Imported food risk statement
Sesame seeds and sesame seed products and *Salmonella* spp.

Commodity: Sesame seed and sesame seed products that are ready-to-eat. This includes sesame seeds and products made from ground or whole sesame seeds, such as tahini, halva and hummus. Sesame oil and products that have received a secondary heat treatment to mitigate post-processing contamination, such as canned, retorted, cooked or baked products are not covered by this risk statement.

Microorganism: *Salmonella* spp.

Recommendation and rationale

Is *Salmonella* spp. in sesame seeds and sesame seed products a medium or high risk to public health:

☑ *Yes*

☐ *No*

☐ *Uncertain, further scientific assessment required*

Rationale:

- *Salmonella* spp. are a serious hazard as they cause incapacitating, though not usually life threatening, illness of moderate duration and sequelae are rare.
- Human illness has been associated with sesame seed products contaminated with *Salmonella* spp.
- Sesame seeds used in sesame seed products undergo a roasting step that should be sufficient to inactivate *Salmonella* spp.
- Post-processing contamination can occur due to poor hygiene. Some foods, such as canned, retorted, cooked or baked products receive a further heat treatment step which will mitigate post-processing contamination.
- *Salmonella* spp. are able to survive in this commodity and there is uncertainty around the level of hygiene post-heat treatment as this process varies between manufacturers.
- International and Australian compliance and recall data have shown detections of *Salmonella* spp. in sesame seeds and sesame seed products.

General description

Nature of the microorganism:

Salmonella spp. are facultative anaerobic Gram-negative, non-spore forming rod-shaped bacteria. They are found in the intestinal tract of warm and cold-blooded vertebrates and in the surrounding environment (FSANZ 2013).

Growth of *Salmonella* spp. can occur at temperatures between 5.2 – 46.2°C, pH of 3.8 – 9.5 and a minimum water activity of 0.93 when other conditions are near optimum. *Salmonella* spp. can survive for months or even years in low moisture foods (and other low moisture environments) and are able to survive frozen storage at -20°C. *Salmonella* spp. are sensitive to normal cooking conditions, however, foods that are high in fat and low in moisture may have a protective effect against heat inactivation (FSANZ 2013; Li et al. 2013).

Adverse health effects:

Salmonella spp. are a serious hazard as they cause incapacitating but not usually life threatening illness of moderate duration. Sequelae can occur but are rare (ICMSF 2002). People of all ages are susceptible to salmonellosis. However, the elderly, infants and immunocompromised individuals are at a greater risk of infection and generally have more severe symptoms (FSANZ 2013).

Salmonellosis symptoms include abdominal cramps, nausea, diarrhoea, mild fever, vomiting, dehydration, headache and/or prostration. The onset of illness of salmonellosis is typically 24 – 48 hours after exposure to an infectious dose (range of 8 – 72 hours) and symptoms usually last for 2 – 7 days. Severe disease such as septicaemia sometimes develops, predominantly in immunocompromised individuals. A small number of individuals develop sequelae such as arthritis, appendicitis, meningitis or pneumonia as a consequence of infection. The fatality rate for salmonellosis is generally less than 1% (FDA 2012; FSANZ 2013).

The particular food matrix and strain of *Salmonella* spp. influence the level of *Salmonella* spp. required for illness to occur. It has been reported that as low as one or 100 cells caused illness, however, in other cases significantly more cells were required for illness to occur (ICMSF 1996; FDA 2012).

Consumption patterns:

In the 2011 – 2012 Nutrition and Physical Activity Survey (part of the 2011 – 2013 Australian Health Survey) <1% of children (aged 2 – 16 years), 2% of adults (aged 17 – 69 years) and <1% of people aged 70 and above reported consumption of sesame seeds and sesame seed products (Australian Bureau of Statistics 2011). The survey derived data from one day of dietary recall data.

Key risk factors:

Key risk factors associated with on-farm production of sesame seeds include the quality of the irrigation water, use of untreated manure as fertilizer and animal access to the crop. Plants may be dried unprotected in the open air and in some cases the product is left to dry directly on the ground. Risk factors associated with this include the cleanliness of the drying area and the presence of animals and birds that can shed or transmit *Salmonella* spp. (ICMSF 2000; FDA 2013).

Sesame seeds used in sesame seed products undergo a roasting step that should be sufficient to inactivate *Salmonella* spp. However, contamination of sesame seed products can occur after the heat treatment step due to poor hygiene during subsequent grinding of the sesame seeds, slicing, packaging and transport. The presence of both high lipid content and low water activity in sesame seed products enables *Salmonella* spp. to survive in these products for long periods (Lake et al. 2010).

Therefore, sesame seeds and sesame seed products that are not further processed after roasting (for example retorting or cooking) have the potential to be contaminated with *Salmonella* spp.

Risk mitigation:

Good agricultural practices on the farm and protection of the product from animals and birds during the drying process will help mitigate the risk of *Salmonella* contamination of sesame seeds. Good manufacturing practices and good hygienic practices in food manufacturing and food handling will minimise *Salmonella* contamination of sesame seed products.

Some foods, such as canned, retorted, cooked or baked products receive a further heat treatment step which will mitigate post-processing contamination. Cooking food to an internal temperature of 70°C for at least 2 minutes will inactivate *Salmonella* spp. (Bell and Kyriakides 2009).

Compliance history:

The imported food compliance data sourced from the Imported Food Inspection Scheme of the Australian Department of Agriculture and Water Resources for January 2007 – May 2016 showed that of the 2432 *Salmonella* spp. tests applied to sesame seed and sesame seed products there were 55 fails, a 2.3% failure rate. The failed samples included sesame seeds and halva and were from multiple countries.

There have been 193 notifications on the European Commission's Rapid Alert System for Food and Feed (RASFF) for *Salmonella* spp. in sesame seeds and sesame seed products from January 2007 – May 2016. The notifications were for halva, hummus, sesame seeds and tahini and were from multiple countries.

There were three food recalls in Australia of sesame seed products due to the presence of *Salmonella* spp. from January 2007 – May 2016. The recalls were for halva and tahini from Egypt, Iran and Israel. There were no recalls for domestic product.

Surveillance information:

Salmonellosis is one of the most commonly reported enteric illnesses worldwide, and the second most frequently reported cause of enteric illness in Australia. It is a notifiable disease in all Australian states and territories with a notification rate in 2015 of 72.8 cases per 100,000 population (17,089 cases). This is an increase from the previous five year mean of 56.4 cases per 100,000 population per year (ranging from 49.2 – 69.4 cases per 100,000 population per year) (FSANZ 2013; NNDSS 2016).

Illness associated with consumption of sesame seeds and sesame seed products contaminated with *Salmonella* spp.

A search of the scientific literature via Web of Science, PubMed, Scopus, CAB abstracts and other publications during the period 1990 – April 2016 identified there have been a number of salmonellosis outbreaks associated with consumption of sesame seeds and sesame seed products:

- Outbreak in the United States in 2013 – 16 cases of salmonellosis linked to consumption of tahini sesame paste imported from Turkey. Both *Salmonella* Montevideo (4 cases) and *Salmonella* Mbandaka (12 cases) were associated with this outbreak. Both outbreak strains were isolated from the product (CDC 2013).
- Outbreak in New Zealand in 2012 – 16 cases of salmonellosis linked to consumption of hummus made from tahini sesame paste imported from Turkey. *Salmonella* Montevideo (12 cases), *Salmonella* Mbandaka (3 cases) and *Salmonella* Maastricht (1 case) were associated with this outbreak. All three outbreak strains were detected in unopened containers of tahini. The tahini associated with this outbreak was imported from the same company in Turkey as that implicated in the United States outbreak described above (CDC 2013; Paine et al. 2014).
- Three outbreaks across Australia and New Zealand in 2002/2003 – with a total of 68 cases of *Salmonella* Montevideo infection linked to consumption of hummus and tahini imported from Egypt and Lebanon. The outbreak strain was isolated from the sesame seed products implicated in the outbreaks (Unicomb et al. 2005).
- International outbreak in 2001 – *Salmonella* Typhimiurium DT104 infection linked to consumption of halva imported from Turkey. There were 27 cases in Sweden and 23 cases in Australia. The outbreak strain was isolated from a number of halva products manufactured in Turkey (OzFoodNet 2001; Brockmann 2001; de Jong et al. 2001).

Prevalence of *Salmonella* spp. in sesame seeds and sesame seed products

A search of the scientific literature via Web of Science, PubMed, Scopus, CAB abstracts and other publications during the period 1990 – April 2016 identified that data on the prevalence of *Salmonella* spp. in sesame seeds and sesame seed products is limited:

- Survey in Germany in 2001 – *Salmonella* spp. were isolated from 11.1% of sesame seeds and sesame seed products (halvah and sesame paste) (n=99) collected at retail (Brockmann et al. 2004).
- Survey in the United States in 2006/2009 – *Salmonella* spp. were isolated from 11.3% of imported shipments of sesame seeds (n=177) (Van Doren et al. 2013a).
- Survey in the United States in 2010 – *Salmonella* spp. were isolated from 9.9% of imported shipments of sesame seed (n=233) (Van Doren et al. 2013b).
- Survey in the United Kingdom in 2007/2008 – *Salmonella* spp. were isolated from 1.7% of sesame seeds (n=771) collected at retail (Willis et al. 2009).

Other relevant standards or guidelines
• FSANZ compendium of microbiological criteria for food categorises food as satisfactory if no *Salmonella* is detected in 25g. Food is deemed potentially hazardous if any *Salmonella* is detected. • 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 hygienic practice for low-moisture foods *CAC/RCP 75-2015* covers good manufacturing practices and good hygienic practices for the manufacturing of low-moisture foods for human consumption (Codex 2016). • Codex regional standard for tehena *CODEX STAN 259-R-2007* covers the production and processing of tehena (product obtained by grinding mature, roasted and husked sesame seeds) (Codex 2007). • Codex regional standard for halwa tehenia *CODEX STAN 309R-2011* covers the production and processing of halwa tehenia (product made of tahina, natural sugars and other ingredients) (Codex 2011).

Approach by overseas countries
Many countries and regions, such as New Zealand and the European Union, have measures in place to minimise *Salmonella* contamination in sesame seeds and sesame seed products imported into their country.

Other considerations
Biosecurity restrictions apply to products under this commodity classification. Refer to the BICON database.

This risk statement was compiled by FSANZ in: November 2016

References

Australian Bureau of Statistics (2011) National Nutrition and Physical Activity survey, 2011-2012, Basic CURF, CD-ROM. Findings based on ABS Curf data.

Bell C, Kyriakides A (2009) *Salmonella*. Ch 18 In: Blackburn CW, McClure PJ (eds) Foodborne pathogens - Hazards, risk analysis and control. 2nd ed, Woodhead Publishing Limited and CRC Press LLC, Cambridge, p. 627–674

Brockmann S (2001) International outbreak of *Salmonella* Typhimurium DT104 due to contaminated sesame seed products - Update from Germany (Baden-Wurttemberg). Eurosurveillance 5(33):1699

Brockmann SO, Piechotowski I, Kimmig P (2004) *Salmonella* in sesame seed products. Journal of Food Protection 67(1):178–180

CDC (2013) Multistate outbreak of *Salmonella* Montevideo and *Salmonella* Mbandaka infections linked to tahini sesame paste (final update). Centers for Disease Control and Prevention, Atlanta. http://www.cdc.gov/salmonella/montevideo-tahini-05-13/. Accessed 4 August 2016

Codex (2003) General principles of food hygiene (CAC/RCP 1 - 1969). Codex Alimentarius, Rome. http://www.fao.org/fao-who-codexalimentarius/standards/list-of-standards/en/. Accessed 5 August 2016

Codex (2007) Regional standard for tehena (CODEX STAN 259-R-2007). Codex Alimentarius, Rome. http://www.fao.org/fao-who-codexalimentarius/standards/list-of-standards/en/. Accessed 5 August 2016

Codex (2011) Regional standard for halwa tehenia (CODEX STAN 309R-2011). Codex Alimentarius, Rome. http://www.fao.org/fao-who-codexalimentarius/standards/list-of-standards/en/. Accessed 5 August 2016

Codex (2016) Code of hygienic practice for low moisture foods (CAC/RCP 75-2015). Codex Alimentarius, Rome. http://www.fao.org/fao-who-codexalimentarius/standards/list-of-standards/en/. Accessed 5 August 2016

de Jong B, Andersson Y, Giesecke J, Hellstrom L, Stamer U, Wollin R (2001) *Salmonella* Typhimurium outbreak in Sweden from contaminated jars of helva (or halva). Eurosurveillance 5(29):1715

FDA (2012) Bad bug book: Foodborne pathogenic microorganisms and natural toxins handbook. 2nd ed, US Food and Drug Administration, Silver Spring. http://www.fda.gov/food/foodborneillnesscontaminants/causesofillnessbadbugbook/default.htm. Accessed 23 July 2015

FDA (2013) Draft risk profile: Pathogens and filth in spices. US Food and Drug Administration, Silver Spring. http://www.fda.gov/downloads/Food/FoodScienceResearch/RiskSafetyAssessment/UCM367337.pdf. Accessed 10 August 2016

FSANZ (2013) Agents of foodborne illness. 2nd ed, Food Standards Australia New Zealand, Canberra. http://www.foodstandards.gov.au/publications/Documents/FSANZ_FoodborneIllness_2013_WEB.pdf. Accessed 4 September 2013

ICMSF (1996) Salmonellae. Ch 14 In: Microorganisms in food 5: Microbiological specifications of food pathogens. Blackie Academic and Professional, London, p. 217–264

ICMSF (2000) Spices, dry soups and oriental flavourings. Ch 7 In: Microorganisms in food 6: Microbial ecology of food commodities. Aspen Publishers, Gaithersburg, p. 274–312

ICMSF (2002) Selection of cases and attributes plans. Ch 8 In: Microorganisms in food 7: Microbiological testing in food safety management. Kluwer Academic/Plenum publishers, London, p. 145–172

Lake R, King N, Cressey P, Gilbert S (2010) *Salmonella* (non Typhoidal) in high lipid foods made from sesame seeds, peanuts or cocoa bean. Institute of Environmental Science and Research Limited, Christchurch, New Zealand. http://www.foodsafety.govt.nz/elibrary/industry/salmonella-in-high-lipid-foods.pdf. Accessed 10 August 2016

Li H, Wang H, D'Aoust JY, Maurer J (2013) *Salmonella* species. Ch 10 In: Doyle MP, Beuchat LR (eds) Food microbiology: Fundamentals and frontiers. 4th ed, ASM Press, Washington D.C., p. 225–261

NNDSS (2016) Notifications of a selected disease by State and Territory and year. National Notifiable Disease Surveillance System, Department of Health and Ageing, Canberra. http://www9.health.gov.au/cda/source/rpt_4_sel.cfm. Accessed 19 May 2016

OzFoodNet (2001) OzFoodNet Quarterly report, April-June 2001. Communicable Diseases Intelligence 25(4):270–272

Paine S, Thornley C, Wilson M, Dufour M, Sexton K, Miller J, King G, Bell S, Bandaranayake D, Mackereth G (2014) An outbreak of multiple serotypes of *Salmonella* in New Zealand linked to consumption of contaminated tahini imported from Turkey. Foodborne Pathogens and Disease 11(11):887–892

Unicomb LE, Simmons G, Merritt T, Gregory J, Nicol C, Jelfs P, Kirk M, Tan A, Thomson R, Adamopoulos J, Little CL, Currie A, Dalton CB (2005) Sesame seed products contaminated with *Salmonella:* Three outbreks associated with tahini. Epidemiology and Infection 133:1065–1072

Van Doren JM, Kleinmeier D, Hammack TS, Westerman A (2013a) Prevalence, serotype diversity, and antimicrobial resistance of *Salmonella* in imported shipments of spice offered for entry to the United States, FY2007-FY2009. Food Microbiology 34:239–251

Van Doren JM, Blodgett RJ, Pouillot R, Westerman A, Kleinmeier D, Ziobro GC, Ma Y, Hammack TS, Gill V, Muckenfuss MF, Fabbri L (2013b) Prevalence, level and distribution of *Salmonella* in shipments of imported capsicum and sesame seed spice offered for entry to the United States: Observations and modeling results. Food Microbiology 36:149–160

Willis C, Little CL, Sagoo S, de Pinna E, Threlfall J (2009) Assessment of the microbiological safety of edible dried seeds from retail premises in the United Kingdom with a focus on *Salmonella* spp. Food Microbiology 26(847):852