Can we Depend on Sunshine for Vitamin D? A Mini Review and Historical Perspective

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Abstract

Worldwide studies have confirmed that vast population globally is suffering from vitamin D deficiency that can be linked to not only calcium and bone metabolic disorders, but also to diabetes, hypertension, rheumatoid arthritis and multiple sclerosis. Traditionally, inadequate sunlight exposure was implicated in Vitamin D deficiency. However, recent studies from the Middle East and other countries suggest the contrary and thus unreliable. Test based diagnostics remain the most desirable way to prevent and treat Vitamin D deficiency rather than relying on sunshine.

Keywords: Vitamin D, supplementation

In 1650, Francis Glisson, a Cambridge physician, published in Latin a treatise on rickets titled “De Rachitide.” Glisson’s work remains a classic among medical texts. Glisson’s report on rickets was based on clinical and postmortem experience. Glisson’s treatise addresses the clinical features of rickets in a scientific tone. Glisson was convinced that rickets was neither contagious nor heritable. His conclusions regarding the relationship of age to onset of rickets has stood the test of times [1].

In late 1890, a Scottish physician Dr Palm, made remarkable observations on the incidence of rickets and its geographical distribution. He spent 10 years in Japan, where he noted that rickets was essentially absent. Back in England, he was intrigued by the very high prevalence of rickets. Rickets abounded in the UK in large towns and industrialized regions: Glasgow and Edinburgh and the coal-bearing regions of the country. Both cities were hazy and smoggy, and the air was filled with soot. It was also an area with the highest prevalence of rickets.

Palm was intrigued to note that children in tropical zones were exposed to filth, poor sanitation and unsafe water, yet they were free of rickets. Medical missionaries from China, Mongolia, Kenya, India, Morocco and Ceylon did not encounter rickets. Palm came to the conclusion that “the geography of rickets appears to involve the temperate latitudes of Europe: Germany, England, Holland, Belgium, France and northern Italy but southern Italy, southern Spain, Turkey and Greece with greater sunshine “enjoy a notable immunity from it.” Exposure to plenty of sunshine, which was the norm for infants residing in the tropics, was responsible for their protection against rickets. In 1889, Palm recommended “systematic use of sun-baths as a preventive and therapeutic measure in rickets.” However, Palm’s observations and recommendations were ignored by the medical world [2].

In 1916, Harry Steenbock, a Professor of Biochemistry at the University of Wisconsin, USA while working on goats found that they were in positive calcium balance when kept in summer sun outdoors, but when kept indoors in the winter in the absence of sunlight, they went into negative calcium balance. Steenbock had then mentally made a connection between sunlight and calcium retention. With this background, Steenbock began to irradiate rats, and their food with UV light. He found that irradiation of not only the rat but also their food could prevent or cure rickets. This led to the industrial irradiation of milk to increase its antirachitic property [3].

In the light of all these reports, the knowledge of anthracitic property of sun shine led to disappearance of rickets and osteomalacia from most parts of the world, by the middle of 20th century. However, the existence of subclinical deficiency of vitamin D remained unknown till a method was developed for the estimation of 25(OH)D. Probably, the first reports of vitamin D insufficiency appeared from the UK. Three group of workers reported low levels of 25(OH) in pregnant Asian immigrants [4-6]. The authors attributed the vitamin D deficiency to inadequate solar exposure due to geographical location of the country, coupled with deficient dietary intake of the vitamin. Subsequently, a large number of reports demonstrated the existence of vitamin D-deficiency not only during pregnancy but also in non-pregnant females and even males. Reports of vitamin D deficiency in males and females appeared from tropical countries such as India [7,8], Pakistan [9], Bangladesh [10], UAE [11], and even Africa [12]. In these countries, sunshine is available almost throughout the year. Therefore, the role of various factors that determine the availability of UV radiation from solar exposure needs to be analysed.
It should be appreciated that all sunshine does not lead to cutaneous vitamin D synthesis. Only radiation energies between 290 and 320 nm are most effective [13]. Because of the complex mechanism of vitamin D3 production in the epidermis, the amount of solar exposure required for providing vitamin D adequate for the body’s requirements varies in different individuals and under different conditions. The photosynthesis of vitamin D3 depends upon:

i. The surface area of the skin exposed to sunlight

ii. The time of the day of exposure (UV radiation is most intense between 11 AM and 2 PM)

iii. The amount of melanin pigment present in the epidermis

iv. Latitude (UV radiation is most intense at the equator)

v. Season (in winter less UV radiation reaches the surface of the earth)

vi. Environmental pollution such as smoke, fog and dust prevent UV radiation from reaching the earth [14].

Probably because of all these factors, unrealistically long exposure times seem to be required to obtain recommended vitamin D doses through skin [15].

Worldwide studies have confirmed that vast population of the world is suffering from vitamin D deficiency. Clinical implication of this fact lies in the reports that have implicated vitamin D deficiency not only in calcium and bone metabolic disorders, but also in type I diabetes [16,17] type II diabetes [18], hypertension [19] rheumatoid arthritis [20] and multiple sclerosis [21]. Furthermore, vitamin D is known to play a role in the human antimicrobial response [22].

Conclusion

The solar exposure incidental to the day-to-day activities of most of the populations seems to be inadequate for their vitamin D requirement, and therefore hypovitaminosis D is a global problem. A controlled multi-centric trial might provide necessary insight for knowing what dose provides vitamin D sufficiency, without raising 25(OH)D3 to toxic levels. Currently, the most desirable way to prevent and treat Vitamin D deficiency related symptoms would thus remain blood test-based diagnostics and then appropriate supplementation rather than relying on sunshine.

References


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