



## Indian Culinary Ethnic Spices Uses in Foods are Palate of Paradise

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### Abstract

Indian cuisines are an enormous array of spicy delicacies. Every food product attains its final profile principally from two components, namely, ingredients and processing methods. Traditional Indian delicacies require varieties of spices in order to obtain an appropriate flavor profile from spices. The quality of ethnic cuisine is due to regional and ethnic practices and to subjective factors such as the skill and style of the preparation. The ethnic cuisine should possess certain attributes such as a well-defined product profile, a scheduled manufacturing procedure, uniform quality and specified shelf-life. Thus, there is a need for a preprocessed ready-to-use and shelf-stable spice mix formulation for the preparation of varieties of plant-based and muscle-based ethnic cuisines food products in order to minimize the drudgeries of processing in kitchen and food preparation time to cater to the needs of increasing population of working couples, single persons living, etc. However, this review covers bioactives, geographical origin, medicinal benefits, multicuisines, liking and preference of spices.

**Keywords:** Cuisines; Spices; Foods

### Introduction

Spices can be defined as any dried, fragrant, aromatic or pungent vegetables or plant substances in whole, broken or ground forms that contribute flavour, whose primary function in food is seasoning rather than nutrition and that may contribute piquancy of foods and beverages. The use of spices as food additives has been practiced widely since ancient times [1,2]. Apart from enhancing the taste and flavour of food, spices have been widely believed to exert digestive stimulant action. A few medicinal properties of spices such as tonic, carminative, stomachic, diuretic and antispasmodic have long been recognized [2-4]. These attributes largely empirical nevertheless efficacious have earned them pharmacological applications in the indigenous systems of medicine as digestive stimulants and to relieve digestive disorders.

### Bioactives of Spices

Spices are a storehouse of many chemically active compounds that impart flavour, fragrance and piquancy. Spices recognized as several health benefits including lowers cholesterol (Table 1). Most spices owe their flavouring properties to volatile oils and in some cases, to fixed oils and a small amount of resin which are known as oleoresins. Phytochemicals in spices are secondary metabolites, which are originated for the protection from herbivorous insects, vertebrates, fungi, pathogen and parasites [1,2]. Most probably, no single compound is responsible for flavours but a blend of different compounds such as alcohols, phenols, esters, terpenes, organic acids, resins, alkaloids and sulphur containing compounds in various proportions produce the flavors [5].

Spices	Major Bio actives	Therapeutic benefits	
Turmeric	Curcumin	Cardiovascular diseases (CVD), platelet aggregation↓, LDL-C↓, TAG and serum cholesterol↓, thromboxane↓, cardiomyocyte apoptosis↓, cancer, pigment cell growth inhibition, obesity, against DNA oxidation, Anti-inflammatory, Antioxidant, neurodegenerative diseases, Immunomodulatory, leukemia	Sugasini, <i>et al.</i> [6] Bower, <i>et al.</i> [7] Srinivasan, <i>et al.</i> [2]
Black Pepper	Piperine,	Antidiabetic, Gastrointestinal diseases, Antioxidant, Anti-inflammatory, hypotriglyceridemic, ↓cholesterol in blood and liver	Krishna, <i>et al.</i> [8] Srinivasan [2]
Chilli	Capsaicin	Protect from CVD, Antioxidant, Anti-inflammatory	Krishna, <i>et al.</i> [8]
Clove	Eugenol	Anti-inflammatory	Yashin, <i>et al.</i> [5] Srinivasan, <i>et al.</i> [2]
Ginger	Gingerol,Shogool, Zerumbone	Protect from CVD, Renal disease, Against DNA oxidation, ↓platelet aggregation, ↓LDL-C, ↓LDL atherogenic modifications, ↓Oxidative responsive of macrophages	Yashin, <i>et al.</i> [5] Srinivasan, <i>et al.</i> [9]
Cinnamon	Cinnamaldehyde Procyanidin	Antidiabetic, hypertension, hepatic, increase coronary blood flow, CVD,neurodegenerative diseases	Yashin, <i>et al.</i> [5] Srinivasan, <i>et al.</i> [2]
Cardomom	Limonene	Antidiabetic, Hypertension, hepatic diseases	Yashin, <i>et al.</i> [5]
Rosemary	Rosemarinic acid, Carnosic acid	Prevent oxidation and delay the onset of rancidity	Lokesh, <i>et al.</i> [10]
Coriander	Linalool	Lower risk of CVD	Lokesh, <i>et al.</i> [12] Srinivasan, <i>et al.</i> [2]
Anise	Camphene	Antioxidant	Lokesh, <i>et al.</i> [12] Srinivasan, <i>et al.</i> [2]
Caraway	Monoterpenes	Prevention of Hepatic diseases	Lokesh, <i>et al.</i> [12]
Onion	Polyphenols, flavonoids, flavonols	CVD, ↓platelet aggregation, ↓cholesterol, ↓fibrinolytic activity, Renal disease, gastric carcinoma	Srinivasan, <i>et al.</i> [12]
Garlic	Allicin	CVD, Renal disease, prostate cancer, colon cancer, inhibit enzymes involved in lipid synthesis, ↓platelet aggregation, ↓lipid peroxidation, antioxidant, inhibit angiotensin converting enzyme	Lokesh, <i>et al.</i> ;Yashin, <i>et al.</i> ,2017[12, 5]
Oregano	Apigenin	Antioxidant	Srinivasan, <i>et al.</i> [2]
Dil	Quercitin	Antioxidant	Srinivasan, <i>et al.</i> [2]
Fenugreek	Rhapotencin, iso-vitexin, Sesquiterpenes	Anti-diabetic, Antioxidant, anti-carcinogenic, lymphatic cleansing, hypoglycaemic, ↓blood pressure	Yashin, <i>et al.</i> [5]
Nutmeg	Catechins	Antioxidant	Lokesh, <i>et al.</i> [13]
Parsley	Apigenin	DNA against oxidation	Bag, <i>et al.</i> [1 2]
Red pepper	Capsaicin	Anti-inflammatory, Antioxidant, hypolipidemic, cholesterol in serum and liver	Krishna, <i>et al.</i> [13]; Lokesh, <i>et al.</i> [12]
Peppermint	Menthol	Lowers CVD risk, neurodegenerative diseases	Lokesh, <i>et al.</i> [13]
Mustard seeds		Rectal cancer, bladder cancer	Yashin, <i>et al.</i> ,2017[5]
Bayleaf		Inhibit melanoma cell growth	Bag, <i>et al.</i> [13]

**Table 1:** Major bioactives in Spices and its health benefits.

**Statistical data of Indian spices**

The legacy of Indian spices is more than 7000 years old (BC 5000). Total number of spices cultivated in the world is perhaps a disputed question. Based on data collected from Bureau of Indian

Standards (BIS), 63 spices are grown in India. But Spices Board (Government of India) has listed only 52 spices However the International Organization for Standardization (ISO) has approved 75 spices and condiments out of 109 listed by ISO [14,15]. India - the

land of spices plays a significant role in the global spices as quality spices come from Kerala. Some of the spices like chillies, coriander seeds, cumin, fenugreek, fennel are coming from other parts of India. At present India produces around 2.75 million tonnes of different spices valued at approximately 4.2 billion US\$ and holds the premier position in the world spices market. Because of the varying climates in India - from tropical to sub-tropical, 45 degrees to 0-degree temperature - almost all spices are grown in this country. In almost all of the 28 states and seven union territories of India, at least one spice is grown in abundance [15,16]. About 4, 00,000 tonnes equivalent to \$1.5 billion worth of spices are traded worldwide annually. The import volume for the spice industry will continue its upward trend but market prices have been moving downwards because of a glut. The US is the largest importer of spices with its 1991 purchases reaching 2,42,719 tonnes worth \$395 million [15,17]. Almost the consumption of major spices in India are used for culinary purposes (Figure 1). The major spices which is used for cooking are chillies, pepper, turmeric and garlic. Hence, increased spice consumption enhanced food quality and alleviate hunger and malnutrition.

spice are more important ones. The main commercial products of these crops are whole spice, ground spice oil and oleoresin. Clove is mainly grown in Kanyakumari and Nilgiris districts of Tamil Nadu and in a few small areas in Kerala and Karnataka States. Nutmeg cultivation is more prevalent in Kerala and to a limited extend in Tamil Nadu and Karnataka. All spice was grown in a few gardens of Kerala, Tamil Nadu, Karnataka, Bengal and Orissa [16,17]. In India, Kerala is highly suitable for the cultivation of spices. Important spices cultivated are black pepper, cardamom, ginger, turmeric, clove, garcinia, nutmeg, and mace. Out of this 95 per cent of the total production is contributed by pepper, cardamom, ginger and turmeric. Pepper and cardamom are cultivated in the high ranges, and ginger and turmeric in plains as well. The major production centers are Idukki and Wayanad districts [16,17].

Spices are high value and low volume commodities of commerce in the world market. All over the world, the fast-growing food industry depends largely on spices as taste and flavour makers. Health conscious consumers in developed countries prefer natural colours and flavours of plant origin instead of cheap synthetic ones. Thus, spices are the basic building blocks of flavour in food applications. The estimated growth rate for spices demand in the world is around 3.19 per cent, which is just above the population growth rate. India has been a traditional producer, consumer and exporter of spices. There are about 109 spices listed by International Organization for Standardization and India grows about 65 of these spices. Almost all the States in the country produce one or other spices. India is the leading producer of about 5.08 to 5.67 million tonnes (2008-2011). In India Andhra Pradesh contributes to the first place among the state wise production, followed by Gujarat, Rajasthan, Karnataka, and Madhya Pradesh. The Tamil Nadu ranks VI place in total spice production of about 0.34 million tonnes for this fiscal year [16]. Moreover, organic spices are promising of snail space [18,19]. However less evidence is available. Amid total turnover of organic products export from India to all over the world contribution was only 1% upto now. Delivery of subsidies, improvement of organic production of spices and post-harvest technology need to boost up in future.

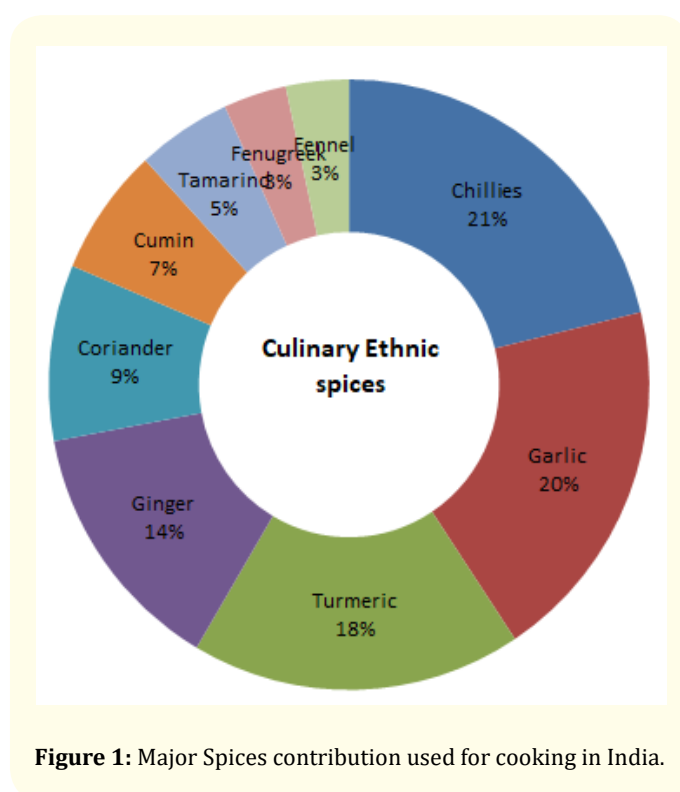


Figure 1: Major Spices contribution used for cooking in India.

**Geographical origin of spices growing in India**

Spices produced from tree crops are called "Tree spices". In India, Tamil Nadu, Kerala, Andhra Pradesh, Maharashtra and Karnataka are the major states cultivating tree spices in larger areas. There are 17 tree spices, commonly grown in India. Among them clove, nutmeg, cinnamon, tamarind, garcinia, kokam, curry leaf and all-

**Assets of Medicinal and Antimicrobial properties**

Indian culinary spices are not only improving taste, aroma, flavor and colour. Most importantly it act as a preservative for various foods, oils and beverage products. Our growth in spices export is remarkable though not spectacular considering the historical importance of India as a land of spices. The demand for organic products is steadily increasing in the western markets at 20 - 25% every year and that of organic spices is about only 2%. The medicinal value of spices is getting attention. Nano or microemulsion of value-added spices like co-delivery of encapsulated spices with edible oils and oleoresin are enhancing the uptake and absorption

of spice bioactives [6,10]. With the reported use of spice oils and oleoresins in soft drinks, food and medicines demand for Indian spice oils and oleoresins are bound to shoot up the bioavailability and helpful for curing the diseases [20,21]. Spices possess nutritional, antioxidant, prebiotic and antimicrobial properties. Moreover, it controls lipid oxidation and delay the onset of rancidity [10,22,23]. Spices of garlic, pepper and bird chili added into fermented meat products to enhance their tastes and flavours. Amid the south Asian spices, pepper shown highest antioxidant activity and garlic showed minimum bactericidal concentration against foodborne pathogens (8.8 - 141.4) and lactic acid bacteria (8.8 - 282.2) in fermented meat products [24]. Hence, spices are play an major role as antioxidant and natural preservatives in the fermented meat products. Recent Studies shown that except curcumin, all other main spices like pepper, cinnamon, ginger, rosemary were enhanced growth of *Bifidobacterium* spp and *Lactobacillus* spp and revealed inhibitory activity against *Ruminococcus* species, *Fusobacterium* spp and *Clostridium* spp [25]. Moreover, spice promoted the growth of beneficial bacteria and overwhelm the pathogenic bacteria. It helps for regulating the intestinal microbiota homeostasis and beneficial for gastrointestinal health. Future directions on the association between spices and gut microbiota, host metabolism and prevention of disease in animals and human's models need to be studied.

### Processing of Spices

Steam treatment can be applied to whole or ground spices. Treating the whole product is technically easy and can be done in the growing exporting country. In this case, the post-treatment handling needs to follow strict hygiene rules in order to limit the risks of recontamination during grinding, handling, storage and packing. Treatment of ground spices has the advantage of limiting the risk of recontamination, as the product can be packed right after it is treated. Continuous technologies that allow direct screening and packing are available [3-5]. Traditional Indian delicacies require processing of varieties of spices including one or more of unit operations such as roasting, frying, powdering, etc., in order to obtain an approximate flavour profile from spices. These flavour profiles are caused by thermal effects and interactive effects due to the processing of spices. There is a need for a pre-processed ready - to - use and shelf-stable spice mix formulation for the preparation of varieties of plant-based and muscle based food products in order to minimize the drudgeries of processing in kitchen and food preparation time to cater the needs of increasing population of working couples, single persons living etc [4,5].

### Indian Spices-Taste of Paradise

Tamil Nadu is in the southernmost part of the Indian Peninsula and is bordered by the union territory of Pondicherry, and the states of Kerala, Karnataka, and Andhra Pradesh [3-5,26]. Tamil Nadu is the eleventh largest state in India by area and the seventh most populous state. Tamil Nadu is also the most urbanized state in India. Tamil Nadu has a hot and humid climate. Rainfall is abundant and the supply of fresh fruits, vegetables and rice are also plentiful. Spices constitute an important group of agricultural commodities which are virtually indispensable in the culinary art. They also play a significant role in our diet in the form of spice blends for various regional specific ethnic food preparations [26-28]. The Tamil Nadu is famous for its various spices and also spicy foods. It's long past has witnessed the export of spices to many countries. A generous but at the same time a balanced use of spices is done in most of the vegetarian and non-vegetarian dishes of Tamil Nadu. Cuisines are a specific set of cooking traditions and practices, often associated with a specific culture.

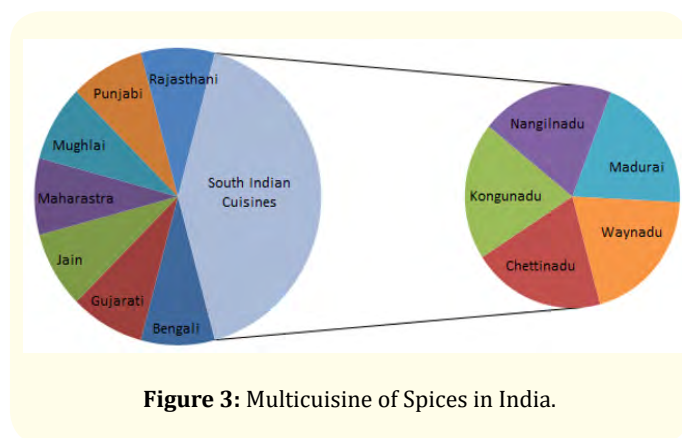


Figure 2: Common South Indian Spices.

### Multicuisine of Spices

Various types of cuisines available in India are Bengali, Gujarati, Jain, Mughlai, Punjabi, Rajasthani and South Indian cuisine [27-30]. Tamil cuisine is basically South Indian cuisine, where rice and rice-based dishes form a major portion of the diet. There are regional sub-varieties namely Chettinad, Kongunadu, Nanjilnadu and Madurai cuisines (Figure 3). The region has a rich cuisine involving both traditional vegetarians, as well as non-vegetarian dishes. It is characterized by the use of rice, legumes and lentils. Its distinct aroma and flavour are achieved by the blending of flavourings and spices. Chettinad cuisine is the cuisine of the Chettinad region of

Tamil Nadu state in South India [29-31]. Chettinad cuisine is one of the spiciest and the most aromatic in India. Chettinad cuisine is famous for its use of a variety of spices in preparing both vegetarian and non-vegetarian food [32-34]. The dishes are hot and pungent with fresh ground masalas that are usually considered an essential part of a meal. They also use a variety of sun dried meats and salted vegetables, reflecting the dry environment of the region. The meat is restricted to fish, prawn, lobster, crab, chicken and lamb [34,35]. Chettinad cuisine is characterized by liberal use of oil and spices. Most Chettinad dishes have generous amounts of pepper corn, cinnamon, bay leaves, cardamom, nutmeg, green and red chillies, etc.



**Figure 3:** Multicuisine of Spices in India.

### Spices- liking and preference

Recent trends focused on the incorporation of spice and herbs in several school lunch programmes for improving taste and liking for rural high school students. Intake of vegetable is very low among the school students, School based lunch programme can improve the quantitative eating consumption towards veggies of cauliflower, broccoli, lettuce and sweet potatoes [36-38]. Future studies need to be explored on acceptance and intake of spices with vegetables. Emerging studies shown that spices have oro-sensory properties and increase glucagon like peptide (GLP-1) secretion when increased the consumption of polyphenols rich spices curry [39,40]. The impact of adding spices to reducing sugar to foods and overall liking were studied with human subjects. The addition of spices to the apple crisp and desert food preserve the hedonic liking and an alternative for low calorie sweetener. Moreover, the efficacy of culinary spices on sugar intake reduces fat and salt and beneficial for healthy eating [41]. Combination of spices and taste intensities endorse inter-meal satiety through suppression of both hunger and desire to eat the meal. The observation of postprandial appetite of spice curries increase plasma ghrelin and GLP-1 concentration [40,42]. Epidemiological data studied on association of spices, inflammation and cancer incidence [43-49]. They observed that cancer incidence is much lower in India (94/100,000) where

spices are consumed as compared to United states where spices are not consumed (318/100,000). Spices prevent cancer prevention [43].

### Summary and Future Directions

India is known in the world over as “The Home of Spices”. Spices constitute an important group of agricultural commodities which are virtually indispensable in the culinary art. They also play a significant role in our diet in the form of spice blends for various regional specific ethnic food preparations. Chettinad cuisines have its own regional specific, traditional and unique taste which is based on the composition of the spice blends. But, there is no proper documentation of these customary spice blends. Due to failure in the documentation of these region-specific spice blends, the original taste of the ethnic cuisines is unable to be maintained in the speedy, modern and fast food world. Hence, it is necessary to collect all the recipes of ethnic cuisines and deserve it for the forthcoming generations.

### Conclusion

Spices are rich source for phytochemicals having precise health benefits. Spices are used individually or in combination as food adjuncts to impart flavor, colour and aroma. Traditional knowledge prevailing in countries like India has shown the medicinal properties of many spices for treating wounds, cough and cold, fever, hyperglycemic and hyperlipidemic conditions. Some of the important bioactive compounds of spices which are shown to possess medicinal value include curcumin from turmeric, capsaicin from red pepper, piperine from black pepper, eugenol from cloves, allyl sulfides from garlic and onion. These compounds are shown to possess antioxidant, anti-inflammatory, antimicrobial, hypolipidemic and anti-lithogenic activities and anti-cancer properties.

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