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Review

Consumer Behavior, Skin Phototype, Sunscreens, and Tools for Photoprotection: A Review

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Abstract: Sunscreens and photoprotection tools along with consumer habits and behaviors, can mitigate the skin damage caused by excessive solar radiation. For example, protecting oneself in the shade, avoiding inadequate sun exposure at times of higher incidence of UVB radiation (between 10:00 a.m. and 4:00 p.m.), wearing clothes with sun protection factors, applying sunscreens at the correct amounts and intervals, and wearing glasses with anti-UVA and UVB lenses are effective measures for protecting an individual. Therefore, the objective of this review was to highlight the importance of photoprotection for all skin phototypes, as skin cancer is a worldwide public health problem. In this review of the scientific literature on the Scopus platform between 2015 and 2022, we addressed the most common behaviors among different individuals and their phototypes, the importance of clarifying population habits against solar radiation, and the use of sunscreens and photoprotection tools to provide advice on healthy and safe sun exposure.

Keywords: solar radiation; photoaging; skin cancer; prevention; healthy habits

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1. Introduction

Excessive solar radiation without adequate skin protection, among several other factors, can aggravate skin aging, the formation of burns (erythema), and the development of different types of skin cancer. However, the use of effective sunscreens and different tools for photoprotection, in addition to healthy habits, can provide satisfactory results in the mitigation, prevention, and combating of these physiological changes observed in the skin. Notably, among these changes, skin cancer is a global public health problem [1,2].

The skin is the most extensive organ of the human body and is constantly exposed to solar radiation, regardless of aesthetic, professional, leisure, or daily habits [3]. However, the habit of exposing the whole body to the sun in order to tan has been adopted, as tanned skin is interpreted as a sign of beauty and health for many people, especially young women [4]. According to Baggerly et al., (2015), a portion of the population ignores the damage caused by inadequate sun exposure to the skin and body [5].

In fact, tanning, through melanin synthesis, is a natural response of the skin to the cumulative deleterious effects of ultraviolet radiation (UVR). The immediate response to UVR boils down to inflammation and tanning, while prolonged exposure leads to photoaging, which is characterized by premature skin ageing, the appearance of wrinkles, skin dryness, sagging, lines of expression and the formation of spots. In addition, photocarcinogenesis, which is another of the consequences of excess UV radiation on human skin, directly induces changes in DNA, which causes mutations and leads to cancer [6]. In this review of the scientific literature on the Scopus platform between 2015 and 2022 approached the most common behaviors among different individuals and their phototypes, the importance of educating the population about habits of using sunscreens, photoprotection tools, and advice on how to allow healthy and safe sun exposure.

2. Sunscreens and Photoprotection Tools

2.1. Solar Radiation and Ultraviolet Index

Solar radiation, especially UVR, is recognized as the main physical exogenous source responsible for the increasing incidence of skin cancer worldwide [7]. However, UV rays are responsible for some beneficial effects, such as the synthesis of vitamin D3 (cholecalciferol), fungicidal and bactericidal activity, and a feeling of well-being. The harmful effects on individuals, in short and medium terms, include water loss and dryness of the skin, causing an opaque aspect, loss of elasticity and collagen, edema, scaling, spots, and sunburns of different degrees. Chronic solar exposure of the skin to UVR leads to a variety of adverse effects, such as decreased immunity [8], wrinkling, basal cell and squamous cell carcinoma, malignant melanoma, elastosis, and irregular pigmentation, which culminate in photoaging. In the search for solutions, the scientific community has expanded the research and development into the production of sunscreens with broad-spectrum protection against solar radiation [9].

The radiation emitted by the sun is non-ionizing radiation, which can be defined as UVR at a wavelength (λ) (100–400 nm), VL (400–750 nm) and infrared radiation (IRR) (750–2000 nm). UVRs are subdivided into UVA (320–400 nm), which is responsible for the induction of free radicals and premature skin ageing; UVB (280–315 nm), which is responsible for sunburn and is also known as erythematogenous radiation; and UVC (100–280 nm), which directly affects cellular DNA. Indeed, the ozone layer depletion, the protective filter of planet Earth, has been affected, and solar radiation now reaches the earth's surface with greater intensity [10]. According to the information on the National Center for Environmental Health website, most evidence now suggests that the main cause of the rising cancer rates is altered behavior, not ozone depletion. More outdoor activities and exaggerated sunbathing habits often result in excessive exposure to UV rays. Greater awareness and lifestyle changes are urgently needed to change the current trends [11].

The World Health Organization (WHO), in collaboration with the United Nations Environment Programme (UNEP), World Meteorological Organization (WMO), and International Commission on Non-Ionizing Radiation Protection (ICNIRP), developed a joint project to protect the public from the harmful effects of UVR [7]. The proposal was to associate a scale, called the ultraviolet index (UVI), that describes the levels of UVR associated with certain biological effects in humans (Figure 1). This decision was based on the fact that 90% of non-melanoma skin cancer occurrences arise in skin types I and II. Furthermore, by protecting these groups, other skin phototypes would also be protected.

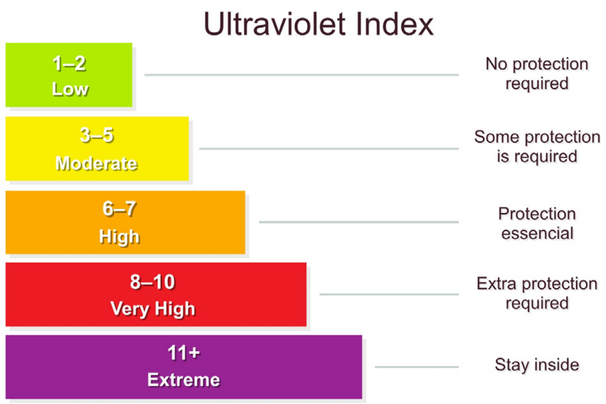

Figure 1. UVI intensity and photoprotection guidelines [12].

UVI is an important parameter that can increase the level of public awareness against the risks of excessive UVR exposure and alert people to the need for preventive and remedial measures. The UVI is a measure of the intensity of solar UVR incident on the Earth's surface. The higher the UVI, the greater the risk of damage and the onset of skin cancer. This index can be checked daily as a part of the weather forecast around the world.

The elements of the UVI are the season, time of day, ozone layer, clouds and haze, altitude (in general, for every 1000 m increase in altitude, the UVR flux increases by approximately 10%), latitude, pollution, and the reflection from surfaces such as sand and snow [13]. UVI can and should be used as an important tool in combating the damage caused by inadequate sun exposure, especially against skin cancer.

2.2. Skin Cancer, Photoaging, the Importance of Sunscreen Use, and Tools for Photoprotection

To better understand the relevance of skin cancer worldwide, 1.20 million (non-melanoma) and 325,000 (melanomas) new patients were registered in 2020 [14]. In Brazil, melanoma corresponded to approximately 30% of all cancers diagnosed in humans, and each year, the National Cancer Institute (INCA) registers approximately 185.000 new patients with non-melanoma skin cancers. Among the external physical causes, the main one is excessive exposure to the sun without protection. The early detection of skin cancer is key to therapeutic success, and the earlier it is detected, the better the treatment effectiveness [15]. The Brazilian Society of Dermatology (SBD) organizes the December Orange campaign annually, which promotes awareness about the risks of skin cancer and guides the population to maintain proper sun protection habits and to regularly visit a dermatologist for a specialized evaluation. In 2022, the campaign message was “do not wait until you feel it on your skin,” and the focus was to warn the public about the need for permanent prevention care, in addition to the services offered to the population. SBD has expanded its presence in social networks and the press to provide diverse content (posts, informative videos, interviews, testimonials, among others) on how to adequately protect oneself against sun exposure, whether during leisure time or in daily work activities [16].

Addor et al. [17] described that to obtain adequate sun protection, within the technical parameters, the dermatologist should indicate a product of assured quality to the patients, as sunscreens are a fundamental part of the prevention of damage caused by solar radiation. Photoaging is a cumulative process that depends on various factors and varies from individual to individual. Sunburn and tanning are visible responses in the skin after hours and days of sun exposure, respectively. The thickening of the stratum corneum, definitive changes in the amount and distribution of melanin, and other chronic effects occur after prolonged and recurrent sun exposure. Understanding these factors has become a major challenge in the development of sunscreens. When evaluating a sunscreen, its organoleptic aspects (sensory, visual, and olfactory) should be considered, as well as the vehicle, composition of the preparation, toxicity, environmental risks, photostability, and protection spectrum. Notably, by having technical knowledge about these characteristics of the products, dermatologists can help patients identify the best sunscreens to be applied in specific situations.

2.3. Sunscreens

At present, the Euromonitor’s forecast is that sales will reach $4.78 billion in 2023, with an average annual growth of more than 6%. In a recent literature review, Ma and Yoo [18] indicated that the global sunscreen market will reach approximately $24.4 billion by 2029, which demonstrates the growing awareness of the harmful effects of sunlight.

Sunscreens have crossed traditional boundaries of literal use; that is, they are present in countless cosmetic products. Previously, sunscreens were restricted to synthetic sunscreens for the protection of the skin before sun exposure; in contrast, at present, sunscreens are present in different products for daily use, including personal skin and hair care products. Recently, Stiefel and Schwack [19] highlighted that sunscreens with a higher sun protection factor (SPF) could offer better protection capacity; on the other hand, they would also encourage the user to spend more time in the sun.

The global sunscreens of the XXI century protect the skin and its annexes over time, in addition to preventing burns, redness, and immediate discomfort after excess UVB solar exposure. In a recent review, Shaath [20] described the worldwide regulatory status of the 55 approved UV filters. Ultraviolet filters can be classified into UV absorbers and inorganic particulates. Zinc oxide and titanium dioxide inorganic particulate filters are considered to be the broad spectrum. The remaining UV absorbing molecules are classified as UVB or UVA filters, or both. These can be classified as derivatives of the following classes of compounds: PABA and p-aminobenzoates, salicylates, cinnamates, benzophenones, dibenzoyl methane, camphor derivatives, and Dalton 500 molecules. UVR interacts with the sunscreens that have absorbed or scattered its electromagnetic energy, the harmful rays are reflected by the inorganic particulate filters. Some sunscreens can cause chemically induced photosensitive reactions, making the individual more sensitive to solar radiation and to the filter itself. There are several specific skin diseases that are triggered by UVR, and each individual will respond differently to the substances contained in the preparations and their respectives quantities. Despite being one of the oldest sunscreens, PABA has many drawbacks. A segment of the population exhibits photosensitivity to this compound. As a result, the photoprotective preparation must be chosen carefully for each individual [20].

Bacqueville et al. [21] developed a dermocosmetic product using an innovative sunscreen with unique optical properties: phenylene bis diphenyltriazine (TriAsorB^{TM}) provided photoprotection against solar radiation with wavelengths ranging between UV and VL. Some ingredients are multifunctional; for example, the same component has different bioactive functions, such as antioxidant, emollient and photoprotective activity. Currently, the following ingredients are frequently present in photoprotective products: sun filters with a broad spectrum, botanical actives, antioxidants, and other natural ingredients [22]. These ingredients from renewable sources become relevant for researchers involved in the development of new sunscreens to identify a possible innovation [23].

For a while, inorganic particulate filters were forgotten as a result of their undesirable strong skin-whitening effect, unpleasant texture, and stained clothes. Nanotechnology emerged and some of these problems were solved. The application of nanostructured systems in topical preparations offers the following advantages: the controlled release of actives on the skin, the modulation of SPF, stability enhancement, and a reduction in systemic absorption and adverse reactions, such as irritation dermal. In addition, in the case of inorganic filters such as titanium dioxide and zinc oxide, nanostructures offer a better sensory and colorless texture, which makes it more pleasant for the user compared to traditional preparations [24].

In a recent review of the literature, Surber and Osterwalder [25] addressed the controversial issues regarding sunscreens, including: the measurement of SPF, efficacy and safety, regulations of sunscreens and nanostructured presentations, daily application, consumer desire to tan, and the benefits and risks of UVR. Throughout the twentieth century, in different regions of the world, the authors described a brief history of the emergence, development, and incorporation of different substances into a wide variety of sunscreen preparations. The classification of sunscreens as preventives for skin cancer (topical medication) or maintainers of good skin health (cosmetics) was also discussed. In Europe, sunscreens are classified as cosmetics; however, dermatologists and regulatory authorities recommend their use for the prevention of skin cancer. The European Union currently maintains a list of 27 sunscreens that are regulated and used as ingredients [18]. Over the years, the perception of sunscreens has gradually changed. Initially, the function was to prevent solar erythema (tanning without burning). Later, the prevention of skin cancer was added and, recently, sunscreen preparations have a multifunctional role, are being increasingly advertised, and perceived as beauty and lifestyle products.

2.4. Sustainable Sunscreens: Eco-Friendly and Not Tested on Animals

The spectrum UV, VL and IRR affect biological systems. The most studied sunscreens are those against the adverse effects of UVR; however, with the discovery of the harmful effects on coral reefs and the endocrinological effects on mammals, new sunscreens have been developed [26,27]. Concerns regarding environmental preservation and animal care have impacted the cosmetics sector, which has resulted in the worldwide trend of sustainable products that are ecologically correct and free of animal cruelty. Many sunscreens available in the market are not aligned with the Sustainable Development Goals (SDGs) of the United Nations (UN) [28]. Synthetic substances are used as sunscreens that have been withdrawn from the market for their proven toxicity and pose a real danger to the health of its users. In the 1960s, dermatologists began treating patients who were allergic to PABA, which proved to be photolabile; this led to its withdrawal from the market and, at the same time, the current labeling of many sunscreens as "PABA-free" [18]. Wang et al. [29] demonstrated that the different sunscreens tested offered adequate UVA protection according to US Food and Drug Administration guidelines for broad-spectrum status, but nearly half of the sunscreens tested did not pass the established standards in the European Union. This is inappropriate in terms of effectiveness and safety for the user. Additionally, cinoxate is no longer used to protect against UVB radiation, and due to the high levels of oxybenzone found in breast milk, in tumors, and the bleaching of coral reefs, these two filters have been banned in the United States of America (USA) state of Hawaii. Many preparations on the market are labeled oxybenzone, octinoxate, and avobenzone free [30,31]. In addition to polluting the environment, chemicals in rivers and oceans and the trophic chain in marine environments can act as endocrine disruptors according to the Environmental Protection Agency (EPA) of the USA [32]. Scientific studies have linked various synthetic filters to problems with coral reproduction and bleaching, which weaken them and, over time, lead to their death. These synthetic filters are released from the skin as people dive, swim, and surf in the sea [27]. Owing to these issues, European legislation recommends toxicity testing for substances that are poorly soluble and poorly degradable in water. In addition to being ecologically friendly, consumers seek sunscreens that are not tested on animals. Since 2013, such appeals have led to a ban on the use of animals for safety testing in cosmetics [33]. In general, consumer preference for sustainable and animal cruelty-free products directs the cosmetic industry to develop sunscreens that are effective and safe for humans but, most importantly, environmentally friendly [34].

2.5. Effectiveness of Sunscreen Products

Before reaching the market, cosmetic products must undergo risk assessment and safety tests to ensure that they are healthy for the general population and guarantee that the substances are not caustic or irritating [35]. Therefore, it is important to evaluate the risks involved in the development of sunscreens to ensure the safe use of these products. Toxicological testing is used to develop cosmetic products safely. For sunscreens, phototoxicity tests of the substances present in the formulation are indispensable. Determining the efficacy and safety of sunscreens is fundamental to understanding the risks that some substances can cause for individual and environmental safety.

The efficacy of sunscreen is the quality or property that produces a greater or lesser photoprotective effect in relation to the formation of erythema. Moreover, its efficacy depends on its incorporation into appropriate vehicles, as their hydrophilic, lipophilic, emollient, pH, and stability properties at elevated temperatures influence the SPF. Several standardized methods are available for determining the SPF of a product against UVR. The ISO 24444:2019 SPF measurement method is considered the gold standard, although it is complex, time-consuming, and expensive. The classic division of SPF measurement is based on methods such as in vivo, in vitro and in silico; in addition to the UVR load to which the skin is exposed. The ISO/AWI 23675 Cosmetics method, approved by Cosmetics Europe (CE), compares in vivo results with in vitro results. The "Fused method" is an unofficial name for a combination of different in vitro transmittance methods. The in silico methods, the most popular for generating realistic results, include the Sunscreen Simulator (BASF) and the Sunscreen Optimizer (DSM). The Hybrid Diffuse Reflectance Spectroscopy (HDRS or H-DRS) is based on non-invasive diffuse reflectance spectroscopy (DRS); in this case, UVA protection is directly evaluated in vivo using in vitro data, this hybrid method is also called UVA measurement sunscreen efficacy by diffuse reflectance spectroscopy, or ISO/AWT 23698 [36]. SPF evaluation uses the erythematous response of the skin formed by the exposure to UVB radiation, the intensity of which is proportional to the dose received [37]. According the position statement by Krutmann et al., (2020), there are three important points to be considered when measuring the SPF of a photoprotective preparation, such as: SPF determination methodologies should evolve to predict sunscreen efficacy in real life conditions in a more reliable manner; for SPF determination alternative endpoints, other than erythema, reflecting both acute and chronic damage should be considered; and photoprotection needs to include protection against wavelengths beyond UV [38].

Surber et al. [25] warned that the measurement and quantification of sunscreen performance has been the subject of constant effort from the beginning of their research to product development. There is a justifiable need to explore the potential of alternative methods to complement the existing methods and to serve as equivalents or even replace them in the future. The suitability of alternative methods and their possible equivalence to the reference methods were proposed by the authors [39].

3. Skin Phototypes

The Skin and Its Phototypes

The skin consists of three layers of tissue: the epidermis, dermis, and hypodermis. The epidermis consists of a group of living cells called the viable epidermis and a group of dead cells that form the stratum corneum (SC). The main function performed by the SC is to ensure cutaneous homeostasis and provide a protective barrier for the organism [40]. Melanin synthesis occurs in the epidermis, and this pigment acts as an intrinsic solar filter and is responsible for the coloration of the skin and its annexes [41].

Thomas B. Fitzpatrick, an American dermatologist and professor at Harvard Medical School, classified skin phototypes between I and VI based on the amount and type of melanin produced in the body. Fitzpatrick's classification, the most widely accepted method for determining skin phototypes, continues to be used as an international reference [42]. The coloration of human skin phototypes varies according to the proportion and type of epidermal melanin and is classified into two types: pheomelanin and eumelanin. People with lighter skin tones tend to possess a greater amount of pheomelanin, while people with darker skin tones tend to possess predominantly eumelanin. The types of melanin differ from each other in several factors, including their ability to act as an intrinsic filter against UVR. In general, eumelanin performs better in this function, absorbing 50–75% of UVR, in addition to eliminating the free radicals formed in the skin. On the other hand, pheomelanin does not act as effectively against UVR and may be an endogenous photosensitizer [43]. The main function performed by the SC is to ensure cutaneous homeostasis and provide a protective barrier for the organism [40].

The human skin reacts in different ways to UVR according to the Fitzpatrick classification (Table 1). Some skin phototypes, typically III, IV, V, and VI, tend to tan more easily, whereas other skin phototypes, such as I and II, fail to tan, regardless of the duration of sun exposure. According to Lim et al. [44], following Fitzpatrick's classification of phototypes, the authors highlighted that visible light (VL) causes burning (erythema) in light-skinned people and induces pigmentary changes in dark-skinned individuals, being an important factor in triggering dermatological diseases. Such events can be explained by the predominant type of melanin in each skin phototype. For example, pheomelanin, a less effective intrinsic UV filter, does not eliminate the reactive oxygen species (ROS) formed during sun exposure, which, in turn, cause epidermal damage, leading to redness and burns. In addition, ROS generation can damage DNA, culminating in long-term carcinogenesis [45].

Table 1. Classification and characteristics of each skin phototype [46,47].

Skin Phototype	Skin Color	Tanning Skill	Erythema and Skin Cancer Susceptibility	Photoaging Characteristics
I		Very low	High	Depigmentation, freckles, lentigo maligna, melanoma, actinic keratosis
II		Low	High	
III		Good	Moderate	Hyperplasia, chronic tanning, solar lentigo, skin thickening, deep wrinkles
IV		Very good	Low	
V		Very good	Very Low	Secondary changes in the elastin and collagen fibers, deficient skeletal support
VI		Very good	Extremely low	

4. Ethnicity and Sunscreen Habits

Despite the geographical, economic, and socio-cultural aspects, people of different ethnicities are subject to the effects of UVR exposure and respond in an individual way, regardless of their skin phototype. However, each person has photoprotection needs that require specific attention from dermatologists [48]. For example, even today, there are individuals of African descent with phototypes IV, V, and VI who are unaware of the need to use sunscreens because they do not feel the negative effects of UVR [49]. Part of this belief may be associated with a reduced susceptibility to erythema and skin cancer, as seen in Table 1, and explained by the intrinsic SPF of darker skin, which resembles SPF 15 sunscreens [50,51]. However, the skin of colored populations also experiences photoaging, pigmentary disorders, and skin cancer, and their diagnoses tend to occur late and at an advanced stage, with a more severe prognosis [52].

Other ethnic groups require special attention regarding photoprotection and exposure to UVR. After researchers investigated the prevalence of sunscreen use among different racial and ethnic groups, it was observed that the sunscreen habits of Asian descendants have been inadequately explored. Understanding how Asians behave during sun exposure is essential, because while part of the Asian population uses cosmetics that reduce melanogenesis in order to obtain lighter skin tones, another part of the population suffers from late diagnoses of skin cancer [53,54]. Furthermore, Roren et al. [55] indicated that Asian countries neglect to raise awareness of the harmful effects of UVR, resulting in an information-deprived population with imminent health risks. Therefore, a survey was conducted to verify the prevalence of sunscreen use in this population, and it was identified that educational background, income, and sex were directly related to the habit of using sunscreen. Moreover, the variation in skin coloration in Asians is diverse, with skin phototypes I to VI; therefore, dermatologists should consider this variation for the correct orientation of sunscreen users [48]. However, regardless of ethnicity or skin phototype, the use of water-resistant, broad-spectrum sunscreen with SPF $\geq$ 30 is recommended, as well as the use of hats, clothing, and sunglasses with sun protection [56].

Albinism is a genetic condition characterized by a melanin production deficiency, making skin, hair, and retina discolored [57]. For this reason, people with albinism need special attention during sun exposure as they do not have the sun protection factor that melanin naturally provides and, consequently, are more exposed to the damage that UVR can cause to the skin [58]. In a cross-sectional study carried out with patients with oculocutaneous albinism, it was observed that people with albinism may develop non-melanoma skin cancer at an early stage when compared to non-albino people [59]. Thus, these people need adequate guidance to protect themselves during sun exposure, for example, creating the habit of wearing clothes with higher SPF, using broad-spectrum sunscreens and reapplying them regularly can significantly contribute to preventing the development of skin cancer and other damages [60].

5. Photoprotection in Specific Populations

The adoption of the appropriate measures against sun exposure should start at the earliest age to allow individuals to develop good habits early in life and maintain them throughout life. The photoprotection of infants and children, especially those up to three years old, requires extra care because their skin has a thinner epidermis and stratum corneum, and UVR penetrates more deeply, causing photodamage and immunosuppression, regardless of skin phototype [50]. Due to the characteristics of the skin of children, dermatologists suggest that photoprotectors containing inorganic particulate filters, such as zinc oxide and titanium dioxide, be used as other photoprotectors may contain sunscreens considered allergens [61]. In addition, the exposure of children and infants to radiation may be a risk factor for the development of skin cancer in the long term. A meta-analysis of 51 studies have pointed out a correlation between burns caused by UVR exposure during childhood and a doubled risk of developing skin cancer in adulthood [50,62]. For infants up to six months of age, direct exposure to sunlight should be avoided and no sunscreen should be applied. Above six months of age, it is recommended to limit the exposure from 10 am to 4 pm, keep them in the shade, and make them wear glasses, clothes with anti-UV protection that cover the whole body, and wide-brimmed hats that protect the face, ears, and neck. Broad-spectrum sunscreen with SPF 15 or higher should be applied before sun exposure and reapplied every two hours, as well as when sweating or leaving the water [63].

Sun exposure precautions are necessary during other phases of human life, such as pregnancy. During this period, the woman's body, including the skin, undergoes several changes. Skin changes occur mainly due to an increase in hormones, resulting in increased skin sensitivity, worsening of pre-existing conditions, and the emergence of new dermatoses, such as melasma and hyperpigmentation [64]. Sun exposure should be carefully monitored, and sunscreen use is essential to protect the skin during this phase. However, dermatologists should be consulted for the choice of the most adequate sunscreen, as clinical research has shown that certain synthetic sunscreens can pose risks to pregnant women and fetuses. Researchers have investigated the maternal-fetal transfer of synthetic filters, such as benzophenone, and it has been observed that benzophenone-3 (BZ-3) crosses the human placental barrier and may affect fetal growth through transient changes in the hemodynamic parameters of the maternal uterine artery [65]. Thus, the use of sunscreens during pregnancy is essential for skin protection and the prevention of dermatoses, although pregnant women should pay attention to the chemical composition of the filters as some organic UV filters, such as the BZ-3, can impact the fetus. Sunscreens containing physical UV filters are the best option, and consulting a dermatologist is an effective way to receive advice on pregnancy-safe sunscreens [66].

6. Consumer Behavior

6.1. Skin Damage Caused by Artificial Tanning

Currently, the standard of beauty includes tanned skin, and the search for socially accepted skin tones has become a goal for many people, especially for western people [67]. The use of tanning beds has been a way to achieve this standard, especially by young, non-Hispanic, and white women who seek to obtain a skin tone associated with health that is visually more pleasant than their baseline tone [68]. A tanning chamber emerged in the 1970s, and as its use was popularized, concerns have arisen about this practice. Several clinical investigations have highlighted the relationship between this type of artificial tanning and malignant skin changes, such as the development of skin cancer. Compared to sunbathing, artificial sources of ultraviolet (UV) light continue to be mistakenly advertised as safe; in reality these artificial UV lights can provide greater harm as the lamps emit both UVA and UVB rays and can be used continuously at high intensity, different from solar radiation, which can vary according to different factors, such as the season of the year and the time of day [69]. Moreover, there is a questionable belief that this form of tanning provides photoprotection, prepares the skin for sun exposure, and prevents sunburn [70].

Artificial tanning should be discouraged, the benefits of this procedure should be demystified, and users should be advised about the harmful effects of this practice through texts, images, and publications in order to raise awareness about premature skin aging, the risk of skin cancer, and other harmful alterations [71]. Although the desire to keep the skin tanned involves psychosocial issues, practitioners should consider alternative and safe ways. For example, the use of sunscreen and sun exposure at times of lower incidence of UVR are options for safe tanning. However, it is possible to use sprays, cosmetics, moisturizers, and tanning lotions to avoid sun exposure [72]. These tanning products are considered safe options as they may contain pigments that provide a false tan when applied to the skin and can be removed after bathing, whereas other products may contain dihydroxyacetone (DHA), a component capable of interacting with the dead cells of the upper layer surface of the skin and provide a longer-lasting color [73].

6.2. Photoprotection Behavior of Adolescents and Young People

In adolescence, intentional tanning and excessive sun exposure occur more frequently, posing a greater risk of skin damage and cancer development [74]. In a recent clinical trial with adolescents, the investigators observed that young people recognized the damage caused by UVR, but a minority used sunscreen daily. Even those who used sun-protection products daily applied insufficient amounts for promoting adequate photoprotection. It is essential to find effective means of communication with adolescents and youth, such as the creation of educational content, campaigns, videos, testimonials, and media targeted at this age group in order to raise their awareness of healthy behaviors against sun exposure and, in particular, to ensure their skin health [75].

7. Consumer Preferences in the Choice of Sunscreen Products

Although the benefits of sunscreen use are well known, encouraging the population to use such products involves issues beyond counseling about the damage that excessive sun exposure can cause to individuals. Consumer preferences are essential for establishing habits related to sunscreens. Xu et al., (2016) investigated public preferences regarding the choice of sunscreens by searching the keyword "sunscreens" on the website of the American retailer "Amazon.com", and the positive aspects considered were cosmetic elegance, product performance, and compatibility with skin phototype. On the other hand, the negative points that led consumers to discard the choice of sunscreens involved cosmetic elegance and the price of the product [76]. During a sunscreen use study, consumers evaluated the fast absorption, ease of application, transparent finish, no glare, no white spots, non-sticky or greasy sensory, sweat and water resistance, no eye burning, and keeping the skin hydrated and soft as important properties. In addition, consumers seek sustainable products that do not negatively impact the environment, but can withstand different climatic conditions, such as humidity, environmental pollution, and temperature [77,78]. Finally, considering consumer preferences allows dermatologists to make personalized recommendations that ensure photoprotection effectiveness and provide a pleasant experience to the consumer, making them loyal to the habit of protecting themselves [17,79].

8. Final Considerations

The different intended purposes (avoidance, mitigation, and prevention of damage) and widespread use of topical sunscreens have promoted many investigations in the scientific environment [80]. This has generated a vast and continuous need for information and education among prescribers, consumers, and patients. Researchers, industry, authorities, and the general public should make concerted efforts to provide information on the performance of products over-the-counter. The ideal sunscreen should be inexpensive to use and the tools for photoprotection should be disseminated to influence a change in the behavior of consumers of all phototypes, sexes, and age groups towards the correct daily application of sunscreens suitable for each case [13].

Researchers have sought to include antioxidants from different sources in sunscreens, as well as oral and natural actives with photoprotective and anticarcinogenic properties, which may also provide protection against the effects of VL and IRR. The use of natural ingredients in photoprotectors presents a great potential for the cosmetic industry [23].

Although the need to prevent skin damage resulting from excessive sun exposure is well understood, the most effective and safe way to achieve photoprotection still presents many challenges. The 21st century sunscreen must provide complete but balanced protection and must be inexpensive, safe, and easy to use [81]. For example, regulatory agencies need to expedite the review of the list of allowed sunscreens so that new, safe, and effective sunscreens can reach the market quickly [25]. In addition to this, there is concern regarding environmental preservation, according to the One Health concept that unites human, animal, and environmental care, as a successful strategy of efforts in public health to ensure the welfare of populations [38].

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