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A REVIEW ON, "SUNSCREEN: USING NATURAL AGENTS"

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ABSTRACT

The exposure of skin to ultraviolet B (UVB) radiation has a destructive effect on keratinocytes by causing DNA damage that can subsequently lead to malignant transformation. Cellular defense mechanisms against this injury begin with the immediate UVB-induced death of damaged cells. In less severely affected cells, cell-cycle progression can be blocked and DNA damage can be repaired through nucleotide excision repair (NER). If repair is successful and cells have not suffered irreversible damage, they will survive. In the absence of appropriate repair, keratinocytes undergo apoptosis, producing characteristic „sunburn cells". Sunscreen is defined as substance that protects the skin from excessive exposure to the ultraviolet radiation of the sun. Sunscreen use is often proposed for sun protection because of their ability to block UV-induced sunburns (the sun protection factor –SPF). It helps to prevent sunburn and reduce the harmful effects of the sun such as premature skin aging and skin cancer. They are routinely tested in humans and can be assigned a sun protection factor (SPF) which reflects their ability to prevent sunburn. Sunscreens are found in cream, lotion, gel, stick, spray, and lip balm type"s forms. They are for external use only. An attempt has been made to review natural sunscreen agents.

KEYWORDS: Sunscreen, Polyphenols, SPF, sunburns.

INTRODUCTION

Sunscreen agents are used to prevent sunburn. Limiting the exposure to the sun and using sunscreen agents when in the sun may help prevent early wrinkling of the skin and skin cancer. There are two kinds of sunscreen agents: chemical and physical. Chemical sunscreen agents protect from the sun by absorbing the ultraviolet (UV) and visible sun rays, while physical sunscreen agents reflect, scatter, absorb, or block these rays. Sunscreen agents often

contain more than one ingredient. For example, products may contain one ingredient that provides protection against the ultraviolet A (UVA) sun rays and another ingredient that protects from the ultraviolet B (UVB) sun rays, which are more likely to cause sunburn than the UVA sun rays. Ideally, coverage should include protection against both UVA and UVB sun rays. The sun protection factor (SPF) that find on the label of these products tells the minimum amount of UVB sunlight that is needed with that product to produce redness on sunscreen-protected skin as compared with unprotected skin. Sunscreen products with high SPFs will provide more protection against the sun. The presented review article is concern with discussion on the sunscreen agents.[1] sunscreen(also commonly known as sunblock, sun tan lotion, sun screen, sunburn cream or block out) is a lotion, spray, gel or other topical product that absorbs or reflects some of the sun's ultraviolet (UV) radiation on the skin exposed to sunlight and thus helps protect against sunburn. Skin-lightening products have sunscreen to protect lightened skin because light skin is more susceptible to sun damage than darker skin. Depending on the mode of action sunscreens can be classified into physical sunscreens (i.e., those that reflect the sunlight) or chemical sunscreens (i.e., those that absorb the UV light). Sunscreens have traditionally been divided into chemical absorbers and physical blockers on the basis of their mechanism of action. Chemical sunscreens are generally aromatic compounds conjugated with a carbonyl group. These chemicals absorb high-intensity UV rays with excitation to a higher energy state.[2] The energy lost results in conversion of the remaining energy into longer lower energy wavelengths with return to ground state. Physical blockers reflect or scatter UVR. Recent research indicates that the newer microsized forms of physical blockers may also function in part by absorption. Sometimes referred to as nonchemical sunscreens, they may be more appropriately designated as inorganic particulate sunscreen ingredients. Allowable ingredients and maximum allowable concentrations, as listed in the FDA monograph, Sunscreen ingredients can also be classified by the portion of UVR that they effectively absorb. Encouraging photoprotection is the leading preventative health strategy used by physicians involved in skin care. Although sun avoidance is most desirable, outdoor occupations and lifestyles make total avoidance impossible for many individuals.[3] The regular use of sunscreens represents a practical compromise in this regard. Sunscreens prevent the formation of squamous cell carcinomas in animals. In humans, the regular use of sunscreens has been shown to reduce actinic keratoses, solar elastosis, and squamous cell carcinoma. The routine use of sunscreens may also reduce melanoma risk. Drug photosensitization and photo-induced or photo-

aggravated dermatoses may be prevented with sunscreen use, especially with products that offer better blockage in the UV-A range.[4]

PRECAUTIONS

Sunscreen products are available with and without doctor's prescription. If we using this medicine without a prescription, carefully should read and follow any precautions on the label. If rash or irritation develops, stop using the sunscreen and check with your doctor. Sunscreen agents containing aminobenzoic acid, lisadimate, padimate O, or roxadimate may discolor and stain light-colored fabrics yellow. In addition to using sunscreen agents, it is advisable to minimize exposure to the sun from 10 a.m. to 2 p.m. (11 a.m. to 3 p.m. daylight savings time) when the sun is at its strongest. Take extra precautions also on cloudy or overcast days and around reflective surfaces such as concrete, sand, snow, or water, since these surfaces can reflect the sun's damaging rays.[5] Wear protective clothing including a hat, long-sleeved shirt, and long pants. Sunglasses also should be worn to avoid sun damage to the eyes (cataract formation). Avoid sunlamps and tanning parlors because these can damage the skin and eyes as direct sunlight can. The following are skin types (complexions) and the appropriate sunscreen agent that should be used.

Very fair; always burns easily; rarely tans—Use SPF 20 to 30.

Fair; always burns easily; tans minimally—Use SPF 12 to 20.

Light; burns moderately; tans gradually (light brown)—Use SPF 8 to 12.

Medium; burns minimally; always tans well (moderate brown)—Use SPF 4 to 8.

Dark; rarely burns; tans profusely (dark brown)—Use SPF 2 to 4.

PROPER USE

Sunscreen agents are for external use only. These products usually come with patient directions. Carefull reading is needed before using any product. In choosing the sunscreen product, following point are considered for better effectiveness.[6]

1. Type of Activity—Take precautions when you are in places of higher elevations (mountains) or on reflective surfaces (concrete, sand, snow, or water), as these may increase the likelihood of sun damage to the skin. Use a sunscreen with ultraviolet A/ultraviolet B (UVA/UVB) coverage and with a sun protection factor (SPF) of 15 or higher. Activities that make you sweat, such as outdoor jobs (gardeners, construction workers), outdoor sports (tennis) or exercise, prolonged sunbathing, or water sports such as swimming, water-skiing, or wind surfing, may result in the removal of the sunscreen agent from the skin. Use a water-

resistant or waterproof sunscreen agent with SPF of 15 or more. When possible, also wear a hat, long-sleeved shirt, long pants, and UV-opaque sunglasses. Wearing UV-opaque sunglasses when you are in the sun is also necessary because the sun rays can cause cataracts.[7]

2. Age—Do not use sunscreen agents on infants younger than 6 months of age. For children 6 months of age and older, use a lotion form of sunscreen with broad spectrum and SPF of 15 or higher. Avoid using alcohol-based sunscreen products for this age group.[8]

3. Site of application—For the ear and nose, use a physical sunscreen agent. For the lips, use a gel-based lip sunscreen or lip balm.[9]

4. Skin condition—If your skin is dry, use a cream or lotion form of sunscreen agent. If your skin is oily, use an alcohol or gel-based sunscreen. Avoid using alcohol-based sunscreens on eczematous or inflamed skin.[10]

NATURAL AGENTS OF SUNSCREEN

ALOE VERA: The leaves of Aloe vera and A. barbadensisare the source of aloe vera gel. Aloe vera gel is widely used in cosmetics and toiletries for its moisturizing and revitalizingaction. It blocks both UVA and UVB rays and maintain skin‟s natural moisture balance. The enzyme bradykinase in aloes stops the sunburns and stimulate immune system intervention. Acemannan which is D-isomer mucopolysaccharides peeds up the repair phase and the increased production of fibroblasts and collagen. Aloe extracts and aloin from the plant have spectrophotometric peaks at about 297 nm and hence can act as a sunscreen for skin as well as hair.[4,5,6] The study was carried out to determine the photo protective activity of Aloe vera juice on Asian hair namely Black, grey which are chemically colored. Tryptophan content of hair treated with aloe vera juice before and after exposure to UV radiation. The tryptophan content measurements revealed that hair which was untreated and exposed showed higher degree of chemical damage while treated with Aloe vera juice offered protection from UV damage.[7]

Aloe Vera

Tomato: Tomato (Lycopersiconesculentum) fruit is the major source of lycopene and studied for its antioxidant activity incosmetic and pharmaceutical field. Tomato is rich in lycopene, a widely studied powerful antioxidant and anti-carcinogenic carotenoid with strong reducing ability. Lycopene is a carotenoid, which gives red color to the tomatoes. It is not merely a pigment but a powerful antioxidant, neutralizes free radicals especially those derived from oxygen, present under the lipid membrane and skin cover. Lycopene scavenges lipid radicals, reduces lipid peroxidation, and prevents erythema caused by UV radiation on the skin. Lycopene may reduce the damaging effect which UV light can have on the skin and can boost protection against both the short term (sunburn) and cumulative effects of sun exposure (cancer).[8,9,10]

Tomato

Almond: Almond is commercially known as almonds. Seeds are rich in polyphenolic compounds especially flavonoids and phenolic acids. The UVB protective property of this plant‟s skin extract was tested. The mice was exposed to UVB radiation and analyzed for changes in lipid peroxidation and glutathione levels. Topical application of formulated cream

to mice after irradiation and 2 hprior to irradiation showed the decreased levels of lipid peroxidation and increased levels of glutathione. The results showed that topical application of cream formulation has significant antioxidant and anti-photo aging properties.[22, 23, 24]

Almond

SHEA BUTTER: Shea Butter (Vitellariaparadoxa) is derived from the fat of the shea nut. The shea tree is native to the savannahs of Africa. Shea butter melts at body temperature and absorbs rapidly into the skin without leaving a greasy feeling. It contains the antioxidants, vitamins A and E both of which enhances skin cell regeneration and promote blood circulation below the skin‟s surface. Cinnamic acidin the oil provides vital protection against harmful UV rays.

Shea Butter

Carrot Seed Oil: Carrot (Daucuscarota) seed oil is an essential oil with significant antioxidant, antiseptic, antifungal and fragrant properties with high levels of vitamin A. When applied topically to the skin in the form of diluted carrier oil, carrot seed oil also provides natural sun protection. According to a study published in “Pharmacognosy Magazine” in 2009, products containing carrot seed oil have a natural SPF of 38 and 40.

Carrot Seed

MATERIAL AND METHOD

INGREDIENTS

- ½ cup almond or olive oil (can infuse with herbs first if desired)
- ¼ cup coconut oil
- ¼ cup beeswax pellets
- 2 TBSP zinc oxide
- 1 tsp red raspberry seed oil (or less, optional)
- 1 tsp carrot seed oil (or less, optional)
- 2 TBSP shea butter (optional)

PROCEDURE

1. Combine all the ingredients except zinc oxide in a pint-sized or larger glass jar.

2. Fill a medium saucepan with a couple inches of water and place on the stove over medium heat.

3. Put a lid loosely on the jar and place it in the pan with the water.

4. Shake or stir the jar occasionally to mix the ingredients as the melt.

5. When all the ingredients are completely melted, stir in the zinc oxide, and pour into whatever jar or tin you will use for storage.

EVALUATION

As in any other preparations, identification and quantitative determination of various ingredients are essential for evaluation and quality control point of view. Apart from these routine tests some special tests are also necessary for these types of products.

1. SPECTROPHOTOMETRIC EVALUATION: This is basically to evaluate the UV radiation absorption ability of the sunscreen compounds. Using a UV spectrophotometer and taking specific concentration of the substance on the preparation, molar extinction coefficient or absorbency can be determined and compared with any other standard substance.

2. ERYTHEMAL DOSAGE: It is important to estimate the erythemally effective radiation or E-vitons/cm², transmitted by a suntan preparation. The erythemal energy is the product of the solar energy transmitted through the film of suntan preparation and the effectiveness factor at that wavelength.

3. SUNSCREEN INDEX: This is evaluation of the relative screening activity of the sunscreen compounds. This is measurement of extinction % coefficient (El1 cm) at 308 mu wavelength and comparison with other. 308 mu is the peak wavelength for effective sunburn.

4. In-vivo skin testing: This is a direct test on animal skin, particularly rabbit, the site normally used is either backside or abdomen as these sites have maximum sensitivity. Preparations are applied on a specific site and exposed to radiation along with a control unprotected site, for a specific period of time. The effects are observed at the end of the period. Several factors or variables are to be taken care of during the test as they may influence the results. Such variables or factors are radiation source, size of the test field, etc.

SUMMERY AND CONCLUSION

Sunscreen is a lotion, spray, or gel that absorbs or reflects some of the sun's ultraviolet (UV) radiation, and helps protect against sunburn. Some cosmetic products also contain ingredients that may help to protect skin. All sunscreens are rated with a SPF (Sun Protection Factor) number. SPF tells how long you may be exposed to UVB light (NOT UVA light) before you burn. An SPF of 15 means that can be exposed to sunlight 15 times longer than unprotected skin before burning. They consist of a delivery vehicle containing one or more sunscreen active ingredients. When applied to the skin, these sunscreen actives intercept solar ultraviolet (UV) rays before they can damage the underlying skin. However, while conceptually simple, a detailed analysis reveals that sunscreen formulations are quite complex, requiring careful selection of sunscreen active and vehicle components to control multiple performance and in-use parameters.

REFERENCES

1. National Institute of Health: National Library of Medicine, 2006.
2. Paris C, Lhiaubet-Vallet V, Jimenez O, Trullas C, Miranda M (January/February 2009). "A Blocked Diketo Form of Avobenzone: Photostability, Photosensitizing Properties and Triplet Quenching by a Triazine-derived UVB-filter". Photochemistry and Photobiology, 85(1): 178–184.
3. Vielhaber G, Grether-Beck S, Koch O, Johncock W, Krutmann J (March 2006). "Sunscreens with an absorption maximum of > or =360 nm provide optimal protection against UVA1-induced expression of matrix metalloproteinase-1, interleukin-1, and interleukin-6 in human dermal fibroblasts". Photochem Photobiol Sci, 5(3): 275–82.
4. Osstervalder U, Luther H, Herzog B (2001). "Über den Lichtschutzfaktor hinaus - neue effiziente und photostabile UVA-Filter" (in German). Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz, 44(5): 463–70.
5. .Herzog, B.; Mongiat, S.; Deshayes, C.; Neuhaus, M.; Sommer, K.; Mantler, A. (2002). "In vivo and in vitro assessment of UVA protection by sunscreen formulations containing either butyl methoxy dibenzoyl methane, methylene bis-benzotriazolyl tetramethylbutylphenol, or microfine ZnO". International Journal of Cosmetic Science, 24(3): 170–85.
6. Mavon A, Miquel C, Lejeune O, Payre B, Moretto P (2007). "In vitro percutaneous absorption and in vivo stratum corneum distribution of an organic and a mineral sunscreen". Skin Pharmacol Physiol, 20(1): 10–20.
7. Ashby J, Tinwell H, Plautz J, Twomey K, Lefevre PA (December 2001). "Lack of binding to isolated estrogen or androgen receptors, and inactivity in the immature rat uterotrophic assay, of the ultraviolet sunscreen filters Tinosorb M-active and Tinosorb S". Regul Toxicol Pharmacol, 34(3): 287–91.
8. Deshpande, Sameer; Patil, Swanand; Kuchibhatla, Satyanarayana VNT; Seal, Sudipta (2005). "Size dependency variation in lattice parameter and valency states in nanocrystalline cerium oxide". Applied Physics Letters, 87(13): 133113.
9. Rao, G. N.; Janardhana, C.; Ramanathan, V.; Rajesh, T.; Kumar, P. H. (November 2006). "Photochemical Dimerization of Dibenzylideneacetone. A Convenient Exercise in [2+2] Cycloaddition Using Chemical Ionization Mass Spectrometry". J. Chem. Educ, 83(11): 1667.
10. Vielhaber G, Grether-Beck S, Koch O, Johncock W, Krutmann J (March 2006). "Sunscreens with an absorption maximum of > or =360 nm provide optimal protection

against UVA1-induced expression of matrix metalloproteinase-1, interleukin-1, and interleukin-6 in human dermal fibroblasts". Photochem Photobiol Sci, 5(3): 275–82.

11. Moyal D. (October 2004). "Prevention of ultraviolet-induced skin pigmentation". Photodermatol Photoimmunol Photomed, 20(5): 243–7.
12. Mueller SO, Kling M, Arifin Firzani P, et al. (April 2003). "Activation of estrogen receptor alpha and ERbeta by 4-methylbenzylidene-camphor in human and rat cells: comparison with phyto- and xenoestrogens". Toxicol. Lett, 142(1-2): 89–101.
13. Hanson Kerry M.; Gratton Enrico; Bardeen Christopher J. (2006). "Sunscreen enhancement of UV-induced reactive oxygen species in the skin". Free Radical Biology and Medicine, 41(8): 1205–1212.
14. Hayden, C. G. J.; Cross, S. E.; Anderson, C.; Saunders, N. A.; Roberts, M. S. (2005). "Sunscreen Penetration of Human Skin and Related Keratinocyte Toxicity after Topical Application". Skin Pharmacology and Physiology, 18(4): 170–174.
15. Castro G.T.; Blanco S.E.; Giordano O.S. (2000). "UV Spectral Properties of Benzophenone. Influence of Solvent and Substituents". Molecules, 5(3): 424.
16. Knowland, John; McKenzie, Edward A.; McHugh, Peter J.; Cridland, Nigel A. (1993). "Sunlight-induced mutagenicity of a common sunscreen ingredient.". FEBS Letters, 324(3): 309–313.
17. Knowland, John; McKenzie, Edward A.; McHugh, Peter J.; Cridland, Nigel A. (1993). "Sunlight-induced mutagenicity of a common sunscreen ingredient.". FEBS Letters, 324(3): 309–313.
18. Winkler, Jochen (2003). Titanium Dioxide. Hannover: Vincentz Network, 5.
19. Barton, D.H.R.; Nakanishi, K.; Meth-Cohn, O., eds, 1999.
20. M/389 EN Standardisation mandate assigned to CEN on methods for testing efficacy of sunscreen products, European Commission, July 2006; 1-78.
21. Commission Recommendation 2006/647/EC on the efficacy of sunscreen products and the claims made relating thereto, Official Journal of the European Union, L 265/39, p. 1-5
22. Council Directive 87/357/EEC of 25 June 1987 on the approximation of the laws of the Member States concerning products which, appearing to be other than they are, endanger the health or safety of consumers, Official Journal L 192, 11/07/1987 p. 0049 – 0050.
23. Communication from the Commission to the European Parliament and the Council on the animal testing and marketing ban and on the state of play in relation to alternative methods in the field of cosmetics, COM (2013) 135 final, p. 1-14.

24. International Cooperation on Cosmetics Regulation (ICCR), Outcomes of the Meeting Held, July 2012; 10-13,1-2.
25. Regulation Impact Statement - Australian and New Zealand Sunscreen Standard AS/NZS 2604: 2012, Therapeutic Goods Administration, OBPR Reference 13498, p. 1-25.
26. Australian regulatory guidelines for sunscreens, November 2012, Therapeutic Goods Administration, Version 1.0, p. 1-47.
27. Therapeutic Goods Advertising Code 2007, Federal Register of Legislative Instruments F2007L00576, p. 1-19.
28. Listed medicines application and submission user guide, TGA eBusiness Services, August 2013; p. 1-32.
29. Australian regulatory guidelines for over-the-counter medicine (ARGOM), Therapeutic Goods Administration, Version, Nov. 2012; 1.4: p. 1-40.
30. Therapeutic Goods Act 1989, Office of Parliamentary Counsel, Canberra, Dec. 2012, No. 180: p. 1-577.
31. Therapeutic Goods Order No. 69 – General requirements for labels of medicines, April 2009, Office of Legislative Drafting and Publishing, Attorney-General´s Department, Canberra, p. 1-31.