Food for skin: IBR’s PhytoflORAL® as a Nutricosmetic Ingredient, Protecting, Lightening and Evening the Skin Tone

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Summary:

Our health and beauty, including that of our skin, is largely dependent on our nourishment. Skin nourishment can take the form of topical applications such as offered by cosmetics or in the form of dietary intake, a current trend referred to as nutricosmetics. IBR’s PhytoflORAL® is such nutricosmetics ingredient, a skin-food. PhytoflORAL® is a natural tomato powder for dietary
intake, delivering to the skin two highly valuable colorless carotenoids, the phytoene and phytofluene. Phytoene and phytofluene have already been established as multifunctional ingredients holding multiple benefits for the skin such as various aspects of anti aging and photo aging, protection and boost of biomolecules and ingredients and other skin benefits. In the present publication we show the products’ capacity to lighten and even the skin tone after continuous dietary consumption. This study provides clinical support for the already established in vitro activities of phytoene and phytofluene such as direct inhibition of melanin synthesis, UVA and UVB protection, anti-inflammatory, anti oxidant capabilities as well protection of biomolecules such as collagen and DNA from damage. The various effects working in concert provide a state of the art natural product for better protected, lighter, more even toned skin - PhytoflORAL®.

Introduction:

Our skin plays a vital role in our beauty and appearance: our age, the climate we live in, our sleepless nights, the level of our health as well as what and how we eat – are all revealed by our skin. This is why quality nourishment of the skin (and body), vital for its health and beauty, has to be maintained. Skin nourishment can take the form of topical applications such as offered by cosmetics or in the form of dietary intake, a current trend referred to as nutricosmetics.

Topical, cosmetic applications, being applied directly on the skin, have the benefit of surpassing many of the body’s protective barriers. The downside of this topical application is that the very deep layers of the skin are left un-addressed and un-cared for. Delivery of beauty ingredients via dietary intake, on the other hand, is challenging, due to the above-mentioned barriers that are physical, chemical and enzymatic processing inside us, reducing the chances of the beauty ingredient to reach the skin. However, when these barriers are crossed and the ingredient is delivered, its effect on the deeper layers of the skin can be achieved. The success of an ingredient to be systemically delivered to the skin may also be a sign of these components stability in biologic systems, enabling them to deliver their desired effect.
Sun protection as well as maintenance of lighter, even skin tone are two pillars for keeping healthy and younger looking skin.

In many cultures lighter skin is correlated with luxury and well-being, while even toned skin is universally translated to healthier and younger appearance. Equally universal is the understanding that primary element for skin health and beauty maintenance is protection from the sun.

IBR now introduces PhytoflORAL, a nutricosmetic ingredient for beauty from within, addressing all the above-mentioned elements of skin health and beauty. PhytoflORAL® is a natural tomato powder for dietary intake, delivering to the skin two highly valuable colorless carotenoids, the phytoene and phytofluene. PhytoflORAL® is sourced from IBR’s proprietary tomato, inherently rich in phytoene and phytofluene, and is produced using non-chemical processing allowing it as food.

Carotenoids are a family of over 600 members able to absorb various parts of the sun light spectrum and quench free radicals generated in biological systems, as a result of UV radiation among other causes. As such they are a natural form of photoprotectants. Humans are not able to produce carotenoids but they are able to accumulate carotenoids from their diet. Often, though, oral or topical use of the strongly colored carotenoids will impart a yellow, orange or reddish coloration to the skin. Thus, the use of carotenoids devoid of visible color such as phytoene and phytofluene, which will therefore not directly affect skin color, yet benefit the skin would be strongly preferred.

Phytoene and phytofluene are natural carotenoids, the precursors in the biosynthesis of all other carotenoids in nature. These carotenoids, phytoene and phytofluene, absorb light in the UV range only (UVB and UVA respectively), and are the only carotenoids in nature that are devoid of visible color. Their unique part in the biosynthesis of other carotenoids and their inherently unique structure translates to superior biological activity.

Distribution of carotenoids throughout the body is not uniform and when compared to other carotenoids, the colorless carotenoids phytoene and phytofluene, have the highest accumulation factor in the skin, lungs, plasma, and lymphocytes. The PhytoflORAL, being rich in
phytoene and phytofluene, is expected to be beneficial in maintenance of skin health and beauty.

Dark, sun-damaged and uneven-toned skin, are all visible outcomes of pigmentation. The multifunctional phytoene and phytofluene address as follows at least four causes of pigmentation:

- Direct inhibition of melanin synthesis
- Control of pigmentation by direct anti-inflammatory activity and absorption of UVB, the cause of inflammation
- Reduction of melanin production by reduction of oxidative stress
- Reduction of skin darkening due to sun exposure by UVA/B absorption

**Melanin synthesis pathways**

![Melanin synthesis pathways diagram](image)
PhytoflORAL for SKIN LIGHTENING, WHITENING AND EVENING OF SKIN TONE

CLINICAL STUDY

A study was designed to evaluate the skin lightening potential of dietary intake of PhytoflORAL®. The supplement was formulated into capsules to provide a dose equivalent to 5 mg of phytoene and phytofluene per day. The trial was carried out as open intra-individual study comparing measurements at day 0 with day 42 and 84 (before and after treatment). The trial was conducted on 22 female volunteers aged 20-40 with Fitzpatrick skin photo type IV.

In both studies instrumental color measurements were taken to assess pigmentation (a*,b*, L* and ITA°). Additional assessment of skin quality parameters on subjects’ face, was performed separately by an expert clinician and by the study participants (self-evaluation) for characteristics such as: dryness, roughness, suppleness, evenness of the complexion and skin texture.

RESULTS & SUMMARY

Lightening effect:
The study results indicate a significant skin lightening effect, with increases in L* value and ITA among up to 82% of panelists.

Skin quality evaluation:
The clinical scoring of the skin quality was significantly improved at D42 and D84 in almost all parameters evaluated. This included significant decrease of skin dryness and skin roughness, significant increase of skin suppleness, achieving more uniform skin complexion (even skin tone) and improvement of skin texture. In the subjective panelists’ evaluation, PhytoflORAL® induced an improvement of skin quality after 42 and 84 days of use. The panelists’ self-assessment confirmed the instrumental readings and clinical evaluation, showing the perception of a great improvement in parameters including: skin radiance; suppleness; evenness; smoothness; moisturizing; elasticity; visible skin health; visible skin youthfulness; and overall skin beauty, as well as skin resistance to UV.
CONCLUSIONS

Under the study conditions a daily intake of PhytoflORAL® tomato powder rich in phytoene and phytofluene, showed a significant skin lightening effect after 42 and 84 days of use.

A significant improvement in skin qualities throughout the study duration shown by both the clinical scoring and subjective volunteers evaluation. The improvement was significant for skin lightening and even complexion, radiance, moisturizing, smoothness, suppleness and elasticity.

This study, previous data established in vivo for photoprotection and in vitro for multiple related benefits, along with literature available on bioavailability and activities of phytoene and phytofluene, provide evidence that dietary intake of phytoene and phytofluene in the form of PhytoflORAL® will result in accumulation of the phytoene and phytofluene in the skin, delivering thereby their skin benefiting activities including protection against oxidative and photo damage, skin lightening and even skin complexion as well as overall anti-aging. The PhytoflORAL, being rich in phytoene and phytofluene, is expected to be beneficial in maintenance of skin health and beauty.

PRECEDING IN VITRO TESTING

In-vitro testing involving exposure of melanocytes to phytoene and phytofluene without external stimulus resulted in reduced melanin production.
Addressing the other causes for pigmentation

Anti-inflammatory effect, UV absorption, reduction of oxidative stress

Simplified pathway of melanin synthesis and ways in which phytoene and phytofluene inhibit melanin synthesis and triggers of melanin formation follows.
**UV Protection and Anti-Oxidation:**

UV radiation generates reactive oxygen species (ROS) and free radicals, which lead to DNA damage, lipid peroxidation, inflammation, collagen degradation and more, resulting in premature skin aging and potential skin cancer. UV irradiation causes DNA damage in two primary ways:

1. **UVB damages DNA directly.** Energy from sunlight causes an alteration in the chemical composition of the nucleotide bases, altering the molecular structure and disrupting DNA transcription; and

2. **UVA causes damage indirectly.** Here, the sunlight itself does not change the physical structure of DNA but rather triggers an array of molecules in the cell to break down and in turn producing free radicals and ROS. These mutagenic agents can cause alterations in the physical structure of DNA.

Phytoene and phytofluene carotenoids can be employed to protect skin from UVA and UVB damage since phytoene has been shown to absorb light in the UVB range, while phytofluene absorbs UVA. Together, they reduce UV transmission through partial absorption.
IBR's phytoene and phytofluene carotenoids are aimed at protection against UVB and most importantly UVA irradiation, both via its nutraceutical beauty supplement PhytoflORAL® and the topical phytoene and phytofluene extracts (active ingredients) from tomatoes or algae, traded as IBR-TCLC® and IBR-CLC® respectively.

Activities of IBR’s phytoene- and phytofluene-containing products were established in vitro including:

1. Anti oxidative capacity particularly against hydroxyl radical, the most damaging and mostly untreated free radical that are commonly formed in interacting with UV or other oxidants
2. UV absorbency: phytoene absorbs in the UVB range with $\lambda_{max}$ at 286nm and phytofluene in the UVA range with $\lambda_{max}$ at 348nm, making them seem colorless.
3. Anti inflammatory activity (inhibition of PGE-2 in keratinocytes among other)
4. Inhibition of melanin synthesis
5. Inhibition of MMP-1 (collagenase) thereby preventing collagen destruction
6. Prevention of damage to DNA;
7. Protection and boost of other biomolecules such as LDLs (Low Density Lipoproteins) and actives. This can be part of a defense system against oxidative stress, more specifically preventing atherosclerosis and lipid peroxidation.

These multifunctionalities enable the phytoene and phytofluene photoprotective, skin lightening and anti aging effects that may be delivered to the skin via dietary intake (PhytoflORAL®) and topically (IBR-CLC®, IBR-TCLC®).