

NEW ADVANCES REGARDING SKIN ANTI-AGING BOTANICALS: A REVIEW

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Abstract

Decreased levels of collagen is a primary cause for skin aging. Collagen is produced from dermal fibroblasts. During photo aging, matrix metalloproteinases (MMPs) break down collagen fibers resulting in severe loss of skin elasticity. This manuscript lists the different types of botanicals that have been shown to provide dermatological benefits for skin regeneration. The literature of the last twenty years—with special attention for the last five years— concerning the different antiaging medicinal plants was reviewed.

Keywords: *Skin aging, Skin anti-aging, Plant extracts.*

Introduction

Skin aging is an advanced deteriorating of the skin's functional properties, related to alterations of dermal connective tissue. Skin aging can be divided into two main processes: intrinsic aging and photoaging.¹ Intrinsic aging is mainly due to the impact of genetic factors, oxidative stress. Whereas photoaging is mostly connected with the harmful effects of solar exposure on the skin. Moreover, diet, pollution, and smoking are also considered as contributing factors.² Aged skin exhibits wrinkling, fragility and loss of elasticity. A variety of mechanisms are involved in skin photoaging, such as inflammatory cytokine and collagenase activities.³ Inflammatory cytokines such as Interleukin (IL)-1 β induce the buildup of reactive oxygen species (ROS) that destroy skin cells, and rise the expression of matrix metalloproteinases (MMPs) that degrade collagen.⁴

Studies regarding prevention of melanin secretion, anti-wrinkle,⁵ and antioxidant studies⁶ have been recently published considering the skin as a crucial element of beauty.

Phyto-bioactive compounds are gaining attractiveness, as cosmeceuticals since they are natural skin protectives.⁷ Herbal cosmetic products are safe and biologically active⁸ in comparison with the synthetic products. Recently, cosmeceuticals, having the benefits of cosmetics and pharmaceuticals products, are acquiring a great attention for handling several skin problems.⁹

Botanical resources include products that could decrease transepidermal water loss (TEWL), increase skin elasticity, or offer antioxidant effects in the skin, can minimize the different signs and symptoms of photoaged skin.^{10,11}

2. Skin anti-aging botanicals

2.1 *Coffea Arabica* extract

Polyphenols such as chlorogenic acid, proanthocyanidins, quinic acid, and ferulic acid, which possess antioxidant properties are highly present in *Coffea arabica*.

Coffea Arabica extract decrease levels of MMP-1 and IL-1 β and downregulated MMPs gene expressions

and upregulated the gene of expressions for collagen structural proteins.¹²

2.2 *Calendula officinalis* extract

Calendula officinalis includes terpenoids, carotenoids, and flavonoids. *Calendula officinalis* flower extract displayed can delay skin aging through its ability to motivate skin tightness, skin elasticity, and increasing the skin hydration by reducing transepidermal water loss (TEWL), which is vital for preventing skin aging.¹³

2.3 *Hippophae rhamnoides* extract

Hippophae rhamnoides includes antioxidants such as β -carotene, vitamin C, and vitamin E. *Hippophae rhamnoides* extract stimulate dermal fibroblasts that is important for producing collagen necessary the skin water holding capability, it also has the tendency to decrease the trans epidermal water loss (TEWL), which in turn increases the hydration content of the skin. Moreover, the extract increased expression of cell surface integrins affecting skin mechanical properties.¹⁴

2.4 *Moringa oleifera*.

The hydroalcoholic extract of *Moringa oleifera* leaves decreased the undesirable skin sebum concentrations and reduced skin transepidermal water loss leading to increased skin hydration. *Moringa oleifera* extract was also effective against skin wrinkles, and scaliness. *Moringa oleifera* extract acquires its antiaging properties because of the presence of phenolic compounds which can scavenge the reactiveoxygen species.¹⁵

2.5 Saffron extract.

Crocin is a naturally active compound, derived from *Crocus sativus* L. It defends squalene against UV-persuaded peroxidation and averts the release of inflammatory mediators. Crocin hinders the release of several pro-inflammatory mediators including IL-8, PGE-2, TNF- α , and LTB₄. Crocin could also decrease the production of reactive oxygen species and restricts apoptosis.^{16,17}

2.6 Pomegranate

The high antioxidant content of *Punica granatum* (pomegranate) makes it a motivating constituent in cosmetics. Pomegranate contains a variety of active components such as, tannins, piperidine alkaloids, niacin, and anthocyanins. In vitro, pomegranate extract shields human fibroblasts from UV-induced cell damage, owing to the deactivation of NF- κ B, inhibition of proapoptotic caspase-3, and augmented DNA repair.¹⁸ Topically, pomegranate extract reduces COX-2 in porcine skin, causing a significant anti-inflammatory properties.¹⁹

2.7 Soy extract

Soy, derived from *Glycine maxi*, contains anti-aging isoflavones, including equol, glycitein, and daidzein. Glycitein exhibits antioxidant effects. Glycitein displayed an increased cell proliferation in dermal fibroblasts. Glycitein improved production of collagen and decreased MMP-1.²⁰ Daidzein, has established skin-lightening, anti-wrinkle, and skin-hydrating properties. Endogenous antioxidants are enhanced by diadzein. In addition, diadzein has decreased the proliferation of keratinocytes.²¹ The soy-derived equol improved collagen and elastin and diminished MMPs in cell culture.²² Soy isoflavones repressed UV-induced keratinocyte death and lessened epidermal thickness, and trans epidermal water loss (TEWL) in UV-exposed mouse skin.²³

2.8 *Salvia officinalis*

Salvia officinalis contains rutin, a polyphenolic bioflavonoid, which is important for skin nourishment. Rutin has the ability to deactivate free radicals which aid in vitamin C regeneration restoring its antioxidant potential.²⁴ Vitamin C plays an important role in collagen secretion, this could certainly stimulate the health of human skin. The antiwrinkle effect of *Salvia officinalis* was investigated by using a UV-induced photoaging model. *Salvia officinalis* extract had revealed antioxidant activity by DPPH radical scavenging assay. *Salvia officinalis* extract successfully repressed the activity of Col-I, Ela-I, and Hla-I enzymes of the skin.²⁵

2.9 Protocatechuic acid

Protocatechuic acid (PCA), is widely found in plants and fruits, including plums (*Prunus domestica* L.), and rosemary (*Rosmarinus officinalis* L.). PCA has an inflammatory antioxidant and effect.²⁶ Protocatechuic acid has the capability to scavenge free radicals (DPPH, ABTS. Using human dermal fibroblasts, PCA induced the synthesis of type I collagen, and prevented MMP-1 production from the UVA-exposed human dermal fibroblast. Treatment with a lotion containing 0.02% PCA for 8 weeks considerably reduced the percentage of all skin wrinkle considerations. Accordingly, PCA shows anti-wrinkle potentials.²⁷

2.10 Coenzyme Q10

Coenzyme Q10 is a free radical scavenger; it is capable of vitamin E regeneration.²⁸ It reduces MMP production and hastens the restoration of ATP levels after UV- irradiation in human fibroblasts in fibroblasts.²⁹ It enhances the production of both collagen and elastin.³⁰ Coenzyme Q10 reduces micro-relief lines and wrinkles.³¹ In a high dose, coenzyme Q10 displayed further enhancement of wrinkles in the upper radial lip lines, nasolabial folds, and corner of the mouth lines.³¹

2.11 *Aloe barbadensis* leaf extract

Aloe barbadensis contains triterpenoids (lupeol, β -sitosterol) that exert a protective effect. A 10% cream of *A. barbadensis* leaf extract was investigated to determine its efficacy on epidermal hydration and the degree of skin elasticity. Consequently, this study has exhibited that the *A. barbadensis* cream increases skin firmness, improves its moisture content, and enhances its elasticity.³²

2.12 Saffron extract and avocado oil

Avocado oil contains phytosterols that are considered as skin rejuvenators.³³ Crocin is a carotenoid present in Avocado oil (*Persea Americana*) that scavenges free radicals, so it can play a major role in preventing skin wrinkles.³⁴ An anti-wrinkle cream that are composed of saffron

extract and avocado oil was prepared and daily applied by twenty healthy volunteers, for 12 weeks. After 12 weeks of topical application, the area of nasolabial folds were meaningfully reduced accompanied by a large increase in skin elasticity.³⁵

2.13 Grape peel extract

Resveratrol present in grape is able to reduce the intracellular concentrations of reactive oxygen species (ROS).³⁶ Using grape peel extract or resveratrol increased the antioxidant enzymes in the skin and prevented metalloproteinases. The grape peel extract (GPE) had a protective effect on formation of wrinkles that are exposed to UVB. Thus, grape peel extract, containing a considerable amount of resveratrol, can be utilized for the production of beauty products.³⁷

2.14 Melatonin

Melatonin protects keratinocytes from UVB-induced oxidative damage.³⁸ Melatonin protects against wrinkle formation, and transdermal water loss. It has inhibited dermal collagen degradation in UVB irradiated hairless mice. Melatonin prevented the production of cyclooxygenase (COX-2), phospho-extracellular signal-regulated kinase-1 (p-ERK) which are responsible for inflammatory reactions in UVB exposed HaCaT keratinocytes. Moreover, melatonin blocked the release of UVB-induced MMP-1 and MMP-1, and increased the production of procollagen in HaCaT keratinocytes. Generally, these results prove that melatonin protects against UVB wrinkle formation.³⁹

2.15 *Sanguisorba officinalis* extract

A skin cream prepared with ziyuglycoside I isolated from *Sanguisorba officinalis* prevented the secretion of interleukin (IL)-1 β , matrix metalloproteinase (MMP)-2, MMP-9, in the mice. Additionally, the skin cream inhibits the formation of wrinkles and breakdown of collagen in UVB-induced hairless mice. Subsequently, the skin cream prepared with ziyuglycoside I may be a photoprotective compound for skincare.⁴⁰

2.16 Sibseonsan extract

The antioxidant, anti-inflammation, skin wrinkle inhibition effects of Sibseonsan was determined in vitro using murine macrophage and melanocyte cell lines. Sibseonsan act as a free radical scavenger. It reduces inflammatory response through its ability to prevent NO production as well as its negative effect on the production of TNF- α . Furthermore, sibseonsan leads to a pronounced decrease in the concentration of PGE₂. There is a progressive production of elastase and collagenase upon treatment of B16/F10 cells with Sibseonsan.⁴¹

2.17 Green tea extract

Green tea is composed of several active components as epigallocatechin gallate, epigallocatechin, and epicatechin gallate. Green tea in a 0.5% possess a noncytotoxic concentration and demonstrated its several activities against skin aging, like suppression of melanin production through its ability for inhibition of tyrosinase activities. Green tea extract is a potent antioxidant, and it has a matrix metalloproteinase-2 inhibition activity. The results of this study demonstrates that green tea is useful as an skin anti-aging agent in cosmetic products.⁴²

2.18 Saffron extract

Curcuma mangga (White saffron) contains several bioactive compounds, some of which are curcuminoids. The antiaging properties of *C. mangga* extract (CME) in oxidative stress-induced human BJ fibroblasts were studied with an emphasis on collagen protection against pro-inflammatory mediators MMP1, MMP3, and MMP13. The results demonstrated that treatment using CME (25 μ g/mL) could protect the collagen contents in H₂O₂-treated fibroblasts, whereas the negative control has the lowest collagen contents.⁴³

2.19 (3,5)-Dicafeoyl-epi-quinic Acid

Caffeoylquinic acid has been reported to display antioxidant effects. The antiphotoreaging effect of 3,5-dicafeoyl-epi-quinic acid DEQA on MMPs and type I procollagen in UVA-irradiated human dermal fibroblasts (HDFs) has been examined. Treatment with DEQA declines MMP-1 secretion and rises type I

collagen production in UVA-deteriorated HDFs. Moreover, treatment of UVA-irradiated HDFs with DEQA inhibited MMP-1, MMP-3, and MMP-9 expression. Furthermore, DEQA alleviates the UVA-mediated suppression of collagen expression. Thus, DEQA is a probable cosmetic agent for the treatment of skin photoaging.⁴⁴

2.20 Licorice root extracts

Glycyrrhiza glabra (Licorice) contains glycyrrhizin that shows anti-inflammatory properties. Certain phenolic components like glycyrrhizin, chalcone, and glabridin are also important for the anti-inflammatory activity of licorice. Glabridin has many advantages in cosmeceutical products. Topically, it has an antioxidant, skin-whitening agent and anti-inflammatory properties.⁴⁵ Licorice extracts have tyrosinase and elastase inhibitory activity which shows the anti-aging properties of the studied root extracts.^{46,47}

3. Conclusion

The skin anti-photoaging aging properties of botanical extracts with their various skin protecting mechanisms have been elucidated. Additional randomized, placebo-controlled, double-blind studies are required to approve many of the claims made about these plant extracts. It would be helpful to study the several combinations of plant bioactive constituents on preventing the different signs of skin photoaging.

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