The Prevalence of *Campylobacter* spp. in Polish Poultry Meat

ANNA SZOSLAND-FAŁTYN¹, BEATA BARTODZIEJSKA¹, JOANNA KRÓLASIK¹, BEATA PAZIAK-DOMAŃSKA¹,
DOROTA KORSAK² and MAGDALENA CHMIELA³

¹Institute of Agricultural and Food Biotechnology, Department of Food Quality, Lodz, Poland
²Department of Food Safety, National Food and Nutrition Institute, Warsaw, Poland
³Division of Gastroimmunology, Department of Immunology and Infectious Biology, Institute of Microbiology, Biotechnology and Immunology, Faculty of Biology and Environmental Protection, University of Lodz, Lodz, Poland

Submitted 09 February 2017, revised and accepted 17 May 2017

**Abstract**

The prevalence, count and molecular identification of *Campylobacter* spp. in Polish poultry meat were analysed. 181 samples of meat from chicken (70), turkey (47), duck (54) and goose (10) were studied. *Campylobacter* spp. was found in 64% of meat samples. The highest prevalence of this pathogen was detected for duck meat. On average 80% of duck samples were contaminated with *Campylobacter* spp. The counts of *Campylobacter* spp. in positive samples remained under ten colony forming units per gram of product in 59% of poultry meat. *C. jejuni* was more frequently detected in poultry meat than *C. coli*.

**Key words:** Campylobacter spp., microbiological quality, poultry meat

During the last few decades, the global production of poultry meat has increased rapidly from 58.5 million tonnes in 2000 to 95.5 million tonnes in 2014. Production is not equally distributed; the Americas accounted for 43% of the total production, Asia (mainly China) for 34%, Europe for 17% and Africa and Oceania for 5% and 1% of the whole production in 2012 (93 million tonnes), respectively. In 2023, poultry meat is expected to be the largest meat sector by around 130.7 million tonnes (Skarp et al., 2016). Chicken meat is currently the first most widely produced poultry meat followed by turkey meat, duck meat and goose meat. Although much attention has focused on microbiological safety of poultry meat, this type of product remains a significant cause of foodborne disease in the world. The most reported poultry-borne gastroenteritis disease is campylobacteriosis. In 2015 there were 229,213 cases of campylobacteriosis diagnosed (EFSA, 2016). Infection in humans is mainly caused by the zoonotic pathogen *Campylobacter* spp. Poultry is a natural host for *Campylobacter* spp. in general, and that colonized birds are the primary vector for transmitting this pathogen to humans (Bless et al., 2014; Rożynek et al., 2009).

Although poultry meat is becoming increasingly popular, relatively little research has been done investigating the presence and count of *Campylobacter* spp. in other than chicken types of poultry meat. In order to add more insight to these issue the objective of this study was to determine the prevalence, count and genetic diversity of *Campylobacter* spp. in different kind of poultry meat available in local trade network.

One hundred and eighty one samples of four types of commercially available fresh poultry meat were microbiologically analysed from 2013 to 2015. The samples of meat were transported to the Laboratory of Microbiology in isothermal containers, maintaining the temperature at 0–2°C, and tested immediately on reaching the laboratory. A total of 70 chicken, 47 turkey, 54 duck and 10 goose meat portions were examined in terms of the prevalence and count of *Campylobacter* spp. isolation and count were performed according to PN-ISO 10272-1:2007+Ap1:2008 and PKN ISO/TS 10272-2:2008. To confirm isolates and identify the species, polymerase chain reaction (PCR) methods was applied (Maćkiw et al., 2012). For quality control, *C. jejuni* ATCC 33291 and *C. coli* ATCC 33559 strains were used. Prevalence data for *Campylobacter* spp. sorted by meat type, and species were analyzed using the analysis of variance test ANOVA (Statistica 6.0 PL). The significance level was P < 0.05. In case of finding
The frequency of Campylobacter spp. detection and counts in the tested poultry meat is shown in Table I. Examination of the meats revealed that the vast majority of samples (64%) were contaminated with Campylobacter spp. The prevalence of this genus ranged from 38% to 80%, respectively for turkey and duck.

The direct plating method yielded enumeration results from < 10 CFU/g to 1.0 × 10^3 CFU/g. Enumeration data showed the greater number of samples were positive only after enrichment (68%) indicating low microbiological load of Campylobacter on analysed poultry meat (Table I).

Of the 116 positive samples, isolates originating from a variety of poultry meat were lost in the course of freeze storage, leaving isolates from 97 samples for inclusion in the PCR analysis. Of the 97 Campylobacter spp. isolates, 61 and 36 were confirmed based on PCR as C. jejuni and C. coli, respectively (Table II). Variability in C. jejuni and C. coli prevalence observed in samples obtained from different types of poultry meat was not statistically significant.

Due to the lack of regulation in the EU legislation routine tests of poultry meat for the presence of Campylobacter spp. are not carried out in Poland (Commission Regulation (EC) No 2073/2005 as amended). Therefore, the above quantitative and qualitative assessment results of Campylobacter spp. prevalence in different types of poultry meat, available in Polish trade are a valuable source of information on this pathogen contamination.

In this study Campylobacter spp. was isolated from 64% of poultry meat. Within the tested meat types, highest Campylobacter spp. prevalence was found in duck (80%) followed by chicken (70%), goose (60%), and turkey (38%). Similar results were obtained by Korsak et al. (2015). Polish studies at the retail level revealed that 49.3% of poultry samples were contaminated with Campylobacter spp. Our results on the prevalence of Campylobacter spp. in raw poultry meat are in agreement with data from other countries (Adzitey et al., 2012; Guyard-Nicodeme et al., 2015; Hansson et al., 2015). During the seven years of the study in the United States the average prevalence of Campylobacter spp. in retail broiler meat was 41%, with no statistical differences in the prevalence by year (P > 0.05) (Williams and Oyarzabal, 2012). In this study the prevalence of Campylobacter spp. in chicken meat was 70% and was lower than the frequency of contamination detected in research performed on chicken in Germany or Ireland, respectively, 87% and 91%. (Luber and Bartelt, 2007; Madden et al., 2011; Moran et al., 2009). The percentage obtained in our experiment for duck samples positive for this pathogen is similar to findings reported from Great Britain (Colles et al., 2011), Tanzania (Nonga and Muhairwa, 2010) and South Korea (Wei et al., 2014). According to Colles et al. (2011) and Wei et al. (2014) the percentage of contaminated duck samples was 93.3–100.0% and 96.6% respectively. Lower values were found by Jamali et al. (2015) and Rahimi et al. (2011). These authors detected Campylobacter spp. in 39.2% and 35.5% duck samples, respectively.

### Table I

<table>
<thead>
<tr>
<th>Meat type</th>
<th>No of samples</th>
<th>No / % of positive samples</th>
<th>No / % of identified strains</th>
<th>No of positive samples</th>
<th>Counts [CFU/g]</th>
</tr>
</thead>
<tbody>
<tr>
<td>chicken</td>
<td>70</td>
<td>49/70</td>
<td>36/31</td>
<td>1/11</td>
<td>&lt;10</td>
</tr>
<tr>
<td>turkey</td>
<td>47</td>
<td>18/38</td>
<td>12/10</td>
<td>6/5</td>
<td>≤100</td>
</tr>
<tr>
<td>duck</td>
<td>54</td>
<td>43/80</td>
<td>27/23</td>
<td>16/14</td>
<td>&gt;100</td>
</tr>
<tr>
<td>goose</td>
<td>10</td>
<td>6/60</td>
<td>4/3</td>
<td>2/2</td>
<td>0</td>
</tr>
<tr>
<td>total</td>
<td>181</td>
<td>116/64</td>
<td>79/68</td>
<td>37/32</td>
<td>68</td>
</tr>
</tbody>
</table>

### Table II

<table>
<thead>
<tr>
<th>Meat type</th>
<th>No of contaminated samples</th>
<th>No / % of strains identified to species</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>C. jejuni</td>
</tr>
<tr>
<td>chicken</td>
<td>37</td>
<td>25/68</td>
</tr>
<tr>
<td>turkey</td>
<td>14</td>
<td>8/57</td>
</tr>
<tr>
<td>duck</td>
<td>40</td>
<td>24/60</td>
</tr>
<tr>
<td>goose</td>
<td>6</td>
<td>4/67</td>
</tr>
<tr>
<td>total</td>
<td>97</td>
<td>61/63</td>
</tr>
</tbody>
</table>
tively. The differences among results might be due to diverse isolation methods, geographic, and seasonal factors (Adzitey et al., 2012; Jamali et al., 2015). With regard to the range of *Campylobacter* sp. – positive samples in turkey meat, the results of Atanassova et al. (2007) and Rahimi and Tajbakhsh (2008) are similar to the results obtained in this investigation. Of the turkey meat examined, 34.0% and 24.7% samples were *Campylobacter* sp. positive (Atanassova et al., 2007; Rahimi and Tajbakhsh, 2008). Other authors have described higher levels. Cakmak and Erol (2012) detected *Campylobacter* spp. from 45.6% of the turkey meat samples. On the other hand Noormohamed and Fakhr (2014) found in their study that 17% of the turkey samples were positive for *Campylobacter* spp. There are very few data about prevalence of microbial contamination on goose meat. The first study has shown the occurrence of *Campylobacter* spp. in 26.5% goose samples (Rahimi et al., 2011). In later research reported by Jamali et al. (2015) prevalence was 26.1%.

Our findings showed that *C. jejuni* was more prevalent than *C. coli* in poultry meat that is in agreement with data from other countries (Ghafir et al., 2007; Jamali et al., 2015; Noormohamed and Fakhr, 2014; Rahimi et al., 2011; Wei et al., 2014; Williams and Oyarzabal, 2012). The higher prevalence of *C. jejuni* in poultry meat is contrary to the findings conducted by researchers from India, Reunion Island and Poland. Malik et al. (2014) observed a shift in the prevalence of important species of *Campylobacter* spp. *C. coli* were prevalent in 93.75% (30/32) and *C. jejuni* in 6.25% (2/32) among broilers slaughtered at chicken shop. Henry et al. (2011) also detected *C. coli* as a predominant species in chicken flocks. McKaw et al. (2012) reported that *C. coli* was the most ubiquitous. Its presence was determined in 75.5% samples of chicken meat and giblets, whereas *C. jejuni* was found in 24.5% of samples.

The quantitative results from present study showed low *Campylobacter* spp. contamination level of examined poultry meat. *Campylobacter* spp. counts were <10 CFU/g in 68% of positive cases. 22% and 26% samples showed a pathogen concentration with a range of ≥10 to <100 CFU/g and with ≥100 CFU/g, respectively. Our findings are similar to data from the Belgian monitoring program where 58% of the samples were contaminated with <10 CFU/g, 29% of the samples were contaminated with a range of ≥10 to <100 CFU/g and 11% of the samples were contaminated with ≥100 CFU/g. The average *Campylobacter* spp. concentration was 4.8×10^1 CFU/g (Habib et al., 2008). The higher *Campylobacter* spp. load were found on Estonian broiler chicken products. Enumeration data, conducted by Mäesaar et al. (2014) showed that the overall arithmetic *Campylobacter* spp. CFU mean was 1.6×10^3 CFU/g of product. Relatively low counts obtained in our study and in research conducted by Habib et al. (2008) might also be considered hazardous. In a restaurant-associated outbreak, the number of *C. jejuni* bacteria in the causative chicken meal was estimated to range from 53 to 750 CFU/g. Additionally, in vitro models indicate that the efficiency with which some Campylobacter strains invade intestinal cell lines is optimal at the lowest range of multiplicities of infection, which suggests that species is a highly efficient solitary invader (Habib et al., 2008). Our study revealed that fresh poultry meat is often contaminated with *Campylobacter* spp. that decreases the quality of this kind of meat and constitutes a public health hazards.

Acknowledgments

This research was financially supported by the Polish Ministry of Science and Higher Education (theme: 500-01-ZJ-03).

Literature


Hansson L., A. Nyman, E. Lahti, P. Gustafsson and E. Olsson Engvall. 2015. Associations between *Campylobacter* levels on


