

# CAMPYLOBACTER INFORMATION AND GUIDANCE

2019



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## 1. Key campylobacter Information

<b>Common sources</b>	Undercooked poultry, unpasteurised dairy products, contaminated drinking water, fresh produce
<b>Transmission mode</b>	Ingestion of contaminated foods, water or direct contact with animals
<b>Occurrence</b>	All people can become ill from campylobacter, however infection rates are highest in children under one and adults over 50 years
<b>Reservoir</b>	Animals including poultry, cattle, sheep, pigs, birds, pets and rodents
<b>Incidence of disease in Scotland</b>	There are approximately 6,000 reported cases of campylobacteriosis per year.
<b>Symptoms</b>	Watery or bloody diarrhoea, abdominal pain, fever, nausea, sometimes with vomiting to more severe symptoms like irritable bowel syndrome and Guillain-Barré syndrome
<b>Illness onset</b>	2-7 days
<b>Duration of illness</b>	Average of 7 days
<b>Infectious period</b>	Not applicable – campylobacter rarely spreads from person to person
<b>Regulatory Limits</b>	1000 cfu/g
<b>Prevention tips</b>	<ul style="list-style-type: none"> <li>• Do not wash poultry before cooking</li> <li>• Cooking kills any harmful bacteria</li> <li>• Ensure food is thoroughly cooked (until the internal temperature is 75°C). Use a thermometer.</li> <li>• Use separate chopping boards and utensils, or wash between uses, for preparing raw and ready-to-eat foods.</li> </ul>

## 2. *Campylobacter* spp.

*Campylobacter* is the most commonly reported bacterial cause of gastrointestinal disease in developed countries. It causes a substantial disease burden to many people in the UK though the exact number of cases can only be estimated due to underreporting. Infection occurs by the transmission pathway of the bacteria from animal faeces contaminating food, water and the environment which if ingested by humans causes infection. *Campylobacter* are 0.2 to 0.8 µm wide and 0.5 to 5 µm long gram negative bacilli that do not form spores<sup>1</sup>. They are motile organisms that have a single polar flagellum at one or both ends of the cell and move in a corkscrew-like motion.

There are many species of *Campylobacter* however the two species that cause most human cases are *Campylobacter jejuni* and *Campylobacter coli* causing approximately 90% and 10% respectively<sup>2</sup>.

## 3. Growth and survival characteristics

*Campylobacter* are thermophilic (able to grow at high temperatures) and microaerophilic (like low oxygen levels). They acquire energy by oxidation of amino acids or tricarboxylic acids and do not grow well in competition with other organisms. *Campylobacter* are susceptible to drying, heating, freezing, disinfectants and acidic conditions.

Growth range for *Campylobacter* spp.

Parameter	optimum	range
Temperature (°C)	37 - 42 <sup>◇</sup>	30 - 45 <sup>†</sup>
Atmosphere	5% O <sub>2</sub> , 10% CO <sub>2</sub> , 85% N <sub>2</sub> <sup>◇</sup>	3-5% O <sub>2</sub> & 2-10% CO <sub>2</sub> <sup>*</sup>
Water activity (a <sub>w</sub> )	0.997 <sup>¤</sup>	>0.987 <sup>¤</sup>
pH	6.5-7.5 <sup>^</sup>	4.9 – 9.0 <sup>¤</sup>
NaCl (%)	0.5 <sup>¶</sup>	0 – 1.5 <sup>¶</sup>

(<sup>◇</sup>Davis and DiRita 2008, <sup>†</sup>Park 2002, <sup>¤</sup>Silvia et al., 2011, <sup>\*</sup>FSAI Microbial Factsheet *Campylobacter* 2011, <sup>^</sup>Doyle and Roman 1981, <sup>¶</sup>Doyle and Roman 1982)

*Campylobacter* present in foods at room temperature (20-25°C) are unlikely to multiply as they typically do not multiply at temperatures below 30°C, however they can survive in temperatures as low as 4°C in moist conditions<sup>3</sup>. It has been found that freeze/thawing has an effect by reducing *Campylobacter*, it took approximately 10 days in the freezer for *Campylobacter* to reduce by 2 log<sup>4</sup>, which could be useful at reducing the exposure of the consumer to high levels of *Campylobacter* in meat preparations.

<sup>1</sup> Allos, 2001; Debruyne, Gevers et al., 2008; Stanley and Jones, 2003

<sup>2</sup> Maiden and Dingle, 2008

<sup>3</sup> Park, 2002

<sup>4</sup> Sampers et al., 2010

## 4. Sources and routes of transmission

Campylobacter causes infection by ingestion (e.g. by consumption of contaminated food or water) which can lead to colonisation of the gastrointestinal tract<sup>5</sup>. Cases of human campylobacteriosis tend to be sporadic making it difficult to identify the source of infection in individuals.

There are three pathways of infection; environmental (e.g. contact with farm animals, accidental ingestion of soil), water exposure (from private drinking supplies) and food (e.g. consumption of undercooked chicken meat). Food is one of the most common routes of campylobacter infection<sup>6</sup> and major food sources include improperly handled or undercooked poultry products, dairy products such as unpasteurised milk and cheese and, contaminated water<sup>6</sup>. Poor hygiene and cross-contamination of raw meat and ready-to-eat products in the home or business can also cause foodborne infection<sup>6</sup>. Other source risk factors associated with campylobacter infection include travel, contact with domestic animals and pets, and swimming in open water<sup>6</sup>.

However exposure to campylobacter by the consumption of retail chicken is the most significant source for human infection. This has been found by previous scientific studies<sup>7</sup>. However FSS have also commissioned projects, conducted in Scotland, that highlighted retail chicken sources were of greatest relevance. It showed that chicken was had the largest attributable source of human infection at 52%, followed by 26% for sheep, 11% cattle, 2% for pigs and 8% for wild birds<sup>8</sup>.

Further evidence with regards to the importance of chicken comes from a Food Standards Agency UK-wide retail survey, conducted from 2014-2017, of whole chickens. The survey showed that, on average, across the whole market, 6.5% of chickens tested positive for the highest level of contamination compared to 19.7% in 2014/15 when the survey began<sup>9</sup>. Currently this research is continuing with the 9 major UK retailers publishing their own campylobacter test results.

## 5. Human disease symptoms

Campylobacter is a self-limiting disease which means that most people can get better without medical intervention. It causes gastrointestinal illness which typically lasts for 7 days, and the time taken from ingestion of the campylobacter to onset is usually 2-5 days. Symptoms of infection include diarrhoea, fever, abdominal cramps and vomiting. Diarrhoea can be mild and watery, or severe and bloody and occurs shortly after abdominal pain starts. Other symptoms often include abdominal pain, nausea, headache and muscle pain. Campylobacter infection is not usually treated because it is self-limiting.

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<sup>5</sup> CDC, 2010: <https://www.cdc.gov/foodsafety/diseases/campylobacter/technical.html>

<sup>6</sup> Unicomb et al., 2009

<sup>7</sup> Domingues et al., 2012

<sup>8</sup> FSS report i-CaMPS4, 2017

<sup>9</sup> FSA report, 2017

In a minority of cases however, campylobacter can cause further complications and long term problems including Guillain-Barre syndrome (GBS), reactive arthritis, meningitis, pancreatitis and urinary problems. These symptoms tend to appear a maximum of 4 weeks after infection. GBS is a disorder that affects the peripheral nervous system and is characterised by paralysis, pain and muscular weakness. Approximately 0.1% of campylobacteriosis patients develop GBS<sup>10</sup>. Reactive arthritis commonly affects knee and other peripheral joints.

### **Human disease incidence**

In 2017, 5796 cases were reported in Scotland which was a 9.1% increase from the previous year and corresponds to an overall rate of 107.2 per 100,000<sup>11</sup>. This data is published by HPS and can be accessed by this link:

<https://www.hps.scot.nhs.uk/resourcedocument.aspx?id=6483>

It is important to remember that laboratory reports underestimate the incidence of campylobacteriosis by a factor of approximately 9 due to under-reporting so the actual number of cases in Scotland could be greater than 45,000 per year<sup>12</sup>.

## **6. Foodborne outbreaks**

There have been a total of 35 general outbreaks of campylobacter reported since 1996 in Scotland<sup>13</sup>. The most common location of campylobacter infection outbreaks was hotels and restaurants. Other locations of outbreaks were outdoor centres, private houses and hospitals. The largest single outbreak occurred at an annual farmers dance in Montrose in 2005 when approximately half of the attendants fell ill and chicken liver pate was the suspected cause<sup>14</sup>. Health Protection Scotland (HPS) monitor and report on foodborne outbreaks and more information can be found from their website:

<https://www.hps.scot.nhs.uk/resourcedocument.aspx?id=6707>

## **7. Legislation**

Food businesses operators (FBOs) must comply with microbiological criteria for foodstuffs, which is set down in Regulation (EC) No 2073/2005. They must comply with food law and general hygiene of foodstuffs legislation.

Process hygiene criteria ((PHC) – 2073/2005 Annex I Chapter 2) has been introduced for broiler carcasses at retail which stipulates permissible levels of campylobacter. Five samples are taken each week (days are alternated each week) for 10 weeks and the results are from 50 samples over the 10 continuous weeks. A satisfactory result is for no more than 40% of samples to exceed 1000 cfu/g. An unsatisfactory result is when over 40% of the samples tested exceed 1000 cfu/g. This is above the UK voluntary national target where no more than 10% of all production exceeds 1000 cfu/g. FSS has produced a poster for [sampling guidelines](#).

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<sup>10</sup> Heymann, 2015

<sup>11</sup> Browning et al., 2017

<sup>12</sup> Tam et al., 2001

<sup>13</sup> Browning et al., 2017

<sup>14</sup> Forbes et al., 2009

Links to relevant regulation:

Regulation (EU) 2017/1495 amending Regulation (EC) No 2073/2005 as regards *Campylobacter* in broiler carcasses - [http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L\\_.2017.218.01.0001.01.ENG&toc=OJ:L:2017:218:TOC](http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2017.218.01.0001.01.ENG&toc=OJ:L:2017:218:TOC)

Regulation (EC) No 2073/2005 on microbiological criteria for foodstuffs - <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1549450046332&uri=CELEX:02005R2073-20180101>

Regulation (EC) No 852/2004 on the hygiene of foodstuffs - <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02004R0852-20090420>

Regulation (EC) No 853/2004 laying down specific hygiene rules for food of animal origin - <http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1503913655953&uri=CELEX:02004R0853-20160401>

## 8. Control in the food chain

Strategies to control *Campylobacter* spp. in food are required in the food chain and need to be implemented across 'farm to fork'. This is especially relevant to poultry production which is reported as the most common cause of campylobacter infection in humans but is also important for cattle, sheep and pig production. Reduction of risk from contaminated poultry products can be achieved through good hygienic practices by manufactures and consumers such as not washing raw chicken meat.

### Farm

At farm level, colonisation of campylobacter in broilers can happen thorough the external environment around the broiler house by farm and wild animals; internally through contaminated water, flock thinning, ineffective broiler house cleaning and disinfection, human traffic in and out of a broiler house and transport. It is acknowledged that reliable control of campylobacter at farm level is hard to achieve although there are additional control measures that are being researched that includes vaccination or phage therapy (a form of bio control that can specifically target pathogens). Therefore it is important to have strict adherence to biosecurity measures on farm to minimise the risk of introduction of campylobacter to the flock.

### Abattoir

In abattoir and poultry plants control measures should be in place to prevent cross-contamination. Therefore it is a legal requirement that food business operators shall put in place, implement and maintain a permanent procedure or procedures based on the Hazard Analysis Critical Control Point (HACCP) principles (EC No 852/2004). This is to minimise product contamination as well as following good manufacturing practices. Processes should be in place that reduce campylobacter levels on broilers such as secondary scald tanks, suitable washing and a thorough chilling process (which prevents campylobacter growth). Washing chicken carcasses in the abattoir is part of the control for keeping the bird clean from the insides after they are gutted. Machines should also be adjusted to minimise gut/faecal spillage during the evisceration process. Given the high level of contamination in poultry, meat processors should use leak-proof packaging.

## **Food handlers**

Food handlers, whether in the domestic or commercial kitchen can reduce campylobacter risk by:

- cooking food thoroughly as this will kill campylobacter (cook until it reaches 75°C internally)
- be aware of the risks associated with raw products, in particular poultry meat
- not washing raw chicken meat as this spreads contamination around the kitchen and may contaminate ready-to-eat foods
- keeping kitchen areas clean – proper cleaning and disinfection will facilitate the removal of harmful bacteria from surfaces and equipment and will help to reduce the risk of cross-contamination
- preventing cross-contamination by keeping raw and cooked foods separate, e.g. using separate chopping boards and utensils and when storing food keep it covered
- using potable drinking water in food preparation, where water from private water supplies is used, it is essential that any disinfection/treatment systems are properly maintained



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