32nd IFSCC Congress
London 19–22 September 2022
"WHERE BEAUTY, SCIENCE AND INNOVATION MEET"

EVALUATING THE DETRIMENTAL IMPACT OF HIGH ENERGY VISIBLE LIGHT ON HUMAN SKIN: AN *EX VIVO* AND *IN VIVO* APPROACH

Francois-Newton, Veronique[1,2]; Lutchmanen Kolanthan, Vimi[1]; Soobramaney, Vitisha[1]; Domun, Adaam[1]; Moga, Alain[3]; Petkar, Gitanjali[1]; Latouche-Veerapen, Mélissa[1]; Philibert, Georges Evans[1]; Cavagnino, Andrea[4]; Sokeechand, Bibi Nusayha[1]; Hosenally, Muzzammil[1]; Ruchaia, Bryna[1]; **Mandary, Madiiha Bibi[1]***.

[1]Centre International de Développement Pharmaceutique Ltée (CIDP), Phoenix, Mauritius
[2]School of Health Science, University of Technology, Port- Louis, Mauritius,
[3]Synelvia SAS Prologue Biotech, Labège Cedex, France
[4]OxiProteomics, SAS, 2, rue Antoine Etex, 94000 Créteil, France
[5]Department of Economics and Statistics, University of Mauritius, Moka, Mauritius

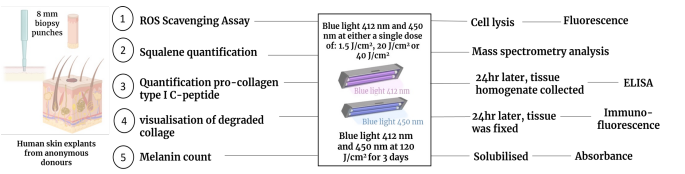
Poster ID 484

INTRODUCTION

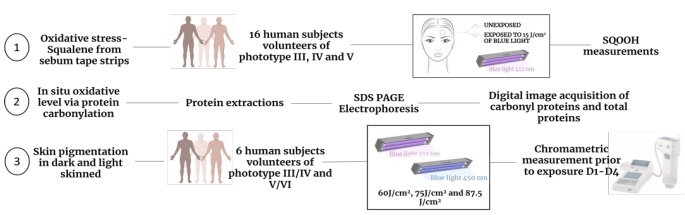
- Until recently, visible light (VL) (400–700 nm) such as blue light was considered as devoid of any cutaneous photobiological effects[1].
- It has since been reported that blue light can affect the molecular structure of the skin by inducing hyperpigmentation, increased oxidative stress leading to lipid peroxidation, protein carbonylation, inflammation which in turn leads to significant photo-aging[2,3,4].
- Through the scientific evidence on the detrimental cutaneous effects of blue light[1-4], cosmetic products purporting sunscreen filters and antioxidant actives with blue light protection claim are increasingly commercially available[5].
- However, a major setback is the lack of standardized methodology to substantiate the efficacy of the products objectively and accurately on human skin[6].
- The aim of this study is to setup *ex vivo* and *in vivo* methodologies that monitor detrimental effects such as pigmentation and oxidative stress as a result of exposure to two wavelengths of blue light (412 nm and 450 nm).

MATERIALS & METHODS

The *ex vivo* methodology:



The *in vivo* methodology:



RESULTS & DISCUSSION

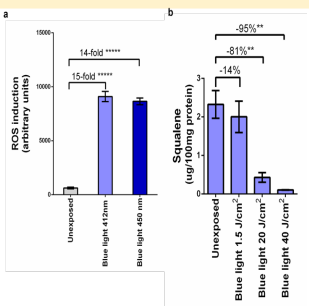


Figure 1(a): The level of oxidation in the human skin explants monitored by measuring the induction of ROS following exposure to blue light 412 nm and 450 nm. **(b):** The quantification of squalene in the human skin explants monitored following exposure to blue light 412 nm and 450 nm.

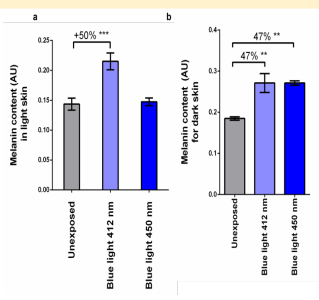


Figure 2: Melanin content in human skin explants from donor of either **(a)** phototype III or **(b)** phototype VI after exposure to different sources of blue light

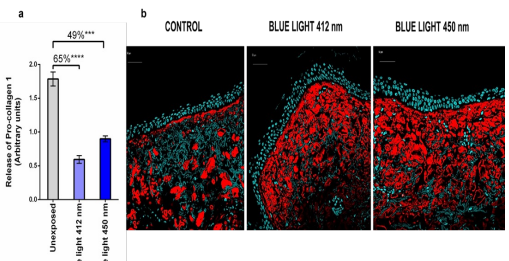


Figure 3(a): The degradation of the extracellular matrix by affecting the induction of the precursor of collagen I (pro-collagen I) **(b):** Using a fluorescent labelled probe targeted at specifically unwound collagen and degraded collagen (Red stained).

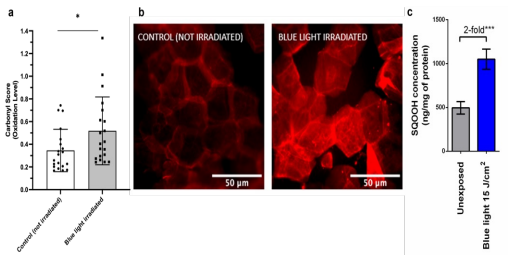


Figure 4(a): Quantification of carbonylated proteins and distribution of individual values. The evolution of the oxidation rate shows a statistically significant increase ($p < 0.05$) of 50% between control and blue light exposure. **(b)** the visualization of the in-situ oxidative level (carbonylation) is presented as intensity of carbonylation signal (in red). Increased levels of oxidative damage (carbonylation) have been observed upon stress (blue light) exposure in comparison to the not exposed zone. **(c)** Level of oxidized squalene (SQOOH) was monitored in the un-exposed and exposed tape strips.

RESULTS & DISCUSSION

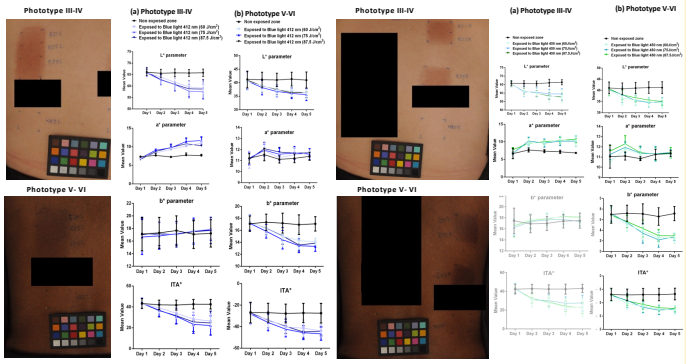


Figure 5: Determination of the L*a*b* and ITA parameters in **(a)** light skinned (phototype III-IV) or **(b)** dark-skinned (phototype V-VI) exposed to different doses of blue light 412 nm

Figure 6: Determination of the L*a*b* and ITA parameters **(a)** in pale skinned (phototype III-IV) or **(b)** dark-skinned (phototype V-VI) exposed to different doses of blue light 450 nm

- Exposure to blue light 412 nm and 450 nm induced in both phototypes a decrease in the L* parameter and ITA° which correlated with an increase in pigmentation.
- For the a* parameter, an increased was noted corresponding to increased erythema in light skin. However, no significant changes in a* parameter was observed for phototype V-VI.
- For b* parameter, no changes was observed for phototype III-IV. As for phototype V-VI, a decrease in b* parameter was observed corresponding to an increase in bluish colour.
- These results suggest that skin of different phototype does not react the same way to blue light.

CONCLUSION

The results presented demonstrate the suitability of our developed monochromatic blue light sources as a standardized method to investigate the effect of blue light on the skin in terms of oxidative stress, extracellular matrix degradation and skin pigmentation. We confirm that a variation in the expression of pigmentation due to blue light **412 nm** and **450 nm** exists in skins of different phototypes. Our data points towards a possible underlaying mechanism of pigmentation following blue light exposure which is dependent on the skin phototype.

REFERENCES

1. Duteil L, Cardot-Leccia N, Queille-Roussel C, Maubert Y, Harmelin Y, Boukari F, et al. (2014) Differences in visible light-induced pigmentation according to wavelengths: a clinical and histological study in comparison with UVB exposure. Pigment Cell Melanoma Res 27(5):822-826.
2. Campiche R, Curpen SJ, Lutchmanen-Kolanthan V, Gougeon S, Cherel M, Laurent G, et al. (2020) Pigmentation effects of blue light irradiation on skin and how to protect against them. Int. J. Cosmet. Sci 42(4):399-406.
3. Mahmoud BH, Ruvolo E, Hexsel CL, Liu Y, Owen MR, Kollias N, et al. (2010) Impact of long-wavelength UVA and visible light on melanocompetent skin. J Invest Dermatol 130(8):2092-2097.
4. Liebel F, Kaur S, Ruvolo E, Kollias N and Southall MD (2012) Irradiation of skin with visible light induces reactive oxygen species and matrix-degrading enzymes. J. Invest. Dermatol 132 (7):1901-1907.
5. Curpen S, Francois-Newton V, Moga A, Hosenally M, Petkar G, Soobramaney V, et al (2020) A novel method for evaluating the effect of pollution on the human skin under controlled conditions. Skin Res. Technol 26(1):50-60.
6. Lim HW, Kohli I, Granger C, Trullàs C, Piquero-Casals J, Narda M et al. (2021) Photoprotection of the skin from visible light–induced pigmentation: current testing methods and proposed harmonization. J. Invest. Dermatol 141(11):2569-2576.

ACKNOWLEDGEMENT

Authors would like to acknowledge Dr Claire Blazy-Jauzac for their valuable input and support during this study.