ijtos 2023

International Journal of Trends on OncoScience

Review Article

Sunlight for Cancer

Sunlight's Role in Preventing Cancer

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Abstract: The health guidelines for sun exposure, which are now mostly focused on the elevated risks for skin cancer, need to be reviewed in light of mounting data indicating sunlight's protective benefits on an array of cancer types with a high death rate. We looked at a few studies on the connection between sun exposure and cancer, except skin cancer. Environmental research on mortality from non-Hodgkin lymphoma (NHL) and sunshine yielded contradictory findings, with early studies demonstrating positive connections and subsequent studies primarily demonstrating negative correlations. In this review, we present UV Radiation, Sunlight and Constituency, Melanoma, Cancer and sun exposure, Vitamin D, Dietary Vitamin D Resources, Sunlight's effects on Pineal Endocrine, Vitamin D3 Derivates, and Sunlight.

Keywords: Analyze Cancer Prevention Cancer, 25-hydroxyvitamin D, sunlight, plus vitamin D

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Received On 11 March, 2023
Revised On 29 March, 2023
Accepted On 8 April, 2023
Published On 17 April, 2023

Funding This research did not receive any specific grant from any funding agencies in the public, commercial or not for profit sectors.

Citation Randa Salah Gomaa , Sunlight's Role in Preventing Cancer.(2023).Int. J. Trends in OncoSci.1(2), 26-33

1. INTRODUCTION

The negative consequences of sunshine, likewise UV radiation on human health, have received the majority of attention up to this point. Recommendations for public health that sun exposure should be avoided have been most often researched in Western countries due to the continuous increase in skin cancer incidence over the recent decades, mostly attributed to increased sun exposure. Squamous cell carcinoma, a kind of skin cancer, and solar radiation exposure have an antagonistic relationship[1]. More complicated is the connection between sunlight and melanoma, the most serious type of skin cancer. Early, intermittent sun exposure that causes severe sunburns is the most external risk factor, yet, some long-term sun exposure may be a protective strategy.[2,3] Additionally, a higher survival rate from melanoma may be linked to sun exposure. Sunlight exposure has long been known to benefit bone metabolism [4-6]. Many additional possible advantages have been discovered recently, including a reduced death rate for certain malignancies, type I diabetes, schizophrenia, and multiple sclerosis.[7–11] Among the first hormones is probably vitamin D. It was created by phytoplankton in reaction to sunlight for at least 750 million years. Furthermore, it's been around ever since. As vertebrates transitioned from their high-calcium aquatic habitat to the calcium-deficient terra firma during evolution, vitamin D was crucial. At the beginning of the 20th century, exposure to sunshine was hailed as a remedy for several skin conditions, including lupus vulgaris, a condition brought on by a skin infection from TB. In organs that could not be treated, malignant tumor incidence was reduced by exposure to adequate sun radiation. In industrialized cities, sunlight deprivation from air pollution or the proximity of tall buildings results in bony deformities of rickets and osteomalacia, which can be corrected by recent sunlight epidemiological. The damage is manifested as accelerated changes associated with aging and frequently leads to the creation of various forms due to skin cancer. Studies support the idea that lack of sunshine may provide the rising prevalence of among the most prevalent cancers affecting populations in temperate regions, including carcinomas of the breast, colon, and prostate[12,13]. The lack of sunshine deprives the body of vitamin D, which is known to have a protective effect against the development of certain cancers. Additionally, the absence of sunshine reduces the antioxidant capacity of the skin, which can lead to oxidative stress and damage near the skin cells, leading to an increased risk of developing skin cancer. Therefore, adequate exposure to sunshine is vital for protecting the body from cancer and other health issues.

1.1 Effects of UV Radiation That Are Negative

It should not be the main objective of sun protection for the skin only to prevent sunburns. Even at dosages that do not cause erythema, sunlight exposure causes cumulative damage with each exposure. With time and exposure intensity, this damage increases. The quantity of time spent under the sun over the years is reflected in wrinkles, uneven pigmentation, and, after enough time, skin cancer. The quantity of natural pigment on the skin and the overall number of UV exposures determine when these effects start to be visible[33]. In addition, sunlight has a positive physiological effect by prompting the skin to generate vitamin D from cholesterol precursors. In the past, this was a crucial way to prevent rickets. Modern diets may easily absorb vitamin D now from a variety of food sources, such as bread, dairy products, and, if required, supplements with vitamin D. However, the over-exposure to sunlight might cause the skin to age prematurely, skin cancer and other negative effects.[34]. This is why it is important to restrict the quantity of UV exposure and to use sun protection when engaging in outdoor activities. Limiting UV exposure and using sun protection when needed is crucial to ensure the best care for your skin.

1.2 Sunlight Constituency

UVB (280-315 nm), UVA (315-400 nm), visible light (400-760 nm), and infrared (760-1Q6 nm) are the four wavelength ranges that make up the majority of the sun's biologically significant output that reaches the earth's surface. UV wavelengths shorter than 290 nm, especially ultraviolet C (UVC), are strongly absorbed by ozone, water vapor, and molecular oxygen in the upper atmosphere and do not reach the earth's surface in appreciable quantities. As a result, UVA is sometimes called "black light." The vast majority of UVA solar UV radiation makes up around 95% of the energy that hits the planet's surface near the equator. Additionally, UVA, the main wavelength generated by tanning beds, has an overview of being the supposedly "safe" size of the UV spectrum. Despite making up just 5% of UV photons that reach the earth's exterior, UVB is the part of sunlight with the greatest biological impact[35]. UVB combines depth of penetration and reactivity with macromolecules so that it is the most biologically potent portion of the UV spectrum in terms of short and long-term effects, despite not penetrating the skin as deeply as UVA or interacting with the epidermis serving as strongly as UVC. In a biological sense, UVB radiation is an active form of ultraviolet (UV) radiation due to its penetration ability through the outermost layer of skin and interaction with melanin, the pigment that gives skin its color[36]. UVB Vitamin D is also produced due to radiation in the body, which is important for healthy bones and skin. Additionally, UVB rays can result in sunburn, skin cancer, and other long-term skin damage. Thus it is crucial to safeguard oneself from UVB radiation by applying sunscreen and wearing protective clothing outdoors.

1.3 The Relationship Between UV Radiation and Melanoma

Because of melanin's proven UV-protective properties, melanoma is largely a disease of those perceptive to light. Studies on people's risk of melanoma indicate that sun protection can help control the condition. Recent data from melanoma-prone families shows that exposure to sunshine is associated with the disease's manifestation in people with the hereditary predisposition[37]. Exposure to the sun oneself, especially frequent sunburns, is currently acknowledged as a risk factor for the development of several benign cancer and recognized as a danger sign of melanoma[38]. The anatomical placement of melanoma lesions indicates sunlight exposure contributes to their development. Compared to women, men often have melanoma lesions on their backs and faces[39]. In addition, there is evidence of injury to the legs. This is likely because men are more inclined to engage in outdoor activities that require exposure to sunlight, such as working outdoors or playing sports. Women are more inclined to take protective measures, such as wearing sunscreen or protective clothing, which can aid in reducing their risk of

melanoma. However, even with these protective measures, it is important that everyone pays attention to alterations in their skin and makes an appointment with a dermatologist for any suspicious spots.

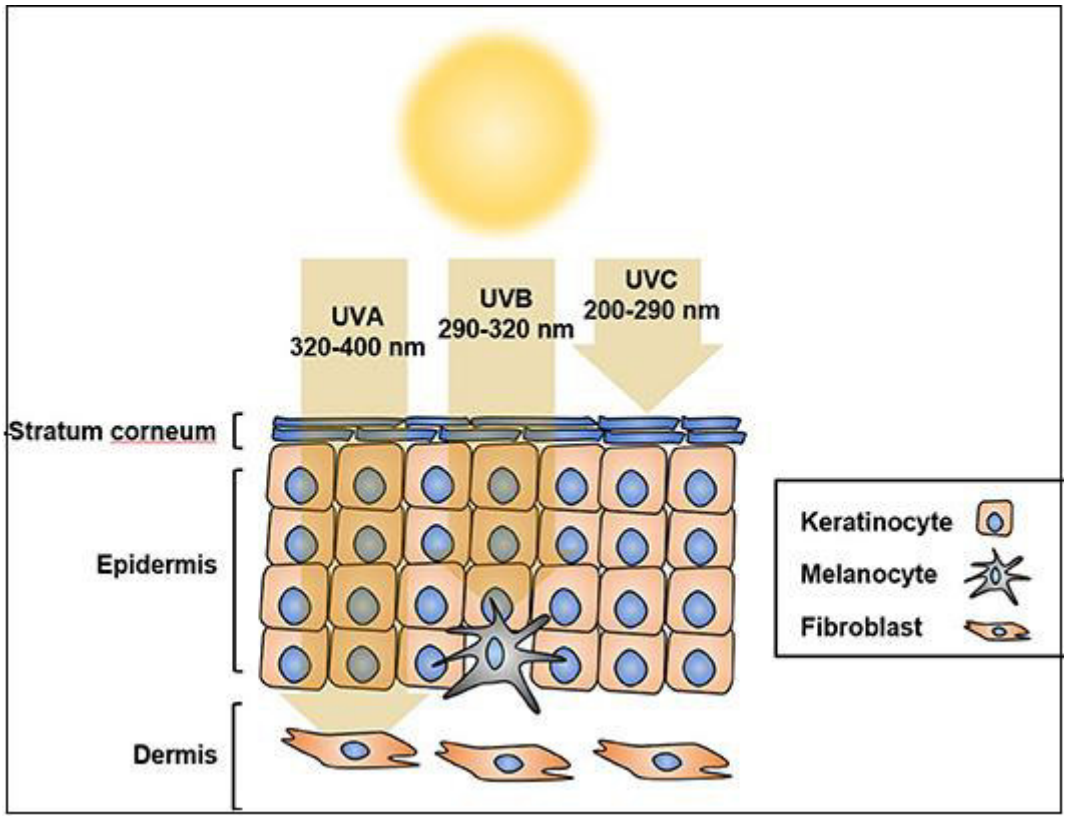


Fig 1. UV Penetration into The Skin[14]

1.4 Cancer and sun exposure

Hoffman first mentioned the connection between latitude and UV radiation and cancer mortality in 1915[15]. He documented cancer mortality in cities at various latitudes and saw a gradient drop in elevated death rates. Epidemiological studies found a strong negative correlation between latitude, sun exposure, and insufficient amounts of vitamin D. Adequate exposure to solar ultraviolet B radiation reduced the risk of developing several colons, breast, and ovarian cancers[40]. This suggests that the UV radiation level influences the risk of developing certain cancers[41]. In addition, sun exposure has been linked to increased levels of vitamin D in the body, demonstrating protective effects against cancer. Therefore, it is important to balance the UV radiation level one is subject to with the protective benefits of vitamin D for reducing cancer risk.

1.5 Vitamin D's sources and metabolism

For most people, exposure to sunshine is the principal origin of vitamin D[16,17]. This is because 7-dehydrocholesterol in the plasma membrane of keratinocytes and fibroblasts is transformed to pre-vitamin D3 when the ultraviolet B part of sunlight penetrates the skin[42]. Pre-vitamin D3 is rapidly transformed into vitamin D3 within the plasma membrane through a membrane-dependent mechanism before being expelled into the extracellular space.[43]. While vitamin D2 and vitamin D3 from food are vitamin D-binding protein-bound and lipoproteins, vitamin D3 from the skin is attached to the protein that binds vitamin D. Vitamin D may be found in very few food sources. Oily fish like salmon, mackerel, and sardines are among them. Several foods, including milk and oranges. In the US, foods, including juice, bread, cereal, and yogurt, are vitamin D-fortified. Vitamin D may also be acquired through sunlight exposure. UVB rays from the sun interact with the cholesterol in the body, forming vitamin D3[44]. Thus it is important to get regular sunlight exposure, especially throughout the summer, to ensure sufficient vitamin D intake. Vitamin D3 is important for bone health and immune system support and can also help reduce inflammation. It is especially important for people who don't eat fish or consume fortified foods, as these are the primary vitamin D sources in the diet. Exposure to the sun is an easy and natural way to obtain vitamin D3, and it is recommended to spend 15 minutes per day outside during the summer months to get adequate vitamin D. Vitamin D3 is so important that even 15 minutes of daily sunlight exposure during the summer months can help ensure. Therefore, to ensure optimal vitamin D3 levels, it is essential to benefit from the natural source of sunlight when it is available.

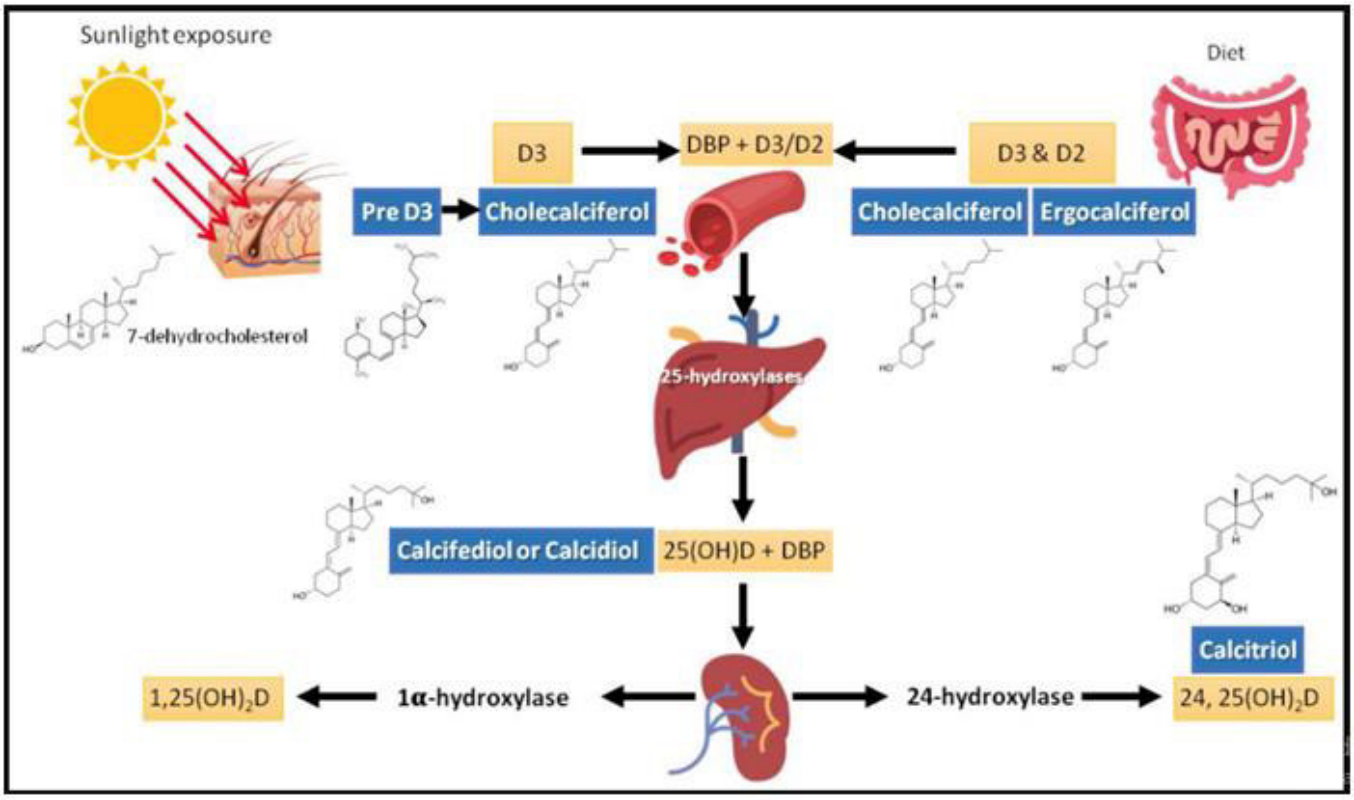


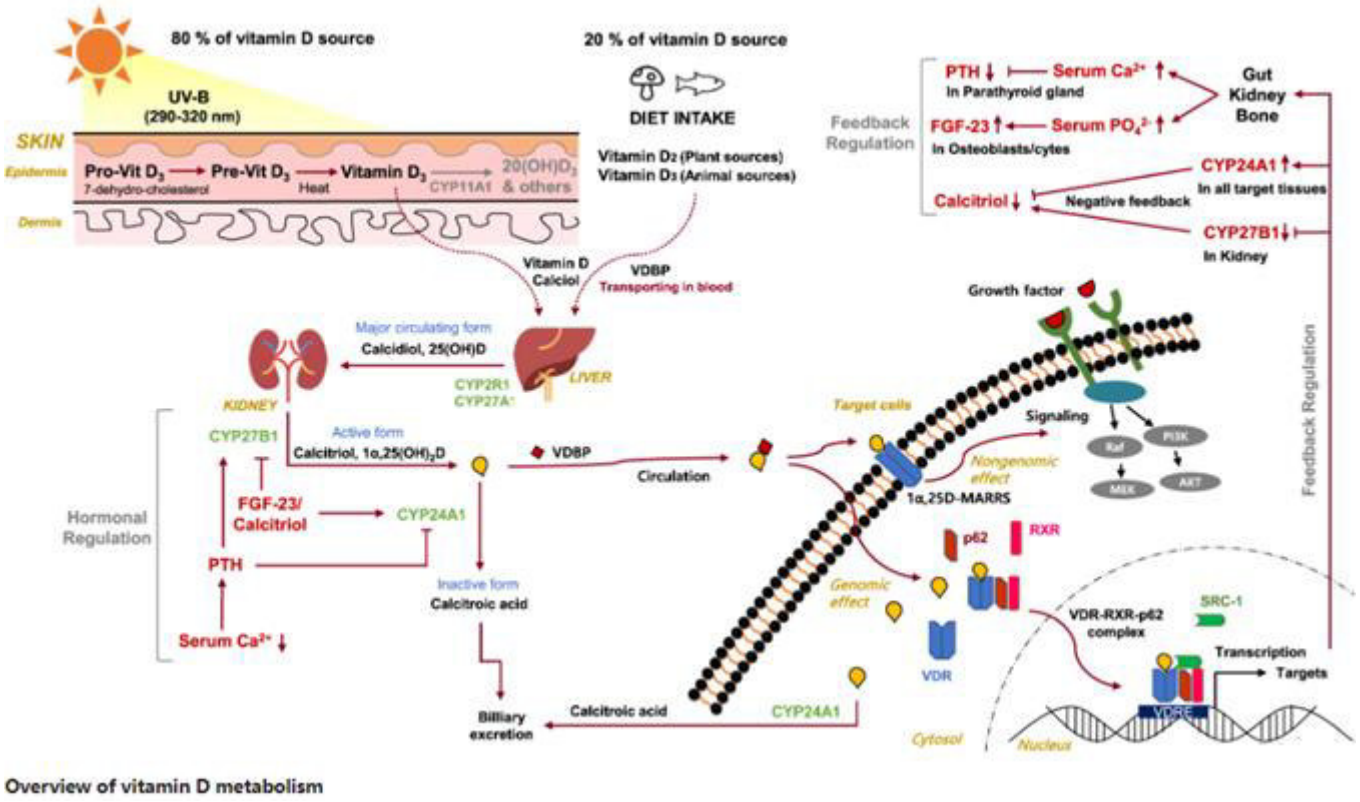
Fig 2: Vitamin D's sources and metabolism[18]

1.6 Sunlight and Dietary Vitamin D Resources

Humans have relied on sunlight exposure throughout evolutionary history to meet vitamin D needs[19]. As a result, the growth and upkeep of the vertebrate skeleton depend on vitamin D. Pre-vitamin D3 is created when 7-dehydrocholesterol, located in the plasma membrane of live cells in the epidermis, is exposed to the Sun. [45]. Pre-vitamin D3, its double bonds by a thermally induced rearrangement to become vitamin D3 after being created.[46]. Vitamin D3 diffuses directly into the dermal capillary bed from the region outside of cells after being expelled from the cellular membrane and is then transported to the liver. Vitamin D3 then binds to a protein that binds vitamin D and arrives in the liver, where it is transformed into either 25-hydroxyvitamin D3 (25(OH)D3) or 1,25-dihydroxy vitamin D3 (1,25(OH)2D3)[47]. The kidneys then adopt these metabolites, converted into 1,25-dihydroxy vitamin D3 active form, which is responsible for its biological effects. This 1,25-dihydroxy vitamin D3 is the active form., and is essential for regulating calcium, phosphate, and bone metabolism. This active vitamin D3 form helps keep a proper balance of calcium, phosphate, and bone metabolism, which is crucial for maintaining general health.

1.7 Vitamin D Metabolism and the Relationship to Cancer

By the middle of the 1990s, it was well recognized that living at a higher latitude and having a higher risk of vitamin D shortage enhanced one's likelihood of developing malignant tumors. Increasing vitamin D consumption or sunlight exposure was once thought to stimulate the kidneys' synthesis of 1,25(OH)2D, which has anticancer effects. However, the possibility that hypercalcemia may result from an improvement in 1,25(OH)2D generation casts doubt on this theory[48]. Prostate cancer cell line LNCaP, which had a VDR lacking the 25-hydroxyvitamin D-1 hydroxylase (cyp 27B1;1 OHase) (Fig. 3), and it was recognized that the renal generation of 1,25(OH)2D was closely controlled by calcium, phosphorus, parathyroid hormone, as well as fibroblast growth factor[20]. 25(OH)D3 treatment unaffected these cells' proliferative activity, and they could not create 1,25(OH)2D3[49].Additionally, It was revealed that the cells 3H-25(OH)D3 changed into 3H 1,25(OH)2D3. The capacity for cells from the lung, breast, colon, and brain, among many other cell types, to convert 25(OH)D3 to 1,25(OH)2D3 was also reported by various researchers simultaneously. More sun exposure and better vitamin D status were linked to a lower risk for fatal malignancies because greater levels of circulating 25(OH)D served as the substrate for the various tissues and organs with 1-OHases to create 1,25(OH)2D locally. This 1,25(OH)2D is the hormone's active form of vitamin D, and it is the vitamin D form that helps the body regulate its calcium levels, which is essential for a healthy immune system[50]. Therefore, increasing exposure to the sun and improving vitamin D status can produce sufficient levels of 1,25(OH)2D, thus helping to reduce the chance of fatal malignancies. As a result, maintaining sufficient levels of 1,25(OH)2D is critical to maintaining a healthy immune system, reducing cancer risk, and ensuring overall well-being.



Overview of vitamin D metabolism

Fig 3: Exploring vitamin D metabolism and function in cancer[21]

1.8 Activity of 1,25(Oh)D3 and Analogues as an Antiproliferative

According to estimates, 1,25(OH)2D may control more than 2000 genes formally or informally [2,2,23]. Leukemic cells were initially detected in the very early 1980s. Being confronted with 1,25(OH)2D3, their proliferation was slowed down, and the cells developed into macrophages with a normal appearance. This suggests that 1,25(OH)2D3 has an impact on controlling the transformation of leukemic cells into mature macrophages and, thus, the progression of the illness [24,25]. Furthermore, 1,25(OH)2D3 has been discovered to show an inhibitory effect on the growth of several tumor cells, suggesting it has potential as an anti-cancer agent. Additionally, 1,25(OH)2D3 could be a promising therapeutic option for treating leukemia and other cancers. These findings point to the prospective 1,25(OH)2D3 as a therapeutic agent for handling leukemia and many forms of cancer.

1.9 Sunlight's Impact on Internal Organs

The eyes[26] sees the reduction of pineal hormone production after strong visible light, and maybe also after it diffuses through the skull and skin when 1.25D spreads all around the body. Intense UVB radiation also promotes melanoma growth in mice through perhaps immunological pathways[27], while UVA reduces cellular immunity in humans, which promotes tumor growth[28,29]. These effects may result from the generation of epidermal cytokines generated by UV-induced DNA damage, which is believed to be mediated via systemic T-lymphocyte-mediated immunosuppression[30]. Kripke has just published a thorough study of photo immunology. Kripke's study suggests UVB rays can stimulate melanoma growth by activating certain cytokines[51]. It also suggests that UVA radiation suppresses the body's immune system, which could lead to tumor growth. This is believed to result from the DNA harm brought on by UVA radiation, which can weaken the body's ability to fight off cancerous cells. Kripke's findings indicate that UVB radiation may be the main reason for melanoma growth, as it is connected to increased cytokine activation. In contrast, UVA radiation is connected to immune suppression and DNA damage, potentially leading to tumor growth. This has led many to imply that UVB radiation should be the primary focus of skin cancer prevention, as it seems more closely associated with melanoma development than UVA radiation.

1.10 Sunlight's Effects on Pineal Endocrine Function

The pineal gland secretes a hormone called melatonin that inhibits reproductive processes and lightens the skin color of invertebrates by causing dendritic cell processes that contain melanin to retract[52]. Since melatonin decreases the area of the skin protected from sunlight by melanin, insufficient pineal gland function may be a factor in sunlight-induced skin cancers. Melatonin also affects the defense mechanism, which may explain why it is connected to a decreased risk of certain types of cancer. Additionally, melatonin is believed to help regulate the body's circadian rhythm, which can affect the production of hormones and other physiological processes[53]. Melatonin stimulates certain immune cells that help protect the body from cancer and inhibit tumor growth. It may also help reduce inflammation and oxidative stress, which are both acknowledged to be associated with a higher risk of certain types of cancer[54]. Additionally, melatonin helps regulate the body's sleep-wake cycle and hormones, which can influence the body's overall health and well-being. Therefore, melatonin is thought to reduce an individual's cancer risk significantly. By doing so, melatonin may help individuals maintain a healthy balance of hormones, which can further reduce the possibility of evolving cancer.

1.11 Effects of Vitamin D3 Derivates and Sunlight on the Fate of Neoplastic Cells

The genetic instability of cancer cells provides the biological foundation for this process, which is supported by the activation of proto-oncogenes and loss of or activation of tumor suppressor genes. Proto-oncogenes are genes that can be converted into oncogenes responsible for the uncontrolled growth of cancer cells[55]. Tumor suppressor genes, on the other hand, are responsible for the regulation of cell growth. When these genes are either lost or activated, it creates an environment where cancer cells can rapidly and uncontrollably grow, leading to genetic instability. Proto-oncogenes are usually turned on by mutations that make them more active, increasing cell growth rate. Tumor suppressor genes, however, are usually turned off by mutations that make them less active, resulting in a decrease in the ability of cells to control their growth rate[56]. When both proto-oncogenes and tumor mutations in suppressor genes result in genetic instability and the uncontrolled growth of cancer cells, this unchecked cell growth can cause abnormal cell divisions and increased cell death, resulting in the development of tumors. As a result, it is essential to maintain the proper functioning of both proto-oncogenes and tumor suppressor genes to reduce the risk of developing cancer. The quantitative association between sunshine and prostate cancer mortality follows a dose-response curve: the more powerful, preventative impact, the more sunlight received. The north-south gradients in the ecological research and the discovery that is increasing chronic exposure results in enhanced protection point to this[31,32]. Acute exposure characteristics, such as childhood sunburn, frequent travel abroad, and a high grade for adult sunbathing, were also shown to have a protective effect on risk. Both genotype and phenotype appeared to impact how sunshine affected the chance of developing prostate cancer. Receptors for vitamin D polymorphisms altered the outcome. The role of vitamin D plays an important role in regulating gene expression, and certain gene variations can affect how a person responds to vitamins D. Vitamin D is important for regulating gene expression because it helps to control the behavior of certain genes that are a part of functions such as cell division and expansion. Certain gene variations can affect how an individual responds to vitamin D, meaning some people may need higher doses of vitamin D to get the same benefits. This can significantly impact the outcome of a study or experiment. Therefore, it is important to consider genetic variations when considering the efficacy of vitamin D dietary supplements. Much scientific data suggests that greater sunshine exposure, which boosts vitamin D3 production and a person's vitamin D level, may impact vitamin D status in numerous lethal malignancies. Numerous studies conducted as well as in vivo on mice, in addition, to the recent discovery that 1100 IU of vitamin D3 and adequate calcium supplementation significantly lower the chance of cancer development, all provide compelling evidence to support the promotion of sensible exposure to the sun the recommendation that both children and adults should increase their intake of vitamin D. It was hypothesized that black men's greater prevalence vitamins D insufficiency is the reason why their increased cancer risk and death when compared to white men[57]. NHL (Non-Hodgkin lymphoma) prevalence rates and sunshine were shown to have a substantial negative correlation in case-control studies, three and one cohort research. It is explained how to use these conclusions to make recommendations for (public) health[58,59]. Therefore, for public health decisions to be evidence-based, it is important to consider the type of study, the results, and the implications of the study on public health. Additionally, any recommendations should consider the potential confounding factors, such as differences in lifestyle and environmental exposures, that may influence the study results. By accounting for these factors, decision-makers can have a more informed perspective on the implications of the research and be better equipped to make decisions based on evidence rather than relying on anecdotal evidence or personal opinion. In addition, considering these factors will give decision-makers greater confidence in their decisions, as the evidence for their decisions can be more accurately assessed. Moreover, this approach can help ensure that the decisions made align with the organization's overall goals, leading to better outcomes in the long run.

2. CONCLUSION

The possibility of developing cancer, including lymphoma, prostate, and breast cancer, among many others, will be decreased by improving a child's and adult's vitamin D levels. Additionally, it will lower the possibility of evolving other chronic illnesses, such as autoimmune conditions such as rheumatoid arthritis, Type I diabetes and multiple sclerosis, infectious diseases, vascular disease, and type 2 diabetes. There are no drawbacks to increasing a person's vitamin D consumption unless they possess a granulomatous condition like sarcoidosis that causes hypersensitivity, a lack of vitamin D, or cancer that can produce 1,25(OH)2D uncontrollably. Vitamin D helps to regulate the defense mechanism and has an impact on controlling inflammation. Therefore, increasing vitamin D consumption can help reduce inflammation and lower the possibility of evolving chronic and infectious diseases, cardiovascular disease, and type 2 diabetes.Moreover, having vitamin D has also been connected to improved behavior and can help to boost mood and reduce stress. While vitamin D is essential for overall health, it is important to get from a balanced diet and get sunshine rather than from supplements. Taking too much vitamin D may result in side effects such as nausea, vomiting, and weakness.

3. CONFLICT OF INTEREST

Conflict of interest declared none.

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