

Prevention of *Campylobacter*

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Abstract

Since 2005, Campylobacteriosis become the most important gastrointestinal infectious disease in Europe. The disease affects especially infants under 4 years of age, causing primarily gastroenteric symptoms but also responsible of different extra intestinal pathologies. The most frequent way of infection is considered to be related to contaminated poultry meat consumption. Prevention relies on general hygienic measures. Of utmost importance is the reduction of bacterial burden in raw meat. The achievement of such objective should ensure a radical decrease of clinical forms, thus representing a sustainable prevention strategy.

Keywords: *Campylobacter*; Infectious disease; Prevention

In Europe the infection caused by thermotolerant *Campylobacter* spp. in man is in constant increase. Since 2005, the disease represents the most common reported infectious gastrointestinal pathology, with more cases than those caused by *Salmonella* spp. [1]. According to the European Center for Disease Prevention & Control (ECDC) surveillance report 2011 based on data from the European Surveillance System (TESSy), Campylobacteriosis in Europe accounted for 178,000 cases in 2006 and 202,000 cases (53.07 per 100,000) in 2009. In 2012, 212,000 confirmed cases have been notified in Europe. More than 60,000 cases have been reported in Germania, Hungary and United Kingdom. In Switzerland Campylobacteriosis is recognized the most frequent bacterial zoonosis. In 2009, notified cases were above 8,000 (100.1 per 100,000) [2]. This induced the authorities to undertake an active monitoring plan, named *Campylobacter* platform. Also in the United States Campylobacteriosis in humans is among the most common causes of foodborne illness. Active surveillance through the Foodborne Diseases Active Surveillance Network (FoodNet) indicates that about 14 cases are diagnosed each year for each 100,000 persons in the population (6.033 notified cases in 2009). Many more cases go undiagnosed or unreported to public health authorities, and Campylobacteriosis is estimated to affect over 1.3 million persons every year [3]. The disease shows a seasonal distribution, with the majority of the cases during summer months. *Campylobacter jejuni* and *C. coli* are the species mainly isolated in man. Most frequently reported *Campylobacter* species in 2009 was *C. jejuni* (36.4%), *C. coli* (2.5%), *C. lari* (0.19%) and *C. upsaliensis* (0.01%). The other confirmed cases (51%) could not be characterised at species level or the species were unknown. Many domestic and wild animal species, primarily avian species, are natural reservoirs. Transmission to humans occurs through contact with animals and their products, such as avian meat and raw milk, consumption of contaminated meat not sufficiently cooked. Often, contaminations occur indirectly in the kitchen through stoves or other kitchen ware utilised first for raw meat and after for other food. Symptoms in man are primarily gastroenteric. A limited number of bacteria are sufficient to cause violent abdominal pain and diarrhea. Both *C. jejuni* and *C. coli* may provoke diarrhea in any category of age. However, the disease affects especially infants under 4 years of age (144.34 per 100,000 in 2009) [1]. In particular *C. jejuni* can cause also extra intestinal forms: bacteremia, meningitis, peritonitis, pancreatitis, cholecystitis, urinary infections, neonatal sepsis, abortion, endocarditis, osteomyelitis, septic thrombophlebitis, septic arthritis, immunomediata chronic forms, nodous eritema. *C. jejuni* is also suspected in the etiopathogenesis of the post infective neurological Guillain Barré syndrome and of the rare variant Miller-Fisher syndrome. The similarity between bacterial lipopolysaccharids and gangliosides might be at the origin of an auto-immune reaction [4-6]. The case-fatality rate for

Campylobacter infection is generally 0.05 per 1000 infections [4]. However, infection related mortality may also be not negligible. In the Netherlands, in 2008, out of 3,340 confirmed cases, 45 patients died, and in 2010 deaths were 58 out of 4,322 cases [7].

Generally, animals are asymptomatic carriers of *Campylobacter* spp. In the framework of the Swiss *Campylobacter* platform, poultry samples showed 44% positivity, with mainly *C. jejuni* strains. In pigs the 67% was positive. Almost the totality of the isolated strains was *C. coli*. In calves only the 1% resulted positive to both *C. jejuni* and *C. coli* [2]. *Campylobacter* is often detected in poultry meat [8]. High percentages of contamination have been reported in the United Kingdom (71%) [9] and in Italy (81.3%) [10]. In wild animals *C. jejuni* have been associated also to different pathologies: abortion, colitis with severe diarrhea and death in mink (*Mustela vison*), severe diarrhea in raccoon (*Procyon lotor*), diarrhea in primates, enteritis and epatitis in ostrich (*Struthio camelus*). Prevalence of *C. jejuni* in wild birds was reported in USA in 6 avian families (7.2%), mainly in crows (*Corvidae*) (23%) and gulls (*Laridae*) (25%) [11]. In Italy was reported a positiveness of 38.8% [12]. Occurrence of *Campylobacter*-related gastroenteritis was reported in members of different animal orders: among mammals Artiodactyla 15%, and among birds Galliformes 15%, Anseriformes 30%, Ciconiformes 34% and Gruiformes 44% [13]. Due to the rising importance of the infection, based on the Commission Decision 516/2007/EC [14], the European Commission financed the first surveillance program in avian zootechnics, through sampling at slaughterhouses and verification of antibiotic resistance. This funding allowed to undertake detailed epidemiological studies. A survey conducted in 9 Italian regions on *Campylobacter* in avian meat in 2008 revealed 72.3% of positive slaughter lots, with percentages of positivity in carcasses up to 71.5% and 75.8 in Veneto and Marche regions, respectively [15]. The 52.1% of characterized isolates were *C. jejuni*; *C. coli* represented the 55.6% and *C. lari* 1.1%. The study revealed also very high levels of contamination: >10.000 colony forming units (CFU)/g.

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Prevention relies on general hygienic measures. Food safety preventive measures are required at all the levels of food chain from primary production to retail, as well as good hygienic practices at household. The World Health Organization (WHO) is developing policies that will further promote the safety of food, promoting the strengthening of food safety systems, promoting good manufacturing practices and educating retailers and consumers about appropriate food handling and avoiding contamination. Education of consumers and training of food handlers in safe food handling is one of the most critical interventions in the prevention of foodborne illnesses [16]. In countries without adequate sewage disposal systems, faeces and articles soiled with faeces may need to be disinfected before disposal. Measures to reduce the prevalence of *Campylobacter* in poultry include enhanced biosecurity to avoid transmission of *Campylobacter* from the environment to the flock of birds on the farm. This control option is feasible only where birds are kept in closed housing conditions. Good hygienic slaughtering practices reduce the contamination of carcasses by faeces, but will not guarantee the absence of *Campylobacter* from meat and meat products. Bactericidal treatment, such as heating (e.g. cooking or pasteurization) or irradiation is the only effective method of eliminating *Campylobacter* from contaminated foods [16].

The main problem is the high level of contamination of food. It is estimate that it is possible to reduce the 90% of the cases of human Campylobacteriosis limiting the level of contamination under 500 CFU per gram in raw poultry meat [2]. It is therefore of outmost importance the reduction of the bacterial burden of raw meat to ensure a radical decrease of clinical forms. Pathogen reduction treatments (PRTs), implying the use of physical treatments or chemical products as such as chlorate compounds, are efficiently applied on poultry carcasses at the end of the slaughtering process to obtain a diminution of pathogens on the surface of the meat [17,18]. However, exception made for the use of lactic acid as PRT in beef plants recently authorized by the European Union (EU) [19], these practices are forbidden by the EU food law [20]. This determined long term disputes between EU and USA [21]. Therefore, research efforts should be focused on the achievement of such objective through alternative means, and taking into account that meat is contaminated by bacteria from caecal intestine contain despite application of hygienic measures during slaughtering and subsequent evisceration. An optimal theoretical approach should be the selective reduction of *Campylobacter* among intestinal bacterial flora. For example, the anti bacterial effects of plants which can be used to integrate animal feed diet should be investigated. This might represents an innovative alternative for a sustainable prevention strategy in the full respect of the EU food law and coping with the increasing consumers' demand of naturally produced and healthy food without use of chemical compounds or antibiotics.

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