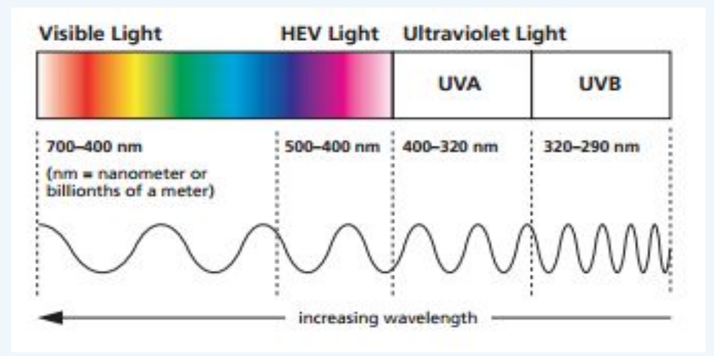
# β-Carotene as an Antioxidant Strategy to Improve Brightening Sunscreen Efficacy Against Blue Light–Induced Melanogenesis

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## INTRODUCTION

- Cutaneous pigmentation is regulated by complex interactions between melanocytes, keratinocytes, and environmental light exposure. Beyond ultraviolet irradiation, increasing evidence indicates that visible light can induce sustained melanogenic responses.
- Blue light is a component of VL in the electromagnetic spectrum, with a wavelength range of 400-500 nm, which penetrates into deeper skin layers, and induces a greater level of cellular dysfunction and DNA damage, cell and tissue injury, causing skin barrier damage, hyperpigmentation and photoageing.
- The current studies suggested Iron oxide as a strong blue light protective ingredient; however, it has a limitation in that it can only be used in tinted sunscreen formulation.
- This study evaluated the contribution of β-carotene as a strong antioxidant in brightening sunscreen formulations to reduce blue light–induced pigmentation beyond conventional sunscreen.



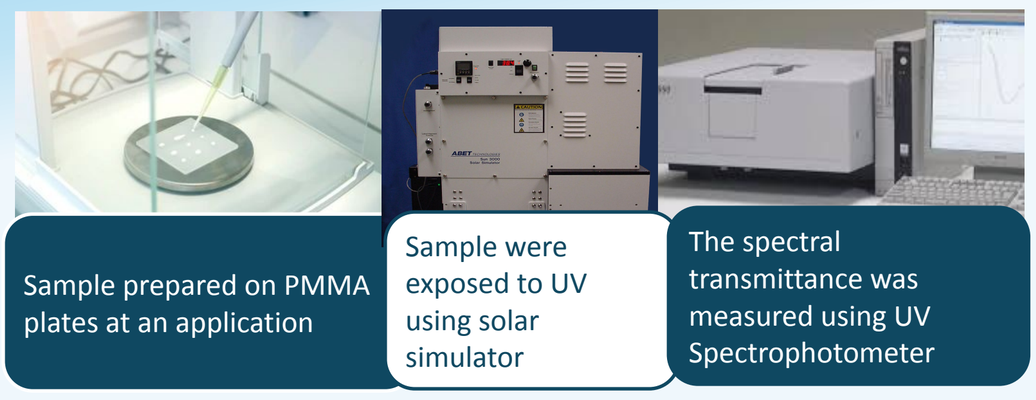

## METHOD

- Blue light protection value (BL-PV) measurement

The protection value of a β-carotene were measured in comparison to Iron oxide in three formulation systems:

- UV Sunscreen + Brightening Actives (Vitamin B3, Liposome cysteamine, Licorice extract, NAD) + Low-dose β-carotene (stated as **sunscreen formulation**)
- **Sunscreen Formulation** + 0.0025% β-carotene
- **Sunscreen Formulation** + 0.025% Iron oxide

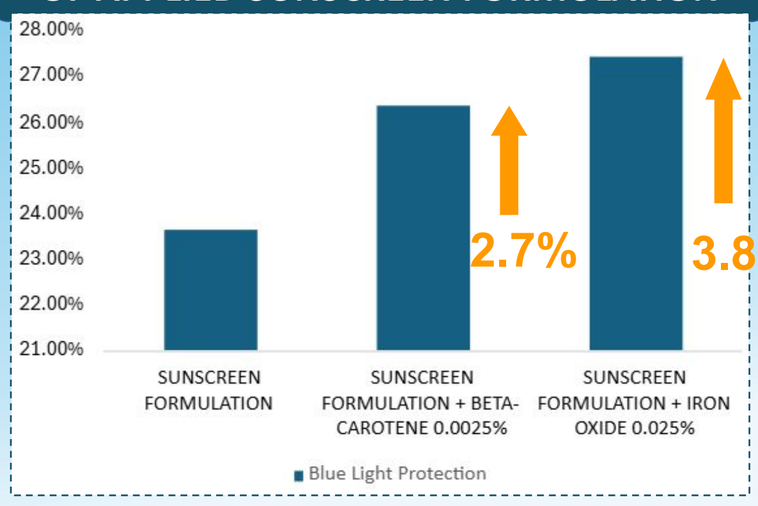
- Clinical Evaluation



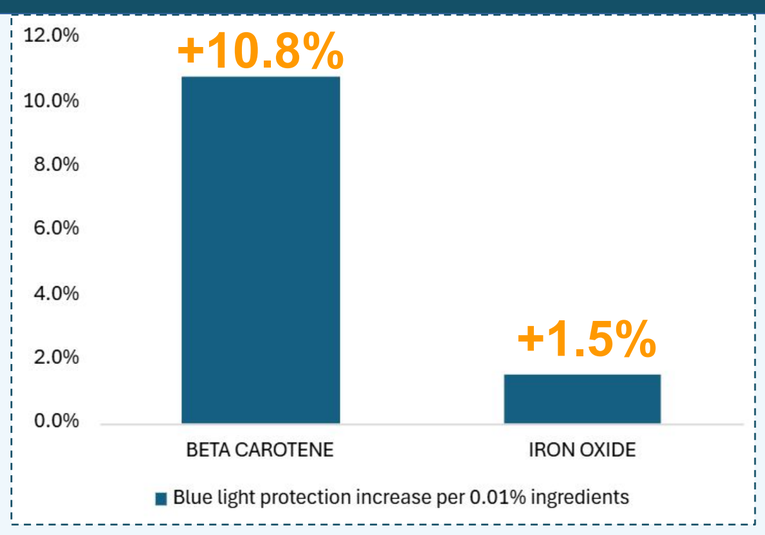

- Sunscreen formulation which contain β-carotene were tested on its anti-pigmentation benefit on clinical evaluation with:
- Subjects : 66 healthy woman with sensitive skin, aged 23-28 years old.
- Application : once in the morning everyday for 2 weeks.
- Parameter: Dark spot, Skin pigmentation, Skin brightness.
- Instruments/ Method: Colorimeter, Mexameter, and Dermatologist Grading

## RESULT AND DISCUSSION

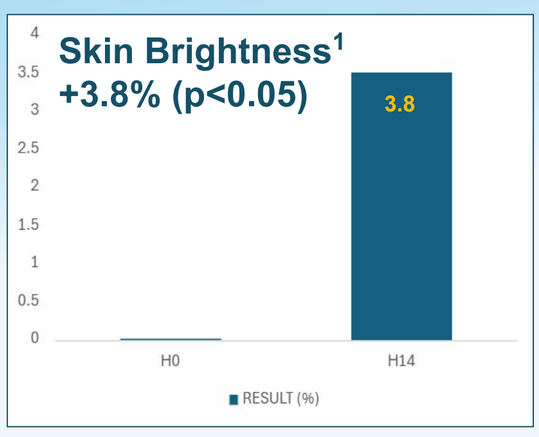
### ABSOLUTE BLUE LIGHT PROTECTION VALUE OF APPLIED SUNSCREEN FORMULATION

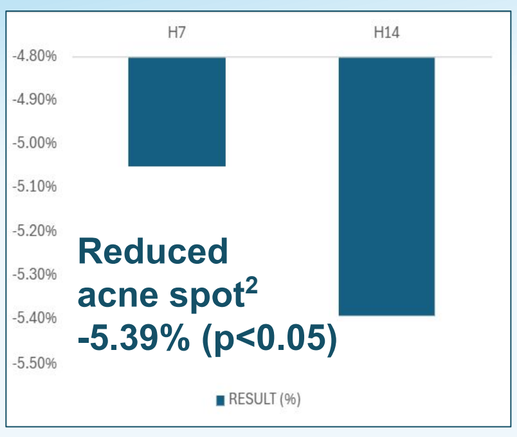


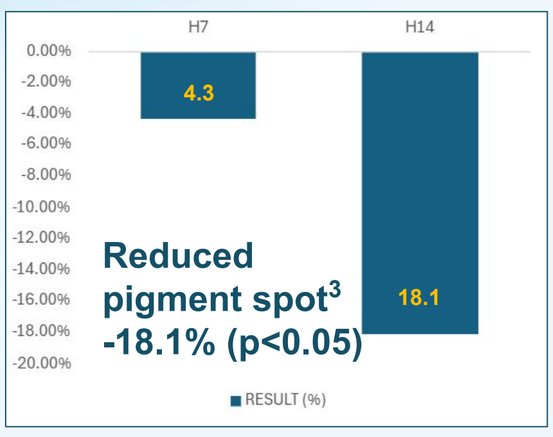

### DOSE-NORMALIZED BLUE LIGHT PROTECTION BOOSTING EFFECT OF ß-CAROTENE & IRON OXIDE




### Clinical Evaluation

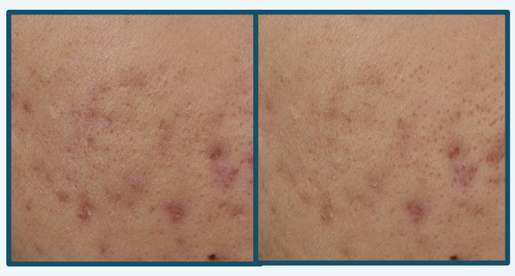


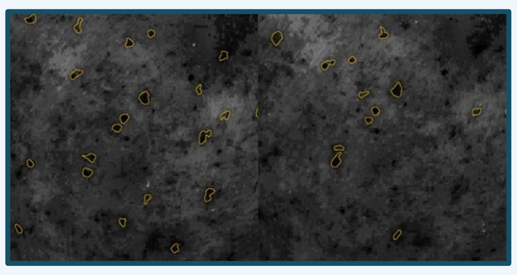






H0 H14



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## CONCLUSION

- The incorporation of β-carotene into brightening sunscreen formulations resulted an increase of blue light-protection value, with an effect comparable to that of iron oxide, highlighting its potential role as an effective blue light–protective antioxidant ingredient.
- Clinical evaluation showed brightening sunscreen with β-carotene gives significant anti-pigmentation effect in women with sensitive skin.
- These findings support the development of multifunctional sunscreen systems that combine UV filters, brightening actives, and antioxidants to provide broader protection against light-induced pigmentation.

## ACKNOWLEDGMENT

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