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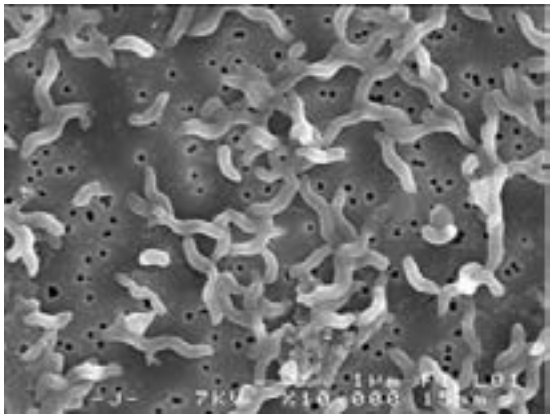
Campylobacter spp. and dairy products

What is *Campylobacter*?

Campylobacter is a genus of Gram-negative, non-spore-forming, spiral-shaped, microaerophilic bacteria. They are widely distributed in warm-blooded animals including cattle, pigs, sheep and poultry. The main route of transmission to humans is food associated, including cross-contamination of other foods during handling, e.g. raw meat (especially poultry), undercooked foods, as well as via raw or contaminated milk. Although there are more than 45 species of *Campylobacter*, approximately 90% of human *Campylobacter* illness is caused by *Campylobacter jejuni*.



Source: *Campylobacter jejuni*, a foodborne pathogen (https://www6.angers-nantes.inrae.fr/secalim_eng/Expertise-Projects/Campylobacter-jejuni)

Campylobacteriosis: the disease

Campylobacter is the leading cause of foodborne bacterial enteric illness in many countries (Liu et al. 2022). Each year there are approximately 250,000 confirmed cases in the European Union (EU) with the vast majority of cases going unreported. The associated cost, in medical expenses and absence from work, is estimated to be €2.4 billion annually (EFSA, 2019). Although the symptoms and severity of illness vary depending on the host's health status and the virulence of the infecting strain, they usually include abdominal cramps, watery or haemorrhagic diarrhoea, fever, myalgia, and in some cases, nausea and vomiting (Kaakoush et al., 2015). These symptoms occur 2 to 5 days after infection, and typically last for at least 3 to 7 days and are usually self-limiting with most cases not requiring medical intervention. However, serious complications, including Guillain Barré Syndrome, Miller Fisher Syndrome, reactive arthritis, and bacteraemia may occur (Kaakoush et al., 2015).

Dairy associated risks

Campylobacter are carried in the gastrointestinal tract of bovine animals and are shed in the faeces, which contaminates the exterior of the animals and the farm environment. If the cow's udder is contaminated, there may be *Campylobacter* present in the raw milk. Transmission to humans occurs when handling animals, in contact with the contaminated farm environment, or from the consumption of unpasteurised milk or unpasteurised milk products.

The organism is sensitive to heat and readily inactivated by pasteurisation treatment or domestic cooking. Heating at temperatures greater than 55°C for several minutes (D time of 0.74-1.0 min at 55°C in milk) readily destroys Campylobacter species (ICMSF, 1996). In unpasteurised cheeses, the production of certain metabolites by the microflora naturally present in the raw milk during fermentation may have an inhibitory effect on *Campylobacter*. The relatively low pH of these products, due to the presence of organic acids such as lactic, acetic, butyric, or sorbic acid may reduce the growth and survival capacity of pathogenic bacteria such as Campylobacter during shelf-life (Possas et al., 2021). Thermization, which is a sub-pasteurisation heat treatment of milk, generally from 57°C to 68°C with a holding time between 5 s and 30 min, may also be used to reduce the pathogen risk in these products (Silva et al., 2023).

Regulations

Although the microbiological criterion set by the amended European Regulation 2073/2005 set limits for pathogenic bacteria such as *Salmonella*, there are no specific criteria for *Campylobacter* in pasteurised dairy products such as cheeses, butter, cream, milk or whey powders, as the pathogen will be inactivated by the heat treatment. In the case of raw milk cheeses, while there is no legal microbiological criterion for *Campylobacter* in these products in many jurisdictions, guideline microbiological criteria for RTE food placed on the market do exist (FSAI, 2020).

Dairy-associated outbreaks of campylobacteriosis

There have been several confirmed outbreaks of campylobacteriosis associated with the consumption of raw milk and raw milk products (Jaakkonen et al., 2020). From 2011 to 2020, raw milk was one of the food vehicles linked most strongly to foodborne *Campylobacter* outbreaks in the EU (EFSA, 2021). In 2021, 0.47% of the 212 raw milk samples tested and reported to the European Food Safety Authority (EFSA) were *Campylobacter* positive (EFSA, 2022). In 2016, there was an outbreak (69 cases) in North West England also associated with the consumption of unpasteurised cows' milk (Kenyon et al., 2020). Among the larger non-EU outbreaks was an outbreak in northern Utah (USA) in 2014, with 99 cases (59 confirmed and 40 probable) of campylobacteriosis associated with the consumption of raw milk, where ten patients were hospitalized and one died (Davis et al., 2014). A recent outbreak in France linked to the consumption of unpasteurized cow milk cheese, was caused by *Campylobacter fetus*, a rare *Campylobacter* more associated with systemic illness and bacteremia (Grouteau et al., 2023). By contrast, campylobacteriosis linked to pasteurised dairy products occurs infrequently and is commonly traced to inadequate pasteurisation (Fernandes et al. 2015).

Controlling *Campylobacter* in dairy products

A recent meta-analysis has estimated the global pooled prevalence of *Campylobacter* in raw milk to be 4%, ranging from 1 – 9% for different regions (Europe, Asia, Africa, America and Oceania) (Taghizadeh et al. 2022). The most recent EFSA Zoonoses report showed that 13.7 % of the 7,529 cattle tested were *Campylobacter* positive (EFSA, 2022). Reducing the risk of *Campylobacter* in dairy products is reliant on adopting good hygiene practices at milking, while food safety is reliant on effective pasteurisation of milk at the processing stage.

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