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**Public health aspects of vitamin D**

Јавноздравствени аспекти витамина Д

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## Public health aspects of vitamin D

### Јавноздравствени аспекти витамина Д

#### SUMMARY

In recent decades, the prevalence of known but insufficiently treated diseases and disorders has increased significantly. However, there is also the manifestation of disorders whose causes were already known but were not sufficiently controlled. Public health problems are becoming more frequent and more current. Among the Current public health problems many symptoms and diseases are linked to certain vitamins, certain unhealthy lifestyles, and other contributing factors. Vitamin D is one of the current public health topics that has recently attracted increasing scientific attention. a biologically essential compound that affects many functions in the human body. And the deficiency of this vitamin is widespread throughout the world. Vitamin D can be found in the form of preparations, but it is also recognized as a registered medication in some contexts.

**Keywords:** disease prevention; public health; vitamin D

#### САЖЕТАК

Последњих деценија све чешће долази до појаве познатих али недовољно третираних болести и поремећаја. Мада долази и до појаве испољавања манифестације поремећаја чији су се узроци већ раније знали али нису били довољно контролисани. Јавноздравствени проблеми постају све учесталији али и актуелнији. Актуелних јавноздравствених проблема који се све више манифестују као што су симптоми и болести, изазвани су одређеним витаминима, одређеним лошим животним стилем, али и другим узрочницима. Витамин Д је једна од актуелних јавноздравствених тема која у последње време привлачи све већу научну пажњу. То је биолошко важно једињење које утиче на многобројне функције у хуманом организму. А дефицијенција овим витамином распрострањена је широм света. Витамин Д се може наћи у форми препарата али може бити регистрован као лек.

**Кључне речи:** превенција болести; јавно здравље; витамин Д

#### INTRODUCTION

The Covid-19 pandemic has highlighted numerous public health issues and significantly increased interest in preventive health measures, both at personal and global levels. Namely, this pandemic has called people to think about the importance and effectiveness of preventive measures in the occurrence of diseases in many fields [1]. One of the leading public health problems was vitamin D deficiency. It is a liposoluble, hydrophobic compound that can be found in two active forms as vitamin D3 (cholecalciferol) and vitamin D2 (ergocalciferol). The most common source of vitamin D is foods of animal origin such as tuna, sardines, cod, turkey. It is also found in plants, but it is very little usable in these foods. We should not leave out the fact that a large part of vitamin D is created endogenously through exposure to sunlight [2]. Vitamin D affects numerous organ systems, but lately its anti-cancer role and its great influence on the immune system have been highlighted. , cardiovascular, endocrine, immune system, but it also affects all other organ systems, which leads to the appearance of a wide range of diseases. Moreover, numerous inflammatory bowel diseases, and some liver and lung diseases can also lead to a decrease in levels of vitamin D in the whole organism (Table 1) [3].

## **PUBLIC HEALTH REVIEW AND PUBLIC HEALTH PLANS AND RECOMMENDATIONS**

Obesity is also one of the examples a condition associated with vitamin D deficiency, as shown by meta-analytical studies that included over twenty-four thousand patients under the age of 18 [4]. These studies statistically clearly indicate the occurrence of deficiency in obese patients compared to patients who were optimally nourished [4]. The depot of vitamin D is mainly located in the liver, but it can also be stored in adipose tissue. This has critical implications, as achieving optimal vitamin D levels is more challenging in obese individuals due to its sequestration in fat stores [3]. It is important to point out that vitamin D<sub>2</sub> can be found in mushrooms, some plants, and yeast, while vitamin D<sub>3</sub> can be found in foods of wheat origin but also in sun exposure [5]. All recommendations are based on the patients' age and vitamin D levels. The primary route of vitamin D elimination is via faeces, along with loss through skin shedding [5]. When it was first reported that over 95 per cent of children with rickets only received vitamin D as infants through breast milk, then the American Pediatric Scientific Council recommended substitution with vitamin D for both newborns and infants, even children. Vitamin D has receptors in all cells in the body, but its best-known role is in the prevention of rickets [6]. and they are caused by vitamin D deficiency [7]. Dental caries represent an important public health problem. Studies have shown that insufficient vitamin D intake through breast milk, coupled with inadequate supplementation, can lead to degenerative changes in tooth enamel and other dental defects in children [8]. In a randomized control study conducted on school children, which lasted for 3 years in Mongolia, the results clearly showed that supplementation with vitamin D in an adequate dose for three years was effective in patients with a deficiency of this vitamin, but was not effective in the physical development of children [9]. A study conducted in China showed that vitamin D deficiency was more common in girls than in boys. Still the study included a pediatric population aged birth to four years [10]. While vitamin D hypervitaminosis is rare, it is often caused by improper and inadequate use of this vitamin. In the USA, about three percent of people take more than the optimal dose of vitamin D, and it has been proven that there can be numerous consequences, namely: increased excretion of calcium in the urine, which can lead to nephrolithiasis, headache, nausea and ataxia [11]. Some studies emphasize numerous advantages of supplementation with vitamin D<sub>3</sub> compared to supplementation with vitamin D<sub>2</sub>, because some studies indicate that vitamin D<sub>3</sub> is more effective in achieving optimal serum levels and elicits a stronger biological response unlike vitamin D<sub>2</sub>, which is obtained exclusively from dietary sources [12]. Vitamin D<sub>3</sub> is synthesized in the skin with sun exposure and has greater potency in activating vitamin D receptors [13]. A

significant risk factor for the development of hypovitaminosis of vitamin D is the darker discoloration of the skin, which absorbs sunlight and reduces the chance of synthesis of vitamin D precursors in the skin [14]. The previous claim is fully supported by systematic meta-analytical studies that indicate that children in Africa have a pronounced hypovitaminosis of vitamin D, thus a greater tendency to respiratory diseases such as asthma [15].

## VITAMIN D DEFICIENCY AND INFECTIOUS DISEASES

Hospital-acquired infections caused by *Clostridioides difficile* have attracted the attention of the scientific public, especially in recent decades. It is known that only three antibiotics work on this bacterium. Recently a new antibiotic from the group of macrolides, Fidaxomicin, has demonstrated high efficacy. Retrospective four-year studies clearly show the severity of this infection in patients with comorbidities [16]. A controlled randomized trial further corroborates earlier findings, revealing that patients who received parenteral vitamin D3 experienced significantly faster recovery. This outcome is attributed to cholecalciferol's dual role in modulating the immune system and positively influencing the intestinal microbiota [17]. Infection with the respiratory and oncogenic Epstein-Barr virus, which is a known and proven cause of sarcoma and cancer [18]. Also causes a major public health problem. Vitamin D deficiency, as well as selenium deficiency, have a significant indirect effect on the occurrence of autoimmune diseases with comorbid Epstein-Barr virus infection [19]. Also, one of the most pressing public health problems in the last five years was the infection caused by the SARS-CoV-2 virus. An important role was played by liposoluble vitamins and their influence on cytokines, and a special role in an adequate immune response was played by vitamin D and vitamin E [20]. Vitamin E is the name for a group of compounds known as tocopherols. The most important biological function is played by alpha-tocopherol, which is responsible for preventing an exaggerated immune response [21].

## INTERACTION OF VITAMIN D AND DRUGS

Vitamin D and its analogs have a strong synergistic effect with azacitidine and other anticancer drugs. Studies have shown that these compounds significantly enhance the efficacy of certain anticancer treatments compared to the effects of the drugs used independently [22]. Some drugs for epilepsy, such as phenytoin, can induce cytochrome 450 and thereby accelerate the breakdown of vitamin D, and if used long-term, this drug can lead to hypovitaminosis, and severe

deficiency of this vitamin. Therefore, patients should be closely monitored through regular check-ups to prevent the consequences of these effects [23]. Phenobarbital, carbamazepine and primidone have a similar effect on vitamin D, these antiepileptic drugs also lead to a decrease in vitamin D [24]. One of the strongest vitamin D antagonists that lowers the level of vitamin D in the blood serum are corticosteroids. They impair vitamin D absorption in the intestines and stimulate the activity of hydroxylase enzymes, leading to a significant reduction in serum vitamin D levels [25].

### **CONSEQUENCES OF SELF-INITIATED VITAMIN D SUPPLEMENTATION**

Limits ranging from vitamin D deficiency (< 20 ng/ml) to insufficiency (20–30 ng/ml) but also adequate doses in serum (30–80 ng/ml) are not completely scientifically based [26]. A randomized cohort study showed that taking vitamin D can have the consequences of severe hypercalcemia, but also that the optimal dose can prevent the occurrence of certain cancers [27]. Dexamethasone, a corticosteroid commonly used in various treatments, is a well-documented example of a drug that negatively impacts vitamin D metabolism [28]. Self-initiated intake of supplements and medicines, including vitamin D, can lead to serious health consequences if undertaken without consulting a healthcare professional. Both the dose and the duration of vitamin D supplementation can lead to serious consequences. A patient who used the prescribed therapy for an inadequate period of time, developed severe complications, including symptoms of vomiting, disorientation, and drowsiness. Laboratory analyses revealed hypercalcemia and acute kidney injury as a result of improper use [28]. Dexamethasone, a corticosteroid commonly used in various treatments, is a well-documented example of a drug that negatively impacts vitamin D metabolism [28].

### **Consequences of vitamin D hypovitaminosis**

Apart from the key impact of vitamin D deficiency on the bone system, which resulted in osteopenia and osteoporosis. As research progressed, vitamin D was linked to diseases of nervous tissue, muscle, kidney, immune and permanent organ systems [29]. Therefore, vitamin D deficiency is associated with the onset of malignant neoplasms of various types, hypertension, autoimmune diseases, type 2 diabetes, depression and other diseases. The duration of vitamin D deficiency also tells about the course and impairment of health. A certain degree of deficiency and the duration of a given deficiency are necessary for the disease to develop [30].

## CONCLUSION

Preventing vitamin D deficiency requires a combination of proper dietary habits and proactive healthcare practices. Regular and timely visits to a physician are essential for early detection and prevention of hypovitaminosis. Routine medical check-ups can help identify symptoms of diseases associated with impaired vitamin D absorption, prompting targeted laboratory tests to assess serum vitamin D levels. Preventive and corrective measures for vitamin D deficiency can significantly reduce the risk of numerous associated diseases. Furthermore, it is crucial to consider the potential interactions between medications and vitamin D metabolism, as certain drugs can interfere with its absorption and function. Careful monitoring and adherence to professional guidance are vital to ensuring safe and effective vitamin D supplementation.

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**Conflict of interest:** None declared.

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**Table 1.** General guidelines for preventing vitamin D deficiency and recommended daily intake [5]

Age (years)	Vitamin D recommended daily intake (IU)
< 1	≤ 1000
1–18	≤ 2000
> 75	4000

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