

Exposure of submarine personnel to house dust mite allergens

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House dust mite (HDM) allergens play an important role in the pathogenesis of perennial allergy and bronchial asthma. There is broad consensus that assessment of exposure to HDM allergens is mainly based on measurements of allergen concentrations in dust and that the "threshold" level for sensitization in atopic children is approximately 2000 ng of group I allergen (sum of Der p 1 and Der f 1) per gram of dust.^{1,2}

Many data are available about exposure to HDM allergens for persons in private homes and public buildings (eg, schools and day care centers) but hardly any for military personnel at their places of duty. In this article we present the results of a pilot study of HDM allergens in German submarines.

METHODS

In April 1996, dust samples were collected from 28 bunk mattresses in 2 submarines. The foam mattresses were covered with a synthetic fabric; cotton sheets were used as bed linens, and personal sleeping bags were used as comforters. On each of the submarines, only 16 bedsteads are available for a crew of about 25 persons, and therefore most of the bedsteads are used alternately by at least 2 persons during cruises. The submarines are identical models

Abbreviation used

HDM: House dust mite

(type 206; length, 48.6 m; width, 4.6 m; height, 4.5 m) built in 1969 and 1970, respectively. One week before collection of the samples, submarine B had returned from an extraordinarily long 3-month cruise, whereas submarine A, with the exception of a 3-week cruise, had stayed in the harbor during the preceding 3 months. When in the harbor, the crew does not use the bunks.

For dust collection, we used a vacuum cleaner (1000 W) equipped with a new dust bag for each mattress and vacuumed the whole mattress (50 cm × 180 to 210 cm) for 2 minutes per square meter. Dust extraction and ELISA were performed as described by Lau et al.³ Precoated polystyrene microtiter trays and reagents for sandwich ELISA were obtained from ALK (Copenhagen, Denmark). Results were expressed as nanograms per gram of dust. Assay sensitivity was 15 ng/g dust. For statistical evaluation, the sum of Der p 1 and Der f 1 was used.

RESULTS

The 13 dust samples from submarine A contained group I mite allergen contents below 500 ng/g dust (median, 182 ng/g dust), whereas all of the 15 dust samples from submarine B exceeded this level (median, 4438 ng/g dust; Fig 1). The age of the mattresses did not correlate with dust content. Total extractable dust weight ranged from 2.2 g to 46.0 g (median, 4.09 g for submarine A) and from 4.3 g to 18.0 g (median, 8.47 g for submarine B), respectively. Eleven (73%) of the 15 dust samples from submarine B contained group I mite aller-

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J Allergy Clin Immunol 1999;104:242-3.

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0091-6749/99 \$8.00 + 0 1/54/98808

gen levels higher than the threshold level of 2000 ng/g dust. Der p 1 was the most predominant allergen on both submarines, whereas the levels of Der f 1 did not exceed 50 ng/g dust (submarine A) and 500 ng/g dust (submarine B), respectively.

DISCUSSION

Our investigation shows that submarines can be a place of relevant exposure to HDM allergens. High (85% to 90%) relative humidity in the submarines during the cruises and "high density" use of the mattresses apparently provide favorable conditions for the growth of HDMs. The lower allergen concentrations on submarine A may be due to the fact that the duration of the last voyage was much shorter compared with submarine B. The range of HDM allergen contents per gram of dust in submarine B is in the range of what is found in private homes (unpublished data). We do not know how the HDMs initially were brought into the submarines; possible vehicles are the sleeping bags of the submariners or their clothing.⁴

Several studies have evaluated the health status and mortality of submarine personnel. However, we are not aware of any data about the rates of sensitization against HDM allergens in this group, and no data are available about the prevalence of asthma among German Navy personnel. Burr and Palinkas⁵ compared hospitalization rates of US Navy submariners with surface ship personnel and found that submarine personnel had lower hospitalization rates for nearly all of the diagnostic categories examined. According to the authors, a possible reason for the reported low rates was that the health status of submariners is screened thoroughly before recruitment (eg, because of difficulty of evacuation from a submarine in case of a medical problem), leading to a pronounced "healthy-worker effect." Of note, the German Navy

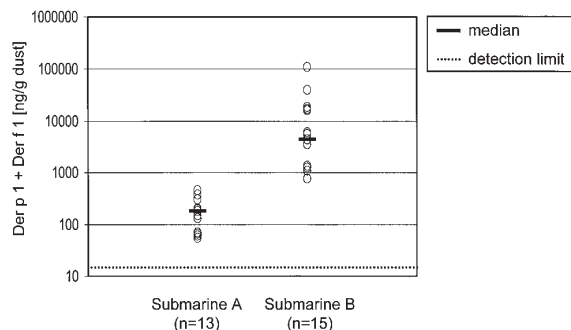


FIG 1. HDM allergen contents in mattresses (n = 28) from 2 submarines.

selects against persons with asthma, but not against persons with allergies that do not affect the lower airways, working on submarines.

The fact that submarines can be a place of relevant exposure to HDM allergens should be considered when selecting submarine personnel. More data are needed to characterize the extent of this problem and to assess under which circumstances measures to reduce exposure to HDM allergens on submarines are warranted.

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