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Scientific Paper

EFFECTS OF PASSIVE SMOKING AT WORK ON RESPIRATORY SYMPTOMS, LUNG FUNCTION, AND BRONCHIAL RESPONSIVENESS IN NEVER-SMOKING OFFICE CLEANING WOMEN

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This cross-sectional study compares respiratory symptoms, lung function, and bronchial responsiveness between 27 office cleaning women exposed to environmental tobacco smoke at work and 57 unexposed controls. The age range of both groups was 24 to 56 years, and none of the women had ever smoked. Information on respiratory symptoms, cleaning work history, and passive smoking in the workplace were obtained with a questionnaire. The subjects also took a skin prick test to common inhalant allergens, a lung function test, and a histamine challenge. Despite smoking restriction in indoor environments, we found a high prevalence of passive smokers in the workplace (32.1 %). In these subjects we found a significantly higher prevalence of wheezing with breathlessness (25.9 % vs. 8.8 %; P=0.036), wheezing without cold (25.9 % vs. 7.0 %; P=0.016), and breathlessness after effort (29.6 % vs. 8.8 %; P=0.014) than in control subjects. Objective measurements showed a significantly lower MEF_{25} (53.6 % vs. 63.7 %; P=0.001) and a significantly higher prevalence of borderline bronchial hyperresponsiveness (22.2 % vs. 7.0 %; P=0.044) in the passive smokers in the workplace. This study provides evidence of adverse respiratory effects in office cleaning women associated with passive smoking in the workplace. Our findings support a stricter implementation of the current national law to protect respiratory health of all workers.

KEY WORDS: *environmental tobacco smoke, respiratory health effects*

Occupational exposures are estimated to be responsible for 5 % to 20 % of all adult asthma cases, and a number of occupations with increased risk have been identified (1-3). Several studies have recently shown an increased risk of respiratory impairment and asthma in household and professional cleaning (4-6). On the other hand, some studies have found that exposure to environmental tobacco smoke (ETS), also referred to as passive smoking and second-hand smoking (SHS), increases the risk of asthma and respiratory symptoms in adulthood (7, 8). Several studies have also indicated that exposure to ETS in adults results in a significant impairment of the lung function (9, 10). ETS exposure includes a variety of indoor environments such as home, workplace, public places, and transportation. The amount of exposure depends on the number of smokers, the amount smoked, room size and ventilation, and duration of exposure (11). ETS exposure can be assessed by measuring air nicotine and respirable suspended particle concentration or by measuring cotinine (a nicotine metabolite specific for tobacco) in body fluids. In health effects studies, ETS exposure is usually assessed using questionnaires, because they are relatively cheap and allow exposure assessment during different time periods and in different indoor environments (12).

To our knowledge, this study is the first to assess respiratory effects of passive smoking in professional cleaning women. Our assessment included respiratory symptoms, lung function, and bronchial responsiveness in women who had never smoked.

METHODS

Study design

This cross-sectional study was performed at the Institute for Occupational Health of Macedonia, Skopje - WHO Collaborating Center and GA²LEN Collaborating Center from June 2007 to September 2008.

Study subjects

We examined 84 never-smoking women aged 24 to 56 years, employed as office cleaners, with employment ranging from 4 to 27 years.

Their working tasks included dusting, washing, and polishing surfaces, and disposing of waste and waste water. The work shift lasted eight hours a day. Occupational exposure included several types of cleaning products such as soaps and detergents, disinfectants, solvents, and polishes; some of which were in spray. The cleaning women used protective clothing, gloves, and a mask.

Questionnaire

The interviewer-led questionnaire included questions on respiratory symptoms, asthma, and allergic rhinitis, questions on passive smoking in the workplace and in the household, and questions on current and previous occupations.

Questions on respiratory symptoms were taken from the European Community Respiratory Health Survey (ECRHS) questionnaire (13). The participants were asked whether they had experienced the following symptoms in the previous 12 months: wheezing or whistling in the chest; wheezing in combination with breathlessness; wheezing when not affected by a cold; being woken by a feeling of tightness in the chest; an attack of shortness of breath during the day when resting; an attack of shortness of breath after strenuous activity; or being woken by an attack of shortness of breath. Current asthma was defined as affirmative answer to the question: "Have you ever had asthma?" and having had asthma attack in the previous 12 months. Allergic rhinitis was defined as answering "yes" to the question "Do you have hay-fever or any other kind of allergic rhinitis?"

Passive smoking was assessed based on several items from the questionnaire. Participants with at least one smoker in the room where they worked were classified as passive smokers in the workplace (14). They were then asked to estimate if they were exposed to other people's tobacco smoke in the workplace for less or more than four hours. Participants with at least one smoker in the household were classified as exposed to tobacco smoke in the household.

We took detailed occupational history, including actual and previous occupations. The subjects were asked about the characteristics of the working process, cleaning products used at work, duration of the work shift, and protective equipment.

Skin prick test

Skin prick testing (SPT) to common inhalant allergens was performed on the volar part of the forearm using allergen extracts (Torlak, Serbia) of birch (5000 PNU), lime (5000 PNU), mixed grass (*Agrostis alba, Alopecurus pralensis, Dactylis glomerata, Festuca pranesis, Phleum pratense, Poa pratensis, Secale cereale, Triticum aestivum,* and *Zea mais*; 5000 PNU), mugwort (5000 PNU), plantain (5000 PNU), mixed fungi (*Alternaria alternata, Aspergilus fumigatus, Mucor, Penicillium notatum, Cladosporium herbarum, Candida albicans*, and *Trychophyton*; 4000 PNU), *Dermatophagoides pteronyssinus* (4000 PNU), dog hair (4000 PNU), cat fur (4000 PNU), and mixed feathers (chicken and duck feathers; 4000 PNU). All tests included positive (1 mg mL^{-1} histamine) and negative (0.9 % saline) controls. Prick tests were considered positive if the mean wheal diameter 20 min after allergen application was at least 3 mm larger than the size of negative control (15).

Spirometry

Measurements were taken using spirometer Ganshorn SanoScope LF8 (Ganshorn Medizin Electronic GmbH, Germany) and included forced vital capacity (FVC), forced expiratory volume in one second (FEV_1), FEV_1/FVC ratio, maximal expiratory flow at 50 %, 25 % and (25 to 75) % of FVC (MEF_{50}, MEF_{25} and MEF_{2575}, respectively). The best of three measurements was recorded and results expressed as percentages of the predicted values, according to the European Community for Coal and Steel (ECCS) norms (16).

Histamine challenge

Histamine challenge tests were performed according to the European Respiratory Society (ERS) / American Thoracic Society (ATS) recommendations (17, 18). Concentrations of 0.5 mg mL^{-1}, 1 mg mL^{-1}, 2 mg mL^{-1}, 4 mg mL^{-1}, and 8 mg mL^{-1} histamine (Torlak, Serbia) were prepared by dilution with buffered saline. The doses of aerosol generated by Pari LC nebulizer (Pari GmbH, Germany) were inhaled through a mouthpiece. The subjects inhaled increasing concentrations of histamine using a tidal breathing method until FEV_1 fell by more than 20 % of its base value (provocative concentration 20, PC20) or the highest concentration was reached. According to the ATS recommendations, bronchial hyperresponsiveness (BHR) was categorised as moderate to severe BHR (PC20<1.0 mg mL^{-1}), mild BHR (PC20=1.0 mg mL^{-1} to 4.0 mg mL^{-1}), and borderline BHR (PC20>4.0 mg mL^{-1}) (18).

Statistical analysis

SPSS version 11.0 for Windows was used for data description and analysis. Continuous variables were expressed as means with standard deviations, and categorical variables as numbers and percentages. Women who had not been exposed to ETS were used as control. Chi-square test (or Fisher's exact test where appropriate) was used to test differences in the prevalence of respiratory symptoms and BHR between exposed and control subjects. Spirometric measurements were compared using the two-independent-samples test (Mann-Whitney *U*-test). A P-value of less than 0.05 was considered statistically significant.

RESULTS

Characteristics of the study subjects are given in Table1. The prevalence of wheezing with breathlessness, wheezing without cold, and breathlessness after effort was significantly higher in the subjects exposed to ETS. The prevalence of wheezing and nocturnal breathlessness was higher in the exposed subjects, but the difference was not statistically significant. We also found a non-significant difference in the prevalence of nocturnal chest tightness, breathlessness when resting, current asthma, and allergic rhinitis (Table 2).

Table 3 shows the results of spirometric measurements. Mean MEF_{25} was significantly lower in the cleaning women exposed to ETS in the workplace. The difference in other spirometric parameters was not statistically significant.

Prevalence of borderline BHR was significantly higher in the exposed subjects, whereas the prevalence

Table 1 *Demographics of the study subjects*

Variable	Exposed to ETS in the workplace (n=27)	Unexposed to ETS in the workplace (n=57)
Age / years[1]	38.4±7.9 (25 to 56)	39.3±9.2 (24 to 55)
<40 years[2]	12 (44.4 %)	27 (47.3 %)
>40 years[2]	15 (55.5 %)	30 (52.6 %)
Duration of employment / years[1]	11.7±4.8 (5 to 24)	12.5±6.9 (4 to 27)
<12 years[2]	12 (44.4 %)	25 (42.5 %)
>12 years[2]	15 (55.5 %)	32 (56.1 %)
Passive smokers in the workplace		
Exposed <4 hours[2]	16 (59.2 %)	/
Exposed >4 hours[2]	11 (40.7 %)	/
Passive smokers in the household[2]	7 (25.9 %)	14 (24.5 %)
Sensitisation to common inhalant allergens[2]	9 (33.3 %)	21 (36.8 %)
Mite sensitization[2]	7 (25.9 %)	15 (26.3 %)

ETS: environmental tobacco smoke
[1] Data are presented as mean ± standard deviation and range
[2] Data are presented as the absolute number and percent of subjects

Table 2 *Prevalence of respiratory symptoms, current asthma, and allergic rhinitis among study subjects*

Respiratory symptoms	Exposed to ETS in the workplace (n=27) N (%)	Unexposed to ETS in the workplace (n=57) N (%)	P-value *
Wheeze	8 (29.6)	8 (14.0)	0.089
Wheeze and breathlessness	7 (25.9)	5 (8.8)	0.036
Wheeze without cold	7 (25.9)	4 (7.0)	0.016
Nocturnal chest tightness	4 (14.8)	5 (8.8)	0.403
Breathless when resting	5 (18.5)	5 (8.8)	0.198
Breathless after effort	8 (29.6)	5 (8.8)	0.014
Nocturnal breathlessness	6 (29.6)	5 (8.8)	0.088
Current asthma	4 (14.8)	3 (5.3)	0.204
Allergic rhinitis	8 (29.6)	9 (15.8)	0.140

ETS: environmental tobacco smoke
** Tested by chi-square test (or Fisher's exact test where appropriate)*

Table 3 *Spirometric parameters in subjects exposed and unexposed to ETS in the workplace*

Spirometric parameter	Exposed to ETS in the workplace (n=27) Mean±SD	Unexposed to ETS in the workplace (n=57) Mean±SD	P-value*
FVC / % pred	90.8±10.6	91.6±9.1	0.981
FEV_1 / % pred	82.8±10.9	85.1±8.7	0.446
FEV_1/FVC / %	74.1±5.4	75.2±4.5	0.369
MEF_{50} / % pred	62.3±7.8	65.9±9.9	0.090
MEF_{25} / % pred	53.6±6.0	63.7±9.4	0.001
MEF_{25-75} / % pred	69.1±12.7	71.8±13.2	0.170

ETS: environmental tobacco smoke; FVC: forced vital capacity;
FEV_1: forced expiratory volume in 1 s;
MEF_{50}, MEF_{25}, MEF_{25-75}: maximal expiratory flow at 50 %, 25 %, and 25 % to 75 % of FVC, respectively; % pred: % of predicted value.
** Tested by Mann-Whitney U-test*

of moderate to severe and mild BHR was similar between exposed and control subjects (Table 4).

DISCUSSION

Cleaning may involve exposure to a number of sensitisers and irritants, which may cause adverse respiratory effects (19, 20). Common active compounds of cleaning products are chlorine, ammonia, and caustic soda. Mixing these cleaning products may lead to unforeseeably high exposure to respiratory sensitisers and irritants (21, 22). Furthermore, most of the cleaning products are perfumed, typically with lemon or pine scent, which may also contain sensitisers (23). Apart from scents, cleaning products contain potentially sensitising additives like isothiozolinones (preservatives), ethanolamines (corrosion inhibitors), and quaternary ammonium compounds (biocides) (24). Spray forms of the cleaning products increase inhalatory exposure during use. Use of natural rubber gloves may involve the risk of sensitisation to latex allergens. In addition, Zock et al. (25) established a higher risk of mite sensitisation among cleaners, especially in households.

ETS is a mixture of sidestream smoke and exhaled mainstream smoke containing the same substances as mainstream smoke inhaled by smokers (11). The prevalence of passive smoking in the workplace varies between countries, and is related to the prevalence of active smoking and implementation of law controlling tobacco consumption. As several

Table 4 *Prevalence of BHR and its categories in subjects exposed and unexposed to ETS in the workplace*

BHR/BHR category*	Exposed to ETS in the workplace (n=27) N (%)	Unexposed to ETS in the workplace (n=57) N (%)	P-value **
BHR	10 (37.0)	10 (17.4)	0.053
Moderate to severe BHR	2 (7.4)	2 (3.6)	0.386
Mild BHR	2 (7.4)	4 (7.0)	0.948
Borderline BHR	6 (22.2)	4 (7.0)	0.044

BHR: bronchial hyperresponsiveness; ETS: environmental tobacco smoke
** Moderate to severe BHR: PC 20<1.0 mg mL^{-1}; mild BHR: PC 20=1.0-4.0 mg mL^{-1}; borderline BHR: PC 20>4.0 mg mL^{-1}*
*** Tested by chi-square test (or Fisher's exact test where appropriate)*

studies have confirmed adverse respiratory effects of passive smoking over the last two decades, smoking ban or restrictions were adopted in many countries worldwide. On 1 January 2006, the Republic of Macedonia adopted a law restricting public indoor smoking to well separated and enclosed areas, while the rest was smoke-free (26). The results of our study carried out in 2007 (27) showed a slight decrease of the prevalence of passive smoking in the workplace since the adoption of this law (28). Since 14 November 2008, Macedonia has a new law in force banning indoor smoking in all public buildings (29).

In our previous studies we demonstrated adverse respiratory effects of active smoking at work in cleaning women (30, 31). In this present study we examined respiratory effects of passive smoking in women who had never smoked. The high prevalence of passive smokers among study subjects suggests that despite restrictions, non-smoking areas were not respected by smokers and that ETS exposure was widespread in non-smoking office cleaners. Demographic characteristics of the exposed and unexposed subjects were similar.

Cleaning occupations run a higher risk of developing respiratory symptoms and asthma. In this study, we found a significantly higher prevalence of wheezing with breathlessness, wheezing without cold, and breathlessness after effort. In a study of Spanish indoor cleaners conducted by Zock et al. (25), work-related respiratory symptoms were reported by more than a half of the subjects.

Investigating cross-sectional and prospective associations between passive smoking and respiratory symptoms in the workplace in general working population of Hong Kong, Ho et al. (32) demonstrated consistent and significant association between respiratory symptoms and passive smoking both cross-sectionally and prospectively after a two-year follow-up. In a study which investigated the relation between respiratory symptoms and ETS exposure at work and at home in never-smoking Italian women, Simoni et al. (33) demonstrated that ETS exposure, especially at work, was significantly associated with respiratory symptoms. Similarly, in the study of police officers in Hong Kong, Lam et al. (34) reported a significant association between respiratory symptoms and passive smoking in the workplace which was dose-related.

We found an inverse association between pulmonary function and passive smoking in the workplace. This relationship was significant for MEF_{25}, but not for MEF_{50}. In a study of the effects of ETS exposure at work, at home, and during childhood among workers with and without occupational exposure to respiratory irritants, Alipour et al. (35) have suggested that ETS exposure may deteriorate pulmonary function, as they found a significant difference in FVC and FEV_1 between the exposed and non-exposed subjects. Our group exposed to ETS was too small to see whether adverse effects on pulmonary function were dose-related. Studies which investigated this relationship are controversial, and vary by design and study population. Chen et al. (36) reported a significant exposure-response relationship between ETS exposure in the workplace and lung function among never-smoking employees. Janson et al. (14) suggested a significant dose-related association between ETS exposure and FEV_1 decline. In contrast, Alipour et al. (35) found no significant dose-response relationship between ETS exposure and pulmonary function.

We found higher prevalence of BHR in passive smokers, which was just short of statistical significance. By BHR categories, a significant relation was found with borderline BHR. Janson et al. (14) reported similar findings, whereas in some previous studies significant association was not observed, i.e. increased bronchial responsiveness was found only in some individuals (37, 38).

There were some limitations to our study, which should be taken into account when interpreting the results. Firstly, we assessed passive smoking with a questionnaire and did not use objective measurements such as serum, salivary, or urine cotinine concentration. Secondly, our exposed sample size is small and may have certain implications in interpreting data. Thirdly, a cross-sectional studies like ours may not include people with serious respiratory symptoms or diseases who had left their job, and the association between exposure and respiratory symptoms or diseases could be underestimated (healthy worker effect). The strength of the study is that it included both subjective effect markers such as respiratory symptoms and reported asthma and objective measurements such as lung function and bronchial responsiveness.

In conclusion, our findings suggest that passive smoking in the workplace can lead to respiratory symptoms, lung function impairment and increased bronchial responsiveness and call for a more resolute implementation of the current law in order to protect respiratory health of all workers.

REFERENCES

1. Blanc PD, Toren K. How much adult asthma can be attributed to occupational factors? Am J Med 1999;107:580-7.
2. Karjalainen A, Kurpa K, Martikainen R, Klaukka T, Karjalainen J. Work is related to substantial portion of adult-onset asthma: incidence in Finnish population. Am J Respir Crit Care Med 2001;164:565-8.
3. Kogevinas M, Anto JM, Sunyer J, Tobias A, Kromhout H, Buney P, and the Eurpean Community Respiratory Health Survey Study Group. Occupational asthma in Europe and other industrialized countries: a population-beased study. Lancet 1999;353:1750-4.
4. Kogevinas M, Anto JM, Soriano JB, Tobias A, Birney P, and the Spanish Group of the European Asthma Study. The risk of asthma attributable to occupational exposures: A population-based study in Spain. Am J Respir Crit Care Med 1996;154:137-43.
5. Fishwick D, Pearce N, D'Souza W, Lewis S, Town I, Armstrong R, Kogevinas M, Crane J. Occupational asthma in New Zealanders: a population based study. Occup Environ Med 1997;54:301-6.
6. Medina-Ramon M, Zock JP, Kogevinas M, Sunyer J, Anto JM. Asthma symptoms in women employed in domestic cleaning: a community-based study. Thorax 2003;58:950-5.
7. Greer JR, Abbey DE, Burchette RJ. Asthma related to occupational and ambient air pollutant in nonsmokers. J Occup Med 1993;35:909-15.
8. Thorn J, Brisman J, Tore K. Adult-onset asthma is associated with self-reported mold or environmental tobacco smoke exposures in the home. Allergy 2001;56:287-92.
9. Xu X, Li B. Exposure-response relationship between passive smoking and adult pulmonary function. Am J Respir Crit Care Med 1995;151:41-6.
10. Carrey IM, Cook DG, Strachan DP. The effect of environmental tobacco smoke exposure on lung function in a longitudinal study of British adults. Epidemiology 1999;10:319-26.
11. Chan-Yeung M, Dimich-Ward H. Respiratory health effects of exposure to environmental tobacco smoke. Respirology 2003;8:131-9.
12. Gilmour MI, Jaakkola MS, London SJ, Nel AE, Rogers CA. How exposure to environmental tobacco smoke, ourdoor air pollutants, and increased pollen burdens influences the incidence of asthma. Environ Health Perspect 2006;114:627-33.
13. European Community Respiratory Health Survey (ECRHS). Variations in the prevalence of respiratory symptoms, self-reported asthma attacks, and use of asthma medication in the European Community Respiratory Health Survey (ECRHS). Eur Respir J 1996;9:687-95.
14. Janson C, Chinn S, Jarvis D, Zock JP, Toren K, Burney P, for the European Community Respiratory Health Survey. Effects of passive smoking on respiratory symptoms, bronchial responsiveness, lung function, and total serum IgE in the European Community Respiratory Health Survey: a cross-sectional study. Lancet 2001;358:2103-9.
15. The European Academy of Allergology and Clinical Immunology. Position paper: Allergen standardization and skin tests. Allergy 1993;48(Suppl 14):48-82.
16. Quajner PhH, editor. Standardization of lung function tests – 1993 update. Report Working Party for the European Community for Steel and Coal. Official Statement of the European Rrespiratory Society. Eur Rrespir J 1993;16(Suppl):1-100.
17. Sterk PJ, Fabbri LM, Quanjer PhH, Cockcroft DW, O'Byrne PM, Anderson SD, Juniper EF, Malo JL. Airways Responsiveness. Standardized challenge testing with pharmacological, physical and sensitizing stimuli in adults. Eur Respir J 1993;6:53-83.
18. American Thoracic Society. Guidelines for metacholine and exercise challenge testing - 1999. Am Respir Crit Care Med 2000;161:309-29.
19. Karjalainen A, Martikainen R, Karjalainen J, Klaukka T, Kurppa K. Excess incidence of asthma among Finnish cleaners employed in different industries. Eur Respir J 2002;19:90-5.
20. Wolkoff P, Schneider T, Kildeso J, Degerth R, Jaroszewski M, Schunk H. Risk in cleaning: chemical and physical exposure. Sci Total Environ 1998;215:135-56.
21. Reilly MJ, Rosenman KD. Use of hospital discharge data for surveillance of chemical-related respiratory disease. Arch Environ Health 1995;50:26-30.
22. Reisz GR, Gammon RS. Toxic pneumonitis from mixing household cleaners. Chest 1986;89:49-52.
23. Karlberg AT, Magnusson K, Nilsson U. Air oxidation of d-limonene (the citrus solvent) creates potent allergens. Contact Dermatitis 1992;26:332-40.
24. Nielsen H. Occupational exposure to isothiazolinones: a study based on a product register. Contact Dermatitis 1992;31:18-21.

25. Zock JP, Kogevinas M, Sunyer J, Almar E, Muniozguren N, Payo F, Sanchez JL, Anto JM, on behalf of the Spanish working group of the European Respiratory Health Survey. Asthma risk, cleaning activities and use of specific cleaninig products among Spanish indoor cleaners. Scand J Work Environ Health 2001;27:76-81.
26. Zakon za zaštita od pušenjeto. [Non-Smoker Protection Act, in Macedonian]. Služben vesnik na Republika Makedonija 37/2005.
27. Minov J, Karadžinska-Bislimovska J, Vasilevska K, Stoleski S. Exposure to environmental tobacco smoke in the workplace in Macedonia: Where are we now? Arh Hig Rada Toksikol 2008;59:103-9.
28. Minov J, Karadzinska-Bislimovska J, Vasilevska K, Stoleski S. Smoking status in exposed and unexposed workers. Mak med pregled 2006;60(68):128.
29. Zakon za izmenuvanje i dopolnuvanje na Zakonot za zaštita od pušenjeto. [Amendments to Non-Smoker Protection Act, in Macedonian]. Služben vesnik na Republika Makedonija 103/2008 and 140/2008.
30. Karadžinska-Bislimovska J, Minov J, Risteska-Kuc S, Stoleski S, Mijakoski D. Bronchial hyperresponsiveness in women cooks and cleaners. Arh Hig Rada Toksikol 2007;58:223-31.
31. Mijakoski D, Karadzinska-Bislimovska J, Minov J, Trajceva L, Ezova N, Risteska-Kuc S, Stoleski S. Nasal symptoms in female cleaners: relation to respiratory symptoms, bronchial hyperresponsiveness, and duration of exposure. Eur Respir J 2007;30:154.
32. Ho SY, Lam TH, Chung SF, Lam TP. Cross-sectional and prospective associations between passive smoking and respiratroy symptoms at the workplace. Ann Epidemiol 2007;17:126-31.
33. Simoni M, Baldacci S, Puntoni R, Pistelli F, Farschi S, Lo Presti E, Pistelli R, Corbo G, Agabiti N, Basso S, Matteelli G, Di Pede F, Carozzi L, Forastiere F, Viegi G. Respiratory symptoms/diseases and environmental tobacco smoke (ETS) in never smoker Italian women. Respir Med 2007;101:531-8.
34. Lam TH, Ho LM, Hedley AJ, Peymane A, Fielding R, McGhee S, Aharonson-Daniel L. Environmental tobacco smoke exposure among police officers in Hong Kong. JAMA 2000;284:756-63.
35. Alipour S, Deschamps F, Lesage F-X. Effects of environmental tobacco smoke on respiratory symptoms and pulmonary function. Inhal Toxicol 2006;18:569-73.
36. Chen R, Tunstall-Pedoe H, Tavendale R. Environmental tobacco smoke and lung function in employees who never smoked: The Scottish MONICA study. Occup Environ Med 2001;56:563-8.
37. Stankus RP, Menon PK, Rando RJ, Glindmeyer H, Salvaggio JE, Lehrer SB. Cigarette-smoke sensitive asthma: challenge studies. J Allergy Clin Immunol 1988;82:331-8.
38. Menon P, Rando RJ, Stankus RP, Salvaggio JE, Lehrer SB. Passive cigarette smoke-challenge studies: increase in bronchial hyperreactivity. J Allergy Clin Immunol 1992;89:560-6.

Sažetak

UTJECAJ PASIVNOG PUŠENJA NA RADNOME MJESTU NA DIŠNE SIMPTOME, FUNKCIJU PLUĆA I BRONHIJALNU REAKTIVNOST U UREDSKIH SPREMAČICA-NEPUŠAČICA

Provedeno je presječno istraživanje na skupini od 84 žene nepušačice u dobi od 24 do 56 godina s ciljem procjene učinaka pasivnog pušenja na radnome mjestu na dišne simptome, funkciju pluća i bronhijalnu reaktivnost.

Podaci o dišnim simptomima, radnom stažu na poslovima spremačica ureda te o pasivnom pušenju na radnome mjestu prikupljeni su primjenom anketnog upitnika. Ispitanicama je zatim učinjen kožni *prick-test* (ubodni test) na najčešće inhalacijske alergene, mjerene su funkcije pluća te su provedena testiranja na histamin. Unatoč propisima o zabrani pušenja u zatvorenim prostorima, utvrdili smo veliku prevalenciju pasivnog pušenja na radnim mjestima (32,1 %). U tih smo ispitanica utvrdili i značajno veću prevalenciju piskanja u plućima i zadihanosti (25,9 % prema 8,8 %; P=0,036), piskanja u plućima bez prehlade (25,9 % prema 7,0 %; P=0,016) te gubitka daha nakon napora (29,6 % prema 8,8 %; P=0,014) u usporedbi s ispitanicama koje na radnim mjestima nisu bile izložene pasivnom pušenju. Mjerenja su pokazala i značajno nižu vrijednost maksimalnog ekspiracijskoga protoka pri 25 % forsiranoga vitalnog kapaciteta (MEF_{25}) (53,6 % prema 63,7 %; P=0,001) te značajno višu pojavnost granične bronhijalne hiperreaktivnosti (22,2 % prema 7,0 %; P=0,044) u ispitanica koje su na radnim mjestima izložene pasivnom pušenju. Ovo je istraživanje dokazalo prisutnost štetnih učinaka na dišni sustav u ispitanica zaposlenih kao spremačice ureda koje su na svojim radnim mjestima bile izložene pasivnom pušenju. Dobiveni rezultati govore u prilog potrebi za oštrijom primjenom postojećih zakonskih propisa kako bi se zaštitilo zdravlje dišnog sustava u svih radnika.

KLJUČNE RIJEČI: *duhanski dim u okolišu, zdravstveni učinci na dišni sustav, žene*

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