

Artificial Ultra-Violet (UV) B Light Exposure May be as Important as Vaccination

Daniel L Clinciu¹, Cheng-Hsien Chen^{2#}, Tzai-Shiuan Li^{3#}, Neng-Wen Lo⁴ and Jyh-Cherng Ju^{1,3,5,6*}

¹Graduate Institute of Medical Sciences, China Medical University, Taichung, Taiwan

²Department of Optics and Photonics, National Central University, Taoyuan, Taiwan

³Translational Medicine Center, Medical Research Department, China Medical University Hospital, Taiwan

⁴Department of Animal Science and Biotechnology, Tunghai University, Taichung

⁵Department of Bioinformatics and Medical Engineering, Asia University, Taichung, Taiwan

⁶Department of Animal Science, National Chung Hsing University, Taichung, Taiwan.

Equal contributors

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ABSTRACT

Ultraviolet (UV) light has been an important source in human health throughout human evolution. However, modern lifestyles, indoor jobs, cultural myths, religious beliefs and the increase of globalization has drastically reduced UV light exposure in humans, amounting to growing cancer rates, diseases and worldwide health deterioration. This commentary details various human activities, lifestyles and their effects on health worldwide. It also examines misinterpreted findings pertaining to the lack of UV light exposure that could further undermine existing health issues. UV light producing technologies to reduce adverse effects on human health are currently being used and are very effective. They are safer than sunlight, available at any time, inexpensive and could reduce healthcare costs by decreasing drug use and extensive cancer therapies. Public health agencies and healthcare providers throughout the world should make individuals aware of UV light exposure benefits.

Keywords: Disease, Health, Immune system, Ultraviolet light

INTRODUCTION

The lack of UV light exposure experienced by many individuals worldwide in recent years, is a matter of serious concern. A constant increase in indoor jobs, persisting cultural myths for white skin in Asia [1] and religions requiring believers to be covered at all times when in public [2] all contribute to major health challenges worldwide (Figure 1). Although a globally growing aging society in recent years also attributes to an increase in cancer, rates, other diseases [3] cancers and various diseases unrelated to aging are linked to a lack of sunlight exposure by recent studies [4-6].

Corresponding author: Jyh-Cherng Ju, Graduate Institute of Medical Sciences, China Medical University, Taichung, Taiwan, Tel: +886-4-2233-7203; +886-4-2286-2799; Fax: +886-4-2284-0265; 886-4-2286-2199; E-mail: jcju@mail.cmu.edu.tw; jcju@dragon.nchu.edu.tw

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Figure 1. Permanent covering of the body in women due to religious practices preventing UV light irradiation in women. (A) Face revealing clothing in less strict religious practices. (B) Complete face and body covering in very strict religious practices.

Melanin, a product of sophisticated human adaptation and evolution, protects the body against UV light. However, it could be a major problem and the cause of adverse health impacts. When individuals with higher melanin content reside or migrate to places with less available sunlight (e.g. England, North America, Northern Europe) than in native place near equator, it impacts their health [4]. The increased melanin in their skin prevents UVB light penetration, thus, reducing the production of vitamin D and of various other beneficiary health factors (**Figure 2**). Moreover, significant findings that could bring great benefits to humanity are sometimes misinterpreted, creating additional health problems. One such study done in the USA by Powe et al. [7] found African-Americans to have much lower levels of circulating vitamin D or 25(OH)D than Caucasians.

Interestingly, African-Americans had higher bone mineral density (BMD) and calcium levels that implies a remarkable adaptation over time; most African-Americans have lived a few generations in North America, a place with relatively less available sunlight than Africa and the equator region/area. This may be an astonishing example of rapid evolution in humans, where the production of calcium and other necessary health factors have found new mechanisms as response to less UV light exposure [8,9]. However, there are many other important factors produced by sunlight which adaptation/evolution is unable to provide. The lack of UVB light and lower vitamin D levels with increased cancer rates and other diseases in blacks as compared to whites [4,10-12].

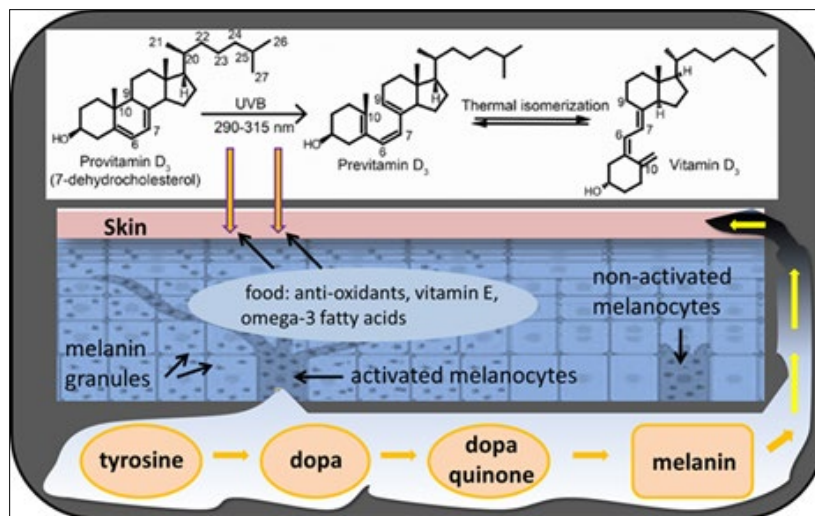


Figure 2. The activities produced by the exposure to UV light. Production of vitamin D in the body and the activation of the melanin pathway along with other protective mechanisms.

Similarly, elderly individuals need additional UV exposure with increasing age, due to their aging skin being unable to allow UV light penetration [6]. In addition, with increased age come aging diseases, particularly cancers and neurodegenerative diseases [13]. Therefore, UV light exposure becomes even more critical in elder people because it is known to have numerous health and therapeutic benefits, such as prevention of neurodegenerative diseases, infections, cancers and more [14,15].

Globalization, a phenomenon of recent and constant human migration around the world due to employment and business opportunities is also a great recent contributor to adverse effects on health, in addition to increased environmental pollutions and stressful life styles. As previously mentioned, dark skinned individuals living or migrating in places with less available sunlight than their once native places are usually at risk, it takes up to 6 times more UV light exposure in dark-skin individuals to obtain the same vitamin D levels and other necessary health benefits than light-skin individuals [16]. Additionally, concerns for rapidly spreading epidemics now and in the future [17] reveal that human immunity may be declining worldwide. One important function of UV light is the killing of many bacterial and viral pathogens [6] as well as cancer cells [18]. With antibiotic resistance constantly, increasing because of overuse and abuse [19] the mounting evidence for increases in diseases and epidemics worldwide should consider what some of their main causes are. The increasing lack of UV light exposure in humans worldwide is likely one of them [1,4,6,20].

HEALTHCARE SYSTEMS - THE CHALLENGES

The International Agency for Research on Cancer (IARC) is predicting the global burden of cancer will grow 70% over the next two decades, with an estimated 22 million new

cases per year. Here we emphasize that indoor lifestyles, aging and globalization will be significant contributors to cancers in the near future. Therefore, people, healthcare systems and governments worldwide should make greater efforts in overcoming this growing challenge by supporting research and educating their citizens on the above issues.

LIFESTYLES, CULTURES AND BELIEFS

Increasing indoor lifestyles due to jobs and hobbies, such as computer and video games [21] and the lack of UV light exposure caused by cultural myths, religious beliefs and globalization are matters of great concern. Excessive sunscreen usage, sun-umbrellas and sun-blocking clothes to maintain white skin is extremely common in Asian populations (Figure 1) [1]. Permanent covering of the entire body due to cultural and religious beliefs in most of Middle East, Africa and parts of Asia likewise contribute to many health challenges [2,22].

As people travel and migrate around the world, they bring their lifestyles, traditions and beliefs with them, often adding to the local healthcare challenges. Studies reveal that dark-skin individuals are affected the most by globalization, as many of them relocate to places with significantly less available sunlight than in their homeland [12]. Various studies support this assumption due to higher cancer rates and other diseases in African-Americans [6,12] although it might be confounded by some other environmental or economic factors such as cloudier and polluted places, low income and education.

NUTRITIONAL SUPPLEMENTS

A worldwide vitamin D deficiency epidemic points to an association among vitamin D and many diseases, particularly cancer. Vitamin D involvement in many important bodily functions is confirmed by 2,776 genomic

positions the vitamin D receptor (VDR) occupies [23]; this makes a strong case for its role in cancers, other diseases and overall health. It also implies that UVB light, the main producer of vitamin D in humans could be a significant contributor to other health benefits, some of which can both, prevent and treat various diseases [5,24,25]. Notably, UV light enhances skin barrier functions, endorphins production, cardiovascular protection, lowering of cholesterol, melatonin production, wound healing, antimicrobial effects, currying of depression [6], protection against and treatment for multiple sclerosis (MS) [24] and treatment of T-cell lymphoma [18]. A low vitamin D status is a good indicator of poor health and high risk for diseases. Direct sunlight exposure to 80% of the total body skin for 30 min can generate 50,000 IU (1.25 mg) vitamin D in light skin individuals within 24 h of exposure and a series of additional health factors [26]. The body has evolved superb UV light protection and the melanin pathway is immediately activated if overexposure occurs (**Figure 2**) [27].

Vitamin D deficiency and related diseases especially in dark skin individuals is becoming a worldwide concern. Promoting lifestyle changes and the use of inexpensive technology (e.g. LEDs) for prevention and treatment could play a significant role in worldwide health [28]. An estimated one billion people of all races worldwide experience significant vitamin D deficiency. These individuals likely experience deficiencies of other important health factors produced by UV light mentioned previously and are at increased risks for cancers and other diseases [4,6].

SIGNIFICANT FINDINGS MISINTERPRETED

A study by Powe et al. [7] on the 25(OH)D (circulating vitamin D) level among African-Americans and Caucasians is of particular significance. It found mean levels of 25(OH)D and vitamin D-binding protein were lower in African-Americans as expected, but revealed what is a great example of recent human adaptation [8]. African-American's BMD and calcium levels were higher than in Caucasians despite lower circulating vitamin D levels. The researchers overlooked the incidence of higher cancer rates and other diseases in blacks as compared to whites [4] and stated African-Americans are inappropriately labeled vitamin D-deficient [7]. The researchers failed to acknowledge that a low vitamin D status generally means a deficiency in all health factors produced by UV light and its associated benefits and an increased risk for diseases [5,6]. Higher level of BMD and calcium coming from lower than normal 25(OH)D levels could be attributed to phenomenal adaptation to decreased sunlight exposure over time in African-Americans as most of them have been in North America over 200 years [8]. Lower 25(OH)D levels caused by darker skin pigmentation in African-Americans require up to 6 times the sunlight exposure of light-skin individuals [16]. Socioeconomic status, stress, diet, and lifestyle all

influence onset and progression of diseases, however, low 25(OH)D levels caused by lack of UV light exposure are associated with all cancers and diseases (**Figure 2**) [4].

INDOOR HOBBIES AND CULTURAL MYTHS

Alarming rates of vitamin D deficiencies in children and teenagers globally are evidence for that they no longer spend adequate time outdoors. Online game technologies for entertainment such as computers, I Pads, smart phones and various other indoor games keep many children and adults indoors. Additionally, both adults and children use too much sunscreen when being outdoors from either scares of skin cancer or "white skin" preferences [1].

Recently, fast developing nations like China experience a significant growing number of cancers [1,17]. Pollution, among many other harmful effects on human health blocks UV light penetration. China experienced a tremendous economic boom over the past decade that brought significant lifestyle changes: the indoor industrial jobs are replacing the outdoor agrarian lifestyles for many individuals. Additionally, cultural myths for "white skin" as a beauty symbol in most of Asia persuade women to often use sun umbrellas just to walk from home to their cars, excluding any possibility for direct UV light exposure (**Figure 1**).

THE SKIN CANCER MYTH

A study in 1999 erroneously published results that linked UV light exposure to very high risk of melanoma [29]. However, the risk was discovered to be much lower a few years after and other studies concluded that genetics and lack of sunlight exposure are the factors that initially make individuals more susceptible to skin cancers [30]. Moreover, 75% of melanomas appear on parts of the body that are not exposed to sunlight [31]. This maybe also an indirect support to one of our recent findings, i.e., cancer cells were more sensitive to UV exposure than other cell types. Although the melanoma scare happened more than a decade ago, the effects of a powerful sunscreen industry still persist.

UV LIGHT USES, BENEFITS AND ARTIFICIAL SOURCES

Direct exposure to artificial UV light (UV light diodes) has been known to treat and cure a variety of diseases. After being first used in the classic treatment of rickets, it is now used in treating many health problems like psoriasis and treatment of multiple sclerosis and even T-cell lymphoma [18,24,25]. In other studies, UV light was shown to decrease the frequency of headaches in men, subside pediatric and adult infections, aid with prevention/reduction of myopia and other health benefits [32,33]. For instances, phototherapy of broadband (BB) UVB (290-320 nm), narrow band (NB) UVB (310-315 nm), monochromatic UVB (308 nm from an excimer laser), broadband UVA (320-400 nm) and UVA-1 (340-400 nm) has been used successfully in treatment of both animal disorders and

human clinical subjects. Recent studies reveal NB UVB (290-315 nm) is most effective and the least to cause erythema in both animals and humans [18,24,28].

CONCLUDING REMARKS

To date, rapid development in technologies offer efficient and inexpensive artificial UVB emission which can successfully mimic sunlight in obtaining irreplaceable benefits and health factors? They also provide great advantages such as availability year-round, adjustable exposure and frequency, reduced DNA damage and reduced risk of skin cancer for optimal health benefits. Nevertheless, UV light performs key roles in mechanisms independent of vitamin D production and other specific physiologic responses which are still elusive [24,34] and require more investigation.

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