

## INTRODUCTION

Sleep is one of the most important elements to health. Disruption of sleep patterns can not only create negative acute and chronic health outcomes, but also degrade skin quality. Indeed, a lack of sleep increases the release of stress hormones or inflammatory cytokines to induce skin dehydration, trans-epidermal water loss (TEWL) or a loss of skin elasticity for instance, to exacerbate signs of ageing.<sup>1</sup>

Melatonin is critical for regulating sleep cycle. But this molecule also showed interesting properties in the skin such as antioxidant or anti-inflammatory effects, through direct or indirect receptor-mediated action to reduce skin ageing.<sup>2</sup>

The present study demonstrates a novel dual approach to improve sleep deficiency-related signs on skin. For that purpose, an essential oil-base active ingredient (Active A), was used in a face cream without smell perception for volunteers. Its capacity to improve sleep quality in addition to have a direct regenerative effect in the skin was further studied.

## MATERIALS & METHODS

### RAW MATERIAL

An upcycled essential oil was diluted at 0,25% in a green solvent to give our active ingredient (Active A).

### CLINICAL EVALUATION OF ACTIVE A OVER SLEEP STUDIES

Active A (1%) or the placebo were typically applied on the face and tested on 32 healthy participants (22-56 years) with self-reported mild sleep disturbances. Participants applied the material at bedtime in their sleep environment for 5 consecutive nights. Sleep measurements were performed with the SleepScore Max device (SleepScore Labs, Carlsbad, CA).

### REGENERATIVE EFFECT OF ACTIVE A AGAINST DAILY STRESS

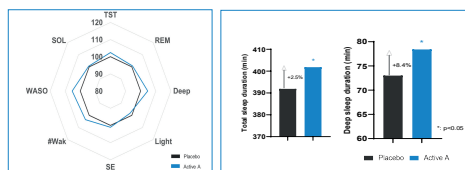
Active A has been evaluated at 1% on human skin explants after stress induction with UV, for 24h. The effect of the stress with or without active on the melatonin pathway has been assessed by RT-qPCR and confirmed by specific immunostaining.

### IN VIVO IMPROVEMENT OF DARK CIRCLES WITH ACTIVE A

Active A (1%) or the placebo were typically applied on the face once a day at bedtime on a panel of 22 volunteers (28-64 years) complaining about lack of sleep and presenting dark circles. Results were obtained after images analysis acquired by VISIA-CR and measurement of Individual Topology Angle (ITA).

## SLEEP RESULTS AND DISCUSSION

### CLINICAL EVALUATION OF ACTIVE A OVER SLEEP STUDIES



TST: Total Sleep Time; REM: REM Sleep Time; Deep: Deep Sleep Time; Light: Light Sleep Time; SE: Sleep Efficiency; #Wak: # of interruptions; WASO: Wake after sleep onset; SOL: Sleep Onset Latency

Objective sleep measure showed a significant improvement in total sleep duration (~10 minutes) with Active A compared to placebo. An effect in a same range as after taking melatonin.<sup>3</sup> This effect can be primarily attributed to a significant increase in deep sleep duration by 8% (73 minutes with placebo vs 79 minutes with Active A). Deep sleep is known as the regenerative sleep and is important to repair the skin system.

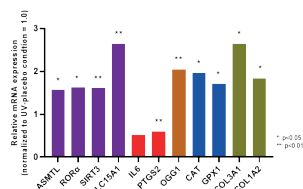
## ACKNOWLEDGEMENTS REFERENCES

The authors gratefully thanks SleepScore Labs for providing the biometric sleep measurement platform and sleep staging data used in this study.

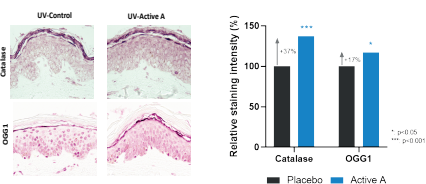
- [1] Kahan V et al. (2010) Med. Hypotheses 75:535-537
- [2] Botcheva G et al. (2022) Int. J. Mol. Sci. 23:1238
- [3] Randall S et al. (2012) Sleep 35 : 1551-1557

## SKIN RESULTS AND DISCUSSION

### REPAIRING EFFECT OF THE ACTIVE A AGAINST DAILY STRESS ON AN EX VIVO MODEL

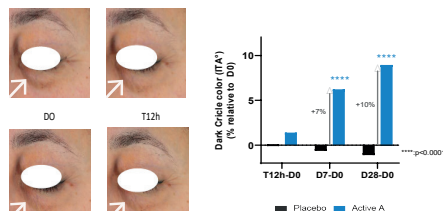


Compared to placebo condition, Active A increases the expression of genes involved in melatonin pathway, after a daily stress aggression. Consequently, a decrease of the inflammation as well as an increase of DNA repair marker, antioxidant enzymes and collagen production were observed compared to placebo. These results were confirmed by immunostaining for the catalase (antioxidant enzyme) and OGG1 (DNA glycosylase enzyme as DNA repair marker).



Therefore, Active A at 1%, allowed skin to regenerate after daily aggression to reproduce what happened during deep sleep.

### IN VIVO EFFECT OF ACTIVE A ON DARK CIRCLES UNDER EYES



Under eye-circles are one of the most quickly visible signs on how lack of sleep affects skin. Active A significantly increases ITA<sup>®</sup> after only 7 days, indicating a lighter skin pigmentation and therefore an improvement of dark circle color intensity.

This quick effect results from the combination of improvement in sleep quality as well as direct topic effect of the Active A.

## CONCLUSION

Deep sleep is the repairing and restorative sleep that is necessary to offer specific physical and mental benefits. It also helps bolster the skin's renewal and repair system. In the present study, we demonstrated that our Active A increases deep sleep in addition to promote regenerative effect by targeting melatonin pathway in the skin. Both effects contribute to reducing visible signs of skin fatigue in volunteers.

