



RAW FISH CONSUMPTION IN AUSTRALIA: HOW SAFE IS IT?

The first reported case of anisakidosis prompted an evaluation of the risks of sushi and sashimi consumption in Australia.

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Consumption of sushi and sashimi in Australia has increased greatly over recent decades with BIS Shrapnel estimating sushi and sashimi consumption at 115.6 million servings per annum (Anon., 2011). Sushi typically comprises rice combined with other ingredients such as seafood (often raw) and vegetables, while sashimi is entirely raw fish.

A downside of raw fish consumption is the possibility of consuming anisakid worms or their larvae (cysts), and contracting Anisakidosis. Documented by Shamsi & Butcher (2011), Australia's first recorded case of anisakidosis was after a 41-year old woman of Tongan descent consumed raw mackerel.

Her symptoms included vomiting, diarrhoea and right-side pain, which developed 10 days later into sore throat, rhinorrhoea, nasal congestion, cough with yellow sputum, myalgia, fevers, chills and sweats. After courses of unsuccessful drug treatment she recovered in hospital, where she passed a threadlike worm about 2 cm long.

Over 90 per cent of global cases of anisakidosis are reported from Japan, with most of the remainder from Spain, the Netherlands and Germany (Audicana & Kennedy, 2008). As well as gastrointestinal symptoms, anisakidosis may also cause dermatitis and other allergic reactions.

Genetic factors are an important predisposing factor with an unusually

high incidence among the Basque population in northern Spain (Audicana & Kennedy, 2008).

As in other countries, a range of Australian marine fish are infested with anisakid nematodes, sometimes at high prevalence and concentration (see Antananawat et al. 2012 for a full review).

The upsurge in raw fish consumption, coupled with the first reported anisakidosis, prompted us to evaluate the exposure of Australian consumers to worms or larvae in Australian finfish used for sushi or sashimi.

Data collection

We calculated volumes of species used for sushi and sashimi by interrogating the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) database for 2007-2010.

Australian Tuna Association and the Sydney Fish Market provided information on proportions of species likely to be consumed raw, as well as rates of detection of worms and larvae during processing in the wholesale, retail and food service sectors.

A brief survey was undertaken of sushi and sashimi operations in Adelaide to determine typical serving sizes.

Prevalence of anisakids in Australian fish used for sushi and sashimi

A literature review on the distribution and concentration of anisakid larvae in fish caught in Australian waters

(Northern Territory, Queensland, Western Australia, South Australia and Victoria) shows that three genera of the family Anisakidae: Anisakis, Terranova and Contracaecum, occur in Australian fishes commonly used for sushi and sashimi production. Some have high prevalence and concentration of anisakids in their viscera and/or body cavity. For instance, Spanish Mackerel has been shown to have Anisakis and Terranova larvae at 100 per cent prevalence and "high" (>20 cysts/fish) concentration (Moore et al., 2003).

The apparent lack of anisakids in farmed versus wild-caught fish has been demonstrated in Australia. Kingfish, a popular fish used for sushi and sashimi, is farmed in South Australia and fed with commercial pellets. It did not contain anisakids, (Shamsi et al., 2011) while wild-caught Kingfish did (Hutson et al., 2007).

Volumes of fish likely to be consumed as sushi and sashimi

In Australia, sushi and sashimi are based predominantly on Salmon and Tuna, with other high-value species such as Kingfish, Snappers and reef fish comprising a small proportion. Since all Salmon in Australia are farmed and raised on pelletised feed, they will not contain anisakid worms or larvae and therefore are not considered in this assessment.

As shown in Table 1, approximately 5927t of finfish species associated in the literature with presence of anisakids are



potentially available for consumption as sushi and sashimi. Based on industry information from the Australian Tuna Association and the Sydney Fish Market, the proportion of each species likely to enter the sushi/sashimi trade is estimated in Table 1 and ranges from five per cent for mackerel to 85 per cent for tuna.

We estimated the edible mass available for each species using the data of Kane (1994). Thus, for the present study an edible portion from the production weight of 70 per cent for tuna and 40 per cent for other species was assumed, yielding around 2937t (assumed edible mass) for potential consumption as sushi and sashimi, of which 1259t is estimated to be actually consumed in this form (Table 1).

Consumption of sashimi and sushi in Australia

The total mass of potentially infested fish consumed raw is 1259t/annum, and if the average mass of fish in a serving is assumed to be 50g, around 25 million servings a year are available for consumption. If it is further assumed that two per cent (as estimated by Ruello, 2005) of Australia's adult population of 16 million (320,000) regularly eat sushi, each will consume 79 servings a year, which is about two servings every ten days.

We acknowledge the simplistic nature

of this assumption, and that some consumers may eat sushi several times a week while others may consume only rarely, with obvious impact on their exposure to ingesting parasites. We also emphasise that, while sushi and sashimi based on salmon and prawns will comprise a large proportion of seafood eaten raw, we are concerned solely with consumption of at-risk species identified in Table 1.

Exposure mitigation

There are several stages in the catching-processing-marketing-retail continuum for reduction of infestation.

Firstly, primary processing (gilling, gutting and filleting) may reveal cysts in the viscera, gut cavity or flesh, leading to exclusion from the human food chain.

Secondly, in Australia it is customary for tuna to be sold via auction, a stage where inspection may reveal the presence of cysts in the gut cavity.

Thirdly, presence of cysts in the flesh may be detected during further processing.

Based on information from the Sydney Fish Market, (Mark Boulter, personal communication) approximately 0.5 per cent of tuna bodies are found to have some infestation when they are further processed in the sushi and sashimi trade. These bodies are returned for

compensation and are diverted to the non-human consumption stream. Finally, in preparation by the chef, fish is sliced into thin portions (3-10mm), which increases the likelihood that worms or cysts will be detected, as the slivers of fish are examined and arranged closely by the chef during presentation on the bed of rice.

Conclusions

The present study indicates that Australian consumers of sushi and sashimi are exposed on at least 25 million occasions annually to fish, which may contain anisakid worms or cysts at high prevalence and concentration. Despite this, there has been only one recorded case of anisakidosis in Australia.

Is the apparent lack of anisakidosis due to elimination of the hazard during processing and preparation? Or are other factors in play such as: underreporting and/or misdiagnosis because most infections are not severe, or the fact that there is no skin prick test for *A. simplex* available in Australia for allergic reactions, which results in confusion with fish allergies in general?

It is tempting to favour the former conclusion given the level of exposure via sushi and sashimi over a number of years, coupled with the fact that the only case to date involved whole fish consumed raw in a home setting. 



Table 1. Mass of finfish potentially used for sushi and sashimi consumption in Australia

| | Production (t) | Assumed edible mass (t) (~70% tuna, 40% other species) | Proportion (%) consumed raw | Mass (t) consumed raw |
|----------------------|----------------|--|-----------------------------|-----------------------|
| Bream | 1143 | 457 | 10 | 46 |
| Coral Trout | 1076 | 430 | 10 | 43 |
| Mackerels | 1286 | 514 | 5 | 26 |
| Orange Roughy | 534 | 214 | 10 | 21 |
| Tuna | 1888 | 1322 | 85 | 1123 |
| Totals | 5927 | 2936 | | 1259 |

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