The protective effect of topical application of combination antioxidants in premature senescence of human skin

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Introduction

Extrinsic skin ageing is characterized by loss of skin laxity, wrinkling and pigmentation. The effect of ultraviolet (UV) radiation is well studied by increasing inflammatory response and oxidative stress leading to degradation of extracellular matrix (ECM) proteins such as collagen. Additionally, increasing numbers of studies have indicated the atmospheric pollution induces intracellular reactive oxygen species (ROS).

Among various substances with potentials to prevent deleterious effect of environmental ageing, antioxidants are most representative and well studied, Especially, the combination formulation of L-ascorbic acid, vitamin E and Ferulic acid (CE Ferulicⓡ, L'Oréal, Clichy, France) have shown it's in vitro and in vivo effect in the prevention of photoaging. However, in presence, environmental ageing is induced by the additive effect of UV and air pollution. Yet current studies are limited to evaluating the effect of single factors in human skin.

Therefore, in this study, we aimed to investigate the effect of UV and PM in human skin and examined whether the topical application of combination antioxidant formulation can potentially prevent and inhibit the signs of environmental skin ageing.

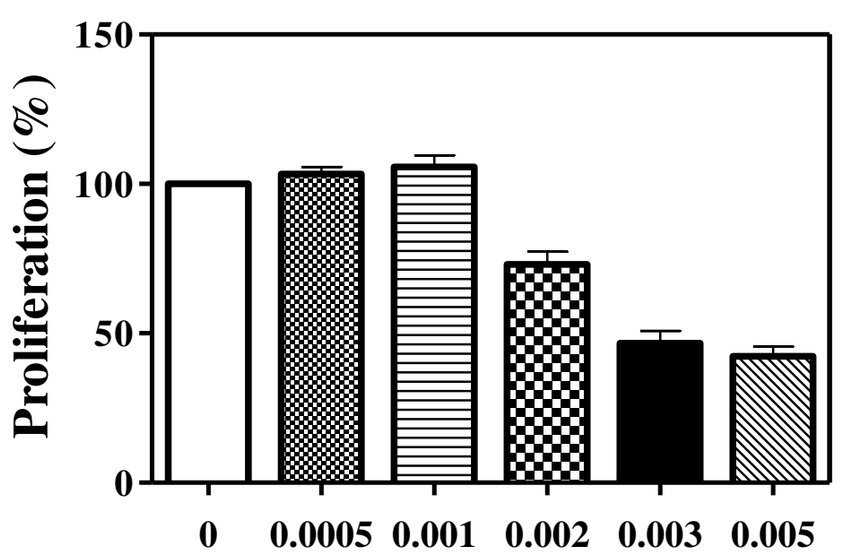

Figure 1. Cell viability upon combination *l*-ascorbic acid formulation application. Cell viability was assessed by 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay following the exposure of various concentrations of l-ascorbic acid formulation (0 ~ 0.005 %) to HDFs incubated for 24 hours. All data are expressed

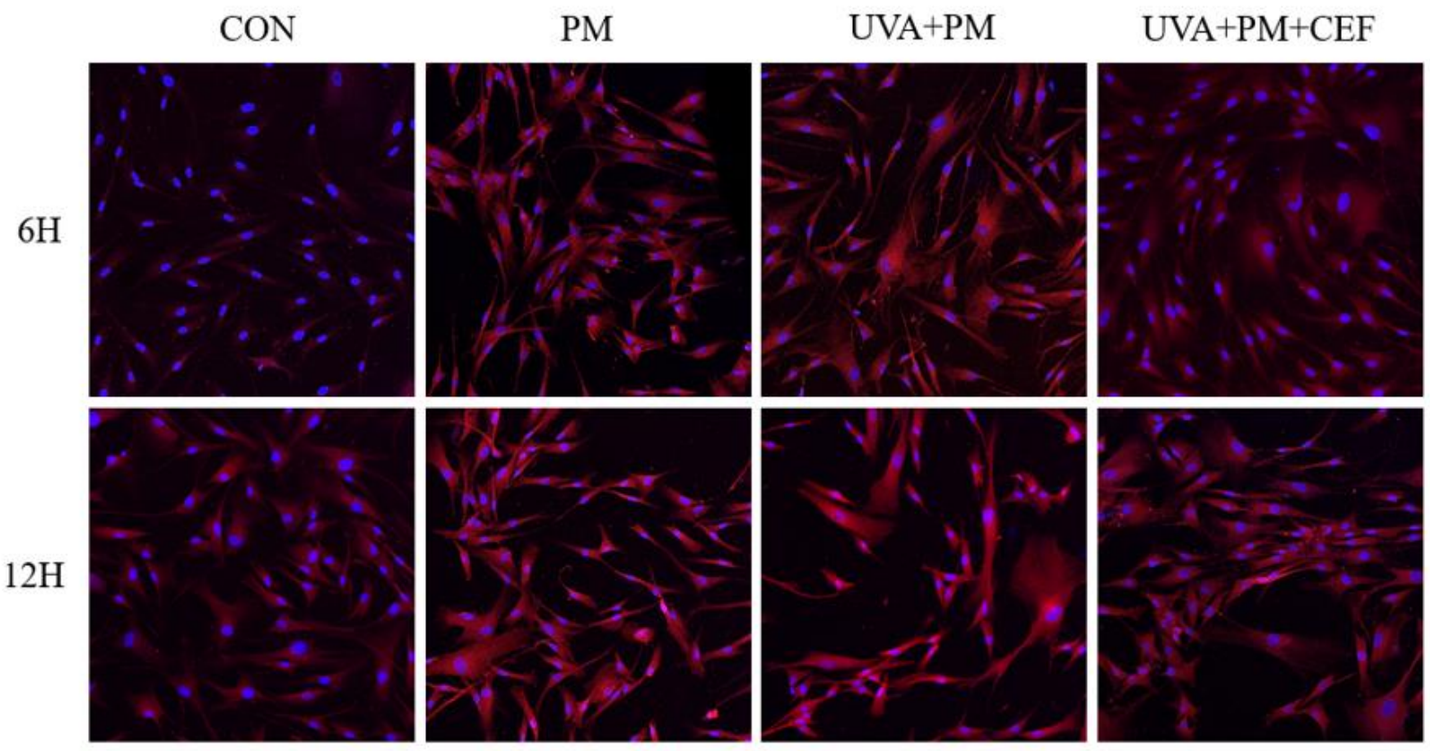

Figure 2. Characterization of AhR expression in PM and UVA exposure to HDF AhR protein expression was analyzed by immunofluorescence (IF). Exposure to PM induced increased Ahr level and UVA exposure further increased AhR induction. IF studies for 6, 12 h revealed both PM and UVA induced AhR expression around the nuclear membrane, suggesting that activated AhR are transported inside the nucleus.

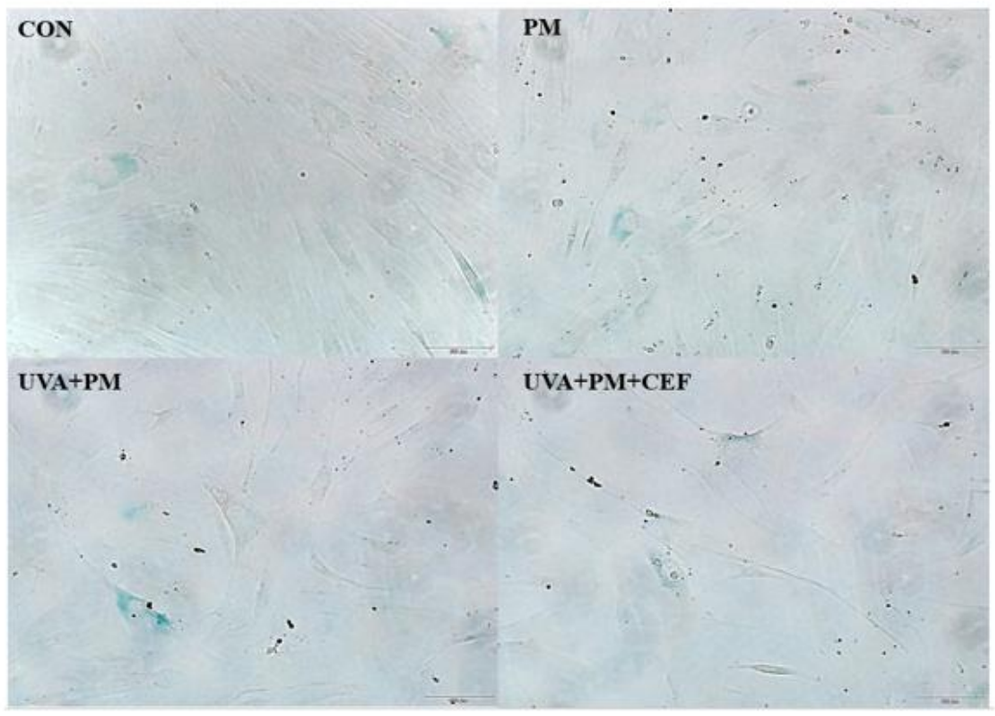

Figure 3. Exposure to PM and UVA induces increased levels of senescence-associated secretory phenotype (SASP) Increased SA-β-gal staining was noted in PM exposed cell, further increase was sound SA-β-gal positive in UVA exposed group. The activity of SA-β-gal was significantly diminished in l-ascorbic acid compound treated fibroblast.

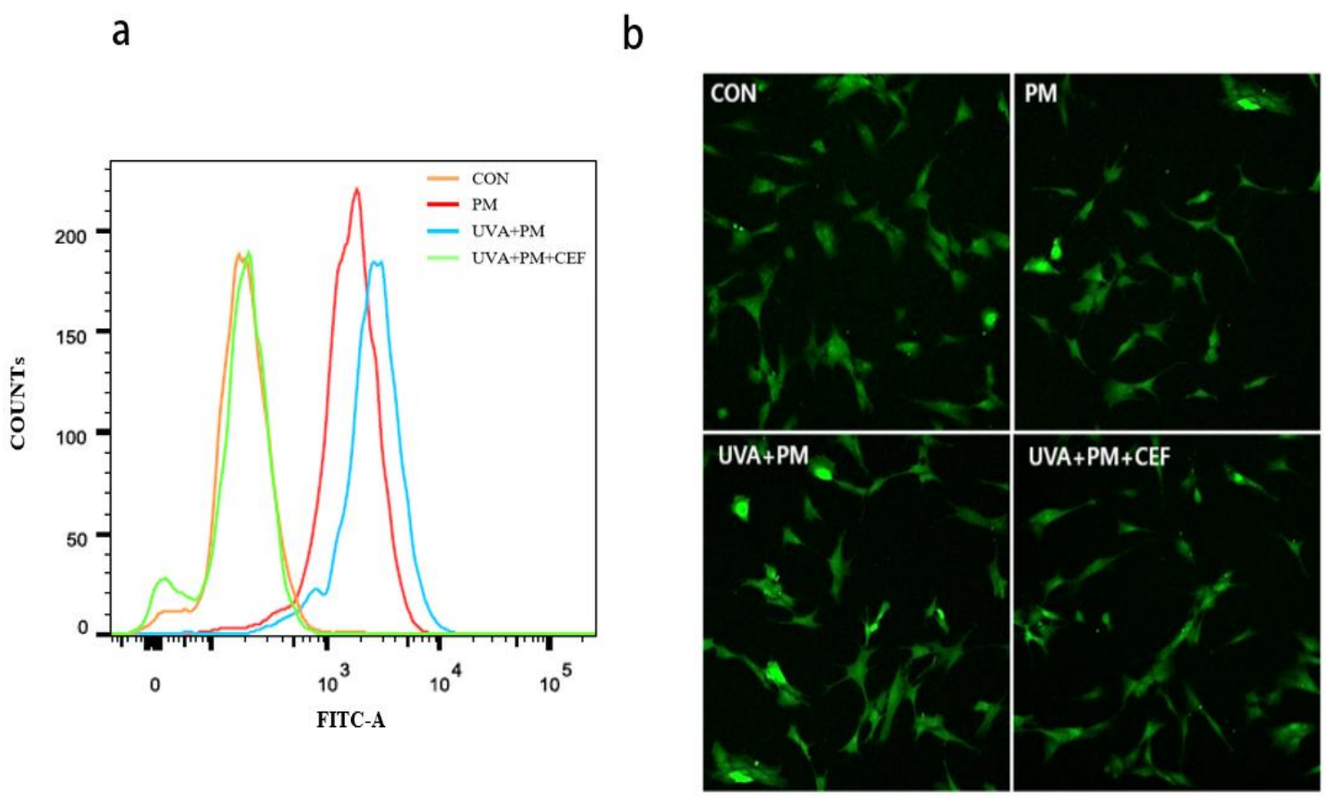

Figure 4. PM and UVA have additive effect on ROS generation in HDFs. DCFDA fluorescent staining method was performed to evaluate ROS generated by PM and PM with UVA, immediately after the exposure. Exposure to PM induced increased ROS generation and further increased by exposure to UVA

Conclusions

Present findings suggest that l-ascorbic acid may have beneficial effects in alleviating skin aging. Inhibiting Ahr by topical antioxidant can be an easily applicable approach against both extrinsic and intrinsic factors of aging. Further study of other desirable antioxidant formulation coupled with other environmental exposomes will decipher the mechanism of skin aging and shed light on the pathogenesis of fibroblast senescence.