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GLOBAL

PERSONAL CARE

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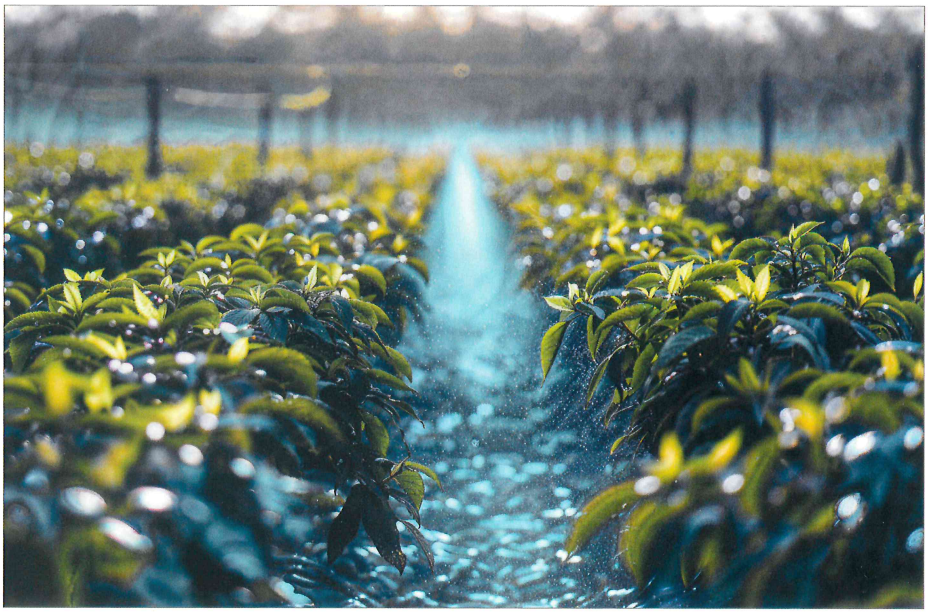
Upcycled maté tea for healthy ageing

Stefan Hettwer, Emina Besic Gyenge, Loya Schoeffel, Chiara Degl'Innocenti, Brigit Suter, Elisa Starace, Barbara Obermayer – Rahn



ABSTRACT

Ilex Paraguariensis Leaf Extract (Yerbaluxe®-Pearl, in the following Ilex Extract), sourced from left-overs from the yerba maté tea production, is a potent ingredient for enhancing skin vitality and supporting healthy ageing. Rich in polyphenols, caffeine, and rutin, it improves skin microcirculation, skin oxygen supply, hydration, and firmness and elasticity, contributing to a youthful appearance. The extract strengthens the skin barrier and protects mitochondria, essential for maintaining cellular health and energy production. Its sustainable production from upcycled maté dust aligns with eco-friendly practices. By fostering resilience and vitality, Ilex Paraguariensis Leaf Extract supports the skin's natural functions, making it a valuable addition to skincare regimens focused on longevity and holistic wellbeing.

The concept of 'skin energy' is central to dermatology and cosmetic science, representing the skin's vitality, radiance, and overall health. Low energy is indicative of fatigue, dullness, and ageing, while high skin energy is often associated with a luminous, youthful complexion. One of the critical factors influencing skin energy is oxygenation, which is closely linked to skin microcirculation.

Skin oxygenation refers to the process by which oxygen is delivered to skin cells, a vital function for maintaining cellular metabolism and energy production. The skin receives oxygen primarily through the blood supply from capillaries, which deliver oxygen-rich blood to the dermal layers. Additionally, a small amount of oxygen is absorbed directly from the air through the outermost layer of the skin, the epidermis (Figure 1).[1]

This dual mechanism ensures that skin cells can perform essential functions such as repair, regeneration, and protection against environmental stressors. Microcirculation plays the crucial role in this process. It facilitates the delivery of oxygen and nutrients to the skin while removing waste products and carbon dioxide. A good microcirculation prevents parts of the skin become hypoxic and less functional.

Ilex Extract, derived from the yerba maté plant, offers a unique solution to enhance skin energy by improving microcirculation and tissue oxygenation. Yerba maté is rich in caffeine, polyphenols, and rutin,[2] compounds known for their vasodilatory and antioxidant properties. These components work synergistically to increase blood flow, enhance oxygen delivery, and protect the skin from oxidative stress, while avoiding skin redness to appear.

This article explores the scientific basis of Ilex Extract, examining its sourcing, environmental impact, and the mechanisms through which it enhances skin vitality. By understanding the relationship between skin oxygenation and microcirculation, we can appreciate the potential of Ilex Extract as a transformative ingredient in skincare.

Methods

The efficacy of Ilex Extract was evaluated through a series of *in vivo* and *in vitro* studies designed to assess its impact on various skin parameters. The multi-ethnic *in vivo* studies employed a double-blind, placebo-controlled design involving

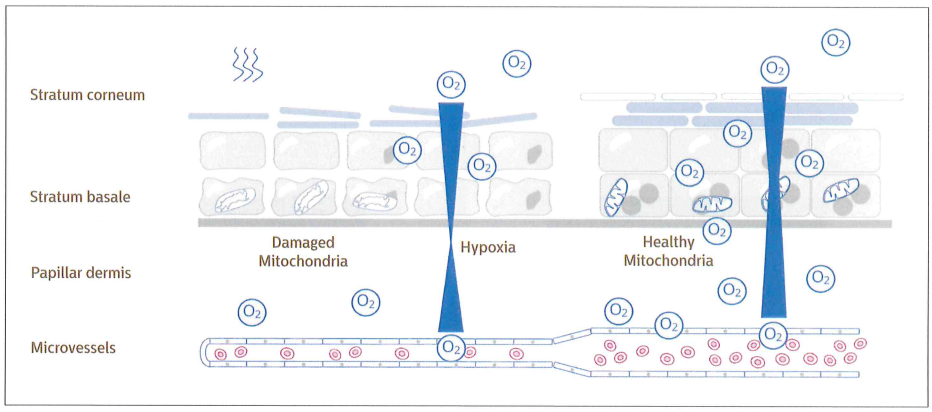


Figure 1: Skin oxygenation comes from air oxygen and capillary oxygen. Both sources create an oxygen gradient with a minimum in the area of the stratum basale of the epidermis and the stratum papillare of the dermis. Poor microcirculation can lead to hypoxia (low oxygen partial pressure). Increasing microcirculation can strengthen the internal oxygen supply

both Caucasian and Chinese study panels. The studies were performed in accordance with the principles of good laboratory practice (GLP), good clinical practice (GCP) and in compliance with the quality assurance system requirements.

The studies were also conducted in accordance with the World Medical Association ethical principles defined in the Declaration of Helsinki. All study participants provided their written informed consent at the beginning of the study. Participants were instructed to apply emulsions containing different concentrations of Ilex Extract over a specified period. The Caucasian panel used 0.5% once daily for 28 days.

Measurements were performed after 14 and 28 days, for some parameters 30 minutes after application. The Chinese panel used 1% in a single application. Measurements were performed after 30 minutes and after one day.

Laser Doppler Flowmetry was utilized to assess changes in skin microcirculation and tissue partial oxygen pressure, while VISIA-CR analysis provided insights into skin texture, redness and wrinkle reduction. Additionally, skin hydration and transepidermal water loss were measured to evaluate the ingredient's moisturizing effects by cutometry and TEWAmetry.

In vitro studies focused on understanding the cellular mechanisms underlying Ilex Extract's benefits. These studies involved the use of *ex vivo* skin explants and 3D reconstructed human epidermis models to assess mitochondrial protection and ceramide production. The accumulation of PINK1, a marker of mitochondrial stress, was measured following UV-A irradiation by immunohistochemistry.

Ceramides production was measured in reference to untreated control by immunohistochemistry as well. Statistics: comparative analysis were done with Wilcoxon signed rank test or Student's t-test.

Results

Yerba maté is native to South America and is traditionally consumed in Brazil, Argentina, Uruguay, and Paraguay (hence the name *Ilex paraguariensis*). It is renowned for its stimulating effect on the central nervous system, containing on average about 55 mg/100 ml of caffeine,[2] making it comparable to coffee, which contains 23 mg – 143 mg/100 ml caffeine.[3]

Our water-based extract contains approximately 13 times the amount of polyphenols, twice the amount of caffeine and 8 times the amount of rutin when compared to conventionally brewed maté tea preparation (Table 1).[2] A contamination with anthraquinones, which can be found in some maté tea preparations,[4] was not found in our extract.

Our plant material is grown organically and sustainably in Argentina. For the production of Ilex Extract, we use the leftovers of maté tea production after the drying process which cannot be exploited commercially. As such, our Ilex Extract is an upcycled product.

The results of the studies demonstrated the significant impact of Ilex Extract on skin health and vitality. In the *in vivo* study on the Caucasian study panel, a notable increase in skin microcirculation was observed, with a 59.1% improvement after 28 days of application (Figure 2). The active ingredient was able to increase microcirculation by 30% already after 30 minutes. This enhancement in blood flow is attributed to the vasodilatory effects of caffeine and polyphenols, which facilitate an increased delivery of oxygen and nutrients to the skin.

Skin oxygenation showed significant improvement already after 30 minutes, reaching 40.5% after 28 days of once daily application. The increased oxygen delivery supports cellular metabolism and energy production, essential for maintaining healthy skin function.

VISIA-CR analysis of the red channel revealed a visible reduction in skin redness after 14 days (not shown) and 28 days (Figure 3). This is an unexpected result as Ilex Extract increases microcirculation which is typically increasing skin redness.

In terms of skin hydration, Ilex Extract led to a 26.9% increase, while transepidermal water loss decreased by 10.5% (Figure 5). These findings indicate the ingredient's ability to strengthen the skin barrier and retain moisture.

The studies also revealed improvements in skin firmness and elasticity, with increases of 12.6% and 20.4%, respectively after 28 days (Figure 4). These changes are likely due to an enhanced collagen synthesis and structural support provided by the active compounds in Ilex Extract.

INCREASE IN MICROCIRCULATION AND SKIN OXYGENATION

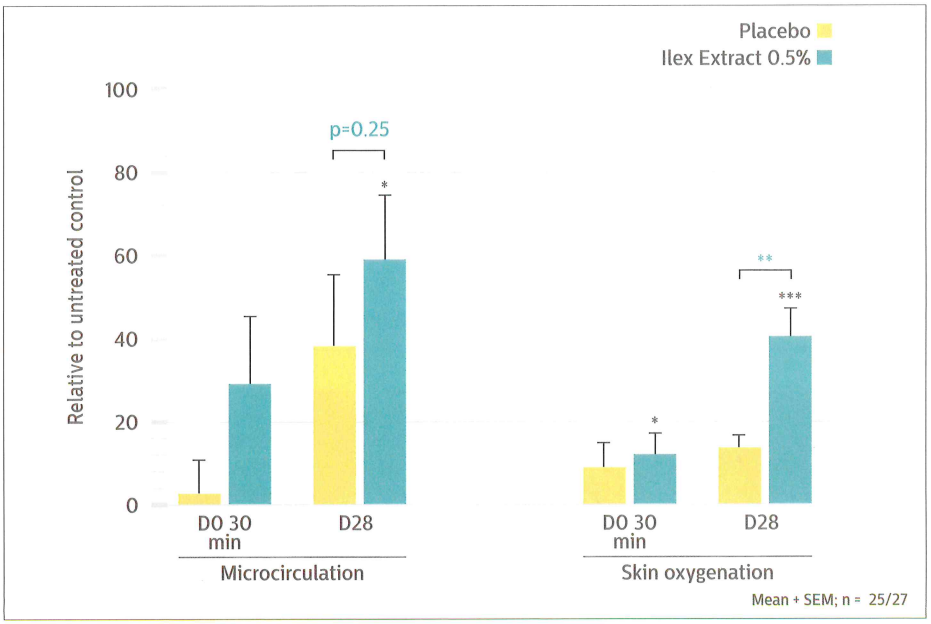


Figure 2: Laser Doppler analysis of microcirculation and transcutaneous partial oxygen pressure revealed significant increases after use of Ilex Extract

TABLE 1: COMPARISON OF COMPOUNDS IN YERBA MATÉ TEA WITH ILEX EXTRACT

Phase	Brasilian maté tea	Ilex Extract
Compound	Amount (mg / 100 ml)	Amount (mg/100 ml)
Total polyphenols	101	1350
Caffeine	55	135
Rutin	8	67

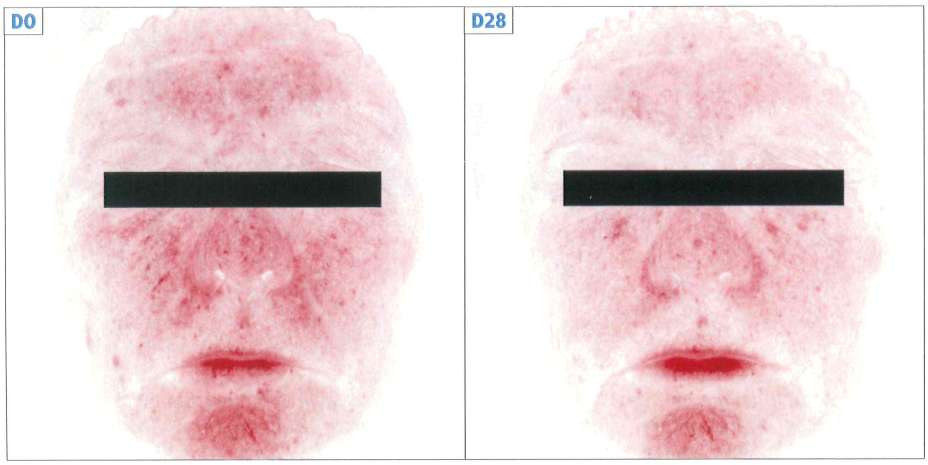


Figure 3: Ilex Extract decreases skin redness. #24A, female, age 59 years, Ilex Extract 0.5%

In addition, Ilex Extract was able to reduce wrinkles, particularly in the crow's feet area, where a 37.2% decrease was observed (not shown). This significant reduction in wrinkle depth and appearance is attributed to the enhanced skin elasticity and firmness, as well as the improved hydration levels facilitated by Ilex Extract. The active compounds in the ingredient, particularly caffeine and polyphenols, are known to stimulate collagen production and improve skin structure, leading to a smoother and more youthful appearance.

The immediate effect study on the Chinese study panel revealed that some of the above measured improvements were already detectable after a single application and lasted for at least 24 hours. After 30 minutes, a significant 10% reduction in skin redness (not shown) was observed as well as a significant 67% increase in hydration and a 12.5% decrease in transepidermal water loss. These effects were all still significant after 24 hours.

Underlining a holistic activity profile, Ilex Extract was capable of increasing skin gloss as well. A significant improvement by 18% was found after 30 minutes, still being significant after 24 hours (Figure 6).

In vitro studies provided further insights into the cellular mechanisms of Ilex Extract. A notable finding was the 25.8% increase in ceramide production (Figure 7), which plays a crucial role in maintaining the skin's barrier function and hydration.

Ceramides are essential lipids that help retain moisture and protect the skin from environmental aggressors.[5] The increase in ceramide levels suggests that Ilex Extract not only enhances hydration but also strengthens the skin's natural defence mechanisms.

Additionally, the active ingredient demonstrated significant mitochondrial protection, as evidenced by the reduced accumulation of PINK1 following UV-A irradiation (Figure 8). PINK1 is a marker of mitochondrial stress, and its reduction indicates that Ilex Extract helps protect the mitochondria from

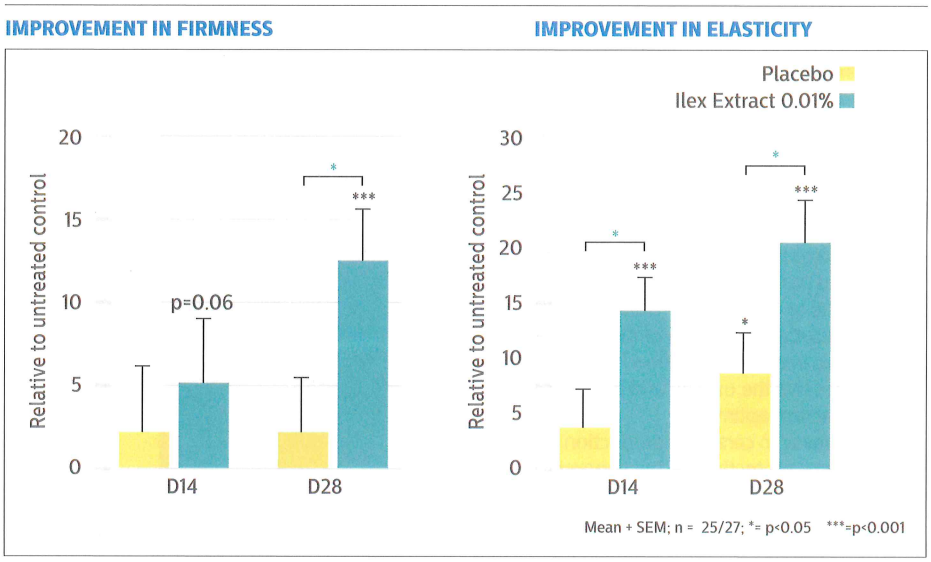


Figure 4: Ilex Extract increases firmness (*left panel*) and elasticity (*right panel*)

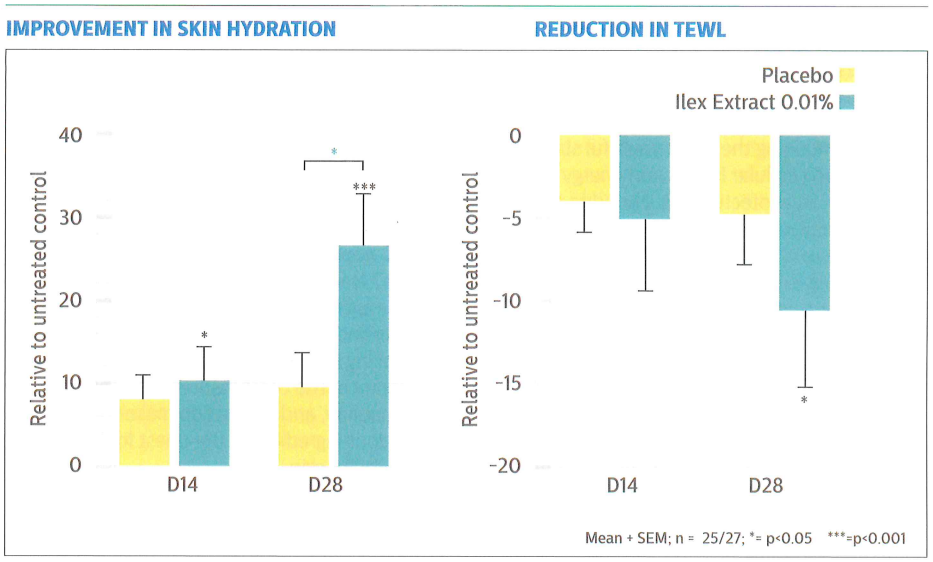


Figure 5: Ilex Extract creates lasting skin hydration (*left*) and improves the skin barrier (*right*) after a single application

Figure 6: Ilex Extract increases skin gloss after a single application. VISIA-CR images in the visible channel show a decent increase in skin gloss after 30 minutes and 1 day. #4, female, age 46 years. Ilex Paraguariensis Extract 1%

damage. This protection is vital for maintaining cellular energy production and preventing premature ageing.

Discussion

The findings from this study underscore the potential of Ilex Extract as a potent skin energizer and a healthy ageing ingredient suitable for longevity products. Its ability to enhance microcirculation and oxygenation is a key factor in its efficacy, as these processes are fundamental to maintaining healthy, vibrant skin. The vasodilatory effects of caffeine and polyphenols improve blood flow,[6,7] ensuring that skin cells receive the oxygen and nutrients they need to function optimally.

The increase in ceramide production and mitochondrial protection further supports Ilex Extract's role in promoting a youthful appearance. By strengthening the skin barrier and protecting cellular structures, the ingredient helps combat the visible signs of ageing, such as wrinkles and loss of elasticity and firmness. Rather than merely addressing the symptoms of ageing, Ilex Extract supports the skin's natural processes, fostering resilience and vitality that contribute to healthy ageing.

In the context of longevity, Ilex Extract aids in maintaining the skin's youthful state by supporting cellular health and energy production. By protecting mitochondria and enhancing microcirculation, it ensures that skin cells remain active and efficient, which is crucial for long-term skin health. This approach aligns with the concept of healthy ageing, where the focus is on preserving the skin's natural functions and appearance over time, rather than simply reversing the signs of ageing.

Moreover, the upcycling of maté dust to produce Ilex Extract aligns with sustainable practices, offering an environmentally friendly source of active ingredients. This approach not only reduces waste but also provides a valuable resource for the cosmetic industry. Not only the CO_2 consumption but also the water footprint of the product was assessed, a one-of-a-kind situation for cosmetic active ingredients.

Conclusion

Yerbaluxe-Pearl (Ilex Extract) emerges as a promising ingredient in the cosmetic industry, offering a scientifically substantiated approach to enhancing skin vitality. Its multifaceted benefits, from improving skin oxygenation and microcirculation to protecting mitochondria, position it as a valuable addition to skincare regimens aimed at promoting a youthful and radiant appearance.

It is ideal for younger buyers who value healthy ageing and follow a holistic approach to body and skin, as well as for customers who are looking for effectiveness for a rejuvenated appearance. The combination of efficacy, sustainability, and innovation makes Ilex Extract a standout ingredient in the quest for healthier, more vibrant skin. PC

IMPROVEMENT IN CERAMIDES AFTER 4 DAYS

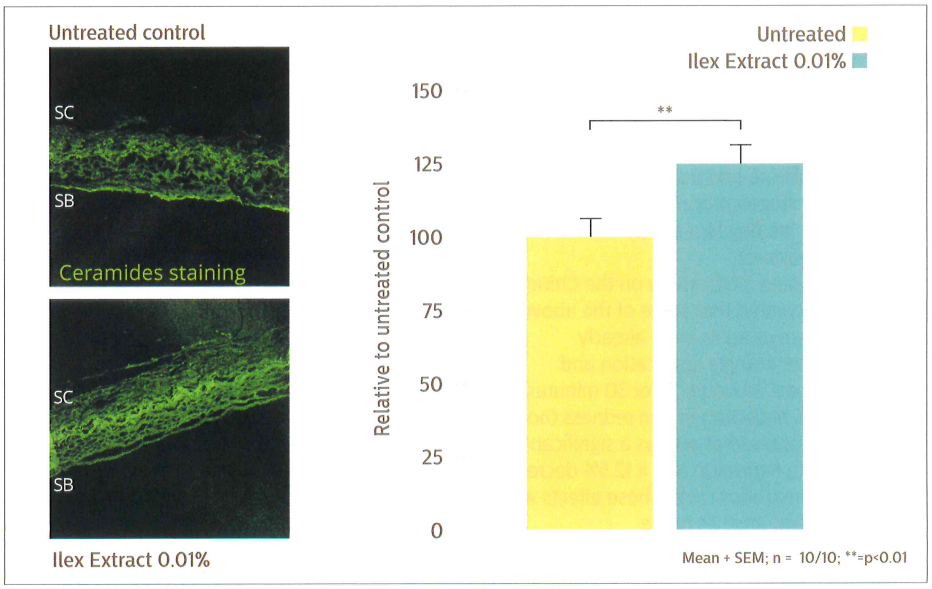


Figure 7: Ilex Extract increases ceramides production. Quantitative immune fluorescent staining of ceramides in the epidermis of a skin explant 3D reconstructed epidermis shows a significant increase in ceramides deposition after 4 days compared to untreated (placebo) condition. Left panels: staining with anti-ceramides antibody, right panel: quantification. SB: Stratum basale, SC: Stratum corneum

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UNTREATED CONTROL **UVA IRRADIATION** **UVA IRRADIATION+ILEX EXTRACT 0.1%**

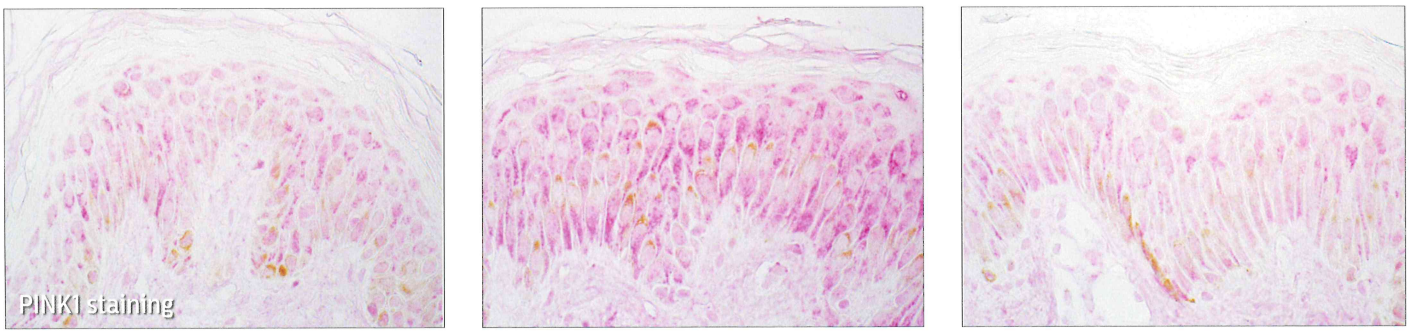

Figure 8: Ilex Extract protects mitochondria from UV-A radiation. Semiquantitative PINK1 staining of skin explants show a marked increase when exposed to UV-A radiation. This is reduced back to non-radiated condition when 0.1% Ilex Paraguariensis Extract was used