

Campylobacter species

1. What are *Campylobacter* spp.?

Campylobacter spp. are microaerophilic, Gram-negative, spiral shaped cells with corkscrew-like motility. They are the most common cause of bacterial gastroenteritis in many countries (including Ireland) and are transmitted primarily through foods to humans. *Campylobacter jejuni* is the predominant species associated with human illness, other species being *Campylobacter coli* and *Campylobacter lari*.

2. General Properties

Limits for growth of *Campylobacter* spp.

PARAMETER	RANGE	OPTIMUM
Temperature (°C)	32 – 45	42 – 43
pH	4.9 – 9.0	6.5 – 7.5
NaCl (%)	0 – 1.5	0.5
Water activity (a_w)	>0.987	0.997
Atmosphere		5% O ₂ & 10% CO ₂

The effect of heat on the number of viable cells is represented by the D-value, i.e. the time in minutes at a given temperature to achieve a 90% reduction in the number of viable cells. D-values for *Campylobacter* spp. in cooked chicken are presented in the following table:

D-VALUE (MIN) FOR <i>CAMPYLOBACTER</i> SPP. IN COOKED CHICKEN*	
55°C	2.12 – 2.25
57°C	0.79 – 0.98

* ICMSF 1996 provides an extensive list of D-values for *Campylobacter* spp. under different conditions and food types.

3. Sources of *Campylobacter* spp.

The principal reservoir of *Campylobacter* spp. is the alimentary tract of wild and domesticated birds and mammals. *Campylobacter* spp. are generally commensal organisms; however, occasionally they serve as enteric pathogens in the young of some species, e.g. calves, lambs and puppies. They have also been isolated from sea water, streams, rivers and estuaries which have been subjected to faecal contamination.

4. Routes of Transmission to Humans

Campylobacter spp. may be transmitted to humans either directly or indirectly. Direct transmission can occur via contact with infected animals, infected carcasses or infected water. Indirect transmission can occur through the ingestion of contaminated food or water.

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5. *Campylobacter* spp. and Food

Campylobacter spp. are frequently isolated from foods of animal origin.

Poultry is regarded as one of the most important reservoirs for *Campylobacter* spp. and constitutes a very significant vehicle for its transmission to humans. The result of an EU wide baseline study revealed an Irish prevalence in broiler batches of 83.1% and a prevalence of 98.3% on carcasses at the end of slaughtering process. Cross-contamination of ready-to-eat foods, direct hand-to-mouth transfer during food preparation and to a lesser extent consumption of undercooked poultry meat have all been identified as important modes of transmission. It is estimated that the handling, preparation and consumption of broiler meat may account for 20% to 30% of human cases of campylobacteriosis in European Member States.

Other foods associated with *Campylobacter* spp. include raw drinking milk (which may become contaminated through faecal contamination or mastitic infection), contaminated drinking water, fresh produce and bivalve molluscs.

6. The Illness (campylobacteriosis)

Campylobacteriosis is the illness caused by *Campylobacter* spp. The incubation period is 2 to 7 days and the illness lasts for a similar period. The symptoms are usually self limiting and primarily include diarrhoea (often bloody), abdominal pain and fever. Complications are rare, but infections have been associated with reactive arthritis, Reiter's syndrome, or Hemolytic Uremic Syndrome (HUS) and approximately 1 in 1,000 cases lead to a neurological disorder called Guillain-Barré Syndrome. These more invasive manifestations are rare and usually only occur in a small minority of patients such as the very young, the elderly and the immuno-compromised.

The infective dose, i.e. the number of cells required to cause infection, is quite low, ranging from 500 to 10,000 cells.

For further information on campylobacteriosis please refer to the HPSC website:

<http://www.hpsc.ie/hpsc/A-Z/Gastroenteric/Campylobacter/Factsheet/>

7. Incidence of the Disease

Campylobacter spp. is the most common bacterial cause of gastroenteritis in Ireland and Europe.

In Ireland, 1,808 cases of campylobacteriosis were reported to the Health Protection Surveillance Centre (HPSC) in 2009, corresponding to a crude incidence rate (CIR) of 42.6 per 100,000 population. This is a slight increase on the number of cases reported in 2008, i.e. 1,758 cases, corresponding to a CIR of 41.4 per 100,000. Trends observed in the Irish data show 1) a high rate of illness in young children, 2) a bias towards male cases in almost all age groups and 3) marked seasonal distribution with a peak occurring in early summer.

In the EU, a total of 198,252 confirmed cases of campylobacteriosis were reported from 25 Member States in 2009. The overall incidence was 45.6 confirmed cases per 100,000 population.

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8. Foodborne Outbreaks of Campylobacteriosis

In Ireland, 9 family outbreaks of campylobacteriosis were reported in 2009. Each outbreak involved no more than 6 cases. The mode(s) of transmission were reported in 7 of the 9 outbreaks. The mode(s) of transmission were person-to-person and foodborne (4 outbreaks), person-to-person (2 outbreaks), animal contact and foodborne (1 outbreak).

In the European Union, 333 foodborne outbreaks were attributed to *Campylobacter* spp. in 2009. This represented 6.0% of all reported foodborne outbreaks.

9. Legislation

All food business operators have a legal responsibility to produce safe food (Regulation 178/2002)¹. The safety of foodstuffs is ensured by a preventative approach, i.e. the implementation of a food safety management system based on the principles of Hazard Analysis and Critical Control Point (HACCP). This system enables hazards to be identified and controlled before they threaten the safety of food. All food business operators, with the exception of primary producers, are legally obliged to put in place, implement and maintain a permanent procedure or procedures based on HACCP principles (Article 5 of Regulation 852/2004)². Furthermore, all food business operators, including primary producers, are legally obliged to implement good hygiene practices (GHP). Regulation 852/2004 lays down hygiene requirements for all foodstuffs; while Regulation 853/2004³ lays down more specific hygiene requirements for foods of animal origin.

Regulation 2073/2005⁴ lays down microbiological criteria for various combinations of food commodities and microorganisms, their toxins or metabolites. It requires food business operators to take measures, as part of their procedures based on GHP and HACCP principles, to ensure compliance with the relevant microbiological criteria.

To date, no criteria have been established in legislation for *Campylobacter* spp. in foodstuffs.

Please note: Food business operators should be aware of their obligations in these and other pieces of legislation. It is the responsibility of the food business operator to keep up-to-date with all amendments to legislation. For further information on the legislation please consult the FSAI website:

http://www.fsai.ie/legislation/food_legislation.html.

¹ Regulation (EC) No 178/2002 of The European Parliament and of The Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety

² Regulation (EC) No 852/2004 of The European Parliament and of The Council of 29 April 2004 on the hygiene of foodstuffs

³ Regulation (EC) No 853/2004 of The European Parliament and of The Council of 29 April 2004 laying down specific hygiene rules for food of animal origin

⁴ Commission Regulation (EC) No 2073/2005 of 15 November 2005 on Microbiological Criteria for Foodstuffs

10. Control of *Campylobacter* spp. in the Food Chain

Strategies to control *Campylobacter* spp. in food are required at all stages of the food chain, i.e. from farm to fork.

At farm level, efforts should be aimed at reducing or eliminating the colonisation of live animals with this organism (strict adherence to biosecurity measures is essential to achieve this). At abattoir and poultry plants, control measures should be implemented to prevent or control contamination of meat from the skin, hides or alimentary tract of infected animals. The scientific committee of the Food Safety Authority of Ireland (FSAI) has recently published recommendations for a practical control programme for campylobacter in the poultry production and slaughter chain.

Given the current high levels of contamination of poultry meat, processors should package poultry in leak proof packaging and retailers should insist on this type of packaging when sourcing pre-packaged poultry (this recommendation followed a national survey conducted in 2008 as part of the FSAI/HSE national microbiological surveillance programme which found that 13% of the external surfaces of poultry packaging sampled at retail level were contaminated with *Campylobacter* spp.).

Food handlers should:

- Be aware of the risks associated with raw products, in particular poultry meat
- Undertake good handling and hygiene practices to prevent cross contamination of ready-to-eat foods from raw products, e.g. by using separate chopping boards and utensils for preparing raw poultry meat and ready-to-eat foods and ensuring that any surface which came in contact with raw poultry meat is thoroughly sanitised
- Refrain from washing oven ready birds, as washing is thought to spread contamination onto the sink and nearby surfaces, which may later come into contact with ready-to-eat foods
- Ensure that food is thoroughly cooked (cooking will eliminate *Campylobacter* spp.)
- Ensure that only drinking water is used in food preparation. Where water from private group schemes or private wells is used, it is essential that any disinfection/treatment systems are properly maintained

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References/Further Reading

European Food Safety Authority – EFSA (2005) Opinion of the Scientific Panel on Biological Hazards on Campylobacter in animals and foodstuffs *EFSA Journal*, 173, 1-10
<http://www.efsa.europa.eu/en/scdocs/scdoc/173.htm>

European Food Safety Authority – EFSA (2010) Panel on Biological Hazards Scientific Opinion on Quantification of the risk posed by broiler meat to human campylobacteriosis in the EU *EFSA Journal*, 8(1), 1437
<http://www.efsa.europa.eu/de/scdocs/doc/s1437,0.pdf>

European Food Safety Authority – EFSA (2010) Analysis of the baseline survey on the prevalence of Campylobacter in broiler batches and of Campylobacter and Salmonella on broiler carcasses in the EU, 2008, Part A: Campylobacter and Salmonella prevalence estimates
<http://www.efsa.europa.eu/en/scdocs/doc/1503.pdf>

European Food Safety Authority – EFSA (2011) The Community Summary Report on Trends and Sources of Zoonoses, Zoonotic Agents and Food-borne Outbreaks in the European Union in 2009 *EFSA Journal*, 9(3), 2090
<http://www.efsa.europa.eu/en/efsajournal/pub/2090.htm>

Food Safety Authority of Ireland (2002) Control of *Campylobacter* species in the food chain
<http://www.fsai.ie/WorkArea/DownloadAsset.aspx?id=1342>

Food Safety Authority of Ireland (2010) Zoonoses in Ireland. Update for 2008
http://www.fsai.ie/zoonosesinirelandupdatefor2008.html?_taxonomyid=636

Food Safety Authority of Ireland (2010) Third National Microbiological Survey 2008 (08NS3): Prevalence of *Campylobacter* spp. on (a) surface of chicken packaging and (b) surface of display cabinets
http://www.fsai.ie/uploadedFiles/Monitoring_and_Enforcement/Monitoring/Surveillance/Prevalence%20of%20Campylobacter%20spp.pdf

Food Safety Authority of Ireland (2011) Recommendations for a Practical Control Programme for Campylobacter in the Poultry production and Slaughter Chain
http://www.fsai.ie/recommendationsforapracticalcontrolprogrammeforcampylobacterinthepoultryproductionandslaughterchain.html?_taxonomyid=214

HPSC – Health Protection Surveillance Centre Annual Reports
<http://www.hpsc.ie/hpsc/AboutHPSC/AnnualReports/>

International Commission on Microbiological Specifications for Foods (1996) Campylobacter. In *Micro-Organisms in Foods. 5. Characteristics of Microbial Pathogens*. Roberts, T.A., Baird Parker, A.C. and Tompkin, R.B. eds. Published by Blackie Academic & Professional, London. p.45-65

Lund, B.M., Baird-parker, T.C. and Gould, G.W. (2000) Campylobacter. In *The Microbiological Safety and Quality of Food. Volume II*. Lund, B.M., Baird-parker, T.C. and Gould, G.W. eds. Published by Aspen Publishers. p1040-1056