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Vitamin D deficiency and tension-type headaches in children - literature review

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Summary

Introduction

Tension-type headache (TTH) is perceived as bilateral pressure, tension or non-pulsatile mild to moderate headache. The etiopathogenesis of the occurrence of this phenomenon among children has been extrapolated from adult studies. The purpose of this review was to show the association between tension-type headaches and vitamin D deficiency in children based on available literature.

Materials and methods

Systematic review based on the content of PubMed, ResearchGate, and Google Scholar databases was performed. In order to identify relevant publications, a search was performed using a combination of key words: "children", "tension-type headache", "vitamin D", "25 (OH) D". Three studies have been included in our review.

Results

Considering the value of the evidence and the results in peer-reviewed publications, we conclude that there is too little evidence to support the hypothesis that there is a connection between tension-type pains and vitamin D deficiency in children.

Conclusions

Due to the small amount of available literature, research on the effects of vitamin D deficiency on tension-type headaches in children should be continued on a larger scale. Based on the above analysis, we find that there is too little evidence to support the hypothesis that the level of vitamin D affects the development of tension-type headaches in children.

Key words: children, tension headaches, vitamin D, 25 (OH) D.

Introduction

Tension-type headaches are the result of a combination of craniofacial dysfunctions and central nociceptive imbalance. The transformation of episodic pain into a chronic one is attributed to increasing central nociceptive dysfunction [1]. Tension-type headache is perceptible as bilateral tension, tension or non-pulsatile, mild to moderate headache, occurring without deterioration through routine physical effort and without nausea or vomiting. It could appear with both photophobia or phonophobia, but not both at once [2].

In the ICD-10 classification, such ailments are referred to as "Tension-type headache", under the G44.2 code, in the group of diseases of the nervous system [3]. According to the classification of the International Headache Society, several groups of headaches are distinguished: primary ones in which, for example, migraines, tension-type headaches, and secondary headaches that arise in the course of other diseases and others. Tension-type headaches have been divided into 4 groups: infrequent episodic tension-type headaches, frequent episodic tension-type headaches, chronic tension-type headaches and probable tension-type headaches [2]. Infrequent episodic tension-type headaches will occur <12 days a year, frequent episodic tension-type headaches 12-180 days per year and chronic tension-type headaches will be classified when the symptoms persist over 180 days in a year [2].

Few works concern the occurrence of this phenomenon in children but the majority of modern knowledge has been extrapolated from adult studies [4]. Childhood and adolescence are characterized by a stage of rapid growth, emotional maturation, physiological disorders and hormonal changes, all of which may influence the expression of primary headache disorders in people with predispositions [5]. The prevalence of TTH increases with

adolescence [6]. To better understand the phenomenon of TTH, a bio-psycho-social model can be used. This model assumes that three groups of factors (biological/physiological, psychological and social) are equally important, but also subject to mutual influences. In this model, different "levels" of the pain are distinguished [7]. At the central level in the biological sphere are placed physiological processes of the nervous system on the course of which the level of vitamin D has a significant influence.

Many studies have proved an correlation between chronic pain and hypovitaminosis D [8–10]. In the meta-analysis concerning the occurrence of headache an increase in the incidence of headaches with an increasing geographical latitude was noted [11]. One possible explanation may be lower 25(OH)D concentration in the serum in countries at high latitudes due to less sun exposure.

Currently, despite the development of medicine, the influence of hypovitaminosis D on the etiopathogenesis of tension-type headaches in children is little understood. The aim of the review was to determine the relationship between tension-type headaches and vitamin D deficiency in children.

Materials and methods

The material for the study were publications searched by two independent authors who used scientific publications databases: PubMed, ResearchGate and Google Scholar. Publication search was carried out with combinations of the words "children", "tension-type headache", "vitamin D", "25 (OH) D" (according to Medical Sct Headings - MeSH).

Exclusion criteria: case studies, literature reviews, and articles older than 5 years.

After reviewing the searched articles, three studies were included in our review. They are presented in table 1.

Tab. 1. Serach results

Author,	Title,	Materials and Results	Conclusions
Year.			
A. Donmez et al.	Vitamin D status in children with headache: A case-control study.	<p>Materials</p> <p>84 females and 63 males with headache (migraine or tension headache (TTH)) and 69 healthy people between the ages of 5 and 16.</p> <p>Results</p> <p>The levels of vitamin D3 (25 OH) were statistically significantly lower compared to the control group (...).</p>	<p>There may be a connection between vitamin D deficiency and headache, with particular importance in low sun exposure. We suggest that this conclusion be supported by randomized clinical trials containing more samples and controls [12].</p>
2018			
Sonmez F.M. et al.	OP30 – 2317: Vitamin D status in children with headache: A case-control study,	<p>Materials</p> <p>150 patients with headache and 101 healthy people in the control group (5-16 years) were evaluated.</p> <p>Results</p> <p>The levels of vitamin D (25-OH) in the group with headache and headache subtypes (migraine, tension type headache) were significantly lower than in the control group (...).</p> <p>This difference was also observed in the groups of high and low insolation (p <0.05). In addition, the levels were lower in migraine patients than in the control</p>	<p>There is a correlation between vitamin D deficiency and headache, with special importance in the low exposure to the sun. Therefore, the deficiency of vitamin D should be assessed during the study of headache in children [13].</p>
2015			

	group in high insolation and in the group of low-intensity headaches ($p < 0.05$).	
Tozzi E. et al.	Materials	Our study showed a high prevalence of vitamin D deficiency in the pediatric population with headache (56%), in general, migraines without aura. Probably this condition may be directly correlated with the higher frequency of migraine attacks in children with migraine and aura [14].
Vitamin D [25(OH)D] Serum Level on Headache Children	67 males (42%) and 92 females (58%), aged 5-18 years, suffering from headaches, divided into three diagnostic categories, according to the classification migraine with aura, migraine without aura and tension type.	
2016	Results (...)Hypovitaminosis D was found in 56% of children with MWOA, in 50% of patients with MWA and in 44.4% with TTH. 12% of all the sample showed severe Hypovitaminosis D (< 10 ng/ml). There were not statistically significant differences comparing Vitamin D serum levels between male and females in each categories of headache ($p=0.36$), but in TTH there is statistically significance ($p=0.05$) in adolescents and pre-adolescent than children under 10 years and in 25(OH)D serum level in children with migraine without aura compared to patient with migraine with aura and tension type headache ($p < 0.05$).	

The studies were evaluated in accordance with the questions presented in Table 2. Questions for scoring were based on:

- "Cochrane Handbook for Systematic Reviews of Interventions 4.2.6 Updated September 2006", PRISMA 2009 Checklist
- "Advice on how to write a systematic review. JM Wardlaw. 14th January 2010 "

- " The quality assessment tool for the diagnostic accuracy studies (QUADAS) " recommended by the Cochrane Collaboration

Each article was graded from 0 to 2 and the results were saved. The materials and methodology of each selected article has been assessed, and the information is included in Table 3.

Tab. 2. Questions and punctuation

Questions and scoring	
Q1	The size of the test group
	0-9 - 0 pts 10-99 - 1 pt > 100 - 2 pts
Q2	Presence of a control group
	Absence – 0 pts Presence – 2 pts
Q3	Presence of exclusion criteria
	Absence – 0 pts Presence – 2 pts
Q4	Types of headache examined in the studies
	Tension-type headaches and others (>2) – 0 pts Tension-type headaches and one more - 1 pt Tension-type headaches – 2 pts
Q5	Determination of the standard level of vitamin D
	Absence – 0 pts Presence – 2 pts
	≤20 ng/ml - deficiency 21-29 ng/ml - insufficiency ≥30 ng/ml - norm
Q6	Presence of a conflict of interest
	Presence – 0 pts No information – 1 pt Absence – 2 pts
Punctuation:	
0-6 pts - low value of evidence	
7-9 pts – moderate value of evidence	
10-12 pts - high value of evidence	

Tab. 3. Evaluation of publications

Author	Title	Punctuation						Results
		Q1	Q2	Q3	Q4	Q5	Q6	
A. Donmez et al.	Vitamin D status in children with headache: A case-control study	1	2	2	1	2	2	10
F. M. Sonmez et al.	OP30 – 2317: Vitamin D status in children with headache: A case-control study	1	2	2	1	2	2	10
E. Tozzi et al.	Vitamin D [25(OH)D] Serum Level on Headache Children.	1	2	0	0	2	1	6

Results

According to the evaluation criteria adopted in this study, A. Donmez et al. [12] as well as F. M. Sonmez et al. [13] have been assessed as 'high value of the evidence provided' (Table III). The work of E. Tozzi et al. [14] was only assessed as "low value of evidence" (Table III). It is worth noting that the results of all assessed works are consistent with the share of vitamin D deficiency in the development of tension-type headaches in children.

Considering the small amount of available literature, the value of the evidence, the size of the groups, their age, we find that there is too little evidence to support the hypothesis that a deficiency of vitamin D can cause tension-type headaches.

Discussion

All studies presented in the presented review (A. Donmez et al [12], F. M. Sonmez et al [13], E. Tozzi et al [14]) have noted the relationship between vitamin D deficiency and tension-type headaches. The above results are consistent with the latest research by Prakash S.

et al. who studied 100 adults with chronic tension headaches (CTTH). In conclusion, the reduction of serum 25 (OH) D concentration was associated with CTTH [13]. Previous study by Prakash S. et al. also confirms the discussed relationship. In the conclusions, the researchers state that both musculoskeletal pain and headaches can be part of the same spectrum of disease in a subset of patients with vitamin D deficiency (or osteomalacia), and vitamin D deficiency can be an important cause of secondary CTTH [11]. In one of the newer works of Prakash S. et al. in which he presented case studies, he notes that people with headaches and musculoskeletal pain have clearly responded to vitamin D (pain relief). This suggests that musculoskeletal pain and headache in a patient may be part of a symptom, and the cause may be a lack of vitamin D [15].

It is also worth considering what may cause this correlation. Especially in children, a deficiency of vitamin D may result in rickets and, therefore, irregularities in the structure of the skull bones. As a consequence, it can lead to craniotabes with an abnormal texture of the cranial vault [16, 17]. Scientific observation suggests that craniotabes may be the earliest sign of subclinical vitamin D deficiency [18]. Osteomalacia (bones other than the skull) is often manifested in spontaneous body pain and muscle tenderness. That is why Prakash S. et al. they speculate that the headache and tenderness of the muscles (or bones) may be associated with skull osteomalacia [16]. In the works of A. Donmez et al. [12], F. M. Sonmez et al. [13] and E. Tozzi et al. [14] the structure of the skull has not been examined, so the suggested etiopathogenesis of the disease cannot be verified.

In addition to the possible abnormal bone structure of the skull, the link between hypovitaminosis D and tension-type headaches in children can be explained by the fact that the deficiency of the discussed vitamin can cause myopathy and type II muscular atrophy. The disappearance of a certain muscle group can cause muscular disproportional overload of the muscles. As a result, muscle overloads and the formation of myofascial trigger points (TrP) [16, 19]. TrP may additionally sensitize second and third order neurons are known mechanisms for generating pain in patients with CTTH [20]. In the works of A. Donmez et al. [12], F. M. Sonmez et al. [13] and E. Tozzi et al. [14] the presence of TrPs that could be associated with tension-type headaches and the pathology discussed was not examined.

Work of A. Cayir et al. in which the effect of vitamin D on the treatment of migraine in children has been studied, notes that the number of migraine attacks has decreased [21]. Migraines are also qualified for primary headaches which can undoubtedly indicate the effectiveness of therapy also in the treatment of the tension-type headaches.

The reviewed works were characterized by large size of the examined groups, but they were not always focused on tension-type headache. There were various exclusion criteria in the articles or none at all. Undoubtedly, this has affected the result. All the work had the same standard determination of the level of vitamin D in the body. Works of A. Donmez et al. [12] as well as F. M. Sonmez et al. [13] have been assessed as 'high value of the evidence provided' (Table III). The work of E. Tozzi et al. [14] has only been assessed as "low value for

evidence". All three works recognize the association between the level of vitamin D and tension-type headaches in children.

Conclusions

Considering the small amount of available literature, the value of evidence, various groups of high numbers, consistency of results in peer-reviewed publications, the analysis showed that there is little evidence to support the hypothesis that vitamin D levels affect the development of tension-type headaches in children. Based on the above review, we find that there is not enough evidence to support the hypothesis that the level of vitamin D is associated with the development of headaches in children.

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