

SPICES – THE SPICE OF LIFE

Dr. Balasirekha R

Department of Food Science and Nutrition, Avinashilingam University, Coimbatore – 641 043,
Tamil Nadu, India

ABSTRACT: *Research is turning up the heat on zesty herbs and spices, pointing out that a spicier life may be a healthier one. Spices are important ingredients in our daily diet although they are used in small quantities.¹ Spices and herbs have occupied an important place in the culinary preparations of several ancient and modern kitchens from time immemorial.*

KEYWORDS: Spices, Life, Human Nutrition

INTRODUCTION

Research is turning up the heat on zesty herbs and spices, pointing out that a spicier life may be a healthier one. Spices are important ingredients in our daily diet although they are used in small quantities.¹ Spices and herbs have occupied an important place in the culinary preparations of several ancient and modern kitchens from time immemorial.

According to the International Organisation for Standardisation of Spices “Spices and Condiments” are defined as “such natural plant or vegetable products or mixtures thereof in whole or ground form which are used for imparting flavour, aroma and piquancy to and for seasoning foods”.² A spice is a dried seed, fruit, root, bark or vegetative substance used in nutritionally insignificant quantities as a food additive for the purpose of flavouring and sometimes as a preservative by killing or preventing the growth of harmful bacteria.³

Spices are usually dried roots, barks or seeds used whole, crushed or powdered. Herbs are usually the fresh leaves, stems or flowers of herbaceous plants. Spices are stronger than herbs but they can be used in combination without loss of flavour.⁴ No country in the world produces as many kinds of spices as India with quality spices coming from Kerala, an Indian state. At present, India produces around 2.5 million tones of different spices valued at approximately 3 billion US \$ and holds the premier position in the world. Because of the varying climates - from tropical to sub-tropical to temperate-almost all spices are grown in this country. In almost all of the 25 states and seven union territories of India, at least one spice is grown in abundance.⁵

Significance of Spices in Human Nutrition

Spices depending on the origin and active principle present are classified as pungent spices – pepper, ginger, chillies and mustard; aromatic fruits – cardamom, nutmeg, mace, fenugreek, aniseed, caraway, dill, celery, cumin, coriander, etc.; aromatic barks – cinnamon and cassia; phenolic spices containing eugenol – clove and pimento; and coloured spices – paprika, saffron and turmeric.⁶

The basic classification of spices based on the parts used is as follows:

- Leaves and/or branches of aromatic plants; all or part of the plant can be used. Examples include basil, bay leaf, parsley, rosemary, tarragon and thyme, oregano and chervil.
- Ripened fruits or seeds of plants. Examples include dill, fennel, coriander, fenugreek, berberis, mustard and black pepper.
- Roots or bulbs of certain plants. Examples include garlic, onion, celery and ginger.

Spices can be classified based on the part of the plant from which the commercial products are produced, their properties and the botanical families to which they belong.² There are nearly 100 major species grown in different parts of the world. If one considers strictly the botanical point of view of the various parts of the plant being used, the classification includes dried flower buds – cloves; fruits – allspice, black pepper, nutmeg and vanilla; bark – cassia and cinnamon; seeds – anise, caraway, fenugreek, coriander, cardamom, dill, poppy and cumin; and leaves – basil, bay, curry leaves, mint, rosemary, ajowan etc.

Culinary Benefits of Spices

India is considered to be the “Home of Spices”.⁶ The fact that spices contain no calorie is of potential interest to many who are calorie conscious. Some of the spices are rich in vitamins and minerals including trace elements.⁷

Spices are used traditionally for aroma and as preservatives. Spices are used to mask spoiled meat flavour, improve colour and flavour and of late to improve shelf life of foods.¹ Hot and spicy foods create a niche for healthy foods. Spices, herbs and chillies will be increasingly used to enhance foods that have reduced or no salt or fat, such as snacks, sauces, salad dressings and marinades. Although spices are used primarily to enhance the taste of otherwise bland foods, their beneficial effects stretch far beyond our tongues.⁸

The advantages of spice and their products like powders of spices, spice extracts, tea etc. are they are sterile, free from extraneous materials, soluble in a variety of systems, stable under good storage conditions and represent up to 98 per cent savings in weight and storage space.⁹

The independent use of nutritional supplements has increased dramatically over the past several years. Cinnamon for improvement of abnormal glucose and insulin regulation and garlic for hypercholesterolemia are among the more popular nutritional supplements being used by the population at large.¹⁰

Therapeutic Value of Spices

Herbal medicines are unique and play a vital role in the indigenous system of medicine all over the world and India is no exception wherein a number of medicinal plants are used as the source of raw drugs in the Indian system of medicine.¹¹ People today are more concerned about the side effects and the cost effectiveness of drugs and have begun to rely more firmly upon herbs which are comparatively less exploited for their nutritive and medicinal qualities.

In traditional medicine, namely, Ayurveda, several spices and herbs are believed to possess medicinal properties. Consuming a diet rich in plant foods will provide a milieu of

phytochemicals, non nutritive substances in plants that possess health protective benefits. The foods and herbs with the highest anticancer activity include garlic, soybeans, cabbage, ginger, licorice and the umbelliferous vegetables.¹²

Herbal medicines have been practised worldwide since time immemorial and are now recognized by WHO as an essential building block for primary health care.¹³ Herbal medicines serve in the healthcare for about 80 per cent of the world population.¹⁴ It also shows that the goal of health for all cannot be achieved without herbal medicines.¹⁵

Even little spice in our diet could boost our immune system, decrease the risk of cardiovascular diseases and high blood pressure and fight against cancer. Spices which are simply plant based ingredients used to flavour foods, contain a variety of powerful phytonutrients and phytochemicals.¹⁶

Diabetic patients in increasing numbers are taking dietary supplements and herbs from which they expect additional health benefits.¹⁷ Curcumin, capsaicin, ginger, black pepper, cumin, mustard, fenugreek and onion significantly lowered adrenal cholesterol levels in rats which were accompanied by reduced ascorbic acid content in the adrenals of curcumin, capsaicin, fenugreek and onion fed rats. These are indicative of the stimulatory influence of dietary spices on adrenal steroidogenesis.¹⁸

The active principles in spices, namely, capsaicin, eugenol, curcumin and ferulic acid, a common plant constituent were found to counter many of the metabolic changes caused by the high sucrose diets which were also found to lower liver triglycerides, free fatty acids, phospholipids, serum total cholesterol, LDL cholesterol, triglycerides and also elevate HDL cholesterol levels.¹⁹ Administration of 50 mg of gugulipid, the compound present in *Commiphora mukul* for 24 weeks decreased the total cholesterol level by 11.7 per cent, the LDL cholesterol by 12.5 per cent and triglycerides by 12 per cent in patients with hypercholesterolemia.²⁰

Cayenne Pepper (*Capsicum annuum*)

Cayenne is the red hot mama of healing spices. Alternative Medicine practitioners are realizing that healing herbs should be part of their arsenal against disease. The newest touted natural herb is Capsicum, found in cayenne pepper. It has many benefits whether taken internally or externally.²¹ When taken internally, capsicum is an antibacterial agent which will encourage healing and deflect infections while slowing the absorption of fat in the intestines to help fight obesity. Because capsicum, this natural herbal remedy is a stimulant, it improves circulation. Capsicum will also stabilize blood pressure and lower cholesterol.²² Herbalists are finding capsicum to be useful in fighting a variety of ailments. The active ingredients in the herbal remedy, Capsicum, stimulate the brain and salivary glands releasing endorphins into our body. Endorphins are nature's natural painkiller giving us the feeling of pleasure. Capsicum is also the main ingredient in pain killing rubs for Arthritis²³ and Diabetes nerve damage.²² Capsicum will affect the breakdown of carbohydrates which will control the fluctuation of sugar levels after eating meals.²⁴

Black Pepper (*Piper nigrum*)

Black pepper induces sweating, which consequently cools down the body and relieves feverish symptoms. Black pepper is useful for those with poor circulation. It is said to promote mental clarity, which is useful when studying. It can help clear up colds, viral infections and flu when prepared in a tea. Black pepper helps to prevent gas and flatulence. It induces urination, which is good when the kidneys are not functioning properly. Black pepper is a powerful anti-oxidant.²⁵ It is antibacterial and hence useful for meat preservation before the introduction of refrigerators. Black pepper helps to break down and digest fats and meat proteins much more easily, as it induces the production of saliva and gastric juices needed for digestion in the stomach.²⁶

Black pepper is a good source of manganese and iron, which are important for the body to function correctly. Components of black pepper are often added to mouthwashes and gargles used to treat sore throats. Black pepper is a stimulant that can stimulate various parts of the body such as the heart, kidneys, circulation and the stomach.²⁷ When foods are eaten with black pepper, the body is able to absorb valuable vitamins and nutrients from the food much easier. Black pepper has been used to treat fatigue and tiredness. It stimulates the appetite and has been used to treat anorexia and people with eating disorders. A strong black pepper and mint tea will help clear chest and lung infections and bring out unwanted mucous and phlegm.²⁸

Bay Leaf (*Laurus nobilis*)

Bay leaf is one of the most popular culinary spices in Western countries and its herbal medicine has pharmacological activity which includes anti bacterial, anti fungal, anti diabetes and anti inflammatory effects.²⁹

Cool Cumin (*Cuminum cyminum*)

Cumin is widely used in Ayurvedic medicine for the treatment of dyspepsia, diarrhoea and jaundice. Oral administration of 0.25 g/kg body weight of cumin for 6 weeks to diabetic rats resulted in significant reduction in blood glucose and glycosylated haemoglobin and an increase in total haemoglobin.³⁰ It also prevented a decrease in body weight. A significant reduction was also seen in tissue cholesterol, phospholipids, free fatty acids and triglycerides.³¹

Flavoury Cardamom (*Elattaria cardamomum*)

Cardamom, sometimes called the “The grains of paradise” is a pungent aromatic herb. The ancient Egyptians chewed cardamom seeds as a tooth cleaner; the Greeks and Romans used it as a perfume.³² Cardamom is broadly used to treat infections in teeth and gums, to prevent and treat throat troubles, congestion of the lungs and pulmonary tuberculosis, inflammation of eyelids and also digestive disorders.³³ It is also reportedly used as an antidote for both snake and scorpion venom. In Chinese medicine it is used to treat stomach-aches, constipation, dysentery and other digestive problems.³⁴

Small Coriander (*Coriandrum sativum*)

Coriander has been used as a folk medicine for the relief of anxiety and insomnia in Iranian folk medicine. Experiments in mice support its use as an anxiolytic (relieving tension or anxiety). Coriander seeds are also used in traditional Indian medicine as a diuretic by boiling equal

amounts of coriander seeds and cumin seeds, then cooling and consuming the resulting liquid. In holistic and some traditional medicine, it is used as a carminative and for general digestive aid.³⁵

Cute Asafoetida (*Ferula assafoetida*)

Asafoetida has certain medicinal uses and is most commonly used as a digestive aid. It is reputed for lessening flatulence and is often added to lentil or eggplant dishes in small quantities. It is also helpful in cases of asthma and bronchitis. As a folk traditional remedy for children's colds it is mixed into a foul-smelling paste and hung in a bag around the afflicted child's neck. In Thailand it is used to aid baby's digestion and is smeared on the child's stomach in an alcohol tincture known as "mahahing".¹² Asafoetida has also been reported to have contraceptive / abortifacient activity. Asafoetida oleo-gum-resin has been reported to be antiepileptic in classical Unani as well as ethnobotanical literature.³⁶

Exotic Fenugreek (*Trigonella foenum graecum*)

Fenugreek is mainly used as a digestive aid.³⁷ Fenugreek seed is widely used as a galactagogue (milk producing agent) by nursing mothers to increase inadequate breast milk supply. Studies have shown that fenugreek is a potent stimulator of breast milk production and its use was associated with increases in milk production of as much as 90 per cent.³⁸ Supplements of fenugreek seeds were shown to lower serum cholesterol, triglyceride and low-density lipoprotein in human patients and experimental models of hypercholesterolemia and hypertriglyceridemia.³⁹

Fenugreek is currently available commercially in encapsulated forms and is being prescribed as dietary supplements for the control of hypercholesterolemia⁴⁰ and diabetes⁴¹ by practitioners of complementary and alternative medicine. In recent research, fenugreek seeds were experimentally shown to protect against cancers of the breast⁴² and colon.⁴³ The hepatoprotective properties of fenugreek seeds have also been reported in experimental models.⁴⁴⁻⁴⁶

Flowering into Saffron (*Crocus sativus*)

Saffron contributes a luminous yellow-orange colouring to foods. Medicinally, saffron has a long history as part of traditional healing; modern medicine has also discovered saffron as having anticarcinogenic (cancer-suppressing)⁴⁷, anti-mutagenic (mutation-preventing), immunomodulating and antioxidant like properties⁴⁸. Saffron has been used as a fabric dye, particularly in China and India and in perfumery.⁴⁹

Glimpsy Aniseed (*Pimpinella anisum*)

Aniseed or Anise, like fennel, contains anethole and is known to be a phytoestrogen. Anise is a mild antiparasitic and its leaves can be used to treat digestive problems, relieve toothache and its essential oil to treat lice and scabies. In aromatherapy, aniseed essential oil is used to treat cold and flu.⁵⁰

Poppy Poppy Sesame (*Sesamum indicum*)

The seeds are rich in manganese, copper and calcium (90 mg per tablespoon for unhulled seeds, 10 mg for hulled) and contain vitamin B1 (thiamine) and vitamin E (tocopherol). They contain lignans, including unique content of sesamin, which are phytoestrogens with antioxidant and anti-cancer properties. Among edible oils from six plants, sesame oil had the highest antioxidant

content. Sesame seeds also contain phytosterols associated with reduced levels of blood cholesterol. The nutrients of sesame seeds are better absorbed if they are ground or pulverized before consumption.⁵¹

Oh, Oregano (*Origanum vulgare*)

Dining on fresh green herbs like oregano can offer the same benefits as eating fruits and vegetables, thanks to generous levels of phytochemicals and antioxidants. In one study, oregano had the highest antioxidant activity among 27 culinary herbs and 12 medicinal herbs tested, ranking even higher than fruits and vegetables. Oregano also presents antimicrobial activity against pathogens like *Salmonella typhimurium*, *E. coli*, *Staphylococcus aureus* and *Staphylococcus epidermidis*.⁵²

Cinnamon (*Cinnamomum zeylanicum*)

Cinnamon has been known from remote antiquity and it was so highly prized among ancient nations that it was regarded as a gift, fit for monarchs and other great potentates. Cinnamon is native to India.⁵³ Cinnamon bark is widely used as a spice. It is principally employed in cookery as a condiment and flavouring material. It is used in the preparation of chocolate, especially in Mexico, which is the main importer of true cinnamon.⁵⁴

In medicine it acts like other volatile oils and once had a reputation as a cure for colds. It has also been used to treat diarrhoea and other problems of the digestive system. Cinnamon is high in antioxidant activity.⁵⁵ The essential oil of cinnamon also has antimicrobial properties⁵⁶ which can aid in the preservation of certain foods. Cinnamon has traditionally been used to treat toothache and fight bad breath and its regular use is believed to stave off common cold and aid digestion.

Two studies have shown that including cinnamon and cinnamon extract in the diet may help type 2 diabetics to control blood glucose levels. One study used *C. cassia*⁵⁷ while the other study used an extract (made from "Chinese *Cinnamomum aromaticum*", an older name for *C. cassia*).⁵⁸

Cloves (*Syzygium aromaticum*)

In Tibetan medicine, cloves are used internally as a tea and topically as oil for hypotonic muscles, including multiple sclerosis.⁵⁹ In West Africa, the Yosubas use clove infused in water as a treatment for stomach upsets, vomiting and diarrhoea. The infusion is called ogun jedi-jedi.⁶⁰ Clove is used in the form of a paste or mixture as dental cement, filler or restorative material.⁶¹ Clove is sometimes added to tobacco in cigarettes and clove cigarettes (kreteks) typically contain 60 per cent tobacco and 40 per cent ground cloves.⁶²

Cloves are used as a carminative, to increase hydrochloric acid in the stomach and to improve peristalsis. Cloves are also said to be a natural antihelmintic.⁶³ The essential oil is used in aromatherapy when stimulation and warming is needed, especially for digestive problems. Topical application over the stomach or abdomen will warm the digestive tract.⁶⁴

Cloves, a commonly used spice could prevent lung cancer, claims a research team at Chittaranjan and at National Cancer Institute, Kolkata. Cloves may inhibit abnormal cell growth in lungs, reduce the abnormal crowding of cells in particular regions of lung tissue and check the

growth of pre malignant cells by more than 85 per cent. According to this study cloves could be a potential herbal remedy for lung cancer.⁶⁵

Garlic (*Allium sativum* L.)

To maximize health benefits from consuming cooked garlic, it has been suggested to allow the crushed or chopped garlic to rest for 15 minutes before use to allow the enzymatic reactions to occur. However allicin is deactivated during cooking due to its instability and may be more beneficial if consumed raw.⁶⁶

Garlic is claimed to help prevent heart disease including atherosclerosis, high cholesterol, high blood pressure and cancer.⁶⁶ Supplementation with garlic extract inhibited vascular calcification in human patients with high blood cholesterol.⁶⁸ The known vasodilative effect of garlic is possibly caused by catabolism of garlic-derived polysulfides to hydrogen sulfide in red blood cells, a reaction that is dependent on reduced thiols in or on the RBC membrane. Hydrogen sulfide is an endogenous cardio-protective vascular cell signaling molecule.⁶⁹

Allium species such as onions and garlic are used as foodstuff, condiment, flavouring and folk medicine. In fact, these common food plants are a rich source of several phytonutrients but are also used in the treatment and prevention of a number of diseases including cancer, coronary heart disease, obesity, hypercholesterolemia, type 2 diabetes, hypertension, cataract and disturbances of gastro intestinal tract. These activities are related to the thiosulfates, volatile sulfur compounds which are also responsible for the pungency of these vegetables.⁷⁰

Turmeric (*Curcuma longa*)

Turmeric “the golden spice of life” is one of the most essential spice used as an important ingredient in culinary all over the world. Curcumin, a potent polyphenolic antioxidant and a Non Steroidal Anti-Inflammatory Drug (NSAID), when low doses are administered (160 ppm), the astrocytic marker Glial Fibrillary Acidic Protein (GFAP) was reduced and insoluble beta amyloid, and soluble abeta and plaque burden were significantly decreased by 43 to 50 per cent thus showing promising results for the prevention of Alzheimer’s disease in mouse.⁷¹

Curcumin, the yellow colouring agent in the spice turmeric exhibited anti-mutagenic activity and has an anti-carcinogenic activity inhibiting chemically induced preneoplastic lesions in breast and colon and neoplastic lesions in the skin, forestomach, duodenum and colon of rodents.⁷² Also curcumin inhibits TPA induced skin tumour promotion in mice. Curcumin enhanced glutathione content and glutathione – S – transferase activity in liver and it inhibits lipid peroxidation and arachidonic acid metabolism in mouse skin, protein kinase C activity in TPA treated NIH3T3 cells, chemically induced ornithine decarboxylase and tyrosine protein kinase activities in rat colon.⁷³

Curcumin prevented oxidative damage mediated through selenium and protected the dehydrogenases possibly through its anti-oxidative property.⁷⁴ *Neisseria gonorrhoeae* (Ngo) is a gram negative pathogenic bacterium responsible for an array of diseases ranging from urethritis to disseminated gonococcal infections.⁷⁵

CONCLUSION

Spices, a dietary source, are needless to further emphasize the miraculous effect in daily dietaries. If spices in the form of dietary supplement can become the daily adjunct the benefit it can give to humans suffering from degenerative disease with or without the ageing process is commendable. Let us popularize the use of spices as a source of food nutrients in our dietaries in order to swiftly reach the dinner tables.

REFERENCES

1. Khanum, F., Krishna, S.K.R., Semwal, A.D. and Vishwanathan, K.R., (2001), Proximate composition and mineral contents of spices, *The Ind. J. Nutr. Diet.*, Vol. 38 (3), pp. 93 - 96
2. Prakash, V., (1990), Leafy spices, CRC Press, Florida, pp. 1 – 2
3. Turner, J., (2004), Spice: The History of a Temptation. Knopf, Vintage Books, p. xv
4. Srilakshmi, B., (1999), Food Science, New Age International Pvt Ltd., New Delhi, pp. 317 – 322, 326 - 328
5. www.spiceskerala.com.
6. Manay, S.N. and Shadaskarswamy, M., (1999), Foods, facts and principles, New age international Pvt Ltd., New Delhi, pp. 321 - 334
7. Pruthi, J.S., (1999), Quality assurance in spices and spice products, Modern methods of analysis, Allied Publishers Ltd., Mumbai, pp. 67 – 70, 77,78, 216 - 219
8. Falcon, M., (2002), Spices and condiments, John Wiley Publications, New York, pp. 3 - 13
9. Hassel, V.N. and Lawrence, B.M., (2001), New trends in essential oils, perfumer and flavourist, The chemists club reading, USA, Vol. 5, pp. 6 - 12
10. Duncan, M.G., (1999), The effects of nutritional supplements on the treatment of depression, diabetes and hypercholesterolemia in the renal patient, *J. of Renal Nutrition*, Vol. 9 (2), pp. 58 – 62
11. Sastry, M.S., (2000), Indian herbal pharmacopota, *Anruth*, pp. 21, 25, 26
12. Craig, W.J., (1999), Health-promoting properties of common herbs, *Am J Clin Nutr*, Vol. 70 (3S), pp. 491S-499S
13. Retnam, K.R. and De Britto, A.J., (2005), Pharmacognostic characterization and standardization of medicinal plant *Enicostema axillare*, *JMAPS*, Vol. 27 (3), pp. 609
14. WHO, (1998), The World Health Report, Life in the 21st century: a vision for all, World Health Forum, WHO, Geneva
15. Kannaiyan, S., Chandrasekaran, M. and Chinnadurai, M., (2001), Conservation and utilization of medicinal plants, Tamilnadu Agricultural University, Coimbatore, pp. 234
16. Moore, E., (2006), Healing with herbal medicine and phytochemicals, Anti-inflammatory Herbs, *Auto immune disease*, October 21
17. Rustenbeck, (2007), *Monatsschr pharm*, Vol. 30 (4), pp. 131 – 137
18. Bapu, P.S. and Srinivasan, K., (1993), Influence of dietary spices on adrenal steroidogenesis in rats, *Nutr. Res.*, Vol. 13 (4), pp. 435 – 444
19. Srinivasan, M.R. and Satyanarayana, M.N., (1988), Influence of capsaicin, eugenol, curcumin and ferulic acid on sucrose induced hypertriglyceridemia in rats, *Nutr. Rep. Int.*, Vol. 38 (3), pp. 571 – 581

20. Singh, R.B., Niaz, M.A. and Ghosh, S., (1994), Hypolipidemic and antioxidant effects of *Commiphora mukul* as an adjunct to dietary therapy in patients with hypercholesterolemia, *Cardiovascular Drugs Therapy*, Vol. 8 (4), pp. 650 – 664
21. Watson, C.P., Evans, R.J., Watt, V.R. *et al.*, (1989), The post-mastectomy pain syndrome and the effect of topical capsaicin, *Pain*, Vol. 38, pp. 177-186
22. Jensen, P.G. and Larson, J.R., (2001), Management of painful diabetic neuropathy, *Drugs Aging*, Vol. 18, pp. 737 - 749
23. Todd, C., (2002), Meeting the therapeutic challenge of the patient with osteoarthritis, *J Am Pharm Assoc* (Wash), Vol. 42, pp. 74-82
24. Hanna, M., (2006), Alternative medicine uses of capsicum or cayenne pepper as an herbal remedy, www.buzzle.com.
25. Srinivasan, K., (2005), Plant foods in the management of diabetes mellitus: Spices as beneficial antidiabetic food adjuncts, *International Journal of Food Science and Nutrition*, Vol. 56 (6), pp. 399 – 414
26. Karpiska, M., Borowski, J. and Oziewicz, D.M., (2001), The use of natural antioxidants in ready-to-serve food, *Food Chemistry*, Vol. 72 (1), pp. 5 - 9
27. Sheila, G., (2007), Herbs and Spices for Good Health, retrieved on Dec 18, 2007, www.herbsspices.com
28. Fragiska, M., (2005), Wild and Cultivated Vegetables, Herbs and Spices in Greek Antiquity, *Environmental Archaeology*, Vol. 10 (1), pp. 73-82
29. Fang, F., Sang, S., Chen, K.Y., Gossiau, A., Chi-Tang Ho and Rosen, R.T., (2005), Isolation and identification of cytotoxic compounds from bay leaf (*Laurus nobilis*), *Food Chemistry*, Vol. 93 (3), pp. 497 – 501
30. Talpur, N., Echard, B., Ingram, C., Bagch, D. and Preuss, H., (2005), Effects of a novel formulation of essential oils on glucose– insulin metabolism in diabetic and hypertensive rats: a pilot study, *Diabetes, Obesity and Metabolism*, Vol. 7(2), p. 193
31. Sahelian, R. and Dhandapani, K., (2002), Hypolipidemic effect of *Cuminum cyminum* L. on alloxan-induced diabetic rats, *Pharmacol Res*, Vol. 46(3), pp.251-255.
32. Ninfali, P., Mea, G., Giorgini, S., *et al.*, (2005), Antioxidant capacity of vegetables, spices and dressings relevant to nutrition, *Br J Nutr*, Vol. 93, pp. 257-266
33. Billing, J. and Sherman, P.W., (1998), Antimicrobial functions of spices: why some like it hot, *Q Rev Biol*, Vol. 73, pp. 43-49
34. Love, C., (2004), *A Dictionary of Culinary Curiosities*, Mark Morton, Insomniac Press, Toronto, Canada
35. Emamghoreishi, M., Khasaki, M. and Aazam, M.F., (2005), *Coriandrum sativum*: evaluation of its anxiolytic effect in the elevated plus-maze, *Journal of Ethnopharmacology*, Vol. 96 (3), pp. 365 - 370
36. Abdin, M., Abdin, Z. and Abrol, Y.P. (2006), *Traditional Systems of Medicine*, Published Alpha Science Int'l Ltd.
37. Sharma, R.D. *et al.* (1996) Hypolipidemic effect of fenugreek seeds. *Phytotherapy Res.* 10:332-334.
38. Swafford, S. and Berens, B., (2000), Effect of fenugreek on breast milk production, *ABM News and Views*, Vol. 6(3): Annual meeting abstracts Sept 11-13
39. Basch, E., *et al.*, (2003), Therapeutic applications of fenugreek, *Altern Med Rev.*, Vol. 8 (1), pp. 20–27.

40. Thompson, C.J.S. and Ernst, E., (2003), Herbs for serum cholesterol reduction: a systematic view, *J Fam Pract*, Vol. 52(6), pp. 468-478
41. Gupta, A., Gupta, R. and Lal, B., (2001), Effect of *Trigonella foenum-graecum* (Fenugreek) Seeds on Glycaemic Control and Insulin Resistance in Type 2 Diabetes Mellitus: A Double Blind Placebo Controlled Study, *JAPI*, Vol. 49, pp. 1057-1061
42. Raju, J., *et al.*, (2004), Diosgenin, a steroid saponin of *Trigonella foenum graecum* (Fenugreek), inhibits azoxymethane-induced aberrant crypt foci formation in F344 rats and induces apoptosis in HT-29 human colon cancer cells, *Cancer Epidemiol Biomarkers Prev*, Vol. 13 (8), pp.1392–1398.
43. Raju, S. and Bird, R.P., (2006), Alleviation of hepatic steatosis accompanied by modulation of plasma and liver TNF-alpha levels by *Trigonella foenum graecum* (fenugreek) seeds in Zucker obese (fa/fa) rats, *International Journal of Obesity*, Vol. 30 (8), pp. 1298 – 1307
44. Kaviarasan, S., *et al.*, (2006), Fenugreek (*Trigonella foenum graecum*) seed extract prevents ethanol-induced toxicity and apoptosis in Chang liver cells, *Alcohol*, Vol. 41 (3), pp. 267 – 273
45. Thirunavukkarasu, V., *et al.*, (2003), Protective effect of fenugreek (*Trigonella foenum graecum*) seeds in experimental ethanol toxicity, *Phytother Res.*, Vol. 17 (7), pp. 737 – 743
46. Aung, H.H., Wang, C.Z., Ni, M., Fishbein, A., Mehendale, S.R., Xie, J.T., Shoyama, C.Y. and Yuan, C.S., (2007), Crocin from *Crocus sativus* possesses significant anti-proliferation effects on human colorectal cancer cells, *Exp Oncol*, Vol. 29(3), pp. 175-180
47. Schmidt, M., Betti, G. and Hensel, A., (2007), Saffron in phytotherapy: pharmacology and clinical uses, *Wien Med Wochenschr*, Vol. 157(13-14), pp. 315-9
48. Ferrence, S.C., (2004), Therapy with saffron and the Goddess at Thera, *Perspectives in Biology and Medicine*, Vol. 47 (2), pp. 543 - 546
49. Chaudhry, N.M. and Tariq, P., (2006), Bactericidal activity of black pepper, bay leaf, aniseed and coriander against oral isolates, *Pak J Pharm Sci.*, Vol. 19(3), pp. 214-218
50. Cheung, S.C., Szeto, Y.T. and Benzie, I.F., (2007), Antioxidant protection of edible oils, *Plant Foods Hum Nutr.*, Vol.62(1), pp. 39-42
51. Arcila, L.C.C, Loarca-Pina, G. and Lecona-Urbe, S, *et al.* (2005), Oregano: properties, composition and biological activity, *Arch Latinoam Nutr.*, Vol. 54(1), pp. 100-111.
52. Encyclopaedia Britannica (2008), p. 567 - 569
53. Mancini-Filho J, Van-Koijj A, Mancini, D.A., Cozzolino, F.F. and Torres, R.P., (1998), Antioxidant activity of cinnamon (*Cinnamomum Zeylanicum*, Breyne) extracts, *Boll Chim Farm*, Vol. 137 (11), pp. 443–447
54. Shan, B., Cai, Y.Z., Sun, M. and Corke, H., (2005), Antioxidant capacity of 26 spice extracts and characterization of their phenolic constituents, *J. Agric. Food Chem.*, Vol. 53 (20), pp. 7749 – 7759
55. López, P., Sánchez, C., Batlle, R. and Nerín, C., (2005), Solid- and vapor-phase antimicrobial activities of six essential oils: susceptibility of selected foodborne bacterial and fungal strains, *J. Agric. Food Chem.*, Vol. 53 (17), pp. 6939–6946.
56. Khan A, Safdar M, Ali Khan MM, Khattak KN, Anderson RA (2003). "Cinnamon improves glucose and lipids of people with type 2 diabetes". *Diabetes Care* **26** (12): 215–218. doi:10.2337/diacare.26.12.3215. PMID 14633804.
57. Lu, T.; Sheng, H.; Wu, J.; Cheng, Y.; Zhu, J.; Chen, Y. (2012). "Cinnamon extract improves fasting blood glucose and glycosylated hemoglobin level in Chinese patients with type

- 2 diabetes". *Nutrition Research* **32** (6): 408–412. doi:10.1016/j.nutres.2012.05.003. PMID 22749176
58. Fu, Y., Zu, Y., Chen, L., Shi, X., Wang, Z., Sun, S. and Efferth, T., (2007), Antimicrobial activity of clove and rosemary essential oils alone and in combination, *Phytother Res.*, Vol. 21(10), pp. 989-994
59. Darshan, S. and Doreswamy, R. (2004), Patented antiinflammatory plant drug development from traditional medicine, *Phytother.Res*, Vol. 18(5), pp. 343 -357
60. Almas, K., Albaker, A. and Felembam, N., (2000), Knowledge of dental health and diseases among dental patients, a multicentre study in Saudi Arabia, *Indian J Dent Res.*, Vol. 11(4), pp. 145-155
61. Stanfill, S.B., Brown, C.R., Yan, X.J., Watson, C.H. and Ashley, D.L., (2006), Quantification of flavor-related compounds in the unburned contents of bidi and clove cigarettes, *J Agric Food Chem.*, Vol. 54(22), pp. 8580-8588
62. Phyllis, B and James, B. (2000), Prescription for Nutritional Healing, 3rd ed., Avery Publishing, pp. 94
63. Andrew, D and Karen, P. (2003), The New American Chef: Cooking with the Best Flavors and Techniques from Around the World, John Wiley and Sons Inc., pp. 342 - 349
64. *Insight – the Consumer Magazine* (2007), Cloves may combat lung cancer, p. 34
65. Pope, T.R., (2007), Unlocking the benefits of garlic, *New York Times*, October 15
66. Sovova, M. and Sova, P., (2004), Pharmaceutical importance of *Allium sativum* L, Hypolipidemic effects of *in vitro* and *in vivo*, *Ceska Slov Farm*, Vol 53 (3), pp. 117 - 123
67. Durak I, Kavutcu M, Aytac B, *et al.*, (2004), Effects of garlic extract consumption on blood lipid and oxidant / antioxidant parameters in humans with high blood cholesterol, *J Nutr Biochem.*, Vol. 15(6), pp. 373-377
68. Durak, A., Ozturk, H.S., Olcay, E., Guven, C., (2002), Effects of garlic extract supplementation on blood lipid and antioxidant parameters and atherosclerotic plaque formation process of cholesterol-fed rabbits, *J Herb Pharmacother*, Vol. 2(2), pp. 19-32
69. Lanzotti, V., (2006), The analysis of garlic and onion, *Jr. of Chromatography*, Vol. 1112 (1 – 2), pp. 3 – 22
70. Lim, G.P., Chu, T., Yang, F., Beech, W., Frautscy, S.A. and Cole, G.M., (2001), The curry spice curcumin reduces oxidative damage and amyloid pathology in an Alzheimer transgenic mouse, *J. Neurosci.*, Vol. 21 (21), pp. 8370 – 8377
71. Ono, K., Hasegawa, K., Naiki, H. and Yamada, M., (2004), Curcumin has potent anti-amyloidogenic effects for Alzheimers beta amyloid fibrils in vitro, *J. Neurosci.*, Vol.75 (6), pp. 724 – 750
72. Stoner, G.D. and Mukhtar, H., (1995), Polyphenols as cancer chemopreventive agents, *J. Cell Biochem. Suppl.*, Vol. 22, pp. 169 – 180
73. Padmaja, S. and Raju, T.N. (2005), Protective effect of curcumin during selenium induced toxicity on dehydrogenases in hepatic tissue, *In. J. Physio. Pharmacol.*, Vol. 29 (1), pp.111 – 114
74. Wessler, S., Muenzner, P., Meyer, T.F. and Naumann, M., (2005), The anti-inflammatory compound curcumin inhibits Neisseria gonorrhoeae induced NF kappaB signaling release of pro-inflammatory cytokines / chemokines and attenuates adhesion in late infection, *Biol. Chem.*, Vol. 386 (5), pp. 481 – 490

75. Katz, D. and McHorney, C., (2000), Atkinson R: Impact of obesity on health-related quality of life in patients with chronic illness, *J Gen Intern Med*, Vol. 15, pp.789 – 796