traditional uses and evidence based science clearly shows that turmeric and its active constituents; can be used for a variety of disorders (Krishnaswamy K, 2006).

***Cinnamomum tamala* (Tejpat)**

The genus Cinnamonum belonging to the family Lauraceae which locally called as Tejpat/dalchini comprises of 270 spices which occur naturally in Asia and Australia. The main constituents of C. *tamala* leaves are a-pipene, camphene, myrcene, limonene, eugenol etc. (Smith *et al*., 2002; Saino *et al*., 2003). Leaves of *C. tamala* (tejpat) are widely used as a spice and also yield an essential oil on distillation. It is medicinally used as a curative for anti-flatulent, diuretic and cardiac disorders (Showkat *et al*., 2004).

***Trigonella foenumgraecum* (Methi)**

Fenugreek (*Trigonella foenum-graecum* L. *Leguminosae*) is one of the oldest medicinal plants, originating in India and Northern Africa. An annual plant, fenugreek grows to an average height of two feet. The leaves and seeds, which mature in long pods, are used to prepare extracts or powders for medicinal use. Applications of fenugreek were documented in ancient Egypt, where it was used in incense and to embalm mummies. Gupta et al., reported the results of a small randomized, controlled, double-blind trial to evaluate the effects of fenugreek seeds on glycemic control (Gupta *et al*., 2001). It can also be used for bread making from maize flour and wheat. *Trigonella foenum graecum* (leguminosae) (Eng: fenugreek, Tamil: Vendayam) is a well known spicy agent which prevent ageing, labour pain, impart immunity, improve mental function and add vitality to the body and it is also used in nervous disorders, dyspepsia, inflammation, tumors, cholesterolemic, hyperglycemic, and ulcer. Reports indicate that the pharmacological activities of *Trigonella foenum graecum* include anti diabetic, antifertility, antifungal, analgesic, anti-inflammatory, antipyretic, and immunomodulatory activities (Subhashini *et al*., 2011).

***Coriandrum sativum* (Dhania)**

*Coriandrum Sativum* belongs to the family Umbelliferae. It is highly reputed ayurvedic medicine commonly known as the Dhanyaka. It grows widely throughout India, Italy, Netherlands, Central and Eastern Europe, China and Bangladesh. The different parts of this plant contain monoterpenes, α-pinene, limpnene, γ-terpinene, p-cymene, borneol, citronellol, camphor, geraniol, coriandrin, dihydrocoriandrin, coriandrons A-E, flavonoids and essential oils. Various parts of this plant such as seed, leaves, flower and fruit, possess Diuretic, Antioxidant Activity, Ant-diabetic Anti-convulsant activity, Sedative Hypnotic Activity, Anti-microbial Activity, Anti mutagenic, Anthelmintic activity( Pathak *et al*., 2011).

***Syzygium aromaticum* (Clove)**

Cloves are the dried flower buds of *Syzygium aromaticum* (L.) Merr. and Perry (Myrtaceae), a tree 10–20 m high which is indigenous to the Moluccas or Clove Island. Cloves contain volatile oil (14 %-21%), tannin (10 %-13 %), phenol, sesquetrepene ester and alcohol (Rastogi and Mehrotra , 1960).

*Syzygium aromaticum* is widely cultivated in Indonesia, Sri Lanka, Madagascar, Tanzania and Brazil. The clove oil from *S. aromaticum* and eugenol have been described as having useful antiseptic, analgesic and anaesthetic effects (Chaieb *et al*., 2007a) and are largely used in dental medicine. Previous studies have reported antifungal activity for clove oil and eugenol against yeasts and filamentous fungi, such as several food-borne fungal species (Lo´pez *et al*., 2005; Velluti *et al*., 2004) and human pathogenic fungi (Chaieb *et al*., 2007b; Gayoso *et al*., 2005). Clove oil and eugenol have also been tested as antifungal agents in animal models (Ahmad *et al*., 2005).

***Cuminum cyminum* (Jeera)**

Fruits of *Cuminum cyminum* (Apiaceae), commonly known as jeera. Fruits of *Cuminum cyminum* (CC) are rich in estrogenic isoflavonoids luteolin and apigenin. Cumin has a broad antibiotic spectrum against both gram-positive and gram-negative bacteria. In particular the sensitivity of *Helicobacter pylori*, *Clavibacter, Curtobacterium, Rhodococcus, Xanthomonas, Agrobacterium* and *Pseudomonas* have been shown to Cumin essential oil previously (Nostro *et al*., 2005). In some reports it has been shown that the essential oil of cumin is equally or more effective when compared with standard antibiotics, at a very low concentration (Singh *et al*., 2002). Generally *Umbeliferae* species including *Cuminum cyminum* have antimicrobial properties (Singh and Goswami, 2000). Cumin seed is generally used as a spicy food in the form of powder for imparting flavor to different food preparations (Kafie *et al*., 2002).

***Ferula asafoetida* (Hing)**

*Ferula assafoetida* is one of the important species of *Ferula* which belongs to family Umbelliferae. This species is native to Afghanistan and Iran and is locally known as 'Hing'. The gum like exude and the raw tops of *Ferulla assafoetida* find application as flavour in Indian vegetarian cooking & salad (Guenther, 1952). The essential oil of *Ferula assafoetida* was found active against all Gram positive (*Bacillus megaterium, B. subtilis, Lactobacillus acidophilus, Micrococcus luteus, Staphylococcus epidermidis, S. aureus, Vibrio cholerae*) and negative (*E. coli, Salmonella typhi, Shigella flexneri*) bacterial strains (Rahman *et al*., 2008)

***Brassica juncea* (Rai)**

*Brassica juncea* (L.) Coss. belongs to the genus *Brassica* of the Cruciferae family. Seeds of this plant are widely used in America, Japan, China and other countries and regions as a traditional pungent spice, a source of edible oil and protein, and a type of medicine. The essential oil of *B. juncea* has very high application value and can be used to suppress the growth of microorganism in seafood, such as

*Helicobacter pyheri* and *Vibrio parahaemolyticus*. The oil exhibits significant inhibitory activities against *Aspergillus niger*, *A. flavus, Trichoderma viride, Candida albicans, C. utilis, C. tropicalis, Cryptococcus neoformans, Trichosporon mucoides, Trichophyton tonsurans* and *Geotrichum capitatum* (Musk and Johnson, 1993.). Moreover, the oil shows inhibitory effect on tumor cells and is effective in antiplatelet and anticancer (Yano *et al*., 2000).

***Allium sativum* (Garlic)**

Garlic is cultivated all over the world. It is grown throughout India; Gujarat and Orissa being the leading states. It is a bulb crop used as a spice or condiment with medicinal values. Garlic bulb is reported to contain volatile oil, alliin ( S-allyl-L-cysteine sulfoxide), S-methyl-L-cysteine sulfoxide and allinase. It is rich in vitamins like thiamine, riboflavin and niacin. Volatile oil contains allicin (diallyl thiosulphinate), an active odour principle of garlic. It works as a antirheumatic, stimulant, diaphoretic, expectorant, diuretic, antispasmodic, astringent, antiparalytic, antileprotic, aperient, febrifuge, carminative, stomachic, alterative and emmenagogue. The essential oil is hypocholestrolemic, hypotensive, antitumour and antidiabetic. Diallyl disulphide and diallyl trisulphide from essential oil have larvicidal action. Bulbs also have anti-bacterial and anti-fungal activity. It is used in cough, whooping cough, bronchitis, asthma, fever, facial paralysis, flatulence, colic, constipation, atonic dyspepsia, helminthiasis, duodenal ulcers, pulmonary and laryngeal tuberculosis, opthalmopathy, cardiopathy, fatigue, leucoderma, leprosy, hysteria, haemorrhoids, sciatica, otalgia, lumbago, swellings, splenopathy, hepatopathy, pneumonopathy, anthralgia, sore eyes, ear ache and dental caries (Kumar *et al*., 1997).

***Murraya koenigii* (Curry leaf)**

The genus *Murray*a of the family Rutaceae includes the following species *M. koenigii* (Linn.) Spreng. syn. *Bergera koenigii* Linn. *M. exotica* Linn. syn. *M. paniculata* (Linn.) Jack. *Murraya koenigii* is a small aromatic tree with dark grey bark and closely crowded spreading dark green foliage. Leaves are imparipinnate and alternate. Leaflets are alternate, obliquely ovate or somewhat rhomboid, gland dotted and strongly aromatic. Flowers are white, arranged in much branched terminal corymbose cymes and fragrant. Fruits are subglobose or ellipsoid berries, purplish black when ripe and 2-seeded (Warrier *et al*., 1995). Curry leaf, a plant of homestead gardens has gained importance as a commercial crop and is cultivated for its culinary and medicinal value. The plant is highly esteemed for its leaves which promote appetite and digestion and destroy pathogenic organisms. It is reported to be useful in emaciation, skin diseases, hemopathy, worm troubles, neurosis and poisons. They are useful in vitiated conditions of *kapha* and *pitta*, hyperdipna, colic, flatulence, diarrhoea, dysentery, vomiting, inflammations and foul ulcers. "*Kaidaryah*" drug is prepared using this plant which improves voice, stimulates digestion and destroys concocted poisons in the system. The important preparations using the drug are *Kalasadi kasayam, Pamantaka tailam, Jatyadi tailam, Jatyadi ghrtam*, etc (Sivarajan *et al*., 1994).

All parts of the plant, especially the leaves are rich in carbazole alkaloids. The leaves gave a coumarin glucoside, scopolin also. Essential oil from leaves contained b-caryophylline, b-gurjunene, b-elemene, b-phellandrene, b-thujene as major constituents.

The roots, bark and leaves are bitter, acrid, astringent, cooling, aromatic, demulcent, depurative, anthelmintic, febrifuge, stomachic, appetising, carminative, antiinflammatory and antiseptic. Aerial part is spasmolytic and antiprotozoal. Root is antiprotozoal, CVS active and has effect on nictitating membrane. Leaf is hypoglycaemic (Hussain *et al*., 1992).

***Piper nigrum L.* (Black pepper)**

The black pepper is one of the most renowned culinary spices. It contains an alkaloid piperine that has been widely used to amplify the body's ability to absorb nutrients contained in the food and aid the digestive process (Nair *et al*., 1996).

***Elettaria cardamomum* (Elaichi)**

Cardamon, a potential herb indigenous to the Indian subcontinent contains a wide variety of compounds, including α-terpineol, myrcene, subinene, limonene, cineol, α-phellandrene, menthone etc. (Duke, 1992). In vitro studies showed that cardamom inhibited platelet aggregation, when induced with agent such as ADP, epinephrine, collagen and calcium ionophore A 23187 (Suneetha and Krishnakantha, 2005).Cardamon reduced blood pressure in rats, probably by acting through cholinergic and calcium antagonist mechanism (Gilani *et al*., 2008).

**Conclusion**

Thus Spices are the major natural products used to add flavor and aesthetic, aromatic and therapeutic treatments to food, drink and other items. They are a form of leaf, flower, roots, bark or nuts which are usually dried and ground to be mixed with other ingredients. Spices appeal to the five senses and influence cultures and societies through trade and daily use. However valued for more than just taste and appearance, spices have nutritional and medicinal merits, as well as, they are sometimes better known as home remedies than proven treatments in medicine. Recently, the general acceptance of traditional medicine for health care and the development of microbial resistance to several available antibiotics have thus led researchers to investigate the activity of medicinal plants against infectious diseases. Thus this review spread lights on the multi-chemo therapeutic uses of the spices chosen along with the aroma and taste they provide to food .Thus playing a big role in preparation of different cuisine with the major benefits to health.

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