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Herbs and Human Health: A Review

Ashok D. Agrawal*, Sunil R. Bavaskar, Yogesh M. Bagad, Mayur R. Bhurat

Shree Sureshdada Jain Pharmaceutical Education and Research Center, Jamner, Jalgaon,
Maharashtra, India

Abstract

Herbs have been used as food and for medicinal purposes for centuries. Research interest has focused on various herbs that possess hypolipidemic, antiplatelet, antitumor, or immunostimulating properties that may be useful adjuncts in helping reduce the risk of cardiovascular disease and cancer. Regular consumption of fruit and vegetables is associated with reduced risks of cancer, cardiovascular disease, stroke, Alzheimer disease, cataracts, and some of the functional declines associated with aging. Prevention is a more effective strategy than is treatment of chronic diseases. In different herbs, a wide variety of active phytochemicals, including the flavonoids, terpenoids, lignans, sulfides, polyphenolics, carotenoids, coumarins, saponins, plant sterols, curcumins, and phthalides have been identified. Several of these phytochemicals either inhibit nitrosation or the formations of DNA adduct or stimulate the activity of protective enzymes such as the Phase II enzyme glutathione transferase [EC 2.5.1.18]. Many of these herbs contain potent antioxidant compounds that provide significant protection against chronic diseases. These compounds may protect LDL cholesterol from oxidation, inhibit cyclooxygenase and lipoxygenase enzymes, inhibit lipid peroxidation, or have antiviral or antitumor activity.

Key Words: Herbs, phytochemicals, flavonoids, terpenoids, antioxidants.

INTRODUCTION

Today we are witnessing a great deal of public interest in the use of herbal remedies. Herbal medicine is based on the premise that plants contain natural substances that can promote health and alleviate illness. In herbal medicine the term *herbs* is used loosely to refer not only to herbaceous plants but also to leaves; bark; roots; seeds; flowers and fruit of trees, shrubs, and woody vines; and extracts of the same that are valued for their savory, aromatic, or medicinal qualities. The botanical term *herb* refers to seed-producing plants. Plants have played a

significant role in maintaining human health and improving the quality of human life for thousands of years, and have served humans well as valuable components of seasonings, beverages, cosmetics, dyes, and medicines. Consumption of fruit and vegetables, as well as grains, has been strongly associated with reduced risk of cardiovascular disease, cancer, diabetes, Alzheimer disease, cataracts, and age-related functional decline [1–3].

The World Health Organization estimated that <80% of the earth's inhabitants rely on traditional medicine for their primary health care needs, and most of this therapy involves the use of plant extracts or their active components. Furthermore, many Western drugs had their origin in a plant extract. Reserpine, which is widely used for the treatment of high blood pressure, was originally extracted from the plant *Rauwolfia serpentina*, whereas digitalis, used as a heart stimulant, was derived from the foxglove plant [*Digitalis purpurea*]. The Chinese herb ephedra [*Ma huang*], which contains the active substance ephedrine, was used early on for the treatment of asthma, whereas salicylic acid [a precursor of aspirin] was obtained from willow tree bark [*Salix alba*] to help relieve fevers. Over-the-counter laxatives commonly contain psyllium, senna, or *Cascara sagrada*. The laxative effect of the latter 2 herbs is due to the presence of anthraquinones, which stimulate peristalsis, whereas the mucilages in psyllium provide a bulking effect [4].

Some herbs are safe in modest amounts but they may become toxic at higher doses. For example, whereas licorice root can be used safely for treating duodenal and gastric ulcers, deaths from its excessive use have been reported. Large amounts of licorice can cause serious side effects such as hypokalemia, high blood pressure, and heart failure [5]. Other herbs are known to be lethal. Germander, an herb used in some weight-loss programs, has been reported to cause fatal hepatitis [6]. The Chinese herbs caowu and chuanwu are used to treat rheumatism, arthritis, bruises, and fractures. They may contain highly toxic alkaloids such as aconitine which produce neurologic, cardiovascular, and gastrointestinal disturbances. Use of these herbs can even result in death [7].

Antioxidant activity

Oxidative stress can cause oxidative damage to large biomolecules such as proteins, DNA, and lipids, resulting in an increased risk for cancer and cardiovascular disease [9, 10]. Fruit and vegetables contain a wide variety of antioxidant compounds [phytochemicals] such as carotenoids and phenolics that may help protect cellular systems from oxidative damage and lower the risk of chronic diseases.

Anthocyanins are the water-soluble pigments responsible for the red, pink, blue, purple, and violet colors for many types of flowers and fruit. Hawthorn, red wine, grapes, juniper berries and rose hips are some examples of herbs that contain anthocyanins. Because anthocyanins are effective in inhibiting LDL-cholesterol oxidation and platelet aggregation, these herbs may provide some protection against heart disease. Anthocyanins may also be useful for the treatment of vascular disorders and capillary fragility [4].

Licorice extract [free of glycyrrhizinic acid] and the isoflavan glabridin, a major polyphenolic compound found in licorice and tea flavonoids, specifically the catechins from green tea leaves or theaflavins [catechin dimers] from black tea leaves were shown to markedly inhibit LDL oxidation via a mechanism involving scavenging of free radicals [11, 12].

Turmeric has been shown to suppress the development of stomach, breast, lung, and skin tumors [13, 14]. Its activity is largely due to the antioxidant curcumin [diferuloylmethane], which has been shown to be an effective antiinflammatory agent in humans [14]. Carotenoids are the pigments found in green, leafy herbs; rose hips; and the herbs used as coloring agents, such as paprika, saffron, and annatto. The carotenoid pigments are effective antioxidants that quench free radicals, provide protection against oxidative damage to cells, and also stimulate immune function.

Cardiovascular activity

Dietary flavonoid intake was significantly inversely associated with mortality from coronary artery disease and inversely related [more weakly but still significantly] with incidence of myocardial infarction [15].

Garlic [*Allium sativum* L.] has been used effectively as food and medicine for many centuries. Regular use of garlic can be effective in reducing the risk of heart attack and stroke because it lowers total- and LDL-cholesterol and triacylglycerol concentrations without affecting HDL-cholesterol concentrations [16, 17]. Blood lipid concentrations are also favorably altered in normocholesterolemic subjects taking garlic [18]. Garlic also increases fibrinolytic activity and inhibits platelet aggregation, in part because of the presence of ajoenes, allyl methyl trisulfide, vinyldithiins, and other sulfur compounds produced by the breakdown of allicin [17, 19–21].

Onions [*Allium cepa* L.] may also be considered natural anticlotting agents because they possess substances that have fibrinolytic activity and can suppress platelet aggregation [17, 20, 22]. A whole family of a-sulfinyl disulfides isolated from onions has been shown to strongly inhibit the arachidonic acid cascade in platelets [22].

Ginseng [*Panax ginseng*] inhibits platelet aggregation by potently inhibiting thromboxane A₂ production [23]. A concentrated extract of the leaves of the Ginkgo tree respond to the vasodilation and improved blood. The active constituents in Ginkgo, which are thought to be flavone glycosides and diterpenoids [ginkgolides], inhibit the activity of the platelet activating factor [24-26].

Hawthorn [*Crataegus spp.*] causes dilation of the smooth muscles of the coronary vessels, thereby increasing blood flow and reducing the tendency for angina [24]. French researchers have identified proanthocyanidins as active principles in the flower heads of hawthorn [*Crataegus oxyacantha*]. These substances were reported to inhibit the biosynthesis of thromboxane A₂ [27].

Anticancer Activity

Several commonly used herbs have been identified by the National Cancer Institute as possessing cancer-preventive properties. These herbs include members of the *Allium* sp. [garlic, onions, and chives]; members of the Labiatae family [basil, mints, oregano, rosemary, sage, and thyme]; members of the Zingiberaceae family [turmeric and ginger]; members of the *Umbelliferae* family [anise, caraway, celery, chervil, cilantro, coriander, cumin, dill, fennel, and parsley] [28]. In addition, many herbs contain a variety of phyosterols, triterpenes, flavonoids, saponins, and carotenoids, which have been shown from studies of legumes, fruit, and vegetables

to be cancer chemoprotective [29]. Garlic is known to have antitumor properties, owing to its content of a wide variety of organic sulfides and polysulfides. Garlic is reported to enhance immune function by stimulating lymphocytes and macrophages to destroy cancer cells; garlic is also reported to disrupt the metabolism of tumor cells. The inhibition of tumors by garlic seems to be most effective when the tumor is small. Various studies have shown that garlic can slow the development of bladder, skin, stomach, and colon cancers [30–33]. Garlic can inhibit the formation of nitrosamines, which are potent carcinogens, and can also inhibit the formation of DNA adducts [34]. Case-control studies in Greece have shown that high consumption of onions, garlic, and other *Allium* species is protective against stomach cancer [29].

Korean studies suggest that ginseng [*Panax ginseng*] may lower the risk of cancer in humans [35]. Ginseng extract and powder have been found to be more effective than fresh sliced ginseng, ginseng juice, or ginseng tea for reducing the risk of cancer [36].

Ginseng seemed to be most protective against cancer of the ovaries, larynx, pancreas, esophagus, and stomach and less effective against breast, cervical, bladder, and thyroid cancers. The main active ingredients in ginseng root are thought to be a family of 6 triterpene saponins called ginsenosides [4].

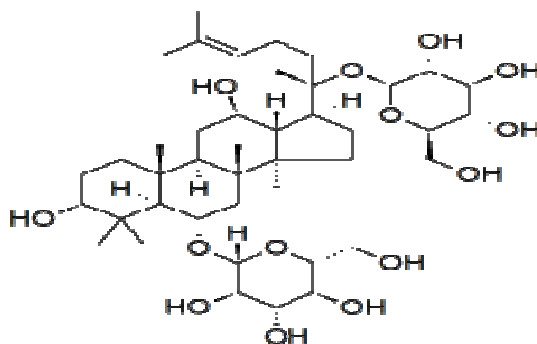


Fig. 1: Ginsenoside

Paclitaxel [TAXOL; Bristol-Myers Squibb, Princeton, NJ], a new chemotherapy agent discovered by the National Cancer Institute screening program, is obtained from the bark of the Pacific yew [*Taxus brevifolia*] as well as the needles of some other yew species. Patients with metastatic breast cancer, advanced lung cancer, cancers of the head and neck, melanoma, ovarian cancer, and lymphomas have responded positively to Taxol [37]. Vinblastine, vinleurosine, vincristine, and vinrosidine are alkaloidal substances can be obtained *Vinca rosea*. Vinblastine has proved effective in chorioepithelioma, Hodgkin's disease, and other lymphomas, and a number of beneficial results have been obtained in carcinoma of the breast and bronchus [66].

Flaxseed [*Linum usitatissimum*] contains a rich supply of lignans. These plant lignans are converted to mammalian lignans [enterolactone and enterodiol] by bacterial fermentation in the colon [38] and they can then act as estrogens. Mammalian lignans appear to be anticarcinogenic; lignan metabolites bear a structural similarity to estrogens and can bind to estrogen receptors and inhibit the growth of estrogen-stimulated breast cancer [39–41]. Urinary excretion of lignans is reduced in women with breast cancer, whereas the consumption of flaxseed powder increases urinary concentration of lignans several-fold [42]. Turmeric [*Curcuma longa*] has been shown to suppress the development of stomach, breast, lung, and skin tumors [13, 14].

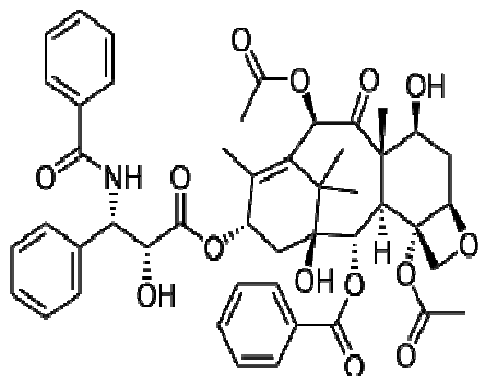


Fig. 2: Paclitaxel

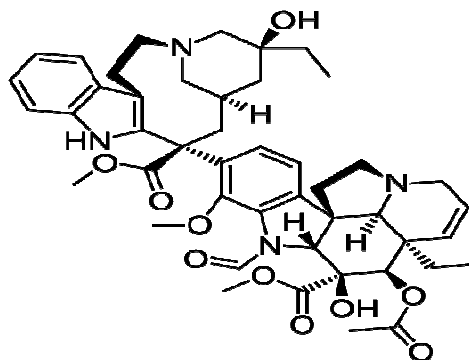


Fig. 3: Vincristine

Persons with high serum concentrations of carotenoids have reduced risk of both heart disease and cancer [43–45]. Polyphenolics in green tea [*Camellia sinensis*] are known to possess antimutagenic and anticancer activity. Some evidence suggests that tea has a protective effect against stomach and colon cancers [46].

Lentianan, β -glucan found in shiitake mushrooms [*Lentinus edodes*], has been shown to have antitumor activity; it was active against lung carcinoma and 2 human melanomas [47]. It is thought that lentianan has its effects by activating the host immune system. Lentianan stimulates increased production and activity of natural killer cells and macrophages, which destroy tumor cells [48].

Herb for the Immune System

Several herbal products that may enhance the function of the immune system. These include *Echinacea*, licorice, cat's claw, and garlic. Herbs that are rich in flavonoids, vitamin C, or the carotenoids may enhance immune function. The flavonoid-rich herbs may also possess mild anti-inflammatory action [4, 49]. *Echinacea* [purple coneflower] appears to be useful in moderating the symptoms of the common cold, flu, and sore throat. It is thought that this activity is provided by certain polysaccharides, flavonoids, and isobutylamides [4].

Garlic preparations have been found to exert an immunopotentiating effect by stimulating natural killer cell activity [50]. In addition, 2 aromatic diones isolated from St John's Wort [*Hypericum perforatum* L.], hypericin and pseudohypericin, have been reported to have potent antiretroviral activity [4, 51]. It was found that incubation of HIV with hypericin [a naphthodianthrone] rendered the virus noninfectious [52]. St John's Wort may be useful for the treatment of HIV-infected patients because hypericin and pseudohypericin lack toxicity at therapeutic doses [51]. St John's Wort and hypericin have also been used successfully for the treatment of depression [4].

Glycyrrhizin, a sweet-tasting triterpenoid saponin, is a major component of licorice root [*Glycyrrhiza glabra* L.]. Glycyrrhizin and its aglycone, glycyrrhetic acid, have been reported to induce interferon activity and augment natural killer cell activity [53]. Hatano and colleagues

[54] reported that the chalcones in licorice possess antiviral activity against HIV. Glycyrrhizin also has antiinflammatory and antiallergic properties [55].

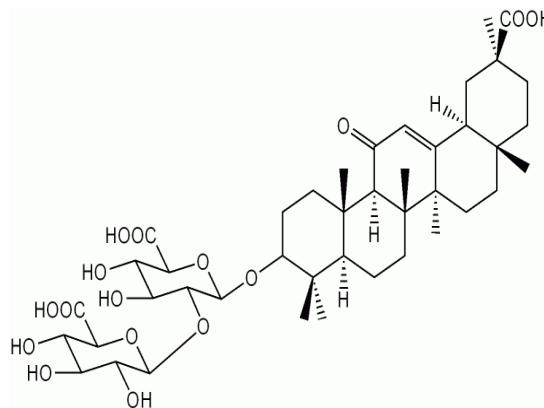


Fig. 4: Glycyrrhizin

Anxiolytic Activity

Valerian Root [*Valeriana Officinalis*] relief anxiety/depression and promotes peaceful sleep. The root has been shown scientifically affect of the brain's GABA system [a major inhibitory neurotransmitter]. Many clinical research studies have shown that Valerian Root relieves symptoms of anxiety [56-59].

Brahmi [*Bacopa moniera*] has been shown in recent studies to have anti-anxiety effects. The relief of anxiety symptoms is thought to be caused by the active chemical interaction with the GABA system in the brain, which has been shown to be related to anxiety disorders. It has the positive side effect of enhancing memory and cognitive functions [60, 61].

Passion Flower [*Passiflora incarnate*] is well known as an herb used for insomnia and anxiety. *Passiflora incarnate* is one of a group of plants classified as "serotonin-derived" for their chemical composition. Clinical studies indicate that the chemical components found in passion flower are effective at regulating the uptake of 5-HTP in the brain and therefore relieve anxiety [62-64].

Kaim [*Mitragyna parvifolia*] is a deciduous tree found in well drained deep soil. It is widely used by tribal peoples and other ayurvedic practitioners. Kaim have significant anxiolytic activity and suggest that the anxiolytic-like activities of this plant are mainly mediated via the GABAergic system [65]

CONCLUSION

A variety of herbs and herbal extracts contain different phytochemicals with biological activity that can provide therapeutic effects. Several herbs can help to reduce high blood cholesterol concentrations, provide some protection against cancer, and stimulate the immune system.

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