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VENTILATORY CAPACITY AND IMMUNOLOGICAL REACTION IN COFFEE WORKERS

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ABSTRACT

Respiratory function and immunological status were studied in a group of 45 coffee workers. The prevalence of all chronic respiratory symptoms was significantly higher in coffee workers than in controls. Coffee workers with positive skin tests to a coffee allergen had a significantly higher prevalence of chronic cough (63.6%) and chronic phlegm (72.7%) than those with negative skin tests (32.4% and 23.5% resp.).

Significant acute reductions over work shift in the maximum expiratory flow rates at 50% VC (MEF50%: −7.9%) and at 25% VC (MEF25%: −17.8%) indicate an obstructive effect mostly in smaller airways. Coffee workers with positive skin tests to coffee allergens had larger acute reductions in flow rates than those with negative skin tests. Workers with asthma symptoms demonstrated a positive reaction after bronchial provocation testing with coffee allergen.

Our study indicates a relationship between the development of respiratory symptoms or obstructive lung function changes and positive skin tests to coffee allergens. Bronchial provocation tests could be used to detect workers sensitive to coffee allergens.

In a preliminary epidemiological study[7] we have found that exposure to green or roasted coffee might cause a development of chronic respiratory symptoms and lung function changes in coffee workers. However, there have been few studies dealing with the immunological analysis related to the coffee dust exposure[1,2,6].

In our study the respiratory function and immunological status of coffee workers employed in the processing of green and roasted coffee were investigated.

POPULATION AND METHODS

Subjects

Forty-five female non-smoking workers employed in the processing of roasted and green coffee were studied. Their mean age was 31 years and duration of employment in the coffee industry 7 years. In addition a group of 45 control workers of identical sex, age and standing height but with no exposure to industrial pollution was included in the study.

Respiratory symptoms

Respiratory symptoms were recorded by means of the standard Medical Research Council questionnaire[3].

Ventilatory capacity

The maximum expiratory flow-volume (MEFV) curves were recorded on the first working day of the week before and after the shift. Flow rates at 50% and at 25% of the control vital capacity (MEF50% and MEF25%) were read from MEFV curves. The MEFV curves were recorded on a portable flow-volume spirometer[4]. The data of ventilatory capacity before shift were compared with the values found in control workers in order to assess a possible chronic effect of coffee dust.

Immunological studies and bronchial provocation testing

The subjects were skin-tested by the standard intradermal test. The testing was done with the occupational allergens prepared from the settled coffee material collected on operating machines in the industry. This included roasted coffee, green coffee and dust collected during emptying of green coffee from sacks. The skin reactions were read after 20 minutes.

Serum levels of total IgE were measured by radioimmunosorbent technique (RIST). The results below 122 i.u./ml were considered as normal values.

Bronchial provocation testing with the green coffee allergen was performed in four coffee workers who complained of asthma symptoms while working with coffee. The coffee allergen was prepared in a concentration of 1 ml of a 1 : 5 000 aqueous extract.

Environmental studies

Air-borne dust was sampled at all the working places of the workers examined by means of Casella personal samplers with cyclons on membrane filters. Total and respirable mass concentrations in the breathing zone were determined. Stationary samples were collected simultaneously by means of home-made two-stage sampler with specially constructed horizontal elutriators.

RESULTS

Respiratory symptoms

Figure 1 shows the prevalence of chronic respiratory symptoms separately in workers with positive and negative skin reactions to coffee allergens. The prevalences was higher in the skin positive group than in the skin negative group, although the differences were statistically significant only for chronic cough ($P < 0.05$) and chronic phlegm ($P < 0.01$).

The prevalence of all the chronic respiratory symptoms i.e. chronic cough, chronic phlegm, chronic bronchitis, asthma and dyspnea (grade 3 or 4) was found to be significantly higher in coffee workers (40%, 36%, 24%, 9%, 40%) than in the corresponding controls (7%, 4%, 4%, 0%, 0%) ($P < 0.01$).

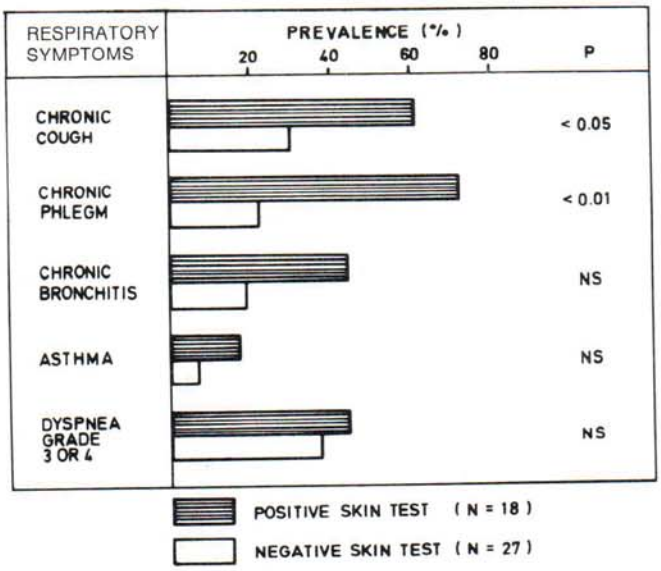

FIG. 1 – Prevalence of chronic respiratory symptoms in coffee workers with positive and negative skin tests to coffee allergens.

Ventilatory capacity

There were statistically significant acute reductions of flow rates in coffee workers over the work shift ($P < 0.01$) which were larger for MEF50% (−8%) than for MEF25% (−18%). The fact that the mean relative acute reduction in MEF25% was considerably greater than that in MEF50% indicates a predominant bronchoconstrictive reaction in the lower airways. The preshift

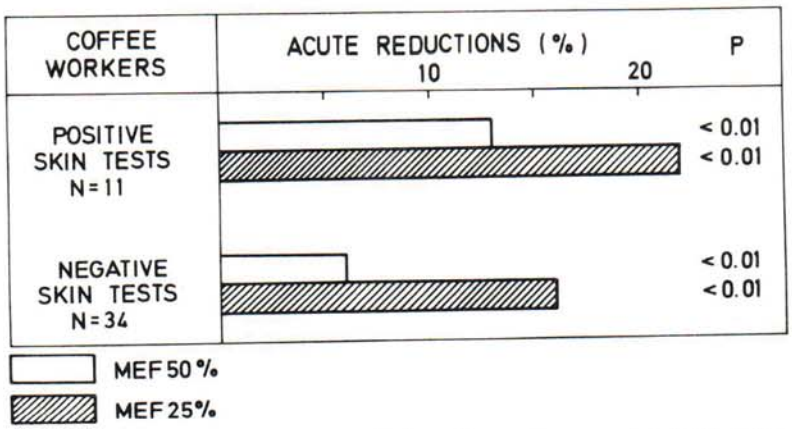

FIG. 2 – Acute reductions of ventilatory capacity in coffee workers according to the skin reaction to coffee allergens.

values of MEF50% (4.80 l/sec) and MEF25% (2.25 l/sec) in coffee workers were significantly smaller than the preshift values in control workers (MEF50%: 5.18 l/sec; MEF25%: 2.85 l/sec) ($P < 0.01$).

Figure 2 shows the relative acute reductions of MEF50% and MEF25% over the work shift in coffee workers with positive and negative skin reactions to coffee allergens. The reductions were more pronounced in the skin positive group, but the difference between the mean acute reductions was not statistically significant. Mean preshift values of flow rates both in the skin positive and in the skin negative group of coffee workers were significantly lower than in corresponding control groups except for MEF50% in the group with negative skin reactions.

Immunological studies and bronchial provocation testing

Among coffee workers, 9% had a positive skin reaction to roasted coffee, 11% to green coffee, and 40% to dust sampled during the emptying of green coffee from sacks.

IgE above the normal level was found in 24% coffee workers. An analysis of the acute reductions of ventilatory capacity separately in workers with normal IgE values (MEF50%: −7.7%; MEF25%: −19.1%) and in those with increased IgE levels (MEF50%: −9.8%; MEF25%: −14.6%) did not reveal significant differences in acute reductions between these two groups ($P > 0.05$). Coffee workers with increased levels of IgE values had significantly lower preshift values of flow rates than control workers.

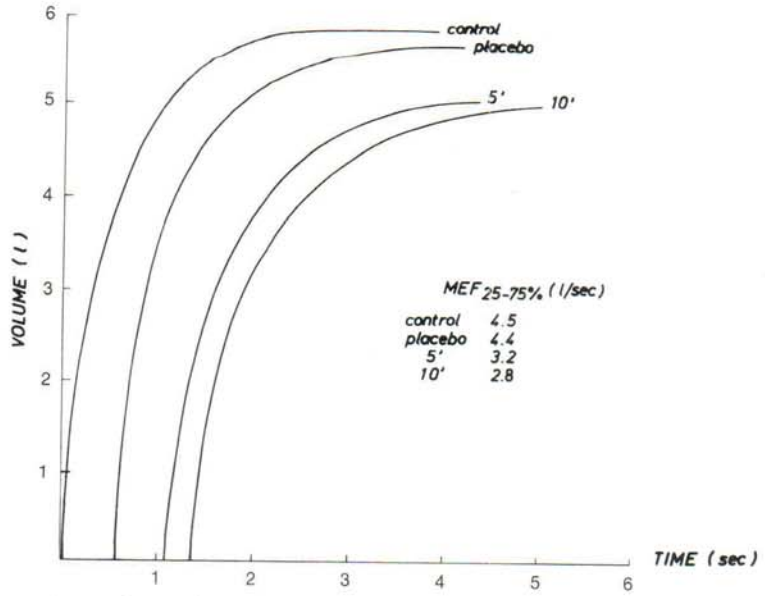

FIG. 3 – Acute changes in ventilatory capacity after bronchial provocation testing with green coffee allergen extract.

Figure 3 shows the forced expiratory curves in one coffee worker before and after bronchial provocation testing with the green coffee extract. There was a considerable decrease in flow rates ($MEF_{25-75\%}$) up to 30 minutes after exposure.

Environmental studies

The mean total dust concentration in green coffee processing (mean: 11.2 mg/m^3; range: 1.4–62.3 mg/m^3) was considerably higher than in the roasted coffee processing (mean: 4.3 mg/m^3; range: 1.1–8.8 mg/m^3). The percentage of the respirable fraction was very similar (green coffee: 3%; roasted coffee: 2%).

DISCUSSION

Our study has demonstrated a significantly higher prevalence of chronic respiratory symptoms in coffee workers than in corresponding controls. A significantly higher prevalence of chronic cough and chronic phlegm in workers with positive skin tests to coffee allergens than in those with negative skin tests indicates that the former group is more sensitive to coffee dust inhalation. This sensitive group of workers should be followed in order to find out if the prevalence of chronic bronchitis, asthma or dyspnea would increase with the continuation of exposure to coffee dust.

The inhalation of coffee dust caused a significant bronchoconstriction with the more pronounced effects in smaller airways. The acute reductions were considerably larger in workers with positive skin tests than in those with negative skin tests. Our data have shown that there is no correlation between increased IgE serum level and acute ventilatory capacity reductions.

In previous studies[1,5] on the effect of coffee dust it was shown that Intal® (DSCG) prevented the acute reductions in ventilatory capacity, indicating that the bronchoconstrictive effect of coffee may be, at least partly, explained by the release of histamine.

From our data it appears that lung function testing as well as skin tests, and bronchial provocation tests with a coffee allergen could be used in medical prevention to detect workers who are more sensitive to coffee dust inhalation. Such workers should be followed and, in case of impairment of lung function or development of chronic respiratory symptoms, removed to another job.

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