



Review

The catering industry as a source of campylobacteriosis in Europe—A review



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ABSTRACT

Thermotolerant species of *Campylobacter* are the causative agents of the human illness called campylobacteriosis. The number of confirmed cases of human campylobacteriosis in the European Union followed a significant increasing trend in the period 2008–2012, and continued to be the most commonly reported zoonosis with 214,779 confirmed cases in 2013; the notification of human campylobacteriosis is today mandatory in most European Member States. Recent reports from the European Food Safety Authority have identified catering (catering services, restaurants, hotels, pubs, bars) as the most frequently reported setting for *Campylobacter* infection (EFSA and ECDC, 2015). As can be evinced from the analysis of the scientific literature, the quality of raw meat has been identified as a parameter of fundamental importance, but the contribution of incorrect food handling procedures is by no means negligible. In fact, poor hygiene during poultry meat preparation as well as inadequate cooking and cross-contamination between raw meat and ready-to-eat food were found to be the main causes for the spread of campylobacteriosis related to the catering industry.

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1. Introduction

The present review focuses on the relevant role that the catering industry plays in the spread of campylobacteriosis in Europe. Firstly, an overview of current legislation in the European Union (EU) in matters of food safety is provided, with particular

emphasis on regulations concerning zoonoses, bearing in mind that campylobacteriosis is included in the list of zoonoses that have to be properly monitored in the EU. The review then describes the main features of the microorganisms belonging to the genus *Campylobacter* and of the associated human illness called campylobacteriosis. The core of this paper is the fourth paragraph that reports information available in current literature concerning the role of the catering industry in the spread of campylobacteriosis. In particular, the review reports published studies on documented campylobacteriosis outbreaks in the EU related to the catering sector between 2003 and 2011. Finally, considering once again the available literature, the authors analyze and discuss the possible risk factors that could have contributed to the reported campylobacteriosis outbreaks, and the achievable corrective actions, as well as the implementation of correct good manufacturing practices.

Abbreviations: CAC, Codex Alimentarius Commission; CRLs, Community Reference Laboratories; EC, European Commission; ECDC, European Centre for Disease Prevention and Control; EFSA, European Food Safety Authority; EU, European Union; FSAI, Food Safety Authority of Ireland; GMPs, Good Manufacturing Practices; HACCP, Hazard Analysis and Critical Control Points; MSs, Member States; PHAB, Public Health Agency of Barcelona; WHO, World Health Organization.

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2. The regulatory background

With the publication of the so-called “Hygiene Package”, European legislation reasserted its comprehensive and integrated policy covering all food sectors, from the farm to the point of sale to the consumer, aimed at guaranteeing that feed and food are safe and wholesome. In particular, [Regulation \(EC\) \(2004a\)](#) on the hygiene of foodstuffs focuses on defining the food safety objectives to be achieved. The same Regulation also requires food operators to implement measures in order to guarantee food safety using a preventive approach based on the principles of the Hazard Analysis and Critical Control Points (HACCP) system. The general rules contained in this Regulation are integrated by more specific rules concerning the hygiene of products of animal origin ([Regulation \(EC\), 2004b](#)), and by the following two Regulations which lay down specific rules for the organization of official controls on products of animal origin intended for human consumption ([Regulation \(EC\), 2004c,d](#)). The fourth Regulation of the hygiene package is especially designed to fill the gaps in the pre-existing legislation concerning the official control of food and feed, by harmonizing the Community approach to the design and implementation of national control systems. To that end Regulation (EC) No 882/2004 establishes that Member States shall ensure that official controls are carried out regularly, on a risk basis and with appropriate frequency, at all stages of production, processing and distribution of feed or food and of animals and animal products. The same Regulation also institutes a number of Community Reference Laboratories (CRLs) (Annex VII, as amended by Commission [Regulation \(EC\), 2006](#)), as well as one or more National Reference Laboratories (NRLs) for each CRL.

While completing the integrated and horizontal approach to feed and food safety designed by the hygiene package, Regulation (EC) No 882/2004 also establishes that more specific pre-existing rules in the areas of feed and food, and animal health and animal welfare controls must be kept in place. Among these, in particular, [Regulation \(EC\) \(2003\)](#) refers to the control of *Salmonella* and other zoonotic agents.

Most of the EU legislation on food safety is indeed guided by the awareness that the protection of human health against diseases and infections which are transmissible directly or indirectly between animals and humans (zoonoses) is of paramount importance because the spread of these diseases through food may cause severe human suffering, as well as huge economic losses for the food industry.

[Council Directive 92/117/EEC of 17 December \(1992\)](#) identified measures for protection against specific zoonoses and zoonotic agents in animals and products of animal origin in order to prevent outbreaks of food-borne infection and intoxication and provided for the establishment of a monitoring system for certain zoonoses at both Member State and Community level. Nevertheless, in its Opinion on zoonoses adopted on 12 April 2000, the Scientific Committee on Veterinary Measures relating to Public Health considered that the measures in place at that time to control food-borne zoonotic infections were insufficient. The Committee further concluded that the epidemiological data collected by the Member States were incomplete and not fully comparable ([Opinion of the Scientific Committee on Veterinary Measures Relating to Public Health on Food-Borne Zoonoses, 2000](#)). This Scientific Opinion focused on the need to improve the specific control measures and, thereafter, the [Directive 2003/99/EC \(2003\)](#) on the monitoring of zoonoses and zoonotic agents repealed the previous Directive 92/117/EEC while at the same time establishing that the measures already adopted by the Member States and the related control plans should remain in force until corresponding control programmes have been approved in accordance with [Regulation \(EC\) \(2003\)](#). More in general, Directive 2003/99/EC was issued to ensure that zoonoses,

zoonotic agents and related antimicrobial resistance are properly monitored, and that food-borne outbreaks receive proper epidemiological investigation. It also envisages the collection within the Community of all the information necessary for evaluating relevant trends and sources. To that end, Annex I provides a list of the zoonoses and zoonotic agents to be monitored including: brucellosis, campylobacteriosis, echinococcosis, listeriosis, salmonellosis, trichinellosis (and agents thereof), tuberculosis due to *Mycobacterium bovis*, verotoxigenic *Escherichia coli*.

3. *Campylobacter* and campylobacteriosis

The genus *Campylobacter* consists of Gram-negative non-spore forming, oxidase and catalase positive bacteria, which are characteristically spiral-shaped (in greek *kampylos* means “curved”), and mobile thanks to a polar flagellum. *Campylobacter* cells are able to grow at between 37 °C and 45 °C, with an optimum at 42 °C and the majority of species associated with human diseases need 3–5% oxygen and 2–10% carbon dioxide ([Forsythe, 2010](#)). The thermotolerant species *Campylobacter jejuni* (the most frequent), *Campylobacter coli*, *Campylobacter lari* and *Campylobacter upsaliensis*, are the causative agents of the human illness called campylobacteriosis, although non-thermotolerant species such as *Campylobacter foetus* may occasionally cause the infection. The main symptom of the infection is acute diarrhoea that is often watery and bloody in children; other symptoms include abdominal pain, fever, and flu-like illness ([Forsythe, 2010](#)). The infective dose of campylobacteriosis is quite low, being usually comprised between 500 and 1000 cells, the incubation time varies from 2 to 10 days (commonly about 4). The disease is normally self-limiting and the only treatment may consist in rehydration and electrolyte replacement; however, in some cases, antimicrobial treatment (erythromycin, tetracycline, quinolones) is recommended ([World Health Organization \(WHO\), 2011](#)). The infection has been associated with complications such as inflammation of the joints (5–10% of cases) and, on rare occasions, Guillain-Barré syndrome, a temporary but severe paralysis that may lead to death ([ECDC, 2013](#)).

The species belonging to the genus *Campylobacter* are usually associated with oral cavities, intestinal and urogenital tracts of warm-blooded animals destined for human consumption, such as swine, cattle, ovine species, and poultry ([Altekruse et al., 1999](#); [Jay et al., 2005](#)).

According to the regulatory framework described in the previous section, a combined effort has been made in recent years by EU Authorities to improve the monitoring and prevention of *Campylobacter* and campylobacteriosis.

In addition to the institution of the CRL for *Campylobacter* (The Statens Veterinärmedicinska Anstalt (SVA) S-751 89 Uppsala Sweden), a continuous surveillance has been carried out, and a series of official documents have been published which report the analysis of the data collected and the related recommendations. In 2005, the European Food Safety Authority (EFSA) issued an Opinion on the presence of *Campylobacter* in animals and food ([Opinion of the Scientific Panel on Biological Hazards, 2005](#)); following this document, in 2007, the task force for the collection of data on zoonoses proposed a coordinated monitoring programme for *Campylobacter* in broiler meat in the EU ([Report of the Task Force of Zoonoses Data Collection, 2007](#)) and, in 2008, a reference survey on the presence of *Campylobacter* in chickens at the slaughtering stage was conducted throughout the EU, following the technical specifications provided by the EFSA Task Force ([Analysis of the Baseline Survey on the prevalence of *Campylobacter* in broiler batches and of *Salmonella* on broiler carcasses in the EU, 2008](#)).

This action, was followed in 2010 by the publication of an investigation on broilers, commissioned by the EFSA, that indicated the presence of *Campylobacter* in more than 75% of the chickens

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