

Prevalence of crab asthma in crab plant workers in Newfoundland and Labrador

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ABSTRACT

Objectives. The aim of the study was to determine the prevalence of snow crab sensitisation and occupational asthma. **Study design.** Prevalence study of symptoms, pulmonary function testing and allergy testing to crab was conducted in four crab plants of different design in Newfoundland and Labrador, Canada. **Methods.** Plants workers in four crab plants were interviewed and offered skin testing, RAST, pulmonary function testing and peak flow monitoring before and during crab processing. **Results.** 38% (n=78) had atopy. 18% (n=39) had certain or highly probable crab asthma. The prevalence of sensitisation in different crab plants varied from 50% (n=19) to 15% (n=16) and the prevalence of certain or highly probable crab asthma varied from 50% (n=19) to 9% (n=3). **Conclusion.** Crab asthma and sensitisation to snow crab is a major health problem for snow crab plant workers in Newfoundland and Labrador.

INTRODUCTION

This research is conducted in Newfoundland and Labrador, which is on the eastern seaboard of Canada. In this province, ground fish catch has dropped 90% from 400,000 metric tonnes in 1988 to 30,000 metric tonnes in 1993. Snow crab is the most commonly processed and the highest revenue-producing species, accounting for \$1.6 billion in revenue in the past 4 years.

One of the earliest researches on snow crab occupational asthma that described the condition was conducted in Newfoundland in 1978 (1). Since that time, the research related to this problem in the province has been limited and there has been no prevalence study on occupational snow crab asthma in the province.

Research in Quebec in 1984 indicated that the prevalence of snow crab occupational asthma was 15% in plants that have been open for only a few years (1). Smoking increases the risk of de-

veloping snow crab occupational asthma while atopy is associated with an increased risk of sensitisation to crab allergens. This research has also shown that occupational asthma is primarily caused by a process of sensitisation to an allergen in the snow crab that becomes airborne during processing: snow crab processing is highly allergenic, as crab allergens are aerosolised in the air during cooking of crab (transported by steam and water droplets and vapours), butchering of crab and sawing of legs (2,3).

Snow crab asthma is mediated through an allergic mechanism involving the production of specific IgE antibodies to crab meat and cooking water (4).

Many workers with crab occupational asthma can continue to work using asthma medications. However, the asthma of some workers will worsen and become permanent (5-7).

The prevalence of upper and lower airway

symptoms in crab plant workers is higher than the level of sensitisation. It has been hypothesised that exposure to chemical irritants may explain these non-specific symptoms. Various amines, responsible for the odour often found in crab plants, are released during the cooking of crab (8). These amines can be toxic at high levels, but their presence in crab plants probably does not explain these symptoms, as levels measured in the plants tested were within acceptable limits.

METHODS

In consultation with the Working Group on Shellfish, comprising plant managers, union representatives, Workplace Health and Safety Compensation Commission (WHSCC) and provincial government officials, four plants with different ages of the plants, types of processing and ventilation systems were assigned for the study.

In the winter of 2002, current and former workers who volunteered for the study were given questions on their work history, symptoms of asthma, rhino-conjunctivitis and rash, currently, in the past and in the last season. Spirometry was conducted and if there was an obstructive pattern this was repeated after ventolin inhalation. Skin tests to common allergens and to snow crab meat were administered to those who agreed. Blood was taken for radio-allergo-sorbent test (RAST) to snow crab cooking water and meat. Current workers were instructed how to perform and record peak flows and were instructed to do peak flows every 2 hours every day 2 weeks before working in the crab plant and two weeks during work. Support was given through a toll-free line.

Occupational crab asthma was categorised into almost certain, highly probable, possible and unlikely or negative. Those with a diagnosis of almost certain occupational asthma had symptoms of asthma during the season, improving after leaving work in their medical history, a positive skin test or RAST indicating allergy to snow crab and positive peak flow monitoring. Those with a diagnosis of highly probable occupational asthma would have had a positive med-

ical history of symptoms of asthma during the season improving after leaving work and positive skin test or RAST indicating sensitization to snow crab but no peak flow monitoring data. Those with a possible diagnosis would have had a positive medical history, negative RAST or skin test and no peak flow monitoring data, and those with a diagnosis of unlikely or negative occupational asthma would have had no history of asthma symptoms at work improving after leaving work, could have had a negative or positive skin test or RAST and no or negative peak flow monitoring data.

Occupational allergy was categorised as highly probable if there were symptoms of rhino-conjunctivitis during the working season and improving after the season, and positive skin test to snow crab meat or RAST to snow crab meat or cooking water, regardless of symptoms of occupational asthma. It was categorised as possible if there were symptoms of rhino-conjunctivitis during the working season and improving after the season, symptoms of occupational crab asthma but negative skin test and RAST to snow crab. It was classified as unlikely if there were symptoms of rhino-conjunctivitis during the working season and improving after the season, but no symptoms for occupational crab asthma and if skin test and RAST were negative. It was negative for occupational allergy if there were no symptoms of rhino-conjunctivitis, occupational crab asthma, negative skin test and negative RAST.

RESULTS

The overall participation rate was 43% (n=215). The range in participation at different plants ranged from 38% to 44%. The size of the current work force ranged from 33 to 87 workers. (See Table I)

The participants' ages ranged from 17 to 62 years, with the mean age of 40 years. Fifty-six percent of the workers were current smokers, 20% ex-smokers and 24% had never smoked. Sixty-nine percent were Caucasian, 17% Inuit

Table 1. Number of participants by plants. All identified former and current workers in 2001 reached.

Plant	Number of workers		Enrolled in 2001			Total (participation rate in %)
	All	reached	Current workers	Former workers	Supervisors	
1	428	233	85	16	2	103(44)
2	126	86	33	5	0	38(44)
3	191	107	30	9	2	41(38)
4	89	75	32		1	33(44)
Total	834	501	180	30	5	215(43)

and 14% Meti. Fifty-six percent of the participants were women.

Overall, 18% (n=39) of the participants had an "almost certain" or "highly probable" diagnosis of snow crab occupational asthma and 22% (n=45) a diagnosis of possible snow crab occupational asthma. In plant 1, ten people (10%) were given an "almost certain" or "highly probable" diagnosis. Twenty-seven people (26%) were given a "possible" diagnosis. In plant 2, nineteen (50%) of participants were given either an "almost certain" or "highly probable" diagnosis. Five workers (13%) were given a "possible" diagnosis of occupational asthma to snow crab. In plant 3, seven people (17%) were given either an "almost certain" or "highly probable" diagnosis of occupational asthma to snow crab. Nine people (22%) were given a "possible" diagnosis. In plant 4, three people (9%) were given either an "almost certain" or "highly probable" diagnosis of occupational asthma to snow crab. Six people (18%) were given a "possible" diagnosis.

The prevalence of occupational allergy was highly likely in 18% (n=39) and possible in 16% (n=35) of workers who participated. The range of highly probable allergy in different crab plants varied from 45% (n=17) to 9% (n=3).

DISCUSSION

Snow crab occupational asthma appears to be a major problem in the province of Newfoundland and Labrador, with a prevalence rate of about 18% in the 4 crab plants studied. The rates for occupational crab asthma range from 50% in the

oldest crab plant with poor ventilation that processed cooked crab. The 2nd lowest prevalence rate of occupational crab asthma of 10% was in the 2nd oldest but largest plant that has good ventilation and that cleaned and butchered crabs raw with cooking as the final process before brine freezing. The lowest prevalence rate of occupational asthma of 9% was in the newest plant of 2 years that cleaned clusters of raw crabs, cooked and brine froze the crabs without butchering. The prevalence rates of snow crab allergy are similar to snow crab asthma. It appears that processing raw crabs may be associated with a lower rate of occupational snow crab allergy and asthma. This will need to be confirmed by further studies to control for other variables including the duration of exposure, the efficiency of ventilation and processing methods.

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REFERENCES

1. Cartier A, Malo JL, Forest F, Lafrance M, Pineau L, St-Aubin JJ et al. Occupational asthma in snow crab-processing workers. *J Allergy Clin Immunol* 1984;74:261-9.
2. Malo JL, Chrétiens P, McCants M, Lehrer S. Detection of snow-crab antigens by air sampling of a snow-crab crab production plant. *Clin Exp Allergy* 1997;27(1):75-8.
3. Weytjens K, Cartier A, Malo JL, Chretien P, Essiembre F, Lehrer S et al. Aerosolized snow-crab allergens in a processing facility. *Allergy* 1999;54(8):892-3.

4. Cartier A, Malo JL, Ghezzi H, McCants M, Lehrer SB. IgE sensitization in snow crab-processing workers. *J Allergy Clin Immunol* 1986;78:344-8.
5. Chan-Yeung M, Maclean L, Paggiaro PL. Follow-up study of 232 patients with occupational asthma caused by western red cedar (*Thuja plicata*). *J Allergy Clin Immunol* 1987;79:792-6.
6. Côté J, Kennedy S, Chan-Yeung M. Outcome of patients with cedar asthma with continuous exposure. *Am Rev Respir Dis* 1990;141:373-6.
7. Moscato G, Dellabianca A, Perfetti L, Brame B, Galdi E, Niniano R et al. Occupational asthma: a longitudinal study on the clinical and socioeconomic outcome after diagnosis. *Chest* 1999;115(1):249-56.
8. Guillot JG. Vapeurs de crabe. *Interface Mars-April*, 27-32. 1984. Ref Type:Abstract

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