

SOY AND SKIN HEALTH: BEAUTY FROM THE INSIDE OUT

By Nasima Afzal, Mildred Min, and Raja K. Sivamani, MD, MS, AP

The pursuit of healthier skin transcends the realm of cosmetics, delving into the interplay between nutrition and dermatology. Soy contains multiple compounds that enhance skin appearance -- particularly isoflavones. A growing body of research indicates that soy supplementation contributes to both skin health and appearance through a variety of mechanisms, favorably influencing various dermatologic parameters such as hydration, elasticity, collagen synthesis, skin barrier function, fine lines, and wrinkles.¹

Isoflavones, which are nonsteroidal compounds found in uniquely high amounts in soybeans, are classified as phytoestrogens.² The three isoflavones in soybeans are genistein, daidzein, and glycitein.³ By binding to estrogen receptors (ER α and ER β), isoflavones may exert some of the same effects as the hormone estrogen, although they may also exert effects opposite to those of estrogen. In other cases, such compounds may have no effects on tissues affected by this hormone.^{4,5} Isoflavones are being studied for their anti-inflammatory, antioxidant, antimicrobial, and anti-cancer effects.⁶⁻⁹

Reducing the Effects of Skin Aging with Soy

As the body's outermost layer of protection, the skin is subject to both extrinsic and intrinsic influences, which impact its structure and function as individuals age.¹⁰ Skin aging can be impacted by a multitude of factors, including genetics, environmental exposures, lifestyle behavior, and the aging process itself.¹¹ As the skin ages, wrinkles, dryness, a diminished barrier integrity, and a reduction in the thickness of the epidermis may occur.¹⁰ The decline in estrogen levels among postmenopausal women lead to diminished synthesis of the protein collagen, which can be regarded as a key factor contributing to alterations in the skin.¹² Evidence increasingly suggests soy isoflavones can help combat the effects of skin aging, potentially among both pre-and postmenopausal women.¹³

For example, a 2007 study evaluated the effects of soy isoflavones on skin health in premenopausal Japanese women. Twenty-six females were randomized to receive either a supplement of 40mg of soy isoflavones or a placebo daily for 12 weeks. Assessments of linear and fine wrinkles, particularly at the lateral angle of the eyes, were conducted throughout the duration of the study. The study found there were statistically significant improvements in fine wrinkles at week 12 and in skin elasticity at week eight when compared to the placebo group. Importantly, no adverse effects due to isoflavones were reported.¹⁴

One year earlier, a study in post-menopausal women examined the effects of isoflavones plus a cocktail of bioactives that included fish protein polysaccharides, white tea extracts, grape seed, tomato, vitamins C and E, zinc, and chamomile extract. Women were randomized to receive either the dietary supplement or a placebo twice daily for six months. Skin aging was assessed via clinical grading and photo evaluation of face, hands, and décolletage. At study termination, compared to the placebo group, women receiving the supplement experienced significant improvements in facial wrinkles, pigmentation,

laxity, under eye dark circles, and overall appearance of the skin.¹⁵ Although the results were impressive, the experimental design of this study does not allow a determination of the extent to which isoflavones contributed to the results.

A 14-week, randomized, double-blind and placebo-controlled trial conducted in 2014 has the same limitations as the previously cited study. In this case, postmenopausal women received a placebo or a mixture of isoflavones along with lycopene, vitamins C and E, and fish oil. A total of 166 women were enrolled and randomly allocated to three groups: test group 1 (n=51), test group 2 (n=53), and placebo group (n=55). Test group 1 contained higher levels of the active ingredients compared to test group 2. At study end, there was a significant improvement in skin texture and a reduction in depth of facial wrinkles in groups 1 and 2 compared to the placebo group. Also, skin biopsy analysis revealed increased levels of collagen in subjects in test group 2 compared to those in the placebo group.¹⁶

The above findings plus results from other studies¹⁷ provided the justification for more specifically examining the influence of soy isoflavones on facial hydration, pigmentation, and wrinkles in postmenopausal women. In the last study, which was conducted by our research laboratory, women in the soy group (n=23) consumed 30g/d soy protein isolate that contained 50mg isoflavones, whereas the placebo group consumed 30g/d casein. Skin biophysical assessments and facial imaging were obtained at baseline, eight, 16, and 24 weeks. Women in the soy group exhibited a significant reduction in the average wrinkle severity: 5.9% at week 16 and 7.1% at week 24, compared to baseline and compared to the casein supplementation group. Imaging analysis also revealed a significant decrease in average facial pigment severity in the soy group of 2.4% at week 24 compared to baseline and the casein supplementation group. Additionally, the soy group experienced a significant increase in skin hydration in both cheeks at week 24, with the right cheek increasing by 68% and the left cheek by 39% when compared to baseline, whereas there were no significant changes in the casein supplementation group.¹⁸ These results provide the most direct support currently available for the efficacy of isoflavones.

Conclusion

Soy isoflavones have garnered an increasing amount of attention for a variety of proposed benefits. Accumulating clinical evidence indicates these naturally occurring soybean components exert a range of beneficial effects on the appearance of the skin. The dose of isoflavones shown to be efficacious in clinical studies ranges from about 40 to 60mg/d, an amount provided by approximately two servings of soy foods. Future research is needed to determine the long-term effects of isoflavones and to gain more insight into the dose needed for optimal benefit.

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MORE THAN SKIN DEEP: THE IMPACT OF NUTRITION ON SKIN HEALTH

By Rajani Katta, MD

Diet and skin health have been linked since ancient times. For example, ancient texts of Ayurvedic medicine describe many herbs, minerals, and fats that could help maintain the health and beauty of skin. In the last few decades, a robust body of research has outlined this relationship more clearly. Population studies have examined the long-term effects of dietary patterns on skin health. For example, in a cross-sectional study of nearly 3,000 elderly Dutch individuals, women with better adherence to healthy dietary guidelines had fewer wrinkles than those with a red meat and snack-dominant pattern of eating.¹ Human intervention studies have also identified the effects of specific dietary patterns, foods, and nutrients on the skin. In one small study, volunteers ingesting tomato paste providing 16mg lycopene daily for 10 weeks showed better resistance to the effects of UV radiation, with less skin erythema after UV exposure.² Researchers have identified multiple other compounds displaying similar photoprotective properties, including vitamins and phytonutrients such as polyphenols from green tea and cocoa.³ Animal and laboratory research has further increased the understanding of how these patterns, foods, and nutrients affect the skin on a biochemical and cellular level

Studies have also looked at the effects of diet on specific skin diseases and processes. Multiple human studies, for example, have found that low glycemic load diets may improve acne.⁴ Research has also highlighted the potential benefits of prebiotics and probiotics for preventing or treating atopic dermatitis.⁵ Additionally, consuming a diet rich in antioxidants, but not anti-oxidant supplements, may reduce risk of developing skin cancer.^{6,7} Although research is ongoing, these results can guide clinicians as they counsel patients.⁸

The Biochemical Processes Linking Diet to Skin Health

The three main processes impacting skin health are oxidation, major and minor inflammation, and glycation.⁹

In much the same way as hail pounding on a roof can cause damage over time, the free radicals produced by oxidation can cause skin damage over time. When exposed to UV radiation, the body produces free radicals. These radicals can damage proteins, lipids, and DNA; ultimately resulting in collagen damage and increasing carcinogenesis risk.

In chronic inflammation, the cytokines and inflammatory mediators produced can cause skin damage. For example, the enzymes collagenase and elastase, produced during the inflammatory cascade, act to “snip away” at the collagen and elastic fibers that support the skin.

The final process is one that can be likened to termites eating away at the structural framework of a house. Glycation is a non-enzymatic process whereby proteins and sugars combine to form advanced glycation end products (AGEs). AGEs cause damage to the collagen framework of the skin, resulting in a loss of elasticity colloquially known as sugar sag.¹⁰

Translating the Science to the Dinner Plate

Dietary choices can combat forces that damage the skin. For patients, I recommend three core principles:

1. Focus on Nutrient-Dense Plant Foods.

- Foods and beverages rich in antioxidants, such as fruits, vegetables, tea, and others, can help replenish the antioxidants in skin.
- Herbs and spices exhibit powerful antioxidant, anti-inflammatory, and anti-glycation properties.¹¹

- Nutrient-rich carbohydrates and fats provide additional compounds to support skin health. Beans, for example, are a source of fiber, resistant starch, vitamins, minerals, and phytonutrients, while walnuts contain antioxidants, vitamins, minerals, and anti-inflammatory omega-3 fatty acids.
 - Prebiotics and probiotics support the gut microbiome. “Good” gut microbes transform fiber into short-chain fatty acids, which can help strengthen skin barrier function.¹²
2. **Control Blood Sugar Levels.** AGEs are produced in the setting of elevated blood sugar levels. Maintain steady blood sugar levels by focusing on glycemic control, so try to reduce added sugar intake and consume high-fiber foods and complex carbohydrates.¹³
 3. **Choose Foods that Support Collagen Framework.** AGEs are produced by the body, but they are also present in certain foods. Research found some of the highest levels of AGEs in fried, grilled, and broiled meats. The highest levels of all are found in bacon.¹⁴

The link between nutrition and skin health is robust and complex and is the subject of ongoing research. This research can guide practitioners in counseling patients and clients about the importance of dietary choices in maintaining skin health.

ABOUT THE AUTHOR

Rajani Katta MD, is a dermatologist and clinical professor at the Baylor College of Medicine. She has published over 100 medical journal articles and book chapters on diet and dermatology and medical education, and is the author of *Glow: The Dermatologist’s Guide to a Whole Foods Younger Skin Diet*.

PUTTING IT INTO PRACTICE: DIETARY APPROACHES FOR SKIN HEALTH

By Shelley Rael, MS, RDN

It is well known that nutrition influences multiple body systems, including the gastrointestinal tract, cardiovascular system, and endocrine system. However, despite the popularity of collagen supplements, in clinical practice, nutrition is sometimes overlooked as a factor in skin health. It is also uncommon for patients to inquire about this connection, much less understand the impact their overall diet can have on skin health.

The Nutrition and Skin Health Connection

A growing body of research supports the conclusion that plant-based or plant-focused diets provide plenty of nutrients (including antioxidants and phytochemicals) to help with overall health and potentially slow the aging of our bodies, including our skin.

However, a plant-predominant diet can help more than just the appearance of fine lines and wrinkles; it also addresses the dark spots and even the “support structure,” aka collagen. Nutrient-rich foods can contribute to healthy skin.^{1,2,3}

Practical Tips for Patients

When counseling patients on enhancing their skin health through nutrition, share the following five tips:

1. **Hydration:** Properly hydrate for overall health and to help maintain skin moisture and minimize dryness. Make sure to hydrate appropriately – enough, but not too much, usually best assessed with urine color (light vs. dark) instead of ounces.

2. **Colorful Fruits and Vegetables:** Consume a variety of fruits and vegetables (including white and brown) to support skin health. Colorful fruits and vegetables provide antioxidants, vitamins, and minerals, including vitamin C which is critical for collagen production and zinc to help with wound healing.
3. **Healthy Fats:** Incorporate sources of unsaturated fats, including omega-3 fatty acids like salmon, flax seeds, and walnuts, to help keep the skin in good condition and minimize inflammation.
4. **Protein Foods:** Expand protein foods for all meals beyond meat, poultry, eggs, and fish to also include plant sources of protein such as tofu, nuts, seeds, and legumes. Proteins are the building blocks for skin and collagen and contribute to helping with the continuous turnover of skin cells.
5. **Minimize Added Sugar and Solid Fats:** Added sugars and solid fats can increase inflammation and may accelerate aging in the body, affecting skin health, especially if consumed in excess.

One-Day Sample Meal Plan for Healthy Skin

To make these recommendations more actionable, consider this sample meal plan that aligns with the principles of promoting skin health.

- **Breakfast:** Smoothie made with greek yogurt, soymilk, frozen berries, and chia seeds.
- **Lunch:** Whole grain toast with avocado, tempeh, and tomato, and apple with soy nut butter.
- **Snack:** Roasted edamame and baby carrots.
- **Dinner:** Baked or grilled salmon or extra firm tofu (with seasoning), steamed broccoli with red bell peppers, and brown rice.

When talking to patients about optimal skin health and minimizing the signs of aging, encourage healthier eating, which also positively affects their overall health as an added benefit. Incorporating a variety of foods from all food groups can help patients make sustainable changes for healthy skin.

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Shelley A. Rael, MS, RDN, is a dietitian in private practice in New Mexico. Shelley aims to make healthy eating and real-world nutrition accessible to all by working with people in individual and group settings. She is also a podcaster, author, speaker, and consultant. Shelley is known for debunking nutrition myths and providing evidence-based guidance.

REFERENCES

SOY AND SKIN HEALTH: BEAUTY FROM THE INSIDE OUT

1. Clinical efficacy of topical or oral soy supplementation in dermatology: A systematic review. N. Ntarelli, N. Gahoonia, J. Maloh and R. K. Sivamani. *J Clin Med* 2023 Vol. 12 Issue 12. Accession Number: 37373864 DOI: 10.3390/jcm12124171.
2. Křížová L, Dadáková K, Kašparovská J, Kašparovský T. Isoflavones. *Molecules*. 2019;24(6):1076. Published 2019 Mar 19. doi:10.3390/molecules24061076.
3. Zaheer K, Humayoun Akhtar M. An updated review of dietary isoflavones: Nutrition, processing, bioavailability and impacts on human health. *Crit Rev Food Sci Nutr*. 2017 Apr 13;57(6):1280-1293 doi: 10.1080/10408398.2014.989958. PMID: 26565435.
4. Kim IS. Current Perspectives on the Beneficial Effects of Soybean Isoflavones and Their Metabolites for Humans. *Antioxidants (Basel)*. 2021;10(7):1064. Published 2021 Jun 30. doi:10.3390/antiox10071064.
5. Wood CE, Register TC, Franke AA, Anthony MS, Cline JM. Dietary soy isoflavones inhibit estrogen effects in the postmenopausal breast. *Cancer Res*. 2006;66(2):1241-1249. doi:10.1158/0008-5472.CAN-05-2067.
6. Yu J, Bi X, Yu B, Chen D. Isoflavones: Anti-Inflammatory Benefit and Possible Caveats. *Nutrients*. 2016;8(6):361. Published 2016 Jun 10. doi:10.3390/nu8060361.
7. Rodríguez-Roque MJ, Rojas-Graü MA, Elez-Martínez P, Martín-Belloso O. Soymilk phenolic compounds, isoflavones and antioxidant activity as affected by in vitro gastrointestinal digestion. *Food Chem*. 2013 Jan 1;136(1):206-12. doi: 10.1016/j.foodchem.2012.07.115. Epub 2012 Aug 8. PMID: 23017414.
8. Dhayakaran, Rekha & Neethirajan, Suresh & Xue, Sophia & Shi, John. (2015). Characterization of antimicrobial efficacy of soy isoflavones against pathogenic biofilms. *LWT - Food Science and Technology*. 63. 10.1016/j.lwt.2015.04.053.

9. Conklin CM, Bechberger JF, MacFabe D, Guthrie N, Kurowska EM, Naus CC. Genistein and quercetin increase connexin43 and suppress growth of breast cancer cells. *Carcinogenesis*. 2007 Jan;28(1):93-100. doi: 10.1093/carcin/bgl106. Epub 2006 Jun 15. PMID: 16777995.
10. Csekés, E.; Račková, L. Skin Aging, Cellular Senescence and Natural Polyphenols. *Int. J. Mol. Sci.* 2021, 22, 12641.
11. Russell-Goldman E, Murphy GF. The Pathobiology of Skin Aging: New Insights into an Old Dilemma. *Am J Pathol.* 2020 Jul;190(7):1356-1369. doi: 10.1016/j.ajpath.2020.03.007. Epub 2020 Apr 1. PMID: 32246919; PMCID: PMC7481755.
12. Rzepecki AK, Murase JE, Juran R, Fabi SG, McLellan BN. Estrogen-deficient skin: The role of topical therapy. *Int J Womens Dermatol.* 2019 Mar 15;5(2):85-90. doi: 10.1016/j.ijwd.2019.01.001. PMID: 30997378; PMCID: PMC6451761.
13. Gopaul R, Knaggs HE, Lephart ED. Biochemical investigation and gene analysis of equol: a plant and soy-derived isoflavonoid with antiaging and antioxidant properties with potential human skin applications. *Biofactors.* 2012;38(1):44-52. doi:10.1002/biof.191.
14. Izumi T, Saito M, Obata A, Arai M, Yamaguchi H, Matsuyama A. Oral intake of soy isoflavone aglycone improves the aged skin of adult women. *J Nutr Sci Vitaminol (Tokyo).* 2007 Feb;53(1):57-62. doi: 10.3177/jnsv.53.57. PMID: 17484381.
15. Skovgaard GR, Jensen AS, Sigler ML. Effect of a novel dietary supplement on skin aging in post-menopausal women. *Eur J Clin Nutr.* 2006 Oct;60(10):1201-6. doi: 10.1038/sj.ejcn.1602438. Epub 2006 May 3. PMID: 16670692.
16. Jenkins G, Wainwright LJ, Holland R, Barrett KE, Casey J. Wrinkle reduction in post-menopausal women consuming a novel oral supplement: a double-blind placebo-controlled randomized study. *Int J Cosmet Sci.* 2014 Feb;36(1):22-31. doi: 10.1111/ics.12087. Epub 2013 Sep 18. PMID: 23927381; PMCID: PMC4265247.
17. Nagino T, Kaga C, Kano M, et al. Effects of fermented soymilk with *Lactobacillus casei* Shirota on skin condition and the gut microbiota: a randomized clinical pilot trial. *Beneficial Microbes.* 2017:1-10.
18. Rizzo J, Min M, Adnan S, Afzal N, Maloh J, Chambers CJ, Fam V, Sivamani RK. Soy Protein Containing Isoflavones Improves Facial Signs of Photoaging and Skin Hydration in Postmenopausal Women: Results of a Prospective Randomized Double-Blind Controlled Trial. *Nutrients.* 2023 Sep 23;15(19):4113. doi: 10.3390/nu15194113. PMID: 37836398; PMCID: PMC10574417.

MORE THAN SKIN DEEP: THE IMPACT OF NUTRITION ON SKIN HEALTH

1. Mekić S, Jacobs LC, Hamer MA, et al. A healthy diet in women is associated with less facial wrinkles in a large Dutch population-based cohort. *J Am Acad Dermatol.* 2019;80(5):1358-1363.e2. doi:10.1016/j.jaad.2018.03.033.
2. Stahl W, Heinrich U, Wiseman S, Eichler O, Sies H, Tronnier H. Dietary tomato paste protects against ultraviolet light-induced erythema in humans. *J Nutr.* 2001;131(5):1449-1451. doi:10.1093/jn/131.5.1449.
3. Parrado C, Philips N, Gilaberte Y, Juarranz A, González S. Oral Photoprotection: Effective Agents and Potential Candidates. *Front Med.* 2018;5:188. doi:10.3389/fmed.2018.00188.
4. Smith RN, Mann NJ, Braue A, Mäkeläinen H, Varigos GA. The effect of a high-protein, low glycemic-load diet versus a conventional, high glycemic-load diet on biochemical parameters associated with acne vulgaris: a randomized, investigator-masked, controlled trial. *J Am Acad Dermatol.* 2007;57(2):247-256. doi:10.1016/j.jaad.2007.01.046.
5. Chang YS, Trivedi MK, Jha A, Lin YF, Dimaano L, Garcia-Romero MT. Synbiotics for Prevention and Treatment of Atopic Dermatitis: A Meta-analysis of Randomized Clinical Trials. *JAMA Pediatr.* 2016;170(3):236-242. doi:10.1001/jamapediatrics.2015.3943.
6. Katta R, Brown DN. Diet and Skin Cancer: The Potential Role of Dietary Antioxidants in Nonmelanoma Skin Cancer Prevention. *J Skin Cancer.* 2015;2015. doi:10.1155/2015/893149.
7. Hercberg S, Ezzedine K, Guinot C, et al. Antioxidant Supplementation Increases the Risk of Skin Cancers in Women but Not in Men. *J Nutr.* 2007;137(9):2098-2105. doi:10.1093/jn/137.9.2098. PMID: 173927381; PMCID: PMC4265247.
8. Katta R, Kramer MJ. Skin and Diet: An Update on the Role of Dietary Change as a Treatment Strategy for Skin Disease. *Skin Ther Lett.* 2018;23(1):1-5.
9. Katta R, Sanchez A, Tantry E. An Anti-Wrinkle Diet: Nutritional Strategies to Combat Oxidation, Inflammation and Glycation. *Skin Ther Lett.* 2020;25(2):3-7.
10. Nguyen H, Katta R SV 20. Sugar Sag: Glycation and the Role of Diet in Aging Skin. *Skin Therapy Letter.* Published December 1, 2015. Accessed July 23, 2019. <https://www.skintherapyletter.com/aging-skin/glycation/>.
11. Dearlove RP, Greenspan P, Hartle DK, Swanson RB, Hargrove JL. Inhibition of protein glycation by extracts of culinary herbs and spices. *J Med Food.* 2008;11(2):275-281. doi:10.1089/jmf.2007.536.
12. Parke MA, Perez-Sanchez A, Zamil DH, Katta R. Diet and Skin Barrier: The Role of Dietary Interventions on Skin Barrier Function. *Dermatol Pract Concept.* 2021;11(1):e2021132. doi:10.5826/dpc.1101a132.
13. Kastorini CM, Panagiotakos DB. Dietary patterns and prevention of type 2 diabetes: from research to clinical practice; a systematic review. *Curr Diabetes Rev.* 2009;5(4):221-227.
14. Uribarri J, Woodruff S, Goodman S, et al. Advanced glycation end products in foods and a practical guide to their reduction in the diet. *J Am Diet Assoc.* 2010;110(6):911-916.e12. doi:10.1016/j.jada.2010.03.018.

PUTTING IT INTO PRACTICE: DIETARY APPROACHES FOR SKIN HEALTH

1. Cao C, Xiao Z, Wu Y, Ge C. Diet and Skin Aging-From the Perspective of Food Nutrition. *Nutrients.* 2020 Mar 24;12(3):870. doi: 10.3390/nu12030870. PMID: 32213934; PMCID: PMC7146365.
2. Schagen SK, Zampeli VA, Makrantonaki E, Zouboulis CC. Discovering the link between nutrition and skin aging. *Dermatoendocrinol.* 2012 Jul 1;4(3):298-307. doi: 10.4161/derm.22876. PMID: 23467449; PMCID: PMC3583891.
3. Rizzo J, Min M, Adnan S, Afzal N, Maloh J, Chambers CJ, Fam V, Sivamani RK. Soy Protein Containing Isoflavones Improves Facial Signs of Photoaging and Skin Hydration in Postmenopausal Women: Results of a Prospective Randomized Double-Blind Controlled Trial. *Nutrients.* 2023; 15(19):4113. <https://doi.org/10.3390/nu15194113>.



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