Imported food risk statement

Fresh raw beef and beef products and *Campylobacter jejuni/coli*

Scope: Fresh raw (chilled and/or frozen) beef and beef products, including carcasses, whole muscle meat, bone-in and non-intact cuts (e.g. mince and trim) and offal from BSE and biosecurity approved countries. Excludes all products not permitted under BSE and biosecurity restrictions such as brain and spinal tissue, blood and blood products, reproductive organs and natural casings.

Recommendation and rationale

Does *Campylobacter jejuni/coli* in imported fresh raw beef and beef products present a potential medium or high risk to public health that may require additional management measures:

☐ *Yes*

☑ *No*

Rationale:

- *Campylobacter* spp. are a moderately infectious organism that cause incapacitating but not life threatening illness. Sequelae can occur but are infrequent.
- There is little evidence that *Campylobacter* spp. has caused foodborne illness associated with beef and beef products or is present in these products.
- The method of producing fresh raw (chilled and/or frozen) beef introduces contamination into the food and does not contain a pathogen elimination step. Some beef products (i.e. trim and offal) may contain higher levels of contamination as further processing steps (i.e. mincing) can introduce contamination into the product.
- HACCP based quality assurance systems are required throughout the entire supply chain to minimise the potential for contamination and subsequent growth of any contaminating pathogens.

General description

Nature of the microorganism:

Campylobacter spp. are Gram-negative, non-spore forming, microaerophilic rod-shaped bacteria with a curved- to S-shaped morphology. More than 80% of human *Campylobacter* infections are caused by *C. jejuni* and more than 18% are caused by *C. coli*. Infections with *C. jejuni* and *C. coli* cause similar disease symptoms. *C. fetus* has also been associated with foodborne disease in humans (FDA 2012; FSANZ 2013). *Campylobacter* spp. are widespread in nature and are commonly present in the intestinal tract of many wild and domestic species (FSANZ 2013). Poultry are a major reservoir for human campylobacteriosis and attribution studies consistently identify poultry as a major source of foodborne human illness (Mullner et al. 2009; Strachan et al. 2012; Mughini Gras et al. 2012). Ruminants, including cattle, can be a source of human campylobacteriosis and environmental and occupational exposure pathways are important risk factors for ruminant attributed human illness (Mughini Gras et al. 2012; Mullner et al. 2009).

Campylobacter spp. are thermotolerant and growth can occur at temperatures ranging from 30 to 45°C and pH of 4.9 – 9.5. *Campylobacter* spp. are not normally capable of multiplying in food during processing or storage, and grow best in an atmosphere containing 5 – 10% carbon dioxide and 3 – 5% oxygen. *C. jejuni* grows best in the presence of 0.5% sodium chloride, and does not grow in the absence of, or ≥2%, sodium chloride. *Campylobacter* spp. are sensitive to air, drying and are readily inactivated by cooking. Freezing causes an approximately 1 $\log_{10}$ reduction in numbers of *Campylobacter* spp. over the first 24 hour period followed by limited reduction during subsequent frozen storage (FSANZ 2013; Habib et al. 2013). *Campylobacter* spp., like all microorganisms, can develop resistance traits in response to various stresses including heat, acid and use of antimicrobial substances.

General description

Adverse health effects:

Some strains of *C. jejuni* can cause chronic sequelae in susceptible persons, however the majority of *C. jejuni* and *C. coli* cause diarrhoea of moderate duration (FSANZ 2013). Infection with antimicrobial resistant strains may result in more severe illness which may be more difficult to treat.

Symptoms include diarrhoea (sometimes bloody), nausea, abdominal pain, fever, muscle pain, headache, and vomiting. The onset of illness is usually two to five days after infection and illness will generally last for two to 10 days. The unique feature of the disease is the severity of abdominal pain which may become continuous and sufficiently intense to mimic acute appendicitis (FDA 2012; FSANZ 2013). As a consequence of infection with certain strains of *C. jejuni*, a small number of individuals may develop a secondary condition such as reactive arthritis or Guillain-Barré syndrome, in which a harmful immune response of the body attacks part of the peripheral nervous system leading to symptoms of muscle weakness or paralysis (Havelaar et al. 2009).

It is generally accepted that about 10,000 ingested *Campylobacter* cells are required to cause infection, but human trials have shown levels below 1,000 cells and as few as 100 ingested cells have been associated with human illness (FDA 2012; FSANZ 2013). Due to the sensitivity of *Campylobacter* spp. to stomach acid, the type of food consumed influences the infective dose (FSANZ 2013).

Consumption patterns:

The 2011 – 2012 Nutrition and Physical Activity Survey (part of the 2011 – 2013 Australian Health Survey) provides detailed, national data on consumption of foods in Australia.

Consumption of beef (excluding mixed foods that contain beef and beef products)

In the survey, 15% of children (aged 2 – 16 years), 18% of adults (aged 17 – 69 years) and 21% of people aged 70 and above reported consumption of beef on the day of the survey. Beef consumption can be divided into minced meat, whole muscle cuts and offal. Nine percent of children (aged 2 – 16 years), 7% of adults (aged 17 – 69 years) and 9% of people aged 70 and above reported consumption of minced meat. Seven percent of children (aged 2 – 16 years), 12% of adults (aged 17 – 69 years) and 11% of people aged 70 and above reported consumption of whole muscle cuts. Less than one percent of adults (aged 17 – 69 years) and <1% of people aged 70 and above reported consumption of offal. No children (aged 2 – 16 years) reported consuming offal (Australian Bureau of Statistics 2011). No data was available for consumption of raw or minimally cooked beef and beef products.

Consumption of mixed foods containing beef

In the survey 51% of children (aged 2 – 16 years), 48% of adults (aged 17 – 69 years) and 43% of people aged 70 and above reported consumption of mixed dishes containing beef on the day of the survey. These beef dishes can be divided into dishes containing whole muscle meat, minced meat or offal. Forty percent of children (aged 2 – 16 years), 32% of adults (aged 17 – 69 years) and 26% of people aged 70 and above reported consumption of minced meat dishes. Fifteen percent of children (aged 2 – 16 years), 22% of adults (aged 17 – 69 years) and 20% of people aged 70 and above reported consumption of whole muscle meat dishes. Less than one percent of children (aged 2 – 16 years), <1% of adults (aged 17 – 69 years) and <1% of people aged 70 and above reported consumption of mixed dishes containing offal (Australian Bureau of Statistics 2011).

Risk factors and risk mitigation

Production of fresh raw beef and beef products does not include a pathogen elimination step. Controls are needed throughout the entire supply chain to minimise the potential for contamination and subsequent growth of any contaminating pathogens. Quality assurance (QA) programs and/or application of a Hazard Analysis and Critical Control Point (HACCP) system should be applied in the design and implementation of hygiene measures throughout the entire food chain including animal production, transport, lairage, slaughter and dressing operations (Codex 2013). Microbiological testing, for example validated process hygiene criteria or appropriate environmental testing, may be helpful in verifying the effectiveness of HACCP-based QA programs.

Ruminants can be a reservoir for *Campylobacter* spp. which may reside in the animal without causing any visible adverse effects. The presence in a herd or animal can only be detected by microbiological testing. During animal production, the key inputs and activities contributing to the presence and level of *Campylobacter* spp. include the health of the animal, stress, inputs such as feed, water and veterinary medicines, and management of environmental and biosecurity factors, including transport, saleyards and lairage. During processing, contamination may occur from external sources (i.e. the animal or the environment), or internal sources during slaughter and dressing operations (FSANZ 2009a). Good agricultural practices, good hygienic practices and good manufacturing practices should be employed throughout the production chain.

General description
Pathogen load in the animal can increase due to illness or stress. Stress occurs when animals are deprived of feed and water and during transport, holding and handling procedures. These stressors can lead to increased pathogen shedding, contamination of the transport vehicle and the lairage, and subsequent transfer of the contamination to other animals (FSANZ 2009a; Adam and Brulisauer 2010; ICMSF 2005). Conditions for transport and holding animals prior to slaughter should minimise the potential for cross-contamination with foodborne pathogens. QA programs should be implemented to achieve the appropriate conditions for transport and lairage (Codex 2013). The competent authority determines the procedures used during anti-mortem and post-mortem inspections to ensure only healthy, sufficiently clean and appropriately identified animals are slaughtered and meat produced for human consumption is wholesome and safe (Codex 2013). During slaughter or fabrication (e.g. quartering, boning and packing) contamination of the external surface of the carcass can occur (Adam and Brulisauer 2010; FSANZ 2009a). Stunning and bleeding can lead to contamination of the slaughtering and processing environment and should be performed in such a manner as to minimise contamination. During slaughter and dressing, hocks, head, hide and viscera are removed and bunging is performed to minimise faecal leakage onto the carcass and processing environment. The objective is to undertake these processes with as little contamination as possible of the exposed carcass tissue and of edible offal. Decontamination processes, such as trimming and washing (i.e. steam, hot water or organic acid sprays) are also used to reduce contamination on carcasses. Further processing of whole muscle meat or trimmings into ground or minced product will transfer any contaminating pathogens from the surface of the meat onto other surfaces or internally into the meat product. Good hygienic practices and good manufacturing practices should be employed. Beef processing equipment, including saws and knives, used throughout the slaughtering and processing environment can also play a role in the contamination of edible meat products (Duffy et al. 2014). Effective and frequent cleaning and decontamination of equipment is essential. Rapid chilling of adequately spaced carcasses will minimise growth of any contaminating pathogens on the surface of carcasses. Surface dehydration during chilling is an additional control measure (FSANZ 2009b). Maintenance of appropriate temperature control throughout the subsequent post-slaughter supply chain minimises further growth of any contaminating pathogens. The competent authority should have the legal power to set and enforce regulatory meat hygiene requirements, and have final responsibility for verifying that regulatory meat hygiene requirements are met. The role and the level of training, knowledge and skills of the veterinary inspector and other personnel involved in meat hygiene activities should be defined by the competent authority. The competent authority should also verify that the establishment operator has adequate systems in place to trace and withdraw meat from the food chain (Codex 2013).
Surveillance information: Infection with *Campylobacter* spp. is a notifiable disease in all Australian states and territories. In New South Wales, *Campylobacter* spp. became notifiable in 2017. The reported incidence rate in 2016 (excluding New South Wales) was 146.7 cases per 100,000 population (24,164 cases), which includes both foodborne and non-foodborne cases. This is a significant increase from the previous five year mean of 115.2 cases per 100,000 population per year (ranging from 93.4 – 139 cases per 100,000 population per year) (NNDSS 2017). **Illness associated with consumption of beef and beef products contaminated with *Campylobacter* spp.** A search of the scientific literature via EBSCO, US CDC Foodborne Outbreak Online Database and other publications from 2000 to June 2017 identified there have been few outbreaks or cases of campylobacteriosis associated with consumption of beef and beef products from 2000 onwards. Examples are listed below: *Ground beef* • USA – three outbreaks of *C. jejuni* associated with ground beef that was raw and/or in hamburgers resulting in 43 cases and five hospitalisations (CDC 2016). *Offal* • USA – one outbreak of *C. jejuni* associated with beef liver resulting in two cases and no hospitalisations (CDC 2016). **Data on the prevalence of *Campylobacter* spp. in beef and beef products** A search of the scientific literature via EBSCO and other publications from 2000 to June 2017 identified that surveys of beef and beef products have isolated *Campylobacter* spp. in 0% to 31.7% of samples. Results of surveys are reported by the sample type (carcass, whole muscle meat, minced meat and trim, and offal) collected from abattoirs or meat processors. Retail surveys were excluded.

General description

Carcass – prevalence of Campylobacter spp. ranged from 0 to 14.9% of samples, with an overall prevalence of 1.5% (95% CI 0.2% – 8.4%) determined using a random effects meta-analysis of four surveys (surveys included product from Australia, Poland and/or Republic of Ireland). Examples are listed below:

- Australia (2004) – *Campylobacter* spp. were not detected on beef carcasses (n=1155) collected from the abattoir (Phillips et al. 2006)
- Poland (2009 – 2011) – *Campylobacter* spp. were detected on 14.9% of beef carcasses (n=114) collected from the abattoir (Wieczorek and Osek 2013).

Whole muscle meat –Campylobacter spp. were not detected in two Australian surveys of whole muscle meat (Phillips et al. 2006; Phillips et al. 2012), with an overall prevalence of 0% (95% CI 0.0% – 0.3%) determined using a random effects meta-analysis.

Minced meat and trim – prevalence of Campylobacter spp. ranged from 0 to 1.3% of samples, with an overall prevalence of 0.8% (95% CI 0.4% - 1.6%) determined using a random effects meta-analysis of two surveys (surveys included product from Australia, Belgium, New Zealand, Uruguay and/or USA). The surveys are listed below:

- USA (2005) – *Campylobacter* spp. were not detected (n=151), detected on 0.5% (n=216) and 1.3% (n=393) of boneless beef trim imported from Australia, New Zealand and Uruguay, respectively, and sampled at the US border. *Campylobacter* spp. were detected on 0.4% of domestic boneless beef trim (n=250) sampled at production facilities (Bosilevac et al. 2007)
- Belgium (2000 – 2001) – *Campylobacter* spp. were not detected on beef minced meat samples (n=303) collected from production plants (Ghafir et al. 2007).

Offal – prevalence of Campylobacter spp. was 5.6% in beef livers (n=182) collected from abattoirs in Japan in 2002 (Enokimoto et al. 2007).

Standards or guidelines

- Division 2 of Standard 4.2.3 in the Australia New Zealand Food Standards Code requires primary producers of meat to control inputs, waste disposal and traceability.
- Australian Standard for the hygienic production and transportation of meat and meat products for human consumption *AS 4696-2002* sets out the outcomes required for the receival and slaughter of animals, the dressing of carcasses, the processing, packaging, handling and storage of meat or meat products; with process controls requiring a HACCP based system. The Standard also contains rules for the construction of premises and transportation of meat and meat products (Standards Australia 2002).
- Codex Code of Hygienic Practice for Meat *CAC/RCP 58-2005* covers 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 2013).
- End product testing for indicator organisms (e.g. generic *E. coli*) can be used to verify process control for fresh chilled and frozen meat. However, these are poor indicators of the prevalence or concentration of enteric pathogens in fresh meat (Codex 2013; ICMSF 2011).

Management approaches used by overseas countries

- Under the European Commission (EC) regulation 178/2002 food imported into the EU must comply with the relevant EU food law or where specific agreement exists between EU and the exporting country. Regulation 852/2004 covers hygiene of food at all stages of the production process from primary production to the final consumer, with Annex I covering activities connected with primary production. Regulation 853/2004 lays down specific hygiene rules for food of animal origin for food business operators, with Section I of Annex III covering primary processing of domestic ungulates (including bovine species).
- EC regulation 1441/2007 amending the microbiological criteria for foodstuffs (European Commission 2007) does not specify a limit for *Campylobacter* spp. in meat or meat products.
- Under the Canadian *Meat Inspection Regulations 1990* (Canadian Ministry of Justice 2014) a meat product can only be imported if the meat product was manufactured in an establishment that was operating under a HACCP principles based system determined to be equivalent to the Canadian Food Safety Enhancement Program.
- In the US, imported meat is subject to the requirements of the Federal Meat Inspection Act (USDA 2016) which sets out that carcasses and meat can only be imported if they are subject to the inspection, sanitary, quality, species verification, residue standards, and humane methods of slaughter applied to products produced in the United States.

Management approaches used by overseas countries
The US Department of Agriculture Food Safety and Inspection Service (FSIS) are responsible for imported food and carry out audits of foreign inspection systems and re-inspect meat at the port-of-entry to ensure that foreign countries have maintained equivalent inspection systems (FSIS 2014). • In New Zealand imported bovine meat is not a food of high (or increased) regulatory interest for the hazard *Campylobacter* spp. (NZ MPI 2016).

This risk statement was compiled in: September 2017

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