Prevalence of smoking and chronic obstructive pulmonary disease amongst teachers working in Kocaeli, Turkey

Prevalenza di tabagismo e bronchite cronica ostruttiva tra gli insegnanti di Kocaeli, Turchia

Serap A. Barış[1], Füsun Yıldız[2], İlknur Başyiğit[2], Haşim Boyacı[2], Ahmet Ilgazlı[2]

[1] Department of Pulmonary Disease, M. Kazım Dinç Kandıra Government Hospital, Kandıra, Kocaeli, Turkey

[2] Department of Pulmonary Disease, School of Medicine, Kocaeli University, Kocaeli, Turkey

ABSTRACT

Aim: **To evaluate smoking and COPD prevalence amongst teachers working in the schools of Kocaeli City, Turkey.**

Method: **In this cross-sectional study, a questionnaire focusing on respiratory symptoms and smoking habits was administered to all participants who accepted to join the study. All subjects also underwent a physical examination and a pulmonary function test performed with portable spirometer. According to GOLD criteria, subjects who had post-bronchodilator $FEV_1/FVC < 70\%$ and negative reversibility test were classified as COPD.**

Results: **A total of 685 teachers were included [female n = 307 (45%), male n = 378 (55%)] with mean age 38.9 ± 8.9 years. Smoking habit was evaluated in 660 subjects: 291 (44.1%) were smokers, 252 (38.2%) were non-smokers and 117 (17.7%) were ex-smokers. Pulmonary function test was available in 651 subjects and 510 (78.3%) were defined as normal on spirometric analysis. Small airway obstruction was found in 115 of the cases (17.7%) in whom FEF_{25-75} level was found to be lower than 70% predicted. FEV_1/FVC level was lower than 70% in 16 subjects (2.5%). Five subjects who had positive reversibility test were excluded from the study. The remaining 11 subjects who were considered as COPD consisted of 2 (18%) females and 9 (82%) males. Six of these subjects were aged over 40 years.**

Conclusion: **Spirometry has an important role in early diagnosis of COPD. Spirometric evaluation of cases with risk factors for COPD could be helpful in diagnosing patients before the progressive decline in lung function begins. Further studies are needed to evaluate whether the interventional strategies at this stage such as smoking cessation could prevent the progression of disease.**

Keywords: **COPD, prevalence, spirometry.**

RIASSUNTO

Scopo: **Valutare la prevalenza di tabagismo e bronchite cronica ostruttiva (BPCO) tra gli insegnanti delle scuole di Kocaeli City in Turchia.**

Metodi: **Studio trasversale per il quale è stato distribuito un questionario incentrato sui sintomi respiratori e sull'abitudine tabagica a tutti i partecipanti che hanno accettato di prendere parte allo studio. Tutti i soggetti si sono sottoposti ad una visita e ad una spirometria effettuata con uno spirometro portatile. Sono stati classificati come BPCO, sulla base dei criteri GOLD, i soggetti che avevano dopo broncodilatatore un rapporto $FEV_1/FVC < 70\%$ e non presentavano reversibilità.**

Risultati: **Sono stati inclusi 685 insegnanti [femmine n = 307 (45%), maschi n = 378 (55%)] con un'età media di 38,9 ± 8,9 anni. In 600 soggetti è stata valutata l'abitudine al fumo: 291 (44,1%) erano fumatori, 252 (38,2%) non fumatori e 117 (17,7%) ex-fumatori. La spirometria era disponibile in 651 soggetti e 510 (78,3%) avevano una spirometria normale. Un'ostruzione delle piccole vie è stata riscontrata in 115 casi (17,7%), individuati per il valore di $FEF_{25-75} < 70\%$ del teorico. Il rapporto FEV_1/FVC era < 70% in 16 soggetti (2,5%). Cinque soggetti che hanno mostrato una broncoreversibilità sono stati esclusi dallo studio. I rimanenti 11 soggetti che sono perciò stati considerati come BPCO risultavano composti da 2 (18%) femmine e 9 (82%) maschi. Sei di questi soggetti avevano un'età superiore a 40 anni.**

Conclusioni: **La spirometria riveste un ruolo importante nella diagnosi precoce di BPCO. Una valutazione spirometrica dei casi con fattori di rischio per BPCO potrebbe essere di aiuto nel riuscire a fare diagnosi prima che inizi la progressione del**

Serap A. Barış
M. Kazım Dinç Kandıra Government Hospital, Department of Pulmonary Disease
Kandıra, Kocaeli, Turkey
email: serapargun2002@yahoo.com

Data di arrivo del testo: 15/09/2010 – Accettato dopo revisione: 10/12/2010

This study was presented as a discussion poster at the 12th Annual Congress of the Turkish Thoracic Society, April 8-12, 2009.

Multidisciplinary Respiratory Medicine 2011; 6(2): 92-96

declino della funzionalità respiratoria. Ulteriori studi sono necessari per valutare se le strategie di intervento in questo stadio, come la cessazione del fumo, possano prevenire la progressione della malattia.

Parole chiave: BPCO, prevalenza, spirometria.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a preventable and treatable disease characterized by chronic progressive airflow limitation that is not fully reversible. As a global health problem, COPD is a major cause of morbidity and mortality worldwide. Today, COPD ranks 6th among all causes of death and it is projected to be the 3rd leading cause of death in 2020 [1].

COPD prevalence is below 1% in all age groups according to the World Health Organization [2]. Recently, parallel with increased smoking rates and a progressive aging of the population, COPD prevalence has risen progressively [3]. The increase of tobacco marketing strategies in developing countries has caused COPD prevalence to rise worldwide [4]. Smoking is the most important risk factor for COPD. Since the majority of smokers start smoking at adolescent age, influence of society is very important at this period. Adolescents are influenced by friends and teachers who are role-models for them [5]. Therefore, smoking attitudes of teachers are especially important for our future generations and for the achievement of the goal of a smoke-free population. Unfortunately, although the data are limited, recent studies have found that smoking rates in teachers in Turkey were from 36.2% to 52.4% [6-10]. As a result of this high smoking rate, it was thought that COPD prevalence might be high in teachers. The aim of this study was to evaluate smoking and COPD prevalence amongst teachers working in the schools of Kocaeli City.

MATERIALS AND METHODS

Study population

In this cross-sectional population-based study, teachers who accepted to join the study and could perform an acceptable spirometer maneuver were included in the study. Cases that did not have appropriate questionnaire data or could not perform an acceptable spirometer maneuver were excluded from the study.

Study design

Teachers who work in Kocaeli were informed about the study aim and design. In this prospective study, the European Community Respiratory Health Survey (ECRHS) questionnaire [11] investigating respiratory symptoms and smoking habits was administered to all participants who accepted to join the study. All subjects underwent a physical examination and a pulmonary function test was performed with portable spirometer (Koko Legend portable spirometer; Ferraris Med, Co, USA). Spirometer calibration was checked daily with a 3-L syringe.

The pulmonary function test was performed according to American Thoracic Society (ATS) criteria by a trained technician with participants in a seated position [12]. Participants performed up to 8 forced expiratory maneuvers to obtain three acceptable maneuvers (difference between largest and second largest values < 200 ml for both forced expiratory volume in 1 sec [FEV_1] and forced vital capacity [FVC]). If the participants were tired or had not an acceptable maneuver, the test was stopped.

Values of FVC, FEV_1, FEV_1/FVC, forced expiratory flow $(FEF)_{25-75}$ were evaluated in the pulmonary function test. Patients with airflow limitation (FEV_1/FVC < 70%) received four puffs (100 mcg each) of salbutamol sulfate administered via a spacer (Volumatic®) and spirometry was performed after 20 minutes. An increase by 12% or 200 ml of the post-bronchodilator FEV_1 value with respect to baseline FEV_1 was defined as reversible [1,13,14]. Cases with reversible airway obstruction and a history suggestive of asthma were excluded while cases that had irreversible airway obstruction were accepted as COPD and medical treatment and follow up were planned for them. Spirometry was evaluated as small airway obstruction if FEF_{25-75} level was lower than 70% predicted. Cases that had FEV_1/FVC ratio greater than 70% with a FVC level lower than 80% predicted were defined as restrictive.

The study was approved by the Kocaeli University Medical Faculty Ethics Committee and all subjects gave their informed consent.

Case definitions

COPD: Post-bronchodilator FEV_1/FVC of less than 70% without reversibility was accepted as COPD whether there were respiratory symptoms or not.

Chronic bronchitis: It was defined as cough and sputum production for at least 3 months of 2 consecutive years.

Asthma: Cases with reversible airway obstruction were accepted as asthmatic if their history was consistent with asthma, and they were excluded from the analysis.

Subjects with reversible airflow obstruction without respiratory complaints and subjects with chronic respiratory symptoms with normal lung function were invited to our out-patient clinic for further investigation, and excluded from the analysis. Furthermore all smokers were recommended to a smoking cessation clinic after medical advice to quit smoking.

Statistical analysis

Statistical analysis was performed with the SPSS 13.0 program. Data are reported as mean ± standard deviation. Student's *t* test and Mann Whitney-U test were used to compare data between groups. Chi-square test was used for the comparison of rates and proportions. A p value of 0.05 or lower was considered significant.

RESULTS

A total of 685 teachers were included in the study. Of these 307 were female (45%) and 378 were male (55%). Mean age was 38.9 ± 8.9 years, and 296 subjects (43.2%) were over the age of 40. The mean age and the number of cases older than 40 years were significantly higher in males than females. Demographic data of the study population is shown in Table I.

Smoking habits were evaluated in 660 subjects, of which 291 (44.1%) were smokers, 252 (38.2%) non-smokers, and 117 (17.7%) ex-smokers. The percentage of current smokers was 43.2% in females and 44.8% in males. There was no statistically significant difference between male and female smokers (p = 0.6).

It was found that 161 subjects (23.5%) had a smoking history over 10 years (103 men, 58 women). There was a statistically significant difference between genders for smoking history over 10 years (p = 0.001).

The mean number of cigarettes smoked in a day was 5.7 ± 8.9 (min: 1, max: 40) and there was a statistically significant difference between genders (males 6.5 ± 9.9, females 4.7 ± 7.3, p = 0.001). In the study there was a considerably large range in the number of cigarettes smoked. So the standard deviation was higher than average. It was found that 76 male (21.3%) and 34 female (11.5%) smokers had a daily consumption of cigarettes over 20. Smoking characteristics according to gender are shown in Table II.

Chronic bronchitis was found in 23 of 631 participants (3.8%) and 73.9% of these cases were smokers. There was a statistically significant difference in smoking rates between chronic bronchitis and non-chronic bronchitis cases (p = 0.007). Only two of the chronic bronchitis cases were diagnosed as COPD. No significant relation was found with COPD.

Pulmonary function tests were available in 651 subjects and 510 of them (78.3%) were defined as normal spirometric analysis. Mean values of FEV_1 and FEF_{25-75} revealed a significant difference between genders (FEV_1 % predicted: male 100.9 ± 14.6 vs. female 98.6 ± 13.0, p = 0.03; FEF_{25-75} %: male 94.4 ± 25.9 vs. female 83.6± 20.7, p=0.001). Small airway obstruction was found in 115 subjects (17.7%) in whom FEF_{25-75} level was found to be lower than 70% predicted. Comparison of pulmonary function tests between males and females is shown in Table III.

FEV_1/FVC level was lower than 70% in 16 subjects (2.5%). Five subjects who had a positive reversibility test were excluded from the study. The remaining 11 subjects (6 of whom were aged over 40) were considered as COPD and consisted of 2 females (18%) and 9 males (82%) (Table IV). All of the cases diagnosed as COPD were current or ex-smokers.

TABLE II: SMOKING CHARACTERISTICS ACCORDING TO GENDER

	Total	Female	Male	P
Smoker, n (%)	291 (44.1%)	128 (43.2%)	163 (44.8%)	0.6
Non-smoker, n (%)	252 (38.2%)	131 (44.3%)	121 (33.2%)	0.5
Ex-smoker, n (%)	117 (17.7%)	37 (12.5%)	80 (22%)	0.001
Smoking history ≥ 10 years, n (%)	161 (23.5%)	58 (20.8%)	103 (30%)	0.001
Number of cigarettes/ day, mean	5.7 ± 8.9 (max: 40)	4.7 ± 7.3	6.5 ± 9.9	0.001

DISCUSSION

This study demonstrates high smoking rates and a considerably high prevalence of COPD in a relatively young population consisting of teachers.

Different COPD definitions can influence the reported prevalence rates. COPD prevalence varies according to epidemiologic definition [17,18] and the local variability of risk factors and other unknown conditions [19,20].

The global burden of COPD was evaluated in a systematic meta-analysis by Halbert and co-workers. The most common spirometric definition was that of GOLD and the pooled prevalence of COPD was 7.6% from 37 studies [21].

Lindberg et al. evaluated COPD prevalence among

TABLE I: DEMOGRAPHIC CHARACTERISTICS OF PARTICIPANTS

	Total	Female	Male	P
n (%)	685	307 (45%)	378 (55%)	0.007
Age, mean (years)	38.9 ± 8.9	35.9 ± 7.9 (min: 18, max: 58)	41.3 ± 9 (min: 20, max: 70)	0.001
≥ 40 years, n (%)	296 (43.2%)	92 (30%)	204 (54%)	0.001
Body mass index, mean (Kg/m^2)	23.7 ± 6.7	21.8 ± 6.4	25.1 ± 6.6	0.9

TABLE III: COMPARISON OF PULMONARY FUNCTION TESTS BETWEEN MALES AND FEMALES

	Total	Female	Male	P
FVC (% pred.)	102.4 ± 13.9	102.7 ± 13.5	102.1 ± 14.2	0.6
FEV_1 (% pred.)	99.8 ± 14.1	98.6 ± 13.3	100.9 ± 14.6	0.03
FEV_1/FVC (%)	101.4 ± 10.3	100.5 ± 9.4	101.5 ± 11	0.1
FEF_{25-75} (% pred.)	89.6 ± 24.3	83.6 ± 20.7	94.4 ± 25.9	0.001

Definition of abbreviations: FVC, forced vital capacity; FEV_1, forced expiratory volume in 1 sec.; FEF, forced expiratory flow.

TABLE IV: PULMONARY FUNCTION TEST RESULTS ACCORDING TO GENDER

	Total n (%)	Female n (%)	Male n (%)	P
Normal	510 (78.3)	217 (74.3)	293 (81.7)	0.001
Obstruction	16 (2.5)	5 (1.7)	11 (3)	0.4
Restriction	10 (1.5)	4 (1.4)	6 (1.7)	0.5
Small airway disease	115 (17.7)	66 (22.6)	49 (13.6)	0.1

666 participants aged 20-69 years. COPD prevalence was 7.6, 14, 14.1, 12.2, and 34.1% according to, respectively, British Thoracic Society (BTS), European Respiratory Society (ERS), GOLD, clinical and spirometric ATS criteria. Prevalence of COPD was related to age and smoking habits but not to gender [22].

Menezes et al. evaluated COPD prevalence according to symptoms, GOLD and ERS criteria. They showed that chronic bronchitis prevalence by questionnaire data was 7.8% and COPD prevalence was 15.2% according to GOLD. COPD was higher among men, elderly and ex-smokers [15].

The PREPOCOL study evaluated COPD prevalence for different altitudes, in 5 Colombian cities.

A respiratory questionnaire was administered and pre-post bronchodilator spirometry performed in 5,539 participants who were over 40 years of age. The overall COPD prevalence was 8.9, 2.8, 3.2% using the spirometric, medical and clinical definitions. The factors related to COPD were age over 60 years, male gender, smoking and low educational level. The overall prevalence of active smoking was 18.3%, higher in men (24.4%) than in women (15.3%) [16].

In our study, COPD was defined by clinical and spirometric data according to GOLD criteria. Chronic bronchitis symptoms were found in 23 of 631 participants (3.8%), a finding in line with Caballero et al. Our study's COPD prevalence according to GOLD was 2%, which was lower than other studies. But smoking prevalence in our study was higher than that of Caballero et al. and there was no difference between male and female gender.

Recently, the Burden of Lung Disease (BOLD) assessment was created for a standardized evaluation of the burden of COPD. The BOLD questionnaire included information on respiratory symptoms and risk factors for COPD and pre-post bronchodilator spirometry performed in BOLD studies. The Australian BOLD study included 1,258 participants older than 40 years of age, and the overall prevalence of COPD at stage I and higher was found to be 26.1%, similar in males and females. Smoking prevalence was 19.2% and also showed no difference between genders [13]. In the BOLD study in Iceland (ISOLD study), COPD prevalence was 18%, and there was no difference between males and females. The prevalence of COPD increased with age and the amount of tobacco smoked [23]. The BOLD study carried out in Poland's Mapolska region showed that COPD prevalence was 22.1% and higher in men than women. Smoking prevalence was 28% (males: 36.1%, females: 21.9%) [14]. In the BOLD study in China, 20,245 participants completed both a questionnaire and spirometry. The overall prevalence of COPD was 8.2% (males: 12.4%, females: 5.1%) [24].

In our study, the method used to detect COPD - a questionnaire that included respiratory symptoms and smoking habits and post-bronchodilator spirometry performed in each participant – was similar to that of the BOLD studies. Also COPD definition was according to GOLD criteria. But the COPD prevalence found in our study (2%) was lower than that of BOLD studies. This might be related to our limited study population.

COPD prevalence is 0.934% in men, 0.733% in women (all age groups) according to the World Health Organization [3]. Recently, in parallel with increased smoking rates and the growing age of the population, COPD prevalence is rising progressively [4]. Furthermore it was thought that the increase of COPD prevalence in women was related to increased smoking rates. While there were no differences in COPD prevalence between gender in some of these studies [13,22,23], in our study COPD prevalence was higher in men than in women, in agreement with other studies [14-16,24].

Epidemiologic data on COPD are limited in our country. In particular, there are no data on occupation and COPD. COPD prevalence, risk factors and burden of disease were evaluated in the Adana BOLD study by Kocabaş et al. in the period December 2003-January 2004. Preliminary results of this study showed that COPD prevalence was about 20% in subjects over 40 years of age in Adana [25].

Örnek et al. evaluated 611 participants who were > 18 years of age by respiratory questionnaire and spirometry (evaluated according to GOLD criteria) in order to determine the prevalence of COPD in Zonguldak. COPD prevalence was found to be 15.2% in the overall population and it was 17.8% regarding the subjects > 40 years of age [26].

Günen et al. evaluated COPD prevalence in a population randomly selected from urban and rural regions of Malatya. Through a respiratory questionnaire and post-bronchodilator spirometry performed in 1,160 participants over the age of 18, COPD prevalence was found to be 6.9%. While the prevalence of COPD was 18.1% in current smokers, the prevalence was 4.5% among young smokers. Biomass exposure was significantly common (54.5%) among female subjects living in rural areas. Smoking prevalence was 57.2% in men, 25.5% in women [27].

In our study, COPD prevalence (2%) was found to be lower than in other studies carried out in our country. This might be related to the fact that our

study population features one occupational group and so may not project all characteristics of society. When COPD prevalence was evaluated according to gender, we found a male predominance, a similar result to other studies in our country. But, in contrast to Günen et al., smoking prevalence was similar in both males and females in our study.

In conclusion, COPD is a preventable and treatable disease. Spirometry has an important role in early diagnosis of COPD. Spirometric evaluation of cases with risk factors for COPD could be helpful to diagnose patients before the progressive decline in lung function begins. Further studies are needed to evaluate whether interventional strategies at this stage such as smoking cessation could prevent the progression of disease.

CONFLICT OF INTEREST STATEMENT: None of the authors has any conflict of interest to declare in relation to the subject matter of this manuscript.

References

1. Rabe KF, Hurd S, Anzueto A, Barnes PJ, Buist SA, Calverley P, Fukuchi Y, Jenkins C, Rodriguez-Roisin R, van Weel C, Zielinski J; Global Initiative for Chronic Obstructive Lung Disease. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease: GOLD executive summary. Am J Respir Crit Care Med 2007;176:532-555.
2. Murray CJ, Lopez AD. Alternative projections of mortality and disability by cause 1990-2020: Global Burden of Disease Study. Lancet 1997;349:1498-1504.
3. Pauwels RA, Rabe KF. Burden and clinical features of chronic obstructive pulmonary disease (COPD). Lancet 2004;364:613-620.
4. Warner KE, Mackay J. The global tobacco disease pandemic: nature, causes, and cures. Glob Public Health 2006;1:65-86.
5. Coogan PF, Adams M, Geller AC, Brooks D, Miller DR, Lew RA, Koh HK. Factors associated with smoking among children and adolescents in Connecticut. Am J Prev Med 1998;15:17-24.
6. Marakoğlu K, Erdem D, Çivi S. Smoking prevalence among the primary school teachers in Konya. Turkish Thoracic Journal 2007;8:37-40.
7. Kocabaş A. Smoking habits among teachers. Ondokuzmayıs University Medical Faculty Journal 1998;5:51-61.
8. Unsal M, Hamzacebi H, Dabak S, Terzi O, Kirisoglu T. Smoking status and levels of knowledge regarding cigarettes among primary school teachers. South Med J 2008;101:1227-1231.
9. Danacı EA, Yorgancıoğlu A, Çelik P, Topçu F, Şen SF. Attitudes of high school teachers in Manisa province towards smoking. Toraks Dergisi 2001;1:16-20.
10. Demirel Y, Toktamış A, Nur N, Sezer E. Smoking among the primary school teachers. Türkiye Klinikleri J Med Sci 2004;24:492-494.
11. Burney PG, Luczynska C, Chinn S, Jarvis D. The European Community Respiratory Health Survey. Eur Respir J 1994;7:954-960.
12. Standardization of Spirometry, 1994 Update. American Thoracic Society. Am J Respir Crit Care Med 1995;152:1107-1136.
13. Schirnhofer L, Lamprecht B, Vollmer WM, Allison MJ, Studnicka M, Jensen RL, Buist AS. COPD prevalence in Salzburg, Austria: results from the Burden of Obstructive Lung Disease (BOLD) Study. Chest 2007;131:29-36.
14. Nizankowska-Mogilnicka E, Mejza F, Buist AS, Vollmer WM, Skucha W, Harat R, Pajak A, Gasowski J, Frey J, Nastalek P, Twardowska M, Janicka J, Szczeklik A. Prevalence of COPD and tobacco smoking in Malopolska region – results from the BOLD study in Poland. Pol Arch Med Wewn 2007;117:402-410.
15. Menezes A, Macedo SC, Gigante DP, da Costa JD, Olinto MT, Fiss E, Chatkin M, Hallal PC, Victora CG. Prevalence and risk factors for chronic obstructive pulmonary disease according to symptoms and spirometry. COPD 2004;1:173-179.
16. Caballero A, Torres-Duque CA, Jaramillo C, Bolívar F, Sanabria F, Osorio P, Orduz C, Guevara DP, Maldonado D. Prevalence of COPD in Five Colombian cities situated at low, medium and high altitude (PREPOCOL study). Chest 2008;133:343-349.
17. Celli BR, Halbert RJ, Isonaka S, Schau B. Population impact of different definitions of airway obstruction. Eur Respir J 2003;22:268-273.
18. Mannino DM. Epidemiology and global impact of chronic obstructive pulmonary disease. Semin Respir Crit Care Med 2005;26:204-210.
19. Antó JM, Vermeire P, Vestbo J, Sunyer J. Epidemiology of chronic obstructive pulmonary disease. Eur Respir J 2001;17:982-994.
20. Mannino DM. COPD: epidemiology, prevalence, morbidity and mortality, and disease heterogeneity. Chest 2002;121(5 suppl):121S-126S.
21. Halbert RJ, Natoli JL, Gano A, Badamgarav E, Buist AS, Mannino DM. Global burden of COPD: systematic review and meta-analysis. Eur Respir J 2006;28:523-532.
22. Lindberg A, Jonsson AC, Rönmark E, Lundgren R, Larsson LG, Lundbäck B. Prevalence of chronic obstructive pulmonary disease according to BTS, ERS, GOLD and ATS criteria in relation to doctor's diagnosis, symptoms, age, gender and smoking habits. Respiration 2005;72:471-479.
23. Benediktsdóttir B, Gudmundsson G, Jörundsdóttir KB, Vollmer W, Gíslason T. Prevalence of COPD in Iceland - the BOLD study. Laeknabladid 2007;93:471-477.
24. Zhong N, Wang C, Yao W, Chen P, Kang J, Huang S, Chen B, Wang C, Ni D, Zhou Y, Liu S, Wang X, Wang D, Lu J, Zheng J, Ran P. Prevalence of chronic obstructive pulmonary disease in China: a large, population-based survey. Am J Respir Crit Care Med 2007;176:753-760.
25. Kocabas A, Hancioglu A, Turkyilmaz S, Unalan T, Umut S, Cakir B, Vollmer W, Buist S. Prevalence of COPD in Adana, Turkey (BOLD-Turkey study) (abstr). In Proceedings of the American Thoracic Society 2006;3:A543.
26. Ornek T, Tor MM, Kiran S, Kart L. Prevalence of COPD in Zonguldak province of Turkey (abstr). In Proceedings of the ERS congress, 2006.
27. Günen H, Hacıevliyagil SS, Yetkin O, Gülbaş G, Mutlu LC, Pehlivan E. Prevalence of COPD: first epidemiological study of a large region in Turkey. Eur J Intern Med 2008;19:499-504.