Imported food risk statement

Cooked poultry meat and *Listeria monocytogenes*

Scope: Cooked poultry meat (chilled or frozen)—including meat from chickens, ducks, turkeys, geese, pigeons, quail, pheasants and guinea fowls. The scope includes cooked poultry meat that has undergone minimal processing steps—such as slicing or dicing—prior to packaging and is ready to eat. Ambient-stable sealed packages are not covered by this risk statement.

Recommendation and rationale
Does *Listeria monocytogenes* in imported cooked poultry meat present a potential medium or high risk to public health: ☑ *Yes* ☐ *No* **Rationale**: • *L. monocytogenes* is a moderately infectious pathogen that can cause severe disease in susceptible populations, with a case fatality rate of 15–30%. • There is very strong evidence that *L. monocytogenes* can be present in cooked poultry meat, and that outbreaks of foodborne illness have been associated with consumption of cooked poultry meat. • The cooking step should eliminate the hazard. However, there is potential for post processing contamination, as *L. monocytogenes* is ubiquitous in the environment and can become established in food processing environments. • Cooked poultry meat is a ready-to-eat (RTE) product which is often eaten with no further cooking or other pathogen elimination step before consumption, and growth of *L. monocytogenes* can occur on cooked poultry meat at refrigeration temperatures.

General description
Nature of the microorganism: *Listeria monocytogenes* is a Gram-positive, non-spore forming rod-shaped bacterium that is found throughout the environment. *L. monocytogenes* has been isolated from domestic and wild animals, birds, soil, vegetation, fodder and water; and from the floors, drains and wet areas of food processing factories (FSANZ 2013). *L. monocytogenes* is a hardy organism. The temperature range for growth is between –1.5 and 45°C, with the optimal temperature being 30–37°C (FSANZ 2013). Temperatures above 50°C are lethal to the bacterium, but it can survive for long periods at temperatures below freezing. *L. monocytogenes* is relatively tolerant to acidic conditions, and will grow in a broad pH range of 4.0–9.6. It can grow at a water activity (a_w) as low as 0.90 and survive for extended periods of time at an a_w of 0.81. *L. monocytogenes* is reasonably salt-tolerant, having been reported to grow in 13–14% sodium chloride (Farber et al. 1992; Lado and Yousef 2007). It grows well under both aerobic and anaerobic conditions (Sutherland et al. 2003).
Adverse health effects: For susceptible populations, *L. monocytogenes* can cause severe disease that is potentially life threatening. People at risk of invasive listeriosis include pregnant women and their foetuses, newborn babies, the elderly and immunocompromised individuals (such as cancer, transplant and HIV/AIDS patients). Patients with diabetes, asthma, cirrhosis and ulcerative colitis are also at a greater risk (FSANZ 2013). In pregnant women, invasive listeriosis can cause spontaneous abortion, stillbirth or neonatal infection. Influenza-like symptoms, fever, and gastrointestinal symptoms can also occur in the mother. In immunocompromised individuals and the elderly, invasive listeriosis can cause potentially fatal bacterial meningitis, with symptoms of fever, malaise, ataxia and altered mental status. The onset of illness of invasive listeriosis generally ranges from 3 days to 3 months after infection. Invasive listeriosis has a fatality rate of 15–30% (FDA 2012; FSANZ 2013).

Exposure to *L. monocytogenes* usually has minimal impact on the general healthy population. If infection does occur, it can be asymptomatic or present as a mild febrile gastrointestinal illness that can be mistaken for a viral infection or flu (FSANZ 2013).

It is generally thought that the minimum infective dose for *L. monocytogenes* is >100 cells (ICMSF 1996).

Consumption patterns:

Twelve percent of children (aged 2-16 years), 14% of adults (aged 17-69 years) and 14% of people aged 70 and above reported consumption of cooked poultry meat (including chicken, turkey, duck and quail) in the 2011-12 Australian National Nutrition and Physical Activity Survey. This excludes mixed foods such as curries and pies. The reported percentages are based on a single day of consumption information from the nutrition survey, and do not indicate the frequency of consumption of cooked poultry meat.

Risk factors and risk mitigation:

L. monocytogenes has previously been identified as a hazard of concern for RTE cooked poultry meat—particularly for susceptible populations (Barnes et al. 1989; FSANZ 2005).

Cooked poultry meat has generally received a listericidal (heat) treatment. However, re-contamination can occur after this processing step, as *L. monocytogenes* is ubiquitous in the environment and can become established in food processing environments. Contamination can occur through poor hygienic practices of food handlers; or by exposure of product to contaminated air, water, raw materials or food-contact surfaces (Codex 2007).

The inherent characteristics of cooked poultry meat allows the growth of the organism—particularly in the absence of competition with the microbial flora usually associated with raw poultry—even when stored at <4°C (FSANZ 2013).

Re-contamination of cooked poultry meat with *L. monocytogenes* can be minimised by heat processing in package and by the application of HACCP and good hygienic practices in manufacturing and throughout the supply chain. Control measures that prevent the growth of high levels of *L. monocytogenes* in food are particularly effective at reducing rates of listeriosis, as nearly all cases of listeriosis result from the consumption of high numbers of the pathogen (FSANZ 2013).

Food preservatives can reduce the growth and survival of Listeria on food products. The effect of preservatives on the growth of *L. monocytogenes* is influenced by temperature, pH, salt content and water activity (Lado and Yousef 2007). For example, sodium diacetate, sodium propionate and sodium benzoate are more effective at preventing growth of *L. monocytogenes* at lower temperatures. Sorbates and parabens are more effective at preventing growth at lower temperatures and low pH. The addition of sodium chloride or lowering the temperature enhances the ability of lactate to prevent *L. monocytogenes* growth.

Several countries, including Australia, permit the use of a specific bacteriophage as a processing aid to eradicate or decrease the levels of *Listeria monocytogenes* on various RTE food products for human consumption.

Advice to vulnerable populations to avoid consumption of RTE foods that supports the growth of *L. monocytogenes* is available on Department of Health websites and the FSANZ website.

Surveillance information:

L. monocytogenes is a notifiable disease in all Australian states and territories, with a reported incidence rate in 2018 of 0.3 cases per 100,000 population (73 cases). This includes both foodborne and non-foodborne cases. The previous five year mean was 0.32 cases per 100,000 population per year, with a range of 0.3 – 0.4 cases per 100,000 population per year (Department of Health 2019).

Illness associated with consumption of RTE cooked poultry meat contaminated with *Listeria monocytogenes*

A search of the scientific literature from 2000 to February 2019 via EBSCO; the US CDC National Outbreak Reporting System; and other publications identified a number of listeriosis outbreaks associated with consumption of cooked poultry meat. Examples are listed below:

- USA 2000 - Thirty cases of listeriosis (including 4 deaths and 3 miscarriages/stillbirths) across ten states were linked to consumption of deli turkey meat contaminated with *L. monocytogenes* serotype 1/2a—all isolates having identical molecular subtypes by pulsed-field gel electrophoresis (PFGE) and ribotyping (Hurd et al. 2000; Olsen et al. 2005). Product was traced back to the same processing plant involved in a previous outbreak (Barnes et al. 1989; Wenger et al. 1990), and the isolate had an identical PFGE pattern as the strain in that outbreak.
- USA 2008 - A fatal case of listeriosis was linked to consumption of chicken salad. *L. monocytogenes* was isolated from unopened product and other chicken products from the same production establishment (Marcus et al. 2009).
- Australia 2009 - Forty cases of listeriosis (including eight perinatal cases and three fatalities) were attributed to consumption of cooked chicken in pre-packaged chicken wraps. The outbreak strain of *Listeria* was isolated from the cooked chicken meat supplier, and deficiencies were identified in the food safety program for the production of the RTE chicken meat (OzFoodNet Working Group 2009).

- Czech Republic 2012–2016 - Twenty six cases of listeriosis (including 2 neonatal, and 3 deaths) across a 5-year period were linked to consumption of RTE turkey meat products from a single producer. PFGE and whole genome sequencing confirmed the close relatedness of the serotype 1/2a strains from cases, food samples and environmental swabs from the processing plant (Gelbíčová et al. 2018).

Data on the prevalence of *Listeria monocytogenes* in RTE cooked poultry meat

A search of the scientific literature from 2000 to February 2019 via EBSCO and through other publications and data sources identified a large number of surveys and regulatory compliance test results for *L. monocytogenes* in cooked poultry meat in retail environments. Examples of survey findings include:

- Czech Republic (2017) - *L. monocytogenes* was not isolated in 85 regulatory surveillance samples of RTE cooked chicken products (EFSA and ECDC 2018).
- USA (2012–2014) - *L. monocytogenes* was isolated in 1.6% of samples (n=896) across 9 RTE cooked poultry meat product types purchased from major retail grocery chains and smaller/regional grocery stores across an 18 month period (Ahmed et al. 2015).
- Germany (2009–2010) - *L. monocytogenes* (serotype 1/2a) was isolated in 1.8% (n=57) of samples of RTE sliced turkey breast from retail stores analysed at the end of their shelf life (Meyer et al. 2012).
- Turkey (2001–2002) - *L. monocytogenes* was isolated in 3.6% (n=28) of samples of cooked chicken meat from supermarkets, butchers and restaurants (Yucel et al. 2005).

Seventeen surveys identified from Europe and the USA showed a prevalence of *L. monocytogenes* ranging from 0–20% of samples. An overall estimated prevalence of 1.1% (95% CI 0.5–2.3%) was determined using a random effects meta-analysis.

Standards or guidelines

In Australia:

- Division 3 of Standard 4.2.3 of the *Australia New Zealand Food Standards Code* (the Code) requires producers of RTE meat to implement a food safety management system which identifies, evaluates and controls food safety hazards
- Standard 1.6.1 of the Code contains limits for *L. monocytogenes* based on whether or not growth can occur:
  - For RTE food in which growth of *L. monocytogenes* will not occur n=5, m=10^2 cfu/g
  - For RTE food in which growth of *L. monocytogenes* can occur n = 5, m=not detected in 25g
- Standard 1.3.3 of the Code permits the use of *Listeria* phage P100 as a processing aid for listericidal treatment of a number of foods, including RTE cooked poultry meat products.

The limits for *L. monocytogenes* in the Code mirror the microbiological criteria set out in the Codex guidelines on the application of general principles of food hygiene to the control of *L. monocytogenes* in foods (Codex 2007).

The Codex general principles of food hygiene (CAC/RCP 1-1969) describe the key hygiene controls at each stage of the food supply chain, from primary production through to final consumption (Codex 2003).

The Codex code of hygienic practice for meat (CAC/RCP 58-2005) sets out additional hygiene provisions for raw meat, meat preparations and manufactured meat from the time of live animal production up to the point of retail sale (Codex 2005).

Management approaches used by overseas countries

- European Union: 100 cfu/g for products during their shelf life, whether or not they support growth; and, for foods that support growth, absence in 5x25g samples at the point they leave control of the food producer (European Commission 2019).
- United States: zero tolerance in ready to eat foods (FDA 2015; FSIS 1989).
- Canada: End-product compliance criteria (Health Canada 2011):
  - For RTE foods in which the growth of *L. monocytogenes* can occur; or which have a shelf-life longer than 5 days; or which have not been validated as either Category 2A or 2B: absence in 5x25g samples
  - Category 2A: RTE foods in which the growth of *L. monocytogenes* can occur but is limited to levels no greater than 100 CFU/g over the course of the stated shelf-life; or RTE foods which have a refrigerated shelf-life of 5 days or less: If shelf life >5 days, processors should validate and verify their processes to ensure that the levels of *L. monocytogenes* are consistently less than or equal to 100 CFU/g throughout the stated shelf-life. If shelf life is ≤5 days, no validation is required.
  - Category 2A: RTE foods in which the growth of *L. monocytogenes* cannot occur over the course of the stated shelf-life. Such foods are frozen; or meet specified pH and/or water activity parameters. Processors need to

monitor their products to ensure that they continue to meet the criteria (e.g., physicochemical parameters such as pH and a_w) that justify their classification.

- New Zealand: Standard 1.6.1 and Standard 1.3.3 of the Australia New Zealand Food Standards Code apply (see above).
- Thailand: Safety Requirements for Agricultural Commodity and Food (voluntary standard issued by the National Bureau of Agricultural Commodity and Food Standards) recommends absence of *L. monocytogenes* in 5x25g samples for heat-treated poultry meat (ACFS 2006).

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