Reflux, Allergic Rhinitis, and Sleep Disorders with Asthma Control and Quality of Life

Reflü, Alerjik Rinit ve Uyku Bozukluklarının, Astım Kontrolü ve Yaşam Kalitesi İle İlişkisi

Astım ve Komorbiditeler / Asthma and Comorbidities

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Özet

Amaç: Bu çalışmada, Türk astmatik hastalarda gastroözefageal reflü, alerjik rinit ve uyku bozukluklarının, astım kontrolü ve astım yaşam kalitesi ile ilişkisinin araştırılması amaçlanmıştır. Gereç ve Yöntem: Çalışmaya astım tanısı ile takip edilen 50 hasta alınmıştır. Başvuru sırasında spirometrik parametreler, Reflü Semptom İndeksi (RSİ), Alerjik Rinokonjonktivit Semptom İndeksi (ARSİ), Pittsburgh Uyku Kalitesi İndeksi (PUKİ), Astım Kontrol Testi (AKT) ve Astım Yaşam Kalitesi Ölçeği (AQLQ) bir doktor gözetiminde doldurduldu, ayrıca sigara alışkanlığı, vücut kitle indeksleri kaydedildi. Spirometrik parametreler ile RSİ, ARSİ ve PUKİ ile AQLQ ve AKT arasındaki ilişki SPSS 15.0 istatistik programı kullanılarak değerlendirildi. Bulgular: AKT ve RSİ arasında (r = - 0.314, p = 0.026) ve de AKT ve PUKİ arasında negatif korelasyon (r= -0,620; p<0.001) saptandı. AKT ve AQLQ arasında pozitif korelasyon saptanırken (r=0.667, p <0.001), AKT ve ARSİ arasında ilişki saptanmadı (p=0,25). AQLQ ve RSİ arasında (r= -0,551; p<0.001) ve de AQLQ ve ARSİ arasında (r= -0,390; p<0.005) negatif korelasyon saptandı. AQLQ ve PUKİ arasında ve ayrıca FEV1 değeri ile AKT, AQLQ, RSİ, ARSİ ve PUKİ arasında ilişki saptanmadı. Tartışma: Sonuç olarak gastroözefageal reflü ve alerjik rinit astımlı hastalarda yaşam kalitesini ve astım kontrolünü olumsuz yönde etkilemektedir, ayrıca kötü uyku kalitesi kötü astım kontrolü ile ilişkilidir.

Anahtar Kelimeler

Astım Kontrol Testi; Astım Yaşam Kalitesi; Gastroözefageal Reflü; Alerjik Rinit; Uyku Bozuklukları

Abstract

Aim: In this study we aimed to investigate the effect of comorbid diseases such as gastroesophageal reflux, allergic rhinitis, sleep disorders with asthma control test and asthma quality of life in Turkish asthma patients. Material and Method: Total of 50 patients who were followed with a diagnosis of asthma were enrolled in this study. During application, spirometric parameters, Reflux Symptom Index (RSI), Allergic Rhinoconjunctivitis Symptom Index (ARSI), Pittsburgh Sleep Quality Index (PSQI), Asthma Control Test (ACT), and Asthma Quality of Life Questionnaires (AQLQ) were filled under the supervision of a physician, also smoking habits, body mass index of cases were recorded. The relation of spirometric parameters, RSI, ARSI and PSQI with AQLQ and ACT tests were investigated by using SPSS 15.0 statistical software. Results: Negative correlation was found between the ACT and RSI (r = - 0.314, p = 0.026), ACT and PSQI (r= -0,620; p<0.001). Positive correlation was found between ACT and AQLQ (r=0.667, p <0.001), there was no relationship between ACT and ARSI (p=0,25). Negative correlation was found between AQLQ and RSI (r= -0,551; p<0.001), AQLQ and ARSI (r= -0,390; p<0.005). There was no relationship between AQLQ and PSQI (p=0.082), also there was no relationship between FEV1 value and ACT, AQLQ, RSI, ARSI, PSQI. Discussion: In conclusion, gastroesophageal reflux and allergic rhinoconjunctivitis negatively effect the quality of life and asthma control in asthmatic patients, also poor sleep quality is associated with poor asthma control.

Keywords

Asthma Control Test; Asthma Quality Of Life; Gastroesophageal Reflux; Allergic Rhinitis; Sleep Disorders

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Introduction

Comorbid conditions among patients with asthma are common and may decrease the quality of life and are associated with adverse behavioral and psychosocial affects [1]. Also, despite therapeutic progress, the morbidity and mortality of asthma is substantial since some comorbidities influence the management of this chronic disease. Therefore, finding and elimination of these influencing factors are one of the priorities. There is a considerable evidence that, special medical conditions affect asthma managing, such as gastroesophageal reflux, allergic rhinitis, infections, surgery, obesity related comorbidities like obstructive sleep apnea [2-6].

Association of asthma with gastroesophageal reflux and allergic rhinitis is well known. Cheung and his colleagues showed that a significant proportion of asthmatic patients in Hong Kong have gastroesophageal reflux disease (GERD) and this is associated with poorer asthmatic control, quality of life and physiological status [3]. Allergic rhinitis and its impact on asthma have also been reported in detail in a review article written by Bousquet and his colleagues [4].

Global Initiative for Asthma (GINA) guideline reported that special consideration are required in managing asthma in relation to gastroesophageal reflux, rhinitis, sinusitis, respiratory infections, obesity and surgery [2]. In order to improve the treatment of patients with asthma and to control disease that is the main goal of therapy, comorbidities must be taken into consideration, and it is important to treat these conditions [5].

The better asthma control means the better quality of life, therefore, we aimed to investigate the effect of gastroesophageal reflux, allergic rhinitis, sleep disorders with asthma control and quality of life in Turkish asthma patients at a major University Hospital in Istanbul.

Material and Metod

The study was approved by the Clinical Researches Ethic Committee of Istanbul University, Cerrahpaşa Medical Faculty (27/09/2010, No: 28936), informed written consent were obtained from all patients. The power analysis is calculated according to statistically meaningful minimal change in ACT and AQLQ values, and found that at least 29 patients are needed for study population.

Study Population

All asthma patients who followed at asthma clinic of Istanbul University Cerrahpasa Faculty of Medicine, Department of Pulmonary Diseases, from September 2010 to November 2010 were screened. Those patients who were 20-65 years of age, were invited to participate in this study. Patients were excluded from study entry if they have; 1) asthma attach in past one month, 2) diagnosis of active lung diseases except asthma, 3) diagnosis of sleep disorders, 4) acute upper respiratory tract infections, 5) uncontrolled hypothyroidism/hyperthyroidism, 6) depression, 7) pregnancy, 8) urinary system disorders, benign prostate hyperplasia, 9) using medicine for other comorbidities.

Patients who signed consent form were asked to fill in the Reflux Symptom Index (RSI), Allergic Rhinoconjunctivitis Symptom Index (ARSI), Pittsburgh Sleep Quality Index (PSQI), Asthma Control Test (ACT), and Asthma Quality of Life Questionnaires (AQLQ) under the supervision of a physician, and also spirometric parameters, smoking habits, height-weight ratios of cases were recorded.

Pulmonary Function test: Lung function tests were performed at the pulmonary function laboratory of Istanbul University Cerrahpasa Medical Faculty, Pulmonology Department by using a ZAN 100 Spiromed (ZAN, Oberthulba, Germany), in accordance with the manufacturer's instructions. The maximum forced expiratory volume in 1 second (FEV_1) was calculated from up to three technically acceptable blows in accordance with the American Thoracic Society criteria for reproducibility [7].

Asthma Control Test (ACT): The ACT survey is a patient-completed questionnaire with 5 items assessing asthma symptoms (daytime and nocturnal), use of rescue medication, and the effect of asthma on daily activities. Each item includes 5 response options corresponding to a 5-point Liker-type rating scale. In scoring the ACT survey responses for each of the 5 items are summed to yield a score ranging from 5 (poor control of asthma) to 25 (complete control of asthma) [8, 9]. The validated Turkish version of ACT was used [10].

Asthma Quality of Life Questionnaire (AQLQ): The questionnaire includes 32 questions. Patients respond to each question on a seven-point scale and recall their experiences during the previous 2 weeks. Results are expressed as four domain scores (symptoms, 12 questions; emotional function, 5 questions; activities, 11 questions; exposure to environmental stimuli, 4 questions), and as an overall score (32 questions). A change in score ≥0.5 on the seven-point scale can be considered clinically important [11-16]. The validated Turkish version of AQLQ was used [17].

Allergic Rhinoconjunctivitis Symptom Index (ARSI): ARSI was a self-recorded questionnaire, includes 12 questions related with eye, nose, throat and general symptoms of rhinoconjunctivitis, questions were modified and translated in Turkish from study of Wassefallen et al [18]. The severity of symptoms was assessed with reference to the previous 2 weeks, and scored on a scale from 0-4 (0=none, 1=mild, 2=moderate, 3=severe, 4=very severe). The time to complete the questionnaire was on average 5 minutes.

Reflux Symptom Index (RSI): RSI is a self-administered questionnaire, includes 9 questions related with laryngopharyngeal reflux. Each of the items is scored from 0 (no problem) to 5 (severe problem) [19-21].

Pittsburgh Sleep Quality Index (PSQI): Pittsburgh Sleep Quality Index (PSQI) is a self-rated questionnaire which assesses sleep quality and disturbances over a 1-month time interval. Nineteen individual items generate seven "component" scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. The sum of scores for these seven components yields one global score. A global PSQI score greater than 5 yielded a diagnostic sensitivity of 89.6% and specificity of 86.5% (kappa = 0.75, $p< 0.001$) in distinguishing good and poor sleepers [22, 23]. The validated Turkish version of PSQI was used [24].

Body Mass Index (BMI): Body Mass Index (BMI) is a simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults. It is defined as the weight in kilograms divided by the square of the height in meters (kg/m2) Table 1 [25].

Results

Total of 50 patients, 16 (32%) male, 34 (68%) female who were followed with a diagnosis of asthma (20% intermittent, 40% mild persistent, 32% moderate persistent, and 8% severe persistent) were enrolled in this study. The mean age was 42.20±14.02 years, 23 (46%) patients had reflux symptoms, 40 (80%) had rhinitis symptoms, and 14 (28%) had comorbidities like diabetes mellitus, hypertension, renal failure. Preobesity and obesity were present in 68% of patients. The minimum, maximum, mean and standart deviation value of age, AQLQ, ACT, PSQI, ARSI, RSI and FEV1% are shown in Table 2.

Table 1. The International Classification of adult underweight, overweight and obesity according to BMI

Classification	BMI(kg/m²)
Underweight	<18.50
Normal range	18.50-24.99
Overweight	≥25.00
Pre-obese	25.00-29.99
Obese	≥30.00
Obese class 1	30.00-34.99
Obese class 2	35.00-39.99
Obese class 3	≥ 40.00

There were no relation between presence of comorbidities like obesity, diabetes mellitus, hypertension, renal failure, smoking history, according to ACT and AQLQ (p>0.05).

Table 2. Age, AQLQ, ACT, PSQI, ARSI, RSI and FEV1% values

	Minimum	Maximum	Mean	SD
Age	18	68	42.20	14.02
AQLQ	51	197	123.64	35.07
ACT	5	25	16.64	5.26
PSQI	0	16	6.04	3.02
ARSI	0	48	17.48	12.51
RSI	0	36	11.26	9.73
FEV1%	38	117	85.30	17.28

According to ACT scores; 2 (4%) cases were completely controlled (score 25), 16 (32%) cases were partly controlled (score: 24-20), 32 (64%) cases were not controlled. Also, 30 patients had FEV1 value ≥80%, 16 had FEV1 between 60% and 80%, 4 had FEV1<60%. There was no relationship between FEV1 value and ACT scores (r=0.176; p=0.220).

PSQI score was ≤5 in 26 (52%) cases, 6-9 in 20 (40%) cases and ≥10 in 4 (8%) cases.

RSI was >13 in 24 (48%) cases. The mean ARSI score was 17.48 ±12.51.

In AQLQ; The mean total score was 123.64±35.07, symptoms score was 52.69 ±16.58, activity restriction score was 41.19±12.19, emotional function score was 20.90±7.56, environmental factors score was 10.93±6.72.

Negative correlation was found between AQLQ and RSI (r=-0,551; p<0.001), also between AQLQ and ARSI (r=- 0,390; p<0.005). There was no relationship between AQLQ and PSQI (p=0.082), also there was no relationship between FEV1 value and ACT, AQLQ, RSI, ARSI, PSQI.

Negative correlation was found between the ACT and RSI (r = - 0.314, p = 0.026), ACT and PSQI (r=-0,620; p<0.001). Positive correlation was found between ACT and AQLQ. There was no relationship between ACT and ARSI (p=0,25). All correlation analysis is shown in Table 3.

Discussion

There was negative correlation between AQLQ and RSI , and between ACT and RSI. These results are in accordance with the recent studies [3, 5]. Cheung and his colleagues showed that, a significant proportion of asthmatic patients in Hong Kong have gastroesophageal reflux disease (GERD), and this is associated with poorer asthmatic control, quality of life, and psychological status [3]. In another study, Bisaccioni and his colleagues analyzed the data that obtained from electronic medical records of patients with severe asthma between 2006 and 2008; and they reported that 70.6 % of all severe asthma patients have GER symptoms [5]. These results were not surprise, at the beginning of 19's century, Sir William Osler formally recognized GERD as a potential trigger of asthma and stated that " ...attacks may be due to direct irritation of the bronchial mucosa or indirectly, too, by reflex influences from stomach..."[26]. When time is going on, some studies supported the association between asthma and gastroesophageal reflux [3, 5, 27-29]. Also, recent studies showed the effectiveness of GERD treatment for improvements in asthma outcomes [30, 31]. However, a meta-analysis of the effectiveness of GERD treatment in patients with asthma reported that improvements in asthma outcomes were inconclusive [32]. Therefore, further studies are needed about effectiveness of GERD treatment and asthma outcomes.

Tablo 3. Correlation analysis between all parameters

	RSI		ACT		PSQI		FEV1%	
	r	p	r	p	r	p	r	p
AQLQ	-,551	,000***	,667	,000***	-,249	,082	,127	,380
Symptoms	-,542	,000***	,686	,000***	-,277	,051	,155	,283
Activity restriction	-,431	,002**	,527	,000***	-,199	,167	,160	,267
Emotional function	-,471	,001**	,672	,000***	-,357	,011*	-,028	,845
Environmental factors	-,361	,010*	,238	,096	,082	,569	,063	,664
ACT	-,314	,026*						
PSQI	,240	,093	-,620	,000***				
FEV1%	-,007	,961	,176	,220	-,112	,437		

The majority of patients with asthma have a history or evidence of rhinitis and up to 30% of patients with persistent rhinitis have or develop asthma [2, 33-35]. Rhinitis and asthma share several risk factors [2]. For these reasons, the Allergic Rhinitis and its Impact on Asthma (ARIA) initiative recommends that the presence of asthma must be considered in all patients with rhinitis, and that in planning treatment , both should be considered together [36, 37]. The recent studies reported that, 75-91% of all asthma patients had also rhinitis symptoms [33, 38, 39]. In our study, 80% of all asthma patients had rhinitis symptoms,

and negative correlation was found between AQLQ and ARSI (r=- 0,390; p<0.005). This result is similar with study of Dan Lu and his colleagues [40]. They reported that, the quality of life of patient with persistent allergic rhinitis is worse than patients with intermittent allergic rhinitis. In addition to this, we found that there was no relationship between ACT and ARSI (p= 0,25), there is limited data in literatures so more studies are needed to conclude.

Recent studies reported that, asthma is more difficult to control in the obese patient [41-43], since different type of airway inflammation, obesity related comorbidities such as obstructive sleep apnea [2]. Luyster and his colleagues showed that, poor sleep quality is associated with poor asthma control and quality of life among asthmatics [44]. Similar to Luyster's result, in our study we found that there was negative correlation between ACT and PSQI (r=-0,620; p<0.001). Nevertheless, in our study, there was no relation between obesity and ACT and AQLQ (p>0.05), and there was no relation between AQLQ and PSQI (p=0.082).

Our study has some limitations like low number of study population and absence of control group, short follow up period.

In conclusion, gastroesophageal reflux and allergic rhinoconjunctivitis negatively effect the quality of life and asthma control in asthmatic patients, also poor sleep quality is associated with poor asthma control. The diagnosis and the treatment of gastroesophageal reflux, allergic rhinoconjunctivitis and having good sleep quality are important for the success of asthma treatment. Further, detailed studies are needed to conclude.

Competing interests

The authors declare that they have no competing interests.

References

1. Hakola R, Kauppi P, Leino T, Ojajarvi A, Pentti J, Oksanen T, et al. Persistent asthma, comorbid conditions and the risk of work disability: a prospective cohort study. Allergy 2011;66(12):1598-603.
2. Global Initiative For Asthma. Global Strategy for Asthma Management and Prevention. Vancouver, WA, USA: GINA, 2012.
3. Cheung TK, Lam B, Lam KF, Ip Mary, Ng C, Kung R, et al. Gastroesophageal reflux disease is associated with poor asthma control, quality of life, and psychological status in Chinese asthma patients. Chest 2009;135(5):1181-5.
4. Bousquet J, Khaltaev N, Cruz A.A, Denburg J, Fokkens W.J, Togias A, et al. Allergic Rhinitis and its Impact on Asthma (ARIA) 2008 update (in collaboration with the World Health Organization, GA(2)LEN and AllerGen) Allergy 2008;63(86):8-160.
5. Bisaccioni C, Aun MV, Cajuela E, Kalil J, Agondi RC, Giavina-Bianchi P. Comorbidities in Severe Asthma: frequency of rhinitis, nasal polyposis, gastroesophageal reflux disease, vocal cord dysfunction and bronchiectasis. Clinics 2009;64(8):769-73.
6. Mastronarde JG, Wise RA, Shade DM, Olopade CO, Scharf SM. Sleep quality in asthma: results of a large prospective clinical trial. J Asthma 2008;45(3):183-9.
7. Standardization of Spirometry, 1994 Update. American Thoracic Society. Am J Respir Crit Care Med 1995;152(3):1107-36.
8. Nathan RA, Sorkness CA, Kosinski M, Schatz M, Li JT, Marcus P, et al. Development of the asthma control test: a survey for assessing asthma control. J Allergy Clin Immunol 2004;113(1):59-65.
9. Schatz M, Sorkness CA, Li JT, Marcus P, Murray JJ, Nathan RA, et al. Asthma Control Test: reliability, validity, and responsiveness in patients not previously followed by asthma specialist. J Allergy Clin Immunol 2006;117(3):549-56.
10. Uysal MA, Mungan D, Yorgancıoğlu A, Yıldız F, Akgun M, Gemicioğlu B, Turktas H. The validation of the Turkish version of Asthma Control Test. Qual Life Res 2013;22(7):1773-9.
11. Juniper EF, Guyatt GH, Epstein RS, Ferrie PJ, Jaeschke R,Hiller TK. Evaluation of impairment of health related quality of life in asthma: development of questionnaire for use in clinical trials. Thorax 1992;47(2):76-83.
12. Juniper EF, Guyatt GH, Ferrie PJ, Griffith LE. Measuring quality of life in asthma. Am Rev Respir Dis 1993;147(4):832-8.
13. Juniper EF, Guyatt GH, Willan A, Griffith LE. Determining a minimal important change in a disease-specific Quality of Life Questionnaire. J Clin Epidemiol 1994;47(1):81-7.
14. Juniper EF, Guyatt GH, Streiner DL, King DR. Clinical impact versus factor analysis for quality of life questionnaire construction. J Clin Epidemiol 1997;50(3):233-8.
15. Juniper EF, O'Byrne PM, Guyatt GH, Ferrie PJ, King DR. Development and validation of questionnaire to measure asthma control. Eur Respir J 1999;14(4):902-7.
16. Juniper EF, Buist AS, Ferrie PJ, King DR. Validation of a standardized version of the Asthma Quality of Life Questionnaire. Chest 1999;115(5):1265-70.
17. Ozgen Alpaydın A, Yorgancıoglu A, Yılmaz O, Bora M, Goktalay T, Celik P, Yuksel H. Validity and reliability of "asthma quality of life questionnaire" in a sample of Turkish adult asthmatic patients. Tuberk Toraks 2011;59(4):321-7.
18. Wasserfallen JB, Gold K, Schulman KA, Baraniuk JN. Development and validation of a rhinoconjunctivitis and asthma symptom score for use as an outcome measure in clinical trials. J Allergy Clin Immunol 1997;100(1):16-22.
19. Belafsky PC, Postma GN, Koufman JA. Validity and reliability of the reflux symptom index (RSI). J Voice 2002;16(2):274-7.
20. Habermann W, Schmid C, Neumann K, Devaney T, Hammer HF. Reflux Symptom Index and Reflux Finding Score in Otolaryngologic Practice. J Voice 2012;26(3):123-7.
21. Belafsky PC, Postma GN, Koufman JA. Laryngopharyngeal reflux symptoms improve before changes in physical findings. Laryngoscope 2001;111(6):979-81.
22. Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Res 1989;28(2):193-213.
23. Buysse DJ, Reynolds CF 3rd, Monk TH, Hoch CC, Yeager AL, Kupfer DJ. Quantification of subjective sleep quality in healthy elderly men and women using the Pittsburg Sleep Quality Index (PSQI). Sleep 1991;14(4):331-8.
24. Akargun MY, Kara H, Anlar O. Pittsburgh Uyku Kalitesi Indeksinin Geçerliligi ve Guvenirligi. Turk Psikiyatri Derg 1996;7(2):107-15.
25. WHO Expert Consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet 2004;363(9403):157-63.
26. Osler WB, editor. The principles and practice of medicine. New York: D Appleton; 1912. p. 1-16.
27. Harding SM. Acid reflux and asthma. Curr Opin Pulm Med 2003;9(1):42-5.
28. Harding SM. Gastroesophageal reflux and asthma:insight into the association. J Allergy Clin Immunol 1999;104(1-2):251-9.
29. Harding SM. Gastroesophageal reflux: a potential asthma trigger. Immunol Allergy Clin N Am 2005;25(1):131-48.
30. Kiljander TO, Harding SM, Field SK, Stein MR, Nelson HS, Ekelund J, et al. Effects of esomeprazole 40 mg twice daily on asthma: a randomized placebo-controlled trial. Am J Respir Crit Care Med 2006;173(10):1091-7.
31. Kiljander TO, Junghard O, Beckman O, Lind T. Effect of esomeprazole 40 mg once or twice daily on asthma: a randomized, placebo-controlled study. Am J Respir Crit Care Med 2010;181(10):1042-8.
32. Gibson PG, Henry RL, Coughlan JL. Gastro-oesophageal reflux treatment for asthma in adults and children. Cochrane Database Syst Rev 2003;(2):CD001496.
33. Leynaert B, Bousquet J, Neukirch C, Liard R, Neukirch F Perennial rhinitis: An independent risk factor for asthma in nonatopic subjects: results from the European Community Respiratory Health Survey.J Allergy Clin Immunol 1999;104(2):301-4.
34. Sibbald B, Rink E. Epidemiology of seasonal and perennial rhinitis: clinical presentation and medical history. Thorax 1991;46(12):895-901.
35. Shaaban R, Zureik M, Soussan D, Neukirch C, Heinrich J, Sunyer J, et al. Rhinitis and onset of asthma: a longitudinal population-based study. Lancet 2008; 372(9643):1049-57.
36. Bousquet J, Khaltaev N, Cruz AA, Denburg J, Fokkens WJ, Fokkens W, et al. Allergic Rhinitis and its Impact on Asthma (ARIA) 2008 update (in collaboration with the World Health Organization, GA(2)LEN and AllerGen). Allergy 2008;63(86):8-160.
37. Bousquet J, Van Cauwenberge P, Khaltaev N; Aria Workshop Group; World Health Organization. Allergic rhinitis and its impact on asthma. J Allergy Clin Immunol 2001;108(5):147-334.
38. Palma-Carlos AG, Branco-Ferreira M, Palma-Carlos ML. Allergic rhinitis and asthma: more similarities than differences. Allerg Immunol 2001;33(6):237-41.
39. Corren J. Allergic rhinitis and asthma: how important is the link? J Allergy Clin Immunol 1997;99(2):781-6.
40. Lu D, Zhao Y, Zheng Y, An P, Wang L, Qiao X, Wang D. Evaluation of quality of life questionnaires for adult patients with moderate to severe allergic rhinitis. Am J Otolaryngol 2011;32(6):494-8.
41. Saint Pierre P, Bourdin A, Chanez P, Daures JP, Godard P. Are overweight asthmatics more difficult to control? Allergy 2006;61(1):79-84.
42. Lavoie KL, Bacon SL, Labrecque M, Cartier A, Ditto B. Higher BMI is associated with worse asthma control and quality of life but not asthma severity. Respir Med 2006;100(4):648-57.
43. Peters-Golden M, Swern A, Bird SS, Hustad CM, Grant E, Edelman JM. Influence of body mass index on the response to asthma controller agents. Eur Respir J 2006;27(3):495-503.
44. Luyster FS, Teodorescu M, Bleecker E, Busse W, Calhoun W, Castro M, et al. Sleep quality and asthma control and quality of life in non-severe and severe asthma. Sleep Breath 2012;16(4):1129-37.