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Serum Vitamin D Status in Patients with Asthma-COPD Overlap

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Abstract

Introduction: *Asthma-COPD overlap shared its risk factors with asthma and COPD, including development in the later decades of life, airway hyper-responsiveness, often tobacco smoke exposure, and progressive loss of lung function. It has been shown that this group of patients might possess vitamin D deficiency. By assessing the level of vitamin D we can identify the deficiency earlier and can give appropriate supplements.* ***Objective:*** *This study was done to assess the serum vitamin D status in patients with Asthma-COPD overlap.* ***Materials and Methods:*** *This cross-sectional study was carried out in the Department of Physiology of Bangabandhu Sheikh Mujib Medical University, Dhaka, from January 2018 to July 2018. Total 47 men subjects age ranged between 40-70 years were involved in this study. Among them 23 (twenty three) men (40-70 years) were involved as study group (Group II) and 24 (twenty four) men (40-70 years) were taken as control group (Group I).* ***Results:*** *The results were expressed as mean with standard error (mean±SEM). The data were statistically analyzed by Graphpad prism (Version 7) using independent sample 't' test. The mean (±SEM) of serum vitamin D of Group I and Group II were 16.37±0.78 kg/m2 & 18.47±1.01 ng/ml respectively.* ***Conclusion:*** *Vitamin D deficiency is present in both groups. By this study we recommended that routine estimation of this parameter is important for early detection and prevention of complication related to Asthma-COPD overlap for managing a healthy life.*

Key words: *Vitamin D, Asthma-COPD overlap, Vitamin D deficiency, Vitamin D insufficiency.*

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Introduction:

Chronic obstructive pulmonary disease (COPD) and bronchial asthma are common airway diseases. COPD is characterized by airway inflammation, increased airway resistance, fibrosis, mucus hypersecretion, parenchymal lesions with reduced elastic recoil and loss of alveolar attachments, leading to airflow limitation, which is not fully reversible with bronchodilator[1]. Asthma is characterized by chronic airway inflammation with wheeze,shortness of breath, chest tightness, cough, but its airflow obstruction is fully reversible after treatment with bronchodilator[2]. Global Initiative for Asthma (GINA) and Global Initiative for Chronic Obstructive Lung Disease (GOLD) describe Asthma-COPD overlap as persistent airflow limitation with several features associated with

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asthma and several features associated with COPD[3]. In recent years, it has become evident that several phenotypes of COPD exist. Of them Asthma-COPD overlap (ACO) is a newer one[4,5]. The prevalence rate of this new entity has been estimated 10 to 55% in Spain[6], 15 to 16.3 % in China[7] and 1.6 to 4.5% in Venezuela[8]. Though, all of airway diseases (ACO/ COPD/ Asthma) are preventable and treatable, once developed the disease along with its comorbidities cannot be cured. But their progression and exacerbation of morbidity can be reduced. Medicine treatment alone cannot do this. Now-a-days the interest of role of different non-pharmacological supplements on different lung diseases are outgoing.Vitamin D is well known for its classical role in bone mineralization and calcium homeostasis. The majority of this circulating steroid is derived from sun exposure with a limited dietary contribution. Provitamin D (7-dehydrocholesterol) is converted to previtamin D in the skin by exposure to Ultraviolet B (UVB) radiation. This previtamin D is then isomerized to vitamin D3 by body heat. Vitamin D3 is then transported by the blood to the liver, where it is hydroxylated to 25-hydroxyvitamin D [25(OH)D] and then to the kidneys, to form the active form of 1,25-dihydroxyvitamin D [1,25(OH)2D]. This activation is finely regulated by the parathyroid hormone (PTH)[9]. In addition, the serum level of this vitamin D is also affected by solar zenith angle (season and lattitude affect UVB radiation), cloudy environment (attenuate UVB radiation), ozone (absorbs UVB radiation), surface reflection (snow reflect upto 95% of UVB radiation), altitude (affects UVB radiation), skin type (melanin decrease conversion of pro to previtamin D), outdoor staying from 10 am to 2 PM (time of highest UVB exposure), use of sunscreen (block UVB radiation), high body mass index (fat sequesters vitamin D), age (elderly has thinner skin) and environmental temperature (at cold population expose less skin area to UVB radiation)[9,10,11,12,13,14&15] . Deficiency of this vitamin D might cause rickets, osteomalacia, osteoporosis etc.[16]. It has been noticed that non classical role of Vitamin D may possess health benefits, such as prevention of autoimmune disease[17] cardiovascular disorders[13,18], hypertension[19] and influenza[20]. Moreover, higher serum vitamin D concentration [assessed by 25(OH)D] has been associated with better lung function as measured by FEV1 in a large cross-sectional study of the US population[21]. Recently, a group of researchers reported that a significant proportion of young COPD patients were with insufficient (20 to 29 ng/ml) serum 25(OH)D. They also found a statistically significant positive relationship between FEV1 and serum 25(OH)D in this group of patients[22]. Furthermore, it has been suggested that, lower vitamin D status in COPD might be due to diminished production of pre-vitamin D3 associated with skin aging caused by smoking and limited UVB radiation exposure[13,23]. In addition, statistically significant association between vitamin D deficiency and asthma has been reported[24]. Moreover, this vitamin's deficiency was also found to increase the risk of severe asthma exacerbation and need for emergency department evaluation or hospitalization[25]. In a very recent study, Vitamin D supplementation was shown to reduce the rate of asthma exacerbations requiring treatment with systemic corticosteroids[26]. However, as far as it has been searched, association of vitamin D status with ACO has only been observed by Odler et al. (2015) along with other airway disorders (COPD and asthma). They reported 60% of ACO, 76% of COPD and 36% of asthmatic patients had vitamin D deficiency (Odler et al. 2015).

Materials and Methods:

This cross-sectional study was conducted from January 2018 to July 2018 in the Department of Physiology and Center for Advanced Biomedical Research, Bangabandhu Sheikh Mujib Medical University (BSMMU). The protocol of this study was approved by the institutional review board of BSMMU. For this study, 23 pulmonologist diagnosed male (age ≥ 40 years) patients of ACO (group II) enrolled by consecutive sampling from Out Patient Department (OPD) of the National Institute of the Diseases of Chest and Hospital (NIDCH). For comparison, 24 age, smoking status and BMI matched apparently healthy male (group I) were selected from community. A written informed consent was taken from all the participants after detailing of study procedure. With all aseptic precautions 5 ml venous blood was drawn from ante-cubital vein by a disposable plastic syringe for estimation of serum 25(OH)D. Vitamin D3 was measured by using automated analyzer: ARCHITECT Plus ci4100.

Results:

The results were expressed as mean with standard error (mean±SEM) and percentage. The data were statistically analyzed by Graphpad prism (Version 7) using independent sample 't' test (to compare serum 25(OH)D between two groups) and Chi square test was done to observe association of vitamin D deficiency and insufficiency with ACO. In the interpretation of results, ≤0.05 level of probability (p) was accepted as significant.

Table I: Group of the subject

Group	Number of subjects (n)
Group-I (control group)	24 healthy subject
Group-II (study group)	23 Patients with ACO

General characteristics of the subjects are presented in Table II.

Table-II: General characteristics of participants (n=47)

Variables	Group I	Group II	p value
Age	54.08 ± 1.68 (40-70)	58.39 ± 1.79 (40-70)	0.09
Duration of smoking	17.35 ± 1.08 (4-30)	14.52±1.20 (4-30)	0.09
BMI(Kg/m^2)	22.51±0.99	22.41 ± 0.59	0.93

Data were expressed as mean±SEM. Figures in parentheses indicate ranges. Pack year = (number of cigarettes smoked per day/20) X number of years smoked. BMI= Body mass index.

In the present study, the mean ± SEM of serum 25(OH)D were 16.37 ± 0.78 and 18.46 ± 1.01 ng/ml in control and study groups patients, respectively (Table III).

Table-III: Serum 25(OH)D level in two groups (n=47)

Parameter	Group I (n=24)	Group II (n=23)	p value
25(OH)D ng/ml mean±SEM	16.37 ± 0.78 (9.5-24.2)	18.46 ± 1.01 (8.9-27.2)	0.11

Statistical analysis was done by Independent sample 't' test. 25(OH)D = Serum 25- Hydroxycholecalciferol

However, the association of vitamin D deficiency and insufficiency was not found with ACO by chi square test (Table IV).

Table-IV: Association of vitamin D deficiency and insufficiency with ACO

Serum vitamin D status			Total
Group	Deficient[25(OH)D<20ng/ml]	Insufficient[25(OH)D:20-29ng/ml]	
Group I	20(83%)	4(17%)	24
Group II	15(65%)	8(35%)	23
Total	35	12	47

Discussion:

The present study was carried out to observe serum vitamin D status in patients with Asthma-COPD overlap. For this, 23 male stable patients with ACO were studied and their serum 25 (OH)D level were assessed. For comparison, 24 age, smoking status and anthropometric status matched apparently healthy male subjects were also assessed for the above-mentioned variable. In this study, all subjects (both healthy control & ACO patients) had serum 25(OH)D deficiency (<30 ng/ml) (vitamin D council 2017). Similar deficiency was also indicated in apparently healthy population of Bangladesh[27,28] and other countries[29] as well as in ACO patients (Odler et al. 2015). The exact reason of this finding cannot be explained directly from this study. However, indoor staying from 10 AM to 2PM (time of highest UVB radiation)[30] and darker skin type (type V with high melanin content)[30,31] of our study subjects might be obstacle for conversion of 7-dehydrocholesterol to pre vitamin D3 in the skin and could be responsible for this vitamin deficiency. In addition, as both of our healthy as well as ACO patients were smoker and the smoking habit individually has a deleterious influence on serum 25(OH)D[29], so this life style could be a causative factor for our findings. In addition, no significant difference was found in the mean serum 25(OH)D level between our control and ACO patients. Similar finding (statistically non-significant) was reported by Odler et al. (2015) in Hungarian ACO population[1].

Conclusion:

From the results of the present study, it may be concluded that, both Bangladeshi healthy population as well as ACO patients might have D3 deficiency. As sunlight is the major natural source of vitamin D we may advice to increase outdoor staying in order to increase duration of sun exposure. We may recommend adequate dietary intake of vitamin D rich food such as milk, cheese, egg yolk, fish etc. Different forms of Vitamin D3 supplementation are also available.

Conflict of Interest: None.

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