

Original Article

Vitamin D and human journey

Shakiba M^{1*}, Shakiba SH²

¹Children Growth Disorder Research Center, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

²Medical Pharmacist

Abstract. Herein, we propose a hypothesis for the low level of vitamin D as a sign of untimely relocation of humans during history. This improper displacement made the human species prone to infectious and noninfectious diseases during the life journey. The low level of vitamin D is a sign that needs to be addressed as a marker of an unsafe journey in a lifetime, not the cause for associated diseases, and the replacement of vitamin D is the least performed in this regard.

Keywords: Vitamin D deficiency, movement, vitamin D supplementation, indoor activity

Introduction

Life has begun to evolve in the oceans over 1 billion years ago. Phytoplankton, as an earlier habitant of the earth, took advantage of sunlight and used it as an energy source to generate carbohydrates. In order to protect the important components of cells, such as deoxyribonucleic acid, ribonucleic acid, and amino acids with double bonds from the phototoxic wavelength of ultraviolet B (290 nm), in this tiny factory of photosynthesis, vitamin D was produced to act as a sunscreen [1]. On the other hand, the adequate level of this the hormone was a photochemical signal encouraging organisms to start a "safe journey" from the surface to the deep ocean in order to prevent excessive exposure to the phototoxic dosage of ultraviolet B (i.e., a signal for timely relocation and protection) [2].

Vertebrates and Vitamin D

All vertebrates need vitamin D for movement and healthy skeleton and produce vitamin D through skin exposure to the sun or consumption of precursors from sea staff eating phytoplankton in their food chain or from plants [3]. This skeleton gives the ability to vertebrates that move freely and sometimes settle in places that are not optimal for vitamin D production.

Humans and Vitamin D

Vitamin D has had a huge impact on the evolution of human skin color. By gradual movement toward higher latitude from the equatorial area, only females who had evolved to lighter skin were able to produce enough vitamin D and have normal pelvis anatomy to normally deliver a healthy neonate; females with a low level of vitamin D (probably dark skin with a low level of vitamin) were

excluded from the reproductive cycle due to maternal complications [4]. This is the reason that the residents of northern latitudes have lighter skin color at present. Skin pigmentation is determined by one favoring photo-protection close to the equator and another favoring vitamin D production closer to the pole.

Two other histories from human *movement* and vitamin D go back to the industrial revolution. In the 16th century, the majority of large cities in Europe hosted people who migrated from rural to urban areas. This *movement* was accompanied by living in homes close to each other. However, coal consumption made cities heavily polluted. Reports showed that more than 80 % of children in these cities had rickets [5].

In 1822, a century before Hess's discovery of sunlight exposure as a treatment of rickets (1923), Sniadecki in Warsaw, Poland, said that a lack of sunlight was the reason for diseases taking a hundred years to be accepted [5]. In the 1980s, when tuberculosis was regarded as an incurable and noninfectious disease and killed more than 20% of individuals in Britain, George Bodington (1799-1882) had stated that "those, such as shepherds and farmers, working in rural areas did not usually get the disease". He advised individuals to follow the lifestyle of the individuals who were immune to the disease [6].

The forced movement of blacks is another history of human *movement* and vitamin D. The slave trade took blacks out of Africa and settled them, among other places, across North America, Canada, and Northern Europe, where for months of the year, sun rays stroke less directly, drastically reducing the amount of sunlight to those whose skin was not adapted and unable to make adequate vitamins D. At that time, medical reports described a disease that is

*Corresponding author: Mehrdad Shakiba (shakiba@ssu.ac.ir)

similar to hypocalcemia of vitamin D deficiency, which was called "negro diseases" observed in black slaves after a period of settling; with neurological symptoms and psychosis, they were also prone to many infectious diseases [7]. The reason was the untimely relocation and fast *displacement* of blacks from one continent to another continent that I would call "*slavery diseases*". Through time, human adaptations to different solar beams have become more cultural than natural. Rapid human migrations with the industrial revolution, increase in urbanization in modern life, and changes in lifestyle have created mismatches between skin pigmentation and environmental conditions [8].

Although vitamin D deficiency was noticed more commonly in blacks and immigrants, it is not currently limited to them and includes all races of black, white, and yellow. Moreover, it is not limited to one continent as it is pandemic.

Can vitamin D deficiency again be a sign of inappropriate human displacement from one place to another places? *Can vitamin D deficiency be an alarming signal for an unsafe mankind journey from outdoor to indoor?* The evidence has shown that indoor activities and lack of sun exposure are the risks for premature deaths, such as obesity, smoking, and inactivity [9, 10].

It will be more important when we realize that during sun exposure, several other byproducts are produced in the skin, such as lumisterol and tachysterol, with anti-proliferative and anti-inflammatory effects, and regulate epidermal growth. In other words, vitamin D production is only 15% of byproducts that are produced during solar exposure, and other photoproducts have other benefits which will turn out in the future [11]. The prescription of a vitamin D supplement to normalize 25-hydroxyl vitamin D is a very simplistic approach to the problem that has been occurred several times in history.

During the last 30 years, the association of low level of vitamin D with several non-skeletal diseases from migraine to cancers was observed; however, in trials of vitamin D supplementation, there were minimal observed effects or still doubts over its benefit; this evidence may demonstrate the low level of vitamin D as a marker and indicative of association, not the major cause for the above-mentioned diseases [12, 13].

Hundred years ago, the world had the experience of a viral pandemic costing the lives of more than 50 million individuals. A brilliant physician in the Massachusetts State Defense Force observed that the outdoor treatment of patients with fresh air and plenty of exposure to the sun decreased mortality and medication consumption. The low level of vitamin D is now believed as a risk factor for the aforementioned disaster [14, 15].

New experience with coronavirus disease 2019 (COVID-19) again highlighted "the low level of vitamin D as a risk factor for severe diseases and mortality"; nevertheless, patients need the modality of treatment only available in places in which there is no direct sun exposure. In addition, the governmental policy for lockdown limits outdoor activities and sun exposure [16]. It is worthy of mentioning that a lack of outdoor activities is the main reason for the low level of vitamin D synthesis. The

countries, such as Uganda, with a high level of outdoor physical activities, had a low prevalence of the disease and a very low level of mortality from COVID-19. The data from the World Health Organization has also shown a trend of low levels of physical activities and severity of COVID-19 [17-20].

At the beginning of life, adequate vitamin D was a signal for a safe journey in phytoplankton, enabling vertebrates to move freely. History reveals that this movement and displacement of humans from one continent to another, rural to urban, was accompanied by a low level of vitamin D making humans prone to some diseases. If humans have adequate sun exposure and do not receive any vitamin D supplement, then an adequate level of 25-hydroxyl vitamin D (>30 ng/dl) would be a marker of the optimal benefit of sun exposure and adequacy of outdoor activity.

The low level of vitamin D is a signal that the life journey is not safe and humans have been improperly displaced. Furthermore, humans are prone to the diseases that slaves get. Vitamin D deficiency should make humans think again and wonder where they have moved earlier in their daily lives, although taking vitamin D is the least that should be performed. Huge human costs might be the result of ignoring this message of nature and history.

Conflict of interest

The authors declare no conflicts of interest.

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