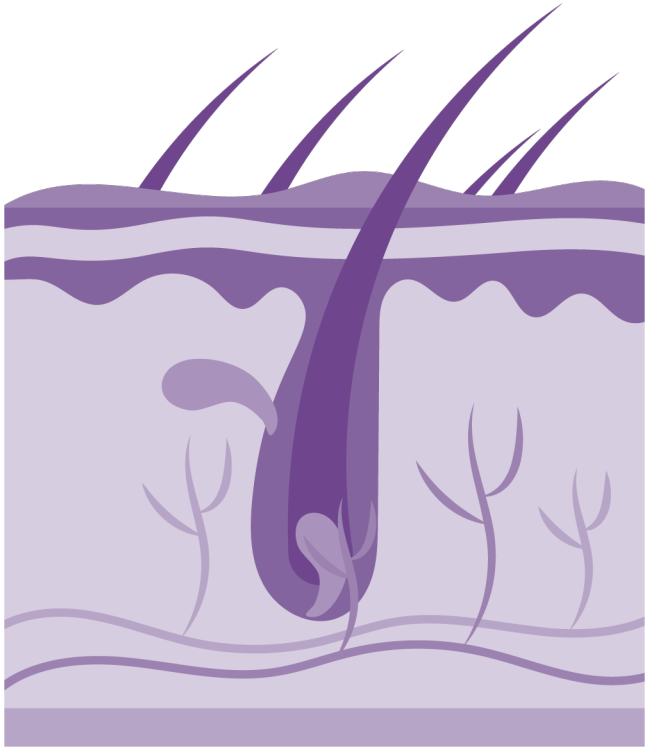
Examine®

Skin, Hair & Nails Supplement Guide



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Introduction

Few sales pitches will get people reaching for their wallets faster than promising that "this will make you more attractive". We all want to look our best, as shown by the billions of dollars we collectively spend each year on the vast array of products that tout ingredients to preserve and improve the appearance of skin, hair, and nails. Most of those are topical, but some can be taken orally, and in this guide we'll be looking at both types.

Like the world of supplements, the world of cosmetics is a bit like the Wild West — there are very few rules, and everyone is trying to make a quick buck. Beware of misleading claims: a skincare product might proudly state it has been "dermatologist-tested", but what does this mean really? Just that a dermatologist tested the product in some unspecified way. What it does *not* mean is that the product was shown to have any cosmetic benefit whatsoever.

But wait! This product also states that its purpose is to, let's say, reduce wrinkles. Here again, however, the product states only one thing: its purpose. There's no guarantee of its *efficacy* for this purpose. Wrinkles, dry hair, and brittle nails can be symptoms of a health condition, but they are not considered health conditions in themselves; this helps explain why, in the US, cosmetics are regulated more like supplements than like drugs. The FDA regulates the legality of the ingredients and the accuracy of the labels — but doesn't evaluate efficacy.

One unique aspect of aesthetic health, though, is that you sometimes need only a mirror to see whether a product works. With most areas of health, you have to rely on laboratory tests; or you might try to judge how you *feel* after taking the product for a while, in which case the truth gets obscured by the placebo effect and faulty memory. But if a facial moisturizer failed to moisturize or a hair conditioner to condition, they probably wouldn't be sold for very long.

However, while a mirror may be enough to assess short-term changes in some areas, to track long-term changes you should take pictures (under the same conditions; lighting, notably, can make a big difference). And even then, it can be hard to be sure if a product is working or not, because anti-aging products claim to *slow down* apparent aging; none claims to be able keep you looking twenty until you reach your hundredth birthday.

But then, what can you do? Spend hundreds of dollars a year on products that may or may not make you look better than you would have without them?

This is where science comes in: it can allow us to evaluate different health aspects of skin, hair, and nails using clinical trials, and how those factors are affected by various products.

Your skin

At a cellular level, your skin has three main enemies: DNA damage and dysfunction, oxidative stress, and inflammation leading to damage to, breakdown of, and improper folding of proteins. As we'll see in this guide, it is plausible that some nutrients and other bioactive components in foods could delay skin aging by playing an antioxidant, anti-inflammatory, or structural role.

Aging skin is characterized by altered pigmentation and a decrease in thickness, moisture, and elasticity.[1][2][3] This decrease results in creasing and the formation of permanent wrinkles.

The two main extrinsic causes of skin degradation are photoaging (caused by UV radiation from the

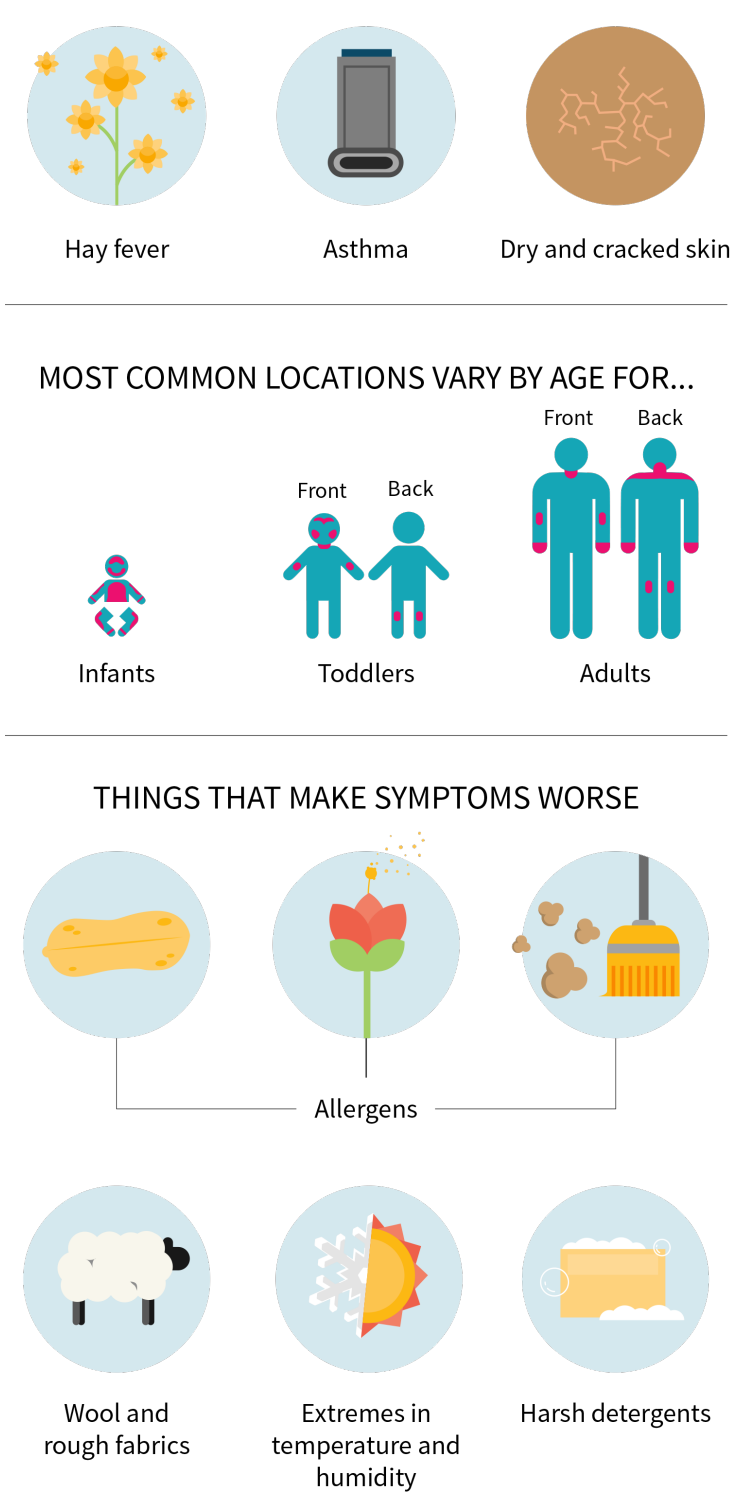
sun[1][2][3] or tanning beds) and smoking, but air pollution is also a plausible factor.[3][4][5] Of course, even if you lived in an air-filtered, sunproof bubble, you'd still get some wrinkles eventually, due to your body's natural breakdown with age. The pull of gravity may also play a role, over years, but this topic is still debated.[6]

As we said, science can allow us to evaluate different health aspects of our skin. By employing imaging technology to measure small differences in skin health, researchers can track small changes to the skin over several months (and thus assess the efficacy of a product). Wrinkles, notably, can be measured in various ways: depth, area, volume, and other less common measurements.[7]

To assess the skin's function, researchers frequently measure the skin's rate of water loss: *transepidermal water loss* (TEWL) provides important information about the integrity of the skin barrier.[8] To measure skin moisture at different points in time, researchers usually measure the skin's conductance (its ability to conduct electricity) or capacitance (its ability to hold an electric charge). Of the instruments used for this purpose, the corneometer is perhaps the most popular.[9][10]

Unfortunately, aging isn't the only enemy. The skin is also commonly afflicted by conditions characterized by lesions with various causes and characteristics. The most common of those conditions is acne. Alas, experts still don't agree on a method or a scale for assessing acne severity.[11] Still, counting the number of lesions may at least provide useful information.

Another common skin condition is atopic dermatitis, a type of eczema that affects many children and a growing number of adults.[12] In atopic dermatitis, the skin barrier is compromised and the skin is dry, itchy, and inflamed — which leads to unsightly red patches.



Reference: Weidinger and Novak. *Lancet*. 2016.[13]

Researchers have designed different scales to assess the severity of atopic dermatitis and other types of eczema, as well as of other skin conditions such as rosacea and psoriasis.[14][15]

🔍 ***Digging Deeper:*** **Grading eczema**

To grade the severity of eczema, researchers use scoring scales, such as the Scoring Atopic Dermatitis (SCORAD) index and Eczema Area and Severity Index (EASI).

SCORAD combines information on the extent (A), intensity (B), and subjective symptoms (C) of the disease.

To determine *extent*, the sites affected by eczema are shaded on a drawing of the body to calculate the affected area as a percentage of the whole body. The maximum score is 100%.

To determine *intensity*, a representative area is selected and six signs of inflammation — redness, dryness, swelling, oozing/crusting, lichenification (skin thickening), and scratch marks — are assessed on a three-point scale, giving a maximum score of 18 points.

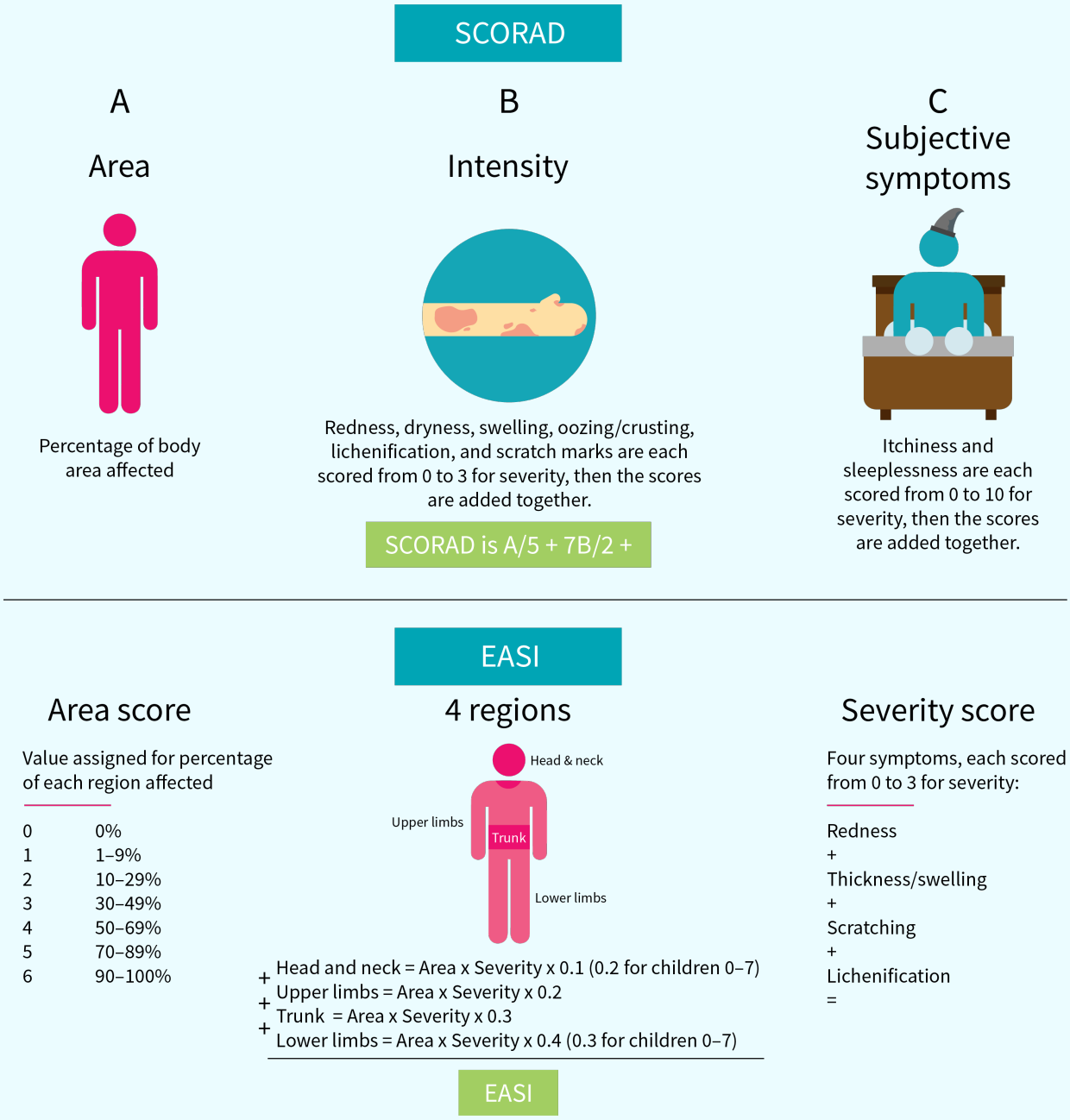
Subjective symptoms include itchiness and sleeplessness, both of which are rated on a ten-point scale and combined for a maximum score of 20 points.

The SCORAD score is calculated as A/5 + 7B/2 + C. A score of <25 is mild, 25–50 is moderate, and >50 is severe.[16]

EASI, as the name indicates, is simpler: it only takes into account the percentage of the body covered by atopic dermatitis and the physical severity of the symptoms. EASI scores range from 0 to 72.

How SCORAD and EASI are calculated

Figure 2: Eczema severity scoring tools: SCORAD and EASI



References: European Task Force on Atopic Dermatitis. *Dermatology*. 1993.[17] Hanifin et al. Exp Dermatol. 2001.[18]

In the case of lesions and disrupted skin barrier, certain bacteria may exacerbate or even initiate a skin condition.[19][20][21] This is another area where food and supplements may be of use, since the proper function of the immune system depends notably on nutrients.

Your hair

Your hair and skin are very different, to be sure, but since hair follicles are embedded in the skin, your skin (particularly your dermal papillae, whose blood vessels nourish hair follicles) plays a vital role in the health of your hair.

The foremost hair issue is alopecia (better known as *hair loss*), and the most common type of alopecia is androgenetic/androgenic alopecia (commonly known as male-pattern baldness, even though it can also affect women). It is characterized by the miniaturization of hair follicles and a shift toward *vellus hair* (thin and short hair found more commonly prior to puberty) and away from *terminal hair* (adult-stage hair).[22]

Androgenetic alopecia has a strong genetic component and is related to androgens (hence the name), but inflammation also plays a prominent role and may be affected by dietary and lifestyle factors. There's a plausible role for various vitamins and minerals in the prevention of hair loss, and the consumption of a dietary pattern close to the nutrient-rich Mediterranean diet has been associated with less hair loss.[23][24]

Alopecia areata is another form of hair loss. It involves severe inflammation and is especially hard on the psyche. With androgenetic alopecia, hair thins and recedes slowly, so that people have time to come to terms with it; in males past a certain age, it is even seen as natural, if undesirable. Alopecia areata, on the other hand, is an autoimmune disorder that strikes fast and looks unnatural: the immune system attacks and destroys healthy hair follicles, causing not only hair thinning but also small yet obvious bald spots, apparently randomly placed on the scalp.[25]

Even non-hair-related autoimmune diseases, such as lupus, can lead to hair loss.[26] This isn't surprising since, as we mentioned, androgenetic alopecia itself has a subclinical inflammatory component. Relatedly, smoking is one of the biggest causes of excessive inflammation and oxidative stress in the body, and both cigarette smoke and nicotine have been observed to cause hair loss in mice.[27][28] However, although smokers do appear more likely to have androgenetic alopecia than non-smokers, the association isn't entirely consistent and evidence isn't strong yet.[29][30][31][32][33][34][35] Obesity has also been found to be more common in people with androgenetic alopecia,[36][37][38][39][40][41][42][43][44][45][46][47][48] and while here again the research isn't entirely consistent, it does suggest that obesity, another common cause of excessive inflammation, can precipitate or worsen androgenetic alopecia.[31][49][50][51][52][53]

Aside from hair loss, there are two main hair issues: breakage and graying.

To measure breakage, researchers have been known to get inventive. One particular method involves a standardized tool that pulls out a small amount of hair (ouch?). The fewer hairs get pulled out, the stronger your hair. Other methods such as simply measuring the number of natural breaks on your scalp are less invasive, though possibly confounded by hat-wearing.

Another hair issue that many people wish they could do more about is graying. A common trope in popular culture and everyday life is that people can worry themselves gray. While this isn't a well-understood subject, a mouse study found that stress can indeed lead to hair graying through activation of the sympathetic nervous system and resultant depletion of melanocyte stem cells responsible for pigmentation.[54] It is plausible that oxidative stress (which is, under certain limits, a normal aspect of your body's metabolism) could play a part as well, but more research is needed.

Your nails

Most oral supplements touted for their hair benefits also claim to benefit your nails. This association is due to keratin (a fibrous protein) being the key structural component of both. Unfortunately, studies that actually looked at the effect of supplementation on nails are scarce.

The bottom line

So to recap: maintaining a healthy weight, getting enough nutrients, reducing stress, and not smoking can help your skin and hair (and probably nails) look their best. Wait … that's basic health advice that everyone should be following anyway. Yes, it is probable that one of the many benefits of healthy living is that it makes you better looking! That's convenient, and for some people might even be a greater motivation than life extension.

Still, for those of us who are playing catch-up or want to optimize, the basics may not be enough, and supplements and topical products can help. But which to choose? This guide doesn't review branded products but rather ingredients. If you know that a given ingredient is effective and innocuous at a certain dose, you can look for products that contain (enough but not too much of) this ingredient.

Beware, though: an ingredient may have been shown to be effective when swallowed but not when applied to the skin, and vice versa. Collagen, for instance, is easily digestible, but you can't replenish the collagen *in* your skin by applying collagen *to* your skin.

Another pitfall is that supplements and cosmetics often use "proprietary blends" to hide how much of each ingredient you're getting. A skin-care product might advertise that it contains *HYALURONIC ACID* (in big, bold letters), when in fact it contains so little as to be meaningless.

So to be safe, seek out brands whose websites provide detailed ingredient information. On a product's label, look for ingredients that have been shown to work in this dose, form, and delivery method.

Wyatt Brown, researcher

Combos

Core Combo

For days when your *sun exposure is less than 2 hours*, apply a broad-spectrum sunscreen or moisturizer with sunscreen that has an SPF of at least 30 in the morning to exposed skin. If you have acne or oily skin, select an oil-free sunscreen.

For days when your *sun exposure is 2 hours or greater*, use a broad-spectrum sunscreen with an SPF of at least 30. If you burn easily, at least 40.

Apply 30–90 mL (1–3 fl. oz.) to exposed skin to ensure adequate coverage. If you will be in the sun longer than 2 hours, reapply at least every 2 hours. More frequent applications are needed if you have been swimming or sweating. An SPF of 70+ may be more optimal for people who burn easily or forget to reapply consistently. If using a sunscreen spray, rub it in to even out the application.

> 💡 ***Tip:*** **Try one combo alone for a few weeks**
>
> Taking too many supplements at once may prevent you from determining which ones are truly working. Start with just one of the combos suggested here for a couple of weeks before you consider making any modification, such as adding another supplement, altering a supplements dosage, or incorporating the supplements from an additional combo.
>
> When adding another supplement to your regimen, be methodical. For example, you may wish to take all the supplements from two combos. Select the combo that you wish to try first and take this for a couple of weeks. Then, add one supplement from the second combo and wait another week to see how it affects you. Continue this process until you've added all the supplements you wish to.
>
> If a supplement appears in two combos you wish to combine, don't stack the doses; instead, combine the ranges. For instance, if the range is 2–4 mg in one combo and 3–6 mg in the other, your new range becomes 2–6 mg. Always start with the lower end of the range — especially in this case, since the reason why one of the ranges has a lower ceiling in one combo may be due to a synergy with another supplement in the same combo. Reading through the full supplement entry may help you decide which dose to aim for, but if you're not sure, lower is usually safer.

Specialized Combos

For people seeking protection from the sun

In addition to using a broad-spectrum sunscreen, take 7.5 mg of *Polypodium leucotomos* per kilogram of body weight per day (3.4 mg/lb/day).

P. leucotomos does not have to be taken daily to benefit from its UV-protective effects. Consume one dose 24-hours prior to sun exposure and a second the day of, at least 2 hours prior to sun exposure. If your

sun exposure is prolonged, you may wish to take a third dose 1–2 hours after the second. Remember that *P. leucotomos* can help protect your skin but is *not potent enough to replace your sunscreen*.

For people who want to improve their facial skin appearance

At night, apply a thin coat of a retinoic acid topical solution after gently washing your face with mild soap and completely patting it dry. Apply once daily, every other day, or every third day, as tolerated.

Additionally, take 320 mg of cocoa flavanols per day. If you see no results after 6 weeks, try 600 mg/day. To obtain these levels, consume one of the following.

- Cocoa powder (dried, unfermented): 6 to 12 g/day
- Dark chocolate (70% or higher): 25 to 50 g/day

In people with acne or a history of acne, chocolate (but not concentrated cocoa flavanols) may exacerbate outbreaks.

For people with dry skin

Ensure that your core option is a moisturizer that contains a broad-spectrum sunscreen with an SPF of at least 30. In the morning, apply it to sun-exposed skin. If you have acne, select an oil-free moisturizer.

Additionally, you can apply unrefined coconut oil to the affected area(s) once or twice daily for at least 2 weeks. If you see no improvements after 4 weeks of daily use, consider seeking other options.

If you use a moisturizing sunscreen in the morning, you can apply unrefined coconut oil in the evening.

For people with acne

Ensure that your core option is an oil-free sunscreen or moisturizer-sunscreen combination.

At night, apply a thin coat of a retinoic acid topical solution after gently washing your face with mild soap and completely patting it dry. Apply once daily, every other day, or every third day, as tolerated.

Alternatively, apply 4% nicotinamide gel twice daily, alone or in combination with 1% clindamycin gel. If no visible improvements are seen after 8 weeks, consider seeking other treatment options.

Do not use topical retinoids in combination with topical nicotinamide without talking to your physician or dermatologist first.

For people seeking to reduce their skin cancer risk

In addition to using a broad-spectrum sunscreen, take 7.5 mg of *Polypodium leucotomos* per kilogram of body weight (3.4 mg/lb/day).

P. leucotomos does not have to be taken daily to benefit from its UV-protective effects. Consume one

dose 24 hours prior to sun exposure and a second the day of, at least 2 hours prior to sun exposure. If your sun exposure is prolonged, you may wish to take a third dose 1–2 hours after the second. Remember that *P. leucotomos* can help protect your skin but is *not potent enough to replace your sunscreen*.

In clinical trials, the dosage tested was 500 mg of oral nicotinamide taken twice daily with or without food.

If you are at high risk for developing non-melanoma skin cancers (NMSCs) or actinic keratoses (people with multiple prior cases of NMSCs or in chronically immunosuppressed kidney transplant recipients), nicotinamide has been tested in clinical trials as a potential preventative measure. In these trials, the dosage tested was 500 mg of oral nicotinamide taken twice daily with or without food. *Speak with your physician, dermatologist, or skin cancer specialist before beginning this treatment.*

For people with androgenic alopecia

Apply a 5% minoxidil formulation once or twice daily or a 2% minoxidil formulation twice daily to a dry scalp. Do not apply the formulation within one hour of washing your hair.

For people with plaque psoriasis

Speak with your physician or dermatologist before beginning this treatment.

At night, apply a thin coat of topical tazarotene, covering only the psoriatic lesions, after gently washing your face with mild soap and completely patting it dry. Apply once daily, every other day, or every third day, as tolerated.

Wash your hands after applying. If you use any moisturizers, apply them 1 hour before applying tazarotene. Tazarotene commonly comes in 0.05 and 0.1% concentrations. Beginning with 0.05% may be prudent to minimize skin irritation. If the 0.05% is well tolerated, 0.1% may be used.

Primary Supplements

Sunscreen (for skin appearance & UV protection)

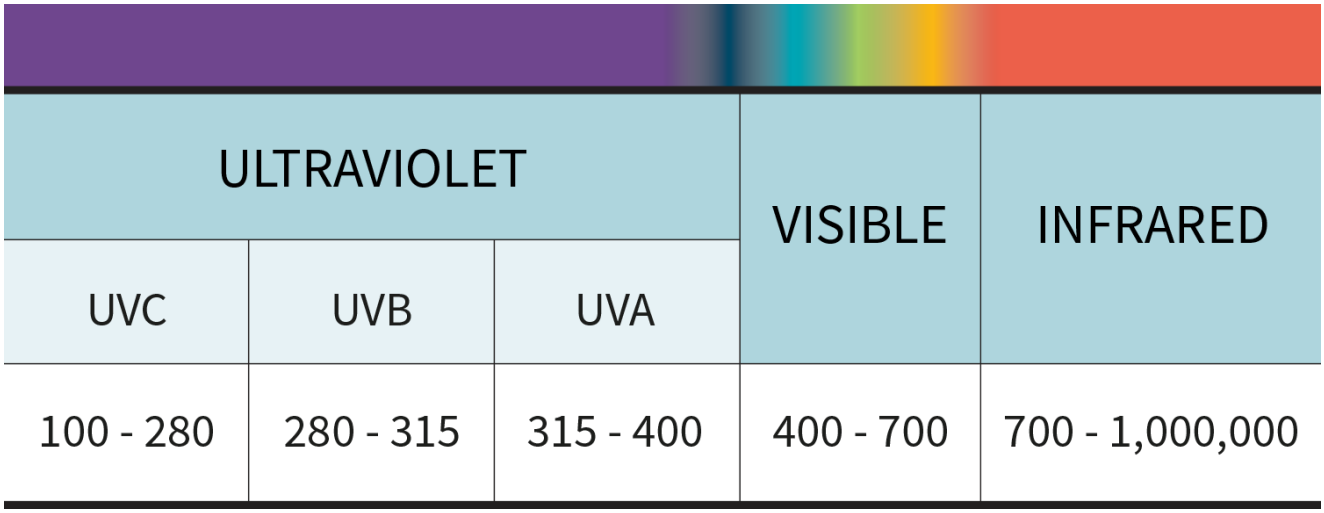
What makes *sunscreen* a primary option

Sunscreen can mitigate photoaging (i.e., sun-induced aging of the skin) and reduce the risk of skin cancer.

SOLAR RADIATION

Solar radiation can promote skin aging and skin cancer. Especially dangerous is the ultraviolet (UV) spectrum,[55][4][56][57] whose wavelength is shorter than that of visible light but longer than that of X-rays.

Sun radiation wavelengths in nanometers



- *Visible light and infrared radiation* may contribute to skin aging more than once thought, but how much more is still being researched.[4]
- *UVA* rays account for 95% of UV rays reaching Earth's surface. They're likely the main external cause of skin aging.[56] Like UVB rays, though to a lesser extent, they can cause sunburn and DNA damage which increase the risk of skin cancer.
- *UVB* rays account for 5% of UV rays reaching Earth's surface. They're the main cause of sunburn[55] and DNA damage, and one of the main causes of skin cancer. They contribute to skin aging, though to a lesser extent than UVA rays.
- *UVC* rays are filtered out by Earth's atmosphere; they don't reach its surface.

UV rays hit hardest during the summer, at high elevations, and between 10 a.m. and 4 p.m. worldwide.[58] Their effects on both cancer risk and skin aging accumulate with time,[55][57] so you'll benefit from using sunscreen consistently over the years, especially if your Fitzpatrick skin type/number (see below) is low (1–3).

Fitzpatrick skin type scale

SKIN TYPE		WITHOUT SUNSCREEN				MED* (mJ/cm^2)	
		Do you ...		How is your skin after ...			
		Burn?	Tan?	24 Hours?	7 Days?	UVA	UVB
	1	Always	Never	Painful	Untanned	20–35	15–30
	2	Readily	Minimally	Tender	Lightly tanned	30–45	25–40
	3	Moderately	Moderately	Sensitive	Moderately tanned	40–55	30–50
	4	Minimally	Easily	Unburnt	Deeply tanned	50–80	40–60
	5	Rarely			Darker	70–100	60–90
	6	Hardly ever			Unchanged	100	90–150

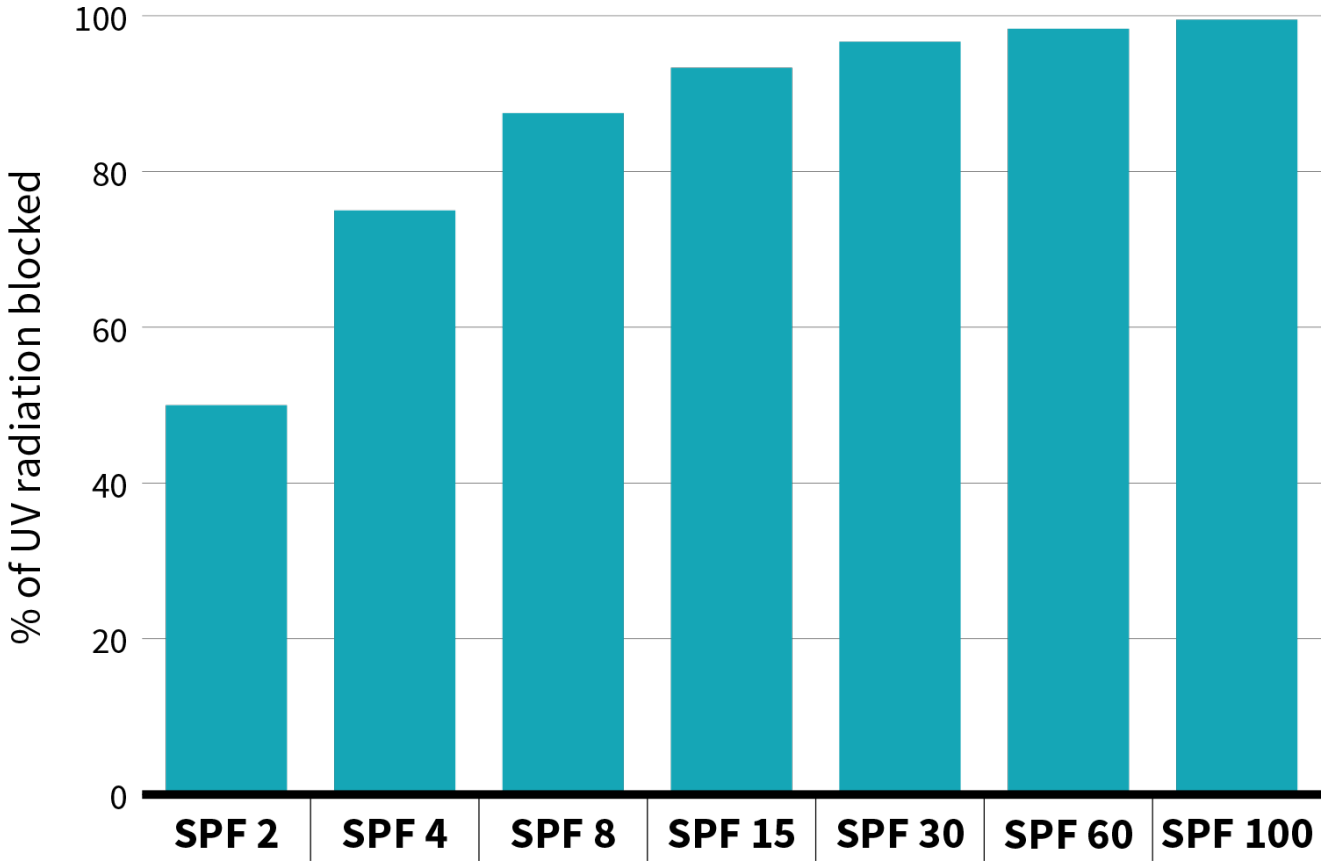
* The MED (minimal erythema dose) is defined here as the least amount of UV *radiation* that causes sunburn 24–48 hours after exposure. *References:* Labban et al. *Saudi Dent J.* 2017.[59] ● Eilers et al. *JAMA Dermatol.* 2013.[60] ● D'Orazio et al. *Int J Mol Sci.* 2013.[61] ● Heckman et al. *J Vis Exp.* 2013.[62] ● Matts et al. *Br J Dermatol.* 2007.[63] ● Astner and Anderson. *J Invest Dermatol.* 2004.[64] ● Fitzpatrick. *Arch Dermatol.* 1988.[65]

SUN PROTECTION FACTOR (SPF)

SPF is not a direct indication of how long the sunscreen will remain effective once applied. Rather, it is a measure of how well it'll protect you.[66] If your sunscreen is rated SPF 30, for instance, your skin will need 30 times more UV exposure to visibly darken (a very mild sunburn), compared with using no sunscreen.[66]

The SPF number, therefore, is inversely related to the percentage of UV radiation that penetrates your skin: SPF 15 will allow about twice as much UV radiation to reach your skin as will SPF 30 (6.67% vs. 3.33%).[67] Importantly, no sunscreen blocks 100% of UV rays (although SPF 100 gets close in lab tests).

Relationship between SPF number and percentage of blocked UV rays



Adapted from Schalka and Silva dos Reis. *An Bras Dermatol.* 2011.[68]

This inverse relationship between UV exposure and SPF holds true only under ideal laboratory testing conditions. In the real world, it'll be influenced by a host of factors: latitude, altitude, season, time of day, reflective surfaces, sweat rate, rate of UV radiation from the sun, cloud cover, amount of sunscreen applied, reapplication frequency, how quickly the UV filters in a product start to break down, and distribution of these filters in the product and on the skin.[67][69][68]

CHEMICAL UV BARRIERS

Some chemicals can block UVA, UVB, or both. Technically, "sunscreen" refers to *organic* chemical barriers, whereas "sunblock" refers to *physical* chemical barriers.[55] But the terms are commonly used interchangeably ("sunscreen" is more popular), and products can combine both barriers.

Physical chemical barriers (aka inorganic chemical barriers or mineral sunscreens) function by reflecting and dissipating UV rays. In the European Union, Canada, and the United States, the only two approved physical barriers are zinc oxide and titanium dioxide.

Organic chemical barriers function by absorbing and dissipating UV rays. They can be made with cinnamates, salicylates, benzophenones, dibenzoylmethanes, or derivatives of *para-aminobenzoic acid* (PABA), among other organic compounds. Approved organic barriers differ by country.

Warnings about *sunscreen*

First of all, be aware that while proper and regular use of sunscreen can reduce the risk of skin cancer, it does not completely eliminate risk.

Benzophenones and dibenzoylmethanes are both potential skin allergens (may cause allergic reactions

when in contact with the skin) and photo-allergens (photo-allergens aren't inherently allergenic but can cause skin allergies when exposed to light or UV rays).[70][71] PABA is a potential skin allergen and irritant[72][73] but seldom used anymore. People with a history of skin allergies or sensitivities may want to select a product without those components, which are usually listed on labels as:

Benzophenones

- Oxybenzone (benzophenone-3)
- Sulisobenzone (benzophenone-4)

Dibenzoylmethanes

- 4-isopropyl-dibenzoylmethane
- 4-tert-butyl-4'-methoxydibenzoylmethane
- Avobenzone (butyl methoxydibenzoylmethane, Parsol 1789)

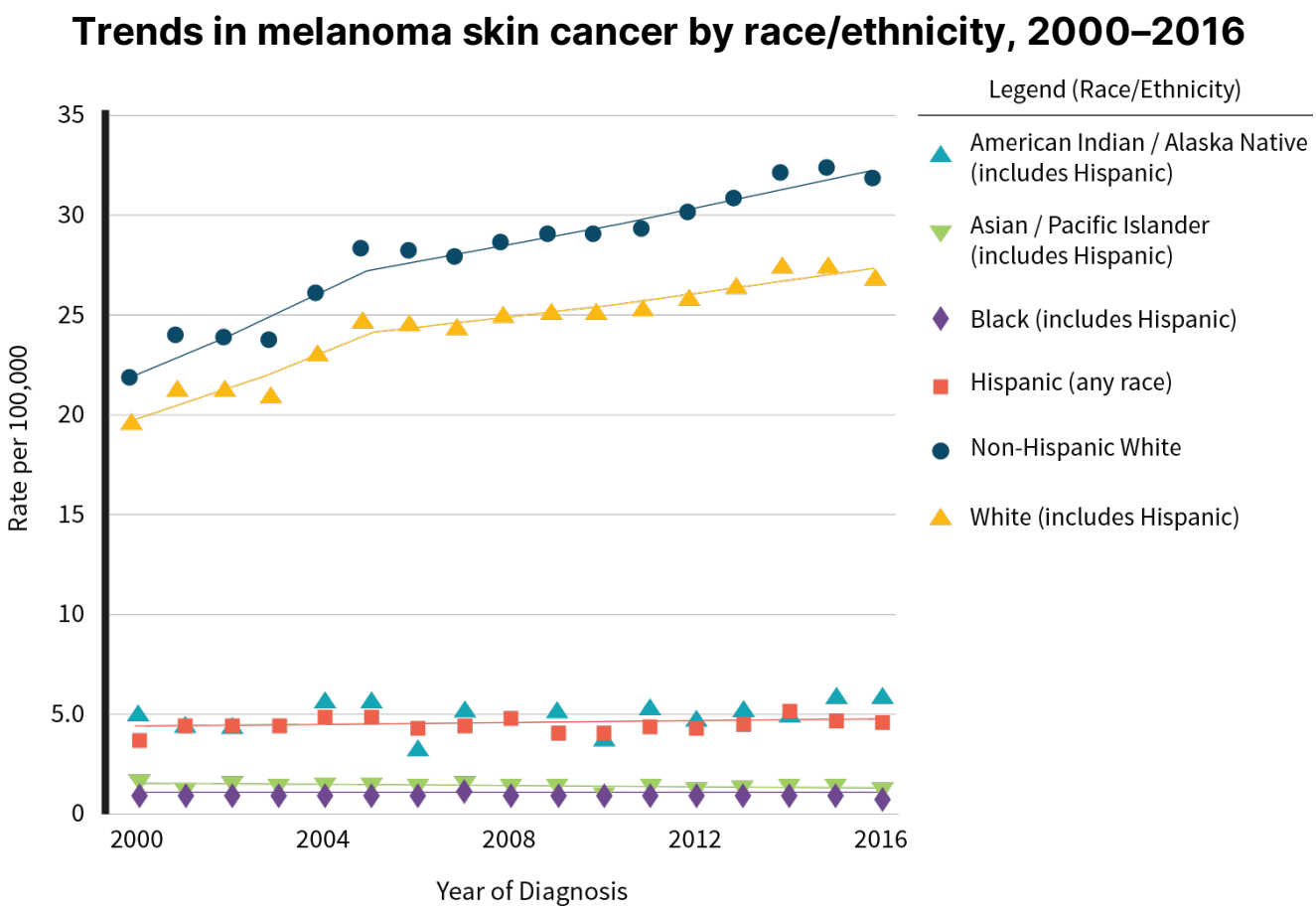
PABA and its derivatives

- 4-Aminobenzoic acid
- Padimate-O (octyl dimethyl PABA)
- Para-aminobenzoic acid

Physical barriers may be the safer choice for infants, children, and people with sensitive skin or skin conditions, such as rosacea, dermatitis, or acne.[74] Water-based sunscreens might be better than oil-based sunscreens for people with acne or oily skin.

In those with high Fitzpatrick numbers (5 and 6), sunscreen will provide some additional protection against developing melanomas,[75][76] but much less so than those with lower Fitzpatrick skin types. This is largely due to more heavily pigmented skin already providing a measure of natural UV protection, so we see a lower rate of melanoma in these populations. It is a myth that people of color do not get skin cancer; it's just that skin cancers in them tend to show up in different places: palms of the hands, soles of the feet, underneath finger- and toenails, inner surface of the mouth, and genitals.[77]

Sunscreen use in these populations can still provide benefits by preventing sunburns, protecting against premature skin aging, and reducing the occurrence of new freckles and wrinkles.



Adapted from SEER Explorer. NIH SEER Program. Last updated April 15, 2019; accessed October 29, 2019

How to use *sunscreen*

Sunscreen is often not used optimally.[78][79][80][81] For maximal benefits, follow these four steps.

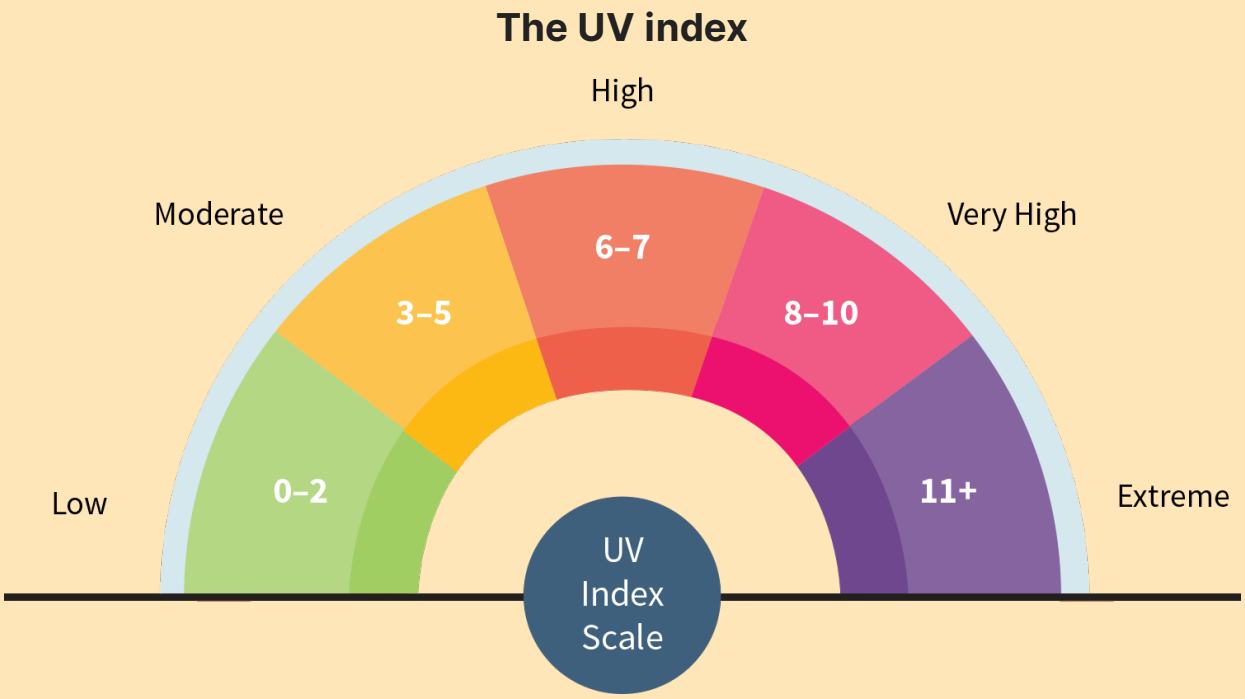
1. Use a broad-spectrum sunscreen.
2. Select an appropriate SPF.
3. Apply the right amount.
4. Reapply at least every 2 hours.

Select a broad-spectrum (UVA + UVB) sunscreen with a *sun protection factor* (SPF) of 30, at minimum, or 40 if you burn easily. Apply it 15–30 minutes before sun exposure — even on cloudy days, since clouds don't entirely block UV rays. They can even _raise _UVB levels on partly cloudy days. On days with clear skies, UVB rays that hit the earth's surface can be easily reflected back into space. On partly cloudy days, the clouds block their escape and reflect the rays back towards earth, creating a "ping pong" effect .[82] Reflective or light-colored surfaces can also increase UV intensity (e.g., snow, water, sand, light concrete).

💡 ***Tip:*** **When should I wear sunscreen?**

To know if you should use sunscreen, check the UV index forecast in your area. When the UV index is 3 or higher, people with Fitzpatrick skin types 1 or 2 should keep unprotected sun exposure to less than 10 minutes; skin types 3 or 4, less than 15 minutes; and skin types 5 or 6, less than 30 minutes.[83][84]

If you plan to exceed these exposure limits, be sure to apply sunscreen and use extra protection as needed (e.g., hat, clothing, sunglasses, umbrella).



Reference: EPA.gov

However high the SPF, you should reapply your sunscreen at least every 2 hours during sun exposure (more frequently if you have been swimming or sweating). If you have a Fitzpatrick skin type of 1 or 2, choose a sunscreen of SPF 40 or higher, as this additional protection can add up over time.[78][85][86] If you often forget to reapply sunscreen, go with an SPF of 70 or higher, as this can offer some additional protection.[78][85]

Using a higher SPF is not a substitute for reapplying every 2 hours during sun exposure. The higher SPF is intended to provide some additional protection *in case* you happen to forget to reapply. Some countries don't allow sunscreens to be labeled higher than SPF 50, instead opting to label them simply as "SPF 50+". Select one of these if this is the case where you live.

How well a sunscreen will protect you also depends on how much you apply.[69][78][87] At least 2 milligrams of sunscreen per square centimeter (mg/cm^2) of sun-exposed skin has been recommended,[88] so use 30–90 mL (1–3 fl. oz.) total, depending on your height and amount of exposed skin. (One ounce or 30 mL is roughly the amount in one shot glass filled to the top.) When in doubt, you'll be safer applying a little too much than not enough.

Under ideal conditions, increases in the SPF protection number will proportionally decrease the amount of UV radiation that reaches your skin (as explained in the Sun Protection Factor section). But if you apply less

than the recommended amount, this relationship falls apart under real-world conditions. Applying half of what is needed would provide you not with 50% of the stated SPF protection but rather ≈30% or less.[89][90][91]

In the United States, sunscreens labeled "water-resistant" or "sweat-resistant" can remain effective for 40–80 minutes of swimming or sweating (the label should specify the duration). There is no such thing as a waterproof or sweatproof sunscreen, and even water- and sweat-resistant sunscreens should be reapplied regularly.

A lotion or cream may ensure better coverage than a spray. If you use a spray, avoid inhaling it, applying it directly to your face (spray it on your hands and then apply to your face), or using it near an open flame. Rub it in to even out the application.

Physical barriers (zinc oxide and titanium dioxide) are more prone to leaving a white film on your skin, but this effect is greatly reduced if the formulation is micronized.

People with Fitzpatrick skin types 1–3 can benefit from additional sun-protective behaviors, such as seeking shade and wearing protective clothing (i.e., sleeves, long pants, or a hat).[92] People with Fitzpatrick skin types 4–6 can still benefit from these additional measures, but to a lesser extent.[92]

For *days of low sun exposure* (less than 2 hours total), apply a broad-spectrum sunscreen of SPF 30 or higher to areas of exposed skin. Reapplication is not necessary.

For *days of high sun exposure* (more than 2 hours total), apply a broad-spectrum sunscreen of SPF 30 or higher to areas of exposed skin. Reapply at least every two hours.

Store your sunscreen at room temperature, as prolonged exposure to heat can decrease its shelf life. When outdoors, keep your sunscreen out of direct sunlight. In the United States, the Food and Drug Administration (FDA) requires that all sunscreens retain their stated efficacy for 3 years from the date of manufacture.

> 💡 ***Tip:*** **Why don't you recommend brands or specific products?**
>
> For two reasons:
>
> - We don't test physical products. What our researchers do — all day, every day — is analyze peer-reviewed studies on supplements and nutrition.
> - We go to great lengths to protect our integrity. As you've probably noticed, we don't sell supplements, or even show ads from supplement companies, even though either option would generate a lot more money than our Supplement Guides ever will — and for a lot less work, too.
>
> If we recommended any brands or specific products, our integrity would be called into question, so … we can't do it. That being said, in the interest of keeping you safe, we drew a short list of steps you should take if a product has caught your interest.

Secondary Supplements

Minoxidil (for hair loss)

What makes *minoxidil* a secondary option

Topical minoxidil is an effective way to slow, stop, or partially reverse the form of hair loss known as androgenetic alopecia, commonly referred to as male- or female-pattern baldness.

Prevalence of androgenetic alopecia

POPULATION	MALE	FEMALE
African	14.6%	3.5%
Caucasian	80.0%	40.0–50.0%
Chinese	21.3%	3.5%
Indian	58.0%	—
Korean	14.1%	5.6%

References: Dhariwala and Ravikumar. *J Cosmet Dermatol*. 2019.[93] ● Shankar et al. *Int J Trichology*. 2009.[94]

Research on topical minoxidil (sold notably under the name Rogaine®) began in the 1970s.[95] Today, this over-the-counter medication is one of the most effective and safest treatments for androgenetic alopecia (balding) in both males and females.[96][97][98][99] It is most effective in the early stages of hair loss and in people with smaller bald patches,[100] but people with more advanced hair loss can also benefit. Although it has mostly been studied in people with androgenetic alopecia, it may also work in people with different underlying causes of hair loss.

Hair regrowth may take a few months to become visible and up to a year to peak.[99] If you stop treatment, you will resume balding[99] and quickly lose the hair you had preserved.

Minoxidil has been tested in combination with many other therapies, including the vitamin A compound tretinoin (in isolation or in the same solution),[101][102] extracts of *Curcuma aeruginosa* (in the same solution),[103] pyrithione zinc (in a separate shampoo),[104] and Korean red ginseng (as an oral supplement).[105] None of these combinations have shown universally superior results over minoxidil alone, but some may be more effective in certain cases. Research is promising, but more is needed.

There is preliminary evidence that the following combinations might be superior to minoxidil alone.

- Solution: 12.5% minoxidil, 5% azelaic acid, 0.025% betamethasone valerate[106]
- Solution: 3% minoxidil, 0.25% finasteride[107]
- Microemulsion: 5% minoxidil, 0.5% diclofenac, 5% tea tree oil[108]
- 2% minoxidil solution, 2% ketoconazole shampoo, 1 mg oral finasteride[109]
- 5% minoxidil solution, microneedling[110]
- 5% minoxidil solution, microneedling, injections of platelet-rich plasma[111]

Warnings about *minoxidil*

If you are unsure what is causing your hair loss, consult a physician or physician specialist certified with the American and International Board of Hair Restoration Surgery (ABHRS) before using minoxidil. Do not use minoxidil if you are breastfeeding, pregnant, or planning to become pregnant.[99]

Topical minoxidil should not be confused with oral minoxidil, which is traditionally used to treat hypertension (high blood pressure). Topical minoxidil seldom affects blood pressure. If your scalp gets sore, itchy, inflamed, or very dry, propylene glycol (an ingredient common in minoxidil *liquid* solutions but absent from *foam* formulations) is a likely culprit,[99][112] but it is _possible _for those symptoms to mean you are absorbing enough minoxidil to affect your blood pressure. If you experience scalp irritation, squamation (scaly skin), or dermatitis (a rash);[97] get dizzy or lightheaded; or experience chest pains or irregular heartbeats, cease treatment immediately. People with cardiovascular conditions should be especially attuned to those symptoms.

When topical minoxidil is paired with the oral drug cyclosporine (Gengraf, Neoral, Sandimmune), used to prevent organ transplant rejection and treat rheumatoid arthritis and psoriasis, it may increase hypertrichosis (excessive growth of body hair).

How to take *minoxidil*

Minoxidil is readily available as 2% and 5% formulations. Twice-daily applications of a 5% solution appear to be moderately more effective than twice-daily applications of a 2% solution.[113] People with sensitive skin may prefer a foam to a solution, as foams may be less irritating.[114]

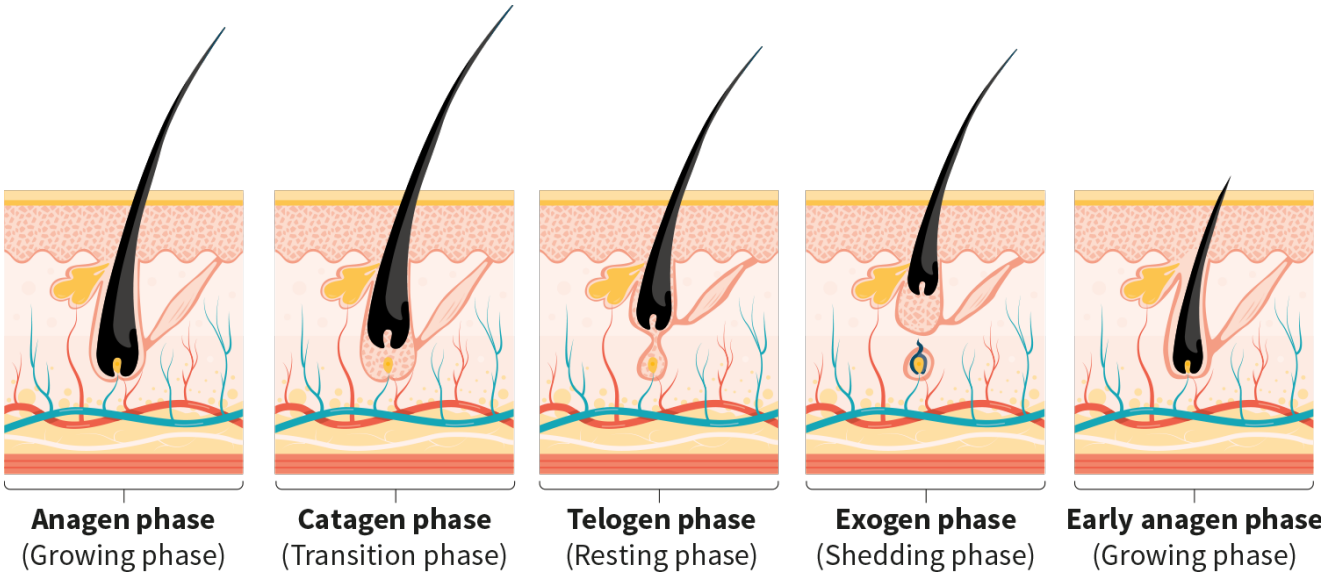
- If you choose a 5% formulation, apply it once or twice daily.
- If you choose a 2% formulation, apply it twice daily.

Apply the formulation to a dry scalp. Do not apply it within one hour of washing your hair. *It is critical that the minoxidil formulation reach the scalp to be effective.* For this reason, people with long hair may wish to use a solution, as a foam may not reach the scalp as easily. Additionally, some minoxidil products come with applicator tips that help ensure the formulation can get past the hair and reach the scalp.

A potential side effect of minoxidil is hypertrichosis (excessive growth of body hair).[99][115] This is more likely to occur on your face and the back of your hands, where minoxidil accidentally gets transferred. After applying minoxidil, wash your hands and wait two hours before going to bed (to avoid transferring some minoxidil to your pillow).

Within the first 2 to 8 weeks of treatment, you may experience increased hair loss,^ ^after which your hair will begin to regrow.[99] If the hair loss persists after 8 weeks, consider consulting a general practitioner or physician specialist certified with the ABHRS, or try using the higher 5% formulation if you're using 2%. If you see no improvement (hair regrowth or reduced hair loss) after consistent use for 6 months, you may want to consider ceasing treatment and seeking other options, as you may be a minoxidil nonresponder.[99][116]

Hair growth cycle



Reference: Ulrike Blume-Peytavi et al. *Biology of the Hair Follicle* (chapter 1 in *Hair Growth and Disorders*. Springer, Berlin, Heidelberg. 2008.[117]

It is not uncommon for people experiencing hair loss to use a multi-treatment approach. If minoxidil does not yield the results you were hoping for, consult a general practitioner or ABHRS-certified physician about other treatment options.

Lastly, store the medicine at room temperature in a dry place and limit its exposure to heat and sunlight.

Vitamin A (for acne & skin appearance)

What makes *retinoids* a secondary option

Topical retinoids are an effective treatment and preventive measure for mild to severe acne and mild to moderate skin photoaging (i.e., wrinkles, uneven skin pigmentation, and decreased skin elasticity accelerated by UV exposure).

Vitamin A is a catch-all term for a number of related compounds. Retinol is one of the most abundant types of vitamin A[118] and can convert into biologically active (e.g., retinal and retinoic acids) or inactive (e.g., retinyl esters[119]) forms.

Retinoids can generally be divided into four groups: retin*yl* esters, retin*ols*, retin*als*, and retin*oic* acids. The legal status of different topical retinoids varies among countries. Retinyl esters, retinol, and retinals are less potent than retinoic acids. Thus, products containing these forms are commonly available in over-the-counter products; those containing retinoic acids tend to be more regulated. For example, in the United States isotretinoin not only requires a prescription, but is also strictly regulated and tracked by the FDA.

Topical retinoid categories

Retinyl esters (_least potent_)	Retinols	Retinals	Retinoic acids (_most potent_)

Retinyl esters (_least potent_)	Retinols	Retinals	Retinoic acids (_most potent_)
Retinyl acetate Retinyl linoleate Retinyl oleate Retinyl palmitate Retinyl propionate Retinyl retinoate Retinyl stearate	Retinol	Retinal Retinaldehyde	Adapalene Isotretinoin Tazarotene Tretinoin

ACNE

Topical retinoids are a first-line treatment option for inflammatory and noninflammatory mild to severe acne.[120][121][122][123] Retinoids can be used as a solo treatment but are typically used in tandem with other therapies, particularly in cases of moderate to severe acne.[120][121][122][123] As an added bonus, retinoids can also reduce acne-induced scarring and uneven skin pigmentation, which can appear on the skin as the acne lesions heal.[124]

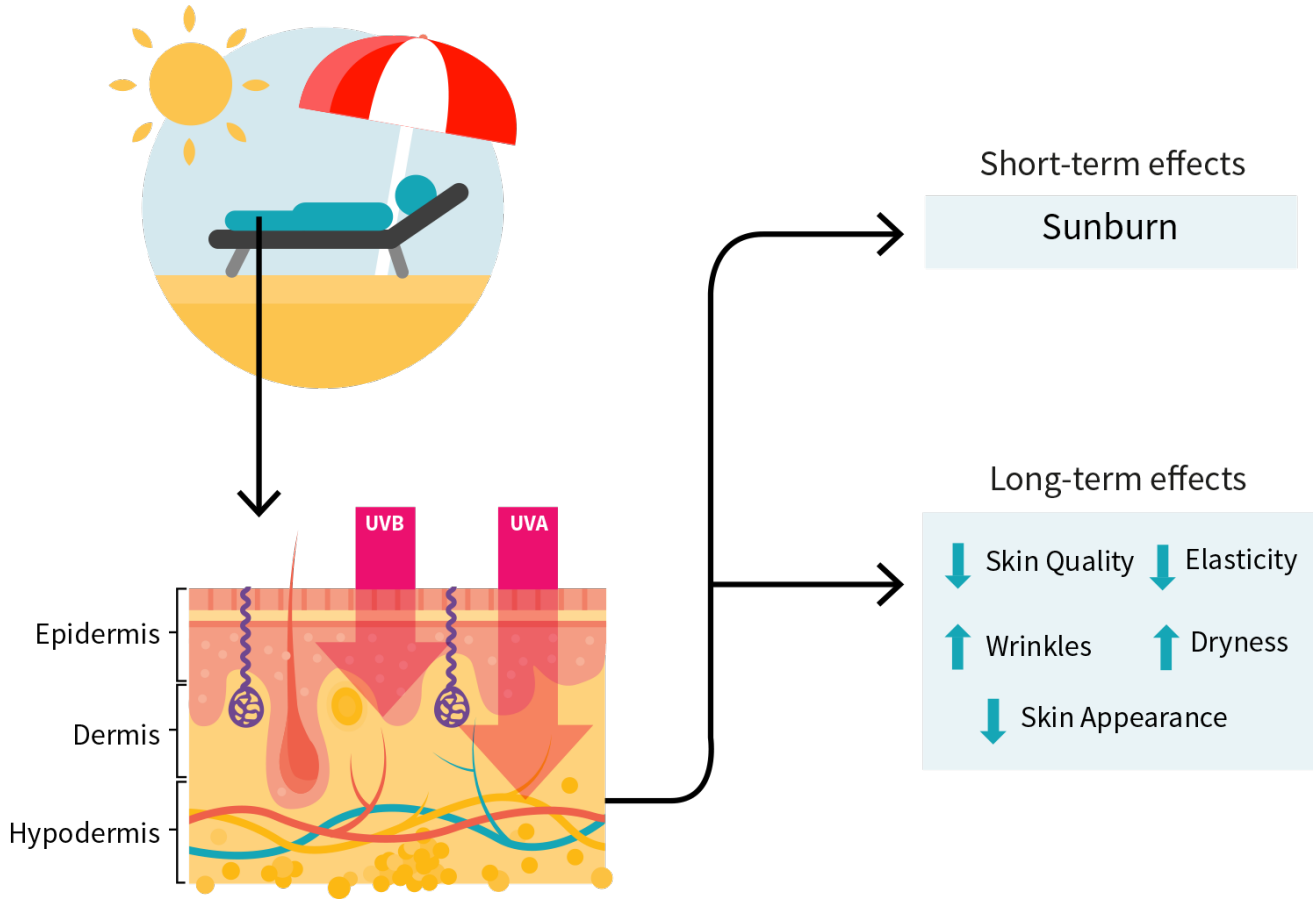
Adapalene, isotretinoin, tazarotene, and tretinoin are the most effective retinoid treatment options.[125][126] All of these work in a dose-dependent manner, with higher concentrations having greater efficacy.[124] However, higher concentrations are prone to producing more unwanted side effects.[127] Of the retinoic acid treatments, adapalene (both 0.1 and 0.3%) is generally better tolerated, producing fewer side effects.[127][128]

There have been far fewer studies examining the effects of retinyl esters, retinol, retinal, and retinaldehyde on acne. To be more effective, these substrates must be converted into the most active form: retinoic acid.[129] While these conversions can take place when applied to the skin, much higher concentrations must be applied to achieve the same effect as a lower-concentration retinoic acid. For example, retinol has been speculated to be 10 to 20 times less effective than the retinoic acid tretinoin, and the skin concentrations of retinoic acid were 1,000-fold less than when tretinoin was applied topically.[130][131]

SKIN PHOTOAGING

Photoaging is primarily driven by repeated, prolonged, and unprotected exposure to UV radiation.[56][57] People who are more susceptible to photoaging include smokers, males, people who receive a large amount of daily sun exposure, and people with Fitzpatrick skin types 1–3.[132] People with types 4–6 generally experience a later onset of photoaging, with less severe manifestations.[133]

Effects of ultraviolet A and B rays (UVA/UVB) on skin health



Reference: Krutmann et al. *J Dermatol Sci.* 2017.[4]

Isotretinoin, tazarotene, and tretinoin are the most well-studied topical retinoids showing the best efficacy for treating photoaged skin.[134] Although potentially less effective, adapalene is possibly a viable treatment as well, but further studies are needed.[135][136]

There are fewer studies looking at the effects of retinyl esters, retinol, retinal, and retinaldehyde on photoaged skin. The retinyl esters that have been studied have not been shown to be effective.[137] Retinol does perform better than placebo,[138][139] but there is insufficient data to say if it works as well as retinoic acids (although it does show promise as a co-treatment[140]). Retinaldehyde has shown the greatest promise as a treatment for photoaged skin, with some studies reporting effects comparable to retinoic acids, but more long-term studies are needed.[141]

Warnings about *retinoids*

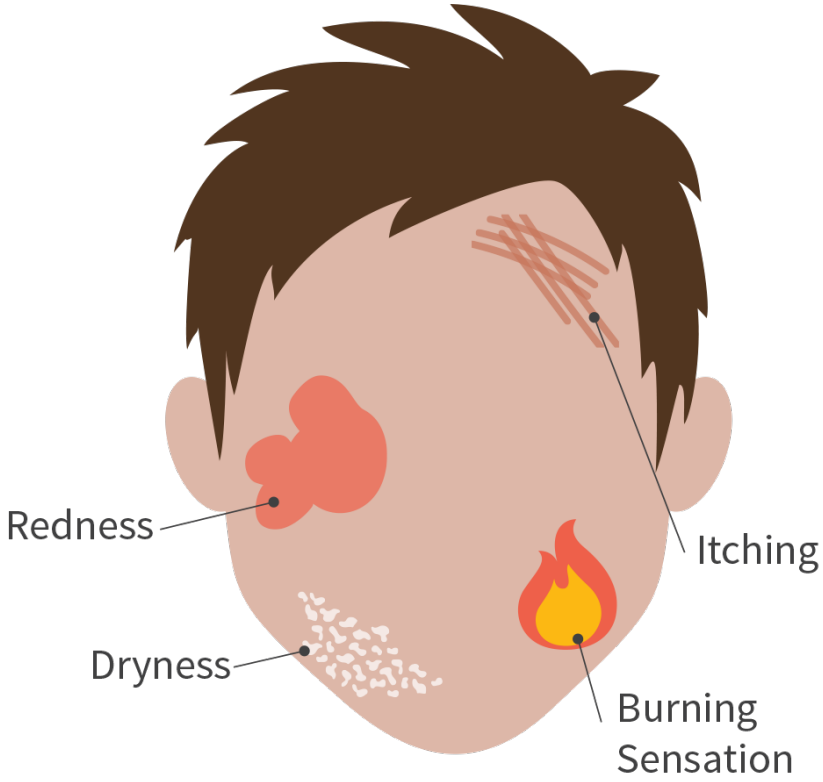
High doses of oral retinoids have been linked to severe birth defects, and although intermittent *topical* retinoid use has not, there are not enough data to conclude if regular use is safe for females who are breastfeeding, pregnant, or planning to become pregnant.[142][143] *Topical retinoids should not be used during these times.*

Retinoids work in a dose-dependent manner: the higher the retinoid concentration, the more effective the treatment.[124] But these higher concentrations also increase the chances of skin irritation (e.g., dryness, redness, scaling, peeling, itching, sun sensitivity, and swelling).[127] If any of these occur, try one or a combination of the following.

- Reduce the application frequency (switch from daily to every other or every third day).
- Reduce the amount (aim for a pea-sized dose on the forehead, each cheek, and chin).
- Apply the retinoid to the intended treatment area. After 30–60 minutes, wash it off with mild soap.
- After washing and drying your face, apply an oil-free moisturizer. Wait 20 to 30 minutes and then apply the treatment.
- Minimize unprotected sun exposure.

For all topical retinoids, skin irritation usually disappears within 2–4 weeks.[127] Discontinue use and consult your physician or dermatologist if skin irritation is severe or persists for 6 weeks or longer.

Common side effects of topical retinoid applications



Most side effects were seen with extended and daily applications but were mostly mild in severity.

Even though some products, such as adapalene, are photostable (i.e., they don't degrade or cause skin irritation when exposed to UV rays), it's best to apply retinoid treatments at night to reduce the risk of skin irritation and maximize their efficacy. Daily morning application of an oil-free moisturizer may aid in reducing adverse treatment effects.[144] An oil-free moisturizer containing broad-spectrum sunscreen with an SPF of at least 30 may provide additional benefits; those with physical sunscreening agents, such as zinc oxide or titanium dioxide, may be better tolerated.

If you are planning to use topical retinoids in combination with other topical treatments (e.g., products that contain azelaic acid, benzoyl peroxide, clindamycin, dapsone, erythromycin, glycolic acid, kojic acid, salicylic acid, sulfacetamide, or vitamin C (L-ascorbic acid)), discuss these options with your physician or dermatologist beforehand. Combining treatments may cause undue skin irritation or damage or alter treatment efficacy.

If you get any retinoids in your mouth, nose, or eyes, rinse thoroughly with water. If you miss a dose, do not "double up" during the next application. Continue your application schedule as usual.

People with fish allergies might want to avoid Atralin^® ^(a micronized tretinoin gel), because it contains

fish proteins.

How to take *retinoids*

While there have been many head-to-head trials of different retinoic acids, concentrations in these studies have varied widely.[128][145][146][147][148][149][150] So it cannot be conclusively stated that one retinoic acid treatment is entirely superior to another. It is possible that choosing an appropriate concentration is more important than the type.[144]

When deciding which retinoid product to use, go with the most potent concentration you can tolerate that produces the least skin irritation. This may take some trial-and-error testing, but a good approach is to begin with the lowest concentration of the retinoid you choose.[151] Products using "gel microspheres" or "micronized" formulations to deliver retinoids to the skin's surface are less likely to cause skin irritation.[152][153][154][155][156][157]

Retinoids can be used as a preventive treatment, so you should apply them to the entire area you intend to treat and not just as a spot treatment for individually affected segments. For example, for facial acne, apply to the entire face and not just to individual acne lesions.

It may take up to 8 weeks to see visible improvements for acne; for photoaged skin, up to 6 months.

For treating *acne*, gently wash the affected areas with mild soap and completely pat dry. Wait 20 to 30 minutes and then apply a thin coat to the treatment areas in the evening once daily, every other day, or every third day, as tolerated. Wash your hands after applying. Select one of the following retinoids:

- Adapalene (0.1–0.3%)
- Isotretinoin (0.05–0.1%)
- Tazarotene (0.05–0.1%)
- Tretinoin (0.01–0.1%)

Adapalene may be the best option to start with for people with mild to moderate acne, as it tends to be tolerated better than other retinoic acids and is commonly available over the counter.[127][128] For people with more severe acne, isotretinoin, tazarotene, or tretinoin in combination with antimicrobials or antibiotics may be warranted.[144] These combination options should be discussed with a physician or dermatologist.

Retinaldehyde topical treatments might be effective against acne, although their effects are less studied. If you opt for a retinaldehyde treatment, select a product with a high concentration (≥0.1%).

For treating *photoaged skin*, gently wash the affected areas with mild soap and completely pat dry. Wait 20 to 30 minutes and then apply a thin coat to the treatment areas in the evening once daily, every other day, or every third day, as tolerated. Wash your hands after applying. Select one of the following retinoids:

- Isotretinoin (0.05–0.1%)
- Tazarotene (0.05–0.1%)
- Tretinoin (0.025–0.1%)

Tretinoin may be the best option to start with, as it offers the lowest retinoic acid concentration and a greater variety of standardized concentrations (0.025%, 0.0375%, 0.05%, and 0.1%) if you want to try various doses. Tretinoin does come in a 0.01% concentration, but this has not been shown to be effective for photoaged skin.

Adapalene (0.1–0.3%) may also be a viable treatment option, but there is less evidence in this area, and the

effects may not be as potent as those of isotretinoin, tazarotene, or tretinoin.

Retinaldehyde topical treatments might be effective for treating photoaged skin, although their effects are less studied. If you opt for retinaldehyde, select a product with a high concentration (≥0.1%).

For treating both *acne and photoaged skin*, follow the application instructions above and select one of the following retinoids:

- Isotretinoin (0.05–0.1%)
- Tazarotene (0.05–0.1%)
- Tretinoin (0.025–0.1%)

Promising Supplements

Cocoa Extract (for skin appearance & UV protection)

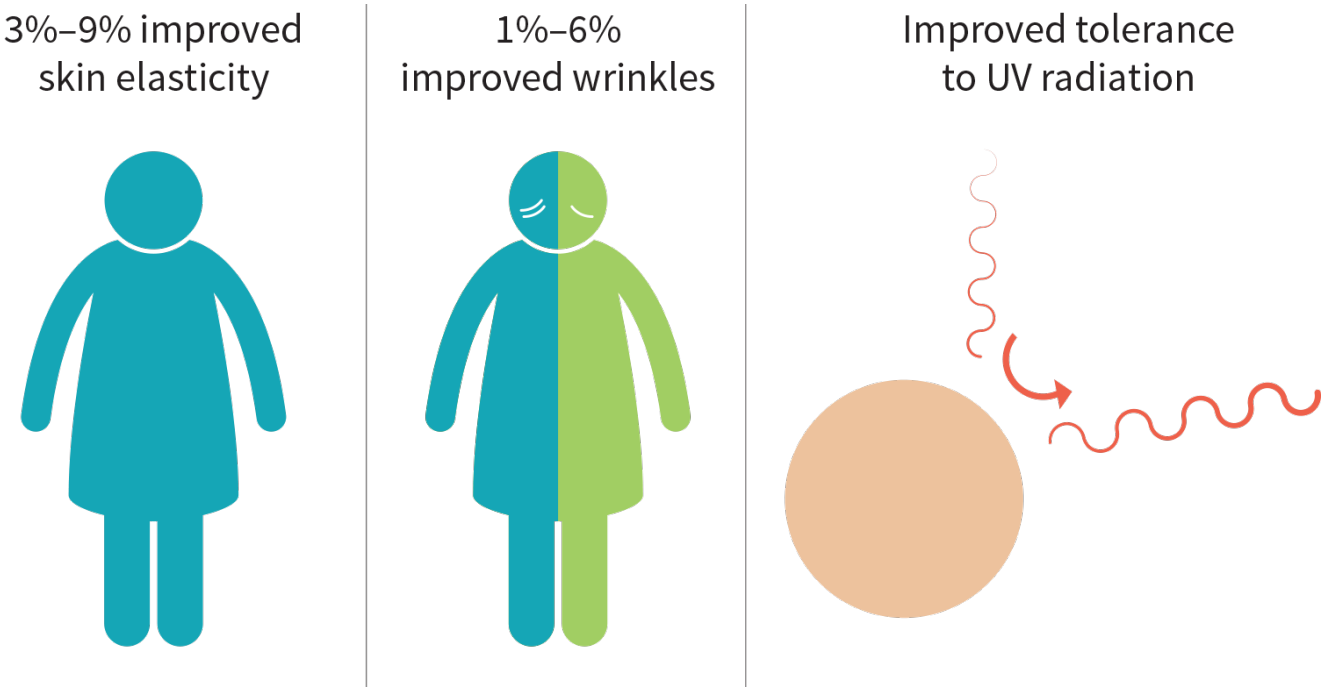
What makes *cocoa extract* a promising option

Cocoa might reduce wrinkles and protect from UV rays, but it might also worsen acne.

Studies on the effects of oral and topical cocoa flavanols on facial skin have mostly been conducted in older females with pale skin (Fitzpatrick skin types 1 or 2).

Two randomized controlled trial (RCTs), lasting 3 and 6 months, saw small reductions in skin *roughness* and *wrinkles* from 320 mg of flavanols (from high-flavanol cocoa powder taken once a day).[158][159] Two studies saw improvements in skin *elasticity* from 320–600 mg of daily flavanols (from chocolate or high-flavanol cocoa powder).[158][160] Cocoa's effects on skin *hydration* are inconsistent.[158][159][160] The effects on facial wrinkles, roughness, and elasticity can take up to 3 months to visibly manifest. Oral cocoa flavanols appear to prevent wrinkles better than they reduce existing ones.

Main effects of 6 months of flavanol supplementation on skin



Reference: Yoon et al. *J Nutr.* 2016.[158]

One 5-week study testing a topical gel with 10% cocoa flavanols saw some reduction in wrinkles by week 3 and a greater reduction by week 5 (12% overall reduction compared with placebo gel).[161] It also reported increases in skin hydration. This study, however, has yet to be replicated.

RCTs on UV protection have used 320–600 mg of daily flavanols (from high-flavanol cocoa powder or

chocolate). The participants, almost all females with pale skin (Fitzpatrick skin types 2 or 3), saw a modest improvement in their skin's ability to resist UV-induced damage in as little as 6 weeks of supplementation.[158][159][162] One trial saw no difference between the cocoa group and the placebo group, but the results may have been confounded by a placebo that contained enough flavanols to significantly raise blood levels, the cocoa group possibly getting more sun (the placebo group finished the study in the spring; the cocoa group, in late spring or early summer), and participants dropping out or not following protocol.[160]

Warnings about *cocoa extract*

Cocoa flavanols should never be used to replace sunscreen. The compounds in cocoa are not potent enough to deliver the same UV protection that a broad-spectrum sunscreen will.

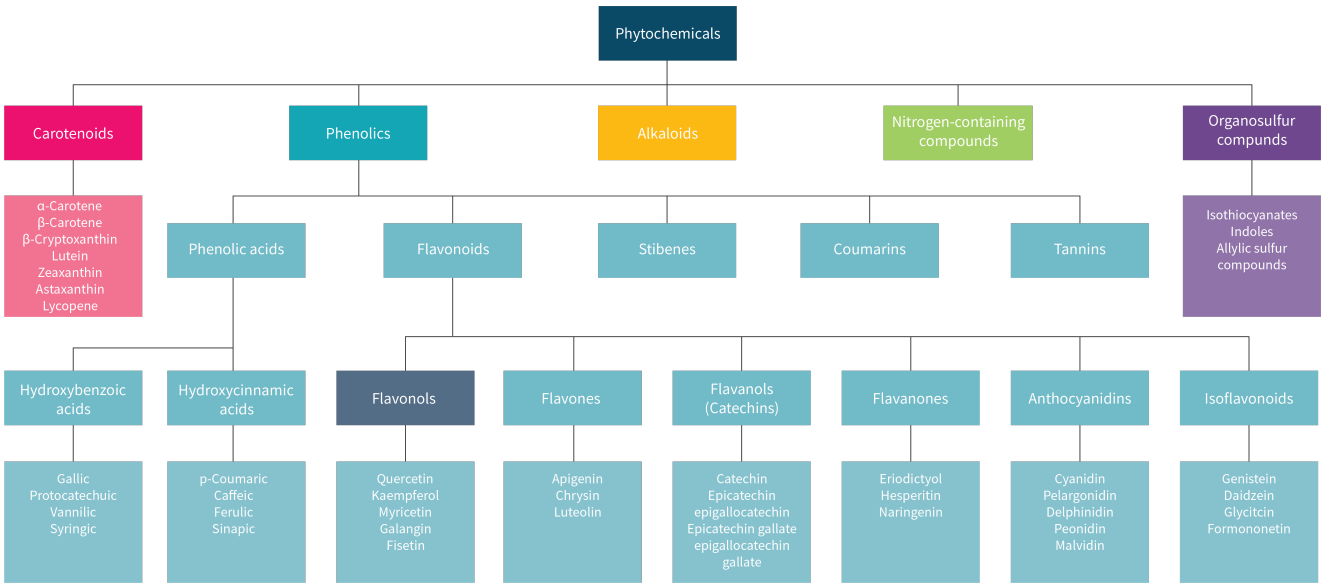
Unfortunately, in people with acne or a history of acne, chocolate — but not concentrated cocoa flavanols — may exacerbate outbreaks. Short-term studies (≤1 month) in people (mostly males) with mild to moderate acne noted increases in outbreaks from various single doses of 100% unsweetened cocoa powder[163] and from 1 to 12 oz of milk chocolate[164] or unsweetened dark chocolate (≥99%)[165][166] per day. It has been hypothesized that the fatty acids in cocoa (cocoa butter) might be the component exacerbating acne.[165] It is not known if chocolate can cause acne outbreaks in people not prone to them.

Cocoa flavanols may increase the risk of bleeding in people with bleeding disorders[167][168][169][170] or who take antiplatelet or anticoagulant drugs, such as aspirin or warfarin (Coumadin). Cocoa flavanols are hypotensive agents (they lower blood pressure). Taken with other hypotensive agents, which can be pharmaceuticals but also supplements, such as garlic, they could cause episodes of low blood pressure.

Cocoa beans contain caffeine. There is about 20 mg of caffeine in 25 g of dark chocolate (70–85% cocoa). If you are pregnant or breastfeeding, remember that you should limit your total caffeine intake to <200 mg/day.[171] For healthy adults, caffeine intake of up to 400 mg/day doesn't raise any general health concerns.[171][172][173]

Cocoa flavanols can hinder the absorption of iron — particularly non-heme iron, found in plants.[174][175][176] If you take an iron supplement, do not take cocoa flavanols at the same time.

Classification hierarchy of polyphenols



How to take *cocoa extract*

Start with 320 mg of cocoa flavanols per day. If you see no results after 6 weeks, try 600 mg/day. The easiest way to get your cocoa flavanols is by consuming cocoa powder or dark chocolate:

- Cocoa powder (dried and *not* fermented, roasted at high temperatures, or Dutch-style): 6–12 g/day
- Dark chocolate (70% or higher): 25–50 g/day

Cocoa powders that have *not* undergone fermentation, Dutching (alkali treatment), or roasting at high temperatures[177][178][179][180] are richer in flavanols (about 60–80 mg of flavanols per gram of powder).[181][182] In contrast, you would need to ingest *at least* 114 g (≈4 oz) of a roasted-and-fermented powder to consume 320 mg of flavanols,[180] so you should investigate how your cocoa powder or dark chocolate was processed.[183]

Acticoa™ powder (≈4% flavanols)[184] and the CocoaVia® high-flavanol cocoa products were shown in company-sponsored clinical trials to reliably raise blood flavanol levels compared with low-flavanol controls.[159][162][185] The Acticoa™ powder provided 320 mg of flavanols per 8 g of powder and 600 mg per 15 g. CocoaVia powder® provided 320 mg of flavanols per 6 g of powder and 600 mg per 11 g.

Milk chocolate is too poor in flavanols for supplementation, as are cocoa nibs. In fact, you would need to ingest more than 60 g (≈400 kcal) of cocoa nibs to reach 320 mg of flavanols.[186]

Coconut Oil (for atopic dermatitis & dry skin)

What makes *coconut oil* a promising option

Unrefined coconut oil may be a viable treatment for both atopic dermatitis and dry skin.

Two RCTs compared unrefined coconut oil with mineral oil in people with mildly to moderately dry skin.[187][188] The oil was applied twice daily to the affected areas. Regardless of the oil used, all participants saw similar improvements.

For atopic dermatitis, two RCTs compared unrefined coconut oil with either mineral or virgin olive oil.[189][190] In each trial, unrefined coconut oil reduced bacteria concentrations and rehydrated the skin better than the comparator, perhaps thanks to the antimicrobial properties of two saturated fatty acids present in coconut oil: lauric acid and monolaurin (a compound formed from lauric acid).[189]

These four RCTs in adults, as well as others in infants,[191][192][193] indicate that coconut oil can be an effective general moisturizer.

Warnings about *coconut oil*

For people with acne or oily skin, coconut oil may not be an ideal moisturizer.

How to use *coconut oil*

When selecting a coconut oil, note that there is no legally-mandated definition of the terms “unrefined”, “virgin”, and “extra-virgin” coconut oil. Any coconut oil with one of these labels will suffice.

For *dry skin or general skin hydration*, apply unrefined coconut oil to the affected area(s) once or twice daily for at least 2 weeks. If you see no improvement after 4 weeks of daily use, consider other treatment options.

For *atopic dermatitis*, there is insufficient evidence to determine if coconut oil works as well as or better than currently available treatment options. If you wish to use it alongside other therapies, discuss this with your physician or dermatologist.

Nicotinamide (for acne)

What makes *nicotinamide* a promising option

Nicotinamide (aka niacinamide) is a compound with anti-inflammatory properties that may be effective in treating acne, a chronic inflammatory skin disease.

Each vitamin has different forms, called vitamers. Nicotinamide is a B_3 vitamer.[194]

The 10 clinical trials conducted on nicotinamide thus far can be categorized into three groups:

- Topical nicotinamide alone *vs* standard-of-care treatment alone[195][196][197][198]
- Topical nicotinamide with standard-of-care treatment *vs* standard of care alone[199][200][201][202]
- Multi-ingredient oral supplement containing nicotinamide *vs* standard-of-care treatment or placebo[203][204]

In the *oral* nicotinamide studies, two studies used 600 and 750 mg/day doses of nicotinamide within a multi-ingredient product; neither had a group testing nicotinamide in isolation.[203][204] Thus, it is uncertain if oral nicotinamide could provide a benefit to acne treatment.

In the *topical* nicotinamide studies, the comparator group (aka standard-of-care) commonly used twice daily 1% clindamycin gel (an antibiotic), whereas the intervention groups commonly used twice daily 4% nicotinamide gel with or without clindamycin gel.

In 9 of the 10 trials, the nicotinamide groups did not perform better compared with standard-of-care acne treatment. In the lone trial that saw a benefit over standard-of-care, a 4% nicotinamide cream treatment was compared with 1% clindamycin cream for 12 weeks.[201] The nicotinamide group saw only a slight advantage over the clindamycin group.

Across all trials, the average duration was 8 weeks, but the standard-of-care treatments being used in the comparison groups often need 12 weeks or more to produce their full benefits.[205] So while it appears nicotinamide may be at least as effective as clindamycin, it is not known if it performs better than or enhances the effectiveness of other first-line acne treatment options currently available (i.e., benzoyl peroxide, topical retinoids), antibiotics, or combinations of these therapies).[206]

Warnings about *nicotinamide*

Side effects of topical nicotinamide may include mild itching, burning, dermatitis, or unusually oily skin.[205] However, these side effects can also accompany topical standard-of-care treatments.[205] If you experience these symptoms, decreasing the application frequency or amount may help until your skin adapts. If symptoms persist, cease treatment and talk to your physician or dermatologist.

Topical nicotinamide is known to have skin-lightening effects,[207] but people recovering from acne may experience skin dyspigmentation or hyperpigmentation (noticeably uneven skin tone), so in certain cases the lightening effects might be beneficial for improving aesthetics. Initial studies are promising,[208] but more research is needed.

How to take *nicotinamide*

For *topical nicotinamide*, apply 4% nicotinamide gel twice daily for at least 8 weeks. This can be used in combination with a 1% clindamycin gel prescription, but you should speak about this option with your physician or dermatologist.

For *oral nicotinamide*, there is not enough evidence to say what an effective dose might be at this time.

When taken orally at high doses, vitamin B3 can cause an unpleasant "flushing" effect,[209] where the blood vessels dilate, causing skin redness often accompanied by itching or burning sensations. Nicotinamide does not produce these same effects.[210]

Nicotinamide (for non-melanoma skin-cancer prevention)

⚠ ***Caution:*** **An important disclaimer**

The following section discusses research on nicotinamide and its effects on skin cancer incidence and recurrence. While supplemental nicotinamide is available without a prescription, *make sure to speak with your physician, dermatologist, or skin cancer specialist before beginning or modifying any cancer prevention modality.*

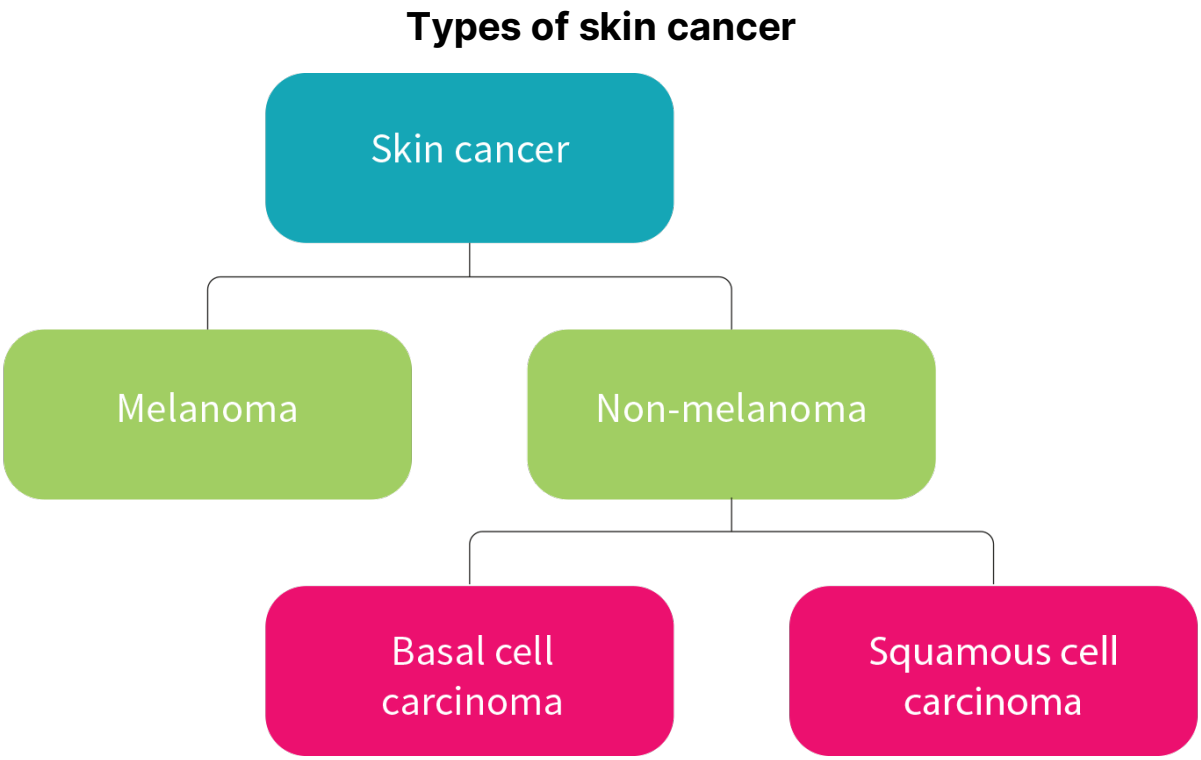
What makes *nicotinamide* a promising option

Each vitamin has different forms, called vitamers. Nicotinamide, also known as niacinamide, is a B_3 vitamer.[194] Nicotinamide may reduce the incidence of new *non-melanoma skin cancers* (NMSCs) and *actinic keratoses* (AKs), which can develop into NMSCs[211] in populations at high risk for developing them,

specifically people with multiple prior cases of NMSCs or in chronically immunosuppressed kidney transplant recipients.[212][213]

Skin cancers can be roughly divided into two groups: melanoma skin cancers and NMSCs, which include squamous cell carcinomas and basal cell carcinomas. Risk for developing these skin cancers is increased with prolonged and unprotected exposure to UV radiation. Nicotinamide can help offset the negative impacts of UV damage through a number of mechanisms:[212][214]

- Accelerates DNA repair
- Reduces the degree to which UV rays suppress immune system repair functions
- Helps regulate skin inflammation and protective barrier function
- Can help restore cellular energy levels



To date, five RCTs have been conducted in this area. Four were smaller trials (24–41 participants) in high-risk populations that lasted less than 6 months.[215][216][217] They examined the effects of oral or topical nicotinamide in reducing AKs. The three studies that tested oral nicotinamide, in doses between 500 and 1,000 mg/day, all saw reductions in AKs over placebo.[215][216] The one study using topical 1% nicotinamide daily saw no noteworthy improvement over placebo.[217]

The longest and largest clinical trial was a 386-participant, 12-month RCT with a 6-month post-trial follow-up period.[218] All participants had been diagnosed with at least 2 NMSCs (histologically confirmed) in the past 5 years and thus were at higher risk for developing further skin cancers. Subjects were randomized to receive 500 mg of nicotinamide or placebo twice daily. At the trial's end, the nicotinamide group saw a 23% reduction in new NMSCs and a 13% reduction in AKs compared with placebo. People who had entered the trial with the highest number of previous NMSCs (>6) appeared to respond most favorably to treatment. Importantly, the benefits disappeared 6 months after the treatment stopped.

When a different group of scientists analyzed this study using a different statistical method, they found nicotinamide produced no meaningful effect.[219] However, they left the door open for future studies to corroborate the beneficial findings initially reported.

Warnings about *nicotinamide*

At present, there is insufficient evidence to determine if nicotinamide could prevent or reduce NMSCs or AKs in people without a prior history of them, in lower-risk populations, or in people susceptible to developing melanomas.[214] Additionally, more studies will be needed to determine if nicotinamide remains an effective and tolerable treatment in high-risk patients over longer periods.

Don't take niacin (aka nicotinic acid, the best-known B_3 vitamer) or nicotinamide riboside instead of nicotinamide (aka niacinamide or nicotinic acid amide). When taken at high doses, niacin can cause an unpleasant "flushing" effect,[209] where the blood vessels dilate, causing skin redness often accompanied by itching or burning sensations. Nicotinamide does not produce these same effects,[210] allowing it to be taken at the high doses needed to elicit a therapeutic effect.

Two public health agencies have set upper limits for nicotinamide. In the European Union, the *Tolerable Upper Intake Level* (UL), or maximal intake deemed unlikely to pose adverse health effects in humans, is set at 900 mg/day, while the United Kingdom has set a *Safe Upper Level* (SUL) at 500 mg/day.[220][221] Additionally, a recent review found that in otherwise healthy individuals, adverse effects were not seen in people consuming up to 1,000 mg/day compared with placebo.[210] The yearlong RCT discussed above reported that adverse effects were slightly higher in the intervention group at the 1,000 mg/day dose.[218]

While few drug interactions have been seen with nicotinamide, it might possibly interact with carbamazepine (Tegretol, Carbatrol, Epitol), an anticonvulsant.[222] People with liver disease or diabetes should consult their physician before taking nicotinamide.

With the dosages suggested below, you should stop taking other forms of vitamin B3 because the combined total intake would be more likely to place you at risk for adverse effects.

How to take *nicotinamide*

In clinical trials, the dosage tested was 500 mg of *oral nicotinamide* taken twice daily with or without food.

For *topical nicotinamide,* there is not enough evidence to say what an effective dose might be at this time.

Polypodium Leucotomos (for UV protection)

What makes *Polypodium leucotomos* a promising option

Polypodium leucotomos (*P. leucotomos*) may help reduce the damaging effect of UV radiation on your skin.

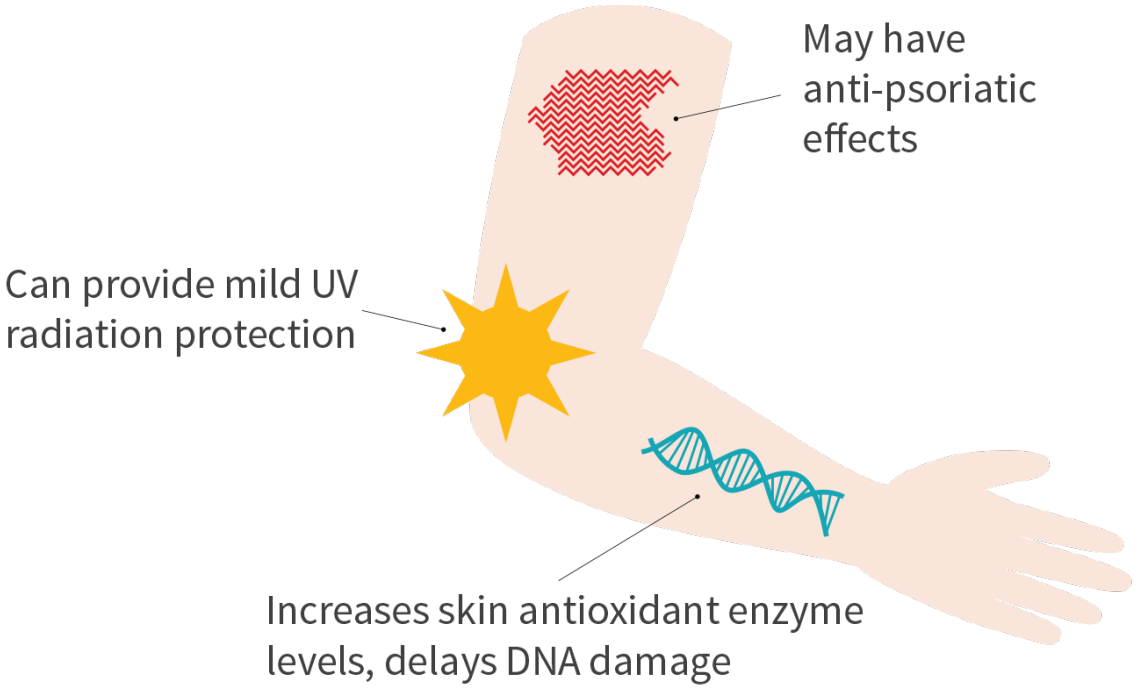
The bioactive compounds in *P. leucotomos*, a tropical fern from Central America, can deliver UV protection to skin through multiple mechanisms. Both animal and human studies have demonstrated its ability to

reduce UV-caused skin cell damage, DNA damage, and oxidative stress; improve immune response to UV damage; and inhibit the release of inflammatory cytokine proteins.[223]

Clinical trials in healthy participants have consistently shown _P. leucotomos _to protect the skin from UV radiation, both in short (<1 week)[224][225][226][227][228][229] and long-term (1- to 3-month) trials.[230][231][232] These UV protective effects have also been seen in clinical trials of people with skin ailments, such as polymorphous light eruptions,[232] or at high risk for melanomas.[226]

Nearly all of these studies have been conducted in people with Fitzpatrick skin types 1–3, which are the most susceptible to UV damage, but people with skin types 4–6 can still see benefits, to a lesser extent. Additionally, research into _P. leucotomos _has mostly been conducted on a proprietary extract sold notably under the brand names Heliocare® and Fernblock®.

Potential benefits of _Polypodium leucotomos_



Warnings about *P. leucotomos*

P. leucotomos should never be used to entirely replace sunscreen. The compounds in this plant are not potent enough to deliver the same UV protection that a broad-spectrum sunscreen will. What UV protection *P. leucotomos* does deliver has an estimated SPF equivalent of ≈4[229] — far below the recommended level of at least 30. Using a broad-spectrum SPF sunscreen in combination with *P. leucotomos* can provide a synergistic benefit.

The majority of clinical trials saw no adverse effects.[227][229][230][232][233][234][235] In the three trials that did, the most common complaint was gastrointestinal upset.[231][236][237] People with uneasy stomachs or health conditions affecting their intestines (e.g., IBD, IBS, celiac, Crohn's, ulcerative colitis) may wish to start with a low dose to see how it affects them.

How to take *P. leucotomos*

For *UV protection*, take 7.5 mg of *P. leucotomos* per kilogram of body weight per day (3.4 mg/lb/day). The dose can be taken all at once or split into two doses, with or without food.

Daily *P. leucotomos* intake by bodyweight

POUNDS	KILOGRAMS	PER DOSE (mg)	TOTAL INTAKE (mg)
100	45	170	340
125	57	215	430
150	68	255	510
175	79	295	590
200	91	340	680
225	102	380	765
250	113	425	850
275	125	470	940

The most commonly available dose is 240 mg, so get as close as you can, but don't go lower than what is recommended for your body weight.

P. leucotomos does not have to be taken daily to benefit from its effects. Consuming one dose at least 24 hours before sun exposure and a second dose the day of — at least 2 hours prior to sun exposure — will be sufficient to reap *P. leucotomos's* benefits.

Like sunscreen, *P. leucotomos's* protective effects will degrade over time but can be effective for up to 3 hours of sun exposure. So, if your sun exposure is prolonged, you may wish to take an additional dose right as your sun exposure begins or up to an hour after.

While some research has shown promise for *P. leucotomos* as a topical UV-protective product,[238] there has only been one clinical trial conducted to date.[229] Some sunscreens incorporate *P. leucotomos*, which may provide additional benefit, but to what degree is hard to say. If you buy a sunscreen with *P. leucotomos*, make sure it is in line with our sunscreen recommendations

Tazarotene (for plaque psoriasis)

What makes *tazarotene* a promising option

In the treatment of mild-to-moderate plaque psoriasis, the use of the topical retinoid tazarotene alone has shown limited benefit over placebo and performed worse than other first-line treatments, such as topical corticosteroids, vitamin D analogues (calcipotriene and calcitriol), and calcineurin inhibitors (tacrolimus and pimecrolimus).[239][240] Because of its high non-response rate as a solo treatment (≈73%), tazarotene might best be used in combination with other treatment options.[241]

The legal status of tazarotene varies among countries. Products containing retinoids tend to be more regulated. For example, in the United States isotretinoin not only requires a prescription, but is also strictly regulated and tracked by the FDA. Tazarotene also requires a prescription in the US.

Warnings about *tazarotene*

High doses of oral retinoids have been linked to severe birth defects, and although intermittent _topical *retinoid use has not, there are not enough data to conclude if regular use is safe for females who are breastfeeding, pregnant, or planning to become pregnant.*[142][143] *Topical retinoids should not be used during these times._*

Retinoids work in a dose-dependent manner: the higher the retinoid concentration, the more effective the treatment.[124] However, these higher concentrations also increase the chances of experiencing skin irritation (e.g., dryness, redness, scaling or peeling, itching, sun sensitivity, and swelling).[127] If any of these occur, try one or a combination of the following.

- Reduce the application frequency (switch from daily to every other or every third day).
- Reduce the application amount (aim for a pea-sized dose).
- After washing and drying your face, apply an oil-free moisturizer. Wait 60 minutes and then apply the treatment.
- Minimize unprotected sun exposure.

Skin irritation usually disappears within 2–4 weeks.[127] Discontinue use and consult your physician or dermatologist if skin irritation is severe or persists for 6 weeks or more.

Regular daily use of an oil-free moisturizer containing broad-spectrum sunscreen with an SPF of at least 30 may aid in reducing adverse effects. SPF moisturizers containing physical sunscreening agents, such as zinc oxide or titanium dioxide, may be better tolerated as chemical sunscreening agents can cause irritations in those with sensitive skin conditions.[74]

If you are planning to use topical retinoids in combination with other topical treatments (e.g., corticosteroids and vitamin D analogues), discuss these options with your physician or dermatologist beforehand. Combining treatments may cause undue skin irritation or damage, or alter treatment efficacy.

If you get any retinoid in your mouth, nose, or eyes, rinse thoroughly with water.

If you miss a dose, do not “double-up” during the next application. Continue your application schedule as usual.

> 💡 ***Tip:*** **Skincare and household products for sensitive skin**
>
> The National Psoriasis Foundation maintains a Seal of Recognition for non-irritating products created for those with psoriasis, sensitive skin, or joint mobility limitations. You can learn about the review process these products undergo here or browse their database of approved products here.

How to take *tazarotene*

For *plaque psoriasis*, gently wash the affected areas with mild soap and completely pat dry. Then apply a thin coat of tazarotene, covering only the psoriatic lesions, in the evening. Apply once daily, every other day, or every third day, as tolerated, to the affected areas. Wash your hands after applying. If you use any moisturizers, apply them 1 hour before applying tazarotene.

Tazarotene commonly comes in 0.05 and 0.1% concentrations. Beginning with the 0.05% concentration may be prudent to minimize skin irritation. If the 0.05% is well-tolerated, 0.1% may be used.

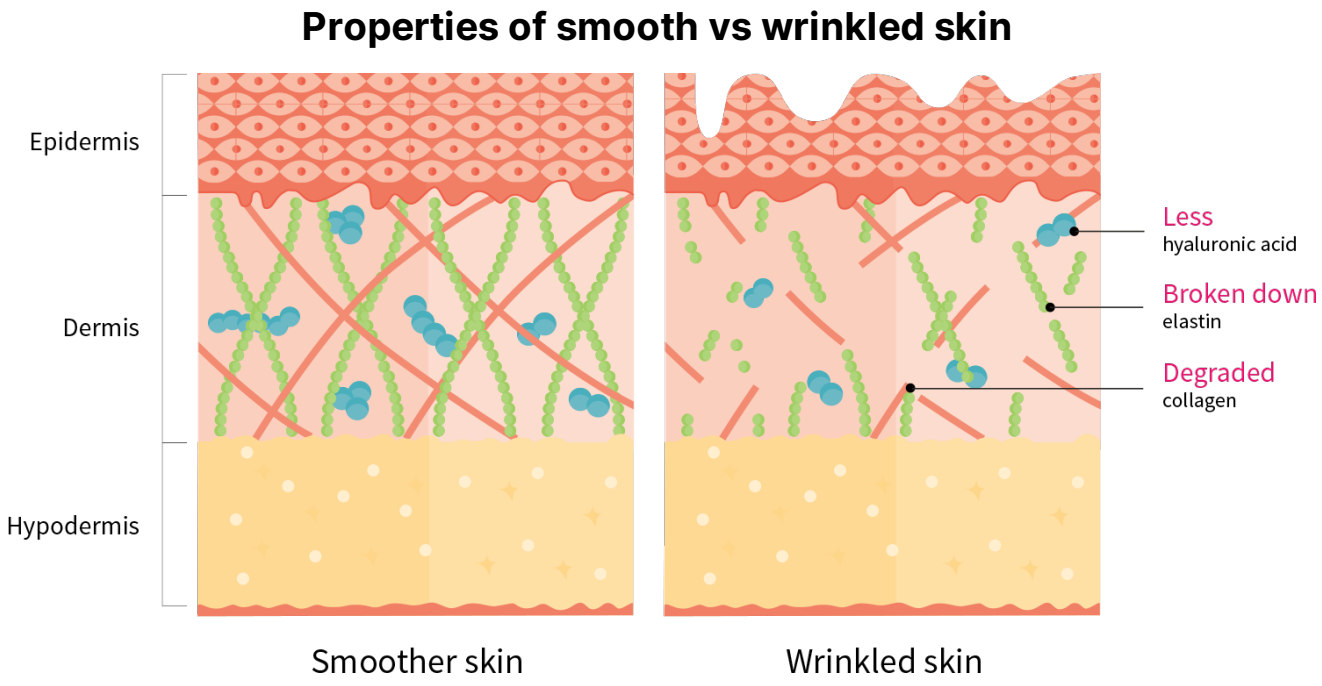
Unproven Supplements

Astaxanthin (for skin appearance & UV protection)

What makes *astaxanthin* an unproven option

Astaxanthin is a powerful antioxidant. Being fat soluble, it accumulates in the skin and other body tissues. It can reduce oxidative stress (a cause of lipid degradation and DNA damage) in human skin damaged by UVA radiation.[242][243]

Taken orally or applied topically, astaxanthin might reduce wrinkles, improve the skin's elasticity and moisture content, and protect against UV radiation. However, the clinical research isn't extensive or particularly high in quality.[242][244][245][246] More and better human studies are required for astaxanthin to become more than an unproven option.



Caffeine (for cellulite & skin disorders)

What makes *caffeine* an unproven option

Cellulite is the fatty deposits that visibly collect below the skin's surface. Its development involves many components: blood vessel microcirculation, lymphatic systems, excess body fat, and the extracellular matrix of cells.[247] When applied topically, caffeine can penetrate and accumulate in the skin, where it may

be able to inhibit some cellular signaling pathways that contribute to cellulite formation.[248]

Evidence from cell and animal models suggests that it can increase lymphatic drainage in fatty tissues, removing by-products of fatty-acid breakdown that might hinder blood vessel microcirculation.[249] Studies using human hair follicles suggest that it might stimulate hair growth,[250] and rodent evidence suggests that its antioxidant activity may prevent damage from UVB radiation.[251]

However, human research on caffeine's cosmetic use is scarce and weak. In a preliminary, uncontrolled, and potentially confounded trial, the participants reported a decrease in cellulite and an increase in elasticity and moisture when asked. But this *subjective* evaluation was not supported by the *objective* clinical evaluation, which found only a minor increase in elasticity and moisture when directly measured.[252]

There is also one study on psoriasis[253] and another on atopic dermatitis,[254] both of which show improvement, but they only provide us with preliminary evidence. A small number of clinical trials have tested caffeine-containing shampoos in balding males diagnosed with androgenetic alopecia.[255] The results indicate it *might* work better than placebo, but the vast majority of these trials did not test caffeine in isolation. Thus far, evidence on the effects of topical caffeine are too weak to say if it could provide benefits for skin or hair.

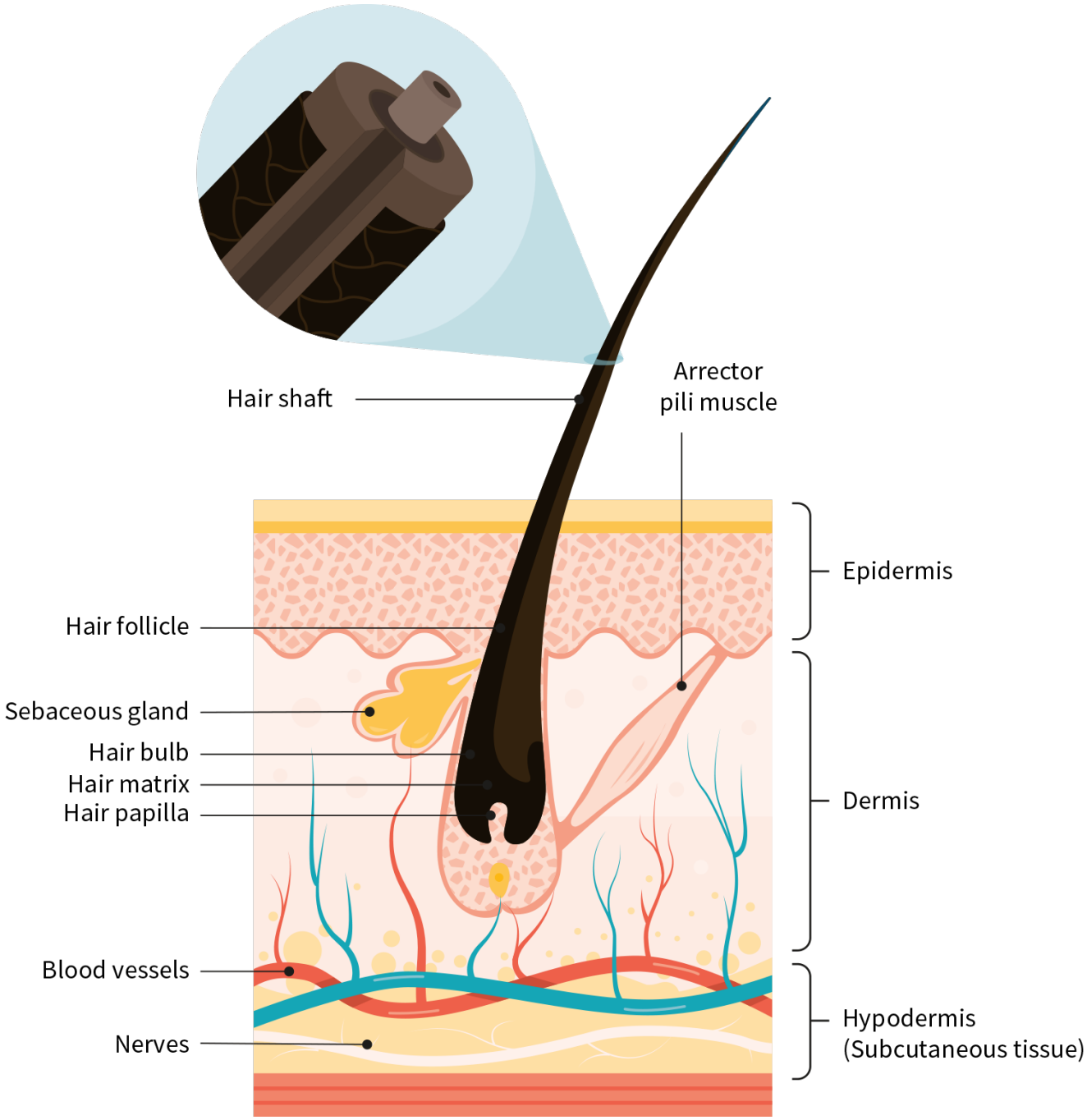
Coconut Oil (for hair appearance)

What makes *coconut oil* an unproven option

Coconut oil has a unique combination of relatively short molecular chains, which enables it to penetrate hair fibers, protecting them from external damage[256][257][258] and helping them retain moisture more than mineral oil does.[259] However, only one human study has tested its effects on hair.[260] In this 16-week study, daily application of coconut oil prior to shampooing increased hair strength by 41.8%.

While initial evidence suggests that coconut oil can improve hair quality, more human and comparator studies are required for confirmation.

Hair follicle anatomy



Reference: Ulrike Blume-Peytavi et al. *Biology of the Hair Follicle* (chapter 1 in *Hair Growth and Disorders*. Springer, Berlin, Heidelberg. 2008.)[117]

Creatine (for skin appearance)

What makes *creatine* an unproven option

Collagen is a structural protein in connective tissues, such as skin, ligaments, and tendons. It degrades as you age, causing wrinkles as skin loses its elasticity. Studies in human skin cells have shown that topical creatine can be absorbed by the skin and stimulate collagen synthesis,[261][262] and human trials have seen improvements in skin appearance from creatine-containing multi-ingredient facial creams.[261][262] Creatine

alone has never been tested, however, so its effects (if any) are uncertain.

One study using oral creatine (20 g/day for 7 days) saw improvements in microvascular function and skin capillary density, which may benefit skin health,[263] but no practical applications can be drawn from this very preliminary association.

Forti5® (for hair loss)

What makes *Forti5* an unproven option

Forti5 is a brand-name oral supplement containing a blend of green tea leaf extract, omega-3 and omega-6 fatty acids, vitamin D_3, beta-sitosterol, melatonin, and soy isoflavone seed extract.

To date, only a single study has been published testing the safety and efficacy of this supplement.[264] It was a single-blinded pilot case series that tested Forti5 on 10 adult subjects with androgenetic alopecia. All subjects took two tablets per day for 24 weeks (≈6 months).

These very preliminary results indicated Forti5 might be able to provide slight to moderate improvements in hair density.

Marine Proteins (for hair loss)

What makes *marine proteins* an unproven option

Interest in the use of marine proteins for improving hair quality were first noted in early double-blind studies investigating their application for repairing sun-damaged skin in females.[265][266] Since then, nearly all research has focused on AminoMar™, a proprietary blend of shark cartilage and mollusk powder, which is sold in the brand-name supplement Viviscal®. It should be noted that nearly all of the studies conducted on AminoMar and Viviscal were funded by the company that sells the product, Lifes2Good Inc.

To date, there have been 12 published clinical trials, seven of them double-blind RCTs, examining the efficacy of Viviscal on hair regrowth and quality.[267][268][269][270][271][272][273][274][275][276][277][278] These studies tested Viviscal in 688 participants with self-perceived thinning hair or physician-diagnosed alopecia and lasted 3–12 months (6 months on average). In general, the majority of participants in these studies saw improvements in hair density and diameter and a decrease in hair shedding.

However, there are some substantial limitations to consider.

- Studies on these marine protein blends stretch back to the early ’90s, and the composition and dose of the tested blends across studies have varied quite a bit.

- AminoMar is a proprietary blend of shark cartilage and mollusk powder. While we know how much of the *total* blend is in a single tablet of Viviscal (currently ≈450 mg), we do not know the *specific* amount of either component. The amounts may have changed from study to study.
- Many secondary ingredients have been included in the Viviscal product when being tested, limiting our ability to say what effect AminoMar might have in isolation. Niacin, vitamin C, Vitamin B_7 (biotin), calcium, iron, zinc, horsetail stem extract, millet seed extract, flaxseed extract, procyanidin B-2 (apple extract powder), L-cystine, and L-methionine have all been included in Viviscal at one time or another.
- The types and amounts of secondary ingredients included have changed from study to study, sometimes in unknown ways, making it difficult to compare study results head-to-head.

Furthermore, the ingredients included in Viviscal (the AminoMar complex and various vitamins, minerals, and plant extracts) are subject to change at the desire of the company without warning, and customers may or may not be notified of these changes. Such alterations can change the product's efficacy in unknown ways.

It is possible that certain marine proteins, in isolation, may improve hair regrowth and quality. To date, there are not enough studies to say if this might be the case.

Common patterns of hair loss

Adapted from Gupta and Mysore. *J Cutan Aesthet Surg*. 2016.[279]

For people who still want to try Viviscal, note that in the studies that reported adverse effects, no consistent ones were seen in participants taking Viviscal.[267][271][272][273][274][275][276][277] People with an intolerance or allergy to fish, seafood, shellfish, or acerola should not take Viviscal. Changes in the Viviscal formulation can affect the safety of this product on an individual level, so be vigilant about looking for any alterations.

Minoxidil (for nail growth & non-androgenic hair loss)

What makes *minoxidil* an unproven option

In a single clinical trial, participants applied a 5% topical minoxidil solution twice daily to some of their fingernails.[280] Compared with the untreated nails, minoxidil was able to increase the rate of nail growth by an average of 0.36 mm (0.014 inches) per month — a 9.2% increase over the control nails. Additional studies are needed to confirm these findings.

While minoxidil has been shown to be effective in treating androgenic alopecia, its role in treating other forms of alopecia is less certain. Studies testing minoxidil for the treatment of alopecia areata and scarring alopecias have yielded uncertain results.[281] Some evidence indicates minoxidil might be useful for treating temporary hair loss (telogen effluvium), monilethrix, early traction alopecia, chemotherapy-induced alopecia, and eyebrow hypotrichosis, but further investigations are needed.[281]

Nicotinamide (for skin appearance & disorders)

What makes *nicotinamide* an unproven option

Each vitamin has different forms, called vitamers. Nicotinamide, also known as niacinamide, is a B_3 vitamer. In studies, it has shown promise as a solo or adjunct treatment for a number of skin conditions: wrinkles,[282][283] melasma,[284] hyperpigmentation,[207][208][283] psoriasis,[285] atopic dermatitis,[286] and bullous dermatoses.[287][288][289][290][291] On the flip side, a single RCT on uremic pruritus (caused by kidney failure) showed no difference between nicotinamide and placebo.[292]

There is currently too little evidence to determine effective dosages for any of the aforementioned conditions.

Nutrafol® (for hair loss)

What makes *Nutrafol®* an unproven option

Nutrafol® is a brand-name oral supplement containing some 23 ingredients, including vitamins A, C, D, and E, ashwagandha, curcumin, saw palmetto, keratin, and hydrolyzed marine collagen, among other vitamin, mineral, and spice or herb.

To date, four case studies and two randomized, double-blind, placebo-controlled studies testing this supplement formula have been published.[293][294][295]

The first RCT was a 6-month trial that enrolled 40 females with thinning hair, 26 of whom were randomized to take four Nutrafol® pills per day while the remainder took placebo pills.[294] At the study's end, women taking Nutrafol® experienced improvements in both hair growth and quality compared with the control group.

The second RCT reported the six-month interim results of a 12-month trial.[295] Sixty women, 40–65 years old, with self-perceived thinning hair, were randomized to consume either a placebo or four Nutrafol® pills per day. Similar to the first RCT, the women in this study also saw significant improvements in hair growth and quality. The final 12-month results of this study are not yet published.

It is difficult to compare the results of the two trials, as the type and amounts of ingredients changed in the Nutrafol® formulation between the first and second RCT. Additionally, both formulations used proprietary blends, so the exact amounts of some of the included ingredients are unknown. These results will need to be replicated in future trials before any confident conclusions about its effectiveness or drawbacks can be made.

Of note is that one of the authors on both RCTs is a researcher for the company that created the product, Nutraceutical Wellness Inc. Nutraceutical Wellness Inc. also provided funding for both studies.

Polypodium Leucotomos (for skin disorders)

What makes *Polypodium leucotomos* an unproven option

Polypodium leucotomos has been studied as a potential treatment for people at high risk for developing melanoma,[226] and for reducing polymorphous light eruptions (the most common sun-induced dermatitis condition).[232][237][296] It's also been studied as an adjunct treatment for actinic keratoses,[233] pigmentation disorders (vitiligo, melasma),[233][234][236][297][298][299] psoriasis,[300] and atopic dermatitis[235][301] and for preventing premature skin aging.[302][303][304] While it shows promise in many of the aforementioned domains, more clinical evidence is needed.

Probiotics (for acne, eczema, & dermatitis)

What makes *probiotics* an unproven option

Various probiotic strains and combinations, taken orally or applied topically, have shown promise in helping treat acne, eczema, and atopic dermatitis. Despite a few human trials, the data are too limited and/or conflicting to suggest which probiotics to use, how long they should be used for, and at what dosage.[305][306]

Retinoids (for hair loss & rosacea)

What makes *retinoids* an unproven option

HAIR GROWTH

Topical tretinoin has not been well studied for the promotion of hair growth. One unblinded, non-randomized trial compared minoxidil 0.5%, tretinoin 0.025%, minoxidil 0.5% with tretinoin 0.025%, and placebo in 56 subjects for 12 months.[101] Oddly, the tretinoin and minoxidil + tretinoin groups saw improvement, but the minoxidil alone group saw none. This calls into question how compliant the groups were with their prescribed treatment, or possibly the minoxidil alone group had a larger number of non-responders.

The second study was an RCT of 31 males using minoxidil 5% twice daily or minoxidil 5% with tretinoin 0.01% once daily for 18 weeks.[102] The minoxidil + tretinoin group saw a small increase in hair growth over the minoxidil group alone. Further high-quality studies are needed to assess these initial results.

ROSACEA

There is mixed evidence on the effects of retinoid creams for the treatment of rosacea. In subtype II rosacea patients (those with papules/pustules), a single trial showed promise for the retinoid adapalene,[307] but two trials have shown conflicting evidence for tretinoin.[308][309] Present guidelines for the treatment of subtype II rosacea have cautiously endorsed the use of topical retinoids but stress that, given their irritative properties, their inclusion as a treatment option should be assessed on a case-by-case basis.[310][311]

Rosmarinic Acid and Grapefruit Extract (for skin appearance & UV protection)

What makes *rosemary* and *grapefruit* an

unproven option

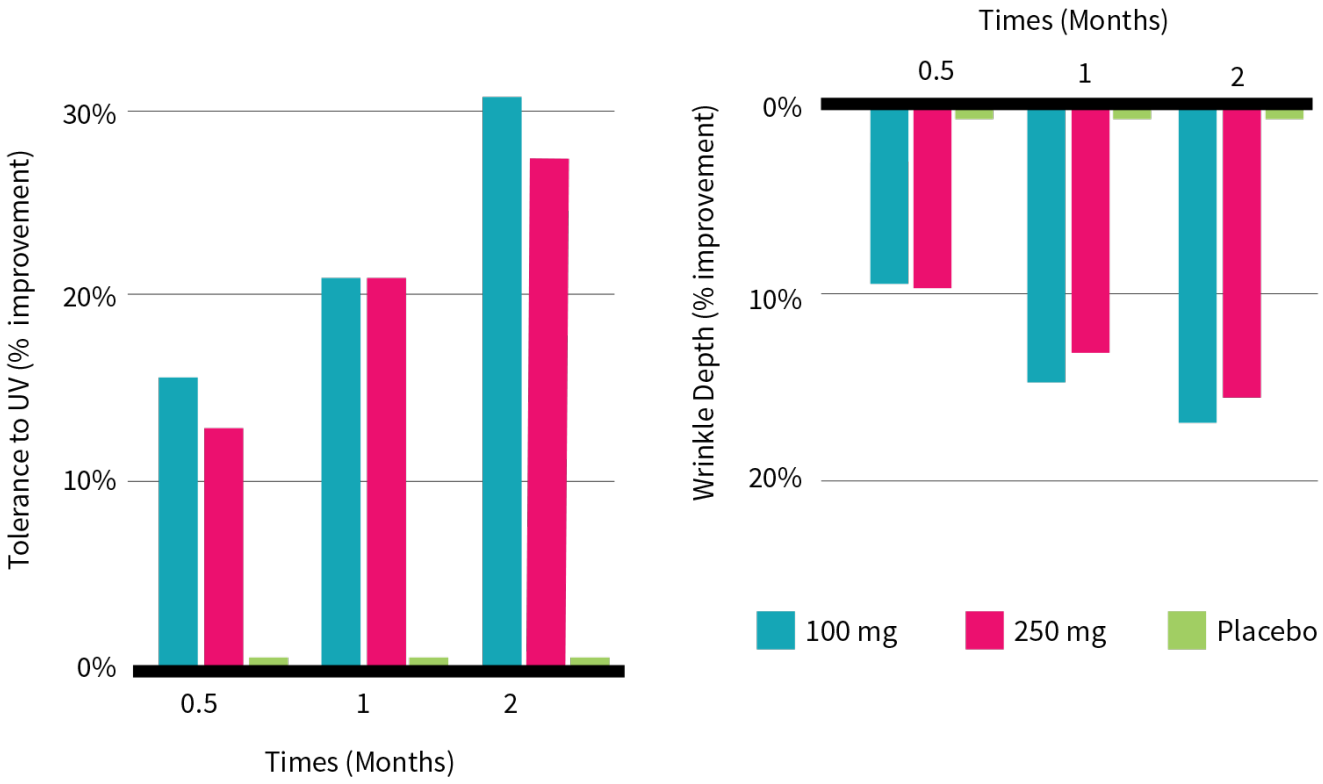
Photoaging and sunburns are both caused, in part, by inflammation and the formation of reactive oxygen species, a type of free radical, in the skin after UV light exposure.[312] So it seems reasonable to hypothesize that antioxidants, such as those found in plant extracts, could help protect against damage caused by UV radiation.

An early study reported synergistic effects of a combination of rosemary and grapefruit extracts (NutroxSun®) in a skin cell model, showing a decrease in free radicals and reduced DNA damage after exposure to UVB radiation.[313] The same study included a small pilot trial in 10 humans taking a 250 mg dose of the combo and showed it was able to increase the dose of UV radiation necessary to cause a sunburn, which indicates greater UV protection.

A follow-up study was conducted to build on those results by using a larger test population (90 participants) and different doses of the extract combination (100 mg, 250 mg, or placebo) over 2 months.[314] In addition to UV protective effects, this study looked at the effects on wrinkles, skin elasticity, and markers of oxidative stress.

The results showed that the extract was able to increase UV tolerance by 28%; postexposure levels of oxidative stress markers in the skin were reduced; and wrinkle depth and skin elasticity both improved. The only measure where the 250 mg dose outperformed the 100 mg dose was in the oxidative stress markers, where the higher dose saw greater reductions.

Effects of a rosemary-grapefruit extract on UV tolerance and wrinkle depth



Reference: Nobile et al. *Food Nutr Res.* 2016.[314]

Despite these two promising human trials, the data are currently too limited to draw any firm conclusions about the potential benefits or drawbacks of this supplement combination.

Vitamin B_7 (biotin) (for hair & nail appearance)

What makes *biotin* an unproven supplement

> ⚠️ ***Caution:*** **Biotin can affect laboratory results**
>
> Biotin can interfere with many laboratory tests, from hormone tests to cardiovascular diagnostics. Stop taking the supplement 3 to 7 days before getting any lab work done.

Biotin, also known as vitamin B_7, plays a part in the production of keratin, the protein at the core of hair and nails. For that reason, it is highly popular as a supplement to improve the appearance of hair and nails.[315][316]

As it stands, no RCTs have tested biotin's effects on the hair or nails of healthy people,[317] but supplementation may promote healthy hair and nails in people with the following conditions:

- Biotin deficiency (which is rare, though maybe less so in people experiencing hair loss)[317][318]
- Genetic disorders affecting biotin metabolism (leading to a deficiency in two enzymes responsible for processing biotin: biotinidase and holocarboxylase synthetase)[317][319]
- Some medical nail conditions (brittle nails, triangular worn-down nails, trachyonychia, and habit-tic deformity)[320][321][322][323][324][325]
- Uncombable hair syndrome[315][326][327]
- Medication-induced hair loss (caused by valproic acid, for example)[328][329][330]

The studies on biotin supplementation for the above conditions are mostly case studies that provide preliminary, though encouraging, data. People who are biotin deficient or have inborn errors of biotin metabolism are most likely to benefit from supplementation.

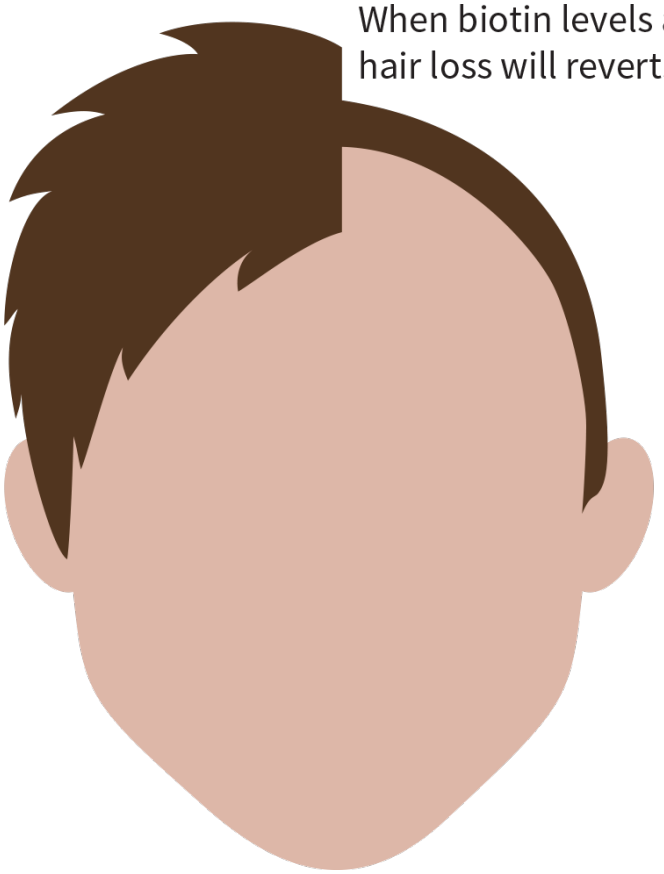
In cases of *genetic disorders affecting biotin metabolism*, larger biotin doses (10–30 mg/day) have helped.[317] If you have one of these genetic disorders, speak with your physician before starting this supplement.

In cases of *biotin deficiency* or *medical conditions* (brittle nails, uncombable hair syndrome, etc.), 0.3–3 mg/day may be beneficial.[317]

Biotin and hair growth

If you are not biotindeficient, there is no evidence that supplemental biotin can improve hair growth or quality.

Biotin deficiency can cause alopecia. When biotin levels are restored to normal, hair loss will revert.



Vitamin E (for skin, hair, & nails)

What makes *vitamin E* an unproven option

Vitamin E is a catchall term for the two main vitamin E groups, tocopherols and tocotrienols. These groups can further be broken down into subgroups that contain many different forms, not to mention there are synthetic forms as well. The specific type being used can greatly influence how the vitamin performs for a given health endpoint.

This is one of the reasons vitamin E remains an unproven option: many studies looking at the same outcome often use different forms, concentrations, and doses, making it difficult to draw any conclusions. Furthermore, there is a lack of dose-response studies using the same vitamin E form to help ascertain an optimal dose.

ATOPIC DERMATITIS

Only a few trials have investigated the use of oral vitamin E, either alone or in combination with other vitamins or minerals.[331][332][333][334][335] The trials are of mixed quality and provided mixed results. The data are too preliminary to include vitamin E as an atopic dermatitis treatment option.[336]

HAIR GROWTH

Only three clinical trials have been conducted examining a vitamin E and hair growth connection.[337][338][339] Of these, only one tested vitamin E in isolation.[337] The other two used differing multi-ingredient supplement blends that contain vitamin E.[338][339] The data are presently too limited to draw any conclusions.

NAIL HEALTH

Case studies and a few clinical trials have reported a benefit in nail quality with either topical or oral vitamin E in people with yellow nail syndrome.[340][341][342] However, the largest double-blind RCT to date reported no benefit with topical vitamin E applications over 6 months.[343]

Topical vitamin E might play a role in treating brittle nails, but much more clinical data are needed in this area.[344]

UV PROTECTION

There is strong mechanistic evidence from animal and cell studies that topical or oral vitamin E can reduce UV damage.[345][346] Studies of topical vitamin E conducted in humans have provided mixed, but promising, results.[347][348][349][350][351]

Studies of oral vitamin E for UV protection have also provided mixed results.[352][353][354][355][356] To complicate matters, oral vitamin E is rarely studied in isolation. The multi-ingredient formulas tested, which contain vitamin E, are seldom replicated in additional trials. Because of these limitations, no firm conclusions can be drawn at this time.

WOUND AND SCAR HEALING

Vitamin E has been tested in six RCTs as a treatment for postsurgical wound and scar healing, as a solo or combination topical therapy. Three RCTs reported a meaningful improvement with using vitamin E alone,[357] vitamin E with silicone gel sheets,[358] and vitamin E with hydrocortisone and silicone sheets.[357] All three of these studies used subjective measures (visual inspection or questionnaire) to assess wound and scar healing progress. These trials were all single-blinded or not blinded at all, which can limit our confidence in their results, but the combined sample size included 538 participants.

The other three RCTs reported no meaningful improvements with the use of topical vitamin E as a solo therapy.[359][360][361] These trials included the only study to use an objective assessment (direct measurement) of wound and scar healing,[361] which can help decrease bias and increase our confidence in the results. Additionally, all trials were double-blinded and had a combined sample size of 211 participants.

To complicate matters further, each of the six RCTs used differing vitamin E concentrations, so there is insufficient evidence to determine what effects vitamin E could have on wound and scar management.

Vitamin K (for skin appearance)

What makes *vitamin K* an unproven option

SKIN APPEARANCE

One study has evaluated vitamin K skin cream for reducing wrinkles and dark under-eye circles and suggested an improvement, but the methodological limitations and overall lack of research prevent any clear conclusions.[362]

More research is needed to explore the proposed mechanisms and evaluate other disorders and parameters of skin health, so vitamin K is an unproven option for skin-related areas of health at this time.

PURPURA

Fat-soluble vitamins (A, D, E, K) tend to accumulate in the skin, and vitamin K may help vitamin A improve skin vascularity (i.e., increase vein density). A cream containing vitamin K has been tested in a handful of studies for its ability to reduce purpura (purple- or red-colored spots) caused by laser skin therapy and acneiform rashes caused by the cancer drug cetuximab.[363][364][365][366][367][368] The results of these studies don't provide compelling evidence for a notable clinical benefit.

Zinc (for acne & eczema)

What makes *zinc* an unproven option

ACNE

Zinc, via its effects on the immune system, might aid in preventing mild-to-moderate acne by reducing skin inflammation and acne-causing bacteria.[369] Overall, the clinical research on zinc for acne treatment suggests a benefit when taken at very high doses of 100+ mg per day over a period of 2 months or more.[370] Contrast this with the daily *Tolerable Upper Intake Level* (UL) for adults in the US of 40 mg per day.[371] These high doses are unsustainable, as they can cause many adverse effects.

Over time, high doses of zinc can irritate the gastrointestinal tract. They can also cause a copper deficiency, since zinc kick-starts the process of creating metallothionein, a protein that binds with zinc but also with other metals, notably copper; the bound metals then leave the body as waste products.[372][373] Even higher doses of zinc can damage the liver and kidneys.[371] Temporary adverse effects include cramping, diarrhea, nausea, vomiting, headache, or dizziness.

It is unclear if a lower, more sustainable zinc dose (≤50 mg/day) would be as effective as the higher doses or if zinc works as well as or better than currently available acne treatment options.[123][206] It is possible zinc could be used in tandem with other treatments, but more studies are needed in this research area.

ECZEMA

Zinc, orally or topically, has also been studied for various skin conditions, such as eczema, rosacea, and psoriasis, but evidence for its use in these cases is inconsistent and sparse.[374][375][376][377][378][379][380]

Inadvisable Supplements

Coconut Oil (for UV protection)

What makes *coconut oil* an inadvisable option

Coconut oil alone should never be used to replace sunscreen. While it may be used as an ingredient in some sunscreens, coconut oil by itself has shown an exceptionally poor ability to protect your skin from UV rays.[381] Its estimated SPF rating across the UVA and UVB spectrums is ≤1.[381]

PABA (for UV protection)

What makes *PABA* an inadvisable option

Para-aminobenzoic acid (PABA), sometimes referred to as vitamin B_x, is related to vitamin B_9 but is not a vitamin itself. It can be found in different foods, such as grains, eggs, livers, kidneys, and milk. Supplemental doses may darken graying hair,[382][383][384] but studies are scarce, are old, and show inconsistent results.

PABA's UVB-absorbing properties made it one of the first ingredients used in sunscreens, particularly in the 1950s and 1960s. A study on UV-induced hair damage and discoloration also found topical PABA to offer some protection, though less than topical benzophenones do.[385]

Alas, PABA is a potential skin allergen and irritant[72][73] (as are benzophenones). Since more effective ingredients are now available for UV protection — avobenzone, zinc oxide, titanium dioxide — sunscreens containing PABA are better avoided.

Proprietary Blends and Multi-Ingredient Products

There are many brand-name products with custom supplement blends that claim to aid in hair growth or make bold claims about how they can improve your skin or nail health. The common hypothesis among these blends is that they can combine various ingredients that can act on different metabolic pathways to halt, reverse, or improve whatever condition you're trying to treat.

There is usually precious little human evidence to support the efficacy of these products. Studies are typically small, short-term, and not often replicated (even when replicated they seldom draw the same conclusions).

Be wary of these products and the claims that they make.

FAQ

Q. What about supplements not covered in this guide?

Our guides are regularly updated, often with new supplements. We prioritize assessing (and reassessing) the most popular of them and those most likely to work. However, if there is a specific supplement you'd like to see covered in a future update, please let us know by filling out this survey.

Q. Can I add a supplement not covered in this guide to my combo?

Supplement with your current combo for a few weeks before attempting any change. Talk to your physician and research each potential addition. Check for known negative interactions with other supplements and pharmaceuticals in your current combo, but also for synergies. If two supplements are synergistic or additive in their effects, you might want to use lower doses of each.

Q. Can I modify the recommended doses?

If a supplement has a recommended dose range, stay within that range. If a supplement has a precise recommended dose, stay within 10% of that dose. Taking more than recommended could be counterproductive or even dangerous. Taking less could render the supplement ineffective, yet starting with half the regular dose could be prudent — especially if you know you tend to react strongly to supplements or pharmaceuticals.

Q. At what time should I take my supplements?

The answer is provided in the "How to take" section of a supplement entry whenever the evidence permits. Too often, however, the evidence is either mixed or absent. Starting with half the regular dose can help minimize the harm a supplement may cause when taken during the day (e.g., fatigue) or in the evening (e.g., insomnia).

Q. Should I take my supplements with or without food?

The answer is provided in the "How to take" section of a supplement entry whenever the evidence permits. Too often, however, the evidence is either mixed or absent. Besides, a supplement's digestion, absorption, and metabolism can be affected differently by different foods. Fat-soluble vitamins (A, D, E, K), for instance, are better absorbed with a small meal containing fat than with a large meal containing little to no fat.

Q. What are DRI, RDA, AI, and UL?

The Dietary Reference Intakes (DRIs) is a system of nutrition recommendations designed by the Institute of Medicine (a US institution now known as the Health and Medicine Division). RDA, AI, and UL are part of this system.

- Contrary to what the name suggests, a *Recommended Dietary Allowance* (RDA) doesn't represent an *ideal* amount; it represents the *minimum* you need in order to avoid deficiency-related health issues. More precisely, it represents an amount just large enough to meet the minimum requirements of 97.5% of healthy males and females over all ages — which implies that the RDA is too low for 2.5% of healthy people.
- The *Adequate Intake* (AI) is like the RDA, except that the number is more uncertain.
- The *Tolerable Upper Intake Level* (UL) is the maximum safe amount. More precisely, it is the maximum daily amount deemed to be safe for 97.5% of healthy males and females over all ages — which implies that the UL is too high for 2.5% of healthy people.

As a general rule, a healthy diet should include at least the RDA of each nutrient — but less than this nutrient's UL. This rule has many exceptions, though. For instance, people who sweat more need more salt (i.e., sodium), whereas people who take metformin (a diabetes medicine) need more vitamin B12.

Moreover, the DRIs are based on the median weight of adults and children in the United States. Everything else being equal (notably age, sex, and percentage of body fat), you likely need a lesser amount of nutrients if you weigh less, and vice versa if you weigh more. The numbers, however, are not proportional — if only because the brains of two people of very different weights have very similar needs. So you can't just double your RDIs for each nutrient if you weigh twice as much as the median adult of your age and sex (even if we overlook that people weighing the same can differ in many respects, notably body fat).

Q. Will sunscreen decrease my vitamin D levels?

Your body can produce vitamin D when the skin is exposed to UVB rays,[386] so it stands to reason that sunscreen use may decrease vitamin D levels. Indeed, sunscreen can cause a drop in vitamin D production under laboratory testing conditions,[387][87] and this decrease is most notable if sunscreen is used consistently and properly[388][69][389] (i.e., when using a broad-spectrum sunscreen and the right SPF, amount, and reapplication schedule). But even then, it appears most need not worry about the effects of sunscreen alone on vitamin D levels.[390]

One important caveat — studies to date have generally been conducted on people with less skin pigmentation (i.e., those with Fitzpatrick skin types 1–3). A different result may be seen in those with Fitzpatrick skin types 4–6.

Generally speaking, 5 to 30 minutes of unprotected sun exposure to the hands, face, and arms at least three times a week between 11 a.m. and 3 p.m. may generally be enough to keep vitamin D levels out of the deficient range (<30 nmol/L or <12 ng/mL).[391][392] When the UV index in your area is 3 or higher, people with Fitzpatrick skin types 1 or 2 should keep unprotected sun exposure to less than 10 minutes; skin types 3 or 4, less than 15 minutes; and skin types 5 or 6, less than 30 minutes.[83][84] You can check out the UV index forecast in your area here.

Keep in mind that longer periods of unprotected sun exposure will not necessarily lead to higher vitamin D production, as the UVB rays will eventually degrade vitamin D in your skin to an inactive state.[393] This actually helps protect your body against vitamin D toxicity. Additionally, UVB-induced vitamin D production can be influenced by *many* other factors, including:[394]

- Age
- Amount of sun-exposed skin
- Certain medications
- Clothing type
- Elevation
- Latitude
- Living environment (e.g., urban, suburban, or rural)
- Pollution
- Skin pigmentation
- Solar angle
- Sun exposure duration and frequency
- Time of year
- Weather conditions

For these reasons, it is not advisable to completely forgo sunscreen to increase vitamin D levels or rely on sun exposure as your *main* source of vitamin D. Rather, a more balanced approach would be to increase vitamin D through diet and supplementation, with some limited unprotected sun exposure added in.

> 💡 ***Tip:*** **Calculate your safe UV exposure for a healthy vitamin D status**
>
> How much UV exposure you need to maximize your body's vitamin D production depends on a number of factors: time of year, location, skin type, weather conditions, and more. Fortunately, the Norwegian Institute for Air Research has developed a calculator, based on peer-reviewed research,[395][396][397][398] that takes these factors and more into account. This tool allows you to calculate UV exposure times to obtain optimal vitamin D synthesis without burning your skin.
>
> You can try the easier simplified model or the more complex full model.

Q. Why don't you mention the hair loss

treatment finasteride (Propecia)?

This guide is a supplement guide. We sometimes include over-the-counter medications (such as topical minoxidil), but if you need prescription medication (such as finasteride), please consult a physician or physician specialist certified with the American Board of Hair Restoration Surgery (ABHRS).

Q. Why aren't there more supplements for nails?

While the market abounds in "hair and nails" products, reliable studies on nails are scarce. Benefits to nails from supplements are most often anecdotal or inferred from studies on hair.

Preliminary evidence suggests that minoxidil might help with nail growth; vitamin B_7 (biotin) might help with brittle nails, triangular worn-down nails, trachyonychia, or habit-tic deformity; and vitamin E might help with yellow nail syndrome and brittle nails.

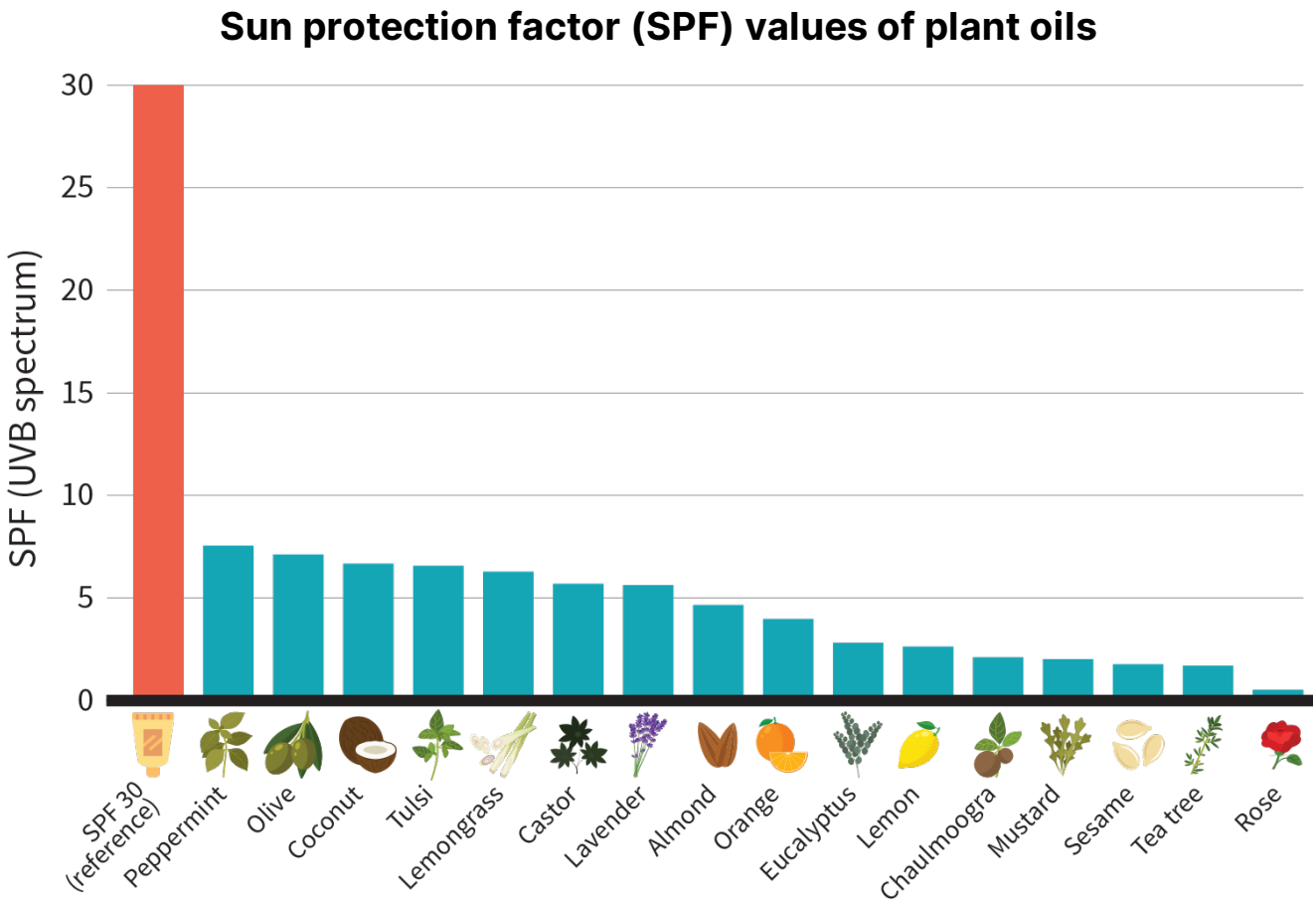
Current evidence suggests that supplementation with calcium, copper, iron, selenium, silic, zinc, vitamin A (retinoids), vitamin B12, or vitamin C doesn't improve nail health or appearance in non-deficient people.[399][400]

Q. Can I create my own sunscreen using natural plant oils?

In short, not really. When tested for protection against UVB radiation only, many plant oils provide an SPF of <8.[401] These oils can be incorporated into commercial sunscreen products to help the overall SPF rating, but on their own they are insufficient for UV protection.

Be aware that some of these plant oils can be potentially allergenic and may cause skin irritation (such as dermatitis) in some.[402][403]

Sunscreens are formulated using specific ingredients in specific amounts in addition to employing manufacturing methods to help ensure these UV-protective ingredients are evenly distributed throughout the sunscreen. This process is very difficult to replicate at home.



Adapted from Kaur and Saraf. *Pharmacognosy Res.* 2010.[401]

Q. Do the "natural" and "clean" labels on skin care products mean anything?

The skin care market is huge, generating $5.6 billion in sales in 2018 alone and "natural" brands were the top contributors to market growth. The explosive growth in the natural skin care market is driven by the desire of consumers to use products that are both safe and nontoxic.

Yet in the US, the terms "clean" and "natural" are not defined or regulated when it comes to skin care products.[404] The inclusion of these terms on the label does not offer any assurances that the product is safer for consumers compared with products that don't contain these labels.

However, there are two natural sunscreen ingredients that have a proven track record — zinc oxide and titanium dioxide. Often referred to as physical chemical barriers (aka inorganic chemical barriers or mineral sunscreens), these naturally occurring compounds function by reflecting and dissipating UV rays.

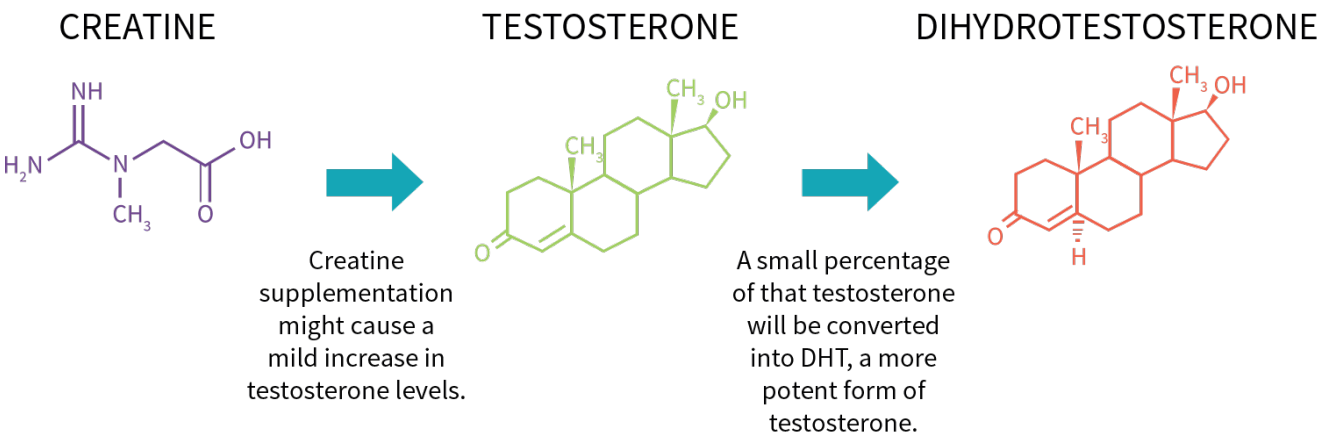
Q. Will creatine cause hair loss?

The idea that creatine *might* increase hair loss stems from a single randomized controlled trial (RCT) whose participants (20 healthy, young, male rugby players) saw a small but statistically significant increase in *dihydrotestosterone* (DHT) after supplementing with creatine for 21 days.[405] When DHT, a potent metabolite of testosterone, binds to DHT receptors on the hair follicles of the scalp, those follicles may shrink and stop producing hair.[406][407]

To date, this RCT is the only one to have tested creatine's effects on DHT. However, a number of RCTs

have examined creatine's effects on testosterone. Out of 12 additional RCTs, two saw a significant increase in testosterone,[408][409] but 10 saw no effect.[405][410][411][412][413][414][415][416][417][418] Of those 12 RCTs, five also tested creatine's effects on free testosterone, the form that gets converted into DHT, and all saw no significant increases.[410][411][413][415][417]

A proposed mechanism behind creatine's effect on testosterone



Creatine *could* nonsignificantly increase free testosterone yet significantly increase DHT (i.e., a small increase in free testosterone, which can convert into DHT, could lead to a much greater increase in total DHT). So while it's *technically* possible that creatine might have some effect on hair loss, current evidence and mechanistic data indicate it's quite unlikely.

A summary of creatine-testosterone studies

BETWEEN-GROUP EFFECT	STUDY	SAMPLE SIZE	POPULATION	AVG AGE	DURATION	DOSE	EFFECT ON TESTOSTERONE
Significant	Arazi 2015	20	Active males	20	1 week	20 g/day	↑
	Vatani 2011	20	Trained males	20	6 days	20 g/day	↑
Mixed Results	van der Merwe 2009	20	Male rugby players	18	3 weeks	25 g/day loading 5 g/day maintenance	↑ DHT ↔ Test
No effect	Cook 2011		Male rugby players	20	10 weeks	4.5 g and 9 g	↔
	Cooke 2014	20	Active males	61	12 weeks	20 g/day loading Then 0.1 g/kg 3x/week (avg. 8.8 g/day)	↔
	Crowe 2003	28	Male rugby players	25	6 weeks	3 g/day HMB* + 3 g/day creatine	↔
	Eijnde 2001	11	untrained males	20	8 days	20 g/day	↔
	Faraji 2010	20	Male Sprinters	21	1 week	20 g/day	↔
	Hoffman 2006	33	Male football players	College	10 weeks	10.5 g/day	↔
	Rhimi 2010	27	Trained males	21	1 week	20 g/day	↔

BETWEEN-GROUP EFFECT	STUDY	SAMPLE SIZE	POPULATION	AVG AGE	DURATION	DOSE	EFFECT ON TESTOSTERONE
	Tyka 2015**	19	Male runners	19–30***	6 weeks	0.07 g/kg of lean body mass	↔
	Volek 1997	13	Active males	23	1 week	25 g/day	↔
	Volek 2004	17	Trained males	21	6 weeks	20 g/day loading 4 g/day maintenance	↔

* While there was no creatine-only group, studies have not shown HMB to independently affect testosterone.[419][420][421][422]

** This study used creatine malate instead of creatine monohydrate.

*** This study reported an age range but not an average age.

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