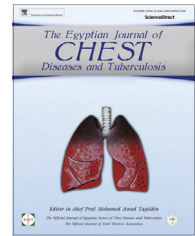




The Egyptian Society of Chest Diseases and Tuberculosis
Egyptian Journal of Chest Diseases and Tuberculosis

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ORIGINAL ARTICLE

Serum vitamin D levels in patients with atopic asthma

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Received 16 November 2014; accepted 1 March 2015

KEYWORDS

Vitamin D;
 Allergy;
 Asthma severity

Abstract *Background:* It must be obvious that no one factor should be held accountable for the etiology of allergic diseases, asthma or acute asthma exacerbations. Operating on a genetic basis many factors must play a role. It has been postulated that vitamin D deficiency, as a result of industrialization and Westernized lifestyles that have led to sun-avoidance behaviors and more time indoors, has a role in the development of asthma and allergies (Green, 2010) [1].

Objective: To assess the relationship between serum vitamin D levels and severity of asthma in patients with atopic asthma.

Patients and methods: The study was carried out on 30 patients with atopic asthma, divided into three groups according to severity of airway obstruction, and ten healthy control subjects. Serum 25-hydroxyvitamin D₃ [25(OH) D], a vitamin D metabolite, was measured using an immunodiagnostic ELISA technique.

Results: 86% of all asthmatic patients were vitamin D insufficient, as defined by a level ≤ 30 ng/ml 25(OH) Vit D. Mean vitamin D levels were the lowest in patients with severe asthma.

Conclusion: Vitamin D insufficiency is common in patients with atopic asthma that is correlated with its degree of severity.

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Introduction

Currently, the burden of asthma in both the developed and the developing world is significant and increasing rapidly with more than 300 million people affected worldwide [1,2].

Although it is well known that positive atopic status, exposure and sensitization to environmental allergens and/or familial history of allergic disease are significant risk factors associated with the development of asthma, recent evidence suggests that vitamin D deficiency may also predispose to allergic phenotype [3,4].

In vitro studies have demonstrated that vitamin D may play an immune-modulatory role in human airway tissue through innate, adaptive immune pathways [5,6]. The underlying mechanisms of how vitamin D modulates the pathogenesis of asthma are not clear. Vitamin D may modulate the

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Peer review under responsibility of The Egyptian Society of Chest Diseases and Tuberculosis.

<http://dx.doi.org/10.1016/j.ejcdt.2015.03.016>

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functions of various immune cells such as B- and T-lymphocytes. Interestingly, the application of vitamin D is potentially capable to overcome the poor glucocorticoid responsiveness in severe asthmatics by upregulation of IL-10 production from CD4+ T cells [7].

Prolonged breastfeeding without vitamin D supplementation, maternal vitamin D deficiency, poor diet and limited sunshine exposure, liver and kidney diseases, poor food absorption, use of certain medicines, including phenytoin, phenobarbital, and rifampin have been suggested as major contributors to vitamin D deficiency [8–10].

Aim of the study

The purpose of this study was to investigate serum Vit D levels in patients with atopic asthma, detecting its correlation with the degree of asthma severity.

Subjects and methods

This study was carried out on 30 patients with atopic asthma divided into mild, moderate and severe asthma (groups; II, III, and IV, respectively) admitted in the Chest Department, Tanta University Hospital during the period from March 2013 to October 2013 and 10 nonsmokers, non-atopic healthy volunteers was taken as a control group (group I).

Each subject received the regular routine of detailed medical history, comprehensive physical examination and appropriate laboratory tests including, skin prick tests (to clarify atopic patients from non-atopics that will be excluded), chest X-ray, lung function tests (to clarify severity), bronchodilator responsiveness (BDR; as defined by an improvement in the FEV1 of > 200 ml and 12% after administration of four puffs [0.1 mg/puff] salbutamol by metered dose inhaler), and BAL total cell and eosinophil count. Patients with non-atopic asthma, significant medical illness other than asthma, a history of respiratory tract infection, or asthma exacerbation within the previous 4 weeks were excluded. Informed consent was obtained from all participants.

Blood collection and serum measurements of vitamin D

A collected venous blood sample was separated into serum and stored at -70°C until analysis. Serum 25-hydroxyvitamin D₃ [25(OH) D], a vitamin D metabolite, was measured using an immunodiagnostic ELISA commercially available kit (Immundiagnostik AG, ALPCO, USA) for the quantitative

determination of the 25-OH-Vitamin D in serum according to the manufacturer's instructions. Vitamin D levels were categorized as deficient if 25(OH) D was < 20 ng/ml, insufficient if it was 20–29 ng/ml and sufficient if it was > 30 ng/ml [11].

Statistical analysis

Data were presented as mean $\pm$ standard deviation ($X \pm SD$) or percentage (%). The means of two groups were compared using Student "t" test. Chi square (χ^2) was used to find the association between row and column variables. Linear correlation and regression were used to test the correlation between the measured parameters. Data were statistically analyzed with the statistical package (SPSS), version 10 software. A *p* value < 0.05 was considered statistically significant.

Results

Characteristics of our study population are illustrated in Table 1.

Insufficient serum Vit D was found in 70% of mild asthmatics, 90% of moderate asthmatics and in all severe asthmatics patients.

Serum Vit D levels [25(OH) D] were 65.4 ± 12.18 , 29.1 ± 2.3 , 26.3 ± 2.3 , and 23.1 ± 1.3 ng/ml in groups I, II, III, and VI, respectively. Serum Vit D was significantly decreased in patients with asthma compared to the healthy subjects, with a significant decrease in patients with severe asthma compared to patients with mild and moderate asthma, and non-significant difference between mild and moderate and between moderate and severe asthmatic patients (see Table 2).

There was a significant positive correlation between serum Vit D levels and FEV1 (% of pred), and significant negative correlation between serum Vit D levels and BAL eosinophils % in patients with asthma with higher significance in patients with severe asthma, Figs. 1 and 2.

Discussion

Low levels of serum vitamin D are associated with impaired pulmonary function, increased incidence of inflammatory and infectious diseases. The exact mechanisms underlying these data appear to have impact on the function of inflammatory and structural cells, including dendritic cells, lymphocytes, monocytes, and epithelial cells [12].

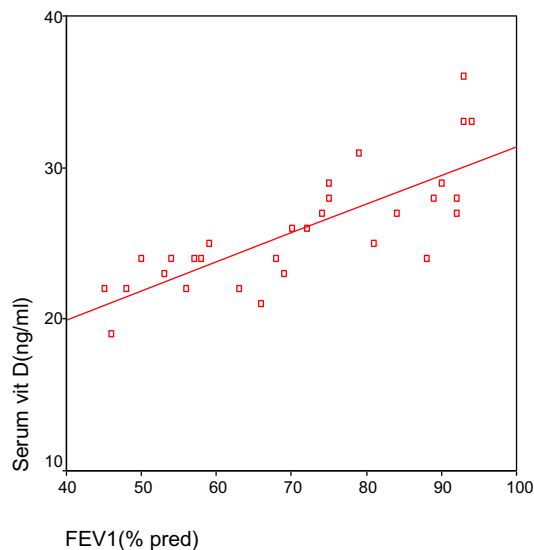
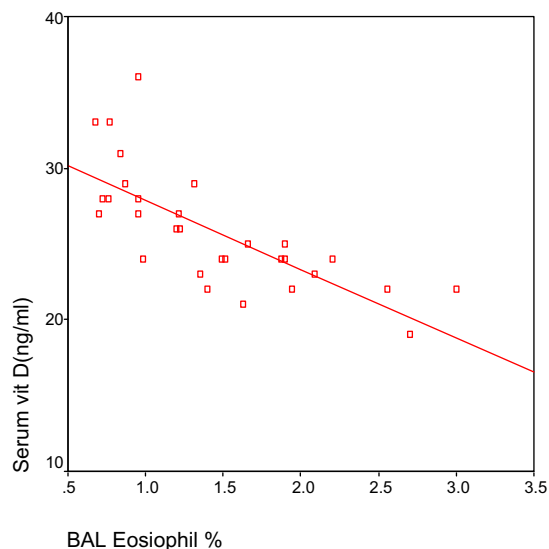
Searing et al. [13], found that serum vitamin D was positively correlated with lung function and enhanced

Table 1 Basic characteristics of study population.

	Control group	Mild asthma	Moderate asthma	Severe asthma
Age	25.3 $\pm$ 4.6	36.5 $\pm$ 5.9	34.4 $\pm$ 4.8	38.4 $\pm$ 5.4
Sex (M/F)	6/4	7/3	5/5	8/2
FVC (% of pred)	99.5 $\pm$ 5.12	93.8 $\pm$ 6.84	90.2 $\pm$ 5.88	76.1 $\pm$ 10.72
FEV1	99.9 $\pm$ 5.54	89.6 $\pm$ 4.24	71.1 $\pm$ 4.81	52.6 $\pm$ 5.08
FEV1/FVC	101.3 $\pm$ 4.76	83.1 $\pm$ 7.90	71.4 $\pm$ 6.67	68.2 $\pm$ 7.91
PEFR	103.1 $\pm$ 5.86	94.1 $\pm$ 6.52	73.4 $\pm$ 4.19	59.0 $\pm$ 5.35
Skin t.	—	+	+	+
Total cell count $\times 10^3$	157.3 $\pm$ 28.1	158.4 $\pm$ 32.3	176.9 $\pm$ 32.8	200.2 $\pm$ 35.3
Eosinophil %	0.49 $\pm$ 0.14	0.96 $\pm$ 0.36	1.26 $\pm$ 0.37	2.08 $\pm$ 0.53

Table 2 Serum Vit D levels (ng/ml) in the studied groups.

	Control	Mild asthma	Moderate asthma	Severe asthma		
Vit D	65.4 ± 12.18	29.1 ± 2.3	26.3 ± 2.3	23.1 ± 1.3		
T test	Control and mild	Control and moderate	Control and severe	Mild and moderate	Mild and severe	Moderate and severe
p	0.001	0.001	0.001	0.21	0.001	0.19

**Figure 1** Correlation between serum Vit D and FEV1 (% of pred) in patients with asthma.**Figure 2** Correlation between serum Vit D and BAL eosinophil % in patients with asthma.

glucocorticoid action in peripheral blood mononuclear cells; vitamin D was inversely correlated with total IgE, degree of atopy, and use of inhaled or oral steroids.

Sutherland et al. [14], found that serum vitamin D was positively correlated with FEV1 and glucocorticoid response; vitamin D insufficiency or deficiency was associated with airway hyperresponsiveness.

Another study showed a strong relationship between serum concentrations of cholecalciferol, forced expiratory volume in 1 s (FEV1), and forced vital capacity, where decreasing pulmonary function is associated with vitamin D deficiency [15].

Against our study findings, Devereux et al. [16], found no significant association between serum vitamin D levels and asthma.

Conclusion

We found that those asthmatics with low vitamin D levels did worse on every measure; especially on pulmonary function tests and also on inflammatory response, indicating vitamin D may play a role in reducing inflammation. So, the results of the study suggest the potential role of serum vitamin D levels in asthmatic patients, affecting its degree of severity. Also, the results suggest the potential importance of maintaining adequate vitamin D levels in patients with atopic asthma, that may help improve their asthma.

Conflict of interest

None declared.

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