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Review Article

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## Pediatric Pneumonia and Vitamin D - A Review

**Magid Reza Akbarizadeh**

Faculty of Medicine, Zabol University of Medical Sciences, Zabol, Iran.

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### Abstract

**Introduction:** Pneumonia is an inflammation in the lung parenchyma. Acute lower respiratory infections, and especially pneumonia, cause 20% of deaths in children. In developing countries, 12 to 20 children out of each 1000 live-born children die before reaching the age of 5 due to developing pneumonia. Pneumonia is the most common cause of death as a result of infection in America.

**Materials and methods:** The present study searches were conducted Google scholars, science direct pub med, ISI,PsycINFO and Web of Science. Keywords used in this research are: pneumonia, vitamin D and pediatric. At first 100 studies were conducted on the search for various information bases Among them, studies that did not have criteria for entering the study were excluded from the study and Finally, were used the 20 studies that were more consistent with the subject of this study. In this study relationship between pediatric pneumonia and vitamin D is discussed .

**Discussion:** Vitamin D deficiency increases the risk of developing viral infections such as bronchiolitis caused by RSV and seasonal influenza. Recent studies have determined the daily need for maintaining musculoskeletal health. However, the daily need for vitamin D for proper function of the immune system and defense against respiratory diseases is not known.

**Keywords:** Pediatric, pneumonia, vitamin D

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### Introduction

Pneumonia is an inflammation in the lung parenchyma. Acute lower respiratory infections, and especially pneumonia, cause 20% of deaths in children. In developing countries, 12 to 20 children out of each 1000 live-born children die before reaching the age of 5 due to developing pneumonia. Pneumonia is the most common cause of death as a result of infection in America (1). The signs and symptoms of pneumonia varies depending on the type of pathogen, the patient's age, and the severity of the disease, in a way that in little infants symptoms may be non-specific with little clinical findings. In a study by Soleimani et al., cough, fever, tachypnea, and dyspnea were reported to be the most common clinical symptoms of pneumonia. In a study in Brazil, the main symptoms of pneumonia in the hospitalized patients were reported to be tachypnea and intercostal retraction (2). The pathogens causing the disease are

viruses, bacteria, and fungi. The main viruses causing pneumonia in children include respiratory syncytial virus, influenza, and rhinoviruses. The most common bacterial causes in normal children under the age of five without any underlying diseases are first streptococcus pneumonia and then haemophilus influenzae. Also, nonpathogenic factors such as food aspiration, allergies, and medicine can cause pneumonia. Environmental factors such as going to the kindergarten, being exposed to cigarette smoke, low socio-economic status, and overpopulation can increase the likelihood of developing pneumonia. However, in most of the cases a specific pathogen is not found for pneumonia in children (3). In a study in America as a developed country, the most common causes of pneumonia in children were reported to be streptococcus pneumonia, mycoplasma pneumonia, and chlamydia. Acute respiratory infections are among the most common infections during childhood, in a way that every child under the age of five develops

## Materials and Methods

this type of infection 4 to 8 times a year, and these infections affect two billion children around the world every year. The results of studies show that these infections are the reason for 30 to 60 percent of children's visit to healthcare centers and 30 to 40 percent of hospitalization cases in children's hospitals (4). The World Health Organization estimated the mortality rate in children under the age of five who die as a result of acute respiratory diseases (other than the cases caused by measles, pertussis, and death during infancy) to be around 2.1 million children in the year 2004. Generally, the mortality rate is higher in childhood and especially in infants under the age of one year old. However, the rate decreases dramatically after the age of five (5). In developing countries, most deaths occur in infants under the age of two months, and almost all cases are due to acute pneumonia. In developing countries, the most common factors causing pneumonia in children are streptococcus pneumonia, haemophilus influenzae, and other respiratory viruses, mycobacterium tuberculosis, staphylococcus aureus, and gram-negative bacteria. However, it should be noted that in a considerable number of cases no specific pathogen is found for pneumonia in children. The results of studies show that in developing countries, in a study conducted in 2004 in America, the most common factors for pneumonia in children are streptococcus pneumonia, mycoplasma pneumonia, and chlamydia pneumonia (6). In most of the cases, pneumonia is caused by micro-organisms. However, some non-infection factors, which are not limited, also cause pneumonia. Non-infection factors include inflammatory processes (systemic lupus erythematosus, sarcoidosis, and histiocytosis) and inhalation or the aspiration of several toxic substances (hydrocarbons, cigarette smoke, molds, dust, chemical substances, and the contents of stomach) (7). Also, food aspiration or stomach acid, external object, hydrocarbons and lipid substances, hypersensitivity reactions, medicine, and radiation can cause pneumonia. Based on an anatomical classification, pneumonia can be divided into the following types: lobar, bronchopneumonia, alveolar, and interstitial. By definition, lobar pneumonia is limited to one or more than one pulmonary lobes, which can be accompanied by complete contraction of one or more than one lobes (8). Interstitial pneumonia refers to the inflammation of interstitial tissues, namely alveolar walls, ducts, pathways, and bronchioles. However, the classification of pneumonia based on etiology is more related to its diagnosis and treatment.

The present study searches were conducted Google scholars, science direct pub med, ISI, PsycINFO and Web of Science. Keywords used in this research are: pneumonia, vitamin D and pediatric. At first 100 studies were conducted on the search for various information bases. Among them, studies that did not have criteria for entering the study were excluded from the study and finally, were used the 20 studies that were more consistent with the subject of this study. In this study relationship between pediatric pneumonia and vitamin D is discussed.

## Results

The most common cause of pneumonia in the first few years of life is respiratory viruses. Mycoplasma pneumonia is the dominant cause of pneumonia in school ages and older children.

Vitamin D plays a vital role in the homeostasis of calcium, phosphorus, and bone growth. Vitamin D deficiency results in rickets in children and osteomalacia in adults. Furthermore, this vitamin has an important role in autoimmune, cardiovascular, allergic disorders, and respiratory diseases. Even if rickets is not considered a common disease, vitamin D deficiency is common across the world and may be witnessed in the absence of nutritional rickets. 10% of the amount of vitamin D needed by the human body is provided by foods containing this vitamin (fish, oil, liver oil, etc.) and 90% of that is provided by being exposed to the sunlight. Epithelial cells have large amounts of alpha-1-hydroxylase enzyme, which transforms the D<sub>3</sub>(OH)<sub>25</sub> pre-vitamin to its active form, namely Vit D<sub>3</sub> 1.25 (OH) (9). This active form connects to vitamin D receptors and applies its effect. Vitamin D deficiency is common all around the world and has a seasonal pattern. The serum level of vitamin D is higher in summer. The reason for this prevalent lack is a combination of behavioral factors such as staying in closed spaces for long periods of time, using sunscreen, and wearing thick clothes, and internal factors such as the destruction of vitamin D in the skin and the melanin content of the skin. Obesity is associated with vitamin D deficiency, which may be because of the reason that this vitamin is dissolved in fat and, as a result, increased withdrawal of the vitamin by the fat tissues. Diseases related to malabsorption such as celiac and cystic fibrosis and also consuming anticonvulsants, rifampin, and antiretroviral compounds may cause vitamin D

deficiency. All tissues and cells have vitamin D receptors (10). To evaluate the body's vitamin D level, Vit D OH 25, which is the main circulating vitamin D metabolite and has the most biologic effects, is measured using methods like ELISA, RIA, etc. Vitamin D deficiency refers to a serum level of the vitamin less than 30 nanograms per milliliter. In order to evaluate the health of bones, alkaline phosphatase, bone density measurement, calcium absorption, and also clinical and radiologic symptoms of rickets are investigated. Vitamin D has regulatory properties for the immune system. By affecting the immune system, this vitamin controls the production of inflammatory cytokines and stimulates the production of antimicrobial peptides (11). During a bacterial infectious disease, macrophages change Vit D 25 OH in the blood to Vit D OH 1, 25. This substance causes the occurrence of gene encoding antibacterial peptide. This peptide plays a key role in defending the body against respiratory pathogens, in a way that both enhances the immune response and clears the bacteria from defense and immune cells (12). Vitamin D plays a substantial role in regulating the functioning of immune cells T1 and T2. Reduced concentration of Vit D OH 25 makes the body prone to tuberculosis infection. Studies have shown that children who suffer from rickets and even people who suffer from subclinical deficiency of vitamin D are more likely to develop pneumonia (13). Children who take vitamin D supplements are less likely to develop respiratory infections, and infants who are solely fed with breast milk and have adequate serum level of vitamin D are less likely to develop lower respiratory diseases. Death rates are higher for children who suffer pneumonia accompanied by vitamin D deficiency. Vitamin D deficiency increases the risk of developing viral infections such as bronchiolitis caused by RSV and seasonal influenza (14). Recent studies have determined the daily need for maintaining musculoskeletal health. However, the daily need for vitamin D for proper function of the immune system and defense against respiratory diseases is not known (15).

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