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EPIDEMIOLOGY AND PREVALENCE OF *CAMPYLOBACTER* INFECTIONS IN THE EUROPEAN UNION AND BULGARIA BETWEEN 2010 AND 2017 (A REVIEW)

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Summary

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In recent years, campylobacteriosis has been among the most common foodborne infections in humans. Campylobacteriosis occurs more frequently than infections caused by *Salmonella* sp., *Shigella* sp. and *Escherichia coli* and represents approximately 70% of all reported cases of acute bacterial gastrointestinal illness in the European Union (EU). The members of the bacterial genus *Campylobacter – C.jejuni, C. coli, C. lari, C. fetus* and *C. upsaliensis* are recognised as leading etiological agents of campylobacteriosis worldwide. *Campylobacter* infection is acquired primarily through the improper handling and consumption of fresh poultry meat and poultry products. In the last few years, the number of reported campylobacteriosis cases and related hospitalisations has continued to increase, with the highest morbidity occurring in Germany, the United Kingdom, the Czech Republic and Spain. A similar trend was observed in Bulgaria where officially reported cases of campylobacteriosis in humans have increased significantly as follows: 6 (2010); 73 (2011); 97 (2012); 124 (2013); 144 (2014); 227 (2015); 202 (2016) and 195 (2017). These numbers demonstrate that campylobacteriosis is an identifiable infectious disease and thus represents a serious problem for the public health sector as well as the food industry.

Key words: *Campylobacter*, campylobacteriosis, foodborne pathogens, infection, diarrhoea

INTRODUCTION

The genus *Campylobacter* belongs to the family *Campylobacteriaceae. Campylobacter* species are Gram-negative, spiral-shaped or curved rods with a single polar flagellum, bipolar flagella, or no flagellum. Members of the genus *Campylobacter* are non-spore-forming bacteria, approximately 0.2-0.8×0.5-5 μm in size, and grow under microaerobic conditions between 30 and 42 °C (Kaakoush *et al.*, 2015). Currently, the genus *Campylobacter* unifies 17 species and 6 subspecies of which the most frequently reported in human diseases are *Campylobacter jejuni* (subspecies *jejuni*) and *C. coli*. Both species are zoonotic pathogens with wide host ranges including farm animals (cattle, sheep, pigs and poultry) and wild animals. The bacteria inhabit the mammalian and avian gut, but can survive for extended periods *ex vivo* in cold, dark and moist environments. *Campylobacter* sp. is also

routinely isolated from fresh and marine water sources, and sewage (Wilson *et al.*, 2008). Other species such as *C. lari* and *C. upsaliensis* have also been isolated from patients with diarrhoeal symptoms, but have been reported less frequently. *C. fetus* (subsp. *fetus* and *venerealis*) is a causative agent of infertility and spontaneous abortions in cattle and sheep, resulting in a decrease in animal productivity and significant economic losses (Mshelia *et al.*, 2009).

Campylobacteriosis in humans is accompanied by symptoms of gastrointestinal illness varying from mild watery diarrhoea to a bloody profuse diarrhoea, fever and abdominal cramps. Although self-limiting and rarely fatal, *Campylobacter* infections in some cases may be associated with severe disabling extragastrointestinal disorders, including reactive arthritis, demyelinating disease (Guillain-Barré syndrome), Miller Fisher syndrome, cardiovascular and reproductive complications, meningitis, abscesses, bacteremia and septicemia (Kaakoush *et al.*, 2015; Pavlova *et al.*, 2016).

EPIDEMIOLOGY AND PREVALENCE

Presently, *Campylobacter* spp. are among the leading etiological agents of acute bacterial gastroenteritis reported in the United States, the European Union and other industrialised countries. In developing countries, members of the genus *Campylobacter* are an important cause of child morbidity caused by diarrhoeal illness. These bacteria are also among the most common causes of diarrhea in travelers from developed nations. Many studies in the United States and other industrialized countries revealed that *Campylobacter* sp. was found to cause diarrhoeal disease 2–7 times more frequently than other foodborne pathogenic bacteria such as *Salmonella* sp., *Shigella* sp., or *Escherichia coli* O157:H7 (Allos, 2001; Coker *et al.*, 2002).

Sources of infection, transmission and spread

Most epidemiological studies have shown that fresh poultry meat from chickens, turkeys and ducks is the primary source of food-related transmission of *Campylobacter* spp. to humans, and its consumption is a main risk factor for infection. Domestic animals (cattle, pigs, sheep and goats) are the second reservoir of *Campylobacter* spp. Fresh and frozen meats are frequently contaminated with *Campylobacter* spp., whereas processed products are less dangerous for consumers. Risk factors for infection also include drinking contaminated water, consuming raw or unpasteurised milk, handling and cooking food – particularly raw meat, and having direct contact with food-producing animals or pets such as dogs and cats (Wingstrand *et al.*, 2006; Kaakoush *et al.*, 2015). Other transmission sources, including insects, have been investigated as reservoirs of *Campylobacter* spp. For example, it has been suggested that flies play an important role in the transmission of *Campylobacter* spp. from contaminated sources to broiler chickens (Jonsson *et al.*, 2012).

Prevalence of human campylobacteriosis in the European Union (2010–2017)

According to the Annual Epidemiological Report of the European Centre for Disease Prevention and Control – ECDC (2016), the number of confirmed and reported cases of campylobacteriosis in humans in all European Union (EU) member countries (except Greece) and two European Economic Area (EEA) countries (Iceland and Norway) for the period 2010–2014 remained relatively stable, with the high-

est value noted in 2014. The number of confirmed cases for this period is as follows: 218,132 (2010); 227,126 (2011); 217,309 (2012); 218,176 (2013) and 240,739 (2014), with notification rates of 53.5 (2010); 55.4 (2011); 52.6 (2012); 52.3 (2013) and 59.8 (2014) cases per 100 000 population. Over this five-year period the highest number of yearly cases occurred in just three countries – Germany, the United Kingdom and the Czech Republic. In 2014, cases of campylobacteriosis in Germany (70,530), the United Kingdom (66,790), the Czech Republic (20,750) and Spain (11,481) represented 71% of all confirmed cases in the EU/EEA. The overall rate of 59.8 cases per 100 000 population was higher than that in previous years, with an increase of 7.5% in comparison with 2013. The results are summarised in Fig. 1A and 1B.

In 2015, 231,650 confirmed cases of campylobacteriosis were reported by 27 EU countries, plus Iceland and Norway (Fig. 1A and 1B). In 2015, Germany, the United Kingdom, the Czech Republic and Spain again reported the highest numbers of cases per year (69,829; 59,846; 20,960 and 13,227 respectively), which accounted for 71% of all confirmed cases. The EU/EEA notification rate of 62.3 cases per 100,000 population was similar to that of previous years, with an increase with 2.5% compared with 2014 (ECDC, 2018a).

In 2016, 29 EU/EEA countries reported 248 752 confirmed cases of campylobacteriosis (Fig. 1A and 1B). Germany, the UK, the Czech Republic and Spain continued to report the highest numbers of cases per year (73,663; 58,987; 24,084 and 14,856, respectively), accounting for 69.8% of all confirmed cases. The overall EU/EEA notification rate of 66.0 cases per 100,000 population was similar to that from previous years, with an increase of 3.7% compared with 2015 (ECDC, 2018b).

In 2017, 29 EU/EEA countries reported 250,826 cases of campylobacteriosis, of which 250,161 were confirmed and 665 were probable, which was the highest morbidity for the entire reporting period (2010–2017) (Fig. 1A and 1B). The greatest number of cases was reported in Germany (69,178), the UK (63,304), the Czech Republic (24,326) and Spain (18 860). Germany and the UK accounted for 53.0% of all confirmed cases. The overall EU/EEA notification rate of 64.9 cases per 100,000 population was similar to previous years, marking a decrease with 1.1% (ECDC, 2019).

Prevalence of human campylobacteriosis in Bulgaria (2010–2017)

According to the Epidemiological Reports of the ECDC (2016; 2018a; 2018b; 2019), the number of cases of campylobacteriosis in humans in Bulgaria between 2010 and 2017 has increased significantly. The number of officially registered cases is as follows: 6 (2010); 73 (2011); 97 (2012); 124 (2013); 144 (2014); 227 (2015); 202 (2016) and 195 (2017), with notification rates of 0.1, 1, 1.3, 1.7, 2, 3.2, 2.8 and 2.7 cases per 100,000 population, respectively (Fig. 2A and 2B). The results of surveillance from this period corresponded with the general increasing trend for the EU. These data demonstrate that campylobacteriosis is an identifiable infectious disease and represents an important problem for the public health sector and food industry not only in Bulgaria, but also in the other EU member states.

Prevalence of campylobacteriosis in poultry and poultry products in Bulgaria

At present, the published data in the literature regarding the prevalence and epide-

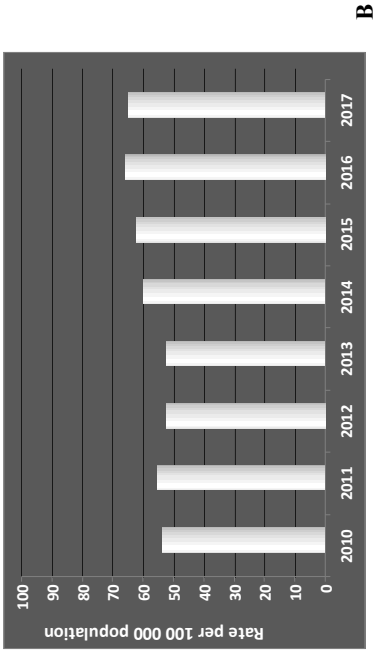

Fig. 1. Prevalence of campylobacteriosis in the European Union for the period 2010–2017.
A – number of cases; B – notification rate – cases per 100,000 population.

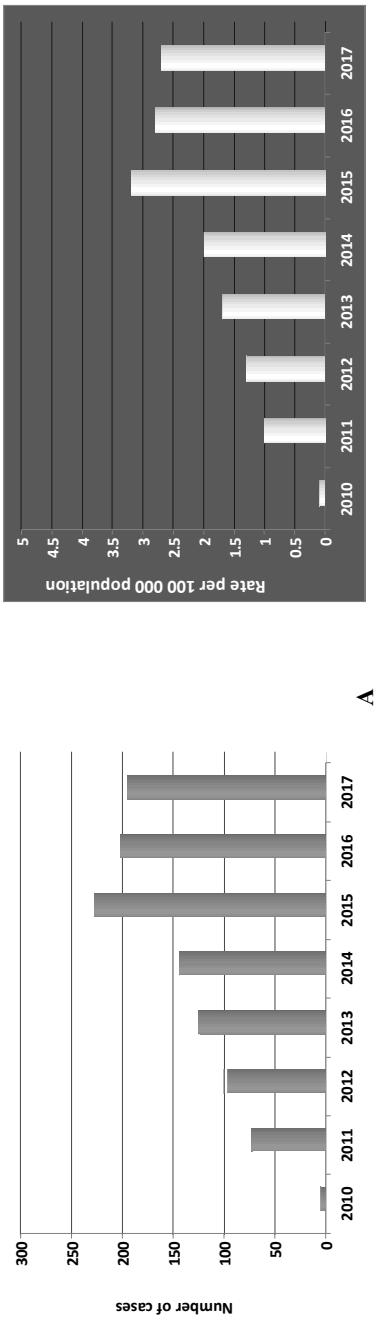

Fig. 2. Prevalence of campylobacteriosis in Bulgaria for the period 2010–2017.
A – number of cases; B – notification rate – cases per 100,000 population.

miological status of campylobacteriosis in Bulgaria are still insufficient. However, two studies in the last two decades reported the prevalence of *Campylobacter* spp. in poultry meat and poultry products in Bulgaria. Stoyanchev *et al.* (2007) tested 210 samples of poultry meat and products (35 frozen whole carcasses, 135 chilled poultry cuts and 40 thermally treated or ready-to-eat products) sold in food stores in Bulgaria for the presence of *Campylobacter* spp. The results showed that 35.2% of the frozen poultry carcasses were contaminated with *Campylobacter*. Among chilled poultry products, the highest percentage of *Campylobacter* was isolated in wing cuts (91.1%), thigh cuts (88.9%) and fillets (48.9%). The authors identified *C. jejuni* and *C. coli* (74.8%/25.2%) in the chilled poultry products, and 70.3%/29.7% in frozen carcasses. *Campylobacter* sp. was not detected in thermally processed poultry products. Daskalov & Maramski (2012) tested 292 samples from 13 poultry slaughterhouses in Bulgaria for the presence of *Campylobacter* spp. and found that 131 (44.9%) of the samples tested positive for *Campylobacter* spp. confirming the presence of *C. coli* (61.8%), *C. jejuni* (37.4%) and *C. lari* (0.8%). The results from these two investigations revealed the high prevalence of *Campylobacter* spp. in the poultry and poultry products. These results, together with the increasing number of cases of campylobacteriosis identified in Bulgaria and the EU in recent years, demonstrate the need for more effective surveillance of the disease and strengthening of control measures during the obtainment, processing, storage and distribution of poultry meat and poultry products.

CONCLUSION

Human campylobacteriosis has been the most frequently reported gastrointestinal disease in the EU since 2005, and in most member countries, poultry meat has been the most common foodborne source of infection. The obtainment, processing and consumption of poultry meat and poultry products represent the most critical hazard points for contamination with *Campylobacter* spp. Consequently, the high hygiene, good technology and cooking practices are essential to avoid the spread of this pathogen. The eradication of *Campylobacter* spp. in poultry industry remains a challenge that will continue to require a combination of different strategies in the food chain in order to reduce the risk of infection in humans.

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