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FINAL PROGRESS REPORT

Project title:

HEALTH EFFECTS OF INDUSTRIAL AEROSOLS

In collaboration with:

Environmental Protection Agency, USA

Principal investigator:

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Duration of the report:

June 1981 - May 1986

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I FIRST YEAR

1. STUDY ON THE EFFECT OF COFFEE DUST

Study has shown that exposure to green or roasted coffee might contribute to the development of chronic respiratory symptoms and lung function changes in exposed workers. Prevalence of almost all chronic respiratory symptoms was significantly higher in coffee workers than in controls. During Monday work shift there was a significant mean acute decrease in MEF_{50%} and in MEF_{25%}. Acute reductions in FEV₁ were considerably smaller. Acute decreases in flow rates at low lung volumes suggest that the bronchoconstrictor effect of the dust acts mostly on smaller airways. Administration of Intal before work shift considerably diminished acute reductions in flow rates. A comparison of ventilatory function values in exposed and matched control workers demonstrated a significantly lower values in coffee workers than in controls. Positive skin reactivity to green coffee beans was considerably more pronounced than to roasted coffee. Such data indicate that occupational exposure to dust of green or roasted coffee may lead in more sensitive subjects to persistent loss of pulmonary function.

2. STUDY ON THE EFFECT OF COTTON BRACK

Decrease in pulmonary function following cotton brack dust can be reproduced in the laboratory in healthy subjects never previously exposed to textile dust after

1. EPIDEMIOLOGICAL STUDY ON THE EFFECT OF TEA DUST

Respiratory function and immunological status were studied in tea workers occupationally exposed to different types of tea. The highest prevalence of almost all chronic respiratory symptoms was found in workers processing dog-rose, followed by sage and gruzyan tea. During Monday work shift there was a significant mean acute decrease in MEF50% and at MEF25%. Pre-shift administration of Intal significantly diminished acute reductions in flow rates except in workers processing indian tea. Comparison of ventilatory capacity in tea workers with those in controls indicate that exposure to tea dust in some workers may lead to chronic respiratory impairment.

Skin tests with tea allergens demonstrated the highest percentage of positive skin reactions to sage, gruzyan tea, mentha and dog-rose. Serum levels of total IgE were increased in considerably larger number of tea than in control workers. Prevalence of almost all chronic respiratory symptoms was higher in tea workers with positive skin tests than in those with negative skin tests to tea allergens.

2. EXPERIMENTAL STUDY ON THE EFFECT OF TEXTILE DUST EXTRACT

Inhalation of cotton bracts extract induced bronchoconstriction in normal healthy subjects. Pulmonary function changes occurred in both central and peripheral

airways. Flow rates on the partial expiratory flow-volume curves were the most sensitive indicators of positive inhalation tests. When bracts extract was freeze dried and reconstituted in deionized water the biological activity was unchanged. Double strength of bracts extract induced a significantly greater bronchospasm than single strength bracts. Dialysis of the extract shows that the active component(s) had of small molecular size since we measured approximately 65% of the original biological activity in the dialysate while the dialysed material was biologically inert. We showed that the active substance(s) is stable to moderate heat, acid or alkali conditions. The bronchoconstrictor agent is readily soluble in water; a single extraction of bracts removes all biologically active material.

Some responders to cotton bract extract exhibit greater airway reactivity than nonresponders. Differences may exist between methacholine and histamine response among these groups or alternatively there may be subgroups of individuals among responders with hyperreactive airways.

3. EXPERIMENTAL STUDY ON THE EFFECT OF COFFEE DUST EXTRACTS

Green coffee extracts induced concentration dependent contraction, but the maximal tension were never exceeded 76.3 ± 5.2 of a maximal histamine contraction. One gram of green coffee dust had a biological activity equivalent to 1.23 ± 0.1 mg of histamine. The potency of green

coffee was unaffected by mepyramine maleate while that of histamine was reduced 500 fold. Tissues contracted with histamine were not significantly relaxed by green coffee extracts. In contrast, roasted coffee extracts induced concentration dependent relaxation uncontracted and histamine contracted tissues. Tissues contracted with green coffee extracts were also completely relaxed by roasted coffee extracts. Our results show that coffee dust extracts have considerable biological activity which changes from a contractile to a relaxant action as a consequence of processing. The greater incidence of adverse reactions to green coffee dust(s) in coffee workers may be related to the contractile activity present in green coffee dust.

4. EPIDEMIOLOGICAL STUDY OF IMMUNOLOGICAL STATUS IN WORKERS EXPOSED TO FOOD AEROSOLS

Our data indicate that sensitive persons could develop immunological changes in occupational exposure to food dusts. Such persons might eventually develop symptoms of allergic diseases. Skin testing demonstrated the highest specificity for coffee allergen, followed by tea and food additives. IgE above normal level was found in 24% of coffee, 23% of tea and 30% of food additives workers.

III THIRD YEAR

1. THE PHARMACOLOGICAL CHARACTERIZATION OF AQUEOUS
EXTRACTS OF VEGETABLE DUSTS

All extracts reduced both basal tone and histamine-induced tone in tracheal spirals. The relaxation of tracheal spirals by theophylline was concentration dependent and it also reduced basal tone. Thus, the total relaxation as a percentage of induced tone is greater than 100%. Efficacy of the extracts varied.

2. CHARACTERIZATION OF TEXTILE DUST EXTRACTS: II BRONCHO-
CONSTRICTION IN MAN

In this study we have developed an assay system that mimics the acute byssinotic response. Inhalation of an aqueous extract of cotton bracts causes a gradually increasing bronchoconstriction that takes up to one hour to reach its peak. Conductance changes, which also occur, reflect constriction in large and central airways. Our data show that the agent(s) is highly water soluble. Steaming of cotton bales has resulted in reduced biological activity, and our results suggest that a vigorous washing of cotton bales before processing might be a simple and effective way to control the acute symptoms of byssinosis.

3. EFFECT OF GREEN COFFEE DUST ON LUNG FUNCTION
IN GUINEA PIGS

Experimental studies with green coffee dust in guinea pigs indicate that there are variations in sensitivity of exposed animals to green coffee dust.

IV FORTH YEAR

1. AIRWAY REACTIVITY AND COTTON BRACT-INDUCED
BRONCHIAL OBSTRUCTION

Most seemingly healthy persons challenged with an aerosol of cotton bract extract develop some degree of bronchospasm. The role of nonspecific reactivity of the airways in this reaction to cotton bract extract is undefined. Some responders to cotton bract extract exhibit greater reactivity of the airways than nonresponders.

2. BRONCHIAL REACTIVITY IN GREEN COFFEE EXPOSURE

Exposure to dust in coffee processing is likely to cause the development of chronic respiratory symptoms and changes in lung function in coffee workers. A significantly higher prevalence of chronic respiratory symptoms was found in exposed than in control workers. Provocative inhalation of green coffee allergen caused immediate bronchoconstriction in four out of nine tested subjects. The effect of coffee allergen in our workers was mostly pronounced in flow rates at low lung volumes. All workers with positive bronchial provocation test had positive skin reaction to green coffee. Such results indicate a great specificity of skin reactions to green coffee allergen in detecting workers sensitive to green coffee.

3. RESPIRATORY FUNCTION IN TEA WORKERS

The prevalence of almost all chronic respiratory symptoms was significantly higher in workers processing dog-rose, sage, and gruzyan tea than in control workers. During Monday shift there was a significant mean acute decrease in ventilatory capacity. Preshift administration of Intal significantly diminished acute reductions in flow rates. Exposure to tea dust may, in some workers, lead to chronic respiratory impairment.

V FIFTH YEAR

1. IMMUNOLOGICAL AND RESPIRATORY CHANGES IN TEA WORKERS

Skin tests with tea allergens demonstrated the highest percentage of positive reaction to sage, gruzyan, mentha and dog rose. Serum levels of IgE were increased in 27% of the tea workers and in 7% of the control subjects. Prevalence of almost all chronic respiratory symptoms was higher in tea workers with positive skin tests than in those with negative skin tests to tea allergen.

2. EFFECT OF FOOD ADDITIVES ON RESPIRATORY FUNCTION IN EXPOSED WORKERS

The same subjects were tested after period of 10 years. There was a decrease in the prevalence of acute and chronic respiratory symptoms in 1985 in comparison to 1976, although the differences were not statistically significant. There was a statistically significant acute mean decrease in all measured ventilatory capacity parameters. Comparison of the mean measured annual decrease for FVC, FEV₁ and MEF50% with the expected mean annual decrease demonstrated considerably larger mean annual decrease in exposed workers. Preshift administration of Intal considerably diminished acute reductions of ventilatory capacity over work shift in comparison to placebo.

3. RESPIRATORY CHANGES IN FURRIERS

The highest prevalence of chronic respiratory symptoms among furriers was recorded for sinusitis, followed by nasal catarrh, dyspnea and chronic cough. A considerably larger number of workers complained of acute symptoms during working hours. The largest mean relative acute reductions in ventilatory capacity were recorded for MEF50% indicating obstructive changes mostly in smaller airways. The measured values of ventilatory capacity were significantly smaller than normal values for FVC and MEF25%. A relatively small number of workers demonstrated positive skin reactions. Furriers mostly reacted to lamb hair and to marten.

4. AIRWAY RESPONSIVENESS IN WORKERS PROCESSING

② POLYESTER RESINS

A relatively large number of workers complained of acute or chronic respiratory symptoms. A higher prevalence of chronic respiratory symptoms was found among men than among women. Atropine significantly prevented the acute reductions in flow rates while propranolol potentiated the acute reductions in relation to a placebo. These results indicate that the autonomic nervous system is important in determining the lung's response to polyester resin.

5. RESPIRATORY FUNCTION IN RUBBER WORKERS

We found significantly higher prevalence of chronic respiratory symptoms in rubber workers than in adequate controls. Exposure to different noxious agents in rubber industry causes significant acute reductions in ventilatory capacity. In comparison to control preshift data, rubber workers had considerably lower preshift values than control workers. In relation to the duration of exposure, smokers and nonsmokers exposed for more than 20 years had considerably lower preshift values of all tests than expected normal values (80%). A mean annual decrease of FEV_1 in rubber workers was significantly greater than in control workers. Our study suggest that exposure in rubber processing might effect pulmonary function. Reductions of exposure and further longitudinal studies are recommended especially in regard to those most heavily exposed.

VI FINANCIAL REPORT

SUMMARY BUDGET

BUDGET CATEGORIES		1981-1986 YEARS (five yrs)		
			ND	US\$
A. Salaries & Wages	Professional Staff		1.497.665	
	Supporting Staff			
	Consultants			
B. Materials, Supplies and Services			3.452.235	
C. Travel Expenses	Travel Within the Country		1.760.400	
	Travel Outside the Country		467.000	3.540
D. Equip-ment	General Purpose		150.000	
	Special Purpose		42.500	
E. Other Direct Costs			2.458.200	
F. Audit				
SUB-TOTAL			9.828.000	3.540
G. Consultative Travel of Project Officer and U. S. Consultants			500.000	
* Writing final report Computing services Yugoslav consultants			250.000	
GRAND TOTAL			10.578.000	3.540

* Since Project Officer Dr. David L. Coffin did not come during the last year of the project, the amount of 250.000- ND has been used to cover expenses of writing the final report, for computing services and for Yugoslav consultants service.

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15. Žuškin, E., Skurić, Z., Ivanković, D.: A ten-year follow-up study in cotton workers. XXI International Congress on Occupational Health, Dublin, 9-14 September, 1984, pp. 177

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17. Žuškin, E. and Skurić, Z.: Respiratory function in tea workers. Brit. J. industr. Med. 41:88, 1984.
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