

ACUTE AND CHRONIC AIRFLOW OBSTRUCTION AND ENDOTOXIN EXPOSURE. Milton DK, Kriebel D, Wypij D, Walters M, Hammond SK, Evans J. Occupational Health Program, Harvard School of Public Health, Boston, MA, USA.

Fiberglass wool manufacturing employees were studied for acute changes in lung function associated with workplace exposures because a previous investigation found a high prevalence of wheeze, asthma medication usage and airway obstruction among workers. Thirty-seven workers participated in personal exposure monitoring (for endotoxin, phenolic resin and formaldehyde exposure), spirometric measurements of lung function (85 work-days), and gathered PEF measurements (187 days at work and 181 days off work). Data were analyzed for association between several measures of exposure and the level of PEF over the course of several workdays, baseline spirometry, and airway hyperreactivity (measured as variability in PEF on days away from work). Generalized estimating equations (GEE) were used to study association between repeated measures of exposure and lung function. Endotoxin exposures above 15 ng/m³ were consistently associated with decrements in PEF [Odds Ratio (OR) across shift decline ≥ 25 lpm 2.88, 95% confidence interval (CI) 0.82, 10.06; OR Start of shift to arising decline ≥ 25 lpm 2.53, CI 1.30, 4.92], and to a lesser extent in the less powerful analysis of spirometric data [OR across shift decline $\geq 5\%$ 5.5, CI 0.81 to 36.5]. The most clearly defined effect on PEF occurred 16-20 hours after exposure suggesting that the mechanism is one of delayed inflammatory response. Phenolic resin exposure was only weakly associated with short term decrements in lung function and, when analyses considered both endotoxin and phenolic resin, endotoxin appeared to be the real determinant. Formaldehyde levels were generally low (1.2 to 265 $\mu\text{g}/\text{m}^3$). There was no overall effect of formaldehyde on lung function, although the data are consistent with presence of a small number of sensitive individuals in the population. Airway hyperreactivity appeared to increase with time since starting frequent assignment to the highest endotoxin exposure area. Thus, this finding is consistent with a long term effect of endotoxin exposure on pulmonary function mediated by chronic airway inflammation. The cross-sectional analysis of FEV₁ and FVC corroborated this finding: after controlling for the effects of smoking, duration of work in the wool plant was associated with reduced lung function. These findings point to both short term and long term effects of exposure to one or more pollutants, the most likely being endotoxin, on lung function in this population. Supported by Owens Corning Fiberglas, and NIEHS Center Grant 2P30 ES 00002.

AIRWAY RESPONSE TO COTTON DUST AND COTTON BRACT EXTRACT E. Neil Schachter, Eugenia Zuskin, Marion Buck, Nicholas Rienzi, James Godbold, Peter Spiro, Vincent Castranova, Michael Whitmer and Paul Siegel Mount Sinai Medical Center New York, N.Y., National Institute of Occupational Safety and Health Morgantown, West Virginia

We have previously shown that naive healthy subjects challenged with cotton bract extract (CBE) exhibit physiologic changes of airway hyperresponsiveness as well as characteristic "Monday Bronchospasm." CBE represents a major component of cotton dust and is thus potentially an important model for the study of byssinosis. In 11 healthy, non-smoking subjects (8 male, 3 female, age = 31.6 \pm 2.7) we examined in a double-blind random order, the effects CBE and cotton dust extract (CDE) for two hours following a ten minute aerosol inhalation. Endotoxin levels were 5.71 EU/mg for CBE and 31.88 EU/mg for CDE, oxFMLP were 90.2 $\mu\text{g}/\text{mg}$ for CBE and 0.2 $\mu\text{g}/\text{mg}$ for CDE. Challenges were separated by one week. The response to methacholine (MC) two hours following CBE or CDE was also measured. Lung function was recorded using maximal and partial flow volume curves. On the latter we measured the maximal expiratory flow 60% of baseline vital capacity below total lung capacity (MEF40%(P)). Responders (R) were defined as subjects who developed a 20% or greater fall in MEF40%(P) following extract challenge. There were 8 responders to CBE and 9 responders to CDE. All CBE responders were CDE responders. The average maximal response to CBE was a fall of MEF40%(P) to 68 \pm 9.1% of baseline compared to 68 \pm 6.8 for CDE (NS). All subjects R and non-responders (NR) enhanced their MC response following CBE or CDE. The PD40 MEF40%(P) was the same for CBE and CDE, 1.3 mg/cc. We conclude that both CBE and CDE exert similar physiologic effects in naive healthy subjects. Supported by NIOSH RO1-OHO-2593-01A1

ORGANIC DUST RELATED CHANGES IN VENTILATORY FUNCTION: A MULTIVARIATE APPROACH

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The effects of organic dust exposure on the configuration of the Maximum Expiratory Flow-Volume curve was examined in a multivariate way. The analyses were based on data from 390 male workers with an occupational exposure to organic dust in the grain processing and animal feed industry. In most epidemiological studies ventilatory function variables are analyzed separately. In the present study a multivariate technique called non-linear canonical correlation analyses was used to study the relationship of a set of organic dust exposure variables and a set of ventilatory function variables. This technique summarizes all information in (two) newly created independent variables. This allows a parsimonious description of organic dust related patterns of abnormality in the ventilatory function, i.e. the configuration of the MEFV-curve. The multivariate analysis facilitated a more comprehensive description of relationships between several indices of organic dust exposure on the ventilatory function as a whole, and comparison of these effects among non-smokers, ex-smokers and current-smokers. The results indicate an almost independent effect of the mean organic dust exposure (MEANDUST) and the number of years of organic dust exposure (EXPYEAR) on ventilatory function. An increasing MEANDUST exposure was associated with a decrease of both FEV₁ and FVC, and decreased flows at high lung volumes only. Increasing EXPYEAR was associated with a decrease of FEV₁ and a decrease of flows at all lung volumes, whilst the FVC remained relatively constant. These two distinct patterns of reduction of ventilatory function might represent two different pathological processes. A short-term process affecting the central airways mainly (MEANDUST), and a long-term process that affects both central and peripheral airways and putatively lung parenchyma (EXPYEAR). Whereas workers with prolonged exposure showed reduced values for all MEFV-curve variables, except the FVC, those with only a few years of exposure showed especially a decrease of FVC and PEF. The effects related to EXPYEAR and smoking habits were very much alike. The effect of present organic dust exposure was more evident in non-smokers than in ex-smokers and current smokers.

EPIDEMIOLOGY OF RESPIRATORY SYMPTOMS AMONG GERMAN FARMERS: A CROSS-SECTIONAL QUESTIONNAIRE STUDY.

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Obstructive airway diseases are the most frequent occupational disorders among German farmers. To study which sort of livestock is most responsible for bronchial symptoms, a random sample of 4 % of all farmers of Lower Saxony (Northern Germany) was drawn, and a total of 1861 (response rate 87 %) were interviewed in the spring of 1993. The standardized face-to-face interview included working history, animal keeping, smoking habits, work-related symptoms (WRS), and general respiratory complaints. Farmers' characteristics are given in the table:

Animals kept	# animals (median)	farmers n	male (%)	age \pm SD (yrs)	smokers (%)	WRS (%)
Pigs: Sows	25	619	78	47 \pm 12	16.8	22.7
Fattening pigs	80	799	79	48 \pm 12	18.3	21.9
Sucking pigs	80	551	77	47 \pm 12	16.7	23.0
Cattle: Cows	24	1245	81	46 \pm 11	18.1	17.4
Bulls	15	895	81	46 \pm 11	18.7	17.2
Calves	15	1190	80	46 \pm 11	18.2	17.8
Laying-hens	15	279	73	50 \pm 11	18.6	15.0
Fattening poultry	150	47	66	47 \pm 10	23.6	12.8

Pig farmers reported more WRS than other farmers ($p < 0.001$). This was true for work-related breathlessness (12.8 %), coughing (15.8 %), and wheezing (6.0 %) which were more prevalent than in non-pig farmers (9.5, 9.9, and 3.8 %, $p < 0.05$, each). Additionally, coughing during winter was more often reported in pig farmers (13.7 vs. 10.4 %, $p < 0.05$). In farmers with the highest numbers of pigs, symptoms related to work in confinement houses were most frequent (highest vs. lowest quartile, sows: 31.3 vs. 17.1 %; fattening pigs: 33.2 vs. 17.1 %; sucking pigs: 33.9 vs. 11.5 %, $p < 0.001$ each). Among pig farmers, animal numbers below the median value were not associated with increased symptom rates. Smoking showed no significant relationship with prevalences of WRS except for farmers keeping fattening pigs. In these, age-corrected odds ratios were 2.4 (95 % C.I., 1.4-4.1) for smoking, 1.8 (C.I., 1.3-2.4) for keeping fattening pigs (median # animals as cut-off), and 2.5 (C.I., 1.3-4.8) as interaction between smoking and keeping fattening pigs. The total odds ratio of 10.4 indicates that farmers who smoke and keep fattening pigs are at highest risk for developing work-related respiratory diseases. Supported by Hannoversche Landwirtschaftliche Berufsgenossenschaft.

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