



CODEN [USA]: IAJ PBB

ISSN: 2349-7750

**INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES**<http://doi.org/10.5281/zenodo.3612421>Available online at: <http://www.iajps.com>

Review Article

VITAMIN D DEFICIENCY AN ARTICLE REVIEW¹Dr Farah Rao,²Dr Hafsa Shabbir,³Dr Zamara Hamid^{1,2} MBBS, Nawaz Sharif Medical College, Gujrat., ³MBBS, Shifa College of Medicine, Islamabad.**Article Received:** November 2019 **Accepted:** December 2019 **Published:** January 2020**Abstract:**

Vitamin D deficiency reported as musculoskeletal pain it is the most common condition which has less awareness but extensively spread in outdoor and indoor rehabilitation units. Many studies have reported that there is significant improvement when normalizing vitamin D in musculoskeletal symptoms including low back pain. Diagnosis of vitamin D deficiency is rarely made by clinicians in the rehabilitation environment. However, it is precisely this population that may be at particular risk for this diagnosis. Moreover, many of the signs and symptoms that are found in this patient population could, in part, be a result of vitamin D deficiency, and these symptoms might be ameliorated by vitamin D replacement therapy.. It is therefore incumbent on physicians to consider this diagnosis in this population, obtain the appropriate diagnostic evaluations, and ensure that appropriate replacement therapy is offered to any patient requiring it. Clinicians should be especially vigilant when treating at-risk populations and should consider screening patients who present with skeletal complaints such as nonspecific muscle pain, bone pain, and muscle weakness. The rehabilitation setting is the ideal setting to study vitamin D deficiency. Further research is needed to address the prevalence of vitamin D deficiency in the pain population, including those that have MRI findings such as spinal stenosis and degenerative disc disease. The inpatient rehabilitation population could also be invaluable in determining the effect of vitamin D deficiency on muscle strength, pain, and recovery from extended hospitalization. The effect of replacement therapy in this population could also shed considerable light on the potential functional benefit that could result from the proper diagnosis and treatment of vitamin D deficiency.

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Please cite this article in press Farah Rao et al., *Vitamin D Deficiency An Article Review.*, Indo Am. J. P. Sci, 2020; 07(01).

INTRODUCTION:

In the general population according to the studies there is 25% incidence of vitamin D in the general population and more than 40% in the older population. Literature has reported that initially vitamin D deficiency reported as musculoskeletal pain it is the most common condition which has less awareness but extensively spread in outdoor and indoor rehabilitation units. Many studies have reported that there is significant improvement when normalizing vitamin D in musculoskeletal symptoms including low back pain [1].

Because the rehabilitation professional is likely to encounter patients with vitamin D deficiency, it is essential to understand the mechanism of deficiency, the population affected, and the potential treatments. Because the rehabilitation center is the main field who treats the patient who are suffering vitamin D deficiency. Sufficient amount of Vitamin D can be acquired directly from the sun even minimum sun exposure providing 90 –100% of the required vitamin D. Vitamin D deficiency is a double problem [2]. The first component is that when sun exposure is limited, dietary intake of vitamin D often falls below the recommended daily allowance (RDA) because vitamin D-rich sources such as eel and cod liver oil are not mainstays in many cultures' diets [3].

Primary element is minimum exposure to the sun because vitamin D-rich sources such as eel and cod liver oil are not main concerns in many cultures' diets dietary intake of vitamin D often falls below the recommended daily allowance (RDA). Second main element is that RDA does not guarantee the vitamin D deficiency. Literature has reported that more than 32% patients were deficient even after the use of more than 400 IU of vitamin D per day [4]. The population who have decreased sun exposure are more prone to have vitamin D deficiency. This may contain the homebound elderly, people with highly pigmented skin, people who live in wintertime in climates above and below latitudes of 35 degrees, and those whose cultural and societal beliefs limit sun exposure. Another group of people who are suffering from Crohn's disease and malabsorption or gastric stapling are more prone to have vitamin D deficiency [5].

Due to decrease absorption in the small intestine vitamin D deficiency could occur.

Number of sign and symptoms presents as a result of vitamin D deficiency. It may contain muscle weakness, back pain muscle pain and bone pain.

Literature has reported that by treating these symptoms patients have reported marked increase in their muscle strength more over patients have reported no pain after having treatment from vitamin D. The chances of having toxicity from vitamin D replacement therapy is very low.

METHODS:

By using the search engines such as PubMed, Cochrane library and Google scholars and the terms was used vitamin D deficiency, Musculoskeletal pain, chronic pain and osteomalacia. The search showed 109 articles in which 65 articles were relevant which were included. Whereas excluded articles were away from the study such as review articles on rickets, manifestation of vitamin D or articles which were other than from English language. 13 articles abstract was not reviewed in English language.

After review of the articles, 53 articles were included in the study. The remaining 9 articles were excluded because they were either irrelevant or review articles or on manifestations of osteomalacia not pertaining to musculoskeletal pain.

The Mechanism of Vitamin D Absorption and Activation:

There are two ways of vitamin D absorption; first is direct exposure to the sun light and other is via food or vitamin supplements. When the body absorbs vitamin D, it must be metabolized by both liver and the kidney before its conversion into the calcitriol which is the final product. Vitamin D absorption through dermis demands ultraviolet rays of wavelength between 290 and 315. Previtamin D3 is formed by activated precursor of 7-dehydrocholesterol. It is then transported to the liver through the bloodstream and hydroxylated into 25 dehydroxyvitamin D. [6]

It is then transported to the kidney and hydroxylated again to 1, 25 dihydroxyvitamin D, otherwise known as calcitriol. In this form, it performs its well-known function of calcium homeostasis. When ingested, vitamin D comes in two forms, vitamin D2 and vitamin D3. Both forms are fat-soluble vitamins and are absorbed in the small intestine. [7]

Then, the vitamin is transported to the liver and enters the same pathway of hydroxylation as sunlight sources of the oral sources, vitamin D3 has been found to yield 70% higher serum levels than vitamin D2. During winters as the sun angle use to change and direct sunlight reduces it results in decrease vitamin D absorption [9]. In many other countries

where temperature exceeds in summer the angle of sun is still sufficient to provide vitamin D even in winters because of the longer days and the atmosphere is more praising to direct sunlight exposure.

These are important studies because medical conditions as cofounders are reduced. These studies include internal medicine residents in Portland with a 52% decrease in winter, healthcare professionals in Boston with a 35% decrease, and adolescents in Bangor, ME with a 48% decrease [10]. Skin pigmentation has also been shown to play an important role in vitamin D deficiency. Melanin, which is found in higher levels in people with more skin pigmentation, blocks the absorption of ultraviolet B rays. Goswani et al. found a dramatic difference between pigmented and depigmented persons.[11]. The African American population is at great risk because of the large amount of melanin in their skin. When comparing African American women with white American women, Harris and Dawson-Hughes found that African American women's levels of vitamin D were half those of age-matched white women regardless of season [12]. Cultural reasons play an important role for Muslim women who remain veiled when outside and who, as a result, are at high risk of vitamin D deficiency. Veiled Arab women living in Denmark had an average vitamin D level of 7.1 nmol/liter compared with 47.1 nmol/liter for native Danish women. Elderly people, especially homebound or nursing home patients, are at increased risk because they rarely get sunlight [13]. This is exacerbated by the fact that the elderly have a twofold decrease in the ability to produce previtamin D₃ in the epidermis, placing them at even greater risk to develop deficiency if they do not double their consumption of vitamin D. Even young healthy people who use sunscreen may be at risk. Sunscreen with a sun protection factor of 8 can eliminate 97.5% of vitamin D absorption from ultraviolet B rays. Those who applied sunscreen 1 hr before ultraviolet B ray exposure did not have any change in vitamin D as opposed to those who did not apply protection. Without any sunscreen, vitamin D levels rose from 1.5–25.6 ng/ml, with only one minimal erythema dose.

Many gastrointestinal disorders can cause deficiency because vitamin D is absorbed by the ileum [14]. Many disorders such as Malabsorption syndromes such as Crohn's disease and celiac sprue are important causes, and gastric stapling has also been correlated with vitamin D deficiency. As now days people are more concern about their weight loss the

overall importance of these conditions as a source of vitamin D deficiency is increasing.

The patients who are complaining about their musculoskeletal problems and their sun exposure is also minimum the clinicians must be aware of their vitamin D level. A study was which was conducted on gastrointestinal disorder endorse these points. 17 participants who were having gastrointestinal disorder, the serum vitamin D level was > 15 mg/mol whereas 14 of them having less than 10. [15] Major population who are at risk in the current era is those who are obese. Obesity is also the major factor of having vitamin D deficiency because fat is stored in fat tissue rather than circulating in the bloodstream.

Many studies have reported bone pain and muscle pain are the main key symptoms of vitamin D deficiency. 93% of patients who are presenting to clinical settings are always present with nonspecific low back pain which turn out of having vitamin D deficiency.

Study has reported presented five cases of severe lower-leg and back pain as well as hyperesthesia after 6 months or more of confinement to home or hospital. Al Faraj and Al Mutairi did an extensive study on patients presenting to internal medicine and spinal clinics with back pain [16]. Many case studies have shown improvement of lower-extremity and back pain with the treatment of vitamin D. Al Faraj and Al Mutairi found that 100% of patients with vitamin D deficiency had complete resolution of pain when their vitamin D levels were normalized. However, the study excluded patients with disc prolapse, spinal stenosis, and degenerative disc disease found on CT and MRI. Treatment with 10,000 IU/wk of ergocalciferol intramuscularly and 400 – 600 IU/day of ergocalciferol reduced symptoms within one and a half months [17]. Gloth et al. presented five cases of severe lower-leg and back pain and hyperesthesia after 6 mos or more of confinement to home or hospital. The pain was resistant to analgesics but responded to treatment with ergocalciferol. Three studies showed that 50,000 IU/wk of ergocalciferol improved lower-extremity and back pain and also made the patients independent with walking.4,6,9 If adequate levels of vitamin D are not maintained, the symptoms will return [18]. Activities such as time required to dress, time from sitting to standing, hand grip, and leg extension power have all been shown to correlate with 25-OH vitamin D levels. Many health and nutrition surveys have done which showed that an increase in vitamin D serum levels from 22.5 to 40 nmol/liter yielded a significant increase in lower-extremity function,

tested by timed sit-to-stand and walking tests. [19] Ziambaras and Dagogo-Jack [10] reported two patients with muscle aches and lower-extremity weakness who had undetectable levels of vitamin D but who improved within 2 mos of treatment with 50,000 units of ergocalciferol orally per day [20]. The same study found a 9% increase in knee extensor strength and an 11% increase in the timed up-and-go test.

Musculoskeletal pain is commonly seen in the rehabilitation setting. In the inpatient setting, many patients arrive after weeks of hospitalization. They often arrive in poor nutritional status, rarely having taken vitamin D supplementation, and many are homebound before the onset of their illness. As was discussed earlier in this paper, these are populations that are at high risk for vitamin D deficiency. Many of these patients also have nonspecific pain complaints that could, in part, be a result of vitamin D deficiency. [21] Rectifying this problem with early intervention could potentially improve patients' muscle strength and mobility and reduce morbidity from their conditions. Study has proven that good muscle strength is directly related with lesser risk of falls and fracture. In clinical settings when the medical practitioners are assessing musculoskeletal pain and problems they must keep in mind about the vitamin D status. In particular, vitamin D deficiency should be considered in patients with low-back pain but with no MRI findings, or in healthy patients with leg pain or unexplained proximal weakness.

Diagnosis of vitamin D deficiency is rarely made by clinicians in the rehabilitation environment. However, it is precisely this population that may be at particular risk for this diagnosis. Moreover, many of the signs and symptoms that are found in this patient population could, in part, be a result of vitamin D deficiency, and these symptoms might be ameliorated by vitamin D replacement therapy [22]. It is therefore incumbent on physicians to consider this diagnosis in this population, obtain the appropriate diagnostic evaluations, and ensure that appropriate replacement therapy is offered to any patient requiring it. Clinicians should be especially vigilant when treating at-risk populations and should consider screening patients who present with skeletal complaints such as nonspecific muscle pain, bone pain, and muscle weakness. The rehabilitation setting is the ideal setting to study vitamin D deficiency [23]. Further research is needed to address the prevalence of vitamin D deficiency in the pain population, including those that have MRI findings such as spinal stenosis and degenerative disc disease. The inpatient rehabilitation population could also be invaluable in determining the effect of vitamin D deficiency on

muscle strength, pain, and recovery from extended hospitalization [24]. The effect of replacement therapy in this population could also shed considerable light on the potential functional benefit that could result from the proper diagnosis and treatment of vitamin D deficiency.

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