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Herbal antioxidant in clinical practice: A review

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PEER REVIEW

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Comments

It is a systematic review that clearly focuses on the clinical applications of herbs as antioxidants. Oxidative stress is being reported as the major hallmark in the etiology of chronic diseases such as diabetes, Alzheimer's disease, renal failures, cancer, *etc*.

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ABSTRACT

Antioxidant-the word itself is magic. Using the antioxidant concept as a spearhead in proposed mechanisms for staving off so-called "free-radical" reactions, the rush is on to mine claims for the latest and most effective combination of free-radical scavenging compounds. We must acknowledge that such "radicals" have definitively been shown to damage all biochemical components such as DNA/RNA, carbohydrates, unsaturated lipids, proteins, and micronutrients such as carotenoids (alpha and beta carotene, lycopene), vitamins A, B_6, B_{12}, and folate. Defense strategies against such aggressive radical species include enzymes, antioxidants that occur naturally in the body (glutathione, uric acid, ubiquinol-10, and others) and radical scavenging nutrients, such as vitamins A, C, and E, and carotenoids. This paper will present a brief discussion of some well- and little-known herbs that may add to the optimization of antioxidant status and therefore offer added preventive values for overall health. It is important to state at the outset that antioxidants vary widely in their free-radical quenching effects and each may be individually attracted to specific cell sites. Further evidence of the specialized nature of the carotenoids is demonstrated by the appearance of two carotenoids in the macula region of the retina where beta-carotene is totally absent.

KEYWORDS
Antioxidant, Carotenoid, Free-radical, Herb

1. Introduction

Herbs and spices are traditionally defined as any part of a plant that is used in the diet for their aromatic properties with no or low nutritional value[1]. However, more recently, herbs and spices have been identified as sources of various phytochemicals, many of which possess powerful antioxidant activity[2]. Thus, herbs and spices may have a role in antioxidant defense and redox signaling[3].

1.1. How the antioxidants complement rather than compete with one another

As scientific inquiry proceeds we will likely learn of other site-specific attractions and functions of the carotenoids. This will help us understand why we need not reject one class of antioxidant compounds to accept another. They each may accumulate in specialized cells and tissues, with some overlapping protection, but a variety of them is required to give us the best protection.

Interestingly, just as foods work together so do the antioxidants. Professor Lester Packer of the University of California at Berkeley is one of the world's pre-eminent antioxidant researchers. He and coworkers recently demonstrated how carotenoids interact with vitamins E and C. Beta-carotene, it was shown, can protect low density lipoprotein against oxidative damage even when vitamin E levels are low[4]. In this regard, antioxidants act synergistically, offering a rainbow of protection rather than a single band of the spectrum. Moreover, plant antioxidants such as phenols and bioflavonoids may potentiate vitamin antioxidants. For example, rutin, a bioflavonoid, potentiates vitamins C and E when taken in combination, producing a more potent radical scavenging action. That is, adding a third antioxidant (rutin)

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creates a combined effect greater than the sum of the parts[4].

1.2. Some major antioxidant herbs

Antioxidant factors found in plants are based upon constituent nutrients with demonstrated radical-scavenging capacities as well as upon non-vitamin or mineral substances. So, in addition to alpha-tocopherol, ascorbate, carotenoids, and zinc, plant-based medicines may contain flavonoids, polyphenols, and flavoproteins. Further, some plants or specific combinations of herbs in formulations may act as antioxidants by exerting superoxide scavenging activity or by increasing superoxide dismutase activity in various tissue sites[5]. These groups of compounds are substances that may exert cell-protective action by more than one biochemical mechanism. In addition to antioxidant properties *per se*, cancer-protective factors are found in many plants including some fruits, vegetables, and commonly used spices and herbs. They can be divided into several different groups based on their chemical structure, *e.g.*, polyphenols, thiols, carotenoids and retinoids, carbohydrates, trace metals, terpenes, tocopherols and degradation products of glucosinolates (isothiocyanates, indoles and dithiothiols) and others. These groups of compounds are substances which may exert their cancer-protective action by more than one biochemical mechanism. The biochemical processes of carcinogenesis are still not known in detail and probably vary with the cancer disease in question. Accordingly, the description of the biochemical backgrounds for the actions of cancer-protective factors must be based on a simplified model of the process of carcinogenesis. The model used in this presentation is a generalized initiation-promotion-conversion model, in which initiators are thought to be directly or indirectly genotoxic, promoters are visualized as substances capable of inferring a growth advantage on initiated cells and converters are believed to be genotoxic, *e.g.* mutagens, clastogens, recombinogens *etc*. Experimental evidence for the mechanisms of action of cancer-protective agents in fruits and vegetables that protect against initiation include the scavenging effects of polyphenols on activated mutagens and carcinogens, the quenching of singlet oxygen and radicals by carotenoids, the antioxidant effects of many compounds including ascorbic acid and polyphenols, the inhibition of activating enzymes by some flavonols and tannins, the induction of oxidation and of conjugation (protective) enzymes by indoles, isothiocyanates and dithiothiones, the shielding of sensitive structures by some polyphenols and the stimulation of DNA-repair exerted by sulphur-containing compounds. Mechanisms at the biochemical level in antipromotion include the antioxidant effects of carotenoids and the membrane stabilizing effects reported with polyphenols, the inhibition of proteases caused by compounds from soybeans, the stimulation of immune responses seen with carotenoids and ascorbic acid, and the inhibition of ornithine decarboxylase by polyphenols and carotenoids. A few inhibitors of conversion have been identified experimentally, and it can be argued on a theoretical basis, that many inhibitors of initiation should also be efficient against conversion. The mechanisms of anticarcinogenic substances in fruits and vegetables are discussed in the light of cancer prevention and inhibition[5].

Plant antioxidants are more than mere supporting players in the battle against cellular damage and disease. As folklore has long instructed, certain plants play specific roles in disease prevention and treatment. A well known hepatic antioxidant, silymarin, from the milk thistle (*Silybum marianum*), for example, inhibits liver damage by scavenging free radicals among other mechanisms[6]. This powerful antioxidant protects the liver against alcohol and pharmaceutical injury and even poisoning from extremely toxic compounds found in the deathcap mushroom, *Amanita phalloides*. Interestingly, the amanita toxins are not thought to be neutralized via any free-radical scavenging effects. Rather, it is theorized that silymarin competes with the amanita toxins for the identical receptor on cell membranes[6]. Here again, contemporary laboratory science confirms and elucidates the liver-protecting attributes of milk thistle, well known to folk medicine for 2000 years.

2. Antioxidant properties in herbs

2.1. Ginger

Scientific name: *Zingiber officinale*; Parts used: Rhizome.

Dosage: 1 ounce of rhizome to 1 pint of water. Boil the water separately, then pour over the plant material and steep for 5 to 20 min, depending on the desired effect. Drink hot or warm, 1 to 2 cups per day.

Currently, Ginger has received new attention as an aid to prevent nausea from motion sickness. Ginger tea has long been an American herbal remedy for coughs and asthma, related to allergy or inflammation. The creation of the soft drink ginger ale, is originated from the common folkloric usage of this herb, and remains a popular beverage for the relief of stomach upset. Externally, ginger is a rubefacient, and has been believed to relief headache and toothache.

The mechanism by which ginger produces anti-inflammatory activity is that of the typical non-steroidal anti-inflammatory drug. This common spice is a more biologically active prostaglandin inhibitor (via cyclo-oxygenase inhibition) than onion and garlic. By slowing associated biochemical pathways an inflammatory reaction is curtailed. In one study, Danish women between the ages of 25 to 65 years consumed either 70 g raw onion or 5 g raw ginger daily for a period of one week. The author measured thromboxane production and discovered that ginger, more clearly than onion, reduced thromboxane production by almost 60%. This confirms the Ayurveda "prescription" for this common spice and its anti-aggregator effects.

By reducing blood platelet "clumping," ginger, onion and garlic may reduce our risk of heart attack or stroke. In a series of experiments with rats, scientists from Japan discovered that extracts of ginger inhibited gastric lesions by up to 97%. The authors concluded that the folkloric usage of ginger in stomachic preparations were effective owing to the constituents zingiberene, the main terpenoid and 6-gingerol, the pungent principle.

In an earlier look at how some of the active components of ginger (and onion) act inside our cells, it was found that the oils of these herbs inhibit the fatty acid oxygenases from platelets, thus decreasing the clumping of these blood cell components.

A 1991 double-blind, randomized crossover trial involved thirty women suffering from hyperemesis gravidarum. Ginger was alternated with a placebo. Seventy percent of the women confirmed they subjectively preferred the period in which they took the ginger. More objective assessment verified the

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