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# The role of vitamin D in the development and prevention of migraine: a review

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ABSTRACT

Introduction and Purpose

Migraine is a widespread neurological disorder characterized by severe, pulsating headaches often accompanied by nausea, vomiting, and hypersensitivity to light and sound. Although its exact cause is still under investigation, recent studies suggest that vitamin D deficiency may play a role in migraine occurrence and severity. Vitamin D, known primarily for its role in bone health, also affects the nervous and immune systems, and may influence inflammatory processes involved in migraine pathogenesis. This literature review aims to explore the relationship between vitamin D supplementation and the frequency and intensity of migraines, and whether supplementation could support migraine treatment.

Material and Methods

A comprehensive literature review was conducted using the PubMed database, focusing on articles published until the end of 2023. The search included the keywords: "vitamin D," "migraine," "headache," and "supplementation" in various combinations. Relevant studies were selected based on criteria such as monitoring vitamin D levels and the use of supplementation as an intervention in migraine patients.

Results

The results of the review suggest that vitamin D deficiency maybe associated with an

increased frequency of migraines. Supplementation with vitamin D was linked to a reduction in both the frequency and severity of migraines. While not all studies were consistent, the majority indicated that supplementation had a positive impact, particularly in individuals with vitamin D deficiency.

Conclusions

The findings suggest that vitamin D deficiency could be a risk factor for migraines, and that supplementation with vitamin D may help reduce the severity and frequency of migraine attacks. Although further research is required to establish optimal dosages and treatment protocols, vitamin D supplementation shows promise as a supportive therapy in migraine management.

Keywords: vitamin D, migraine, headache, supplementation Introduction

The primary role of the D switch in the body is the regulation of metabolism and phosphorus. A serious D certificate maybe rickets in infants and children and osteomalacia in adults, but in developed countries it often occurs. More often visible D manifests itself as osteoporosis and susceptibility to minor falls after minor falls.[23] The research found during this time is also included in other data from D. Many studies have shown a connection that comes from the D device and that comes from some autoimmune, civilization and radio diseases. Only part of the vitamin D requirement can be obtained through food. Some are produced by radiation under the influence of radiation. D protection deficiency is a common problem and concerns the general, species and species. groups of people who are more advanced onboard the D device and include people with civilization equipment, e.g.: diabetes or ramp, cardiovascular devices, e.g., arterial hypertension or ischemic heart function, autoimmune devices, allergy devices, on-board devices, and , person from digestion and absorption, disorders of calcium-phosphate therapy and long-term treatment with some, e.g. steroids,

ketoconazole and anticonvulsants and antiretrovirals.[25] D safety deficiency damage beyond the skeletal symptoms that may occur under the operating system system damage or damage. Many studies of these disorders include migraine, the treatment of which is controlled in a way that reduces the quality of life of patients. Migraine treatment is difficult. In some patients and children, classic treatment methods turn out to be ineffective. It is very important to understand the factors influencing the frequency of migraine attacks and to improve preventive treatment inpatients experiencing frequent attacks. The aim of this study is to describe, based on the results of studies, D deficiency and supplementation with the attack and severity of migraine attacks.

Table 1. Assessment of the body's supply of vitamin D based on the concentration of 25(OH)D in serum [27]

| Status | Serum 25(OH)D concentration (nmol/l) | Serum 25(OH)D concentration (ng/ml) |
|---|---|---|
| Deficit | <25 | <10 |
| Deficiency | 25-50 | 10-20 |
| Recommended concentration | 75-200 | 30-80 |
| Toxic concentration | >250 | >100 |

Migraine

Migraine is a primary headache. Its prevalence in Poland, is estimated at about 8%,but its actual incidence maybe underestimated due to the fact that a large proportion of patients do not see a doctor.[24] Migraine is characterized by severe, recurrent, throbbing pain that usually involves one side of the head and can last from 4 to 72 hours. Other symptoms that can accompany migraine include hypersensitivity to light and sound, nausea,vomiting. Some patients may also experience a visual disturbance, known as an "aura," which manifests itself nay usually as zigzag lines or flashing lights that appear before or during a migraine.[22] Less commonly, auras present in the form of numbness in the face or limbs, dizziness and speech disturbances. In a few cases, a temporary and completely reversible weakness of one half of

the body can occur during the course of an aura. In most cases, aura symptoms last from a few to several minutes, but in exceptional cases their duration can be up to 24 hours.[24] Migraine can be divided into two main types: episodic migraine and chronic migraine. Episodic migraine is defined as migraine that occurs for less than 15 days per month. Chronic migraine, on the other hand, is diagnosed when it occurs more than 15 days per month for a period of at least 3 consecutive months. It is worth noting that episodic migraine can progress to chronic migraine, which is often associated with the abuse of certain medications, such as opioids, barbiturates, non-steroidal anti-inflammatory drugs and triptans, and excessive caffeine consumption. In addition, chronic migraine can be associated with other medical conditions, such as obesity, obstructive sleep apnea, depression and anxiety. [22] Migraine treatment can be divided into acute treatment and prophylactic treatment, which aims to reduce the incidence of migraine. In ad hoc treatment, analgesics such as paracetamol, acetylsalicylic acid, nonsteroidal anti-inflammatory drugs, ergotamine derivatives or triptans are often used. If migraine attacks are very frequent and significantly affect the patient's quality of life, preventive treatment is used. For this purpose, various groups of drugs mi: cardiovascular drugs, antiepileptic drugs, such or antidepressants are used.[24]Many studies also indicate the effectiveness of vitamin D supplementation in reducing the frequency of migraine attacks.[6]The treatment of migraine in children is a challenge for doctors. Recent studies of conventional drugs such as propranolol, pizotifen, topiramate and amitriptyline do not show much efficacy in treating migraine in children. In contrast, peripheral nerve blocks and botulinum toxin are gaining popularity for treating migraine in adults. [3] Table 2 Differentiation of headaches[26].

Table 2. Differentiation of headaches [26].

| Type of headache | Tension-type headache | Migraine | Cluster headache |
|---|---|---|---|
| Gender (male:female) | 1:3 | 1:3 | 3:1 |
| Prevalence | 78% | 12% | 0,9% |
| Onset (age of patient) | 20-50 | 20-35 | 20-60 |
| Type of pain | tense | pulsating | piercing |
| Intensity | mild or moderate | moderate or severe | very severe |
| Location | bilateral | unilateral | unilateral |
| Duration of attack | 30 minutes up 7 days | 4-72h<br>aura < 60min | 15-180min |
| Additional symptoms | absence | nausea, vomiting, hypersensitivity to light, sound or smell, aura | conjunctivitis, rhinitis, epiphora, pupil constriction, eyelid drooping, excessive sweating |

Effect of vitamin D deficiency on migraine

One study observed a significant relationship between the incidence of tension headache and migraine and latitude. The frequency of headaches showed an increasing trend with increasing latitude. Studies conducted at different times of the year revealed that headache attacks occurred more frequently in autumn and winter and less frequently in summer. This seasonal profile of migraine attacks correlates with seasonal changes in serum vitamin D levels and the relationship between vitamin D levels and latitude. These findings suggest that low vitamin D levels are associated with migraine incidence.[1] In another study, participants were children suffering from migraine headaches. These children were divided into groups characterized by

high and low sun exposure. The results of this study showed that both the high sun exposure group and the low sun exposure group had significantly lower vitamin D levels compared to the control group.[2] Vitamin D plays an important role in the nervous system and its deficiency maybe a risk factor for many neurological diseases. Observational, cross-sectional and case-control studies have shown an association between low serum vitamin D levels and the occurrence of headaches. This association is not limited to migraine, but has also been observed for other types of headaches, including tension headache, and the study conducted included both adults and children. Another clinical study tested the effects of vitamin D supplementation in migraine patients. Different doses were used, and the observation period was variable. Regardless, patients reported a reduction in seizure counts. In addition, a recent study noted that vitamin D deficiency is more common inpatients suffering from chronic migraine associated with drug abuse compared to patients with episodic migraine or tension headache. The results of this study were from the time of year in which the study was conducted, the patient's lifestyle, and the migraine treatment.[4] Another study conducted on

two different groups of patients provided important information on the relationship between genetically determined vitamin D levels and the risk of migraine. It was discovered that people who have genetically higher levels of circulating vitamin D show a lower risk of developing migraine. The effect was consistent across different types of migraine. In addition, the results suggest that the role of serum calcium levels as a mediator, in the relationship between vitamin D and migraine, is small.[5] Another study examined vitamin D levels in people with migraine and in healthy subjects, and compared the results of oral vitamin D supplementation to placebo. The results of the study indicated a significant association between low vitamin D levels and the occurrence of migraine, and supplementation significantly reduced the number of attacks.[6] A retrospective study of 92 children suffering from migraine also yielded interesting results related to serum vitamin D levels. The patients were divided into two groups: the first had low vitamin D levels and received vitamin D supplementation, while the second group had normal vitamin D levels and received no supplementation. After six months, in the group receiving vitamin D therapy, migraine duration became shorter, migraine frequency decreased, and scores on the Pain Rating Scale and PedMIDAS, which assesses the impact of migraine on daily life, were lower compared to baseline. The conclusion of this study is that there is a clear correlation between migraine in children and vitamin D levels, as well as the benefit of vitamin D therapy.[8] Another study

found that vitamin D deficiency is an independent risk factor for restless legs syndrome (RLS) in migraine patients. The mechanism of migraine chronicity is not yet well understood, but researchers suspect that it maybe related to neurotransmitter imbalances and regulation of inflammatory pathways in the central nervous system, leading to amplification of peripheral pain signals in the central nervous system. The findings suggest complex effects of vitamin D on the nervous system, and that vitamin D deficiency may affect various neurological conditions, including migraine.[9] Vitamin D deficiency may affect various mechanisms related to pain and mental health. Studies indicate that vitamin D deficiency may affect inflammatory pain mechanisms associated with myopathy which may result in migraine exacerbation. Another theory is that vitamin D deficiency may cause symptoms of emotional distress and fatigue inpatients, which likely acts as triggers for migraine and contributes to more frequent migraine attacks.[11] Other studies have shown that patients with migraine and vitamin D deficiency were more likely to have aura, phonophobia, photophobia, autonomic symptoms, allodynia, and pain medication resistance. In addition, there was a statistically significant negative correlation between vitamin D levels and various migraine parameters such as the duration of attacks, their frequency and severity. The conclusion of these studies indicates that vitamin D deficiency has a significant impact on migraine characteristics.[14]
Effect of vitamin D supplementation on migraine

One study on the effects of vitamin D supplementation on migraine divided children suffering from the condition into two groups: the first was treated with topiramate and 5000IU of vitamin D, while the second was treated with topiramate and a placebo capsule. After 4 months of treatment, the first group showed a reduction in seizure frequency, severity and duration compared to the placbo group. These results indicate a clear relationship and the effectiveness of vitamin D supplementation in the treatment of this disease.[7] Another study involved two female patients with frequent and very severe migraine attacks. The inclusion of vitamin D in the treatment resulted in a dramatic reduction in the frequency and duration of migraine headaches in these patients.[10] The frequent coexistence of mental illness and migraine promotes the evolution of episodic migraine to chronic migraine. Studies have been conducted to evaluate the effect of vitamin D supplementation on the severity of depression accompanying migraine. The results showed that vitamin D therapy reduces the severity of depression and may lead to additional psychocognitive benefits in migraine patients.[16] The

mechanism of action of vitamin D depends largely on the type of pain present. Studies have observed that vitamin D supplementation improves patients' quality of life and reduces the severity of pain not only inpatients with migraine, but also inpatients with chronic unexplained pain. Studies suggest that vitamin D can be used as an adjunctive treatment in combination with other medications in migraine headache.[17] In another study, patients taking vitamin D supplementation saw an almost twofold reduction in the number of headache days after 24 weeks of treatment. In the placebo group, the decrease in the number of migraine attacks was much smaller.[18] Another study also observed the effect of vitamin D therapy on migraine attacks. The results indicated a reduction in the frequency of attacks and an improvement inpatients' quality of life, but there was no clear effect on the duration or severity of headaches.[21] Although there is ample evidence to suggest a link between vitamin D deficiency and headaches, especially migraine, this evidence is not sufficient to recommend routine vitamin D supplementation to all migraine patients. Studies indicate that some patients, particularly those with vitamin D deficiency, may benefit from supplementation, which can help reduce the frequency of attacks.[19]

Table 3 Vitamin D supplementation - recommended doses [27]

| Age of patient | Dose (IU/day) |
|---|---|
| Newborns (0-6 months) | 400 |
| Infants (6-12 months) | 400-600 |
| Children (1-10 years of age) | 600-1000 |
| Teenagers (11-18 years of age) | 800-2000 |
| Adults (19-65 years of age). | 800-2000 |
| Seniors (65-75 years of age). | 800-2000 |
| Older seniors (>75 years old) | 2000-4000 |
| Children above the 90th percentile and adults with BMI > 30kg/m2 | Dose double the standard recommended |

Summary

Vitamin D has many important functions in the human body. Recent studies have shown that supplementation and compensation of vitamin D deficiency maybe useful in the prevention

of migraine in both children and adults. The awareness of this issue is very important, given the high prevalence of migraine among patients and the significant reduction in their quality of life. It is worth noting, however, that while there is evidence to suggest an association between vitamin D deficiency and migraine and other neurological conditions, further research, including randomized clinical trials, is needed to more conclusively confirm these relationships and determine the effectiveness of vitamin D supplementation as an adjunctive therapy for migraine. Such studies will help determine the optimal doses of vitamin D and its effect on the risk and severity of migraine inpatients, especially those with vitamin D deficiency.

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