

Review Article

Role of Spices in Preventing Chronic Problems: A Review

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Abstract

There is a growing consensus of individuals that food acts as a main determinant of health. Whatever we eat is directly under our control. It is a high time to live and promote a lifestyle where food can be used as a form of medicine. Healthy foods, fresh fruits and vegetables, meats, dairy and high fiber carbohydrates, contain a large amount of antioxidants, minerals and vitamins required by our body on a daily basis. These constituents not only help the body to perform at the optimum level, but also contribute in preventing overall aging, chronic diseases such as cancer and heart disease. Ginger, garlic, fenugreek, turmeric, curry leaves and black pepper are some of the major spices used in almost every household kitchen. These spices possess various medicinal properties that help in prevention and treatment of chronic health problems.

Keywords: food, antioxidants, chronic, health, medicinal, spices

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Introduction

The traditional healthcare system i. e., ethnomedicine is gaining popularity now a days in combating chronic health problems. Use of herbs, spices and plants present in nature is widely used since ancient times and is passed on from one generation to other. These plants provide us with a large range of bioactive constituents that make them suitable to be used in the pharmaceutical industry. Plants contain various photochemical which play a major role in reducing or preventing occurrence of many diseases enhancing various organ functions of the human body, by acting as antioxidants or by supplying necessary nutrients. It has been proven that many traditional healing herbs and their parts possess medicinal value and can be used to prevent, alleviate or cure several human diseases [1]. It is reported that 70– 80% of people worldwide rely mainly on traditional, largely herbal medicine to meet their primary healthcare needs [2]. For patients with systolic hypertension, congestive heart failure, angina pectoris, cerebral insufficiency, atherosclerosis and venous insufficiency, plant based treatments have been used. The effectiveness of plant sterols and stanols for lowering cholesterol and as such, reducing the chances for heart disorders has been proven. Health authorities are also paying attention to use herbal medicines. It has also been observed that a number of modern drugs have been derived from plants used by the indigenous people [3]. Many herbs and spices are used in Indian cooking, like garlic, ginger, turmeric, clove, cardamom, cumin, coriander, cinnamon, fenugreek, fennel, ajowan (ajwain), anise, amchur, bay leaf, hing (asafoetida) etc. Ayurvedic medicine uses all of these either in diet or as a medicine.

Characteristics of Medicinal Plants

Medicinal plants possess many characteristics when used as a treatment:

- Synergic medicine- the plant constituents interact simultaneously, so that their use can complement or damage others or neutralize their possible negative effects.
- Support of official medicine- In the treatment of complex cases like cancer diseases the components of the plants proved to be very effective.
- Preventive medicine- plant components are also characterized by their ability to prevent the appearance of some diseases. This will help to reduce the use of the chemical remedies which will be used when the disease is already present i. e., reduce the side effect of synthetic treatment [4].

Fenugreek

Fenugreek (*Trigonella foenum-graecum* L.) or methi, belongs to the family Leguminosae. It is a self-pollinating, leguminous crop and is a native to the Indian subcontinent and the Eastern Mediterranean region [5]. Studies revealed

that extracts of leaves, seeds and stems of methi leaves and green leafy vegetables are rich sources of phytochemicals [6]. Presence of poly-phenolic substances, volatile constituents, amino acids, etc in methi are responsible for its pharmacological and biological properties. Medicinal advantages of methi include its anti-diabetic, and blood sugar lowering potential. Methi also possess qualities of lowering cholesterol level, anti-cancer and anti-microbial activities [7].



Seeds of methi are of commercial interest as these are source of diosgenin, a steroid which is of great importance to the pharmaceutical industry. Fenugreek is extensively cultivated as a drug plant, nowadays. Methi seeds are mucilageneous and possesses several medicinal qualities as a tonic, carminative (relieving flatulence), emollient (softening or soothing the skin), demulcent (relieving irritation or inflammation), restorative, diuretic, aphrodisiac and vermifugal properties. It can also be used to cure chapped lips, mouth ulcers, and stomach irritation [8].

Fenugreek seeds contain L tryptophan and lysine rich proteins, mucilaginous fibre, saponins, , nicotinic acid coumarin, fenugreekine, sapogenins, phytic acid, trigonelline and scopoletin, responsible for its therapeutic effects. Fenugreekine, a steroidal sapogenin peptide ester exhibits hypoglycemic properties and delays gastric emptying. It also slows carbohydrate absorption, and thus inhibits glucose transport in humans. It also improves the pancreatic function by increasing the erythrocyte insulin receptors and peripheral glucose utilization. Trigonelline is reported to bear hypoglycemic effects in healthy patients without diabetes. Thus it can control blood sugar in both type 1 (insulin-dependent) and type 2 (noninsulin - dependent) diabetics. Seed powder helps in normalizing the increased lipid peroxidation and enhanced vulnerability to oxidative stress related to depletion of antioxidants in diabetic rats. Supplementation with methi in normal rats showed increased antioxidant status with reduction in peroxidation. Potential role of methi in arteriosclerosis is due to steroidal saponins (diosgenin, yamogenin, tigogenin and neotigogenin) which inhibit cholesterol absorption and synthesis [9].

Clinical studies showed a significant decline in human serum triglycerides, LDL cholesterol and total cholesterol levels by consumption of fenugreek. Methi can also be used topically to treat inflammation and promote postpartum lactation in animals. The important gastro protective effect of fenugreek seeds has been reported in gastric ulcers of rats. Phenolic compounds present in plants possess antioxidant properties like reactive oxygen species (ROS) scavenging and inhibition, electrophile scavenging and metal chelation. Studies supported the relationship between the consumption of phenolic rich food products with a low incidence of atherosclerosis, coronary heart disease, certain forms of cancer and stroke. They also exhibit pharmacological properties like as antiviral, antitumor, , antimicrobial, anti-inflammatory, antioxidant and hypotensive activity [10].

Turmeric



Turmeric (*Curcuma longa*) belongs to family Zingiberaceae. It is one of the most useful medicinal plant provided by the nature. Oil of turmeric obtained by steam distillation has sesquiterpenes, zingiberene, α -phellandrene, sabinene (0.6%), cineol (1%), and borneol (0.5%). Curcumin a diferuloylmethane is responsible for the yellow colour and is comprised of curcumin I (94%), curcumin II (6%) and curcumin III (0.3%) [11].

Studies have reported that curcumin is able to hinder carcinogenesis at three stages: angiogenesis, tumor promotion, and tumor growth. The anticarcinogenic effects of turmeric and curcumin are related to direct antioxidant and free-radical scavenging effects. These possess the ability to indirectly increase glutathione levels thus, helping in hepatic detoxification of mutagens and carcinogens, and inhibiting nitrosamine formation [12, 13].

Turmeric also bears antimicrobial, antifungal, renal and hepatoprotective activities. The hepatoprotective and renoprotective effects of turmeric is linked to its antioxidant properties and its ability to reduce the formation of pro-inflammatory cytokines [14]. Turmeric has the potential to combat against various allergies, cancers, diabetes, arthritis, Alzheimer's disease and other chronic and hard curable diseases [15].

A study revealed that ingestion or intake of turmeric oleoresin and essential oil inhibits the development of increased blood glucose and abdominal fat mass in obese, diabetic rats [16]. Volatile oil of Turmeric is effective against respiratory tract disorders. It helps in relieving cough, removing sputum and preventing asthma [17]. Ethanolic extract of turmeric increases the serotonin turnover and thus useful against depression [18].

Turmeric possesses potent vasorelaxant activity and aids in decreasing the atherogenic properties of cholesterol. Studies revealed that supplementation of turmeric in the diet helped in controlling arterial blood pressure in animals and also improved vasorelaxant responses to acetylcholine, adenosine and isoproterenol [19]. The antiatherosclerotic effect of turmeric is associated with prevention of lipoperoxidation, inhibition of low-density lipoprotein oxidation, and reduction in levels of cholesterol [20, 21]. Turmeric possesses antibacterial, antiviral, anti-inflammatory, antitumor, antioxidant, antiseptic, cardioprotective, hepatoprotective, nephroprotective, radioprotective, and digestive activities.

Ginger



Ginger (*Zingiber officinale* Rosc.) belongs to the family Zingiberaceae. Rich phytochemistry of ginger leads to its health-promoting perspective [22]. Volatile components of ginger includes sesquiterpene and monoterpene hydrocarbons providing the distinct aroma and taste of ginger, non-volatile pungent compounds in turmeric include shogaols, gingerols, paradols, and zingerone [23].

Ginger has a strong potential to treat a number of diseases including digestive health (indigestion, constipation and ulcer), degenerative disorders (arthritis and rheumatism), cardiovascular disorders (atherosclerosis and hypertension), diabetes mellitus, vomiting and cancer. It possesses anti-inflammatory and anti-oxidative properties and thus aids in controlling the process of aging. Ginger can also treat infectious diseases as it has antimicrobial activity [24].

Oxidative stress plays an important role in heart diseases, cancer, neurodegenerative diseases and in the aging process. The bioactive compound gingerols present in ginger have shown antioxidant activity in various models. It has been indicated that the ethanolic extract of ginger reduced body weights and levels of glucose, insulin, total cholesterol, LDL cholesterol, triglycerides, free fatty acids, and phospholipids in high-fat diets [25].

As ginger possesses strong anti-inflammatory effect, it can help in reducing muscle pain after intense physical work out or activity. The anticancer potential of ginger is due to its functional ingredients like shogaol, gingerols and paradols that can prevent various cancers, metastasis and angiogenesis, induction of apoptosis, and inhibition of cell-cycle progression. A good correlation between the total phenolic content and antioxidant activities of the non-volatile extracts of ginger was also reported. Ginger also aids in improving cardiovascular disorders, diabetes mellitus, and gastrointestinal health [22].

6-Shogaol showed the most potent antioxidant and anti-inflammatory properties in ginger, which can be credited to the presence of alpha, beta-unsaturated ketone moiety [26]. Animal modeling showed that ginger significantly lowered induced lipid peroxidation and raised the levels of antioxidant enzymes, together with serum glutathione [27].

The most common use of ginger throughout history is its utilization in alleviating symptoms of vomiting and nausea. The carminative nature of ginger helps in effectiveness of its use as an antiemetic as it helps to break up and expel intestinal gas [28].

It has been showed that treatment of patients with ginger has hypo-algesic effects. 2 g of ginger supplementation for 11 days has been used on 36 participants to cure muscle pain. The study proved that daily consumption of raw and heat-treated ginger resulted in moderate-to-large reductions in muscle pain [29].

Garlic



Garlic (*Allium sativum* L.) has acquired a reputation in different traditions as a prophylactic as well as therapeutic medicinal plant. It is a member of the Lillaceae family, along with onions, shallots and chives. Garlic has played important dietary and medicinal roles throughout the history. Ancient Chinese and Indian medicine suggested garlic to aid digestion and respiration and to treat and parasitic infestation and leprosy [30].

Botanically, garlic is a useful compound in treatment of arthritis, toothache, chronic cough, constipation, parasitic infestation, snake and insect bites, gynecologic diseases, as well as in infectious diseases (as antibiotic). Several experimental and clinical investigations suggest many favorable effects of garlic and its preparations. These effects have been largely attributed to *i*) reduction of risk factors for cardiovascular diseases, *ii*) reduction of cancer risk, *iii*) antioxidant effect, *iv*) antimicrobial effect, and *v*) enhancement of detoxification foreign compound and hepatoprotection [31, 32].

Allicin (allyl 2-propenethiosulfinate or diallyl thiosulfinate) is the principal bioactive compound present in the aqueous extract of garlic or raw garlic homogenate. When garlic is chopped or crushed, allinase enzyme is activated and produce allicin from alliin (present in intact garlic). Other important compounds present in garlic homogenate are 1-propenyl allyl thiosulfonate, allyl methyl thiosulfonate, (E, Z)-4, 5, 9-trithiadodeca- 1, 6, 11-triene 9- oxide (ajoene), and γ -L-glutamyl-S-alkyl- L-cysteine.

Scientific literature reported that garlic consumption plays important role in lowering blood pressure, reduction of serum cholesterol and triglyceride, prevention of atherosclerosis, inhibition of platelet aggregation and an increase in fibrinolytic activity [33]. Preventive effect of garlic on atherosclerosis is due to its capacity to lessen lipid content in arterial membrane. Allicin, S-allyl cysteine, present in aged garlic extract and diallyldi-sulfide, present in garlic oil are the active constituents responsible for anti-atherosclerotic effect [34].

Possible anticarcinogenic mechanisms of garlic and its constituents may include the inhibition of carcinogen activation [35], the enhancement of detoxification [36], excretion [37] and the protection of DNA from activated carcinogens [38].

Allicin and other garlic compounds have hypocholesterolemic, hypolipidemic and antihypertensive activity [35, 39]. The anti-cholesterolemic and antilipidemic action of garlic has experimentally been proved in rabbits and rats [40] and the antihypertensive action of garlic in rats. Garlic protects from LDL cholesterol. It decreases the concentration of triglycerides and cholesterol in blood. By decreasing the serum lipids, garlic reduces the risk of atherosclerosis, whereby it prevents depositing of lipids in blood vessels [39, 41]. People from countries that often use garlic in their cuisine are less susceptible to blood vessel diseases, especially atherosclerosis [42].

Ajoenes from garlic possess antithrombotic effect. they inhibit *lipoxigenases*, increase fibrinolysis and decrease *thrombocytes* aggregation. The proven antioxidative, hypocholesterolemic, antithrombotic and

antihypertensive properties of garlic help in the prevention of cardiovascular and cerebrovascular diseases, and lessen the risk of development of dementia and Alzheimer's disease [43].

The action of garlic is manifold. Because of allicin and other sulfur compounds, garlic has antibiotic, antibacterial and antimycotic action, which has been testified by in vitro studies [44]. The allicin is excreted partly by the respiratory organs so garlic is used to treat respiratory tract diseases.

Curry leaves



Curry leaves (*Murraya koenigii*) belongs to family rutaceae. The major constituent responsible for the aroma and flavor in curry leaves are pinene, sabinene, caryophyllene, cadinol and cadinene. The antioxidative properties of the leaves extracts of *Murraya koenigii* using different solvents were evaluated based on the oil stability index. It possesses significant hypoglycemic potential in STZ-induced diabetic rats. The *M. koenigii* extract appeared to be more effective than glibenclamide, a known antidiabetic drug [45]. It also revealed hepato-protective activity against ethanol-induced hepatotoxicity. Chronic ethanol consumption reduces the cellular antioxidant levels through free radical induced injury causing hepatitis and cirrhosis with mortality in severe cases [46].

It also shows antibacterial activity against *S. typhi* and *E. coli*. [47]. Carbazole derivatives are well known for their various pharmacological activities, including anti-HIV, anticancer, antibacterial and antifungal activities. N-alkylated 3, 6-dihalogenocarbazoles which is a series of substituted carbazoles exhibits fungicidal activity against emerging pathogen *Candida glabrata* and *C. albicans*. [48]. The various notable pharmacological activities of this plant includes activity on heart, anti diabetic and cholesterol reducing property, antimicrobial activity, antiulcer activity, antioxidative property, cytotoxic activity, anti diarrhea activity, phagocytic activity.

Black pepper



Piper nigrum (family Piperaceae) is a vital medicinal plant. It is one of the most commonly used spices and considered as “The King of spices” among various spices. Black pepper is grown in many tropical regions like Brazil, Indonesia and India.

Piperine was the first pharmacologically active compound isolated from different members of Piperaceae family. Other compounds include Phenolics, alkaloids, flavonoids, amides and steroids, lignans, terpenes, neolignans, chalcones etc. The different pharmacological activities were reported due to the presence of these phytochemicals. Piperine has four isomers viz; Piperine, Isopiperine, Chavicine and Isochavicine. All these compounds possess diverse pharmacological activities [49, 50].

Piperine is a pungent alkaloid. Piperine helps in increasing bioavailability of many drugs and nutrients by inhibition of many metabolising enzymes. Piper and its active component “Piperine” shows diverse pharmacological

activities like antiplatelet, antihypertensive, antioxidant, antitumor, anti-asthmatics, anti-inflammatory, analgesic, anti-diarrheal, antidepressants, immunomodulatory, anticonvulsant, antispasmodic, anti-thyroids, antibacterial, antifungal, hepato-protective, insecticidal and larvicidal activities etc. [51].

Some in vitro studies revealed that Piperine inhibited free radicals and reactive oxygen species, therefore known to possess protective effects against oxidative damage. Piper nigrum or piperine also found to decrease lipid peroxidation in vivo. The antioxidant activity of pipe nigrum might be because of the presence of phenolic and flavonoids contents. Piper nigrum prevented the oxidative stress by inhibiting lipid peroxidation, human lipoxygenase and arresting hydroxyl and superoxide free radicals, decrease lung carcinogenesis in animal [51].

Dietary piperine helps in enhancing digestion by stimulating pancreatic enzymes and significantly decreases the food transit time of gastrointestinal tract. Piperine has been reported to enhance the saliva production and gastric secretions, and increase the production and activation of salivary amylase. . The oral administration of active compounds like piperine, pipene, piperamines and piperamides significantly increases the activities of enzymes like pancreatic amylase activity, protease activity, lipase activity and chymotrypsin activation [52, 53].

These results showed that piperine produces an antidepressant-like effect in corticosterone-induced model of depression in mice [54]. The alcoholic extract of peppercorn and piperine exhibited effective immunomodulatory and antitumor activities. Piperine is also reported to reduce the lung cancer by altering lipid peroxidation and by antioxidative protection enzymes activation [49].

Conclusion

Spices are the most common dietary adjuncts added to the food for flavor and taste. These spices exert beneficial physiological effects. The bioactive compounds present in various spices have the potential to be used in the pharmacological industry to provide natural products to the population suffering from various chronic problems. Increase in the popularity of alternative medicine and natural products have renewed interest in these plants and their derivatives as potential natural remedies. The various prominent pharmacological properties of these plant include activity on heart, cholesterol reducing property, anti diabetic, antiulcer activity, antimicrobial activity, antioxidative property, anti diarrhea activity, cytotoxic activity, phagocytic activity etc.

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