

Latent period for symptomatic sensitization in bakeries

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Aim	To describe the latent period for symptomatic sensitization in bread bakery workers.
Methods	Data on the latent period for symptomatic sensitization, resulting in either asthma or rhinitis, were obtained from an in-house health surveillance programme in a single large organization.
Results	Over a period of 10 years, 90 employees were identified with symptoms attributable to sensitization. The mean latent period was 7.3 years, with three employees describing the onset of symptoms in their first year of exposure.
Conclusions	The long latent period, typically more than 1 year, suggests that health surveillance on appointment and then at annual intervals thereafter should be adequate to identify affected individuals in a bakery environment.
Key words	Amylase; asthma; flour; latent period; rhinitis.

Background

Asthma due to grain or flour dust (Bakers' asthma) is one of the original causes of occupational asthma recognized as a Prescribed Industrial Disease within the UK. The recognized sensitizers in bread bakeries include wheat flour, soya flour, rice flour, fungal amylase and hemi-cellulase. Research on Bakers' asthma has largely concentrated on the nature of the causative substances in the baking process and the level of exposure required to produce symptoms [1–4]. In contrast, information on the latent period between the onset of exposure and the development of symptoms, in those whose respiratory condition is the result of sensitization, is sparse.

The aim of this paper was to examine the latent period for symptomatic immunoglobulin E (IgE) mediated sensitization in bread-baking operations, using data from an in-house health surveillance programme in a single large organization.

Methods

Cases of sensitization were identified from a respiratory health surveillance programme that began in January 1993 and is ongoing. The total number of bread bakery employees covered by the surveillance programme was around 1750 during a period of 10 years. The employees

included for surveillance were those exposed to dusts from any powdered ingredient. Approximately 1500 of the employees are from plant bakeries, with the remaining 250 in large-scale craft bakeries.

New starters were screened prior to appointment. Those with a history of asthma over the previous 5 years were not employed in jobs where there was any possible dust exposure. History of atopy was not a bar to employment in exposed jobs. Individuals with pre-existing rhinitis were not excluded from the study.

The health surveillance consists of an annual questionnaire administered by an occupational health nurse. In addition, the employees are encouraged to report any new persistent respiratory or nasal symptoms, arising between tests, to the nurse. Those who give a history of symptoms arising solely at work or worse at work are referred to an occupational physician for further assessment that consists of a structured interview and skin prick testing. Where considered appropriate, serial peak flow readings have also been performed. The interview covers the individual's occupational history in relation to ingredient exposure and enquiry regarding work-related or allergic respiratory symptoms. In particular, the employees are asked about symptoms relating to possible rhinitis, conjunctivitis and asthma with particular emphasis on the relationship between exposure to dust and the pattern of symptoms. The diagnosis of symptomatic sensitization (whether asthma or rhinitis) requires a persistent history of work-related symptoms plus a positive skin prick test to at least one work-related allergen.

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Skin prick testing is performed against a standard set of solutions, namely: saline and histamine controls; commercially available common environmental allergens, i.e. house dust mite, cat fur and mixed grass pollens (Biodiagnostics Limited); work-related allergens at a concentration of 1 mg/ml, i.e. wheat flour, soya flour, rice flour and *Aspergillus*-derived amylase (prepared from base ingredients by the National Heart and Lung Institute). The wheat flour used to make up the skin prick test solution was a standard bread-making variety with no fungal amylase added during milling. The skin prick tests are read after 10 min and are considered to be positive if there is a weal of at least 3 mm diameter greater than the saline control.

Individuals who describe symptoms due to sensitization are asked to date the onset of their symptoms and also to date their first exposure to any powdered bakery ingredient in order to establish the latent period.

Results

Over the 10-year surveillance period, 90 employees were identified as having symptoms that could be attributed to sensitization to baking ingredients. A majority of those with symptoms (48/90) developed their symptoms before the start of the programme. The mean latent period for the overall group was 7.3 years, with only three of the employees developing symptoms in the first year of exposure. Table 1 gives the latent period for both the subgroups who developed symptoms before the health surveillance programme began (i.e. January 1993), where

Table 1. Distribution of latent period

Latent period (years)	Symptoms before 1993	Symptoms after 1993	Overall number
< 1	2	1	3
1–4	22	18	40
5–9	16	11	27
10–14	4	6	10
15–19	2	4	6
20–24	1	2	3
> 24	1	0	1
Total	48	42	90

Table 2. Arithmetic mean and maximum latent period

	Symptoms before 1993	Symptoms after 1993	Overall
Mean latent period (years)	6.8	7.9	7.3
Maximum latent period (years)	26	24	26

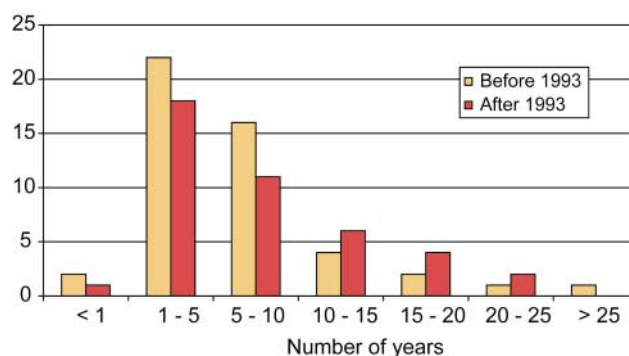


Figure 1. Distribution of latent period.

recollection of the date of onset of symptoms may be less reliable, and those whose symptoms started after this date. The mean latent period was longer for those individuals who developed symptoms in the last 10 years (7.9 years) compared with the previous years (6.8 years). The mean and maximum durations for the latent periods are shown in Table 2. A graphical distribution of the latent period is represented in Figure 1.

Of particular interest are the three employees whose symptoms began during the first year of exposure. Two of the three (i.e. the employee whose symptoms began after the beginning of the programme and one of those whose symptoms started before the beginning of the programme) had pre-existing atopic symptoms prior to their exposure to bakery ingredients and described the symptoms in bakeries as arising from their first exposure to bakery dust. It is questionable whether the symptoms attributable to the early stages of dust exposure in these two employees are indeed the result of sensitization or whether they may have been due to aggravation of pre-existing atopic symptoms. The third employee described that new symptoms arose 6 months after his first bakery dust exposure.

Discussion

In this study, symptomatic sensitization to bread bakery ingredients typically has quite a long latent period, i.e. a number of years, and rarely arises during the first year of exposure. Other longitudinal studies have looked at bakery populations in terms of both the timing of sensitization to ingredients, as defined by skin prick testing, and also the onset of respiratory symptoms, through the application of questionnaires [4–7], but have not specifically aimed to make a causal link between the symptoms and sensitization. These studies suggest that IgE seroconversion can occur quite early, and certainly in the first year of exposure [5–7]. Equally, respiratory symptoms can appear at an early stage [4–6]. However, the general finding from a number of studies is that

a large majority of bakers with respiratory symptoms have no evidence of sensitization to flour or other ingredients [1,8–10].

In practice, the main determinant of the latent period is probably the likelihood of employees meeting a sensitizing exposure. In turn, the chance of this arising will be determined by the potency of the sensitizer and the actual exposure levels. It is interesting to speculate whether the difference in mean latent period for the group whose symptoms began before 1993 (6.8 years) and those becoming symptomatic after 1993 (7.9 years) has any significance. A possible explanation for the lengthening of the mean latent period after 1993 could be that the chance of meeting a sensitizing exposure has been reduced. Certainly, extensive control measures were put in place after 1993 to reduce the risk of sensitization. Essentially, the controls were aimed at reducing exposure to dust from bread improvers containing enzymes below 1 mg/m^3 and all other dust below 10 mg/m^3 .

The observation that quite a long duration of exposure, typically more than 1 year, is usually necessary to produce symptomatic sensitization to flour and other bakery ingredients has implications for the intervals at which health surveillance needs to be performed. In this study, the highest incidence of new cases was between 1 and 5 years following first exposure. This contrasts with experience for a number of other sensitizers [11], where sensitization typically arises soon after first exposure. For the bakery employees, it might be argued that the frequency of surveillance should be increased during 1–5 years after first exposure rather than during the first year, which is the usual recommendation [12]. However, a programme where surveillance takes place on appointment and then at annual intervals thereafter should be adequate to identify affected individuals in a bakery environment, provided the employees are encouraged to report any persistent new nasal or respiratory symptoms when they arise rather than waiting for the next health surveillance appointment.

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