

White paper

CAN THIS PLANT-BASED INGREDIENT GIVE YOU STRONGER NAILS?

Mibelle Biochemistry discusses how its hair care stalwart KeraGuard can act as a protective shield for the nails

Healthy nails are functionally and cosmetically important, particularly for women. With 85-90% of female consumers using nail care products, the global market for nail cosmetics is increasing constantly.

Nails are a complex appendage of our skin. Covering the distal dorsal surface of fingers and toes, their main function is to provide protection from injuries and infection. Additionally, nails serve to enhance precise, delicate movements, as well as the sensitivity of the fingertip. And they have aesthetic purposes.

The development of the nail unit already begins *in utero* during the 9th week of gestation. By the 17th week of the embryo's life, most of the nail bed is covered by the nail plate. In adults, the average nail growth rate is 0.1mm/day, whereas toenails grow at one-third to half the rate of fingernails.

NAIL STRUCTURE

The human nail unit consists of four main structures, which together form the nail plate (figure 1):

- the nail folds;
- the nail matrix;
- the nail bed and;
- the hyponychium.

The nail plate is the rigid, visible portion of the nail that continues growing throughout one's life. It is composed of compact translucent keratinocytes called onychocytes. Although it is similar to the stratum corneum, the horny layer of the skin, the nail plate has a lower proportion of fat and water. Instead, it contains a higher ratio of the amino acid cysteine. Cysteine forms strong disulfide crosslinks, which, together with keratin

fibres, contributes to the strength of the nail plate.

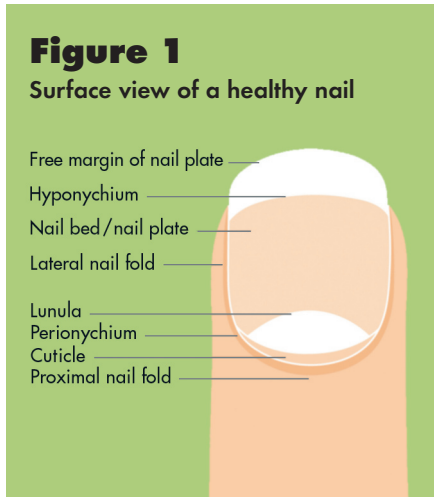
The curvy form of the nail plate allows a perfect fit into the proximal and lateral nail folds. The nail folds are soft tissue structures that protect the edges of the nail plate. Situated around the margin of the proximal nail fold is a rim of keratinous material, called perionychium, which is an important barrier to pathogens. Disruption of the perionychium increases the susceptibility of the nail to bacterial or fungal infections.

Positioned directly underneath the proximal nail fold is the nail matrix, which is a small area of highly proliferative epidermal tissue that produces the nail plate. The visible white area of the nail matrix is called the lunula ('small moon').

The nail bed is the part of the skin situated beneath the nail plate. It extends from the nail matrix to the hyponychium, which is the protective thickened epidermis beneath the free distal end of the nail. The nail bed

Figure 1

Surface view of a healthy nail



The diagram shows a top-down view of a single fingernail. It is divided into several colored regions: a white crescent at the base (lunula), a pinkish area below it (nail bed), and a white tip (free margin). The nail is surrounded by skin folds (proximal and lateral) and a thin layer of skin (cuticle) at the base. Labels with lines point to each of these parts.

- Free margin of nail plate
- Hyponychium
- Nail bed/nail plate
- Lateral nail fold
- Lunula
- Perionychium
- Cuticle
- Proximal nail fold

consists of a thin epithelium and is considered to be a transitional zone where living cells keratinise and are integrated into the nail plate.

Furthermore, as it contains nerve endings, it also contributes to the finger's sensitivity to pain, touch and pressure. The pink colour of the nail bed can be ascribed to the rich vascular network that is found in the deeper portion of the nail bed, which is composed of collagen and elastin fibres.

SIMILARITIES BETWEEN HAIR & NAILS

Hair and nails are often said to have much in common. Both are predominantly epithelial structures derived from the skin and made of fibrous proteins, mainly keratins. Indeed, the keratins found in the human nail plate are nearly identical to those of the hair. Both are primarily made of the hard α -keratin.

Keratin filaments of nails and hair are characterised by high chemical and physical resistance owing to their



extensive folding supported by extremely stable disulfide bonds. This resistance is vital to provide protection against environmental damage, toxins and pathogens.

However, strong hair and nails are not only essential barriers, but they are also cosmetically important for both men and women. Thus, cosmetics are frequently used to enhance their aesthetic appearance.

Unfortunately, physical processes and materials used in cosmetics may cause complications rather than supporting the health of hair and nails. Additionally, environmental factors including UV radiation and pollution trigger oxidative stress that can lead to damage of the keratin structure.

Oxygen radicals created by UV radiation, for instance, have been shown to break down the disulfide bonds of the structural hair units and reduce the integrity of the keratin fibre network. Physical stress such as blowdrying, or chemicals contained in styling products, can further increase the oxidative damage. As a consequence, the hair is

more susceptible to breakage and colour fading.

Since nails are composed of structural proteins similar to those of the hair, free radicals may also impact the health and function of the nail unit. In fact, experts suggest that oxidative damage to nail keratins could explain the molecular basis of weak and brittle nails, at least partly.

It has recently been demonstrated that the structural strength of the nail decreases significantly upon nail exposure to UVA irradiation or chemical stressors found in nail polish. Moreover, the hydration status of the nail plate is another factor determining its hardness and damage to the keratin structure may impact the water holding capacity of the fibre network.

ANTIOXIDANTS: POWERFUL MOLECULES TO PROTECT HEALTHY NAILS

Although the role of oxidative stress in skin ageing is widely recognised, little focus has been placed on its impact on nail conditions, yet. Oxidative stress

reflects an imbalance between the production of reactive oxygen species (ROS) and the body's ability to neutralise the reactive compounds.

In order to counterbalance the effects of oxidants, the human body is equipped with a variety of antioxidants. Antioxidants not only prevent the formation of reactive oxygen species, but also neutralise the damage caused by them. Protection against oxidative stress can be achieved through a variety of enzymatic (eg, glutathione dismutase, SOD) and non-enzymatic antioxidants (eg, vitamin E, vitamin C).

A healthy diet rich in vitamins and minerals as well as secondary plant compounds is essential to support the body's antioxidant network. In addition, nails may benefit from an external supply of antioxidant compounds. The treatment of the nail with the antioxidant acetylcysteine (NAC) reduced protein carbonylation induced by UV radiation and chemical treatments, indicating that the application of antioxidants to the nail plate may prevent nail damage due to daily treatment or environmental factors.

To date, many over-the-counter products already claim to improve nail strength and health, but there is usually little evidence for clinically measurable benefits. In contrast, KeraGuard contains natural ingredients with clinically proven benefits on nail thickness.

KERAGUARD: HIGHLY-EFFECTIVE NATURAL ANTIOXIDANT COMPLEX

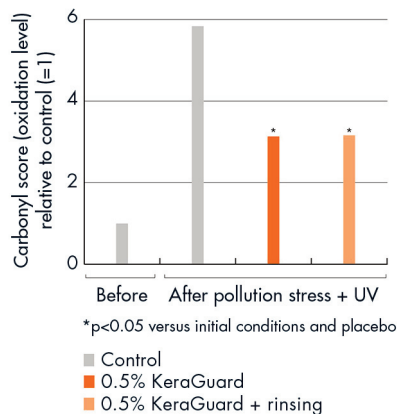
KeraGuard is an innovative natural antioxidant complex combining *Caesalpinia spinosa* tannins with organic sunflower (*Helianthus annuus*) sprout extract. *Caesalpinia spinosa* (tara) is a small leguminous tree native to the Peruvian Andes, an area characterised by dry climate and poor soils.

Tara pods are usually used in traditional medicine to treat infections and improve healing. They are rich in hydrolysable tannins, particularly gallic acid, known to have astringent and antimicrobial effects. Thanks to their capacity to bind proteins, tannins inhibit the growth of fungal and bacterial microorganisms by interfering with their cell wall. Tara tannins are also stable and highly efficient antioxidants.

Their combination with the organic sunflower sprout extract, which also

Figure 2

Reduced protein oxidation induced by exposure to pollution and UV stress after treatment with KeraGuard in hair strands



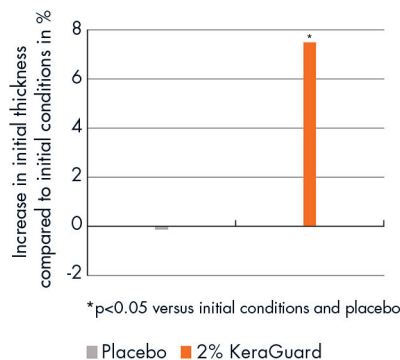
contains an array of valuable ingredients (eg, essential fatty acids, vitamins, minerals and secondary plant metabolites), results in a powerful natural complex. In fact, KeraGuard has an antioxidant potential similar to those of pure vitamin C and higher than that of green tea.

Evidence from various studies further confirms that KeraGuard is not only capable of neutralising the harmful effects of free radicals coming from environmental factors, as well as physical and chemical stresses, but also encourages strong and healthy hair and nails.

For example, KeraGuard protected the hair against UV radiation and pollution as evidenced by a significant reduction of carbonylated protein

Figure 3

Increase in nail thickness after 56 days of treatment with KeraGuard



(a marker of oxidative damage) in hair strands (figure 2).

KeraGuard further showed colour-preserving potential and contributed to the repair of the hair structure after bleaching, another drastic procedure leading to structural damage and to the generation of free radicals. Last but not least, KeraGuard protected the hair from heat damage induced by flat iron treatment.

Encouraged by the positive effects of KeraGuard for the hair, the benefits of the antioxidant complex for nail strength and protection were investigated.

STRONG & BEAUTIFUL NAILS

In a randomised, placebo-controlled clinical study, 23 women with weak nails were asked to apply a serum containing 2% KeraGuard or a serum without active (placebo) on their fingernails twice daily.

Nail plate thickness was assessed before treatment and after 56 days of the serum application using an ultrasound-based method (Dermascan C). Moreover, a questionnaire about the nail condition was filled in by the participants.

At the end of the intervention, the nail thickness of women using KeraGuard was significantly improved by 7.6% compared with placebo and initial conditions (figure 3). In addition, 75% of women agreed they had harder, stronger and more beautiful nails than before the intervention. 83% felt that the product acts as a protective shield on their nails and 79% stated that the product improved the overall appearance of their nails.

The protective potential of KeraGuard has been further confirmed in an *ex vivo* nail model assessing its effect against UV-induced protein oxidation.

Clipped-off nails were treated with KeraGuard and stressed with UVA irradiation. Subsequently, proteins were extracted from the nails and protein carbonylation, a marker of protein oxidation, was quantified. UVA irradiation increased protein oxidation by 33% compared with unstressed nails. The treatment with KeraGuard was able to reduce this UV-induced damage significantly by 50%. The attenuation of protein carbonylation could also be visualised by microscopy analysis (figure 4).

NATURALLY BEAUTIFUL NAILS

Strong and healthy nails are important for daily function and wellbeing, especially for women. However, oxidative stress produced by environmental factors (eg UV radiation) and chemicals present in nail cosmetics often compromises nail health and aesthetic appearance.

KeraGuard is an innovative nail care ingredient acting as a protective shield on the nails. The carefully selected combination of antioxidant *Caesalpinia spinosa* tannins and sunflower sprout extract effectively blocks the formation of reactive oxygen species and helps to maintain strong and beautiful nails, naturally ●

Author

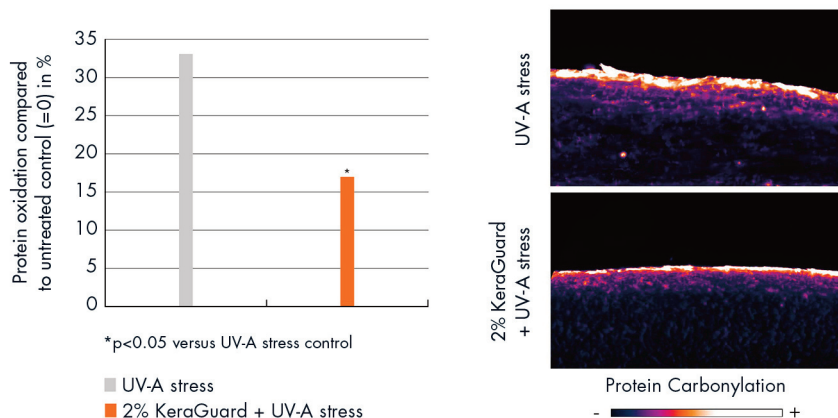
Mibelle Biochemistry
www.mibellebiochemistry.com

References

Full references for this article can be found at cosmeticsbusiness.com.

Figure 4

Reduced protein oxidation following KeraGuard treatment of clipped-off nails





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KeraGuard

Powerful protection and repair for hair and nails

KeraGuard is an effective antioxidant protection complex for damaged hair and weak and brittle nails. The unique combination of extremely stable tannins from the tara tree and sunflower sprout extract makes rough and exhausted hair shiny and beautiful again and strengthens the nails.

- Protects hair against heat, urban pollution and UV stress
- Repairs chemically treated hair
- Prevents the color fading of hair
- Protects and strengthens nails
- Improves nail thickness

