INHIBITING THE EFFECTS OF OXIDATIVE STRESS VIA TOPICALLY APPLIED ANTIOXIDANT FORMULATIONS

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INTRODUCTION

Environmentally generated reactive oxygen species (ROS) are increasingly considered to be a major source of oxidative stress for the skin, attacking proteins and membrane structures. ROS can also react with stratum corneum lipids to form lipid peroxide species (LPOs), which have links to premature aging and ultimately, DNA adducts.[1,2] The presence of LPOs in skin can therefore be viewed as a biomarker for oxidative damage.

OBJECTIVE

Scavenging antioxidants can reduce ROS damage by breaking or 'quenching' the free radical chain reaction. This study explores the ability of topically applied antioxidant formulations to inhibit ROS generation in tissue exposed to different sources of environmental oxidative stress. The study also aims to determine the protective effect of antioxidants for reducing lipid peroxidation.

METHODS

Fluorescence Imaging: Living skin equivalents (LSE) (Epiderm 200, Mattek) were separately treated with an antioxidant formulation with or without SPF 15 or vehicle control, then doped with a radical visualization tag. Samples were then exposed either to UV irradiation or automotive emissions and imaged using a fluorescence microscope.

Lipid Peroxide Analysis: Tape strips were collected from the foreheads of human volunteers, following treatment with antioxidant formulation with or without SPF 15 or a no treatment control. After exposure under a solar simulator, sebum on the tape was extracted and LPO species were quantified spectrophotometrically.

RESULTS

Fluorescence imaging generated coloured intensity maps of ROS in skin tissue for each sample. Fluorescence signals were used to calculate the % quenching of ROS generated by UV/automotive emissions for each antioxidant formulation vs control. In this study, topically applied antioxidant formulations were found to significantly inhibit ROS formation in tissue vs. a no-antioxidant control ($p<0.05$). A similar effect was noted for automotive emissions.

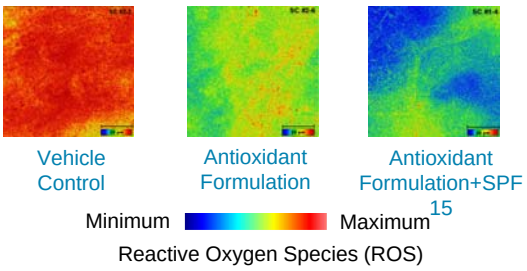

Figure 1: Fluorescence maps showing suppression of UV-induced ROS in LSE by antioxidant formulations

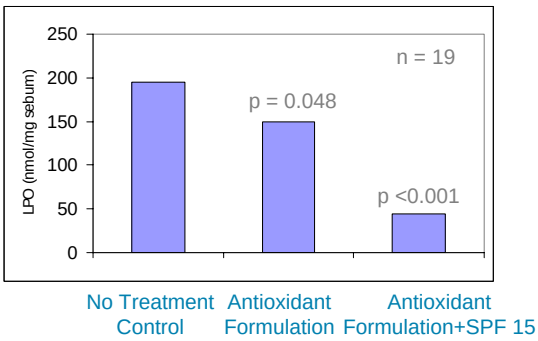

Figure 2: Antioxidant suppression of UV-induced LPO formation in extracted sebum

LPO formation was successfully inhibited by the antioxidant/SPF system. Versus a no treatment control, the full formulations were found to suppress UV-induced LPO production in sebum by 25% (antioxidant package), and 75% (antioxidants + SPF 15) respectively.

CONCLUSIONS

Using a dual method approach, we have demonstrated that topically applied antioxidant skin care formulations can suppress the generation of free radical species in skin models exposed to environmentally-induced oxidative stress and inhibit the formation of skin-damaging lipid peroxide species.

This work was funded by P&G Beauty.

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