

Assessment of Serum Vitamin D Level in Asthmatic Patients

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Abstract:

Aim: Asthma is a clinical condition which causes constriction in airway with shortness of breath, chest tightness, cough and wheeze. It can be mild, moderate and severe. Vitamin D is obtained directly from sunlight and through the diet. It is a fat-soluble natural nutrient which is a modulator of calcium absorption and bone health. It also plays an important role in immune regulation and in respiratory infections.

Materials & Methods: This study was conducted in the department of Biochemistry, People's College of Medical Science & Research Centre Bhopal (M.P.). For the study purpose 100 cases and 100 controls were selected randomly and perform Vitamin D test by CLIA method (kit method) in the laboratory. This study was based on comparison of serum vitamin D level of cases and controls. Compare serum vitamin D level according to the age groups of patients and according to duration of asthma and found the level of significance.

Results: Serum vitamin D level is found to be lower in asthmatic patients than controls. There were no significant result found among the different age groups of asthmatic patients and groups of duration of asthma.

Conclusion: Vitamin D plays a significant role in inborn and adaptive immunity but still it is under discussion. The discovery of vitamin D receptor (VDR) connected vitamin D to the immune system. Several researches suggested an autoimmune role of vitamin D due to its effects on immune cells such as T lymphocytes, B lymphocytes, and dendritic cells.

Key Words: Vitamin D, Asthma, Immune system, infection

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I. Introduction

Asthma is a chronic inflammatory pulmonary disorder which causes constriction in airway with shortness of breath, chest tightness, cough and wheeze. It can be mild, moderate and severe. Asthma can start at any age but most commonly starts in childhood. Sometimes it runs in families but many people with asthma have no family history [1]. According to WHO promoted organization GINA (Global initiative for Asthma, www.gina.com) the global burden of asthma is around 300 million people [2]. It is associated with high morbidity and mortality especially in the adult population. As a result, national and global efforts have been implemented to reduce asthma prevalence, mortality and morbidity [3,4]. There are several unclear factors responsible for the development of asthma because children and adults have different presentation [5]. T-helper cell type-2 cytokines like interleukin (IL)-4, IL-5 and IL-13 are regulated in the asthmatic airway and are related with increased eosinophilia, mast cell degranulation and increased level of immunoglobulin E (IgE) [5, 6]. The complex interaction between cells and inflammatory mediators and impairment of immunogenic tolerance promotes airway injury. This process is known as airway "remodelling" [7]. Airway remodelling causes hypertrophy of smooth muscle, hyperplasia of epithelial goblet cell and deposition of airway extracellular matrix protein due to this air flow obstruction increases and finally creating the pulmonary symptoms [8]. From all vitamin D, serum 25OHD is the best indicator which reflects the overall vitamin D status in the body. It accounts the intake of vitamin D from dietary sources as well as sun exposure and adaptation of vitamin D from adipose stores in the liver [10].

Although there are several researches done on the role of vitamin D in asthmatic patients but the clinical theory is still unclear. Vitamin D is obtained directly from sunlight and through the diet. It is a fat-soluble natural nutrient which is a modulator of calcium absorption and bone health. It also plays an important role in immune regulation and in respiratory infections [9, 10].

II. Material & Methods

This study was conducted in the department of Biochemistry, People's College of Medical Science & Research Centre Bhopal (M.P.). For the study purpose 100 cases and 100 controls were selected randomly and perform Vitamin D test by CLIA method (kit method) in the laboratory. Blood sample were collected in the red vial and after centrifugation serum were used for the analysis. Informed consent was obtained from all individual participants included in the study. Following are the values that indicate the serum vitamin D level.

S.No.	Vitamin D level (ng/ml)	Status
1.	<20	Deficiency
2.	20 - 30	Insufficiency
3.	30 - 100	Sufficiency
4.	>100	Toxicity

The studied population were divided into three groups according to their age: 01 year to 15 year age group (n = 04), 16 year to 45 year age group (n = 44) and 46 year and above (n = 52). Cases were divided into three groups according to the duration of asthma: Patients suffering from asthma 0 to 10 years (n = 76), 11 to 20 years (n = 20) and more than 20 years (n = 04).

Exclusion criteria

Patients with upper or lower respiratory tract infection, trauma, collagen vascular disease, malignancy, osteomalacia, rickets, smokers, alcoholics and pregnant women were excluded.

Inclusion Criteria

Patients having physician diagnosed asthma.

Statistical analysis

Data tabulated in Microsoft excel and analysis was performed by using minitab-18 software in which a value of $p < 0.001$ and $p < 0.05$ considered highly significant and significant respectively. Results are expressed as mean \pm SD.

III. Results

The mean value of serum vitamin D was 17.98 ± 2.69 in the cases of asthma and 55.56 ± 17.52 in control group (Graph 1) and the p value is < 0.001 which shows that serum vitamin D level was highly significantly lower in asthmatic patients in comparison to the control group. Among the age groups of asthmatic patients there were no significant difference found but when compare the age of patients with controls there was highly significant difference found in serum vitamin D level (Table 1). If compare among duration of asthma, there was no significant difference observed (Table 2).

IV. Discussion

Vitamin D plays a significant role in inborn and adaptive immunity but still it is under discussion [11, 12]. It is estimated that vitamin D regulates over 900 genes [13]. The discovery of vitamin D receptor (VDR) connected vitamin D to the immune system [14]. Several researches suggested an autoimmune role of vitamin D due to its effects on immune cells such as T lymphocytes, B lymphocytes, and dendritic cells [15, 16, 17]. Enzyme released by the peripheral blood mononuclear cells associated with the activation and degradation of the active form of vitamin D which describe the hormonal action of $1,25(\text{OH})_2\text{D}_3$. Specially, $25(\text{OH})\text{D}_3$ has been metabolized to $1,25(\text{OH})_2\text{D}_3$ by the T cells [18]. $1,25(\text{OH})_2\text{D}_3$ form a complex with VDRs and perform their mechanism of action. This complex binds to vitamin D responsive elements inside the promoter region of vitamin D responsive genes which affects the rate of RNA polymerase II – mediated transcription [19].

The pathophysiology of asthma is explained by the host immune response which included Th1 cells, Th2 cells and CD4+ cells. Th1 cells secrete interferon γ (IFN- γ), interleukin (IL)-2 and TNF- α with cell mediated responses. Th2 secretes IL-4 and IL-5 with antibody-mediated immunity [16]. Asthma is caused by increased level of Th2 cells which stimulate IgE production and promote eosinophilic airway inflammation and airway hyper-responsiveness [20, 21].

There can be one more reason responsible for vitamin D deficiency. Vitamin D has thermal instability. It is degraded at higher temperature above 200°C . Therefore, slow cooking and deep frying of food destroy vitamin D. The reciprocal relationship is between thermal stability and temperature and time. During cooking vitamin D present in the food comes out into the cooking medium and degraded. Short time pressure cooking is suggested to retain some essential nutrients [22].

Li. Et al. conducted a study on 435 adults with asthma and found that the concentration of 25(OH)D was low in asthmatic patients [23].

Shaaban and Hashem also observed serum vitamin D levels in 75 adults with asthma and 75 healthy controls and found that 78.66% vitamin D deficient asthmatic patients whereas 85% of healthy controls expressed sufficient levels [24].

Similarly Stephanie Korn et al. studied serum vitamin D levels in 280 adults with asthma and reported that 25(OH)D concentrations in adult asthmatics were low and vitamin D insufficiency or deficiency was significantly related to asthma severity [25].

Montero Arias et al. demonstrated that serum vitamin D levels were examined in 121 adults with asthma and noted that in asthmatic patients with low vitamin D levels there was a significant Association between vitamin D levels and the risk of severe asthma, the risk of hospitalization or visit to the emergency department due to asthma [26].

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Fig 1: Comparison of vitamin D level in Asthmatic patients and Controls

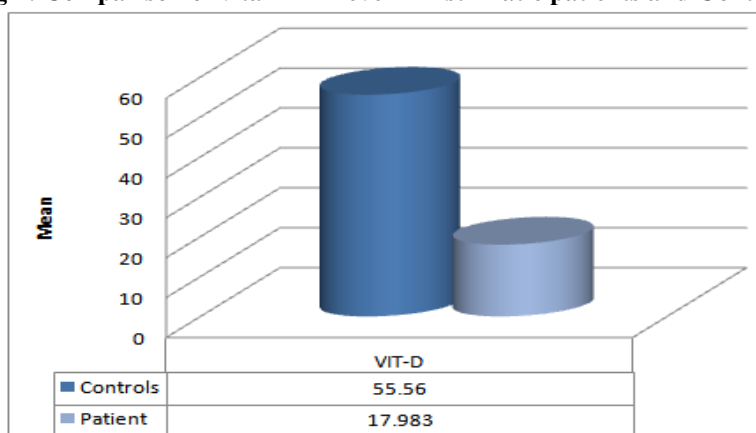


TABLE NO. 1 Serum Vitamin D level in different age group of patients

S.No.	Groups	Mean±SD	p-value	Significance
1	1-15 Year (n = 4)	18.42±1.58	>0.5	NS*
2	16-45 year (n = 44)	18.18±2.91	>0.5	NS*
3	46 and above (n = 52)	17.79±2.59	>0.5	NS*

*NS – Non Significant

TABLE NO. 2 Serum Vitamin D level in different duration of Asthma Patients

S.No.	Groups	Mean±SD	p-value	Significance
1	1-10 Year (n = 76)	18.11±2.69	>0.5	NS*
2	11-20 Year (n = 20)	17.86±2.83	>0.5	NS*
3	20 and above (n = 4)	16.74±2.27	>0.5	NS*

*NS – Non Significant

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