

PROTECTIVE EFFECTS OF C E FERULIC FROM COMBINATION OF ATMOSPHERIC AGGRESSORS

INTRODUCTION

The skin is one of the main target organs of harmful effects caused by frequent environmental insults. Consequently, ozone (O₃), particulate matter (PM), and ultraviolet (UV) light have all been shown to play a role as atmospheric aggressors by inducing skin damage through disruption of redox homeostasis and induction of pro-inflammatory status. In the last few decades, several studies have been focused on the effect of individual pollutants on cutaneous tissues. However, very few have investigated the additive effects of different aggressors combined.¹⁻³

A study was conducted to assess the additive effect of the most represented atmospheric aggressors in an outdoor environment in terms of skin oxidation and inflammation and whether topical application of C E Ferulic (CEF), containing 15% L-ascorbic acid, 1% α-tocopherol, and 0.5% ferulic acid, could prevent such aggressor-induced damage.

OBJECTIVE

The study evaluated the possible synergistic effects of a combination of atmospheric aggressors on skin damage and whether topical application of C E Ferulic can prevent such effects.

EXPERIMENTAL METHODOLOGY

A total of 180 skin tissue explants obtained from three different subjects were pre-treated with C E Ferulic (15% L-ascorbic acid, 1% α-tocopherol, and 0.5% ferulic acid), and were exposed to combinations of different atmospheric aggressors, including 200 mJ ultraviolet light (UV), diesel engine exhaust (DEE) as a source of PM, and ozone (O₃), daily over a period of 4 days. A control was also utilized to validate the effects of the aggressors on the skin tissue.

Key markers representing oxidative stress (4HNE), inflammation (NFκB), and keratinocyte differentiation (filaggrin), were measured using immunofluorescence to assess whether the atmospheric aggressors acted synergistically in promoting aggressor-induced skin damage.

Exposure Conditions

- Control
- UV
- UV+O₃
- UV+DEE
- UV+DEE+O₃

Exposure time each day

- UV 2J/Cm² for 18 sec
- DEE for 30 minutes
- O₃ 0.25 ppm for 2 hours

RESULTS

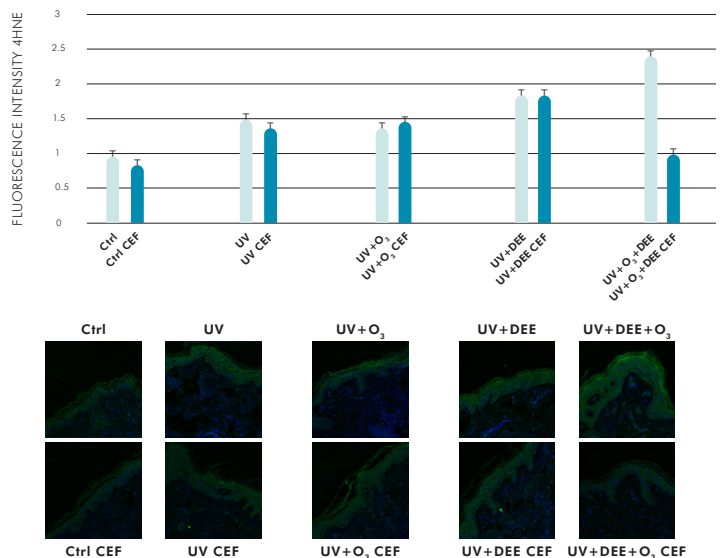
The combination of atmospheric aggressors demonstrated a synergistic effect in cutaneous damage. Pre-treatment with C E Ferulic aided in mitigating the disruptive effects.

As shown in **Figure 1**, 4-hydroxynonenal (4HNE) levels, a marker of peroxidation, increased in response to individual UV light exposure and in combination with O₃ and DEE. Topical application of C E Ferulic aided in the reduction of marker expression.

In addition, NFκB, a key marker involved in the regulation of tissue inflammatory responses, also showed an increase when exposed to the combination of aggressors (**Figure 2**). Specifically, there was an increased level of NFκB in response to exposure of UV light individually and in combination with O₃ and DEE. Topical application of C E Ferulic prevented aggressor-induced increase in NFκB levels.

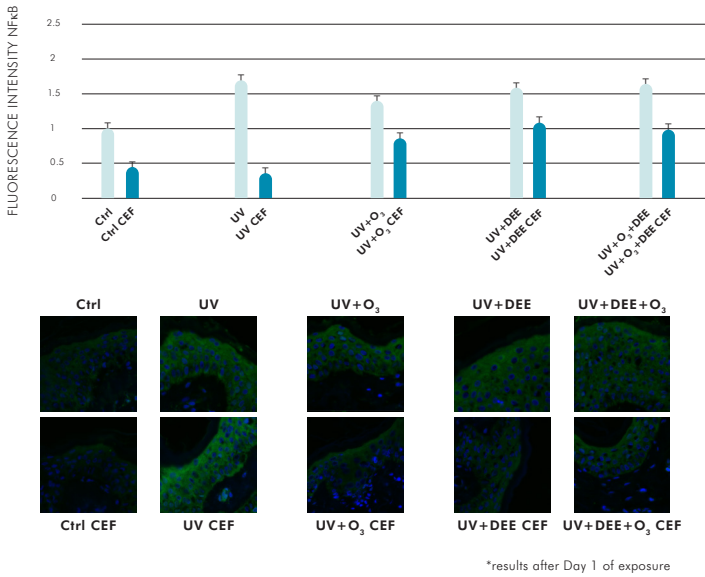
Furthermore, filaggrin, which facilitates keratin matrix formation, demonstrated a decrease in levels in response to exposure of the combined aggressors (**Figure 3**). Once again, pre-treatment with C E Ferulic played a role in preventing this effect.

Figure 1: Topical application of C E Ferulic prevents increase of 4HNE exposure in skin explant tissue*



*results after Day 1 of exposure

Figure 2: Topical application of C E Ferulic prevents increase of NFkB exposure in skin explant tissue*



CONCLUSION

The data showed a clear additive effect of ozone and PM in combination with UV in increasing levels of several oxidative and inflammatory markers such as 4HNE, NFkB, and filaggrin. The results demonstrate that topical application of C E Ferulic counteracts the alterations in redox homeostasis, increased inflammation, and damage to the skin structure induced by the additive effects of the combined aggressors in ex-vivo human skin explants. Therefore, daily application of C E Ferulic is an effective approach to protect the skin from daily atmospheric aggressors.

1. Krutmann, J. et al., The skin aging exposome. *J Dermatol Sci*, 2017. 85(3): p. 152-161.
2. Puri, P., et al., Effects of air pollution on the skin: A review. *Indian J Dermatol Venereol Leprol*, 2017. 83(4): p. 415-423.
3. Fuks, K.B., B. Woodby, and G. Valacchi, Skin damage by tropospheric ozone. *Hautarzt*, 2019

Figure 3: Topical application of C E Ferulic prevents decrease of filaggrin exposure in skin explant tissue*

