

EXPOSURE, LUNG FUNCTION AND RHIZOPUS ANTIBODIES IN WOOD TRIMMERS. A LONGITUDINAL STUDY.

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Sixty-six wood trimmers and local control subjects were examined several times in a 27-month follow-up study. FVC and FEV₁ were reduced by an average of 0.4 and 0.3 L, respectively, after a month of no exposure. Repeated measurements three months later, on a Monday before work, showed a further reduction in FVC and FEV₁ by an average of 0.21 L in a saw-mill with a high exposure to moulds (5×10^4 colony-forming units/m³), but not in another saw-mill with a 10 times lower exposure. Further recordings 27 months later, on a Monday before work, displayed no further reduction in any spirometric variable. No change in lung function was noted after one day of work (Monday), but a further reduction in FVC of an average of 0.3 L was seen in non-smokers at the end of the week, with apparent resolution over the weekend. The impairment was more obvious at the saw-mill with the higher air concentrations of organic dust than at the other saw-mill. It is concluded that wood trimmers may develop a restrictive pulmonary dysfunction, which might be explained by an immunopathological reaction to heavy mould exposure.

Inhalation of organic dust may cause pulmonary disease, commonly called extrinsic allergic alveolitis or hypersensitivity pneumonitis. During the 1970s, saw-mill workers in Sweden began to complain of attacks of coughing, shivering, malaise and fever. These reports coincided with the introduction of modified techniques for wood handling, including the fast drying of timber in closed areas. Heavy growths of mould colonies of the rhizopus species, were cultivated from dust and air samples collected in enclosed areas where dried planks were being trimmed, sorted and packed for shipping. Specific antibodies against these moulds were demonstrated by *Belin* in 1980 (1). No pulmonary function studies appear to have been conducted in wood trimmers without the typical acute reactions. The aim of this study was to examine any acute, delayed or chronic effect on lung function in wood trimmers.

SUBJECTS AND METHODS

The study was conducted at two large saw-mills in northern Sweden. All the subjects who had been employed full-time for more than one year and who worked during the period of the study were examined. This resulted in a group of 40 wood trimmers with an average age of 34 years at the start of the study. The average duration of their employment as wood trimmers was nine years (1–42 years). Another 40 subjects employed at the same saw-mills, but not exposed to irritative agents served as local controls (Table 1).

Table 1
Subjects' data

	N	Smokers	Non-smokers	Age years
Exposed*	40	16	24	34
Controls	40	10	30	37

* Duration of employment, 9 years.
Ref. (6,7)

Airborne spores were collected by personal sampling on filters (Millipore type A). Precipitating antibodies were assayed by the traditional double diffusion-in-gel (2) technique against a panel of common microbial antigens (1) and by a method, known as Dig-Elisa, using peroxidase-labelled anti-IgG for the detection of antibody binding to the solid phase antigen (3). Lung function was examined using the methods of spirometry and single breath nitrogen washout (4) under five different conditions: 1. before work, after four to five weeks without exposure 2. three months after the previous measurement, on a Monday morning before work, 3. on a Monday after work shift, 4. after a week of work in exposure, and 5. 27 months after the first measurement, on a Monday before work. Standard statistical methods were employed, using Student's paired t-test and linear regression analysis when applicable (5). Two-tailed tests were performed. The exposed workers and local controls were compared to external reference data (6–8).

RESULTS AND DISCUSSION

The forced vital capacity (FVC) and forced vital capacity in one second (FEV₁) were reduced by an average of 0.4 and 0.3 L, respectively, after a month of no exposure (Table 2). However, the nitrogen washout variables showed no clear changes. Repeated measurements three months later, on a Monday morning after two days of no exposure, showed a further reduction in FVC and FEV₁ by an average of 0.2 L in a saw-mill with

Table 2
Spirometry after one month of no exposure

	FVC	FEV ₁	FEV %	MMF
Exposed	5.10	4.03	78.9	4.13
Reference values	-0.43**	-0.35**	0.0	-0.14
Controls	5.02	3.92	78.3	3.62
Reference values	-0.15	-0.03	+2.0	-0.20

** p < 0.01

Table 3
Saw-mill A. Low exposure

	FVC	FEV ₁	FEV %	MMF
After 1 month of no exposure	5.36	4.21	78.6	4.37
After 3 months of exposure	5.27	4.10	78.1	4.24

Table 4
Saw-mill B. High exposure

	FVC	FEV ₁	FEV %	MMF
After 1 month of no exposure	5.09	4.05	79.5	4.14
After 3 months of exposure	4.82**	3.87*	79.9	4.13
After 27 months of exposure	4.88**	3.81*	77.3	3.72

* p < 0.05; ** p < 0.01 (Significant differences from the initial value)

Table 5
Low exposure. Saw-mill A

	FVC	FEV ₁	FEV%	MMF
Monday a.m.	5.28	4.17	79.2	4.28
p.m.	-0.01	+0.02	+0.02	+0.06
Thursday a.m.	0.00	+0.02	+0.05	-0.04

Table 6
High exposure. Saw-mill B

		FVC	FEV ₁	FEV% ₁	MMF
Monday	a.m.	4.83	3.83	79.0	3.96
	p.m.	-0.03	-0.04	-1.1	-0.22
Thursday	p.m.	-0.33 *	-0.05	+4.8 *	-0.39

* p < 0.01. Significant difference from the initial value

higher exposure to moulds (10^4 colony-forming units/m³), but not in another saw-mill with a ten times lower exposure (Tables 3 and 4). Further recordings 27 months later (Monday morning before work) displayed no further worsening in any spirometric variable. No change in lung function was noted after one day of work (Monday morning to Monday afternoon), but a further reduction in FVC of an average of 0.3 L was seen in the whole group. This was especially noticeable in non-smokers at the end of the week, with apparent resolution over the weekend (Tables 5 and 6). The impairment was more obvious at saw-mill B with higher air concentrations of organic dust than at saw-mill A with lower exposure (Figure 1). Precipitating antibodies to rhizopus antigens were found in ten of the 30 analysed sera from the wood trimmers in the saw-mill with the higher exposure, but only in one among 23 sera from the saw-mill with the lower exposure to moulds.

To conclude, wood trimmers may develop a restrictive pulmonary dysfunction which could be explained by an immunopathological reaction to heavy mould exposure. This

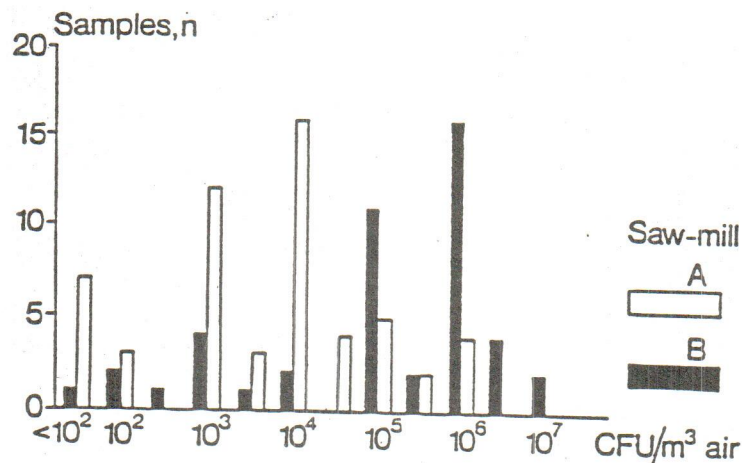


Figure 1 A frequency histogram showing the number of fungus colonies at saw-mills A and B. Saw-mill B has higher concentrations of colony-forming units (CFU)

indicates that wood trimmers constitute a risk group that needs to be followed up for longer periods to establish health hazards and to define threshold levels for organic dust which are acceptable to industry.

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Sažetak

PROFESIONALNA IZLOŽENOST, PLUĆNA FUNKCIJA I ANTITIJELA NA RHIZOPUS U RADNIKA U PILANAMA

U 27-mjesečnoj studiji višekratno je ispitivano 66 radnika zaposlenih u dvije pilane sjeverne Švedske i lokalnih kontrola. Smanjenje vrijednosti FVC i FEV₁ nađeno je u radnika nakon mjesec dana odmora, i to za 0,4 odnosno 0,3 L. Ponovljeno mjerenje nakon tri mjeseca, a prije početka rada, pokazalo je daljnju redukciju ovih vrijednosti, i to u prosjeku za 0,21 L u radnika pilana s visokom izloženosti plijesnima (5 x 10⁴ kolonija), što nije primijećeno u drugoj pilani s 10 puta manjom koncentracijom plijesni. Pri opetovanom ispitivanju nakon 27 mjeseci, u ponedjeljak, i to prije početka i nakon završetka radne smjene, nije došlo do daljnjeg smanjenja spirometrijskih varijabli. Međutim, daljnje smanjenje FVC-a (u prosjeku 0,3 L) primijećeno je krajem tjedna, i to u nepušača, s prividnim poboljšanjem tijekom vikenda. Smanjenje plućnih funkcija bilo je uočljivije u pilani s većom koncentracijom organskih prašina. Zaključuje se da se u radnika u pilanama mogu razviti restriktivne promjene plućne funkcije, koje se mogu objasniti kao imunopatološka reakcija na veliko zagađenje plijesnima.

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