

## Pharmacological and Economical Miracles - Five Common Spices

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### ABSTRACT

The world is heading towards new and advanced farming procedures, yet the cultivation of spices under natural conditions commercially may prove much more fruitful. The spices were earlier confined to kitchen only, but their pharmacological and economical values have broken all boundaries. The miracle with spices in pharma world is now a proven fact. The medicinal, nutritional and economic prospects of five common spices are reviewed through this paper.

**Keywords:** Spices, Pharmacology, Economics, Nutritional Value, Market Trend

### INTRODUCTION

The word SPICE in Microelectronic Engineering means Simulation Program for Integrated Circuit Engineering. Similarly the spices used in daily food items are used to stimulate the internal body secretions which intern stimulate the overall functioning of the body. Humans started using spices back in 50,000 BC. The spice trade developed throughout the Middle East around 2000 BC with cinnamon and pepper and in East Asia with herbs and pepper. By 1000 BC, medical systems based upon herbs could be found in China, Korea and India. Early uses were connected with magic, medicine, religion, tradition, and preservation<sup>1</sup>. The spices can be classified based upon their botanical source (Table 1)

**Table 1: Botanical Classification Of Spices**

S. No.	Botanical Source	Plants
1	Dried Fruits	Fennel, Mustard, Black Pepper
2	Dried Flower Buds	Cloves
3	Roots And Rhizomes,	Turmeric, Ginger, Galingale.
4	Resins	Asafoetida
5	Arils	Mace
6	Barks	Cinnamon And Cassia
7	Stigmas	Saffron

These plants which are utilized as spices required to be mixed in different proportions to enhance its bioavailability as well as its aroma. In different parts of the world various spice mixtures are available with unique terminology. Table 2 enlisted the common spice mixtures along with the geographical locations and specified terminology.

**Table 2: List Of Common Spice Mixtures Across The World**

S. No.	Geographical Locations	Common Spice Mixtures
1	United States	Old Bay Seasoning, Pumpkin pie spice
2	Iran	Advieh
3	India and Pakistan	Chaat Masala, Chili powder, Curry powder
4	Ethiopia and Eritrea	Berbere
5	Georgia	Khmeli suneli
6	Japan	Shichimi togarashi
7	Africa	Ras el hanout, Harissa
8	France	Quatre épices
9	Jamaica	Jerk spice
10	Yemen	Hawaij
11	China	Five-spice powder






### **CULINARY USES OF SPICES<sup>2-3</sup>**

Entry of spices in the kitchen fills the aroma in every corner of the house. The organoleptic organs of the human beings also notify this aroma. This brings the extra flavor to the food and enhances the curiosity too. Spices not only just excites the taste buds but are composed of phyto-nutrients, essential oils, antioxidants, minerals and vitamins that are essential for our well being. Spices have been in use as our food since centuries and now become integral part of our life. Spices can be aromatic or pungent in flavors and peppery or slightly bitter in taste. In order to keep their fragrance and flavor intact, they are generally added at the last to prevent the evaporation of essential oils as the results of prolonged cooking. Turmeric powder is used as food colorant, natural food preservative and flavor. Cumin and Coriander seeds are widely used as a spice and principally employed in cookery as a condiment and flavoring base. Fennel seed is widely used as a savory spice.

### **NUTRITIONAL VALUE OF SOME COMMON RAW SPICES**

Spices contain impressive list of plant-derived chemical compounds that are known to have disease preventing and health promoting properties. They have been in use since ancient times for its anti-inflammatory, carminative, anti-flatulent properties. The active principles in the spices may increase the motility of the intestinal tract as well as increases the digestion power by increasing gastro-intestinal secretions. Spices essential oils are being used in aromatherapy also employed as de-odorants in the perfume industry. Table 3 enlisted the nutritional value of some common spices.

**Table 3: Nutritional Value Of Some Common Spices (Per 100g)<sup>4</sup>**

PRINCIPLE	NUTRIENT VALUE				
	Garlic	Turmeric	Ginger	Coriander	Chili Pepper
					
<b>Energy</b>	149 Kcal	354 Kcal	80 Kcal	298 Kcal	40 Kcal
<b>Carbohydrates</b>	33.06 g	64.9 g	17.77 g	54.99 g	8.81 g
<b>Protein</b>	6.36 g	7.83 g	1.82 g	12.37 g	1.87 g
<b>Fat</b>	0.5 g	9.88 g	0.75 g	17.77 g	0.44 g
<b>Cholesterol</b>	0 mg	0 mg	0 mg	0 mg	0 mg
<b>Dietary Fiber</b>	2.1 g	21 g	2.0 g	41.9 g	1.5 g

### MEDICINAL AND PHARMACOLOGICAL ASPECTS OF SPICES<sup>5-6</sup>

Spices contain good amount of minerals like potassium, manganese, iron and magnesium. Potassium is an important component of cell and body fluids that helps controlling heart rate and blood pressure. Manganese is used by the body as a co-factor for the antioxidant enzyme, superoxide dismutase. The essential volatile oils in spices functions as rubefacient which helps in soothing of the skin at the site of application and expands the local blood vessels. This increase in blood flow makes the skin feel warmer and used for the treatment of arthritis, sore muscles and even as a poultice. The components in the spices have been found to have anti-clotting action, prevent clogging of platelets in the blood vessels, thus helps easing blood flow, preventing stroke and coronary artery disease. The active principles in the spices may increase the motility of the intestinal tract as well as increase the digestion power by increasing gastro-intestinal secretions.

#### GARLIC (*Allium sativum*)

Allicin has antimicrobial effects *in vitro* against many viruses, bacteria, fungi and parasites, although powdered and oil preparations of garlic have not been shown significant antimicrobial activity<sup>7</sup>. Garlic and its sulfur constituents demonstrated antiviral activity against *Coxsackie virus spp*, *Herpes Simplex Virus types 1 & 2*, *Influenza B*, *Parainfluenza Virus type 3*, *Vaccinia Virus*, *Vesicular Stomatitis Virus*, *Human Immunodeficiency Virus type 1* and *Human Rhinovirus type 2*. Garlic extract exhibited a dose dependent inhibitory effect against human cytomegalovirus in tissue cultures<sup>8</sup>. Garlic administration prior to exposure to hepatotoxins (such as carbon tetrachloride, galactosamine and doxorubicin) provided protection against histologic and biochemical evidence of damage<sup>9-11</sup>. In toads and rats, pretreatment with garlic protected against aflatoxin- and chemically induced liver tumors<sup>12-13</sup>. Aged garlic and garlic's diallyl sulfur compounds protected against acute chemically induced hepatotoxicity in rats<sup>14-15</sup>. At least two anti-carcinogenic agents have been identified in garlic: diallyl sulfide and

glutathione-S-transferase<sup>16</sup>. Garlic constituents, particularly allicin, are cytotoxic against HeLa and Vero cell lines at concentrations used to achieve anti-viral effects<sup>17</sup>. Ajoene induces apoptosis in human promyeloleukemic cells<sup>18</sup>. Numerous epidemiologic studies suggest that diets rich in garlic are associated with reduced risks of several kinds of solid tumors<sup>19-24</sup>. Whole garlic and aged garlic extract exhibit direct antioxidant effects and enhance the serum levels of two antioxidant enzymes, catalase and glutathione peroxidase<sup>25-26</sup>.

### **TURMERIC (*CURCUMA LONGA*)**

The water extracts of *C. longa* along with volatile oil, petroleum ether and alcohol shows anti-inflammatory effects<sup>27</sup>. Curcumin offers anti-inflammatory effect through inhibition of NF $\kappa$ B activation<sup>28</sup>. Curcumin has also been shown to reduce the TNF- $\alpha$ -induced expression of the tissue factor gene in bovine aortic-endothelial cells by repressing activation of both AP-1 and NF $\kappa$ B. The anti-inflammatory role of curcumin is also mediated through down regulation of cyclooxygenase-2 and inducible nitric oxide synthetase through suppression of NF $\kappa$ B activation<sup>29</sup>. A number of animal studies have shown that curcumin has a dose-dependent chemopreventive effect in colon, duodenal, stomach, esophageal and oral carcinogenesis<sup>30</sup>. By inhibiting collagen and adrenaline-induced platelet aggregation curcumin shows anticoagulant activity both *in vitro* as well as *in vivo* in rat thoracic aorta<sup>31</sup>. Curcumin suppresses bleomycin-induced pulmonary fibrosis in rats<sup>32</sup>. It also suppresses bleomycin-induced alveolar macrophage-production of TNF- $\alpha$ , superoxide and nitric oxide. Thus curcumin acts as a potent anti-fibrotic agent. Curcumin has shown the reduction in the number of aberrant cells in cyclophosphamide-induced chromosomal aberration with the dose of 100 and 200 mg/kg body wt in Wistar rats<sup>33</sup>. Curcumin exerts both pro-mutagenic and anti-mutagenic effects. 100% anti-fertility effect has been observed with aqueous extracts of turmeric rhizomes in rats on oral administration<sup>34</sup>. Curcumin inhibits 5 $\alpha$ -reductase, which converts testosterone to 5 $\alpha$ -dihydrotestosterone, thereby inhibiting the growth of flank organs in hamster<sup>35</sup>. Ability of curcumin to inhibit human sperm motility has developed the potential for its application in the development of novel intra-vaginal contraceptive<sup>36</sup>. *In vitro* curcumin has anti-*Leishmania* activity<sup>37</sup>. Several synthetic derivatives of curcumin have anti- *Leishmania. amazonensis* effect<sup>38</sup>. Anti-*Plasmodium falciparum* and anti- *Leishmania major* effects of curcumin have also been reported<sup>39</sup>. Curcumin decreases advanced glycation end products induced complications in diabetes mellitus<sup>40</sup>. At very low doses, curcumin prevents galactose-induced cataract formation<sup>41</sup>. Curcumin decrease blood sugar level in alloxan-induced diabetes in rat<sup>42</sup>.

### **GINGER (*Zingiber officinale*)**

The compounds 6-gingerol and 6-shogaol have been shown to have a number of pharmacological activities, including antipyretic, analgesic, antitussive and hypotensive effects<sup>43</sup>. Ginger extracts exhibit inhibition of platelet aggregation and thromboxane synthesis *in vitro*<sup>44-45</sup>, which has led to concerns ginger extracts may prolong bleeding. *In vitro* studies suggest ginger may produce anti-inflammatory effects by inhibiting arachidonic acid metabolism in both the cyclooxygenase and lipoxygenase pathways<sup>46-48</sup>. Ginger extract has been studied as an alternative to NSAID therapy for arthritic conditions. Randomized, placebo-controlled, crossover study comparing ginger extracts and ibuprofen was performed on 75 individuals with osteoarthritis of the hip or knee<sup>49</sup>. This study revealed significant improvement in symptoms for both the ginger and ibuprofen groups. Efficacy of these ginger

preparations was also observed in antiemetic studies against cisplatin-induced emesis in dogs<sup>50</sup>. Ginger also acts as anti-carcinogenic in initiation, post-initiation stages of 1, 2 dimethylhydrazine-induced colon cancer<sup>51</sup>.

### **CORIANDER (*Coriandrum sativum*)**

In addition to the traditional food coriander have been widely used in the folk medicine system as carminative, spasmolytic, digestive and galactagogue<sup>52-53</sup>. Essential oil obtained from coriander seed as well as seed extracts possesses antibacterial, antioxidant, anticancer and antimutagenic activities<sup>53-57</sup>. Cosmeceutical uses of coriander have also been suggested by many researchers, as an ingredient in cosmetics, creams, lotions, emulsifiers, soaps, shampoos and detergents imparting a distinctive essence to the products<sup>58-61</sup>. The seeds were included in a host of prescriptions for fever, diarrhoea, vomiting and indigestion<sup>62-64</sup>. Fresh juice of leaves is used as a gargle in sore throat and stomatitis. Paste is prepared by pounding green leaves with barley flour. This paste is applied over swellings, boils and cervical adenitis. The paste prepared from dry fruits is applied over forehead and temples during headache. Fresh juice of the leaves, mixed with sugar provides cooling effect on the mind and induces sleep. It is also given in biliousness, intestinal irritations, heartburn, thirst and nausea<sup>65-67</sup>.

### **CHILI PEPPERS (*Capsicum annum*)**

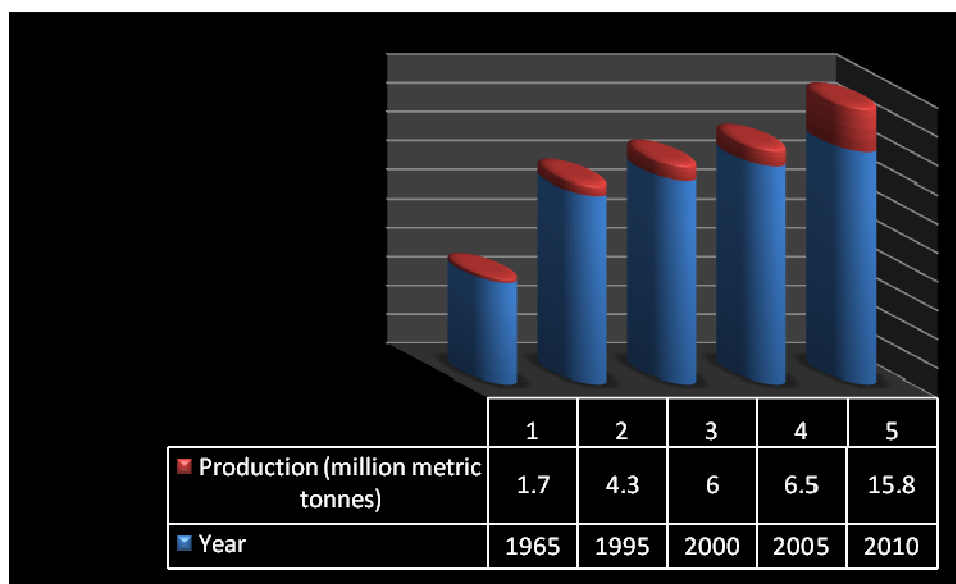
Capsaicin is considered as safe and effective topical analgesic agent in the management of pain associated with arthritis, herpes zoster, diabetic neuropathy, post-mastectomy and headaches<sup>68</sup>. Chili peppers contain chemical compound capsaicin. Capsaicin along with other phyto-constituents is used in the preparation of ointments, tinctures and rubs for their astringent, counter-irritant and analgesic properties. These formulations have been in use in the treatment of arthritic pain, post herpetic neuropathic pain and sore muscles. Scientific studies on experimental mammals suggest that capsaicin has anti-bacterial, anti-carcinogenic, analgesic and anti-diabetic properties. It also found to reduce LDL cholesterol levels in obese persons. Capsaicin is used as an insecticide in addition to its use as a repellent<sup>69</sup>. Capsaicin is toxic to some bacteria and has been evaluated for use as a marine antifoulant<sup>70</sup>.

### **ECONOMICAL PROSPECT OF SPICES<sup>71</sup>**

Humans are using spices from ancient time as medicines and culinary purposes. Various spices are used for other purposes, such as cosmetics, preservative, perfumery, in religious rituals and for eating as vegetables etc. For instance, turmeric is used as a cosmetic and preservative; clove and cardamom in religious rituals; onion and garlic as a vegetables. Due to materialistic approach of human beings they want different taste in their food items. Spices can add flavor to food and also have medicinal properties. So the rational use of spices may protect the mankind from various ailments.

From their research over spices Douglas 2005 concluded that there are about 50 spices which are globally and economically accepted. Total global production of spices has rapidly increased since the 1960s. In 1965, the total world production of spices was around 1.7 million metric tonnes, after that there is continuous rise in world production of spices 4.3, 6.0, 6.5 and 15.8 million metric tonnes in 1995, 2000, 2005 and 2010 respectively (Figure 1). There is a significant increase in the production of spices over the period 2005-10, due to increase in demand for industrial and culinary purposes.

Spices and herbs are perfect articles for international trade. As they are easy to store in raw and dried form, accompanied by their easy transportation, facilitate their export. Advance storage facilities are not the condition for spices and they also need no advanced evaluation techniques as well. Their shelf life is long in dried state and need no expensive warehousing facilities. They are globally recognized as high value products which can be produced easily on small scale.



**Figure 1: Total global production of spices<sup>72</sup>**

In 2005, India exported over \$90 million worth of Chili pepper which increases nearly by 20% per annum from 2000 onwards. Export value of turmeric was \$36 million, coriander seeds \$17 million, ginger \$14 million and other spices were \$52 million. India leads the world market in spice production, but domestic consumption limits its exports. Organic farming techniques still holds good in spice production compare to advanced modern farming techniques.

## CONCLUSION

In the present age of globalization opportunities of international trade has increased many folds, so there are ample scope to raise the production and export especially in Indian context. Though India has attained top rank in the production of spices still it lacks in exports, which needs improvisation. The results of economic aspects of spices suggest that the production has increased many folds in last decade. This indicates that demand for spices has increased worldwide domestically and commercially. It might attract the attention of farmers to adopt mixed cropping pattern in place of traditional cropping pattern and raise their standard of living.

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