

WORK-RELATED SYMPTOMS AMONG FURNITURE FACTORY WORKERS IN LUBLIN REGION (EASTERN POLAND)

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Milanowski J, Góra A, Skórska C, Krysińska-Traczyk E, Mackiewicz B, Sitkowska J, Cholewa G, Dutkiewicz J: Work-related symptoms among furniture factory workers in Lublin region (eastern Poland). *Ann Agric Environ Med* 2002, **9**, 99–103.

Abstract: 48 woodworkers employed in the furniture factory were examined. The control group consisted of 41 office workers with no exposure to organic dust. The examination included: interview on work-related symptoms, physical examination, and lung function test performed before and after the working-day. 38 out of 48 (79.2%) woodworkers reported work-related symptoms. The most common complaint was dry cough reported by 25 workers (52.1%), followed by general malaise - reported by 17 (35.45%), conjunctivitis - by 16 (33.3%), rhinitis - by 16 (33.3%), and skin symptoms by 16 (33.3%). Other symptoms such as headache, shortness of breath and chest pain occurred less frequently. Subjects working in initial processing and board processing departments had a higher prevalence of cough compared to workers employed in the varnishing department ($p < 0.01$). The prevalence of skin symptoms was significantly higher in board processing and varnishing departments compared to initial processing department ($p < 0.05$). Occupational asthma and allergic alveolitis were recorded in 3 out of 48 (6.2%) and 2 out of 48 (4.2%) workers, respectively. Baseline FVC and FEV₁ values were lower in woodworkers compared to controls ($p < 0.01$). The increased lung function parameters (FVC, FEV₁) were observed in woodworkers who smoked compared to non-smokers. The difference was not statistically significant. There was a significant over-shift decrease of all measured spirometric values: FVC, FEV₁, FEV₁/VC, PEF among woodworkers ($p < 0.001$). There was a significant pre-shift, post-shift decline in FVC, FEV₁, FVC/FEV₁, and PEF among workers under 30 years of age ($p < 0.001$). The same tendency was seen for FVC and FEV₁ in subjects over 30. The percentage changes in FVC and FEV₁ were greater in the group of younger workers (15.1% and 17.6%) respectively, than in the group of older subject (6.2%, 7.1%). The difference was not statistically significant.

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Key words: woodworkers, furniture factories, respiratory symptoms, lung function.

INTRODUCTION

A large numbers of workers, especially those employed in sawmills, fibreboard and chipboard factories, and furniture factories, may be regularly exposed to wood dust [3, 4, 6, 7, 12, 20], "wood extracts" (such as: terpens, terpen derivates such as abietic acide, plicatic acide) [18, 20] and various chemicals widely used in that industry

(including lacquers, vapours from organic solvents and formaldehyde) [21, 24]. The results of previous studies show that exposure to all these potentially allergic or irritant agents may result in increased risk of asthma, bronchial hyperresponsiveness, decline in lung function [1, 21, 22, 13, 9], acute nasal obstruction [2, 10, 15, 20], nasal carcinoma [11] or skin problems [8]. Malo *et al.* [13] described 3 cases of occupational asthma to oak

Table 1. Demographic characteristics of the study groups.

	Age (Mean \pm SD)	Male N (%)	Female N (%)	Smokers N (%)	Non-smokers N (%)
Woodworkers (N = 48)	29.6 \pm 5.1	17 (35.4%)	31 (64.6%)	28 (58.3%)	20 (41.6%)
Controls (N = 41)	31.6 \pm 9.4	16 (39%)	25 (61%)	21 (51.2%)	20 (48.8%)

Table 2. Frequency of work-related symptoms reported by woodworkers employed in different departments.

	Initial processing (N = 17)	Board processing (N = 10)	Varnishing (N = 21)	Total (N = 48)
Age (mean \pm SD)	28.2 \pm 3.3	30.3 \pm 4.0	30.5 \pm 6.6	29.6 \pm 5.1
Years of employment (mean \pm SD)	8.3 \pm 3.4	10.5 \pm 3.6	10.7 \pm 6.2	9.8 \pm 4.9
Workers reporting symptoms	12 (70.6%)	10 (100%)	16 (76.2%)	38 (79.2%)
Cough	12 (70.6%)	8 (80%)**	5 (23.8%)	25 (52.1%)
Shortness of breath	3 (17.6)	2 (20%)	1 (4.8%)	6 (12.5%)
Chest pain	3 (17.6%)	2 (20%)	0 (0%)	5 (10.4%)
Headache	6 (35.3%)	3 (30%)	4 (19%)	13 (27.1%)
General malaise	6 (35.3%)	6 (60%)	5 (23.8%)	17 (35.4%)
Skin lesion	1 (5.9%)	5 (50%)*	10 (47.6%)*	16 (33.3%)
Conjunctivitis	3 (17.6%)	4 (40%)	9 (42.9%)	16 (33.3%)
Rhinitis	3 (17.6%)	4 (40%)	9 (42.9%)	16 (33.3%)

** significantly greater compared to varnishing department ($p < 0.01$); * significantly greater compared to initial processing ($p < 0.05$).

wood. In all 3 cases the diagnosis of asthma was demonstrated using specific inhalation challenges test which induced a dual asthmatic reaction in 2 cases, and atypical prolonged immediate reaction in 1 subject.

Simultaneously to wood dust exposure, woodworkers are exposed to large concentrations of bacterial and fungal spores [7, 12] which are known as a potential causative agents of respiratory disorders such as Organic Dust Toxic Syndrome (ODTS) and allergic alveolitis [7, 16]. The pollution of the air of wood processing facilities with microorganisms results from primary or secondary infection of timber [3, 6].

Eduard [7] found a high prevalence of ODTS and allergic alveolitis among wood trimmers exposed at work to the spores of *Rhizopus microsporus*.

The objective of this paper was to evaluate the lung function and work-related symptoms in furniture factory workers of the Lublin region.

MATERIALS AND METHODS

The study was conducted in 3 departments of a furniture factory (plant "A") located in Lublin region (eastern Poland). The main work processes carried out in the first department (initial processing) were sawing, trimming and sanding of fiber- and chipboards. In the second department (board processing) the formatted

boards were coated with veneer and than again trimmed, planed and sanded. Finally, at the varnishing workshop, the boards were painted with polyester or nitric lacquers.

Study group. A group of 48 woodworkers employed at plant "A" was involved in the study: 31 females and 17 males aged 20–42 (mean \pm SD: 29.6 \pm 5.1 years). Of these, 17 were employed in the initial processing department, 10 in the board processing department and 21 in the varnishing department. The mean duration of employment was 9.8 \pm 4.9 (range: 1–21) years.

Control group. The control group consisted of 41 office workers, aged between 20–48 (mean \pm SD: 31 \pm 9.4 years), with no exposure to organic dust.

Demographics of the study population are shown in Table 1.

All subjects gave formal consent to participate in the study. The Ethics Commission of the Institute of Agricultural Medicine approved human subjects protocols.

Medical examination. All workers were interviewed with the physician-administrated questionnaire. The questions referred to work-related symptoms (including: cough, shortness of breath, chest pain, headache, general malaise, skin lesion, conjunctivitis, rhinitis) smoking habits and occupational history. Next, the participants were subjected

Table 3. Lung function among woodworkers and controls with regard to sex and smoking habit.

	Non-smokers Mean \pm SD	Smokers Mean \pm SD	Females Mean \pm SD	Males Mean \pm SD	Total
Woodworkers					
FVC (l)	3.19 \pm 0.52*	3.49 \pm 0.71 ⁺	3.08 \pm 0.45 ^a	3.89 \pm 0.64 ^{bbb}	3.37 \pm 0.65 ^{cc}
FEV ₁ (l)	2.65 \pm 0.7*	3.01 \pm 0.83	2.54 \pm 0.56 ^a	3.45 \pm 0.54 ^{bbb}	2.86 \pm 0.70 ^{cc}
FEV ₁ %/VC (%)	83.2 \pm 15.3	83.1 \pm 9.75	82.9 \pm 13.4	87.5 \pm 9.5 ^b	84.49 \pm 12.2
Controls					
FVC (l)	3.93 \pm 0.91	4.17 \pm 0.96	3.45 \pm 0.54	4.99 \pm 0.57	4.05 \pm 0.93
FEV ₁ (l)	3.28 \pm 0.67	3.4 \pm 0.67	2.87 \pm 0.44	4.07 \pm 0.51	3.34 \pm 0.75
FEV ₁ %/VC (%)	82.7 \pm 7.6	85.4 \pm 10.6	83.8 \pm 8.4	81.6 \pm 10.4	82.9 \pm 9.2

* $p < 0.05$ non-smoking woodworkers *versus* non-smoking controls; ⁺ $p < 0.05$ smoking woodworkers *versus* smoking controls; ^a $p < 0.05$ female woodworkers *versus* female controls; ^b $p < 0.05$ male woodworkers *versus* male controls; ^{bbb} $p < 0.001$ male woodworkers *versus* male controls; ^{cc} $p < 0.01$ woodworkers *versus* controls.

to routine physical examination and pulmonary function examinations with a Vitalograph spirometer. The spirometric tests were performed both before (7–8 a.m.) and after (4–5 p.m.) the working-day.

Forced expiratory volume in the first second (FEV₁), forced vital capacity (FVC) and peak expiratory volume (PEF) were recorded. The over-shift changes in spirometric values were calculated as pre-shift – post-shift. The changes in volume were divided by FEV₁ max or FVC max and reported as percentage change (% FEV₁ change, % FVC change).

Statistical analyses. Chi-square test was used for comparison of categorical variables. For comparison of continuous data the Mann-Whitney U-test was performed. To test over-shift changes, the Wilcoxon matched pairs, sign-ranks test was used. A value of $p < 0.05$ was regarded as a level of significance.

Most of the study was performed in the years 1987–1989 and continued in 1998–2001. All the medical examinations of the members of workers' group and reference group were conducted at similar times. Preliminary results of this work have been reported elsewhere [12, 17].

RESULTS

Table 2 presents prevalence of work-related symptoms in woodworkers. Among 48 examined subjects, 38 (79.2%) reported symptoms directly associated with their job. The most common complaint was dry cough reported by 25 workers (52.1%), followed by general malaise reported by 17 (35.45%) and conjunctivitis - by 16 (33.3%), rhinitis - by 16 (33.3%), and skin symptoms by 16 (33.3%). Other symptoms, such as headache, shortness of breath and chest pain occurred less frequently.

Nobody in the control group reported symptoms associated with work.

Analysis of the prevalence of work related-symptoms by job category demonstrated that subjects working in the initial processing and board processing departments had a higher prevalence of cough than workers employed in the varnishing department ($p < 0.01$).

The prevalence of skin, eyes and nose symptoms was higher in board processing and varnishing departments compared to the initial processing department. The difference was statistically significant only for skin lesions ($p < 0.05$).

The same cluster of symptoms (skin, eyes, nose) occurred more frequently in a group of subjects working for less than 5 years compared to rest of the group (working 5–10 and over 10 years). The difference was not statistically significant.

There were no significant differences in prevalence of symptoms among smokers and non-smokers.

Occupational asthma and allergic alveolitis were recorded in 3 out of 48 (6.2%) and in 2 out of 48 (4.2%) respectively.

On auscultation of the lung, wheezes and dry rales were detected in 3 out of 48 (6.2%) and 2 out of 48 (4.2%) workers respectively.

Table 3 presents the results of baseline lung function in woodworkers and controls with regard to sex and smoking habit. Among woodworkers, lower baseline FVC and FEV₁ values were seen compared to controls ($p < 0.01$). In all woodworkers' subgroups (male/female/ smokers/non-smokers) the measured FVC, FEV₁ were significantly decreased compared to control groups ($p < 0.05$ or $p < 0.001$) except for FEV₁ in smokers. The increased lung function parameters (FVC, FEV₁) were observed in smoking woodworkers compared to non-smoking ones. The difference was not statistically significant.

There was a statistically significant over-shift decrease of all measured spirometric values: FVC, FEV₁, FEV₁/VC, PEF among woodworkers ($p < 0.001$). No significant differences were seen in over-shift percentage changes (% FEV₁ change, % FVC change) between the subgroups of workers employed in different departments.

Table 4. Pre- and post-shift lung function among woodworkers with regard to age groups.

Age groups	FVC (l)		FEV ₁ (l)		FEV ₁ /VC (%)		PEF (l/s)	
	Mean ± SD		Mean ± SD		Mean ± SD		Mean ± SD	
	Pre-shift	Post-shift	Pre-shift	Post-shift	Pre-shift	Post-shift	Pre-shift	Post-shift
Group 1: <30 years, n=25	3.34 ± 0.62***	2.85 ± 0.71	2.87 ± 0.67***	2.37 ± 0.69	85.5 ± 11.2***	74.2 ± 18.7	5.5 ± 1.53***	4.69 ± 1.55
Group 2: >30 years, n=23	3.4 ± 0.69***	3.2 ± 0.69	2.85 ± 0.74*	2.63 ± 0.73	83.4 ± 13.5	81.7 ± 11.4	4.85 ± 1.78	4.51 ± 1.5

***p < 0.001 spirometric values pre-shift *versus* post shift; *p < 0.05 spirometric values pre-shift *versus* post shift.

Table 4 shows the pre-shift, post-shift changes in lung function parameters with regard to age. There was a significant pre-shift, post-shift decline in FVC, FEV₁, FVC/FEV₁, PEF among workers under 30 years of age (p < 0.001). The same tendency was seen for FVC and FEV₁ in subjects over 30. The percentage changes in FVC, FEV₁ were higher in the group of younger workers (15.1% and 17.6% respectively) than in group of older subject (6.2%, 7.1%). The difference was not significant.

DISCUSSION

Several authors report that, in spite of low concentration of total wood dust in furniture factories, the workers employed stand an increased risk of suffering from asthma, bronchial hyperresponsiveness, decline in lung function, rhinitis, conjunctivitis and skin problems [7, 14, 18, 20, 21]. This may be partly explained by exposure to agents other than wood components, such as microorganisms, vapours from organic solvents, lacquers, and formaldehyde.

In our study, the frequency of work-related symptoms among examined woodworkers was higher than that presented in other environments [5]. The analysis of reported symptoms indicates an increased prevalence of cough and general malaise (52.1% and 35.4% respectively) among woodworkers. This is in agreement with data reported by Mandryk *et al.*, Eduard *et al.*, Schlünssen [7, 15, 21]. We also found that cough more frequently occurred among workers employed in initial processing and board processing departments than in varnishing workshops. Different results were presented by Talini *et al.* [23] who reported a higher prevalence of cough and asthma-like symptoms among spray painters. He concluded that the differences were due to the atopic subjects, who showed a higher prevalence of cough, wheeze, shortness of breath in spray painters than in others group.

The prevalence of mucous membrane irritation (eye and nose symptoms) reported in our study was within the range of data presented by Eduard *et al.* and Mandryk *et al.* [7, 15], but higher than results published by Dutkiewicz *et al.* and Schlünssen *et al.* [5, 20]. This cluster of symptoms occurred more frequently in varnishing and board processing departments where the exposure to irritant agents is higher.

Our study revealed lower baseline values of FVC and FEV₁ among woodworkers compared to controls. There was also a statistically significant over-shift decrease of all measured spirometric values: FVC, FEV₁, FEV₁/VC, PEF in all groups of woodworkers. Similar results were presented by Mandryk *et al.* [15]. Other authors did not report any changes in baseline spirometric values [10, 20].

The difference in lung function was more strongly seen in younger workers (before age of 30) compared to those who were older ones. This may be due to the process of shifting people with slightly impaired lung function towards less a dusty job. Another explanation is that in young people the respiratory tracts are much more reactive compared to those who are older.

CONCLUSION

Our data suggest that exposure to hazardous agents in furniture factory environment may lead to the development of work-related symptoms and lung function impairment.

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