World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(REVIEW ARTICLE)

Check for updates

Serum Vitamin D concentrations and their association with the clinical severity of vitiligo

Silvia Juliana Serrano Baez [1,*], Shalom Esther Doria Mangones [2], Gabriela Carvajales Lozano [3], Juan Luis Pareja Rodríguez [4], Paula Andrea Chavarro Carvajal [5], Dylis María Avilez Estrella [6], Teresa Lucía Suárez Dau [7] and Néstor Fabián Sanabria Duarte [8]

[1] *General Physician, Universidad Autónoma de Bucaramanga, Colombia.*
[2] *General Physician, Universidad Del Sinú, Cartagena, Colombia.*
[3] *General Physician, Universidad Del Norte, Barranquilla, Colombia.*
[4] *General Physician, Universidad Privada Antenor Orrego, Perú.*
[5] *General Physician, Universidad de Boyacá, Colombia.*
[6] *General Physician, Universidad de Sucre, Colombia.*
[7] *General Physician, Universidad del Sinú, Colombia.*
[8] *Intern Physician, Universidad Autónoma de Bucaramanga, Colombia.*

World Journal of Advanced Research and Reviews, 2022, 14(01), 001–006

Publication history: Received on 04 February 2022; revised on 26 March 2022; accepted on 28 March 2022

Article DOI: https://doi.org/10.30574/wjarr.2022.14.1.0218

Abstract

Vitiligo is the most common acquired depigmentation of the skin, affecting the patient's self- image and negatively affecting quality of life. As for the pathogenesis of vitiligo, there is an autoimmune theory. Vitamin D deficiency has been shown to exist in many autoimmune diseases. Vitamin D is an essential hormone with pleiotropic effects, especially anti-apoptosis and regulatory functions of melanocyte proliferation and differentiation. It has been hypothesized that it may play a supportive role in the repigmentation of white matter lesions. The immunomodulatory activity of vitamin D may be used to treat vitiligo.

Keywords: Vitiligo; Vitamin D; Vitamin D Concentrations; Severity

1. Introduction

Vitamin D is a fat-soluble hormone obtained through sun exposure, diet, and oral supplements. It has autocrine properties which inhibit cell progression, stimulate differentiation and apoptosis through the receptors of the different cell lines [1]. When serum values of this molecule do not exceed 20 ng/ml, it is considered that there is a deficit of this molecule, which has been associated with alterations in the organism at the cutaneous, respiratory, bone and other levels [2].

In recent decades vitamin D has achieved an important role in skin diseases, due to its multiple functions, such as sustaining the epidermal barrier, modulation of antimicrobial peptides and immune response in the pathophysiology of atopic dermatitis and have been associated with the development of other pathologies such as psoriasis and vitiligo.

Vitiligo is the most common acquired depigmenting skin disorder, affecting about 0.06 to 2.3% of the world population between children and adults, because it can form at any age, although 50% of cases occur in the first 2 decades of life, India is the country with the highest incidence rate in the world, where 8.8% of its population is affected with this

* Corresponding author: Silvia Juliana Serrano Baez
General Physician, Universidad Autónoma de Bucaramanga, Colombia.

pathology. It is characterized by the development of acromic macules, which greatly influences the quality of life of those who have it because it compromises self-image and mental health. It is also characterized by the development of acromic macules, which greatly influences the quality of life of those who have it because it compromises self-image and mental health [3].

2. Methodology

This is a study aimed at a narrative review, it was carried out through the selection of original articles, review of available research, written in English and/or Spanish, by means of recognized databases such as PubMed, scielo, science direct, Wiley, plos one. Regardless of their year of publication, using for the search terms such as vitiligo, vitamin D, vitamin D concentrations, and skin diseases. We did not establish a search criterion for a defined language, however, we selected all the articles that contained the corresponding information and were of great importance for our review.

3. Results

Vitamin D is a fat-soluble provitamin 1, 25-hydroxyvitamin D3, a steroid hormone synthesized photo chemically in keratinocytes, plays a very important role within the body. Vitamin D is essentially a steroid hormone that binds to high-affinity intracellular receptors and induces them to bind to RXR [3]. The heterodimer binds to precursors of genes of choice by vitamin D at the level of the small intestine, the skeletal system and at the renal level to control plasma calcium and phosphorus; it also has immunomodulatory and ant proliferative activity, folliculogenesis regulatory genes, this hormone also plays a role in membrane receptors by activating protein kinase C and performing calcium channel opening. Vitamin D also plays a role in membrane receptors by activating protein kinase C and performing calcium channel opening.

There are 2 ways to obtain vitamin D, the first is through food, a portion of the active form, called cholecalciferol which can be acquired after the consumption of foods of animal origin, among them we can highlight the egg especially the yolk and oily fish, the other way of obtaining vitamin D orally is through food of vegetable origin, which contains small portions of ergocalciferol (vitamin D2), and the second way of acquiring vitamin D is exposure to sunlight, this is due to photons derived from ultraviolet B radiation, what they do is that they isomerize the 7-dehydrocholesterol at the level of the epidermis, 25-hydroxylase and 1α- hydroxylase are metabolized in the liver by the process of hydroxylation to calcifediol (25- hydroxyvitamin D [25 (OH) D]), and then undergo a second hydroxylation in the kidney, All this through the enzymatic action of 25 (OH) D-1-hydroxylase to calcitriol, this being an active metabolite that fulfills different functions by binding to the receptor at the cellular level, PTH, calcium and phosphorus, and even TGF-beta are part of the molecules involved in the regulation of this process (Figure 1 and 2) [4].

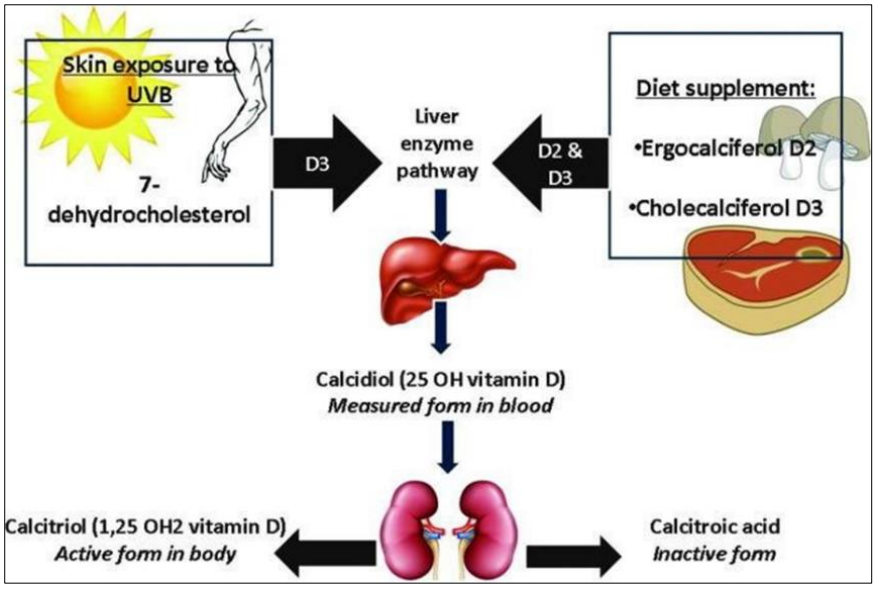

Figure 1 A diagram illustrating the different sources and forms of vitamin D.

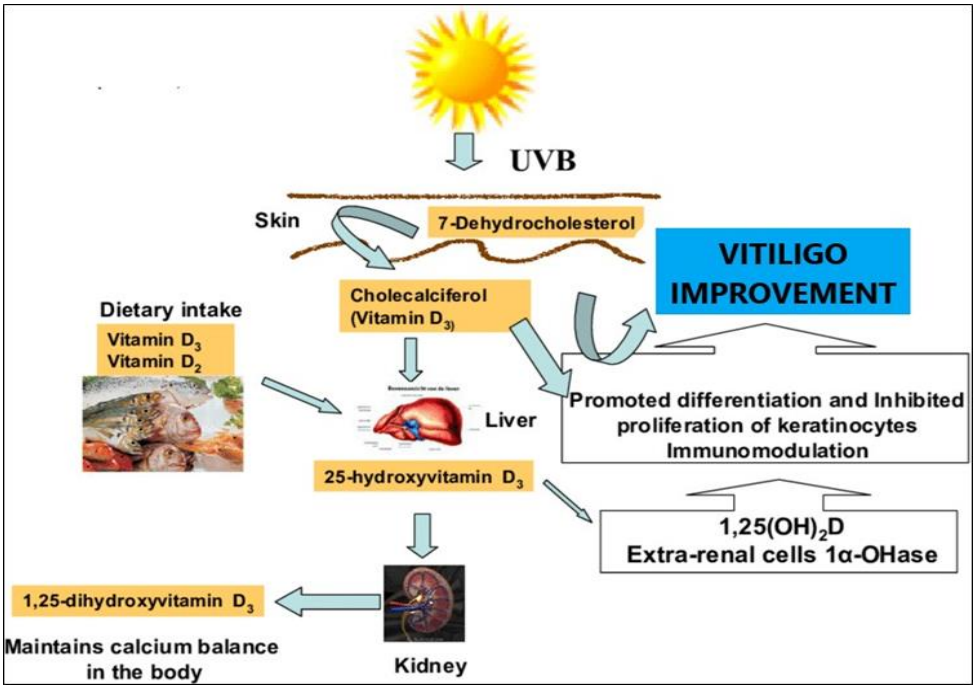

Figure 2 Mechanism of vitamin D participation.

The necessary amount of vitamin D per day will be subject to age since the requirements vary proportionally according to the age range of the patient. In the first year of life 400 IU are required, 1 year to 70 years the amount increases requiring 600 IU per day, in the population that is older than 70 years 800 IU per day is needed, but these values may change depending on the guide or organization that raises it, for example the American Endocrine Society states that the first year of life there is a requirement of 400 to 1,000 IU/day and for the population that exceeds this age range was established the need 600-1,000 IU/day (table 1) [4].

Table 1 Vitamin D requirement per day

	The Institute of Medicine (IOM)	**American Endocrine Society**
< 1 year of life	400 IU /DAY	400-1000 UI/DAY
1 year- 70 years	600 IU /DAY	600-1000 UI/DAY
> 70 years	800 IU /DAY	600-1000 UI/DAY

Regarding the optimal vitamin D ranges, they also vary depending on the society or institute that establishes it, the Institute of Medicine (IOM) establishes that the levels of this provitamin to maintain optimal health should exceed 20 ng/ml, On the other hand, the American Endocrine Society establishes that levels below 20 ng/dl are called deficiency, and for values between 20 and 30 ng/ml, it is considered as insufficiency, highlighting ranges greater than 30 ng/dl as optimal or sufficient values to be able to fulfill the physiological tasks of vitamin D (Table 2) [5].

Table 2 Vitamin D levels according to societies

	The Institute of Medicine (IOM)	**American Endocrine Society**
Optimum level	>20 NG/DL	>30 NG/DL
Insufficiency	< 20 NG/DL	20- 30 NG/DL
Deficiency	< 20 NG/DL	< 20 NG/DL

Usually when there is a vitamin D deficiency, it is the result of an incorrect diet, alterations in absorption, an increase in the need or an increase in excretion. In this case, vitamin D deficiency can be due to several factors, when vitamin D

intake is decreased for a long time, limiting the time of exposure to sunlight, inability of the kidney to synthesize the active form of 25(OH) D, impaired absorption process in the digestive tract, generally deficiencies associated with the diet are in cases of people who are allergic to milk, vegan diets and lactose intolerance. Vitamin D deficiency can be due to a lack of vitamin D. Vitamin D deficiency can also be due to a lack of vitamin D in the body.

The varied characteristics of the population are also important factors that alter the production of vitamin D at the skin level, among them are age, due to the deterioration of the skin over time, so that older adults have thinner skin, which reduces the ability to synthesize vitamin D, also influences the way of dressing, the place of work, quality of life and the different measures used over the years to limit sun exposure generally have a great impact on the synthesis of vitamin D [6].

The production of this provitamin is conditioned by the Fitzpatrick prototype (Table 3), body mass index (BMI), sex of the individual, polymorphisms in the receptor of this vitamin, and includes environmental factors such as time of day, season, latitude, geographical position, climate change, air pollution, among others. Serum levels of 25- hydroxyvitamin D is a good indicator of the vitamin D status, as it evidences the contributions derived from cutaneous and oral synthesis. Serum levels of 25-hydroxyvitamin D is a good indicator of the vitamin D status, as it evidences the contributions derived from cutaneous and oral synthesis.

The alteration of vitamin D levels has been associated with different cutaneous, neoplastic, autoimmune, musculoskeletal, and cardiovascular pathologies. In dermatology, vitamin D levels are altered in melanoma and non-melanoma skin cancer, psoriasis, ichthyosis, vitiligo, blistering diseases, scleroderma, systemic lupus erythematosus, atopic dermatitis, acne, and alopecia and photo dermatosis.

Vitiligo stands out as one of the most common acquired dyschromia, a melanocytopenic leukoderma, i.e. a hypochromic discoloration of the skin, affecting about 0.06 to 2.3% of the world's population India is the country with the highest incidence rate with 8.8%, followed by Mexico and Japan. It can manifest itself in any age range, but has a higher incidence in the first 20 years of life, it has no racial predominance, some literatures speak of no gender preference, but there is another that speaks of a slight predominance in women.

Vitiligo is clinically manifested by macules or acromic spots at cutaneous and mucosal level, this is generally due to the lack of melanocytes, and this could spread to anybody area or follow the dermatomes. Vitiligo can be localized or generalized, each of these has its own characteristics (Table 3) and can also be classified as progressive or stable depending on the clinical activity of the disease [7].

Table 3 Clinical classification of vitiligo according to its extent

Localized Vitiligo	Generalized Vitiligo
Focal: Macules and spots limited in number and extension without segmentaldistribution.	Vulgar: the pattern is symmetrical and progressive with inclination to periorificial regions (eyelid, mouth and genitalia), extension areas, interphalangeal joints, elbows and knees.
Segmental: Unilateral following the distribution of the dermatomes, respecting the midline.	Acrofacial: lesions located on distal portions of the extremities and face.
Mucosal: this has predominance by the mucous membranes, especially the gums.	Mixed: it is the combination of the acrofacial pattern with the vulgar pattern. And/or segmental.
	Universal: it is the total or almost total involvement of the body surface. It usually has a slow progression, may be stable, and there may be spontaneous repigmentation.

Vitiligo is a complex alteration, product of a reduction of melanocytes of multifactorial origin, the possibility of a joint or individual participation of these factors is established, and among them we find neurogenic, autoimmune, metabolic, and self-destructive mechanisms in patients with genetic predisposition (Table 4). Several theories have been established to determine the pathophysiology of vitiligo and the processes leading to melanocyte deficiency [8].

Table 4 Theories on the pathophysiology of vitiligo

Genetic Predisposition	
Biochemical theory	Altered redox state coupled with melanocytedamage
Neural theory	Increased sympathetic response and catecholamine/neurotransmitter-mediatedmelanocyte damage
Melanocytorrhagia	Impaired melanocyte adhesion
Convergent theory	This brings together all the mechanisms, statingthat they act jointly or individually.

Despite the different theories there is no fully accepted mechanism, it has also been established that vitamin D deficiency is a possible cause, and an aggravating factor in the clinic. This theory is explained by the role of calcitriol in the skin pigmentation process.

Calcitriol promotes the formation of ceramide from sphingomyelin, at the same time ceramide increases the pro-differentiating activity of calcitriol within keratinocytes generating a feedback loop. The physiological concentrations of calcitriol prevent the pro- apoptotic action of ceramides, tumor necrosis factor α (TNF-α) and UV radiation levels, which generates an anti-apoptotic activity, stimulates the excitation of melanocytes and keratinocytes, increases the process of melanogenesis and the amount of tyrosinase contained in human melanocytes, thus establishing its role in skin pigmentation. Vitamin D preserves the melanin unit at the epidermal level and restores the well-being of melanocytes through various processes, including activation, the proliferative mechanism, migration of these cells and pigmentation by controlling the excitation of T cells, which are supposedly associated with melanocyte injury in this disease. Vitamin D is also involved in the development of melanocytes in the epidermis. Vitamin D is also involved in the development of melanocytes in the epidermis [8].

4. Discussion

In a case-control study conducted by Saleh et al, It was evaluated whether there is correlation between vitamin D levels in patients with vitiligo, which concluded that patients with vitiligo if they have vitamin D deficiency, but when compared with patients who in addition to vitiligo have autoimmune diseases these had serum concentrations of 25 (OH) D is lower than in patients with vitiligo without autoimmune disease, On the other hand, a study that sought to look at the relationship between serum vitamin D concentrations and the clinical extent of vitiligo concluded that vitamin D levels and the extent of the affected body surface area are not related, but about 60% of the population studied showed a decrease in serum vitamin D concentration [9].

5. Conclusion

Natural vitamin D metabolites have been found to contribute to the normal functioning of major human organs (including the skin) and play an important role in the production of cutaneous melanin. To date, the results of studies on the relationship between vitamin D deficiency and the development of vitiligo are contradictory; however, there is a strong tendency to associate hormone levels with vitiligo. Thus, a relationship is proposed that may guide the understanding of the origin, pathophysiology, especially autoimmunity and, to some extent, the use of vitamin D3 supplementation in the future.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare no conflicts of interest.

References

[1] Andrea Castaño-Villegas,1 Catalina Moreno-Zuluaga,1 Andrés Rangel Martínez- Villaba,2 Leonardo Medina Alvis,3 Oscar Jairo Valencia-O campo3. Serum vitamin D concentrations and their association with clinical severity of vitiligo in patients attending a phototherapy service. Dermatol Rev Mex. 2020; 64(2): 129-143.

[2] Castaño Villegas A, Moreno Zuluaga C, Medina Albis LJ, Valencia Ocampo SJ. Vitiligo and vitamin D. Journal of the Colombian Association of Dermatology and Dermatologic Surgery. 2019; 27(1): 36-51.

[3] García-Galaviz R, Díaz-González J, Cano-Aguilar L, Domínguez-Cherit J. Current use of vitamin D in dermatology. Medicina Cutánea Ibero-Latinoamericana. 2019; 47(3): 170-177.

[4] Navarro-Triviño F, Arias-Santiago S, Gilaberte-Calzada Y. Vitamin D and the skin. A review for dermatologists. Actas Dermo-Sifiliográficas. 2019; 110(4): 262-272.

[5] Ana García Gil, Karen Sánchez Armendáriz, Judith Domínguez Cherit. Vitamin D in dermatology: a review of the literature. CMQ Dermatology. 2013; 11(4): 270- 276.

[6] Saudi, W. M., Swelam, M. M., El-Barbary, R. A., Zakaria, L., & Gaber, D. A. Vitamin D receptor (VDR) gene polymorphism in Egyptian vitiligo patients. Journal of Cosmetic Dermatology, 2021; 20(3), 980-986.

[7] Zhang JZ, Wang M, Ding Y, Gao F, Feng YY, Yakeya B, Wang P, Wu XJ, Hu FX, Xian J, Kang XJ. Vitamin D receptor gene polymorphism, serum 25-hydroxyvitamin D levels, and risk of vitiligo: A meta-analysis. Medicine. 2018; 97(29): e11506.

[8] Varikasuvu, S. R., Aloori, S., Varshney, S., & Bhongir, A. V. Decreased circulatory levels of Vitamin D in Vitiligo: a meta-analysis. Anais Brasileiros de Dermatologia, 2021; 96, 284-294.

[9] Mostafa WZ, Hegazy RA. Vitamin D and the skin: Focus on a complex relationship: A review. *Journal of advanced research*. 2015; 6(6): 793-804.