

# Nutritional Antioxidants And Skin Health

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## Introduction

The skin is the largest organ in the body, weighing approximately 20 pounds. It is a highly proliferative tissue, which is prone to various diseases, defects, infections and insults from chemical, physical and ultra-violet light sources. Modern day nutrition and biochemical research has demonstrated that specific dietary nutrients significantly affect the health and appearance of the skin and can slow the biological processes associated with skin aging. Specific dietary agents and certain supplements are known to enhance the health and appearance of the skin by providing photo-protection against sun damage, improving immune function at the skin level, reducing changes linked to skin cancer development and providing therapeutic bioactive agents that assist in the treatment of many skin conditions, such as psoriasis, eczema and acne. Along with hair and nails, skin is the fastest growing and most superficial tissue in the body. As such, it has a high demand for nutrients in order to continuously replenish itself with rapidly developing immature skin cells from the layers below. Even a marginal deficiency of Vitamin A, the carotenoids, Vitamin D, Vitamins B1, B2, niacin, pantothenic acid, biotin, folic acid Vitamin B12, Vitamin E, Vitamin C or essential fatty acids can result in impaired development of skin cells that manifests itself in skin that is less smooth, prone to lesions, less elastic and more prone to accelerated aging.

In the pursuit of healthy looking skin many individuals limit their approach to the application of topical skin creams and lotions. However, studies indicate that the addition of specific nutrient supplementation and a healthy diet to a skin care regimen can significantly enhance skin texture and appearance, beyond what is attainable from the use of topical creams and lotions alone. In fact, the color and luster of the skin can be an important clue to underlying nutritional problems. The skin should be soft, moist and relatively wrinkle-free, neither too dry nor too oily. Excessive cross-linking of collagen caused by exposure to free radicals promotes wrinkling. That is why smokers are three times as likely as non-smokers to develop premature wrinkles and the reason those who have over-exposed their skin to sunlight also reveal premature skin wrinkling. Of course, antioxidant supplements and antioxidant-enriched skin creams can help to reduce this form of skin damage as we shall discuss.

As reported by R Hoffman, the medical director of the Hoffman Center for Holistic Medicine in Manhattan, an inner facial consisting of changing to a healthier diet, better elimination and supplementation with vital skin nutrients, including essential fatty acids, can result in dramatic improvements in skin appearance in three to four months. The evidence is now strong and consistent that the outer beauty of the skin and the effective treatment of damaged skin and other skin disorders requires a comprehensive strategy that must include the intake of optimal levels of certain vitamins, minerals and essential fatty acids.



## Topical Skin Nutrients

Before examining the relationship between dietary nutrients and skin health it is important to address the value of incorporating certain nutrients into topical creams and lotions. Recently, in particular, there has been much attention given to the use of lotions containing phytoestrogens. A review of this evidence indicates that the use of topically applied estrogen, (as well as hormone replacement therapy) and the use of natural progesterone by postmenopausal women may improve the skin's texture and appearance to a significant degree. However, estrogen replacement has been shown to increase the risk of breast cancer and influence the risk of other health conditions, which must be factored in to the decision-making process. In regards to the topical application of phytoestrogens (plant-based estrogens), studies reveal that the transdermal absorption of the soy isoflavones genistein and diadzein is possible from studies that used specific oils (e.g. olive oil) as a transdermal chaperone agent. It appears that, with repeated use, these phytoestrogens are captured in the skin where they may exert a positive effect on skin cell development and texture. At this point it is too premature to make any definitive statements in this regard and thus, the topical application of phytoestrogens as an intervention for skin health should be regarded as experimental at this time.

Other nutrients, however, are well established as topical agents that may be considered for use to protect the skin from free radical damage and improve the health of the skin in various ways. This list would include the antioxidants, Vitamins C, Vitamin E, and selenium, as well as other health-promoting and protective nutrients such as zinc oxide, green tea extract, witch hazel, aloe vera and milk thistle, which have all demonstrated impressive outcomes in clinical and experimental studies when used as topical agents.

### **NUTRITIONAL SUPPLEMENTS AND HEALTHY SKIN**

The oral ingestion of certain vitamins and minerals has been shown to be of proven value in the prevention and treatment of many skin conditions and is a fundamental consideration in lifelong skin health and maintenance, and a cornerstone of skin anti-aging practices. In particular, antioxidant vitamins and minerals are emerging as vital nutrients that protect the skin from the inside out in a manner that is not achievable through topical application alone. However, this review also includes a discussion of other nutrients that are essential to consider in the pursuit of healthy skin appearance, and anti-aging of the skin.



## Antioxidants And Free Radicals

Premature aging of the skin, including solar elastosis (premature wrinkling), damage to the genetic material of epidermal cells and underlying melanin pigment, as well as other aspects of photoaging skin damage, are known to result from free radical damage, which most commonly occurs due to over exposure to ultraviolet light from solar radiation (sunlight). Free radicals generated from cigarette smoking and alcohol consumption can also damage the skin in a similar way. Free radical damage hastens the process of skin aging and wrinkling and creates mutations that are known to lead to the development of skin cancer (basal cell carcinoma, squamous cell carcinoma and melanoma). Presently, non-melanoma skin cancer is the most common malignancy in the United States and the estimated lifetime risk of developing malignant melanoma in the U.S. has risen from 1 in 250, in 1981, to 1 in 87, in 1996. Cumulative lifetime sun exposure and decreased protection from the earth's shrinking ozone layer are considered to be the primary culprits for these disquieting statistics. Too much sun exposure also leads to sunburn, which is an inflammation of the skin caused in part by the sunlight's activation of free radical molecules. Excessive sun exposure also impairs the skin's genetic material (DNA and RNA) and immune function, which further increase the risk of skin cancer. Therefore, avoiding over exposure to sunlight, (and other known sources of free radicals), wearing protective clothing and using antioxidant-containing sun block creams and lotions are prudent strategies to minimize risk of premature skin aging and skin cancer.

In addition to these factors, recent studies have indicated that the use of antioxidant supplements can further help to protect the skin from free radical damage and age-related changes linked to premature wrinkling and cancerous mutations. A double-blind, placebo-controlled study in human subjects demonstrated that subjects taking the Vitamin C (2000 mg per day) and Vitamin E (1000 I.U.) supplements had significantly less free-radical damage to their skin after UV-light exposure than did the group not given the antioxidant supplement regime. They also showed significantly less sunburn reaction. Further, it also been shown that free radicals (especially sun exposure) deplete the skin of its antioxidant defenses quite rapidly, further increasing the requirement for nutritional antioxidants to replenish these important cellular antioxidants. Other laboratory studies reveal that selenium, zinc and N-acetylcysteine supplementation can also defend skin cells against free radicals from UV-light. Intensive investigation in this area of study strongly suggests that the daily supplementation of Vitamins A,C,E, Beta-carotene, selenium and zinc, at levels above those typically consumed from food alone, provides the skin with additional and possibly essential antioxidant defenses to help slow skin aging and lends important support to other skin cancer prevention initiatives.



## B-Vitamins And Skin Health

Virtually, all B-Vitamins are required at sufficient doses to ensure healthy development of skin cells. In fact, deficiencies in many B-Vitamins directly result in various types of skin conditions, skin diseases and alterations in the normal appearance of the skin. Even marginal deficiencies of B-Vitamins can produce chronic skin lesions that are not treatable with topical agents alone. For instance, nasolabial seborrhoea is known to result from marginal deficiencies in niacin, Vitamin B6 or Vitamin B2. Hyperpigmentation (color of skin changes first to red then to brown) can result from niacin deficiency. Angular stomatitis (redness, cracking and flaking at the corners of the mouth) can result from a marginal deficiency of Vitamin B2, Vitamin B6, niacin or iron. Supplementation with the appropriate doses of specific B-Vitamins can reverse these conditions if a B-Vitamin deficiency is a contributing cause of the problem, as is often the case. In addition to these findings, human studies reveal that folic acid and/or Vitamin B6 supplementation have been effective in treating acne vulgaris. B-complex vitamin supplementation has been used successfully in the treatment of eczema (atopic dermatitis) in conjunction with essential fatty acids and hydrochloric acid supplementation. Some patients with psoriasis respond favorably to supplementation with folic acid and/or Vitamin B12 and patients with seborrheic dermatitis have been shown to improve with supplementation of biotin (a B-vitamin), folic acid and/or Vitamin B12. Investigation into this area demonstrates that sub-optimal B-Vitamin status can give rise to dermatitis (skin inflammation conditions), as well as lack of skin smoothness, seborrheic-type scaly lesions and/or irregular pigmentation.

Certain B-Vitamins (B6, B2) also participate as cofactors in the synthesis of prostaglandin hormones that, in part, determine the smoothness and texture of the skin. More recently, niacin (Vitamin B3) has been shown to help prevent skin damage or photo-aging induced by sunlight (ultra-violet light) by increasing the cellular energy required by skin cells to repair free radical damage and preserve their immune function. These experiments suggest that Vitamin B3 supplementation may be an important aspect of preventing cancerous changes to skin cells and is involved in slowing the process of photo-aging of the skin over our lifetime.

Unfortunately, data from the National Health and Nutrition Examination Survey II revealed that as a daily average across the US population, 80% of Americans ingest less than the recommended daily allowance (RDA) for Vitamin B6, 45% ingest less than the RDA for Vitamin B1, 34% ingest less than the RDA for Vitamin B2 and Vitamin B12, and 33% ingest less than the RDA for niacin (Vitamin B3). Moreover, the RDA values were not designed to represent optimal intake levels, but rather as levels of intake to guard against overt deficiency states. Thus, the RDAs are by no means the desired level of intake to maximize health and guard against degenerative and age-related diseases. By all accounts, the daily use of a B-50 complex vitamin may be considered an important strategy to enhance and maintain the healthy appearance of the skin, aid in the treatment of various skin conditions, prevent the development of B-Vitamin deficiency states that produce skin lesions and diseases, and help combat the underlying metabolic processes associated with photo-aging of the skin and skin cancer development.



## Skin Cell Maturation (Differentiation)

The normal growth and development of skin cells is also dependent upon the influence of bioactive agents that promote epithelial cell maturation and differentiation to fully developed adult cells. The transformation process of immature-looking cells to fully developed adult skin cells depends largely upon an individual's nutritional status of Vitamin A, Beta-carotene and Vitamin D. All epithelial cells (including skin cells) require Vitamin A (which the body can make from Beta-carotene if necessary) to achieve their full mature development and for the production of mucus and other secretions that keep these tissues moist and resistant to infection. In the absence of adequate Vitamin A, epithelial tissue does not produce these secretions, but becomes covered with keratin, a dry, water-insoluble protein that transforms skin that is soft and moist into skin that is hard and dry, or keratinised. Vitamin A deficiency, in fact produces a pre cancerous-type of condition known as metaplasia in various epithelial cells, whereby affected cells appear grossly enlarged and appear highly irregular and abnormal upon microscopic examination. At the same time, skin cells are particularly responsive to Vitamin A supplementation treatment in a number of conditions and a topical form of Vitamin A has been used with success in the treatment of acne vulgaris. Vitamin A supplementation has been shown to be beneficial in wound healing as it stimulates the synthesis of collagen. As such, some physicians recommend short-term supplementation with 25,000-50,000 I.U. of Vitamin A, prior to and following surgery and dermatological procedures to enhance healing and to help ensure more complete healing of the skin and connective tissues.

As was true for the average daily consumption of many B-Vitamins, the National Health and Nutrition Examination Survey II demonstrated that Vitamin A intake across the U.S. population is also of concern, with 50% of adult Americans consuming less than the RDA value for Vitamin A each day. For this reason it is advisable to consider a daily supplement containing 2,000-3,000 I.U. of Vitamin A and 10,000-15,000 I.U. of Beta-carotene to help support skin health and appearance. Certain conditions may require higher doses for short periods of time, but long-term supplementation with higher doses of preformed Vitamin A (Beta-carotene is non toxic by comparison) can result in Vitamin A toxicity, which among other serious outcomes can cause severe skin dryness and peeling.

In the case of Vitamin D it has recently been discovered that most skin cells have Vitamin D receptors on their surface. Vitamin D is well known for its positive effects on cellular differentiation (promoting the full maturation of epithelial cells), slowing the rate of epithelial cell division and for its tumor suppressant effects on epithelial cells that express Vitamin D receptors. Experimental studies indicate that Vitamin D (1,25 dihydroxy Vitamin D) can inhibit the growth of some types of melanomas by inducing apoptosis (programmed cell death of cancer cells). Generally speaking, cells that contain Vitamin D receptors are able to produce their own 1,25 dihydroxy Vitamin D (the most potent form of Vitamin D) from the 25-hydroxy Vitamin D, which is made in the liver (25-hydroxy Vitamin D is made from the Vitamin D synthesized under the skin upon sunlight exposure and the Vitamin D consumed from food and supplements). Individuals living in more northerly areas of North America tend to have significantly lower levels of Vitamin D in their blood stream due to insufficient intensity of year round direct sunlight exposure to the skin. Thus, Vitamin D supplementation is considered to more crucial for North American individuals living above the 40th degree latitude. Therapeutically, Vitamin D supplementation has been shown to be helpful in the treatment of psoriasis. The mechanism of action is thought to involve the slowing of skin cell division, which is otherwise excessive in psoriatic cases. For general health promotion purposes and to enhance the Vitamin D availability to skin cells, 400 I.U. per day of Vitamin D supplementation is regarded as safe and effective. This amount is easily obtained from a respectable multi vitamin formula.

### **The Minerals Zinc And Selenium**

The minerals zinc and selenium are also emerging as vital nutrients for skin health and appearance. Zinc nutritional status is necessary for oil gland function, local skin hormone activation, wound healing, skin inflammation control and regeneration of skin cells. Zinc supplementation has been used with success in the treatment of many acne cases and as part of the nutritional treatment for psoriasis and eczema. Studies indicate that most individuals consume only 8-9 mg per day of zinc from dietary sources, whereas the RDA for zinc is set at 15 mg for adults.

The mineral selenium is also important in this regard. Selenium helps to provide antioxidant protection as part of the glutathione peroxidase enzyme. Selenium modulates the synthesis of prostaglandin hormones, which affect the smoothness and texture of the skin and it affects immune system function. Low blood levels of selenium have been associated with both eczema and psoriasis in human studies.



## Summary And Conclusion

The skin is a dynamic, highly proliferative organ that has an inherent need for specific vitamin and minerals to support its structure, function and development. Exposure of the skin to both internal and external sources of free radicals appears to create a demand for appropriate nutritional and topical antioxidant support to defend against photo aging and mutations linked to cancer development. In addition, scientific investigation reveals that certain vitamins and minerals play a vital role in the prevention and management of many skin conditions and diseases, and affect other aspects of skin cell maturation that determine the texture, moisture and smoothness of the skin. Although various topical skin lotions and treatments provide effective anti-aging and therapeutic benefits, the addition of a high potency multi vitamin and mineral supplement to the client's skin care program is emerging as an invaluable intervention to complement topical and cosmetic practices. The scientific reality is that in the presence of sub-optimal intake of vitamins and minerals (which is prevalent in our society), it is not possible for clients to achieve the maximum anti-aging and therapeutic benefits provided by other skin care practices or procedures. The available evidence indicates that it is prudent to incorporate the use of a high potency multi vitamin and mineral into a daily program dealing with general skin care health, appearance and anti-aging. In today's marketplace it is now possible to find all of the essential vitamins and minerals, at optimal doses, formulated into a single high potency multi-vitamin and mineral product. (See Table 2 for a detailed account of desirable levels of nutrients provided by a high potency multi-vitamin and mineral formula.)

*(Note: Tables 1 & 2 appear on following pages)*

**Table 1**

Skin Problem	Supplements That Help
Sun- and chemical-induced free radical damage that causes premature aging of the skin, wrinkling, cancerous conditions, other forms of skin damage	<p>Contains optimal levels of antioxidants to help protect your skin from the aging and damaging effects caused by the sun:</p> <p>Antioxidants Vitamin C, Vitamin E, Beta-carotene, selenium and zinc intercept and neutralize free radicals and defend skin cells from these damaging effects</p> <p>Antioxidants protect skin from ultra-violet light damage</p> <p>Replenishes the skin's antioxidant nutrient supply</p>
Skin Disorders such as dermatitis (skin inflammation problems), lack of smoothness, seborrhoea-like scaly lesions, irregular pigmentation	<p>Contains B-Vitamins at sufficient doses to ensure the healthy development of skin cells</p> <p>B-Vitamin supplementation corrects these skin problems and successfully treats a wide range of dermatitis problems</p> <p>B-Vitamins help to improve the smoothness and texture of the skin Niacin (Vitamin B3) supplementation helps prevent ultra-violet light damage to the skin and prevent weakened skin immune function by increasing energy availability to skin cells, helping them repair any ultra-violet light damage before it becomes permanent.</p>
Abnormal Development of Skin Cells, sometimes producing thickened dry skin, which is prone to infection	<p>Contains Vitamin A and Vitamin D to assist in normal growth and development of skin cells</p> <p>Vitamin D receptors present on skin cells require adequate Vitamin D stimulation from within the body in order to develop normally</p> <p>Vitamin A is involved in growth and repair of skin cells</p> <p>Correct doses of Vitamin A and D to achieve maximum benefit without risk of toxicity</p>
Unhealthy Skin, Acne and other conditions	<p>Provides the appropriate daily doses of Zinc and Selenium to enhance your skin's vitality and appearance</p> <p>Zinc improves oil gland function, local skin hormone activation, wound healing, inflammation control within the skin and tissue regeneration of skin cells.</p> <p>Zinc supplementation is emerging as an important aspect of acne control and in the treatment of eczema and psoriasis.</p> <p>Selenium plays a key role in antioxidant protection, and in the prevention and management of various skin conditions</p>

**Table 2**

Characteristics of a High Potency Multi Vitamin & Mineral Supplement		
Vitamin A	Retinyl Palmitate	2,000-3,000 I.U.
Beta Carotene		15,000 I.U.
Vitamin C	Ascorbic Acid	500-1,000 mg
Vitamin D	Cholecalciferol	1000 I.U.
Vitamin E	D-alpha tocopheryl succinate	200-400 I.U.
Thiamin	Thiamine Mononitrate	50 mg
Riboflavin		50 mg
Niacin	Niacinamide	50 mg
Vitamin B-6	Pyridoxine Hydrochloride	50 mg
Folic Acid		400 mcg
Vitamin B-12	Cyanocobalmin	50 mcg
Biotin	D-Biotin	300 mcg
Pantothenic Acid	Calcium Pantothenate	50 mg
Calcium	Calcium Carbonate, Calcium Citrate	500 mg
Iron	Ferrous Fumarate	6 mg
Magnesium	Magnesium Oxide	200 mg
Zinc	Zinc Citrate	15 mg
Selenium	Selenium HVP/HAP Chelate	100-200 mcg
Copper	Copper Gluconate	2 mg
Manganese	Manganese Gluconate	5 mg
Chromium	Chromium Amino Acid Chelate	50 mcg
Molybdenum	Molybdenum Citrate	50 mcg
Citrus Bioflavonoids		50 mg
Lutein		6 mg
Lycopene		6 mg



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