

Photoprotective properties of a hydrophilic extract of the fern *Polypodium leucotomos* on human skin cells

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Abstract

The effect of a hydrophilic extract of the fern *Polypodium leucotomos* (PLE) has been investigated in terms of photoprotection against UV-induced cell damage. PLE efficiently preserved human fibroblast survival and restored their proliferative capability when the cells were exposed to UVA light. This effect was specific and dose-dependent. Photoprotection was not restricted to fibroblasts, as demonstrated by its effect on survival and proliferation of the human keratinocyte cell line HaCat. Finally, treatment of the cells with PLE prevented UV-induced morphological changes in human fibroblasts, namely disorganisation of F-actin-based cytoskeletal structures, coalescence of the tubulin cytoskeleton and mislocalization of adhesion molecules such as cadherins and integrins. Our in vitro results demonstrate the photoprotective effect of PLE on human cells and support its use in the preventive treatment of sunburning and skin pathologies associated with UV-mediated damage.

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1. Introduction

The effect of overexposure to ultraviolet radiation in the development of skin diseases and melanoma has been clearly demonstrated in recent years [1,2], and thus the need for developing protective reagents is an active field of study. Protection should prevent the development of severe burns, hyperpigmentation, photoallergy and phototoxicity, skin cancer and chronic skin damage, and premature aging. There has been considerable controversy on the type of UV radiation involved in the injurious effects described above. Although it was first conceived that UVB was most involved in these processes, the general consensus points to a role of both UVA and UVB in the development of skin cancer [3] and melanoma [4].

It is well stated that any live organism exposed to UV

radiation reacts in different ways, such as avoidance of the UV source (phototaxis), screening under inert materials, and specially the production of photoprotective compounds that specifically screen UV radiation, such as mycosporine-like amino acids, scytonemin secreted by cyanobacteria, flavonoids secreted by plants and melanin expressed by skin cells in animals and humans [5]. Thus, agents that may induce skin damage in animals may also induce the production of secondary metabolites entitled with photoprotective effect in organisms such as microorganisms or higher plants [5].

The beneficial effect of an extract of the fern *Polypodium leucotomos* (PLE), minimizing photoaging changes and preventing acute sunburn, has been described [6,7]. PLE has also been reported to inhibit the formation of reactive oxygen species induced by UV light [8] and to possess antiinflammatory properties [9]. In this report, we describe the in vitro photoprotective effect of the PLE, as it preserves the proliferative ability of UV-treated cells and protects the cells from UVA-induced cytoskeletal changes. We propose that the PLE exhibits photoprotective prop-

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