EFFECTIVENESS OF A BROAD-SPECTRUM SUNSCREEN IN THE PREVENTION OF UVA-1 INDUCED MMP-1 AND ICAM-1 EXPRESSION IN HUMAN SKIN

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INTRODUCTION

Ultraviolet radiation (UVR) is able to induce a number of deleterious effects in human skin including premature aging (photoaging). Photoaging is mainly due to chronic exposure to longwave UV radiation (UVA radiation). Studies on the mechanisms by which UVA cause skin aging have revealed that an increased expression of matrix metalloproteinase 1 (MMP-1 or collagenase 1) is of major importance. Furthermore, UVA exposure increases also expression of proinflammatory molecules such as ICAM-1. As a consequence, prevention of photoaging should be directed towards the prevention of UVA radiation-induced upregulation of MMP-1 or ICAM-1 expression. In this regard, a broad-spectrum sunscreen which contains a combination of UVB and UVA filters may offer a powerful protection against these UV-induced effects on gene expression.

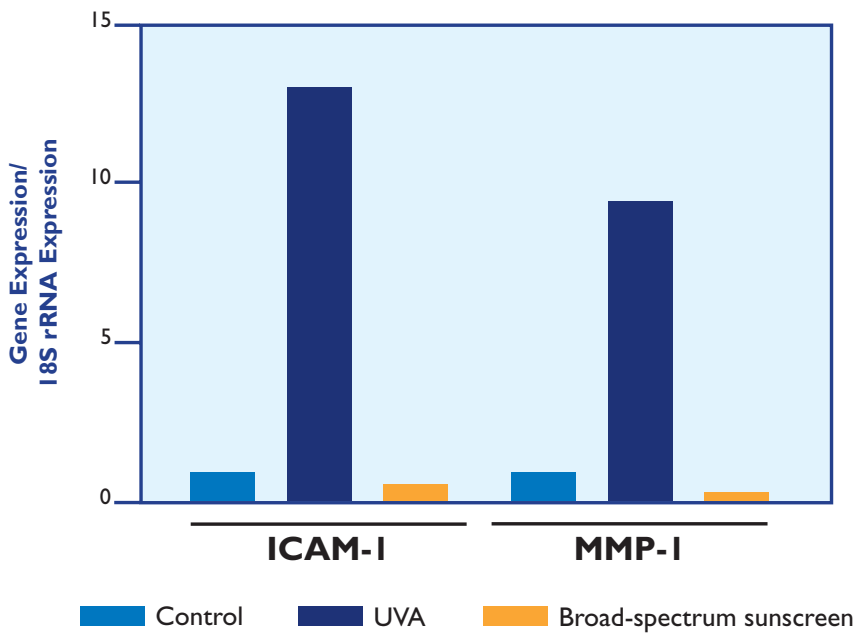
METHOD

Prior to start this study positive vote of local ethical committee at the Heinrich-Heine-University was obtained. After informed consent, a total of 10 human volunteers with healthy skin, no history of skin cancer, photodermatosis or recent (within the last 6 months) visits to a tanning salon were enrolled. In each individual, two areas of 4x4 cm were defined on the left and on the right buttock. Both sides were exposed to 100 J/cm^2 UV irradiation from a Sellas UVA-1 irradiation device. This dose was previously shown to induce MMP-1 and ICAM-1 expression. 20 min prior to irradiation (according to COLIPA) one test area was treated with 2 mg/cm^2 of broad-spectrum sunscreen (SPF 50$^+$, UVA-PF 28 determined by the persistent pigment darkening (PPD) method). The collateral test side was left untreated. 24 hours later, 4 mm punch biopsies were taken under local anesthesia from each side. Moreover an unirradiated control has been taken. Total RNA was isolated from these biopsies and MMP-1, ICAM-1 and 18S rRNA expression was assessed by Real time (RT) PCR. The PCR reactions were carried out on an Opticon 1 (MJ Research, Waltham, MA, USA) using SYBR Green® PCR Master Mix (Applied Biosystems, Darmstadt, Germany). For comparison or relative expression in real time PCR control cells and treated cells the $2^{(-\text{delta delta } C(T))}$ method was used according to Livak and Schmittgen (2001). Expression was normalized to expression of 18S rRNA as «housekeeping gene». Unstimulated controls were set equal to one. Results are given for each individual as fold increase versus an untreated control.

RESULTS

24 hours after exposure to 100 J/cm^2 of UVA-1 an increased expression of MMP-1 and ICAM-1 mRNA was noticed.

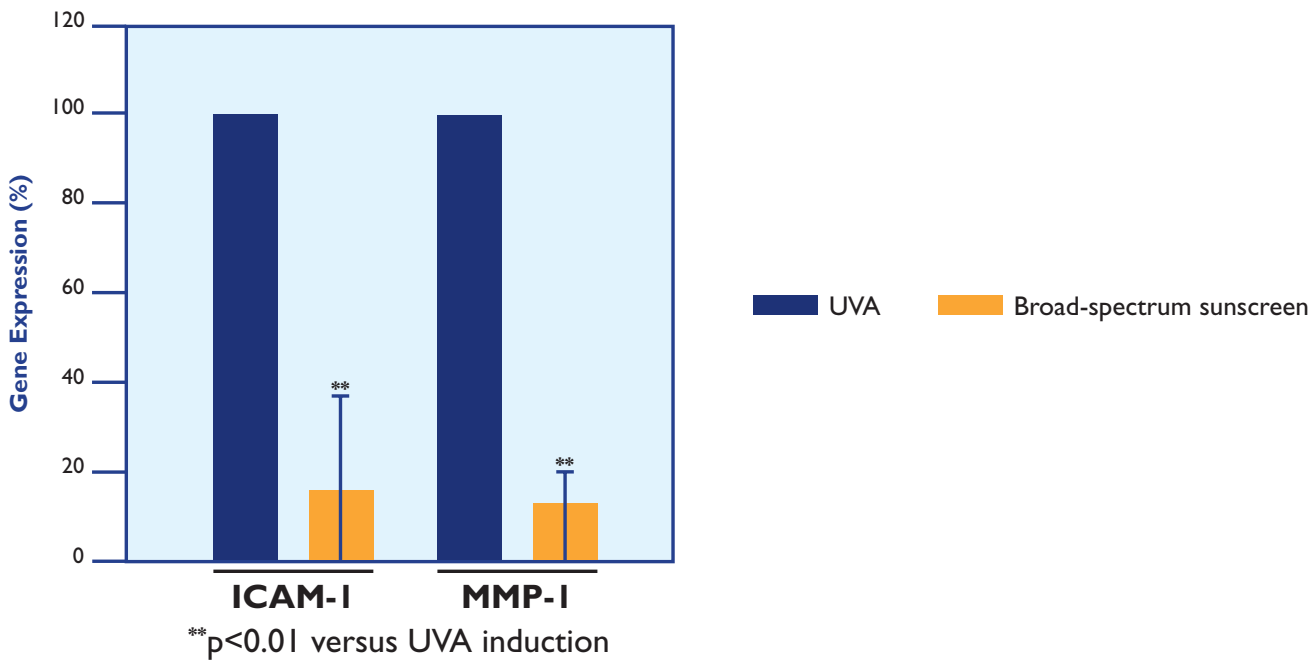
Semiquantitative RT-PCR for ICAM-1 and MMP-1 mRNA expression after UVA-1 exposure of subject n°1.



Relative expression of ICAM-1 and MMP-1 mRNA after UVA-1 exposure in all 10 subjects.

	ICAM-1		MMP-1	
Subject N°	UVA	Broad-spectrum sunscreen + UVA	UVA	Broad-spectrum sunscreen + UVA
1	12.6	0.6	9.5	0.4
2	1.7	1.0	2.0	1.0
3	2.8	0.6	4.5	0.9
4	2.3	1.2	2.8	1.5
5	3.5	1.3	6.0	1.3
6	0.9	0.1	68.0	0.2
7	3.3	2.0	14.4	4.0
8	0.9	0.1	68.0	0.2
9	2.1	1.2	34.3	7.4
10	5.4	2.9	4.6	1.0

The application of broad-spectrum sunscreen prior to UVA-1 exposure significantly prevented the UVA-1 induced increase in MMP-1 and ICAM-1 mRNA expression (paired student's t-test).



**p<0.01 versus UVA induction

CONCLUSION

This study clearly demonstrates the effective protection offered by a broad-spectrum sunscreen (SPF 50$^+$, PPD 28) in the prevention of UVA-1 radiation-induced photoaging (MMP-1 gene expression) and inflammation (ICAM-1 gene expression).

REFERENCE

Livak KJ, Schmittgen TD. Analysis of relative gene expression data using real-time quantitative PCR and the $2^{(-\text{delta delta } C(T))}$ Method. Methods; **25**: 402-8 (2001).

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