

7 Nutrients to Boost Your Skin's Natural SPF

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STORY AT-A-GLANCE

- › You can support healthy skin and protect it from ultraviolet damage from the inside. Scientists have identified several nutrients that have UV protective activity, reducing your risk of sunburn and related skin damage
- › Astaxanthin, lycopene, beta carotene, vitamins D, E and epigallocatechin gallate (EGCG) have all been shown to help protect your skin against sun damage
- › Astaxanthin specifically helps protect against UV-induced cell death. Unlike topical sun block, astaxanthin does not actually block UV rays, so it doesn't prevent UVB from converting into vitamin D in your skin; it simply protects your skin against damage
- › Lycopene also acts as an internal sunscreen, although it's not nearly as protective as astaxanthin. A 2001 study found tomato paste helped protect fair-skinned individuals with a tendency to burn rather than tan
- › Vitamin E absorbs energy from UV light, thus plays an important role in photoprotection, preventing UV-induced free radical damage to skin

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Summer and sunshine-filled days are upon us and, with that, increased calls for the use of sunscreen. Unfortunately, most sunscreens contain toxic ingredients that are easily absorbed through your skin and can jeopardize your health.

The good news is you can support healthy skin and protect it from ultraviolet damage from the inside. Scientists have identified several nutrients that have UV protective activity which can reduce your risk of sunburn and related skin damage. Here, I'll review the top contenders: astaxanthin, lycopene and beta carotene, vitamins D and E, and epigallocatechin gallate (EGCG).

Astaxanthin – Most Potent Nature-Made Sunscreen

Astaxanthin is one of nature's most potent antioxidants, has been shown to offer significant protection against UV radiation damage by acting as internal sunscreen. It has very strong free radical scavenging activity that protects your cells, organs and body tissues from oxidative damage.

Astaxanthin is produced by the microalgae *Haematococcus pluvialis* when its water supply dries up, forcing it to protect itself from ultraviolet radiation. Astaxanthin is essentially the algae's survival mechanism. It is this "radiation shield" that explains how astaxanthin can protect you from similar radiation, thereby helping prevent skin photo-aging and wrinkles. As noted in a 2010 study:¹

"Repetitive exposure of the skin to UVA radiation elicits sagging more frequently than wrinkling, which is mainly attributed to its biochemical mechanism to up-regulate the expression of matrix-metalloproteinase (MMP)-1 and skin fibroblast elastase (SFE)/neutral endopeptidase (NEP), respectively.

In this study, we examined the effects of a potent antioxidant, astaxanthin (AX), on the induction of MMP-1 and SFE by UVA treatment of cultured human dermal fibroblasts ...

UVA radiation elicited a significant increase in the gene expression of MMP-1 as well as SFE/NEP (to a lesser extent) which was followed by distinct increases in their protein and enzymatic activity levels ...

These findings indicate that, based on different effective concentrations of AX, a major mode of action leading to the inhibition elicited by AX depends on

inhibition of UVA effects of the reactive oxygen species-directed signaling cascade, but not on interruption of the IL-6-mediated signaling cascade. We hypothesize that AX would have a significant benefit on protecting against UVA-induced skin photo-aging such as sagging and wrinkles."

A second paper,² "Cosmetic Benefits of Astaxanthin on Human Subjects" published online in 2012, noted a combination of 6 milligrams taken internally with 2 milliliters per day of topical astaxanthin led to "significant improvements" in skin wrinkling, age spots and skin elasticity, texture and moisture content by week eight.

Astaxanthin Protects Against UV-Induced Cell Death

When it comes to UV radiation protection, astaxanthin specifically helps protect against UV-induced cell death. Unlike topical sun block, astaxanthin does not actually block UV rays, so it doesn't prevent UVB from converting into vitamin D in your skin; it simply protects your skin against damage. This protective effect is so potent studies even show it helps protect against:

- Total body irradiation,³ primarily by scavenging intracellular reactive oxygen species and reducing cell apoptosis (programmed cell death)
- Burn-wound progression, by reducing oxidative stress-induced inflammation and mitochondrial-related apoptosis⁴

Cyanotech Corporation funded a study⁵ through an independent consumer research laboratory to measure the skin's resistance to both UVA and UVB light, before and after astaxanthin supplementation. After taking 4 mg of astaxanthin per day for two weeks, subjects showed a significant increase in the amount of time necessary for UV radiation to redden their skin. According to the authors:⁶

"Results ranged from over 50% more energy needed to burn the skin on some subjects to little or no effect on some subjects. The average of all subjects was approximately 20% more energy, a statistically significant improvement."

Animal studies lend further evidence to astaxanthin's effects as an internal sunscreen. For example, in a 1998 in vitro study⁷ using fibroblasts from rat kidneys, beta-carotene, lutein and astaxanthin were all found to protect against UVA-induced oxidative stress, "with astaxanthin exhibiting superior protective properties."

Another study demonstrated the UV protective properties of other carotenoids: lutein and zeaxanthin. Here, lutein and zeaxanthin were found to provide a fourfold increase in protection when taken internally, and a sixfold increase when used topically as well as internally.^{8,9}

Many athletes report astaxanthin allows them to stay in the sun for longer periods of time without feeling ill and without burning. Less burning also means lower skin cancer risk.

For general skin health and protection against the sun, a daily dose of 4 mg is likely sufficient, although if you're an outdoorsman or athlete who exercises outdoors on a regular basis, you may want to consider a dose between 8 mg and 12 mg/day, at which you'll also start reaping benefits in exercise performance and recovery.

Lycopene and Beta Carotene Also Improve Skin's Natural SPF

Lycopene also acts as an internal sunscreen, although it's not nearly as protective as astaxanthin. A study^{10,11} published in 2001 found tomato paste helped protect fair-skinned individuals with a tendency to burn rather than tan.

Nineteen men and women with fair complexions, blue eyes and light-colored hair were instructed to add either 10 grams of olive oil or a combination of 10 grams of olive oil plus 40 grams of tomato paste (about 5 tablespoons or half a small can) to their daily diet.

Previous work by this research team had shown cooking improves the bioavailability of lycopene in tomatoes;¹² hence the use of tomato paste in this study. The oil further facilitates your body's uptake of the nutrient.

During the 10-week trial, the researchers periodically tested the participants' tolerance to sunlight by irradiating a small patch of skin on their backs with a sun lamp, to see how long it took for reddening (erythema) to occur.

The olive oil only group experienced no change in tolerance over the course of the study, but those who ate oil and tomato paste combo experienced 40% less reddening at the end of the 10 weeks compared to the first four weeks.

According to the authors, "The data demonstrate that it is feasible to achieve protection against UV light-induced erythema by ingestion of a commonly consumed dietary source of lycopene."¹³ Similarly, a 2008 systematic review¹⁴ of feeding studies evaluating the effectiveness of beta carotene for the protection against sunburn concluded that:

"... (1) beta-carotene supplementation protects against sunburn and (2) the study duration had a significant influence on the effected size. Regression plot analysis revealed that protection required a minimum of 10 weeks of supplementation with a mean increase of the protective effect of 0.5 standard deviations with every additional month of supplementation.

Thus, dietary supplementation of humans with beta-carotene provides protection against sunburn in a time-dependent manner."

Vitamin D Lowers Skin Cancer Risk

If you're like most people, you've probably fallen for the misguided advice from most dermatologists and public health officials to stay out of the sun to avoid skin cancer.

Unfortunately, total sun avoidance is inadvisable, as it can actually increase your risk rather than lower it. In a nutshell, the vitamin D your body produces in response to UVB radiation helps protect against melanoma. As noted in one Lancet study:¹⁵

"Paradoxically, outdoor workers have a decreased risk of melanoma compared with indoor workers, suggesting that chronic sunlight exposure can have a protective effect."

Optimizing your vitamin D through sensible sun exposure can also help protect against many internal cancers, the death tolls of which are far greater than melanoma. Vitamin D is also crucial for the prevention of many chronic diseases, and has been shown to be an important criteria for longevity.

For example, a Swedish study¹⁶ published in 2014, which followed 29,518 middle-aged to older women for up to 20 years, found women who avoided sun exposure and tanning beds were twice as likely to die over the course of the study. The researchers attributed this finding to the protective influence of vitamin D. As noted by the authors:

"We found that all-cause mortality was inversely related to sun exposure habits. The mortality rate amongst avoiders of sun exposure was approximately twofold higher compared with the highest sun exposure group, resulting in excess mortality with a population attributable risk of 3%."

The key is to optimize your vitamin D level while avoiding sunburn, as sunburn is the factor that raises your risk of skin cancer (including squamous cell carcinoma, basal cell carcinoma and melanoma). As noted in one 2009 paper on vitamin D synthesis versus cancer development:¹⁷

"Concerning MM [malignant melanoma], numerous epidemiologic investigations analysing solar UV-exposure parameters have consistently reported an association between the development of MM and short-term intense UV-exposure, particularly burning in childhood.

It has been convincingly demonstrated by many investigators, that the incidence of MM increases with decreasing latitude towards the equator. However, in contrast to short-term intense exposure, more chronic less intense exposure has not been found to be a risk factor for the development of MM and in fact has been found in several studies to be protective."

Vitamin E Plays Important Role in Photoprotection

Another vitamin that helps prevent sun-related skin damage is vitamin E, especially when combined with vitamin C.¹⁸ An article¹⁹ on Oregon State University's Micronutrient Information Center website discusses the many functions of vitamin E in skin, noting that "vitamin E can absorb the energy from UV light. Thus, it plays important roles in photoprotection, preventing UV-induced free radical damage to skin."

Food is your best source of vitamin E, since food contains a combination of the eight types of vitamin E. If you're using a supplement, there are key considerations that need to be heeded. Synthetic vitamin E (alpha-tocopherol) is derived from petrochemicals and has known toxic effects.

Natural vitamin E includes a total of eight different compounds, and having a balance of all eight helps optimize its antioxidant functions. These compounds are divided into two groups of molecules as follows:

1. Tocopherols

- a. Alpha
- b. Beta
- c. Gamma
- d. Delta

2. Tocotrienols

- a. Alpha
- b. Beta
- c. Gamma
- d. Delta

Tocopherols are considered the "true" vitamin E, and many claim it's the only kind that has health benefits. Part of the problem with tocotrienols is that they simply haven't received as much scientific attention. In my view, it's safe to assume you would benefit from a balance of all eight and not just one.

Synthetic vitamin E supplements typically include only alpha-tocopherol, and research^{20,21} published in 2012 concluded that synthetic alpha tocopherols found in vitamin E supplements provided no discernible cancer protection while gamma and delta tocopherols found in foods do help prevent colon, lung, breast and prostate cancers. Bear in mind that a supplement will not actually tell you it's synthetic, so you have to know what to look for on the label.

- Synthetic alpha-tocopherol is typically listed with a "dl" (i.e., dl-alpha-tocopherol)
- Nonsynthetic or naturally-derived is typically listed with a "d" (d-alpha-tocopherol). Note that when vitamin E is stabilized by adding either succinic acid or acetic acid, the chemical name changes from tocopherol to tocopheryl (as in d-alpha-tocopheryl succinate, for example)

Vitamin E Recommendations

I strongly recommend avoiding synthetic vitamin E supplements as they've been shown to have toxic effects in higher amounts and/or over the long term. Synthetic vitamin E has also been linked to an increased tumor progression and accelerated lung cancer in mice.²²

So, if you opt for a supplement, make sure you're getting a well-balanced all-natural vitamin E supplement, not a synthetic one. Also look for a supplement that is free of soy, soybean oil derivatives and genetically engineered (GE) ingredients (some of the most common GE ingredients found in supplements are derivatives of corn, soy and cotton seed). And, be sure to take your vitamin E with another antioxidant for it to work optimally.²³

According to the Linus Pauling Institute, severe vitamin E deficiency rarely occurs in humans, even though earlier research indicated that it was highly prevalent.²⁴ Researchers at Linus Pauling said.²⁵

"This contrasts with the data from dietary surveys that suggest vitamin E inadequacy in the US is widespread.

Discrepancies may be due to a number of factors, including underreporting of fat and fat-soluble vitamin intake, inaccuracies in the food composition database that lists nutrient values of foods, and/or lack of correction of circulating vitamin E concentrations to lipid concentrations. Some have questioned whether the nutritional requirement of vitamin E needs to be reevaluated."

According to the National Institutes of Health²⁶ the recommended dietary allowances for vitamin E are:

Age	Males	Females	Pregnancy	Lactation
0–6 months	4 mg	4 mg		
7–12 months	5 mg	5 mg		
1–3 years	6 mg	6 mg		
4–8 years	7 mg	7 mg		
9–13 years	11 mg	11 mg		
14+ years	15 mg	15 mg	15 mg	19 mg

Foods with the highest sources of vitamin E include sunflower seeds, almonds, peanut butter and wheat germ oil. One reason vitamin E, as well as other nutrient deficiencies occur is that most people eat a primarily processed food diet, which tends to be lacking in vitamin E and other important nutrients.

Moreover, following a low-fat diet can have the undesirable side effect of lowering your vitamin E level, as your ability to absorb the vitamin E present in the foods you eat or supplements you take is then impaired. Since vitamin E is fat-soluble, taking it with some healthy fat, such as coconut oil or avocado, will increase its bioavailability.

Green Tea Antioxidant Helps Prevent Genetic Damage in Skin

The antioxidant epigallocatechin gallate (EGCG), found in green tea, has also been shown to prevent genetic damage in skin cells exposed to UV radiation. The study,²⁷ published in The Journal of Nutrition in 2011, found women who drank a beverage with green tea polyphenols (total catechin content 1,402 mg) reduced their risk of sunburn compared to controls. As reported in this study:

"Skin photoprotection, structure, and function were measured at baseline (wk 0), wk 6, and wk 12. Following exposure of the skin areas to 1.25 minimal erythemal dose of radiation from a solar simulator, UV-induced erythema decreased significantly in the intervention group by 16 and 25% after 6 and 12 wk, respectively.

Skin structural characteristics that were positively affected included elasticity, roughness, scaling, density, and water homeostasis ... In summary, green tea polyphenols delivered in a beverage were shown to protect skin against harmful UV radiation and helped to improve overall skin quality of women."

To boost the benefits of green tea further, add a squirt of lemon juice to your cup. Research²⁸ has demonstrated vitamin C significantly increases the amount of tea catechins available for your body to absorb. The addition of 30mg of ascorbic acid (vitamin C) to 250 ml of tea boosted EGCG recovery to 56% to 76%, while normally less than 20% of green tea catechins remain post-digestion.

Another study²⁹ published in 2012 confirmed plant polyphenols in green tea "exhibit significant antioxidant, chemopreventive, and immunomodulatory effects in protecting the skin," noting that:

"UVA radiation is far more abundant (90%) and penetrates much deeper into the epidermis and dermis of the skin. It is weakly absorbed by DNA but reacts with other nonDNA chromophores that lead to the formation of ROS which damage DNA, proteins, and lipids in the skin.

Singlet molecular oxygen produced by UVA targets DNA base guanine producing 8-oxo-7,8-dihydroguanine (8-oxdHG) which is an important marker of oxidative stress ... Additionally, stress signals created by UVR [ultraviolet radiation] trigger protective signaling responses in the cell membrane, nucleus, and mitochondria that lead to cell cycle arrest or apoptosis.

Chronic and excessive UVR exposure overwhelms and depletes these cutaneous defense mechanisms. Therefore, compounds with antioxidant and cell repair potential are promising additions to our sun protection armamentarium ...

Topical application of EGCG in a hydrophilic ointment demonstrated better photoprotective properties versus oral consumption in mice ... Earlier studies using topical and orally consumed GTPP [green tea polyphenols] in mice decreased UVR-induced carcinogenesis, by inhibiting the activity of chemical tumor initiators and promoters ...

Photoaging is caused by chronic UV exposure. In vitro studies using cultured human skin fibroblasts pretreated with GTPP showed a decrease in hydrogen peroxide (H₂O₂)-induced ROS ... As discussed in this paper, GTPPs have important antioxidant, immunomodulatory, and photoprotective functions.

Their ability to modulate critical biochemical functions through topical and oral formulations makes GTPPs a promising candidate for chemoprevention and treatment of disease."

Healthy Skin, Natural Sun Protection Created From Inside Out

One of the most important strategies to radically lower your risk of sunburn will be to decrease the amount of seed oils and processed foods as they contain large amounts of seed oils. These seed oils are loaded with omega-6 fats, specifically linoleic acid (LA). Most people don't realize that sunburn is a result of the UV rays damaging the highly perishable LA that is embedded in the cell membranes of your skin from your diet.

If you have very low LA in your diet your skin cells have much less of this easily damaged fat in the cell membranes of your skin and thus it will not be able to be damaged from the UV in sunlight. However it is important to understand that it takes years of a low LA diet to reduce the LA content in your body as its half life is on the order of years, not a day or two like it is with carbs.

As you can see, there are many ways to improve your skin's ability to withstand the sun's rays, thereby allowing you to get the benefits without adding much risk. As mentioned, the key to preventing skin damage and skin cancer is to avoid burning.

As soon as your skin starts turning the lightest shade of pink (which will be relative, depending on your base skin color), it's time to get out of the sun or put on protective clothing. A wide-brimmed hat to protect your face is advisable at all times. A majority of your vitamin D production comes from exposing large areas of your body – not your face.

Topping the list of nutrients that protect your skin from sun damage is astaxanthin. Taking somewhere between 4 mg and 12 mg daily can allow you to spend far more time outdoors without risking a sunburn. Just remember – it will take a few weeks before the effects become apparent, so start early.

That said, optimizing your vitamin D and taking natural vitamin E can further add to your body's natural sun protection, as can drinking green tea or taking an ECGC supplement.

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