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Vitamin D, ventilatory function and asthma control among bronchial asthma patients

Abstract

Background: Asthma is a chronic conducting airway disorder which characterized by reversible airway inflammation and obstruction. However, prevalence of some pulmonary disorders as bronchial asthma is increased with Vitamin D deficiency. Objective: The target of this study is to evaluate the association between status of vitamin D and ventilatory function & asthma control in patients with bronchial asthma in Jeddah area.

Material and methods: One hundred Saudi patients with asthma of both sex; their age mean was 35.18±6.27 year were selected on referral to Internal Medicine Department, King Abdulaziz University Teaching Hospital, Saudi Arabia. Asthma was diagnosed by spirometry tests. Criteria for asthma diagnosis were in accordance with the Global Strategy for Asthma Management and Prevention (GINA 2016). Exclusion criteria included patients with renal, cardiac and liver diseases. All participants will be free to withdraw from the study at any time. Following pre-training testing, participants were enrolled in three groups according to 25-OHD levels: vitamin D deficiency group (A) 25-OHD level <20ng/ml, vitamin D deficiency group (B) 25-OHD level=20–30 ng/ml and normal vitamin D group(C) 25-OHD level >30ng/ml.

Results: There was significant higher values of FVC, FEV1 and FEV1/FVC in group (C) compared to subgroup (A) and group (B) in addition to lower values of asthma control test in subgroup (C) compared to group (A) and group (B). While there was significant difference between groups. Moreover, the 25-OHD showed a strong direct relationship with FVC, FEV1, FEV1/FVC and asthma control test in the three groups ($P<0.05$).

Conclusion: There is a close direct relationship between level of vitamin D, ventilatory function and asthma control in patients with bronchial asthma.

Keywords: asthma control, bronchial asthma, ventilatory function, Vitamin D

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Introduction

Asthma is a chronic conducting airway disorder which characterized by reversible airway inflammation and obstruction.[1] Asthma is the leading chronic respiratory diseases which affect more than 334 million people worldwide.[2-4] By 2025, this number will be expected to reach greater than 100 million.[5] Approximately 500,000 annual hospitalizations are due to asthma, and 250 000 deaths annually.[4] The economic burden of asthma management is huge.[6]

Although the advances in management of medical disorders, there is no cure from asthma as there is limitation in management options from asthma associated symptoms, however corticosteroid is the most common used drug for control of asthma symptoms which can control inflammatory criteria with no prevention of long-term pulmonary function decline.[7]

Vitamin D plays an important role in regulation of functions in body organs and systems as metabolism of bone and immune system.[8] In the other hand, there are some disorders of cardiovascular system and allergy associated with vitamin deficiency D.[9,10] Moreover, prevalence of some pulmonary disorders as bronchial asthma is increased with Vitamin D deficiency.[11]

Many previous studies reported an association between the pathogenesis of asthma and deficiency of vitamin D which was evident by the association between severity of asthmatic symptoms and level of vitamin D.[12,13] Even genetic researches proved a link between vitamin D receptors polymorphisms and susceptibility to asthma.[14] Moreover, studies found an association between exacerbations of asthmatic symptoms and low level of serum vitamin D.[15-17]

This study designed to measure the association between vitamin D and ventilatory function & asthma control in patients with bronchial asthma.

Materials and methods

Subjects

One hundred patients with asthma, the mean of their age was 35.18±6.27 year participated in this study. Patient with hepatic, renal and cardiac failure were excluded from the study. According to the level of 25-OHD, participants were assigned equally to three groups where vitamin D deficiency group (A) 25-OHD level <20ng/ml, vitamin D deficiency group (B) 25-OHD level=20–30ng/ml and normal vitamin D group(C) 25-OHD level >30ng/ml. All participants signed consent form.

Measurements

A. **Level of 25-hydroxyvitamin D (25-OHD) serum measurements:** Overnight fasting venous blood sample will be drain and will be centrifuged to measure 25(OH) vitamin

D for all participant using Elisa Kit; DiaSorin, Stillwater, MN, USA.[8,18]

B. Ventilatory function test: A computerized spirometer (Schiler- Spirovit SP-10, Swizerland) will be used to measure forced vital capacity (FVC), forced expiratory volume in the first second (FEV1) and Ratio between forced expiratory volume in the first second and forced vital capacity (FEV1/FVC).

C. The Asthma Control Test (ACT): It is a survey for assessment of asthma control that is composed of five item which is a valid clinical test to measure the level of asthma control in different asthmatic patient populations.[19]

Results

Baseline characteristics of all participants in both groups showed that there was no statistically significant difference between the three groups as regards all variables (Table 1).

Table 1 Baseline characteristics of all participants in both groups

Variable	Group (A) (25-OHD<20 ng/ml)	Group (B) (25-OHD = 20-30 ng/ml)	Group (C) (25-OHD level >30 ng/ml)	P value
Age (year)	36.28±6.47	35.81± 5.49	34.92± 4.87	0.075
BMI (kg/m^2)	27.34±3.16	26.52±4.21	28.14±3.25	0.148
SBP (mm Hg)	144.25±11.37	146.13±10.86	146.56±9.71	0.032
DBP (mm Hg)	87.13±6.15	85.28±5.42	84.94±4.87	0.174
Hemoglobin (gm/dl)	12.78±1.92	13.11±1.85	12.63±1.74	0.028

BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure

There was significant higher values of FVC, FEV1 and FEV1/FVC in group (C) compared to subgroup (A) and group (B) in addition to lower values of asthma control test in subgroup (C) compared to group (A) and group (B) (Table 2). While there was significant difference between groups. Moreover, the 25-OHD showed a strong direct relationship with FVC, FEV1 ,FEV1/FVC and asthma control test in the three groups (Table 3) (P<0.05).

Table 2 Comparison between Patients' groups regarding FVC, FEV_1, FEV_1/FVC and Asthma control test

Variable	Group (A) (25-OHD<20 ng/ml)	Group (B) (25-OHD = 20-30 ng/ml)	Group (C) (25-OHD level >30 ng/ml)	P value
FVC (L)	2.73±1.15	2.94± 1.23	3.75± 1.27	0.014*
FEV_1(L)	1.62±0.76	1.91±0.82	2.62±0.79	0.016*
FEV_1/FVC (%)	58.16±4.97	63.24±5.12	67.95±5.48	0.002*
Asthma control test	16.85±2.67	18.41±3.15	21.85±3.24	0.004*

FVC, forced vital capacity; FEV_1, forced expiratory volume in the first second; FEV_1/FVC, ratio between forced expiratory volume in the first second and forced vital capacity; (*) indicates a significant difference between groups, P < 0.05

Table 3 Correlation coefficient (r) of 25-OHD, FVC, FEV_1, FEV_1/FVC and Asthma control test in the three groups

	Group (A) (25-OHD<20 ng/ml)	Group (B) (25-OHD = 20-30 ng/ml)	Group (C) (25-OHD level >30 ng/ml)
FVC (L)	0.615*	0.549**	0.735**
FEV_1(L)	0.582 **	0.634*	0.629*
FEV_1/FVC (%)	0.716 **	0.671**	0.612*
Asthma control test	0.684 *	0.722**	0.657**

Spearman's correlation was used *: P < 0.05 **: P < 0.01

Discussion

Bronchial asthma characterized by the inflammation of the airways, leading to bronchial hyper-responsiveness and airflow obstruction.[20] However, low serum vitamin D levels have been observed to be associated with increased corticosteroid use among asthmatic children.[21] Many studies confirmed a positive relationship between asthma and vitamin D deficiency,[22,23] while others failed to show any association between the risk factors.[24,25] Therefore, this study aimed to evaluate the association between status of vitamin D and ventilatory function among asthmatic patients.

The results of the confirmed that concentration of vitamin D was lower in asthmatic patients with worse ventilatory function test and asthma control test, these results agreed with Li. et al., Korn et al. and Montero-Arias et al. reported the same findings.[26-28] However, Shaaban and Hashem confirmed low vitamin D among 79% of asthmatic patients.[29] While, Eman Shebl et al. stated that 40% of asthmatic patients had low vitamin D.[30]

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Concerning relation between vitamin D & both asthma control and ventilatory function, there was a positive correlation between them among asthma patients.[28,31] However, several studies reported positive correlation between Vitamin D and lung function.[28,30,32] In the other hand, many previous studies reported that Vitamin D was positively associated with level of asthma control among asthma patients.[33-36] While, Boonpiyathad and colleagues proved that supplemented vitamin D improved asthma control in in adult patients with asthma exacerbation.[37]

There are several mechanisms that clarify how vitamin D deficiency induced in asthma pathogenesis include the regulatory effects of Vitamin D in immune system performance,[38] in addition vitamin D stimulates steroid sensitivity inside body and modulates cytokine production.[39] However, Hall and Agrawal reported that vitamin D deficiency may influence the inflammatory response in the airways.[40] In the other hand, vitamin D affects synthesis of collagen that probably improve lung function.[41]

Conclusion

There is a close direct relationship between level of vitamin D, ventilatory function and asthma control in patients with bronchial asthma.

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References

1. Hall SC, Fischer KD, Agrawal DK. The impact of vitamin D on asthmatic human airway smooth muscle. *Expert Rev Respir Med*. 2016;10(2):127–135.
2. Masoli M, Fabian D, Holt S, et al. The global burden of asthma: executive summary of the GINA Dissemination Committee report. *Allergy*. 2004;59(5):469–478.
3. Beasley R. The Global Burden of Asthma Report, Global Initiative for Asthma. 2004.
4. World Health Organization. Global surveillance, prevention and control of chronic respiratory diseases: a comprehensive approach. 2007.
5. Centers for Disease Control and Prevention, Vital Signs. 2011.
6. Loftus PA, Wise SK. Epidemiology and economic burden of asthma. *Int Forum Allergy Rhinol*. 2015;5(Suppl1):S7–S10.
7. Fergeson JE , Patel SS, Lockey RF. Acute asthma, prognosis, and treatment. *J Allergy ClinImmunol*. 2016.
8. Holick MF. Medical progress: vitamin D deficiency. *New England Journal of Medicine*. 2007;357(3):266–281.
9. Zhang R, Naughton DP. Vitamin D in health and disease: current perspectives. *Nutrition Journal*. 2010;9(1):65.
10. Frieri M, Valluri A. Vitamin D deficiency as a risk factor for allergic disorders and immune mechanisms. *Allergy and Asthma Proceedings*. 2011;32(6):438–444.
11. Mirzakhani H, Al-Garawi A, Weiss ST, et al. Vitamin D and the development of allergic disease: How important is it? *Clin E xp Allergy*. 2015;45:114–125.
12. Yawn J, Lawrence LA, Carroll WW, et al. Vitamin D for the treatment of respiratory diseases: Is it the end or just the beginning? *J Steroid Biochem Mol Biol*. 2015;148:326–337.
13. Bozzetto S, Carraro S, Giordano G, et al. Asthma, allergy and respiratory infections: The vitamin D hypothesis. *Allergy*. 2012;67(1):10–17.
14. Tizaoui K, Berraies A, Hamdi B, et al. Association of vitamin D receptor gene polymorphisms with asthma risk: Systematic review and updated meta-analysis of case- control studies. *Lung*. 2014;192(6):955–965.
15. Thacher TD, Clarke BL. Vitamin D insufficiency. *Mayo Clin Proc*. 2011;86:50–60.
16. Gupta A, Bush A, Hawrylowicz C, et al. Vitamin D and asthma in children. *Paediatr Respir Rev*. 2012;13():236–243.
17. Global Initiative for Asthma (GINA). Global Strategy for Asthma Management and Prevention (Updated 2016), Global Initiative for Asthma (GINA). 2016.
18. Effraimidis G, Badenhoop K, Tijssen JG, et al. Vitamin D deficiency is not associated with early stages of thyroid autoimmunity. *Eur J Endocrinol*. 2012;167(1):43–48.
19. Nathan RA, Sorkness CA, Kosinski M, et al. Development of the Asthma Control Test: a survey for assessing asthma control. *J Allergy Clin Immunol. 2004*;113(1):59–65.
20. Contoli M, Bousquet J, Fabbri LM, et al. The small airways and distal lung compartment in asthma and COPD: a time for reappraisal. *Allergy*. 2010;65(2):141–151.
21. Brehm JM, Celedo´n JC, Soto-Quiros ME, et al. Serum vitamin D levels and markers of severity of childhood asthma in Costa Rica. *Am J Respir Crit Care Med*. 2009;179(9):765–771.
22. Krobtrakulchai W, Praikanahok J, Visitsunthorn N, et al. The effect of vitamin d status on pediatric asthma at a university hospital, Thailand. *Allergy Asthma Immunol Res*. 2013;5(5):289–294.
23. Carraro S, Giordano G, Reniero F, et al. Asthma severity in childhood and metabolomic profiling of breath condensate. *Allergy*. 2013;68(1):110–117.
24. Bener A, Ehlayel MS, Tulic MK, et al. Vitamin D deficiency as a strong predictor of asthma in children. *Int Arch Allergy Immunol*. 2012;157(2):168–175.
25. Gergen PJ, Teach SJ, Mitchell HE, et al. Lack of a relation between serum 25-hydroxyvitamin D concentrations and asthma in adolescents. *Am J Clin Nutr*. 2013;97(6):1228–1234.
26. F Li, M Peng, L Jiang, et al. Vitamin D deficiency is associated with decreased lung function in Chinese adults with asthma. *Respiration*. 2011;81:469–475.
27. Stephanie Korn, Marisa Hubner, Matthias Jung, et al. Severe and uncontrolled adult asthma is associated with vitamin D insufficiency and deficiency. *Respir Res*. 2013(14):25.
28. Felicia Montero-Arias, Giovanni Sedo´-Mejıa, Allan Ramos-Esquivel. Vitamin D insufficiency is associated with asthma severity. *Allergy Asthma Immunol Res*. 2013;5:283–288.
29. Mostafa M Shaaban, Manal Hashem. Serum 25 hydroxy vitamin D levels in adult asthmatic patients. *Egypt J Hosp Med*. 2012;49:946–952.
30. R Eman Shebl, Samah M Shehata, Maha Elgabry, et al. Vitamin D and phenotypes of bronchial asthma. *Egypt J Chest Dis Tuberc*. 2013;201–205.
31. Atul Gupta, Alies Sjoukes, David Richards, et al. Relationship between serum vitamin D, disease severity, and airway remodeling in children with asthma. *Am J Respir Crit Care Med*. 2011;184(12):1342–1349.

32. Abd El Aaty H, Abd El Aziz A, El Habashy M, et al. Assessment of Serum Vitamin D in Patients with Bronchial Asthma. *Egyptian Journal of Chest Diseases and Tuberculosis.* 2015;64:1–5.

33. Beyhan-Sagmen S, Baykan O, Balcan B, et al. Association Between Severe Vitamin D Deficiency, Lung Function and Asthma Control. *Arch Bronconeumol.* 2017;53(4):186–191.

34. Chinellato I, Piazza M, Sandri M, et al. Vitamin D Serum Levels and Markers of Asthma Control in Italian Children. *J Pediatr.* 2011;158(3):437–441.

35. Karanam S, Reddy S, Ramesh H. Vitamin D status in asthmatic children and its correlation to asthma control. *Int J Contemp Pediatr.* 2018;5(2):520–525.

36. Havan M, Razi CH, Bulus AD, et al. Effects of 25 hydroxy vitamin D levels on the severity and asthma control in school age asthma patients. *Arch Argent Pediatr.* 2017;115(4):336–342.

37. Boonpiyathad T, Chantveerawong T, Pradubpongsa P, et al. Serum Vitamin D Levels and Vitamin D Supplement in Adult Patients with Asthma Exacerbation. *J Allergy.* 2016;2016:4070635.

38. Mora JR, Iwata M, von Andriano UH. Vitamin effect on the immune system: vitamin A and D centre stage. *Nat Rew Immunol.* 2008;8:685–698.

39. Ginde AA, Mansbach JM, Camargo CA. Vitamin D, respiratory infections and asthma. *Curr Allergy Asthma Rep.* 2009;9:81–87.

40. Hall SC, Agrawal DK. Vitamin D and Bronchial Asthma: An Overview of Data from the Past 5 Years. *Clin Ther.* 2017;39(5):917–929.

41. G Damera, HW Fogle, P Lim,, et al, Vitamin D inhibits growth of human airway smooth muscle cells through growth factor-induced phosphorylation of retinoblastoma protein and checkpoint kinase 1. *Br J Pharmacol.* 2009;158:1429–1441.

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