Herbal Sunscreens and Ultraviolet Protectants

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Abstract

Some herbal agents taken orally appear to be able to reduce local and systemic negative effects of excessive ultraviolet (UV) light exposure. What is notable in this category is the well-researched *Phlebodium aureum* (golden serpent fern), frequently referred to in the literature by an old name *Polypodium leucatomos*. Sufficiently high oral doses of *Camellia sinensis* (green tea), as well as topical applications, also appear to be photoprotective.

In addition, *Panax ginseng* (Asian ginseng) may be helpful as a systemic immunomodulator to prevent the harm done by excessive UV light on local and general immune function. What is much less well-established is the potential of the immunomodulating fungus *Cordyceps sinensis* to have this same benefit. Redox modulators such as propolis and proanthocyanidins (from *Pinus maritima* or *Vitis vinifera*) have also shown the ability topically to prevent sunburn and UV-related toxicities.

More research is needed but natural products look promising as photoprotectives. *Note:* The next article related to this topic will discuss herbal photosensitizers, or agents that enhance the therapeutic properties of UV light.

Introduction

Sunburn and chronic excessive ultraviolet (UV) light exposure are common problems, predominantly in people with light skin. Chronic excessive UV-light exposure also causes photoaging. Intermittent sunburn is a strong risk factor for malignant melanoma; particularly in childhood.[1,2] There are data showing that high sun exposure is also associated with causing less-aggressive melanomas that are survived more easily.[3] Existing chemical sunscreens are not particularly effective for preventing melanoma, however, because risk factors besides intermittent sunburn are even more important, the sunscreens do not work, or the sunscreens have toxicities that aggravate disease.[4]

Continuous sun exposure is associated with basal and squamous-cell carcinomas, which are certainly far less lethal than malignant melanomas. Some patients also have conditions that make them more photosensitive, such as systemic lupus erythematosus or idiopathic polymorphic light eruptions.

Natural sunscreens and systemic agents that reduce damage from UV light are of interest for preventing the discomfort or pain of sunburn, reducing photoaging of skin, and reducing the risk of various skin cancers or symptoms of photosensitivity conditions. Safe, effective natural agents might prove more acceptable to a wider range of the population than chemical agents. (See Terminology in UV-Light–Related Medicine).

Golden Serpent Fern

Phlebodium aureum, formerly known as *Polypodium leucatomos* (frequently misspelled as *P. leucotomos*), is commonly referred to as golden serpent fern or, in Spanish, as *calaguala*. It is found as far north as Florida and Georgia but is most prolific in Central and South America. It is epiphytic. An extract of the fronds has been widely studied as an oral supplement for combating the effects of excessive UV exposure. The extract appears to work as an antioxidant and protects DNA and skin compounds from damage.[5] Various simple phenolic and hydroxycinnamic acid compounds appear to be significant in the activity of this fern.[6] In patients with light skin color, 7.5 mg/kg of an extract reduced erythema significantly, and biopsy specimens showed less inflammation and less skin damage that would have been caused by a certain dose of UV light after 24 hours, compared to the same dose of exposure without golden serpent fern extract.[7] Minimal erythemal dose (MED) increased an average of almost 3 times in healthy people with a range of skin types in one clinical trial using oral golden serpent fern.[8]

UV-A phototherapy for vitiligo or psoriasis is common and effective, but can be immunosuppressive and may predispose patients to cancer. Oral intake of golden serpent fern extract reduced the immunosuppressive effects of UV-A phototherapy (psoralen), compared to placebo in a group of 19 patients with vitiligo.[9]

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Terminology in UV-Light–Related Medicine

Minimal erythemal dose (MED)—The minimum amount of UV light necessary to induce sunburn 24 hours after exposure

Photoaging—Damage done to the skin by UV light

SPF—Sun protection factor, degree to which sunscreens block UV-B; note that this says nothing about the ability to block UV-A

UV-A—Long-wave ultraviolet light, 315–400 nm wavelength; large majority of sunlight is made up of this; causes photoaging; indirectly carcinogenic by inducing free-radical formation

UV-B—Medium-wave ultraviolet light; 280–315 nm wavelength; induces erythema; carcinogenic; induces photoaging; induces vitamin D activation

UV, ultraviolet.

In another randomized, double-blinded trial, 50 patients with vitiligo were treated with UV-B phototherapy and golden serpent fern extract 250 mg three times per day or placebo.[10] Repigmentation in the head and neck area was improved just slightly below the threshold for statistical significance (p = 0.06) in the fern group versus the control group, and in a subset of patients who attended at least 80% of their weekly phototherapy sessions for 26 weeks, there was a significant difference.

Golden serpent fern was studied in an open trial of 35 patients with polymorphic light eruptions (PLE).[11] After 2 weeks of golden serpent fern extract, 30% of patients were protected from artificial UV light–induced eruptions, and all other patients did not get eruptions unless they were exposed to higher amounts of UV light. In yet another study, 57 patients with PLE or solar urticaria of unknown origin took golden serpent fern (480 mg per day) and 74% had a reduced severity of photodermatitis.[12]

The data on golden serpent fern extracts look very promising for counteracting negative effects of UV exposure in healthy people wishing to avoid sunburn and in patients with conditions aggravated by the sun. Further research is warranted, but it appears that this herb is safe and effective for clinical use as one of the first oral herbal photoprotectives.

Green Tea

Green tea consists of unoxidized (often incorrectly said to be "unfermented") young leaves of the *Camellia sinensis* bush and is one of the most widely consumed plants in the world. Among its many other beneficial properties, green tea appears to abate negative effects of excessive UV exposure. Topical green tea extract significantly increased the MED of UV on healthy human skin and reduced signs of UV damage on that skin.[13] (-)-Epigallocatechin-3-gallate (EGCG) and (-)-epicatechin-3-gallate (ECG) were the most active components in this study.

Topical application of 10% green tea cream combined with a green tea extract of 300 mg twice daily by mouth improved skin elasticity, compared to placebos in 40 women with moderate photoaging in a double-blinded, randomized trial.[14] In a larger, more rigorous, 2-year trial involving 56 healthy women, taking 250 mg of a green tea polyphenols extract twice daily did not affect photoaging any differently than did placebo.[15] In a cohort of 60 healthy women, drinking a beverage with 1402 mg of green tea polyphenols per day decreased skin damage and photoaging from a 1.25 MED.[16] These results suggest that either the whole herb and/or larger doses should be used to have any chance of efficacy.

A 2%–3% green tea polyphenol concentration was superior to a 4%-5% concentration for preventing UV-B-induced skin damage and immune suppression in healthy volunteers.[17] Topical EGCG photodegrades rapidly (within an hour), so long-term protection may be difficult to achieve.[18] Adding vitamin E actually accelerates EGCG degradation, while the UV-A blocking chemical benzophenone-4 decreases degradation. This suggests titanium dioxide or zinc oxide, both of which block UV-A, may be particularly good agents to combine with topical green tea.

A combination of topical products containing similar polyphenols to those in green tea but coming from *Coffea arabica* (coffee) was also studied. The combination was more effective than placebo for reducing skin photoaging in a 12-week, double-blinded, randomized trial.[19]

Immunomodulators

Chronic and excessive UV exposure exerts some of its negative effects through immunosuppression, both locally and systemically.[20] There is active research on numerous herbs that affect the immune system to offset this problem.

Panax ginseng (Asian ginseng) root is a very well-established immunomodulating herbal medicine. Numerous studies in animal models show that whole-root extracts and isolated saponins protect the body against photoimmunosuppression.[21–23] A combination of Asian red ginseng (steamed, dried roots) extract 45% with *Torilis japonica* (*qie yi*) fruit and *Cornus officinalis* (Asiatic cornelian cherry) fruit extracts 55%, 3 g daily, or placebo was administered to 82 healthy women for 24 weeks.[24] Some, but not all, measures of photoaging and skin inflammation were significantly reduced by the herbal product, compared to controls.

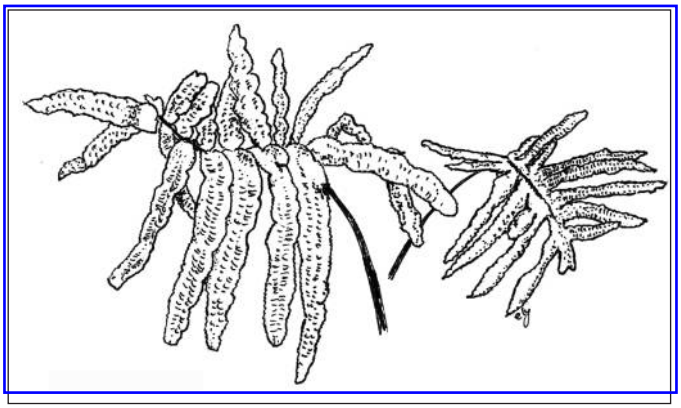
Cordyceps sinensis (cordyceps) is a fungus containing immunomodulatory polysaccharides. Culturing human fibroblasts with cordyceps polysaccharides reduced UV-B-induced DNA damage in vitro.[25] Obviously, this provides far less definitive evidence than the studies on Asian ginseng. Note that only cultivated cordyceps or a sustainably harvested product should be used, as wild populations have been severely overharvested.[26] More research is needed on other immunomodulating herbs to determine their role in preventing photoimmunosuppression and UV-related cancers.

Topical Redox Modulators

Propolis is a combination of plant resins and intermixed compounds collected by bees from plants in their habitats. Among its many actions of relevance to UV-related disease are modulation of redox states to prevent free-radical formation and inflammation-modulating properties.[27] Propolis is highly sustainable and generally quite safe, although there is a small potential for topical sensitization or local irritation with repeated use.

An ethanol extract of raw Italian propolis at a concentration of 16% had a sun-protection factor (SPF) of 20 in one study.[28] Caffeic acid, a compound prevalent in propolis, had an SPF of 20 at just 4% concentration, which is superior to the potency of synthetic sunscreen chemicals such as oxybenzone and octinoxate. Adding 10% titanium dioxide to 4% caffeic acid and 16% propolis extract raised the combination's SPF to 55. Propolis extract and many isolated compounds from it were also effective UV-A blockers based on two different standards of measuring this, unlike most synthetic UV-B blockers, which do not act against UV-A. Other studies provide support to the concept that propolis is photoprotective when applied topically.[29] Mice treated with topical propolis sourced from Sydney, Australia, were protected against sunburn.[30]

Proanthocyanidins are flavonoid oligomers found in numerous plants, but are most well-known in pine bark and grape seeds. These oligomers also act as redox and inflammation modulators and are, thus, ideally suited to be photoprotective. An extract of proanthocyanidins from pine bark at a concentration of 0.05%–0.2% increased MED and greatly limited carcinogenesis caused by repeated UV exposure in mice.[31] Topical application of *Vitis vinifera* (grape)–seed extract to healthy volunteers exposed to 2 MED of UV led to significantly fewer signs of immune damage in the skin, compared to untreated skin.[32] Other data from animal studies support the photoprotective nature of grape-seed extract.[33,34] These are extremely safe and common compounds that are unlikely to have sustainability issues or cause adverse effects. Many other herbal extracts, many of them probably redox modulators, have been reported to counteract photoaging in vitro (Table 1).



Phlebodium aureum (golden serpent fern). Drawing © 2012, by Eric Yarnell, ND, RH (AHG).

Conclusion

Numerous natural products show promise as photoprotective agents. Unlike anything in conventional medicine, there are several herbal products that appear to be active, when taken orally, to prevent sunburn or other local negative effects of excessive UV exposure, and also systemic negative effects. Some agents are also effective topically with good safety profiles, although these have generally not been as well-studied as sys-

Table 1. Sample of Herbs Reported to Prevent Photoaging In Vitro

Clematis spp. (clematis) root, Ranunculaceae	Lee, et al. 2009[a]
Gynura procumbens (velvet plant) leaf, Asteraceae	Kim, et al. 2011[b]
Phyllanthus emblica (amla) fruit, Phyllanthaceae	Majeed, et al. 2011[c]
Polygonum multiflorum (*he shou wu*) root, Polygonaceae	Hwang, et al. 2006[d]
Punica granatum (pomegranate) rind, seed, fruit, Lythraceae	Park, et al. 2010[e]; Pacheco-Palencia, et al. 2008[f]
Quercus robur (oak) leaf, Fagaceae	Almeida, et al. 2008[g]
Rosmarinus officinalis (rosemary) leaf, Lamiaceae	Martin, et al. 2008[h]
Vaccinium uliginosum (bog blueberry) fruit, Ericaceae	Bae, et al. 2009[i]

[a]Lee YR, Noh EM, Kwon KB, et al. Radix clematidis extract inhibits UVB-induced MMP expression by suppressing the NF-kappaB pathway in human dermal fibroblasts. Int J Mol Med 2009;23:679–684; [b]Kim J, Lee CW, Kim EK, et al. Inhibition effect of *Gynura procumbens* extract on UV-B-induced matrix-metalloproteinase expression in human dermal fibroblasts. J Ethnopharmacol 2011;137:427–433; [c]Majeed M, Bhat B, Anand S, et al. Inhibition of UV-induced ROS and collagen damage by *Phyllanthus emblica* extract in normal human dermal fibroblasts. J Cosmet Sci 2011;62:49–56; [d]Hwang IK, Yoo KY, Kim DW, et al. An extract of *Polygonum multiflorum* protects against free radical damage induced by ultraviolet B irradiation of the skin. Braz J Med Biol Res 2006;39:1181–1188; [e]Park HM, Moon E, Kim AJ, et al. Extract of *Punica granatum* inhibits skin photoaging induced by UVB irradiation. Int J Dermatol 2010;49:276–282; [f]Pacheco-Palencia LA, Noratto G, Hingorani L, et al. Protective effects of standardized pomegranate (*Punica granatum* L.) polyphenolic extract in ultraviolet-irradiated human skin fibroblasts. J Agric Food Chem 2008;56:8434–8441; [g]Almeida IF, Fernandes E, Lima JL, et al. Protective effect of *Castanea sativa* and *Quercus robur* leaf extracts against oxygen and nitrogen reactive species. J Photochem Photobiol B 2008;91:87–95; [h]Martin R, Pierrard C, Lejeune F, et al. Photoprotective effect of a water-soluble extract of *Rosmarinus officinalis* L. against UV-induced matrix metalloproteinase-1 in human dermal fibroblasts and reconstructed skin. Eur J Dermatol 2008;18:128–135; [i]Bae JY, Lim SS, Kim SJ, et al. Bog blueberry anthocyanins alleviate photoaging in ultraviolet-B irradiation–induced human dermal fibroblasts. Mol Nutr Food Res 2009;53:726–738.

temic herbal extracts. More thorough and complete research including work on optimal dosing and preparations—with direct comparisons to existing synthetic agents in every case to prove equivalence or superiority in terms of efficacy and safety—are urgently needed. Studies are also needed to determine optimal dose timing to ensure that vitamin D activation is not stopped by natural photoprotective agents, an area of study that has been nearly completely ignored. ■

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