

# Antistress skincare: Role of antioxidants, adaptogens, and neurocosmetics



**Mridula U. Kini<sup>1</sup>, Namita D. Desai<sup>2\*</sup>**

C. U. Shah College of Pharmacy, SNDT Women's University, Mumbai 49

Email: namitadd@rediffmail.com

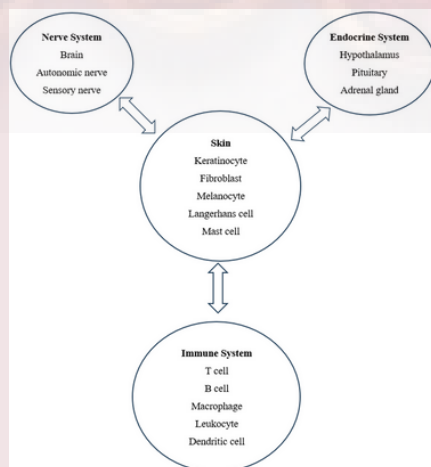
## Abstract

Skin, a key sensory organ, gets affected by internal as well as external stress. Stress triggers cortisol release centrally as well as locally in the skin, which is then responsible for several types of skin disorders, including acne, pigmentation, premature ageing, sensitivity, etc. To overcome this stress, the most ideal approach would be to identify the cause of stress and address the same. Several cosmetic preparations are used to manage such skin disorders. Complementary approaches such as healthy lifestyle choices, well-balanced diet, meditation, etc, are also very useful. This article dives into three classes of compounds, namely antioxidants, adaptogens, and the newly emerging class of neurocosmetics, when used topically, will help address these skin conditions effectively.

**Keywords:** Skin, stress, homeostasis, antioxidants, adaptogens, neurocosmetics

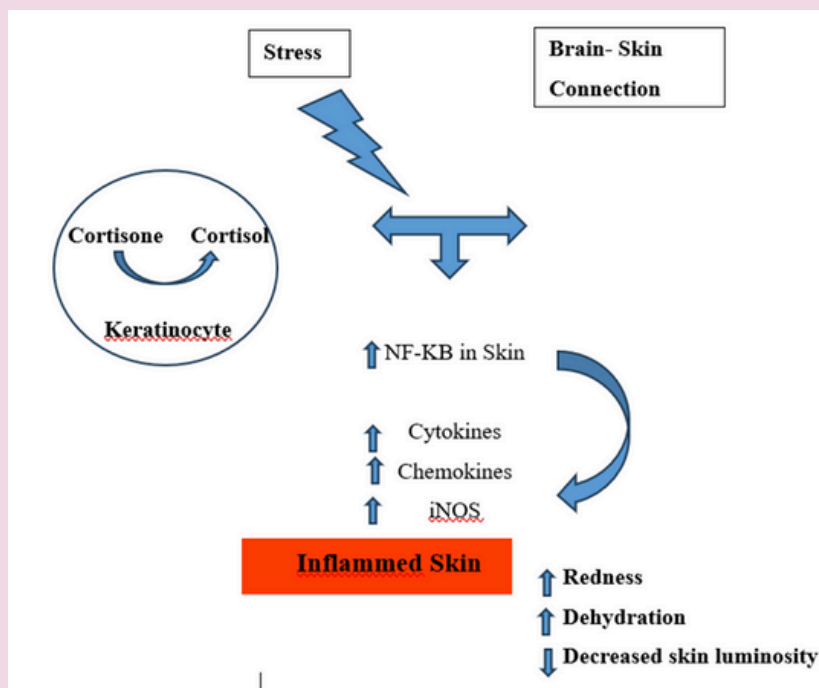
## 1. Introduction

Skin is a multifunctional sensory organ that helps manage our relationship with the external environment and is directly connected to the central nervous system. Epidermis, the outer layer of skin, has ectodermal origin and has dense innervation except for the stratum corneum. This innervation helps skin to examine both internal (mental, emotional) as well as external (environmental changes, heat, light) stimuli and respond appropriately via mediators known as neurotransmitters. The receptors for neurotransmitters and the enzymes to degrade them are also present in the cutaneous and immune cells. This connection of the nervous, immune, cutaneous, and endocrine (NICE) network helps maintain skin homeostasis, i.e tendency of skin to resist change despite changes in its environment (1-3,12).



**Figure 1.** Diagrammatical demonstration of how the skin(cutaneous), nervous, immune, and endocrine systems interact with each other and regulate several skin functions like the immune function, skin barrier function, melanin production via regulators like neurotransmitters, hormones, and interleukins (Reproduced from (4))

Stress is any condition that triggers anxiety and constantly negatively challenges the state of homeostasis. Stress can be internal (mental, emotional, psychological) or external (harsh environmental factors heat, UV light, pollution). Stress, if short lived, may not impact skin, but if not; it constantly assaults human body and can affect several body systems including skin. Skin responds to stress in the form of acne (due to increased sebum secretion), redness (due to increased skin inflammation), rashes (due to weakened skin barrier, shortened lifetime of skin cells), fine lines and wrinkles (due to premature skin ageing, lack of sleep, collagen breakdown), and hyperpigmentation (due to prolonged exposure to UV light and pollution).



**Figure 2.** Representation of the stress pathway (Reproduced from (1))

Skin cannot differentiate between the origin of the stressors and responds to all kinds of stress. Any kind of stress increases cortisol levels in the body as well as in epidermal skin layers, leading to inflammation, thus triggering and aggravating skin disorders. Oxidative stress is most prevalent under internal and external long-term stressful conditions. Reactive species generated in skin due to oxidative stress also impact the skin microbiome population, which ultimately results in skin dysbiosis (5). Skin symptoms created by stress can also be addressed by using appropriate skincare cosmetic formulations that contain ceramides to strengthen the skin barrier, niacinamide, kojic acid to address skin pigmentation, hyaluronic acid for skin hydration, D-panthenol and cica extracts to soothe skin, and salicylic acid to address acne. These skin care formulations can further be infused with stress-alleviating actives like antioxidants, adaptogens, and neurocosmetics to provide a multitargeted approach to achieve skin homeostasis. Along with the concoction of actives, stress can be minimized through correct dietary habits, good sleep, healthy lifestyles and life choices, meditation, exercises, yoga, etc. This topic will cover more details on the role and types of antioxidants, adaptogens, and neurocosmetics that can be utilised in “antistress skin care”.

## 2. Antioxidants

Skin is affected by oxidative stress, excess generation of reactive species triggers skin inflammation and results in several skin disorders. Reactive oxygen species are also generated internally in our bodies due to mitochondrial metabolism. However, the body’s innate antioxidant defense mechanism in the form of several antioxidant enzymes, eg, catalase, glutathione peroxidase, help maintain skin homeostasis. Antioxidants themselves oxidise and prevent free radical generation thereby reducing skin inflammation and preventing as well as reversing skin disorders. The use of natural plant-based antioxidants is on rise. Plant extracts contain several molecules which have antioxidant potential mainly polyphenols (flavonoids, stilbenes, terpenes). Polyphenols are found in natural sources like tea leaves, grapes, pomegranate, blue berries etc. Their phenolic group influences protein phosphorylation and thus inhibits

lipid peroxidation. Flavonoids are also known for their antioxidant potential which helps scavenge free radicals eg. pycnogenol from pine bark and epicatechin -3-gallate (EGCG) found in green tea. Resveratrol, a stilbene derivative found in grapes, berries is not only a powerful antioxidant but is also known to upregulate endogenous antioxidant pathway via Nrf2 pathway activation. Some examples of potential natural terpene antioxidants are limonene, 1,8-Cineole. Similarly, mineral antioxidants such as selenium, copper, zinc also have a role to play in skin cosmetics as they are the co-factors of enzymatic antioxidants. Other antioxidants include L-Ascorbic acid (Vitamin C) that helps reduce production of ROS created by exposure to sunlight, dust, pollution, particulate matter, smoke etc. As L-Ascorbic acid is unstable in dissolved aqueous condition, several stable esters are also widely used like magnesium ascorbyl phosphate, ascorbic acid 2-glucoside, sodium ascorbyl phosphate, O-ethyl ascorbic acid. L-ascorbic acid and its derivatives have been widely used to tackle skin conditions like pigmentation, skin sagging due to overexposure to sun and pollution. Also, tocopherol(Vitamin E) and its derivative tocopherol acetate is widely used as oil soluble strong antioxidant which works synergistically with Vitamin C. Thus, several antioxidants have been used in skincare to address skin inflammation. However, their limitations include low stability, poor bioavailability, sensitivity to light and heat and their potential to induce allergic reactions (5,6).

### 3. Adaptogens

Adaptogens are powerful plant-based molecules which help improve blood circulation, balance out skin stress and thus help improve overall skin health. They are mainly obtained from traditionally known herbs, roots and extracts well documented in Ayurvedic and Chinese texts known for their antioxidant and anti-inflammatory action. They negate skin inflammation caused due to heightened cortisol and adrenaline levels and thus help calm skin, rebuild skin barrier, improve skin health and hydration. Some known and widely used adaptogens are (7)

- 3.1. Ashwagandha (*Withania somnifera*):** Key active molecules in ashwagandha extract are withanolides and alkaloids. It helps preserve hyaluronic acid levels in skin.
- 3.2. Amla (*Phyllanthus emblica*):** Rich in vitamin C, polyphenol (ellagic acid) and helps calm skin inflammation and also preserve skin collagen.
- 3.3. Turmeric (*Curcuma longa*):** Key polyphenol present in turmeric is curcumin which is known antioxidant, anti-inflammatory and well as antimicrobial agent
- 3.4. Gotukola (*Centella asiatica*):** Gotukola is rich source of triterpene saponins and improves skin firmness and enhances dermal repair

Other adaptogens well documented in Chinese medicines are mushrooms (Reishi, Chaga) & *Panax ginseng* (red, white).

For best efficacy of adaptogens in skin care, following should be considered:

- a) Use of standardised extracts for ensuring potency
- b) Use at active levels
- c) Store in dark places as these are light sensitive
- d) Recommend regular use for best results

### 4. Neurocosmetics

Neurocosmetics are products which are intended to work only at topical neurological level and not elsewhere. As skin and brain have same ectodermal origin, both trigger release of cytokines, chemokines, neurotransmitters and neurohormones when under stress and homeostasis is impacted. It is known that the conversion of inactive cortisone to cortisol triggers skin inflammation leading to several skin disorders (1,8,9) Recently several neurocosmetics have been designed to balance cortisol levels and thus help combat skin stress. Neurocosmetics activate or inhibit skin's neuroreceptors or modulate neurotransmitters to improve cell to cell communication (10). Some examples of marketed neurocosmetics include:

#### 4.1. Agascal™ by Provital

*Agastache mexicana* flower /leaf/ stem extract is proven to inhibit release of cytokines by 104% in *in vitro* study and also inhibits movement of NF-κB transcription factor to nucleus by upto 70% *in vitro*

thus indicating its potential to reduce skin inflammation and redness with regular use (11).

#### **4.2. Sepicalm™ S WP by Seppic**

*Nymphaea alba* flower extract combined with amino acids and minerals is proven to reduce skin inflammation by reducing inflammatory mediators (IL-6 and IL-8) and improving production of  $\beta$ -endorphins. It also helps soothe irritated and also boost skin radiance (1).

#### **4.3. Marilience™ by GIVAUDAN**

“Neuro-soothing” extract derived from *Rhodospirillum rubrum*, a red microalga has been proven to downregulate TRPV1 expression, inhibit the release of neuroinflammatory mediators (IL-1 $\alpha$  and NGF). This active can be used effectively in products targeting sensitive skin, in post depilatory care, after sun care, post peeling treatments and in aftershave lotions for reducing skin sensitivity and providing feeling of comfort to sensitive skin (1).

#### **4.4. Pinolumin™ by Mibelle Biochemistry**

Concentrated extract of Swiss stone pine wood is a rich source of stilbenoid pinosylin, a neurorelaxing molecule. This is proven to reduce generation of inflammatory markers during oxidative stress and thus address local redness and inflammation (1).

#### **4.5. Neurophroline™ by Givaudan Active Beauty**

The extract of wild indigo (*Tephrosia purpurea*) is proven to reduce skin's cortisol levels and boost  $\beta$ -endorphins levels. Neurophroline has been clinically proven to reduce skin and improved skin luminosity (1).

#### **4.6. Algaktiv® Zen by Greenaltech**

This microalgal active blend has been proven to bind to glucocorticoid receptors and clinically proven to improve skin youth and radiance (13).

#### **4.7. Zenakine™ by Croda Beauty**

This biotechnology based active stimulates production of feel-good messengers in skin, alleviates cortisol stress. Proven skin benefits been fewer lines, smoother skin (14).

Neurocosmetics is a new emerging class of actives which, when utilised in cosmetics, hold promise to further improve its cosmetic pleasantness. Key caution- currently claims around mechanisms of action of neurocosmetics pose concerns from regulatory aspects. Formulators need to ensure that levels used need to ensure only topical, local action.

### **5. Conclusions**

This article discusses the role of skin and the importance of its healthy state to maintain homeostasis. It further deep dives into types of stress and their impact on skin. The article further discusses various antioxidants, adaptogens, and neurocosmetics, which hold promise to alleviate skin concerns when used along with current conventional skin care actives. The key advantage of including these compounds in skincare cosmetics is that they will help address the root cause of stress (within the cosmetic domain, i.e, epidermis) and thus will further support the specific skincare actives to achieve the state of homeostasis faster.

### **References**

1. Rizzi V, Gubitosa J, Fini P, Cosma P. Neurocosmetics in Skincare—The Fascinating World of Skin–Brain Connection: A Review to Explore Ingredients, Commercial Products for Skin Aging, and Cosmetic Regulation. *Cosmetics*. 2021 Sep;8(3):66.
2. Jiao Q, Zhi L, You B, Wang G, Wu N, Jia Y. Skin homeostasis: Mechanism and influencing factors. *Journal of Cosmetic Dermatology*. 2024;23(5):1518–26.
3. Cibrián D, de la Fuente H, Sánchez-Madrid F. Metabolic Pathways That Control Skin Homeostasis and Inflammation. *Trends Mol Med*. 2020 Nov;26(11):975–86.

- 4.Hosoi J. Stress and the skin. *Int J Cosmet Sci.* 2006 Aug;28(4):243–6.
- 5.Chen J, Liu Y, Zhao Z, Qiu J. Oxidative stress in the skin: Impact and related protection. *Int J Cosmet Sci.* 2021 Oct;43(5):495–509.
- 6.Hoang HT, Moon JY, Lee YC. Natural Antioxidants from Plant Extracts in Skincare Cosmetics: Recent Applications, Challenges and Perspectives. *Cosmetics.* 2021 Dec;8(4):106.
- 7.Gadberry R. Skin Inc. 2025 [cited 2025 May 19]. Adaptogens: Nature’s Destressors. Available from: <https://www.skininc.com/science/ingredients/article/22928157/adaptogens-natures-destressors>
- 8.Chen Y, Lyga J. Brain-Skin Connection: Stress, Inflammation and Skin Aging. *Inflamm Allergy Drug Targets.* 2014 Jun;13(3):177–90.
- 9.Terao M, Katayama I. Local cortisol/corticosterone activation in skin physiology and pathology. *J Dermatol Sci.* 2016 Oct;84(1):11–6.
- 10.Dobos KA. Beauty and the brain: How the nervous system shapes neurocosmetic innovations. 2024;19.
- 11Agascal™ | CareActives | Cosmetic ingredients by Provital [Internet]. [cited 2025 May 19]. Available from: <https://www.weareprovital.com/en/careactives/agascal>
- 12.Vidal Yucha SE, Tamamoto KA, Kaplan DL. The importance of the neuro-immuno-cutaneous system on human skin equivalent design. *Cell Prolif.* 2019 Nov;52(6):e12677.
- 13.Algaktiv® Zen by Greenaltech [Internet] Discover our exclusive and innovative plant-based actives.. Available from: Greenaltech Launches Algaktiv Zen to Reduce Stress | Cosmetics & Toiletries [cited 2016 Feb 24].
- 14.Zenakine™ by Crodabeauty [Internet] Zenakine™ | Croda Beauty. Available from: Croda Beauty Launches Zenakine, Taking Sleep x Emotion x Skin Health Connection to a New Level | Cosmetics & Toiletries [cited 2025 April 8].