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ORIGINAL ARTICLE

The Effect of Vitamin D Levels on the Frequency of Upper Respiratory Tract Infection in Children

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Abstract

Introduction: Vitamin D insufficiency and deficiency affect many systems other than bone and mineral metabolism. In our study, the relationship between the frequency of upper respiratory tract infection (URTI) and Vitamin D levels was investigated.

Methods: The records of patients who applied to our pediatric outpatient clinic between 2015 and 2016 and were diagnosed with URTI were evaluated retrospectively. A total of 430 cases whose Vitamin D levels were measured were included in the study. The number of URTIs of patients in the past 1 year was recorded and they were divided into three groups according to their Vitamin D levels. Serum 25 (OH)D levels were considered adequate between 20 and 100 ng/ml, insufficient between 12 and 20 ng/ml, and deficient if <12 ng/ml, and the relationship with these levels and the diseases was evaluated.

Results: Our study included 225 (52.3%) females and 205 (47.7%) males between the ages of 0 and 18. The Vitamin D level of 15.3% of the children was below 12 ng/ml (Group 1), 32.2% of them were between 12 and 20 ng/ml (Group 2), and 52.5% of them were between 20 and 100 ng/ml (Group 3). In our study, the annual mean frequency of URTI was 1.95 in the first group, 2.12 in the second group, and 1.75 in the third group. The frequency of URTI was found to be statistically significantly lower in the group with Vitamin D levels 20–100 ng/ml, compared to the group with <20 ng/ml ($p<0.05$).

Discussion and Conclusion: The frequency of URTI was found to be significantly lower in children with adequate Vitamin D levels compared to other groups. It can be thought that providing Vitamin D supplementation in children with insufficient and deficient Vitamin D levels will have a positive effect on many systems, as well as reducing the frequency of URTI.

Keywords: Child; upper respiratory tract infection; vitamin D.

Vitamin D provides calcium and phosphorus levels necessary for the mineralization of bone tissue in children. There are two types of Vitamin D: Calciferol (Vitamin D2) and cholecalciferol (vit. D3). Calciferol (D2 vit.) is found in plants, its provitamin is taken in the form of ergosterol, and accumulated in the skin. The provitamin of cholecalciferol (Vitamin D3) is 7-dehydrocholesterol and is synthesized in the body. It is known as a hormone precursor. It can also be taken in foods of animal origin (fish; especially sardine meat and fish oil). It is activated with ultraviolet and functions in the body by undergoing hydroxylation in the liver (25-hydroxylase) and kidney (1-α hydroxylase), respectively. Its low level has been associated with malaise, growth retardation, rickets, tendency to infections, obesity, diabetes mellitus, muscle weakness, depression, and development of autoimmune diseases in children. Its high levels may cause

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hypercalcemia, polyuria, hypertension, nephrolithiasis, and renal failure. Measurement in the body is usually done in the form of serum 25(OH)D3[1,2].

Materials and Methods

The files of 430 patients who applied to our pediatric outpatient clinic for upper respiratory tract infection (URTI) symptoms between January and December 2015 and whose Vitamin D levels were measured in the same period were evaluated retrospectively. The previous URTI numbers of the cases were recorded and they were divided into three groups according to the cases' Vitamin D levels: Serum 25(OH)D levels were considered adequate between if >20 ng/ml, insufficient if between 12 and 20 ng/ml, and deficient if <12 ng/ml[3]. While evaluating the findings obtained in the study, IBM SPSS Statistics 22 (IBM SPSS, Turkey) program was used for statistical analysis. The Shapiro–Wilk test was used to assess the conformity of the parameters to the normal distribution. In addition to descriptive statistical methods (mean, standard deviation, and frequency), a Chi-square test was used to compare qualitative data. Significance was evaluated at p<0.05 level.

Results

The distribution of children according to gender, age, and Vitamin D levels is given in Tables 1 and 2. A total of 225 (52.3%) females and 205 (47.7%) males were included in the study. The mean age of the patients was 70.4 months, and the mean Vitamin D levels were 22.37 ng/mL. Vitamin D level was deficient (<12 ng/ml) in 15.3% of children, insufficient (between 12 and 20 ng/ml) in 32.2%, and normal (between 20 and 100 ng/ml) in 52.5% of children. The number of URTIs experienced in the past 1 year is given in Table 3. Of 802 infections in 430 cases, 57.1% (458) was acute nasopharyngitis and tonsillopharyngitis, 24.2% (194) was acute tonsillitis, 8.7% (70) was acute otitis media, 8.2% (66) was acute sinusitis, and 1.8% (14) was acute laryngitis. It was seen that 58.4% of the cases had URTI 1 time, 18.6% had 2 times, 13% had 3, 4.7% had 4, and 3.3% had 5 times. The frequency of URTI according to Vitamin D levels is given in Table 4. The annual mean frequency of URTI was 1.95 in Group 1, 2.12 in the Group 2, and 1.75 in Group 3. No difference was found between the groups in terms of the frequency of URTI. However, the group with 20–100 ng /ml level of Vitamin D was found to have statistically significantly lower results when compared to the group with <20 ng/ml (p<0.05). In addition, a negative correlation between Vitamin D levels and the mean age of the subjects was observed.

Table 1. General distributions

	n	%
Gender		
Male	205	47.7
Female	225	52.3
Vitamin D		
<12	66	15.3
12–20	138	32.2
>20	226	52.5

Table 2. Age distributions

	Age (month)	%
Gender		
Male	64±54	47.7
Female	78±61	52.3
Vitamin D		
<12	112±64	15.3
12–20	83±54	32.2
>20	51±50	52.5

Table 3. Annual URTI frequency

URTI frequency	n	%
1	251	58.4
2	80	18.6
3	56	13.0
4	20	4.7
5	14	3.3
6	2	0.5
7	3	0.7
8	1	0.2
10	2	0.5
12	1	0.2
Total	430	100

UTRI: Upper respiratory tract infection.

Table 4. Average frequency of UTRIs by Vitamin D levels

	URTI frequency	%
Vitamin D		
<12	1.95	15.3
12–20	2.12	32.2
>20	1.75	52.5

Chi-square test. *p<0.05. UTRI: Upper respiratory tract infection.

Discussion

Vitamin D deficiency and insufficiency continue to be a problem in our country, as well as globally. Its rate has been reported with varying frequency in studies conducted in many countries in children[4,5]. In a study conducted in our country, Akman et al.[6] found a 8% rate of Vitamin D deficiency and a 25.5% rate of Vitamin D insufficiency in healthy children aged 1–16 years. In the same study, it was determined that daily calcium intake was low in children over 8 years old.

The relationship between infectious diseases and Vitamin D levels has been examined in many studies. The role of Vitamin D in lower respiratory tract infections has been frequently examined, and a negative effect of Vitamin D deficiency on the severity and frequency of infection have been observed[7,8].

In the literature, it has been observed that the relationship between URTI and Vitamin D levels has generally been investigated in adults. In a retrospective study conducted by Laaksi et al.[9] on 800 Finnish military students, they investigated serum 25(OH)D levels and found that those with vitamin levels below 40 nmol/L had more rest due to URTI. They also determined that the amount of physical activity of these military students before they joined the army had a positive effect on serum 25(OH)D levels. In the study of Ginde et al.,[10] 19% of nearly 19 thousand cases had a recent URTI and that serum 25(OH)D level was below 10 ng/mL in 24% of these cases, between 10 and 30 ng/mL in 20%, and more than 30 ng/mL in 17% of the patients, and that low Vitamin D levels were statistically significantly associated with URTI. Sabetta et al.[11] also examined the serum 25(OH)D levels of 198 healthy subjects and found that the risk of acute viral URTI in the winter season was decreased 2-fold in the follow-up of those with serum levels above 38 nmol/L, and they recovered faster than those with serum levels of 25(OH)D below 38 nmol/L. In the study of Murdoch et al.[12] in healthy subjects, subjects who received 100,000 IU/month (3300 IU/day) oral Vitamin D supplementation for 1.5 years were compared with the placebo group, and a significant decrease was found in the frequency of URTI in the group receiving supportive treatment. Li-Ng et al.[13] obtained similar results in a parallel study.

Camargo et al.'s[14] study, which is one of the few studies conducted in the pediatric population, reported that Vitamin D supplementation in children with Vitamin D deficiency reduced the frequency of URTIs. Camargo et al.[15] followed 247 schoolchildren for 3 months and showed that URTIs were less common in 143 cases who received Vitamin D supplementation. In another study, Urashima et al.[16] gave Vitamin D supplementation treatment at a dose of 1200 IU/day to 334 healthy children for 4 months and showed that the frequency of URTI caused by influenza A virus decreased, but they reported that this supplement treatment was not effective in cases of URTI caused by influenza B[14,15]. In a study conducted in our country, Elbistanli et al.[16] evaluated 336 cases in 2015 and it was observed that the incidence of URTI was higher in children with low Vitamin D levels. In our study, results compatible with the literature were obtained. The fact that the frequency of infection is lower in the younger age group with normal Vitamin D level shows once again the importance of Vitamin D support program in the newborn and infancy period. In older children and adolescence, factors such as nutritional deficiency and insufficient exposure to sunlight often play a role in the development of Vitamin D insufficiency or deficiency[17,18]. This situation may be encountered with an increase in the frequency of URTI along with other findings.

Conclusion

To prevent Vitamin D deficiency in children, precautions can be taken, such as supporting mothers in terms of Vitamin D supplementation during pregnancy and lactation, not interrupting Vitamin D prophylactic treatment in children and considering prophylactic treatment protocols for older ages, recommending nutrients rich and enriched with Vitamin D, recommending adequate amount of sunlight exposure, inclusion of having frequent URTIs in risk groups, and monitoring of serum 25(OH)D levels at certain periods in healthy child follow-up and treatment if necessary.

Considering the incidence in our country, since Vitamin D insufficiency or deficiency is an important public health problem, more comprehensive and detailed studies are needed on the subject.

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