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OCCUPATIONAL ALLERGIES IN THE SEAFOOD INDUSTRY – A COMPARATIVE STUDY OF AUSTRALIAN AND SOUTH AFRICAN WORKPLACES

LOPATA AL¹, BAATJIES R², THROWER SJ³, JEEBHAY MF²

ABSTRACT

Although seafood allergy due to ingestion is commonly observed in clinical practice, the incidence of seafood allergies in general and more specifically in the occupational setting in Australia is largely unknown. The work practices, occupational health services and allergic health problems in 140 seafood processing workplaces in Australia were examined and compared to previous studies in South Africa. A cross-sectional employer-based survey design was used to conduct the study in both countries. In the South African study a response rate of 60% (n=41) was obtained, compared to a

¹ Division of Immunology, NHLS, Groote Schuur Hospital, University of Cape Town, South Africa

² Occupational and Environmental Health Research Unit, School of Public Health and Family Medicine, University of Cape Town, South Africa

³ Agency for Food and Fibre Sciences (Food Technology), Department of Primary Industries, Queensland

Corresponding author:

Andreas L Lopata, PhD

Division of Immunology, Allergology Section, IIDMM

Faculty of Health Sciences

Cape Town, Observatory 7925

South Africa

Tel: 27-21-406 6033

Fax: 27-21-406 6029

E-mail: ALOPATA@UCTGSH1.UCT.AC.ZA

response rate of 18% (n = 140) in Australia. The most common seafood processed by workplaces in South Africa was finfish (76%) and rock lobster (34%). Similarly in Australia, finfish (34%) was the most frequently handled seafood. However, processing of prawns (24%) and oysters (21%) was more common in Australia. Common work processes in South Africa involved freezing (71%), cutting/filleting (63%) and degutting (58%) procedures. Similar processes were followed in Australian industries with the exception of shucking of oysters, particularly common in the aquaculture industries. About half of the workplaces in both countries provided an occupational health service and medical surveillance of workers. However, none of the workplaces in South Africa and only 9% of the workplaces in Australia had industrial hygiene programs for seafood aerosols in place. In both countries positive trends were observed between the size of the workforce and the provision of occupational health services ($p < 0.005$). Similarly, skin rash accounted for highest of all reported health problems (78-81%) followed by asthmatic symptoms (7-10%) and other non-specific allergic symptoms (9-15%) in both countries. Most workplaces reported the annual prevalence of work-related symptoms to be less than 5%. In Australia 7% of respondents in workplaces reported workers having left their workplace due to work-related allergic problems. Despite a low response rate of contacted companies in Australia, there were great similarities between the two countries suggesting that there is a significantly elevated prevalence of work related allergic symptoms in both countries. Unexpectedly, mollusc processing was more common in Australia although the occupational health related effects among exposed workers has previously not been investigated in detail and merits further study. It is recommended that further epidemiological studies focus on seafood exposure in Australia and identify specific risk factors for sensitisation.

Keywords:

seafood allergy; occupational allergy; seafood processing; occupational health services; work-related symptoms; fish, mollusc

INTRODUCTION

Recent years have seen increased levels of production and processing of seafood which have led to more frequent reporting of occupational seafood allergies. Workers in the fishing and seafood processing industries are commonly exposed to seafood, especially those involved in either manual or automated processing of crabs, prawns, mussels, fish and fishmeal. The Food and Agriculture Organisation (FAO) estimates that over 28.5 million workers worldwide work aboard fishing trawlers (52%),

aquaculture production (marine and freshwater) (32%) and work inland as capture fishers or other land-based activities such as processing (16%).

One of the better-studied seafood sectors for the prevalence of occupational allergic reactions is the snow crab industry of North America. Studies of workers involved in land based processing activities revealed that up to 16% of workers had occupational asthma. A recent study conducted among crab processing workers aboard crab processing vessels demonstrated that workers were also exposed to high levels of crab allergens with high variability of exposures. In this study wheeze and other asthmatic symptoms were reported in 4% of these workers.

Recently, more detailed investigations have been conducted on fish processing activities in South Africa. The pattern of occupational seafood allergies in the occupational setting in Australia on the other hand is largely unknown. A study conducted among Australian prawn trawlers found the most common health problems to be lacerations, sprains, fractures, skin sepsis and dermatitis, however this study did not investigate allergic reactions and/or symptoms. A report on cases involving the Western Australian salmon has also been documented, but these cases were due to scombroid poisoning due to ingestion by individuals rather than caused by an allergic reaction. The only published study documenting occupational allergic reactions to seafood in Australia was a case report of a fisherman with respiratory allergy to abalone. It is evident that while the spectrum of work-related allergy in South Africa is beginning to emerge, the picture in Australia remains unclear.

The main objectives of the study were to compare the demographic profile of seafood processing workplaces in South Africa and Australia; to determine the various occupational settings in which exposure to seafood occurs; to identify specific workprocesses associated with high risk exposure; to determine the level of occupational health service provision with specific reference to the medical surveillance of workers in these various workplaces and to determine the employer-reported prevalence of common work-related symptoms (dermatitis and asthma) associated with seafood exposure in these various workplaces.

METHODS

Cross-sectional employer-based studies were conducted in South Africa and in Australia. The detailed methodology employed in the South African study is reported elsewhere.

The target Australia study population included seafood handling and processing workplaces in Australia listed in the most recent version of the database of the Australian Seafood Industry Directory. A self-administered questionnaire was sent to 779 companies in the aquaculture and processing sectors of the Australian seafood industry. In an effort to maximise the response rate, each workplace that did not reply or fully complete the survey form was contacted by telephone.

The questionnaire similar to that used in South Africa, included questions on: details of the company and the contact person; types of seafood processed and the production processes involved; demographic details of the workforce; presence and nature of occupational health activities provided; number of workers with common work-related symptoms associated with seafood processing; and number of workers leaving the industry due to work-related problems associated with seafood processing (see Appendix 1). Since this was a postal survey, no medical data or occupational exposure related allergic sensitisation patterns were available for analysis.

Data entry and analysis was conducted using Stata statistical package (Version 6). Univariate analyses summarized the distribution of each measured variable. The Mantel-Haenszel chi-square test for linear trend was used to explore the relationship between workforce size and the provision of various occupational health activities. The Mantel-Haenszel chi-square test was used to identify significant differences among workplaces conducting various occupational health activities.

RESULTS

Demographic characteristics of respondents

In the South African study a response rate of 60% (n=41 of 68) was obtained. Three workplaces were subsequently removed from the final analysis (n=38) since they were involved primarily with exporting rather than processing seafood. The majority of respondents to the questionnaire were factory managers (60%) followed by occupational health nurse practitioners (20%) and risk/loss control officers (3%). A large proportion (48%) of workplaces were small (employing 5-49 workers) and (24%) medium-sized (employing 50-199 workers) enterprises, while 29% of workplaces employed more than 200 workers (Table 1).

The response rate for the Australian survey was relatively low with 140 responses (18%) from 779 survey forms sent out. Among the responses, there were 85 respondents from the post-harvest processing sector and 55 from aquaculture. The majority of responses to the questionnaire came from managers (74%) (similar as in South Africa)

and only 4% were from occupational health and safety officers. Of the 130 workplaces that responded to all questions regarding occupational health activities, 32% were small, and 60% were medium size and only 8% workplaces employed more than 200 workers (Table 1).

Table 1. Percentage of seafood processing workplaces that conduct occupational health activities according to size of workforce in South Africa and Australia

Occupational health activity	Total no. of workplaces	Number of workplaces by workforce size (%)			
		Small(%)	Medium(%)	Large(%)	*p-value
Occupational health service on-site					
- South Africa	17 (45%)	4 (22%)	4 (44%)	9 (82%)	0.002
- Australia	67 (52%)	12 (29%)	46 (59%)	9 (82%)	<0.001
Medical surveillance programme					
- South Africa	22 (58%)	8 (44%)	5 (56%)	9 (82%)	0.055
- Australia	65 (50%)	17(41%)	43 (55%)	5 (45%)	0.337
Industrial hygiene programme					
- South Africa	0	0	0	0	0
- Australia	11 (9%)	6 (15%)	4 (5%)	1 (9%)	0.192
Work-related symptoms/ailments reported in the past year					
- South Africa	19 (50%)	5 (28%)	5 (56%)	9 (82%)	0.016
- Australia	37 (28%)	8 (20%)	25 (32%)	4 (36%)	0.154
Workers leaving employment due To work-related allergic symptoms					
- South Africa	ND	ND	ND	ND	ND
- Australia	9 (7%)	0	6 (8%)	3 (27%)	0.004

* Mantel Haenszel Chi-square test for trend; ND: Not done

Note: small=5-49 workers; medium=50-199 workers; large=200 or more workers

South African survey [N = 38, small = 18 (47%); medium = 9 (24%); large = 11 (29%)]

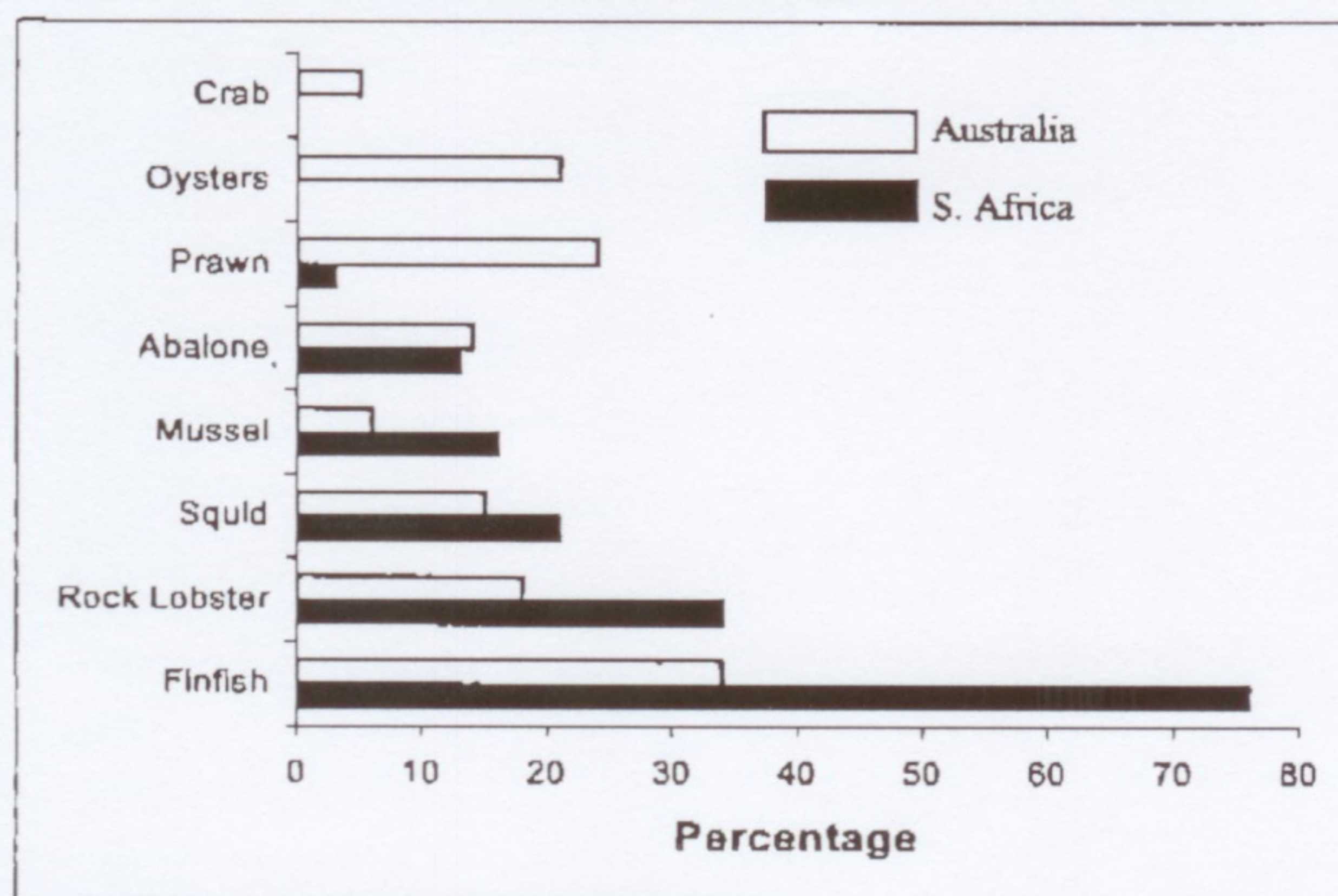
Australian survey [N=130, small = 41 (32%); medium = 78 (60%); large = 11 (8%)]

Seafood species processed/ handled

The most common seafood processed (Figure 1) by workplaces in South Africa were finfish (76%) and rock lobster (34%). Among the finfish, hake (47%) and pilchard (26%) were by far the most commonly processed species. The former is primarily used for filleting purposes and the latter for canning. Similarly in Australia, finfish was the most common (34%) seafood handled. However, processing of prawns and oysters was more common in Australia in comparison to South Africa. In Australia, the post-harvest

sector processed most species except oyster shucking which was done mainly by the aquaculture sector (44% versus 7%). Grouping the processed seafood species into the three marine phyla, finfish was the least processed group (34%) in Australia, preceded by crustaceans (47%) and the majority of the processed species belong to the group of the molluscs with 56%. This data is consistent with the official statistics published by the fishing industry in these countries.

Figure 1. Common seafood processed in workplaces in South African (S.A.)



and Australian seafood processing industries.

Seafood work processes

More than half the workplaces in South Africa employed freezing (71%), cutting/filleting (63%) and degutting (58%) procedures (Figure 2). Work processes in Australia were very similar to that employed in South Africa, with the exception of shucking of oysters which was particularly common in the Australian aquaculture sector. Other seafood associated processing activities not commonly used but reported were farming, drying, smoking, mincing, frying, filleting and fishmeal production.

Occupational health services

About half the workplaces in both countries provided an occupational health service and medical surveillance of workers (Table 1). None of the workplaces in South Africa had industrial hygiene surveillance programs designed to evaluate the aerosols

generated during the production process. Although 9% of the workplaces in Australia reportedly had an industrial hygiene program, it is unclear whether these programs included evaluating the aerosols generated by the production process.

Within both surveys positive trends were observed between the size of the workforce and the provision of an occupational health service ($p < 0.005$) (Table 1). Workplaces employing more than 200 workers were more likely to provide an occupational health service, conduct medical surveillance programmes, identify at least one worker per workplace with work-related symptoms associated with seafood processing, and identify at least one worker who left employment due to allergic health problems.

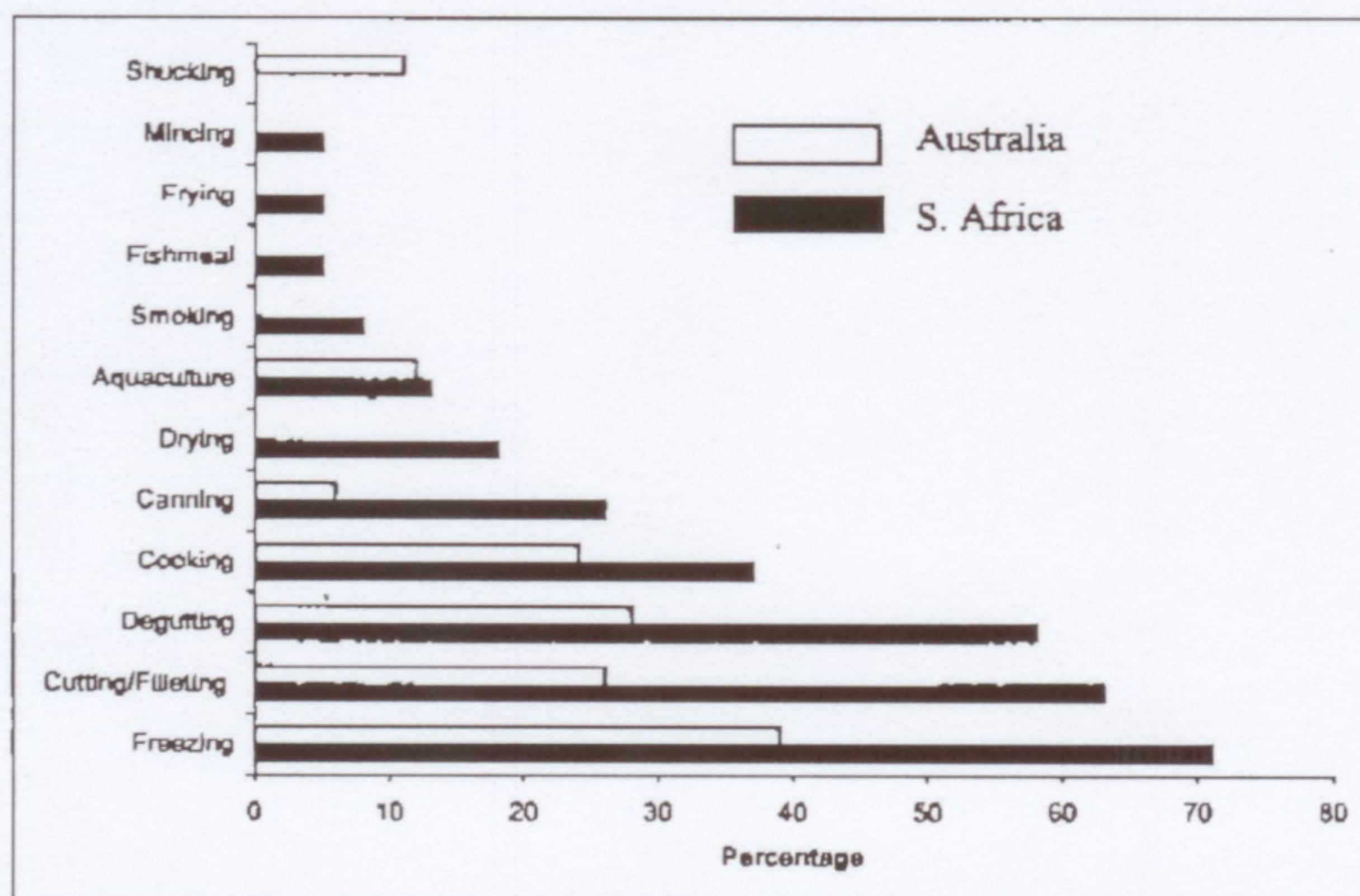


Figure 2. Common work processes utilized in seafood processing industries in South African and Australian workplaces.

In both surveys a significant association was demonstrated between workplaces with an on-site occupational health service and the existence of a medical surveillance programme ($p < 0.05$). Furthermore, a statistically significant association was also found between workplaces providing medical surveillance programmes and those that had reported work-related symptoms in the past year ($p < 0.05$).

Work-related symptoms

The work-related symptoms as reported by workplace managers and/or occupational health practitioners are summarised in Table 2. In both countries skin rash accounted for the highest of all reported health problems (78-81%) followed by asthmatic symptoms (7-10%) and other non-specific allergic symptoms (9-15%) (eg. rhinitis, conjunctivitis, angioedema). Most workplaces reported the annual prevalence of work-related symptoms to be less than 5%. However, the annual prevalence of work-related skin symptoms reported per workplace was substantially higher for skin than for asthmatic symptoms. Skin symptoms of more than 5% were reported by 13% and 14.5% of workplaces in South Africa and Australia respectively. In Australia nine workplaces (7%) reported at least one worker who had left the workplace due to work-related allergic problems. No further medical data were available on these workers.

Table 2. Distribution of annual prevalence figures of common work-related symptoms/ailments reported by seafood processing workplaces in South Africa and Australia

Prevalence (%)	Skin rash		Asthma symptoms		Other allergic symptoms (eg. rhinitis, conjunctivitis)	
	South Africa	Australia	South Africa	Australia	South Africa	Australia
0	22 (58%)	108 (81%)	31 (81%)	125 (94%)	32 (84%)	129 (97%)
1 - 5	11 (29%)	6 (4.5%)	7 (19%)	5 (4%)	3 (8%)	1 (1%)
6 - 10	1 (3%)	5 (4%)	0	1 (1%)	0	0
≥ 11	4 (10%)	14 (10.5%)	0	2 (1%)	3 (8%)	3 (2%)
Total	38 (100%)	133 (100%)	38 (100%)	133 (100%)	38 (100%)	133 (100%)

DISCUSSION

This is the first study to document (employer-acknowledged) work-related symptoms and allergic health problems among workers in the seafood processing industry in Australia and South Africa. The trends in work-related allergic symptoms observed in Australia mirror those observed in South Africa, suggesting similar occupational health risks associated with similar production processes. However, the source seafood exposures in the two countries were slightly different. The most common type of seafood groups handled in Australia were molluscs (mainly oysters and

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mussels) and crustaceans (mainly prawns), whilst in South Africa the most common seafood processed by workplaces were finfish and crustaceans (mainly rock lobster). This data is consistent with the official statistics published by the fishing industry in these countries. While epidemiological studies have recently been conducted to better characterise the allergic manifestations among fish processing workers in South Africa, the disease burden associated with mussel and oyster processing in Australia merits further study. This is important in the light of Japanese studies of oyster farm workers which demonstrated a 29% prevalence of occupational asthma due to Hoya (sea squirt), a seafood parasite. Similar epidemiological studies among New Zealand mussel openers suggested a 20-23% prevalence of occupational asthma symptoms. In this study, working as a mussel opener for more than two years was associated with a two-fold increased risk of having work-related respiratory symptoms.

In both countries employers reported work-related skin symptoms to be the most commonly reported health problem (78-80%) among workers. This is not surprising, as the skin is in frequent contact during handling and processing with the seafood products and fish juice containing proteins, biogenic amines such as histamine and cadaverine as well as degradation compounds of old fish, and digestive enzymes. Aside for contact irritant dermatitis associated with wet work, many seafood species have sharp spines and scales that can cause abrasions and sometimes puncture wounds. Loss of skin integrity exposes the immune system to a wide variety of seafood proteins, some of which are capable of inducing an allergic reaction. It is therefore important that occupational skin problems be prevented. Where there is skin contact with the hazardous agent (fish sorting, spice mixing), appropriate gloves (cotton-lined) and plastic sleeves can be worn. Special care should be taken when instituting preventive measures that one hazard is not replaced by another, such as using latex gloves and inadvertently causing latex allergy. Occupational skin diseases are an important cause of work-related disability in Australia and in the seafood industry worldwide.

The annual prevalence of work-related asthmatic symptoms, based on employer reports, among Australian, as with South African workplaces was between 0-5%. The prevalence of work-related asthma symptoms is relatively low in comparison to much higher prevalence's of occupational asthma reported in other studies among seafood workers, which varies from 7 to 36%. This finding suggests the possibility of under-reporting and/or under-recognition of work-related asthma among these workers. This could furthermore be related to the lack of occupational health surveillance, especially in workplaces with less than 200 workers, compared to those workplaces with more than 200 workers (22% versus 82%). Underreporting could be attributed to a lack of awareness and experience among doctors and nurses in appropriate diagnostic techniques. Most of the questionnaires (60-70%) were completed by factory managers

which might have influenced the underreporting of health problems among exposed workers. Furthermore, due to the cross-sectional nature of the study, the potential for a 'healthy' worker effect being in operation was high. Susceptible workers avoid 'high-risk' jobs and alternatively most affected workers may have already left at the time of the study. This was evident in the Australian study in which 9 workplaces (7%) reported at least one worker who had left the workplace due to work-related allergic problems.

None of the South African workplaces undertook industrial hygiene surveillance programs and only 9% of Australian workplaces, possibly designed to evaluate the aerosols generated during the production process. The lack of specific industrial hygiene programs may be in part due to the lack of statutory enforcement, and lack of expertise with regard to the evaluation of bio-aerosols in the work environment in the country. Recently, specific regulations for hazardous biological agents have been promulgated in South Africa under the Occupational Health and Safety Act, bringing South African laws more in line with international standards. It is envisaged that this will result in improved health and safety measures and surveillance of the seafood processing environment. Australian occupational health legislation appears to lack specific focus in so far as it relates to seafood allergen exposures in the industry as no regulations regarding hazardous biological reagents exists (Department of Primary Industries; Queensland, Australia).

Although only 18% of the contacted Australian companies responded, in comparison to 60% in South Africa, this study provides some insight into the level of occupational health service provision, allergic health problems and processing activities. The extent to which these findings can be generalizable for the entire Australian situation is uncertain, due to the low response rate and the fact that detailed information was not easily obtainable from the non-responders.

In conclusion, it is recommended that further epidemiological studies focus on quantifying the disease burden attributed to seafood exposures, especially mollusc exposures in Australian workplaces to identify specific risk factors for allergic sensitization to occupational seafood allergens. This would necessitate the development of appropriate industrial hygiene monitoring techniques for exposure characterisation of at-risk workers and medical surveillance protocols that utilise more sensitive immunological markers for early diagnosis. In this manner the pattern of occupational seafood allergy in seafood processing factories can be better characterised.

In the interim, employers have a duty to protect the health and safety of their employees. In the case of work-related allergic health problems, the best form of protection is avoidance of contact with the allergen. Several steps could be taken to achieve this. These include education of employers and workers to enable them to recognise an allergic response; instituting industrial hygiene and medical surveillance

programs (focussing on skin, lung and serum analysis) through the provision of occupational health services especially in small and medium sized enterprises; introducing workplace controls such as the provision of local exhaust extraction systems; protective clothing where this is practical and placement of workers with early allergic symptoms to areas of low/no exposure to prevent them from developing further complications.

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