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THE ROLE OF VITAMIN D IN THE REGULATION OF THE IMMUNE SYSTEM

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Abstract. Vitamin is an organic chemical compound necessary for the body for normal growth, development and metabolism. In recent years, our understanding of how vitamin D affects human health has expanded. In addition to its well-known effect on bone metabolism, vitamin D is involved in many other processes in the human body, including the regulation of immune responses. This article also presents the importance of vitamin D in the pathogenesis of some autoimmune diseases. This review article is devoted to the study of the role of vitamin D in the regulation of the immune system, as it is of considerable importance in the body of adults and children.

Keywords: vitamin, immunity, vitamin D deficiency.

Introduction. One of the main modern medical problems is vitamin D deficiency, which affects 1.5 billion of the world's population. [5]

Over the past decade, it has been proven that adequate supply of vitamin D has a significant impact on the prevention of many diseases [16]. Physiologically, vitamin D promotes the absorption of calcium in the intestines and maintains the necessary levels of calcium and phosphate in the blood to ensure the desired level of mineralization of bone tissue, as well as creating conditions for bone growth and the process of their repair. The functions of vitamin D are not limited only to the control of calcium-phosphorus metabolism. It also affects other physiological processes in the body, including cell growth, neuromuscular conduction, immunity, and the expression of many genes encoding proteins involved in the processes of tissue cell reproduction [9]

Problems with vitamin D deficiency is a priority in medicine due to its widespread prevalence among various population groups.

These staggering statistics on vitamin D deficiency are alarming given that this component is essential for human health. In fact, a wealth of experimental, clinical, and epidemiological evidence links low vitamin D levels to a range of adverse health effects, including decreased immunity. [7]

The body's supply of vitamin D differs depending on the area of residence and race: residents of northern regions and people with hyperpigmentation are most at risk of developing hypovitaminosis. Most studies point to a link between adequate vitamin D levels and a reduced risk of developing autoimmune diseases. [8]

Vitamin D is produced in the human body. There are intermediate metabolites and active forms of the vitamin. One of them, 1,25 dihydroxyvitamin D [1,25(OH)2D3], has the properties of a hormone, the receptors for which are present in all cells, tissues and organs. This is what determines the global role of vitamin D for the functioning of almost all organs and systems. [14]

The purpose of the work: is to study and summarize the available literature data on the influence of vitamin D levels in the regulation of immune reactions.

The relevance of this study lies in the accelerated globalization of the problem of decreased immunity associated with low levels of vitamin D among various population groups.

Materials and methods: the authors of this scientific work studied and conducted literature reviews of scientific works in the last 5-10 years from the search engines eLIBRARY, elpub and GOOGLE ACADEMY, SCIENCE-EDUCATION using the above keywords.

Main part. Vitamin D (VD) plays an important role in maintaining the homeostasis of the immune system; it belongs to the group of fat-soluble vitamins, but due to its characteristics, the active form of the vitamin, or calciferol, is called D-hormone.

Calciferol is necessary for the division of all cells, for their regeneration, growth and development, including cells of the immune system. Therefore, vitamin D, albeit indirectly, is associated with immunity.

In recent years, many scientists have studied the role of vitamin D in the regulation of the immune system and discovered that activated T-lymphocytes, macrophages and other cells of the immune system have special receptors for calcitriol (the active form of vitamin D), which proved that "the sun vitamin "affects the functioning of the immune system, so its deficiency can lead to a number of systemic diseases. [13]

Vitamin D acts through its membrane receptor, which is found in cells of a wide variety of human organs and tissues, in particular in most cells of the immune system and epithelial cells lining the mucous membranes. The following effects of this vitamin in relation to the immune system have been established: it weakens the presentation of antigen by dendritic cells, inhibits Th1 cell differentiation and the production of Th1 cytokines, shifts the balance of Th1/Th2 cell responses towards the Th2 response, has an inhibitory effect on Th17 cells, promotes the development of Treg cells and increases their activity. In addition, vitamin D enhances the production of "endogenous antibiotics" that can have a powerful effect on gram-positive and gram-negative bacteria, fungi and viruses. [1, 2, 6, 10]

In recent years, scientists have conducted experimental studies and proven the effect of vitamin D on innate cellular and adaptive immunity. Innate immunity is the body's first line of defense, which is provided by the barrier function of mucous membranes - neutrophils, monocytes, dendritic cells. The adaptive immune response is associated with the activation of antigen-presenting cells T and B lymphocytes. Vitamin D deficiency or insufficiency plays a role in the pathogenesis of a number of infectious diseases: tuberculosis, human immunodeficiency virus, hepatitis C virus, influenza, parasitic and systemic fungal infections.

The following immune effects of vitamin D have now been identified:

1. Influence on innate immune factors - vitamin D, by binding to its receptors, promotes the expression of genes that trigger the transcription of cathelicidin and β-defensins - low molecular weight cationic proteins called "endogenous antibiotics"

2. The effect of vitamin D on monocytes and dendritic cells (DC) - in monocytes, VD, by binding to receptors, suppresses the expression of Toll-like

receptors, namely TLR proteins 2 and 4, thereby reducing the ability of monocytes to recognize pathogens.

3. Effect on T lymphocytes - VD suppresses the proliferation of T lymphocytes and inhibits chemokine-mediated migration and homing to lymph nodes

4. VD prevents the polarization of Th0 cells into Th1 or Th2 cells by suppressing the production of IL-12 by dendritic cells and the production of inflammatory cytokines

5. VD has an inhibitory effect on Th17 cells

6. Effect on B-lymphocytes. It is assumed that VD prevents the differentiation and polarization of B cells, reduces their production of immunoglobulins and facilitates their apoptosis. [15]

It has also been found that Vitamin D affects antigen-presenting cells of the immune system, affecting the differentiation and function of these cells, which is accompanied by an increase in their tolerance and a decrease in the expression of the major histocompatibility complex on the cell membrane. This leads to decreased antigen presentation and production of interleukin-12 (IL-12), and increased production of interleukin-10 (IL-10) (a tolerogenic cytokine). [3]

The study revealed that against the background of hypovitaminosis D, chronic inflammation and immune disorders significantly reduce the body's resistance to tuberculosis, viral hepatitis, acute respiratory diseases, chronic bronchitis and increases the risk of chronic obstructive pulmonary disease in adults. [5]

It is interesting to note that in cells located at the site of inflammation, in comparison with healthy cells of the same organ, there is a local increase in the concentration of active metabolites of vitamin D, which has a pronounced protective nature, since Vitamin D is an immunomodulator. [12]

Effect of vitamin D on autoimmune diseases.

In addition to the above data, numerous studies over the past 10 years have revealed other important effects of VD on the body:

– inhibitory effect on autoimmune and allergic reactions that damage one’s own tissues;

– stimulation of the production of endogenous antimicrobial peptides, which effectively protect the body against a wide range of infectious diseases, including tuberculosis, viral infections, leprosy, etc.;

– suppression of carcinogenesis in the colon, prostate gland, mammary glands and other organs. [15]

Autoimmune diseases are characterized by loss of immune homeostasis, resulting in impaired recognition of self-antigens and subsequent destruction of body tissue by autoreactive immune cells. A combination of genetic predisposition, epidemiological risk factors and adverse environmental factors contributes to the development of autoimmune diseases. One important factor may be having insufficient vitamin D levels, as various epidemiological studies show a link between vitamin D deficiency and a higher incidence of autoimmune diseases such as T1DM, multiple sclerosis, systemic lupus erythematosus, rheumatoid arthritis and more. [11]

Conclusion. The data obtained allow us to study the role of vitamin D in the regulation of the immune system in the body. Increasing the supply of vitamin D reduces the incidence of respiratory diseases, inflammatory processes, autoimmune and cancer diseases, as well as allergic reactions. Thus, research has shown that the biological functions of vitamin D in the body are diverse.

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