EVALUATION OF ANTIOXIDANT AND PHOTOPROTECTIVE ACTIVITY OF VEGETABLE OILS

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Introduction

The solar radiation emits electromagnetic radiation UVA (320-400 nm) and UVB (290-320) that cause several harmful effects. Among the main ones we can mention skin aging, skin cancer, and the generation of reactive oxygen species (ROS). One of the ways to protect yourself from such damage is to use sunscreen. Currently, it is desirable that formulations, in addition to having a photoprotective action, have antioxidant properties [1]. In this context, vegetable oils can be a strategy ingredient to offer antioxidant capacity, acting against oxidative stress and ROS, in addition to its possible contribution to the final sun protector factor (SPF) [2]. Therefore, the aim of this study was to investigate the photoprotective and antioxidant activity (AA) of grape seed oil (*Vitis vinifera*), sunflower oil (*Helianthus annus*), almond oil (*Oleum amygdalae)*, and coconut palm oil (*Elaeis guineenses*) generally used in cosmetics formulations.

Material and Methods

The vegetable oils studied were purchased commercially. The *in vitro* SPF of the vegetable oils studied was determined by the spectrophotometric method developed by Mansur et al [3]. A 10% of grape seed oil (GSO); sunflower oil (SO); almond oil (AO); coconut palm oil (CPO) and the UV filter octyl methoxycinnamate (OMC) solution were prepared, separately, using isopropyl alcohol. After, these solutions were diluted to 0.2 **µ**L/mL and subsequently scanned in the range of 200 to 400 nm in a UV/Vis spectrophotometer. The FPS was determined in triplicate and calculated according to the mathematical equation (1):

$$FPS = FC \sum_{290}^{320} EE(\lambda) I(\lambda)\, abs(\lambda) \qquad (1)$$

were, correction factor (FC) = 10, erythemogenic effect (EE) at wavelength (λ), solar intensity (I) at λ, spectrophotometric absorption (abs) of the solution at λ. The SPF value of the vegetable oils under study was obtained by the arithmetic mean of the triplicate of each oil. For data analysis, ANOVA followed by Tukey's post-hoc test was used to compare the SPF between the oils and UV filter. The AA was evaluated using the method Trolox Equivalent Antioxidant Capacity (TEAC) where the ability of the antioxidant substance to eliminate the 2,2'-azino-bis-(3-ethyl-benzothiazoline)-6-sulfonic (ABTS) chromophore radical by reducing its absorbance is estimated. 6-hydroxy-2,5,7,8-tetramethylchroman-2-carboxylic acid (Trolox) is used as a standard and its result is expressed in molar equivalents of that standard [4]. A solution of 7 mmoles/L ABTS with ethanol was prepared for this assay. A calibration curve was prepared with Trolox. Samples of each investigated oil were previously weighed and dissolved in 175 **µ**l of hexane. ABTS solution was added separately to the oil samples to react and subsequently, a kinetic reading was performed for 4 minutes at a wavelength of 734 nm. The final result was calculated with the aid of the Graphpad Pris 8.0 software using a formula (2):

$$TEAC\ (mmoles/Kg) = AUCsample - INTERCEPT\ Ycurve/SLOPEcurve \qquad (2)$$

where AUC corresponds to the area under the curve. *p-values* <0.05 were considered statistically significant.

Results and Discussion

The oils AO; SO; GSO and CPO showed respectively SPF ±SD of 0,550 ±0,030; 0,551 ±0,019; 0,543 ±0,017; 0,500 ±0,026. For the AA assay, the results found for GSO, AO, SO and CPO were 0,92±0,06; 0,98±0,04; 0,91±0,01 and 0,69±0,07 mmol TEAC/Kg respectively. In relation to the FPS, it was observed that the oils showed absorption in the UV region, however, they did not show, individually, significant SPF value. For comparative purposes the SPF of OMC was 15,972 ±0,815. Furthermore, they show no significant difference between the types of oils analyzed (*p*-value >0,999). Regarding AA, the quantitative comparison of the AA of vegetable oils through the TEAC assay with other research is limited due to the use of several tests, which differ in terms of the solvent used, endpoints of reaction, and ways of expressing the results. However, it is possible to rank the vegetable oils when using the same conditions of analysis, and according to Tukey's statistical test, GSO, SO and AO did not present significantly different AA, only CPO presented the lowest AA values among the oils studied.

Conclusion

The results found for the FPS of the vegetable oils corroborate the findings in the literature. Most vegetable oils alone have negligible SPF values, however, the use of vegetable oils in formulations can contribute by acting as an adjuvant with their antioxidant activity, a highly desirable characteristic for products intended for sun protection. The AA assay showed that GSO, SO, and AO have higher AA when compared to CPO oil.

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Bibliographic References

[1] Cerquerira-Coutinho, C. et al.: 'Development of a photoprotective and antioxidant nanoemulsion containing chitosan as an agent for improving skin retention', Eng. Life Sci., 2015, 15, (6), pp. 593-604.

[2] Badea, G., Lăcătuşu, I., Badea, N., et. al.: 'Use of various vegetable oils in designing photoprotective nanostructured formulations for UV protection and antioxidant activity', Ind. Crops. Prod., 2015, (67), pp 18-24.

[3] Mansur, J. S.; Breder, M. N. R.; Mansur, M. C. A. et al.: 'Determinação do fator de proteção solar por espectrofotometria'. An. Bras. Dermatol., 1986, 61, (3), pp. 121-24.

[4] Re, Roberta, et al.: 'Antioxidant activity applying an improved ABTS radical cation decolorization assay' Free Radic. Biol. Med., 1999, 26, (9-10), pp. 1231-1237.