ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Sunscreens Containing Various Herbs For Protecting Skin From UV Sunray.

Zainab Tuama Al-Dallee, and Kawther T. Khalaf*.

Pharmacognosay Department, College of Pharmacy, University of Basra, Basra, Iraq, [2]Clinical laboratory science Department, College of Pharmacy, University of Basra, Basra, Iraq.

ABSTRACT

Overexposure to sun ultraviolet (UV) radiation is the main external cause of skin damage, and thus it is a factor in aging skin and increasing the risk of skin cancer, which speeds up skin aging and raises the risk of skin cancer. The students have tended to use sunscreens containing plant extracts as a substitute for sunscreen that contains organic compounds causing allergic. Plant-based sunscreens are used to protect skin cells and DNA damage from UV rays due to they contain antioxidant compounds that restricts free radical activity. In addition to their antioxidant properties, plant-products contain polyphenols like flavonoids and carotenoids. Therefore, the aim of the research is to present a review of the plant species generally applied in sunblock to save the skin from UV rays of the sunlight.

Keywords: Ultraviolet radiation, Skin damage, Natural sun blocker, DNA damages

https://doi.org/10.33887/rjpbcs/2021.12.2.4

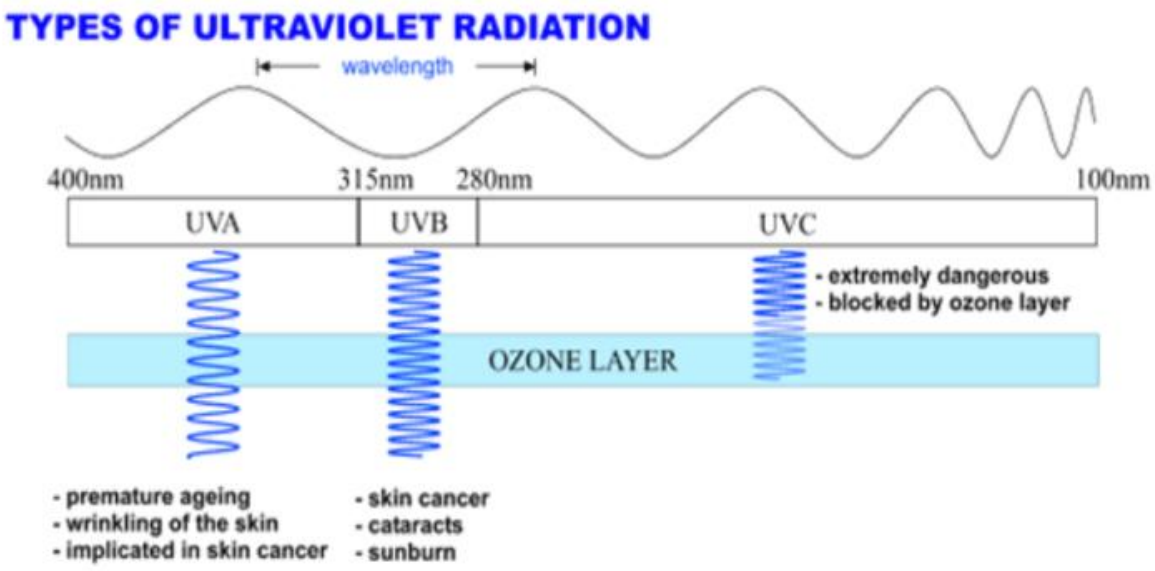
Corresponding author

ISSN: 0975-8585

INTRODUCTION

Herbs have been known since ancient times for their ability to treat, improve and decorate skin diseases, so they have been used in cosmetics [1]. Given the fact that ultraviolet (UV) radiation rays play a role in causing sunburn, wrinkles, premature aging, and reducing immunity to infection and cancer, there is constant need for UV protection and prevention of its side effects [2]. Antioxidants like vitamins (vitamin C and E), phenolic acids and flavonoids, play a major role in eliminating free radicals, which are the main reason of many negative skin changes [3]. Herbs contain a high content of antioxidant compounds, so herbal preparations have a high ability to protect the skin due to their activity as an antioxidant[4].

There are three forms of ultraviolet rays: ultraviolet A (UVA), ultraviolet B (UVB), and ultraviolet C (UVC). Depending on its wavelength, which is measured in nanometers (nm = 0.000000001 meters or 1 x 10-9 meters)[5]



Types of ultraviolet radiation (arpansa.gov.au)

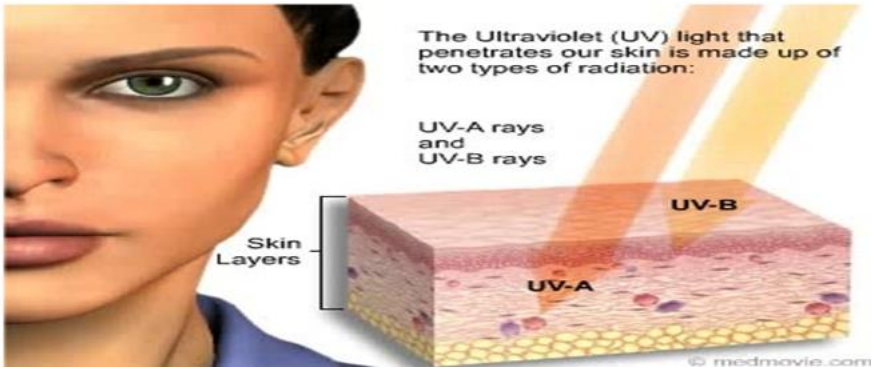
UVA Rays

Wavelength is higher than other types of ultraviolet rays, but with less energy[6], and thus its ability to penetrate the skin and its effect on deep cells is greater. It causes indirect DNA damage, premature skin aging, as it causes visual effects such as wrinkles, and its effect is associated with some skin cancers. Unlike other types of UV rays, about 95 percent of UVA reaches the ground and does not absorb by the ozone layer [7]. It causes an instant tanning effect and possibly sunburn. UVA rays are the main light used in tanning beds [8].

UVB RAYS

Wavelength is lower than UVA rays but higher energy levels [7]. UVB rays damage the outer layers of skin and directly destroy DNA and most skin cancers are caused by UVB rays, they can also lead to premature skin aging [9]. 5% of UVB rays reach the earth because it is partially absorbed by the ozone layer. Excessive exposure to UVB rays leads to sunburn. Usually, the effects of UV rays are delayed, or appear a few hours after sun exposure. Most tanning beds use a combination of UVA and UVB rays. UVB only tanning beds can be described as safe, but they still cause skin damage [10].

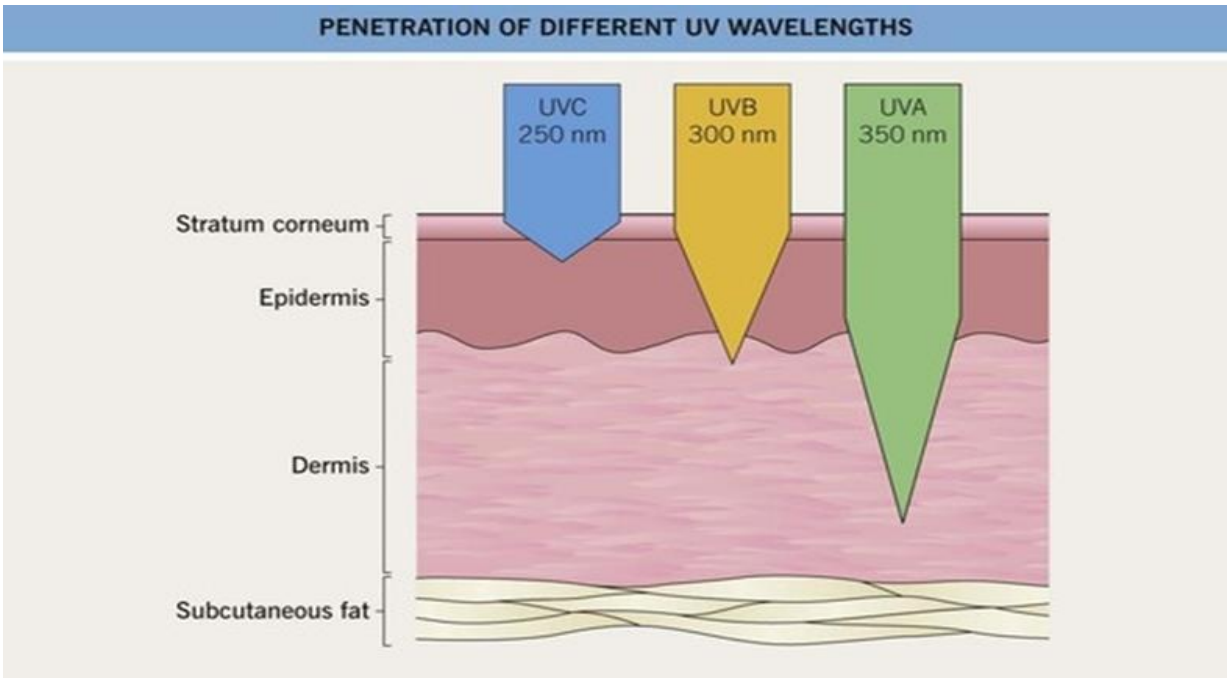
ISSN: 0975-8585



UVA and UVB Wavelengths Can Penetrate Skin and Cause Damage [11]

UVC rays

Have the shortest wavelengths and the highest energy levels of the three types of ultraviolet rays. Therefore, they have a damage effect on all life. UVC rays are completely absorbed by the ozone layer as a result, these rays never reach the ground, and are represented by human sources of ultraviolet rays, such as special lamps to kill bacteria, welding lamps and mercury lamps, and although they do not pose a risk of skin cancer, their danger lies in causing damage For eyes and skin[5]



Depth of penetration of different wavelengths of UV light into human skin (Bolgnia, Jorizzo and Rapini: Dermtext.com)

Mechanism of DNA damage by UV radiation

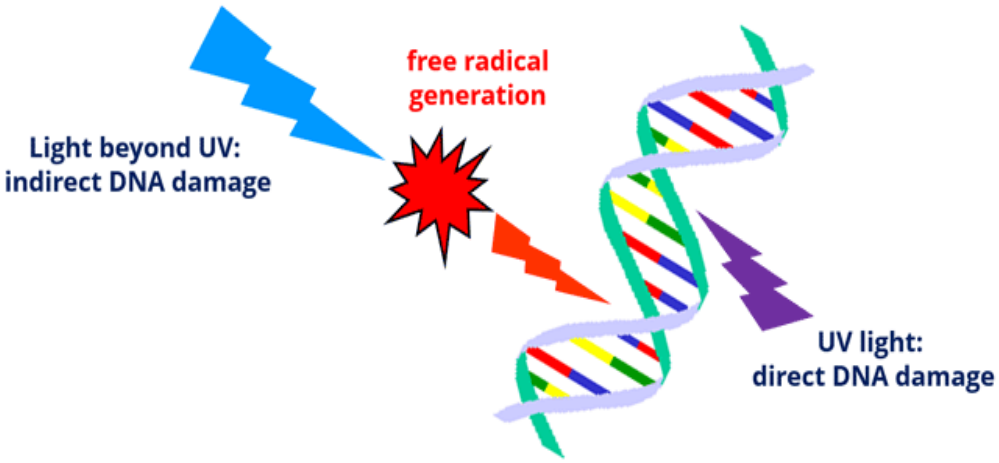
Direct DNA damage

When ultraviolet UVB rays penetrate the skin, these rays collide with a DNA strands, a change in the structure of the DNA occurs anywhere in the chain where two bases of thymine in a row are located. The capacity of the UVB light causes a change in thymine bond, which causes the neighboring thymine to sticky together. The resulting pair of thymine molecules attached to the dimer is called a dimer. Wherever these dimers are form, the strand of DNA is bent from its normal shape, and the cell cannot read it properly [12].

Up to 100 dimers can be created in the cell every second that it is exposed to UV rays in sunlight. If a cell accumulates too many diodes, the cell may die or develop cancer if these dimers accumulate inside the cell [13].

Indirect DNA damage

UVA rays are less dangerous than type B because they are not active enough to damage or alter the DNA directly. However, it may aid in the formation of harmful oxygen radicals. Which can directly attack DNA, adding to it by changing proteins and fats in such a way that they are harmful to DNA. This damage is thought to cause cancer. This type of damage is caused by ultraviolet rays (UVA) used in tanning beds and booths, so continuing exposure to this raises the risk of developing skin cancer [14].



Direct and indirect DNA damage [15]

Types of sunscreen products

Common sunscreens are two types which are chemical and physical sunscreens. Physical type form a layer on the skin that removes ultraviolet rays from the sun, while chemical type absorb the sun's rays and scatter the harsh UV rays [16].

Natural sun blockers

Proteins (peptide-bonds), absorbed nucleotides and lipids are all classified as natural sun blockers for the skin. The high concentration of plant peptides protect and squalene is also the most significant preventative lipid for the skin. Allantoin is a nucleotide found naturally in the body that can protect DNA from damage by absorbing the ultraviolet spectrum. Allantoin, extracted from the comfrey plant, protects the skin from oxygenated molecules often called "free radicals". It also helps catalyze the skin to reform and build itself naturally. The "antioxidant power" of plants and herbs makes it one of the main ingredients used in sunscreens and cosmetics [1

Plant types used in sunscreens

Calendula officinalis

Marigold flowers of *Calendula officinalis* contain flavonoid (Apigenin) , Research has confirmed that the presence of Apigenin is an effective ingredient in protecting the skin from cancer caused by UVA / UVB and demonstrated anti-inflammatory activity [18].

ISSN: 0975-8585

Calendula officinalis

Cosmetic and sunblock products : Life Basics

Silybum marianum

Milk thistle seed (*Silybum marianum*) is rich in flavonoids of the silymarin type [19]. Silymarin decreases the quantity of UVB radiation- stimulate DNA damage. Silymarin topically has been shown to be effective against neoplasms [20].

Silybum marianum

Cosmetic and sunblock products : BANOBAGI

Curcuma longa

Curcumin (diferuloyl methane) is an odorless, yellow pigment isolated from the turmeric rhizome. Curcumin has anti-inflammatory and anti-tumor efficacy as well as antioxidant activity. Prevents the activity of ornithine decarboxylase ornithine decarboxylase (ODC) induced by UVA rays and suppresses reactive oxygen species (ROS). Curcumin can stop the programmed changes induced by ultraviolet radiation in A431 human melanoma cells [21].

ISSN: 0975-8585

Curcuma longa

Cosmetic and sunblock products : VIVAIODAYS

Vitis vinifera

Grape seed, of *Vitis vinifera*, contains Proanthocyanidin (OPC). OPC that protects DNA from genetic mutations [22]. Also, OPC prevent elastase, thus preserving the safety of the elastin present in the skin and working Operate jointly with both Vitamin C and E, in protecting and regenerating the skin. Grape OPCs work in a way that aids in recycle an inactivate Vitamin E, converting it to the active form and therefore serving as a default extender of Vitamin E[23]. Proanthocyanidins (GSP) are powerful antioxidants and free radicals removers.

Vitis vinifera

Cosmetic and sun block products : pure shade

Polygonum cuspidatum

The roots of the herb *Polygonum cuspidatum* are one of the richest sources of resveratrol. Resveratrol is a fat-soluble compound belonging to a class of polyphenols. Resveratrol works as an anti-oxidant and an anti-mutagen. Studies

have confirmed that tumor induced by UV rays can be prevented with topical use of resveratrol[24].

ISSN: 0975-8585

Polygonum cuspidatum

Lotus Herbals Safe Sun – Sunblock Cream Breezy Berry

Dacus carota

Carrots are one of the most significant root plants rich in antioxidants. They contain-carotene, which protects the skin from ultraviolet rays [25]. Antioxidants neutralize free radical activity that occurs as a result of exposure to sunlight, so carrots are an essential ingredient in skin protection products [26].

Dacus carota

metic and sunblock products : Biotique

Fragaria ananassa

Strawberry fruits have been shown to be efficient in preserving the skin from damage caused by ultraviolet radiation and oxidative stress factors, thereby reducing DNA damage. This activity was explained by the presence of vitamins polyphenols like anthocyanins, phenolic acids, and flavonoids [27]

ISSN: 0975-8585

Fragaria ananassa

Lotus Herbals Sun Block Cream SPF 20 PA+

Solanum lycopersicum

Tomatoes contain lycopene carotene, which is one of the most powerful natural antioxidants, and it has an effective role in reducing DNA damage resulting from exposure to ultraviolet rays, and studies have shown that lycopene improves the skin and increase its ability to protect against harmful UV rays [28].

Solanum lycopersicum

Cosmetic and sunblock products : Tomato sun cream

Sambucus nigra

Sambucus nigra (elderberry) fruit is an antioxidant because it contains Cyanidin-3-O-sambubioside and cyanidin-3-O-glucoside [29]. Which protects the lipid materials in the membranes of cells from oxidation, in addition to protect the connective tissue from the enzymes that destroy them by neutralizing these enzymes, as well as repairing damaged proteins.[30]

Sambucus nigra

Cosmetic and sunblock products:SIMPLICITE

ISSN: 0975-8585

Ginkgo Biloba

Ginkgo biloba leave has medicinal importance because it contains the flavonoid quercetin, which is attributed to its medicinal importance. It has anti-free radical and anti-inflammatory properties, as well as stimulates blood circulation and rejuvenates the surface of the skin. Research has confirmed that it provides skin protection from UVA and UVB rays, and prevents peroxidation of particles produced by UVC and SPF rays, so quercetin is widely used as sunscreen agent [31].

Ginkgo Biloba

Cosmetic and sun block products : a*lba*

Camellia sinensis

Epigallocatechin-3-gallate (EGCG), the main ingredient of green tea is working well as an antioxidant, anti-inflammatory, and sunscreen. Topically, green tea provides a protective effect on the skin, protecting skin cells from sunburn, as well as protecting Langerhans-cells from UV damage, and reduces DNA damage that is formed after UV rays [32].

Camellia sinensis

Cosmetic and sun block products : Eco

Aloe vera

Studies have shown that Aloe vera or Aloe barbadensis is suitable for burns caused by radiation or by sunlight. This is for its calming and cooling effect. But studies confirm that its beneficial effect is by using it at a rate of 100%. The importance of aloe vera is that it contains poly-saccharides, mannose-6-phosphate, and complex anthraquinones. In addition to enzymes, salicylic acid, minerals, lignin, saponins, sterols, and vitamins [33]

ISSN: 0975-8585

Aloe vera

Cosmetic and sun block products : aloe vera

Helianthus annuus

Sunflower seeds oil helps protecting the skin from the harmful effect of sun's UV rays as well as other environmental stressors. The reason is the presence of Vitamin E, which effectively eliminates free radicals and thus prevents them from cell damage [34].

Helianthus annuus

Cosmetic and sunblock products : Innisfree

Triticum aestivum

Wheat germ oil contains large amounts of linoleic fatty acid (omega-6). In addition, it contains vitamins E, K and B, which have antioxidant efficacy, so it works to protect the skin from ultraviolet rays, in addition to moisturizing it [35].

ISSN: 0975-8585

Triticum aestivum

Cosmetic and sunblock products :GIVERNY

Krameria triandra

Krameria root extract has the ability to protect the skin's keratinocytes from UV damage. This is due to the presence of polyphenolic compounds (such as flavonoids and tannins) that have received special attention due to their ability to be absorbed in ultraviolet rays and its antioxidant activity .Therefore, it is used as a topical antioxidant that protects the skin from light damage [14].

Krameria triandra

Cosmetic and sunblock: LATANIA ATO

Persea americana

Avocado oil is one of the oils rich in vitamin E, in addition to potassium, lecithin and many other nutrients that nourish and moisturize the skin. Oleic acid, which supports collagen production in new skin cells, thus speeds up the healing process, from sunburn and protects the skin from UV damage [36].

ISSN: 0975-8585

Persea americana

Cosmetic and sunblock products :VAADI

Eucalyptus globulus

Eucalyptus leaves are an important source of antioxidants, especially flavonoids, which protect the body from free radicals. *Eucalyptus* leaves also contain essential oils that can keep the skin from the sun's radiation [37]

Eucalyptus globulus

Cosmetic and sunblock products: ART SHAVING

CONCLUSION

Herbal sunscreens are natural products that contain powerful ingredients to rejuvenate the skin and protect it from UV rays. Ultraviolet (UV) radiation rays play a role in causing sunburn, wrinkles, premature aging, and reducing immunity to infection and cancer Antioxidants like vitamins (vitamin C and E), flavonoids and phenolic acids play a major role in eliminating free radicals, which are the main reason of many negative skin changes. Hence, numerous studies are being conducted with the aim of developing new safe and effective natural formulated sunscreens.

REFERENCES

[1] Amaro-Ortiz A, Yan B, D'Orazio J A. Ultraviolet radiation, aging and the skin: prevention of damage by topical cAMP manipulation. Molecules. 2014;19: 6202-6219.

[2] Zduńska K, Dana A, Kolodziejczak A, Rotsztejn H.. Antioxidant properties of ferulic acid and its possible application. Skin Pharmacol Physiol. 2018; 31(6): 332-336.

[3] Manessis G, Kalogianni A I, Lazou T et al. Plant-Derived Natural Antioxidants in Meat and Meat Products. Antioxid. 2020; 9(12): 1215.

[4] Gulumian M, Yahaya E S, Steenkamp V. African herbal remedies with antioxidant activity: A potential resource base for wound treatment. Evidence-Based Complementary and Alternative Medicine. 2018: 2018.

[5] Nguyen L A. Protective Effects of Milk Phospholipids against UV-induced DNA Damage in Human Skin Cells. 2014.

[6] de Gruijl F and Leun J. Environment and health: 3. Ozone depletion and ultraviolet radiation. Cmaj. 2000; 163(7): 851-855.

[7] D'Orazio J, Jarrett S, Amaro-Ortiz A, Scott T. (2013). UV radiation and the skin. Int. J. Mol. Sci.2013; 14(6):12222-12248.

[8] Panich U, Sittithumcharee G, Rathviboon, N, Jirawatnotai S. Ultraviolet radiation-induced skin aging: the role of DNA damage and oxidative stress in epidermal stem cell damage mediated skin aging. Stem Cells Int. 2016;2016:7370642. doi: 10.1155/2016/7370642.

[9] Ravanat J L, Douki T, Cadet J. Direct and indirect effects of UV radiation on DNA and its components. J Photochem Photobiol B. 2001 Oct;63(1-3):88-102. doi: 10.1016/s1011-1344(01)00206-8

[10] Coussens A K . The role of UV radiation and vitamin D in the seasonality and outcomes of infectious disease. Photochem Photobiol Sci. 2017. 16;16(3):314-338. doi: 10.1039/c6pp00355a

[11] Administration, F. U. F. a. D. "Ultraviolet (UV) Radiation." Retrieved July 14th, 2014, from http://www.fda.gov/RadiationEmittingProducts/RadiationEmittingProductsandProcedures/Tanning/ucm116425.htm. 2014.

[12] Rastogi R P, Kumar A, Tyagi M B, Sinha R P. Molecular mechanisms of ultraviolet radiation-induced DNA damage and repair. J Nucleic Acids. 2010. 16;2010:592980. doi: 10.4061/2010/592980

[13] Brozyna A, Zbytek B, Granese J et al. Mechanism of UV-related carcinogenesis and its contribution to nevi/melanoma. Expert Rev Dermatol. 2007; 2(4): 451–469.

[14] Korać R R and Khambholja K M. (2011). Potential of herbs in skin protection from ultraviolet radiation. Pharmacogn Rev. 2011; 5(10):164-73. doi: 10.4103/0973-7847.91114.

[15] https://createsolveinnovate.com/protection-beyond-uv

[16] Gabros S and Zito P M. Sunscreens and Photoprotection. In StatPearls [Internet]. 2019

[17] Korać R R and Khambholja, K M. Potential of herbs in skin protection from ultraviolet radiation. Pharmacogn Rev. 2011 ;5(10):164-73. doi: 10.4103/0973-7847.91114

[18] Chinembiri T N, Du Plessis L H, Gerber M et al . Review of natural compounds for potential skin cancer treatment. Molecules.2014;19(8):11679-11721.doi: 10.3390/molecules190811679

[19] Bijak M Silybin, a major bioactive component of milk thistle (Silybum marianum L. Gaernt.)—Chemistry, bioavailability, and metabolism. Molecules. 2017; 22(11): 1942.

[20] Katiyar S K, Mantena S K, Meeran S M. Silymarin protects epidermal keratinocytes from ultraviolet radiation-induced apoptosis and DNA damage by nucleotide excision repair mechanism. PloS one.2011; 6(6): e21410.

[21] García-Bores A M and Avila J G. Natural products: Molecular mechanisms in the photochemoprevention of skin cancer. Rev Latinoamer Quím.2008; 36: 83-102.

[22] Belsito M D, Hill R A, Klaassen C D et al. (2012). Safety Assessment of Vitis Vinifera (Grape)-Derived Ingredients as Used in Cosmetics.2012.

[23] Murdock K A and Schauss A G. Jucara and Açai fruit-based dietary supplements. U.S. Patent No.2009; 7: 465.

[24] Narendhirakannan R T and Hannah M A C. Oxidative stress and skin cancer: an overview. Indian J Clin Biochem. 2013 ; 28(2): 110–115. doi: 10.1007/s12291-012-0278-8

[25] Ahmad T, Cawood M, Iqbal Q et al. (2019). Phytochemicals in Daucus carota and Their Health Benefits. Foods.2019; 8(9): 424.

[26] Fikselová M, Šilhár S, Mareček J, Frančáková H.. Extraction of carrot (*Daucus carota L.*) carotenes under different conditions. Czech J. Food Sci. 2008; 26(4): 268-274.

[27] Gasparrini M, Forbes-Hernandez TY, Afrin S et al. (2017). Strawberry-based cosmetic formulations protect human dermal fibroblasts against UVA-induced damage. Nutrients. 2017; 9(6): 605.
[28] Mishra A K, Mishra A, Chattopadhyay P. Herbal cosmeceuticals for photoprotection from ultraviolet B radiation: A review. Trop J Pharm Res. 2011; 10 (3): 351-360.
[29] Holst L, Havnen G C, Nordeng H. Echinacea and elderberry—should they be used against upper respiratory tract infections during pregnancy?. Front Pharmacol. 2014; 5: 31
[30] He Y, Hu Y, Jiang X, Chen T et al. Cyanidin-3-O-glucoside inhibits the UVB-induced ROS/COX-2 pathway in HaCaT cells. J. Photochem. Photobiol. B, Biol. 2017; 177: 24-31.
[31] Hibatallah J, Carduner C, Poelman M C. In-vivo and in-vitro assessment of the free-radical-scavenger activity of Ginkgo flavone glycosides at high concentration. J Pharm Pharmacol. 1999 ;51(12):1435-40. doi: 10.1211/0022357991777083
[32] OyetakinWhite P, Tribout H, Baron E. Protective mechanisms of green tea polyphenols in skin. Oxid Med Cell Longev. 2012; 2012: 560682. doi: 10.1155/2012/560682.
[33] Kumar M S, Datta P K, Gupta S D. In vitro evaluation of UV opacity potential of Aloe vera L. gel from different germplasms. J Nat Med. 2009 ;63(2):195-9. doi: 10.1007/s11418-008-0299-z. Epub 2008 Nov 27
[34] Tamara N, Angkasa C, Ginting C N et al. Determination Sunscreen Potential Based on Sunflower Seed Oil (Helianthus Annuus) in Cream Preparation With Combination of Oxybenzone and Octyl Methoxycinnamate by in Vitro Method. ASRJETS. 2019; 60(1): 33-39.
[35] Niu L Y, Jiang S T, Pan L J, Pang M. Characterization of wheat germ oil in terms of volatile compounds, lipid composition, thermal behavior, and structure. Int J Food Prop.2013;16(8): 1740-1749.
[36] https://www.purewow.com/beauty/avocado-oil-for-skin
[37] Vecchio M G, Loganes C, Minto C. Beneficial and healthy properties of Eucalyptus plants: A great potential use. Open Agr J.2016; 10(1): 52-57.