RESPIRATORY FUNCTION IN FLOUR-MILL WORKERS


* Laboratoire de Santé Publique, Université de Bordeaux II, Faculté de Médecine, Place de la Victoire, 33076, Bordeaux cedex, France
** Laboratoire municipal de Bordeaux
*** Institut d'Administration des Entreprises

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The frequency of bronchial symptoms and the alteration of respiratory function parameters were studied in a group of 63 workers of an industrial flour-mill, and in a control group matched according to age, social class, and tobacco intake. In the exposed group the answers to a questionnaire indicated a greater incidence of cough (p<0.01) and chronic expectoration (p<0.01) as well as clinical airway hyperreactivity (p<0.01). No differences were noted for either asthma or allergy. The respiratory function parameters did not differ between the two groups studied. These results suggest that workers exposed to the vegetable dust found in flour-mills are subject to develop chronic bronchial irritation.

INTRODUCTION

Ever since the time of Ramazini’s observations (21), attention has been drawn to the frequency of respiratory symptoms, abnormalities of respiratory function and bronchial reactivity among workers exposed to cereal dust. This work environment contains numerous biological and chemical pollutants to which other risk factors (i.e. tobacco) are added. Mill work has not inspired many epidemiological studies although the allergic symptoms of bakers have attracted the clinician’s attention. Still, mill-dust is more specific and concerns essentially one type of cereal: wheat. In addition, this type of work is divided into very specific operations, allowing a precise inventory of the characteristics for each work site. Our goal was to study the prevalence of clinical symptoms and abnormalities in respiratory function in an industrial flour mill.

POPULATION, MATERIAL AND METHODS

Population

A. The survey involved 136 workers, 82.4% of the available work force in an industrial flour mill. In order to be able to follow them for 5 years we retained, for the analysis, only subjects who were less than 50 years old (N = 63). They constituted the exposed population.

Subjects came from 4 different work sites within the mill: grain reception, silo filling, flour bagging, and animal food bagging.

Female workers were not studied since their small number made it difficult to constitute a control group.

B. As it was impossible to find valid control subjects in the factory, the control group belonged almost exclusively (92%) to the Bordeaux hospital (kitchen, maintenance, workshop, linen room).
staff. The remaining 8% were members of mill's administrative staff who were not exposed to dust (drivers, switchboard operators, computer personnel).

C. The two groups were matched according to age (± 5 years), social class (based on their professional qualification), and smoking habits. They were separated into three groups:

- smokers (at least one cigarette a day for a year);
- former smokers (having stopped smoking at least 6 months prior to the study);
- non-smokers.

Questionnaire

The questionnaire was developed from the MRC and CECA. It was based on a modification of the French study PAARC questionnaire (14).

The questions concerned the usual bronchial symptoms (cough, chronic expectoration, dyspnea, asthma, bronchial wheezing), allergy and symptoms suggesting airway reactivity (rhinitis, sneezing, bronchial wheezing when exposed to a smokey environment, to cold air or to the work environment after the week-end break). In addition, the questionnaire also included questions on the subject’s each person’s professional career and conditions of the exposure. The questionnaire was administered to all subjects on the work site by the same trained interviewers.

Study of the respiratory function

We used a computerised spirometer. We traced a flow/volume curve and measured the forced expiratory volume in one second (FEV1), the maximum mean expiratory flow rate between 25% and 75% of the forced vital capacity (MMEF 25-75), the maximum expiratory flow at 25%, 50%, and 75% of the forced vital capacity (MEF 25, MEF 50, MEF 75). The residual volume (RV) was measured with the diluted helium technique.

Spirometric measurements were performed on the work site. At least 3 readings were obtained in order to realise 2 reproducible curves.

Aero-biology of the professional environment

A. Quantitative analysis

The average concentration of global dust (organic or mineral) was measured for each work site by filtration of 10 to 140 m³ of air (80 m³ an hour).

B. Qualitative analysis

The microbiological study was established using two methods:

- sedimentation on Petri dish and two kinds of culture: standard Agar for aerobic bacteria and Agar malt for yeasts and moulds. The results were converted into CFU numbers (colony forming units) deposited on 63.5 cm² per 15 min period.
- Impaction on solid environment by surface air system. The results are given in number of CFU/m³. A microscopic study of dust suspended in the air was also made after sampling on an EGAI impactor that allows the selection of particles according to their diameters (>5, 5 to 2, 2 to 1, 1 to 0.7, 0.7 to 0.3 μ). Each sample was observed at 250 and 400 magnification.

Computer processing and statistical analysis

After matching, the dependency between two variables was studied by Chi² test and the means of the ventilatory function values were compared using a t test. The Yates correction was applied for the small populations.

RESULTS

Demographic characteristics of both populations

The main characteristics of both populations are summarized in Table 1. For the exposed subjects who smoked (n = 41), the tobacco intake at the time of the survey varied from 5 to 50 cigarettes a day, with an average of 21 ± 11 cigarettes per day. For the smokers of the control group, the tobacco intake varied from 2 to 50 cigarettes a day, with an average of 16 ± 11 cigarettes a day.

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Flour Mill Workers</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-30 years</td>
<td>22 35</td>
<td>22 35</td>
</tr>
<tr>
<td>31-40</td>
<td>16 25</td>
<td>16 25</td>
</tr>
<tr>
<td>41-50</td>
<td>25 40</td>
<td>25 40</td>
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<tr>
<td>Non Smokers</td>
<td>12 19</td>
<td>12 19</td>
</tr>
<tr>
<td>Ex Smokers</td>
<td>10 16</td>
<td>10 16</td>
</tr>
<tr>
<td>Smokers</td>
<td>41 65</td>
<td>41 65</td>
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<tr>
<td>Employment years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;6 months ≤5 years</td>
<td>28 44</td>
<td></td>
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<tr>
<td>&gt;5 years</td>
<td>35 56</td>
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