

Imported food risk statement
Ready-to-eat cooked crustaceans and staphylococcal enterotoxin

Commodity: Ready-to-eat (RTE) cooked crustaceans. This includes crustaceans, such as prawns and seafood mixes containing crustacea (e.g. marinara mix), which is cooked. RTE cooked crustaceans that are dried or in ambient stable sealed packages are not covered by this risk statement.

Microbial enterotoxin: Staphylococcal enterotoxin (SE)

Recommendation and rationale
<p>Is SE in RTE cooked crustaceans a medium or high risk to public health:</p> <p><input type="checkbox"/> Yes</p> <p><input checked="" type="checkbox"/> No</p> <p><input type="checkbox"/> Uncertain, further scientific assessment required</p> <p>Rationale:</p> <ul style="list-style-type: none"> • SE is a moderate hazard as it generally causes illness of short duration and usually no sequelae. • There is limited evidence for staphylococcal food poisoning attributed to RTE cooked crustaceans. • <i>Staphylococcus aureus</i> will be inactivated by adequate cooking applied during the production of RTE cooked crustaceans. • Post-cooking contamination from food handlers and subsequent growth of <i>S. aureus</i> can occur in temperature-abused product. However, for illness to occur, generally large numbers of <i>S. aureus</i> are required for the production of SE. • International and Australian compliance, recall and surveillance data has shown limited evidence of <i>S. aureus</i> associated with RTE cooked crustaceans.

General description
<p>Nature of the microbial enterotoxin:</p> <p><i>Staphylococcus</i> spp. are facultative anaerobic Gram-positive, non-spore forming spherical-shaped bacteria. They are commonly found in the environment, humans (nose and skin) and animals. Although several <i>Staphylococcus</i> species can produce SEs, including both coagulase-negative and coagulase-positive isolates, the majority of staphylococcal food poisoning (SFP) is attributed to SE produced by coagulase-positive <i>S. aureus</i> (FDA 2012; FSANZ 2013).</p> <p>Growth of <i>S. aureus</i> can occur at temperatures ranging between 7 – 48°C, pH of 4.0 – 10.0 and a minimum water activity of 0.83 when other conditions are near optimum. SEs are resistant to heat inactivation and cannot be destroyed by cooking. SEs remain stable under frozen storage (FSANZ 2013).</p>
<p>Adverse health effects:</p> <p>SE is a moderate hazard as it generally causes illness of short duration and usually no sequelae (ICMSF 2002). People of all ages are susceptible to SFP. However, the severity of symptoms may vary depending on the amount of SE consumed and the general health status of individuals. The young and elderly are more likely to develop more serious symptoms (FSANZ 2013).</p>

SFP is characterized by rapid onset gastroenteritis that appears around three hours after exposure to an infective dose (normal range of 1 – 6 hours). Common symptoms of SFP include nausea, vomiting, abdominal cramps and diarrhoea. Recovery is usually between 1 – 3 days (FSANZ 2013).

People become ill after exposure to very small quantities of SE (less than 1 µg). These levels of toxin are generally observed when *S. aureus* populations exceed 10⁵ CFU/g of food (FDA 2012).

Consumption patterns:

In the 2011 – 2012 Nutrition and Physical Activity Survey (part of the 2011 – 2013 Australian Health Survey) <1% children (aged 2 – 16 years), 1% of adults (aged 17 – 69 years) and 1% of people aged 70 and above reported consumption of RTE cooked crustaceans (Australian Bureau of Statistics 2011). Mixed foods that contained RTE cooked crustaceans were excluded from the analysis. Survey data was derived from one day of dietary recall data.

Key risk factors:

The key risk factor for *S. aureus* contamination of RTE cooked crustaceans is post-harvest handling and processing of cooked product, particularly where the process involves human handling (e.g. the hand-peeling of cooked shrimp and crab), whereby *S. aureus* can be reintroduced into the product by food handlers. The use of brine flotation to remove shell fragments can also select for *S. aureus* due to its salt tolerance. Temperature abuse can also occur during handling, transport and/or storage of cooked product allowing growth of *S. aureus* and potentially SE production (ICMSF 2005; FSANZ 2005).

Risk mitigation:

Use of low temperatures (<5°C) during processing, transport and storage will reduce the rate of growth for most microbial pathogens (FSANZ 2005; Codex 2013). Good manufacturing practices and good hygienic practices will minimise *S. aureus* contamination. Avoiding time and temperature abuse of food products is essential in preventing the proliferation of staphylococci and subsequent production of SE. Levels of SE likely to cause illness are generally observed when *S. aureus* populations exceed 10⁵ CFU/g of food (FDA 2012).

In Australia Division 2 of [Standards 4.2.1 in the Australia New Zealand Foods Standards Code](#) (the Code) states that a seafood business must systematically examine all of its primary production and processing operations to identify potential seafood safety hazards and implement controls that are commensurate with the food safety risk, and must take all necessary steps to prevent the likelihood of seafood being or becoming contaminated.

[Schedule 27 of the Code](#) has a microbiological limit for cooked crustacea for coagulase-positive staphylococci of n=5, c=2, m=10²/g and M=10³/g.

Compliance history:

The imported food compliance data sourced from the Imported Food Inspection Scheme of the Australian Department of Agriculture for January 2007 – May 2016 showed that of the 3673 coagulase positive staphylococci tests applied to cooked crustaceans there were 16 fails, a 0.4% failure rate. The failed samples were from multiple countries and included cooked crab, lobster and prawns.

There have been no notifications on the European Commission's Rapid Alert System for Food and Feed (RASFF) for SE or *S. aureus* in cooked crustaceans from January 2007 – May 2016.

There have been no food recalls in Australia due to the presence of SE or *S. aureus* in imported or domestic cooked crustaceans from January 2007 – May 2016.

Surveillance information:

SFP is not a notifiable disease in Australia. There was one reported outbreak in Australia in 2013 associated with chicken sushi, one reported outbreak in 2012 suspected to be associated with fried rice and two reported outbreaks in 2011 associated with a range of foods (fried rice, chicken, egg fu yung, mussels) and lamprias. Factors that may have contributed to the outbreaks include the role of infected food handlers, poor

food handling practices and temperature abuse of food. It is generally recognised that there may be significant under reporting of SFP due to the short duration of illness and self-limiting symptoms. In Australia it is estimated that *S. aureus* accounts for 1% of foodborne illness caused by known pathogens (FSANZ 2013; Pillsbury et al. 2013; OzFoodNet 2013; OzFoodNet 2014; OzFoodNet 2015).

Illness associated with consumption of RTE cooked crustaceans contaminated with SE

A search of the scientific literature via Web of Science, PubMed, Scopus and other publications during the period 1990 – April 2016 identified limited SFP outbreaks associated with RTE crustaceans:

- There was one suspected SFP outbreak linked to consumption of RTE cooked crustaceans and three outbreaks associated with crustaceans (not stated if it was cooked) on the US CDC Foodborne Outbreak Online Database from 1998 – 2014 (CDC 2015).
- There was one SFP outbreak linked to consumption of crustaceans (not stated if it was cooked) reported to the national surveillance scheme for general outbreaks of infectious intestinal disease in England and Wales between 1992-1999 (Gillespie et al. 2001).

Prevalence of coagulase positive *S. aureus* in RTE cooked crustaceans

A search of the scientific literature via Web of Science, PubMed, Scopus and other publications during the period 1990 – April 2016 identified data on the prevalence of *S. aureus* in RTE cooked crustaceans is limited:

- Survey in the United Kingdom in 2003 – all cooked crustacean batches from production premises were satisfactory for *S. aureus* (n=35) (*S. aureus* counts <300 CFU/g). Of the batches of cooked crustaceans that were tested for *S. aureus* from retail premises, 0.3% were unsatisfactory (*S. aureus* counts ≥1000 CFU/g or at least 3 samples had counts between 100 – 1000 CFU/g), 0.3% were acceptable (n=5, c=2, m=100 CFU/g, M=1000 CFU/g), and the remainder of the batches were satisfactory (*S. aureus* counts <300 CFU/g) (n=372) (Sagoo et al. 2007).
- Survey in India in 1998/999 – coagulase positive staphylococci were not detected in quick frozen cooked, peeled and deveined tail-on tiger shrimp (n=928) collected at the processing plant (Hatha et al. 2003).
- Survey in India in 1994/1995 – coagulase positive staphylococci were not detected in quick frozen cooked ready-to-eat shrimp (n=914) collected at the processing plant (Hatha et al. 1998).
- Survey in Iceland in 1993/1998 – *S. aureus* was detected in <0.2% of cooked peeled and frozen shrimp samples collected from the processing factory (Valdimarsson et al. 1998).

Other relevant standards or guidelines

- Codex general principles of food hygiene *CAC/RCP 1 – 1969* follows the food chain from primary production through to final consumption, highlighting the key hygiene controls at each stage (Codex 2003).
- Codex code of practice for fish and fishery products *CAC/RCP 52-2003* applies to the growing, harvesting, handling, production, processing, storage, transportation and retail of fish, shellfish and aquatic invertebrates and products thereof from marine and freshwater sources that are intended for human consumption. Section 13A, 13B and 14 of *CAC/RCP 52-2003* is specific to the processing of lobsters, crabs, and shrimps and prawns, respectively, and describes controls at individual processing steps (Codex 2013).
- Codex standard for quick frozen lobsters *CODEX STAN 95-1981* covers the production and processing of quick frozen lobsters, including cooked squat lobsters (red and yellow) (Codex 2014a).
- Codex standard for quick frozen shrimps or prawns *CODEX STAN 92-1981* covers the production and processing of quick frozen shrimps or prawns, including fully cooked shrimps or prawns (Codex 2014b).

Approach by overseas countries

Many countries and regions, such as the United States, Canada and the European Union, have HACCP-based regulatory measures in place for production of this commodity.

In Europe, shelled and shucked products of cooked crustaceans and molluscan shellfish have a coagulase-positive staphylococci limit of n=5, c=2, m=100 CFU/g, M=1000 CFU/g for products at the end of the manufacturing process (European Commission 2007).

Other considerations

Testing for high levels of coagulase-positive staphylococci may be used as an indicator test for the presence of SE.

Biosecurity restrictions apply to products under this commodity classification. Refer to the [BICON database](#).

This risk statement was compiled by FSANZ in: November 2016

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