VIA MEDICA

ORYGINAL ARTICLE

Mohammad Hossein Boskabady[1], Mahbobeh Mahmoudinia[1], Mohammad Javad Eslamizade[1], Morteza Boskabady[1], Mohammad Taghai Shakeri[1], Gholam Reza Heydari[2]

[1]Department of Physiology and Pharmaceutical Research Centre, Medical School, Mashhad University of Medical Sciences, Mashhad
[2]Tobacco Prevention and Control Research Centre, Iran

The prevalence of smoking among the population in the city of Mashhad (north east of Iran) and pulmonary function tests among smokers

Rozpowszechnienie palenia tytoniu w populacji miasta Mashhad (północno-wschodni Iran) i badania czynnościowe płuc u osób palących

Abstract

Introduction: Smoking is known as a major cause of chronic obstructive pulmonary disease (COPD). In this study the prevalence of smoking in the population of Mashhad city was evaluated as well as pulmonary function tests (PFTs) of smokers.

Material and methods: The prevalence of smoking was studied using a standard questionnaire. Pulmonary function tests, including forced vital capacity (FVC), forced expiratory volume in one second (FEV_1), maximal mid-expiratory flow (MMEF), peak expiratory flow (PEF), and maximal expiratory flow at 75%, 50%, and 25% of the FVC (MEF75,50,25), were measured in all smokers.

Results: In total, 1435 individuals were interviewed including 999 males and 436 females. The number of smokers among the interviewed individuals was 183 (12.7%) including 172 male (17.2%) and 11 female (2.5%). The results showed that all values of PFTs in smokers were reduced. There were significant negative correlations between smoking duration and rate as pack/year and values of PFT ($p < 0.05$).

Conclusions: In this study the prevalence of smoking in the population of Mashhad city was shown for the first time. The effect of smoking on PFTs showed that smoking leads to constriction of large and medium airways, which is due to duration and rate of smoking.

Key words: prevalence of smoking, smoking duration, smoking amount, pulmonary function tests

Pneumonol. Alergol. Pol. 2011; 79, 1: 21–25

Streszczenie

Wstęp: Palenie tytoniu jest główną przyczyną przewlekłej obturacyjnej choroby płuc. Celem niniejszego badania było określenie rozpowszechnienia palenia tytoniu w populacji miasta Mashhad oraz przeprowadzenie testów czynnościowych płuc u osób palących.

Materiał i metody: Rozpowszechnienie palenia tytoniu określono za pomocą standardowego kwestionariusza. U wszystkich osób palących wykonano badania czynnościowe płuc obejmujące pomiar natężonej pojemności życiowej (FVC), natężonej objętości wydechowej pierwszosekundowej (FEV_1), przepływu środkowowydechowego (MMEF), szczytowego przepływu wydechowego (PEF) i maksymalnego przepływu wydechowego przy FVC równej 75, 50 i 25% (MEF75, 50, 25).

Wyniki: W badaniu wzięło udział 1435 osób, 999 mężczyzn i 436 kobiet. Palenie tytoniu zadeklarowały 183 (12,7%) osoby spośród respondentów — 172 mężczyzn (17,2%) i 11 kobiet (2,5%). Wszystkie wyniki badań czynnościowych płuc u osób palący były obniżone. Zaobserwowano istotą ujemną korelację między czasem palenia tytoniu i liczbą paczek papierosów wypalanych w ciągu roku a parametrami ocenianymi w badaniach czynnościowych ($p < 0,05$).

Adres do korespondencji: M.H. Boskabady M.D., Ph.D., Department of Physiology, Medical School, Mashhad, Mashhad, postcode 9177948564, Iran, fax: +98 511 8828564, e-mail: boskabadymh@mums.ac.ir, mhboskabady@hotmail.com

Praca wpłynęła do Redakcji: 27.04.2010 r.

ISSN 0867–7077

Wnioski: W niniejszym badaniu po raz pierwszy oceniono odsetek osób palących w populacji Mashhadu. Ocena parametrów czynnościowych płuc wykazała, że palenie tytoniu prowadzi do zwężenia dużych i średnich oskrzeli, a efekt ten zależy od długości okresu palenia i od liczby wypalanych papierosów.

Słowa kluczowe: rozpowszechnienie palenia tytoniu, czas palenia tytoniu, liczba wypalanych papierosów, testy czynnościowe płuc

Pneumonol. Alergol. Pol. 2011; 79, 1: 21–25

Introduction

Chronic obstructive pulmonary disease (COPD) is a major cause of chronic morbidity throughout the world. Many people suffer from this disease for years and die prematurely from it or its complications. COPD is currently the fourth leading cause of death in the world [1], and a further increase in its prevalence and COPD-related mortality is predicted for the coming decades [2].

Cigarette smoking is by far the most important risk factor for COPD and the most important way that tobacco contributes to the risk of COPD [3]. Smoking leads to a rapid decline in pulmonary function tests (PFTs), especially those indicating the diameter of airways, such as forced expiratory flow in one second (FEV_1) [4]. The differences between cigarette smokers and non-smokers increase in direct proportion to the quantity of smoking. Even in teenagers who have smoked for only a few years, maximum expiratory flow-volume curves demonstrate decreases in flow rates at small lung volumes [5]. The effect of acute smoking on airway calibre was also documented by Ress et al. [6]. The obstruction to airflow that develops in 15 to 20% of heavy smokers is thought to be due to abnormalities in airways with less than 2 mm internal diameter [7]. It is believed that the airway obstruction in COPD and the decline in PFTs are irreversible.

Therefore, in the present study the prevalence of smoking in the city of Mashhad and the effect of the quantity and duration of smoking on PFTs were examined.

Material and methods

Study area and population

One thousand four hundred and thirty-five subjects (999 M and 436 F) were interviewed from 21 randomly selected areas in the city of Mashhad. Data regarding the prevalence of smoking were collected. The city of Mashhad has moderate industry and heavy traffic. Mashhad is a holy city located in the north east of Iran with a population of two-million people, many of whom are immigrants from all over Iran. The study was performed in March — July 2008.

Protocol

A Persian language questionnaire was used to assess the prevalence of smoking among the population of the city of Mashhad.

Pulmonary function tests of smokers and a control group were measured using a spirometer with a pneumotachograph sensor (Model ST90, Fukuda, Sangyo Co., Ltd. Japan). The control group (150 subjects) were chosen from the same areas of the city with similar age, height, and sex with no previous history of respiratory disease. Prior to pulmonary function testing, the required manoeuvre was demonstrated by a trained final medical student, and subjects were encouraged and supervised throughout test performance. Pulmonary function testing was performed using the acceptability standards outlined by the American Thoracic Society (ATS), with subjects in a standing position and wearing nose clips [8]. All tests were carried out between 10.00 and 17.00 hours. Pulmonary function tests were performed three times in each subject with an acceptable technique. The highest level for forced vital capacity (FVC), forced expiratory volume in one second (FEV_1), peak expiratory flow (PEF), maximal mid expiratory flow (MMEF), and maximal expiratory flow at 75%, 50%, and 25% of the FVC (MEF_{75}, MEF_{50}, and MEF_{25}, respectively) were taken independently from the three curves. The PFT values were presented as percent predicted [9, 10]. The study was approved by the ethical committee of Mashhad University of Medical Sciences.

Data analysis

The data of PFT values and age were expressed as mean ± SD and data of smoking as percentage of total studied population of each group. The correlation between PFT values and duration and quantity of smoking was performed using regression analysis. A two-sided p value of 0.05 was the criterion for statistical significance. All analyses were performed with SPSS software (version 11.5, SPSS Inc. USA).

Results

Prevalence of smoking

The prevalence of smoking among interviewed subjects was 12.7% (183 among 1435 interviewed

Table 1. Smoking prevalence, smoking amount, and duration in different age groups

Tablela 1. Rozpowszechnienie palenia tytoniu, liczba wypalonych papierosów i okresów palenia w różnych grupach wiekowych

Age (years)/ */Wiek (lata)*	Male/ */Mężczyźni*			Female/ */Kobiety*			Total/ */Razem*			S — amount	S — duration
	Stu	S	%	Stu	S	%	Stu	S	%	Pack/Y	Y
10–19	14	2	14.3	15	0	0	29	2	6.9	2.0 ± 1.41	3.5 ± 0.71
20–29	175	30	17.1	53	1	1.9	228	31	13.6	5.0 ± 5.94	7.9 ± 2.79
30–39	285	52	18.2	114	2	1.7	399	54	13.5	9.4 ± 9.33	11.8 ± 5.43
40–49	267	49	18.4	132	2	1.5	399	51	13.5	15.3 ± 15.86	18.4 ± 10.01
50–59	162	26	16.0	73	3	4.1	235	29	12.3	20.8 ± 27.31	20.7 ± 12.65
60–69	68	10	17.7	42	2	4.7	110	12	10.9	21.8 ± 9.73	31.7 ± 9.35
> 70	28	3	10.7	7	1	8.0	35	4	11.4	58.3 ± 36.86	36.6 ± 11.54
Total/*Razem*	999	172	17.2	436	11	2.5	1435	183	12.7	13.8 ± 16.66	16.0 ± 10.62

Stu — studied subjects; S — smokers; % — prevalence of smoking (percentage); Y — year

Table 2. Smoking prevalence in different income (Rial) level groups

Tabela 2. Rozpowszechnienie palenia tytoniu w zależności od dochodów (w rialach)

Income (year) *Roczny dochód*	Studied subjects/ */Grupa badana*	Smokers/ */Palacze*	Prevalence (%) */Odsetek palących (%)*
> 10,000,000	45	3	6.6
5,000,000–10,000,000	290	30	10.3
3,000,000–5,000,000	430	41	9.5
1,500,000–3,000,000	610	102	16.7
< 1,500,000	60	7	11.6

One thousand Rial is equal to one US dollar

Table 3. Smoking prevalence in different educational level groups

Tabela 3. Rozpowszechnienie palenia tytoniu w zależności od wykształcenia

Educational level/*Skala edukacji*	Studied subjects/*Grupa badana*	Smokers/*Palacze*	Prevalence (%)/*Odsetek palących (%)*
Highly educated	52	3	5.8
Medium educated	741	83	11.2
Poorly educated	642	97	15.1

The highly educated group consisted of subjects with B.Sc. level and above; the medium educated group are subjects who attended high school; and the poorly educated group are subjects who did not attend high school

subjects). The rate of smoking among male subjects was 17.2% (172 of 999 subjects) and in female subjects 2.5% (11 of 436) (Table 1). The prevalence of smoking was higher among people with lower income, except those with very low income (Table 2). The rate of smoking was higher in the poorly educated population (Table 3).

The smoking prevalence was higher in male subjects aged 20–69 and in female subjects aged 50–70 than in the remaining age groups (Table 1).

Pulmonary function tests

All PFT values of smokers were significantly lower than those of the control group of the same age, height and sex distribution ($p < 0.001$ for all cases) (Table 4). There were weak but significant negative correlations between both duration and amount of smoking with all PFT values ($r = -0.155$–0.305, $p < 0.05$ for all cases). Twenty-three percent of smokers (41 subjects) and only 4% of controls (6 subjects) showed FVC of less

Table 4. Pulmonary function tests (PFT) of studied smokers and non-smokers and statistical differences between the two groups

Tabela 4. Badania czynnościowe płuc w grupie osób palących i niepalących

PFT values/*Wyniki PFT*	Smokers/*Palacze*	Non-smokers/*Niepalący*	Statistical difference/*Różnice statystyczne*
FVC	76.40 ± 10.40	87.86 ± 14.70	$p < 0.001$
FEV_1	78.30 ± 13.50	91.00 ± 14.00	$p < 0.001$
FEV_1/FVC	96.45 ± 13.81	104.17 ± 8.67	$p < 0.001$
MMEF	81.69 ± 25.00	91.04 ± 13.00	$p < 0.001$
PEF	59.41 ± 20.00	92.00 ± 18.80	$p < 0.001$
MEF_{75}	61.80 ± 34.00	97.05 ± 17.91	$p < 0.001$
MEF_{50}	80.18 ± 26.20	93.18 ± 15.00	$p < 0.001$
MEF_{25}	90.51 ± 24.80	98.60 ± 24.31	$p < 0.001$

Values presented as mean ± SD of percent predicted (for smokers and non-smokers n = 183 and 150, respectively); FVC — forced vital capacity, FEV_1 — forced expiratory volume in one second; MMEF — maximal mid-expiratory flow; PEF — peak expiratory flow; MEF_{75}, MEF_{50}, MEF_{25} — maximal expiratory flow at 75%, 50%, and 25% of the FVC, respectively;

than 80% of the predicted values. In addition, 19% of smokers (34 subjects) and only 5% of controls (8 subjects) showed FEV_1 of less than 80% of the predicted values. The number of patients with FEV_1/VC% less than 70% was 24 (13%).

Discussion

In the present study, which was performed in the population sample, the prevalence of smoking in the city of Mashhad (north east Iran) was studied. PFT values of smokers were also evaluated. The results showed that 12.7% of the population of the city are regular smokers. The prevalence of smoking was much lower in females (2.5%) compared to males (17.2%). The smoking rate was highest in men aged 20–69 years (17.1–18.4%) and women aged 50–70 (4.1–8%). The smoking prevalence was higher in the poorly educated population and in people with lower income (except the very low income group).

The results of the study of Ahmadi et al. showed a higher prevalence of smoking in the city of Shiraz (18.7%) [11]. The sample population of their study was smaller than the present study, which might be the reason of the differences in the prevalence of smoking between the two studies. The other reason for the differences in the prevalence of smoking between Shiraz and Mashhad city could be differences in the culture of the populations of the two cities. However, the results of the study of Ahmadi et al. also showed a higher prevalence of smoking among males (26%) compared to females (3.6%), similar to the results of the present study. Their results also showed that the average age of starting smoking in Shiraz is 21 years, which is very similar to the results for Mashhad city shown in the present study. In another study, Ahmadi et al. showed a smoking prevalence of 25% among nursing students in Iran [12]. Turcić et al. showed a higher smoking prevalence among male (27.2%) compared to female subjects (12.6%) the among population of Zagreb [13]. However, the difference in smoking prevalence between males and females in this part of Europe is much lower than that of the Iranian population. The higher duration of smoking seen for older age groups in our study as well as Turcić et al. [13] is expected. However, the higher amount of smoking in the older population seems to be an important health issue.

The results also showed a reduction of most values of pulmonary function tests in smokers. Although the FEV_1/FVC ratio in the majority of smokers was within the normal range, these values were also significantly lower than in non-smokers, confirming the effect of smoking on the respiratory system. There were also negative correlations between all PFT values and both quantity and duration of smoking. Several previous studies [14–20] also showed reductions of different values of PFTs among smokers compared to normal subjects. The results of the present study show the reduction in PEF and MEF_{75} among smokers compared to non-smokers was more prominent than the reduction of other PFT values.

The results of our study were supported by previous studies indicating a reduction of primarily PEF, MMEF, and MEF_{75} in smokers [21–24]. The results of our previous study in a smaller population and in mild smokers showed similar results, i.e. greater reduction in PEF and MEF_{75} than other PFT values among smoker subjects [25]. As indicated in the method section, every effort was

made to perform PFT measurements correctly; therefore, the great reduction in PEF and MEF_{75} seen in this study is unlikely to be due to poor cooperation regarding PFT measurements in some subjects.

The results of the present study also showed weak but significant negative correlations between decreases in all values of PFTs and parameters such as amount and duration of smoking. The studies of Sherrill et al. [26] and Verschakelen et al. [27] also showed correlations between the amount of smoking and a reduction in most values of PFTs, supporting the results of the present study.

The limitations of the present study are: the possible poor cooperation of subjects in performing PFT measurements for small proportion of subjects, and the subjective character of questions regarding smoking. In addition, the prevalence of smoking should also be examined in rural areas of northeast Iran as well as urban and rural areas of other parts of the country.

Conclusions

In conclusion, the results of the present study showed a 12.7% prevalence of smoking among the population of the city of Mashhad, which was much higher in males (17.2%) than in females (2.5%). The smoking prevalence was greater in people with lower income and lower level of education. The rate of smoking was also higher among the middle-aged population. The results also demonstrated the significant effect of smoking on PFTs.

Acknowledgments

This study was financially supported by the Tobacco Prevention and Control Research Centre and the Research Department of Mashhad University of Medical Sciences.

References

1. World Health Organization. World health report. Geneva: World Health Organization; 2000.
2. Murray C.J.L., Lopez A.D. Evidence-based health policy-lessons from the global burden of disease study. Science 1996; 274: 740–743.
3. Gillooly M., Lamb D. Microscopic emphysema in relation to age and smoking habit. Thorax 1993; 48: 491–495.
4. Jaakkola M.S., Ernst P., Jaakkola J.J., L N'gan'ga W., and Becklake M.R. Effect of cigarette smoking on evolution of ventilatory lung function in young adults: an eight year longitudinal study. Thorax 1991; 46: 907–913.
5. Gold D.R., Wang X., Wypij D., Speizer F.E., Ware J.H., Dockery D.W. Effects of cigarette smoking on lung function in adolescent boys and girls. N. Engl. J. Med. 1996; 335: 931–917.
6. Rees P.J., Chowienczyk P.J., Clark T.J. Immediate response to cigarette smoke. Thorax 1982; 37: 417–422.
7. Hogg J.C., Chu F., Utokaparch S. et al. The nature of small-airway obstruction in chronic obstructive pulmonary disease. N. Engl. J. Med. 2004; 350: 2645–2653.
8. American Thoracic Society. Standardization of spirometry: 1994 Update. Official Statement of American Thoracic Society. Am. J. Respir. Crit. Car. Med. 1995; 152: 1107–1136.
9. Quanjer P.H., Dalhuijsen A., Van Zomeren B.C. Summary equations of reference values. Standardized lung function testing. Report of the European Community for Steel and Coal Party. Bull. Eur. Physiopathol. Respir. 1983; 19 (supl. 5): 45–51.
10. Quanjer P.H., Stocks J., Polgar G., Wise M., Karlberg J., Borsboom G. Compilation of reference values for lung function measurements in children. Eur. Respir. J. 1989; 4 (supl.): 184S–261S.
11. Ahmadi J., Khalili H., Jooybar R., Namazi N., Mohammadagaei P. Prevalence of smoking in Iran. Psychol. Rep. 2001; 89: 339–341.
12. Ahmadi G., Mahrlooy N., Alishahi M. Substance abuse: prevalence in a sample of nursing students. J. Clin. Nurs. 2004; 13: 60–64.
13. Turcić N., Zuskin E., Mustajbegović J., Smolej-Narancić N., Ivanković D. Respiratory symptom, disease and pulmonary ventilation capacity in person in the third stage of life. Lijec Vjesn 2002; 124: 247–254.
14. Lange P., Groth S., Nyboe J., Morten J., Appleyard M., Jensen G., Schnohr P. Effects of smoking and changes in smoking habits on the decline of FEV1. Eur. Respir. J. 1989; 2: 811–816.
15. Bosken C.H., Wiggs B.R., Pare P.D., Hogg J.C. Small airway dimensions in smokers with obstruction to airflow. Am. Rev. Respir. Dis. 1990; 142: 563–570.
16. Eidelman D.H., Ghezzo H., Kim W.D., Hyatt R.E., Cosio M.G. Pressure-volume curves in smokers, comparison with alpha-1-antitrypsin deficiency. Am. Rev. Respir. Dis. 1989; 139: 1452–1458.
17. Aparici M., Fernandez Gonzalez A.L., Alegria E. Respiratory function tests, differences between smokers and non-smokers: effects of withdrawal. Rev. Clin. Esp. 1993; 192: 169–172.
18. Nemery B., Moavero N.E., Brasseur L., Stanescu D.C. Changes in lung function after smoking cessation: an assessment from a cross-sectional survey. Am. Rev. Respir. Dis. 1982; 125: 122–124.
19. Lubinski W., Targowski T., Frank-Piskorska A. Evaluation of tobacco smoking on pulmonary function in young men. Pneumonol. Alergol. Pol. 2000; 68: 226–231.
20. Welty C., Weiss S.T., Tager I.B., Munoz A., Becker C., Speizer F.E., Ingram R.H. Jr. The relationship of airways responsiveness to cold air, cigarette smoking, and atopy to respiratory symptoms and pulmonary function in adults. Am. Rev. Respir. Dis. 1984; 130: 198–203.
21. Geijer R.M., Sachs A.P., Hoes A.W., Salome P.L., Lammers J.W., Verheij T.J. Prevalence of undetected persistent airflow obstruction in male smokers 40–65 years old. Fam. Pract. 2005; 22: 485–489.
22. Khan A., Shabbir K., Ansari J.K., Zia N. Comparison of forced expiratory volume in one second (FEV_1) among asymptomatic smokers and non-smokers. J. Pak. Med. Assoc. 2010; 60: 209–213.
23. Bajentri A.L., Veeranna N., Dixit P.D., Kulkarni S.B. Effect of 2–5 years of tobacco smoking on ventilatory function tests. J. Indian. Med. Assoc. 2003; 101: 96–7, 108.
24. Gregg I., Nunn A.J. Peak expiratory flow in symptomless elderly smokers. BMJ 1989; 298: 1071–1072.
25. Boskabady M.H., Dehghani H., Esmaeilizadah M. Pulmonary function tests and their reversibility in smokers. Tanafoos 2003; 2: 23–30.
26. Sherrill D.L., Lebowitz M.D., Knudson R.J., Burrows B. Longitudinal methods for describing the relationship between pulmonary function, respiratory symptoms and smoking in elderly subjects, The Tucson Study. Eur. Respir. J. 1993; 6: 325–327.
27. Varschakelen J.A., Scheinbaum K., Bogaert J., Demedts M., Lacquet L.L., Baert A.L. Expiratory CT in cigarette smokers: correlation between areas of decreased lung attenuation, pulmonary function tests and smoking history. Eur. Radiol. 1998; 8:1391–1399.