Antibiotic Sensitivity Patterns of Thermophilic Campylobacters Isolated from Cattle, Poultry and Humans

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ABSTRACT

The present study was conducted to study the antibiotic sensitivity patterns of 29 thermophilic Campylobacter isolates consisting of 7 C. jejuni (cattle - 1, poultry - 3, human - 3) and 22 C. coli (all from poultry) recovered from human, poultry and cattle fecal/stool samples against eight antimicrobial agents by disc diffusion method. The antibiogram revealed that C. coli isolates were more resistant to several antibiotics like gentamicin, ampicillin, cotrimoxazole, cephalothin, ceftriaxone and others compared to C. jejuni. The study also revealed the occurrence of ciprofloxacin and erythromycin resistance among the Campylobacter isolates tested. The resistance pattern observed between human and poultry isolates of C. jejuni differed slightly suggesting that they could have been acquired from sources other than that of poultry alone.

Keywords: Antibiotic sensitivity, Campylobacter, C. coli, C. jejuni.

Thermophilic campylobacters are Gram negative ‘S’ shaped bacterium, which has been recognized worldwide as the major cause of foodborne bacterial gastroenteritis. Among them, C. jejuni alone accounts for 80-90% of the foodborne outbreaks in humans followed by C. coli and C. lari (Fitzgerald et al., 2008 and Silva et al., 2011). They are widely distributed in the nature and are adapted to occur as commensal in poultry and several warm blooded animals including swine and cattle. Poultry act as the major reservoir of campylobacters with an isolation rate as high as 90-100% (Kurincic et al., 2005; Rozynek et al., 2008 and Lutgen et al., 2009). Transmission occurs mainly by ingestion of contaminated food especially of animal origin and contaminated water and vegetables (Luangtongkum et al., 2009 and Silva et al., 2011). They seldom cause disease in poultry and animals, but are of zoonotic significance, and reported to cause self limiting diarrheal disease in humans which resolves within a period of 3-4 days without the need for antibiotic therapy. Rarely, in immuno-compromised patients and others secondary complications like reactive arthritis (Reiter’s syndrome, RS), meningitis, recurrent colitis and Guillain-Barré syndrome (GBS) may occur, requiring antimicrobial therapy (Vucic et al., 2009; Luangtongkum et al., 2009 and Hardy et al., 2011). Macrolides and fluoroquinolones (erythromycin and ciprofloxacin) are employed as the drug of choice in the treatment of campylobacteriosis (Moore et al., 2005; Kurincic et al., 2005; Lutgen et al., 2009 and Kirkpatrick and Tribble, 2011). But recently, worldwide, there is an increase resistance against them and several other antimicrobials among thermophilic campylobacters (Luangtongkum et al., 2009). The use of antimicrobials in food animal

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production determines the drug resistance pattern of bacterial population, acting as a potential threat to human health (Kurincic et al., 2005). Infection with these resistant strains could result in life threatening illnesses, which is of increasing public health concern (Ewnetu and Mihret, 2010 and Deckert et al., 2010). Therefore, it becomes imperative to study the antibiotic resistance pattern of thermophilic campylobacters from a variety of sources.

In the present work, the antibiotic sensitivity patterns of 29 thermophilic Campylobacter isolates consisting of 7 C. jejuni and 22 C. coli recovered by direct culturing of fecal/stool samples collected from Pantnagar locality (Udham Singh Nagar, Uttarakhand, India) from poultry, cattle and humans. Out of the 7 C. jejuni isolates, 3 were recovered from poultry, 3 from human beings and 1 from cattle, while all the 22 C. coli were isolated from poultry droppings. All of these isolates were subjected to antibiotic sensitivity testing for knowing their antibiogram against 8 commonly used antimicrobial agents viz., gentamicin (10 μg), nalidixic acid (30 μg), cephalothin (30 μg), ciprofloxacin (5 μg), ampicillin (10 μg), co-trimoxazole (1.25/23.75 μg), erythromycin (15 μg) and ceftriaxone (30 μg) by disc diffusion method in Muller Hinton agar supplemented with 5% sheep blood as described by Taremi et al. (2006). The agar plates were incubated in a CO2 incubator at 5% CO2 tension and the results were recorded after 48 h of incubation.

The antibiogram of all the C. jejuni isolates revealed complete susceptibility against gentamicin, ampicillin and erythromycin, but all were observed to be resistant to cephalothin and co-trimoxazole. Only 71.4% of the C. jejuni isolates were found to be sensitive against nalidixic acid, while the same percentage of isolates also exhibited intermediate resistance pattern against ceftriaxone and ciprofloxacin (Table 1). Two out of the three human C. jejuni isolates tested during the present study were found to be resistant against ciprofloxacin and the remaining five isolates exhibited only intermediate resistance pattern against it (Table 2). Thus, an increased prevalence of ciprofloxacin resistance amongst C. jejuni isolates was observed during the present study, and which has been reported to be increasing amongst Campylobacter spp. following the introduction of fluoroquinolones in veterinary medicine (Kurincic et al., 2005 and Luangtongkum et al., 2009).

All the 22 isolates of C. coli showed resistance against cephalothin and co-trimoxazole, whereas 95.5%, 90.1%, 77.2% and 68.2% of them were sensitive against erythromycin, nalidixic acid, ampicillin and gentamicin, respectively. As many as 68.2% of the isolates showed intermediate resistance pattern towards ceftriaxone and a higher percentage of the isolates were also found to exhibit intermediate resistance pattern against ciprofloxacin, with a single isolate exhibiting complete resistance against it (Table 1).

Prevalence and emergence of antimicrobial resistance among Campylobacter spp. isolated from different sources has been reported all over the world (Luangtongkum et al., 2009; Cokal et al., 2009; Chen et al., 2010). The findings of the present study support the report of Desmonts et al. (2004) that C. coli isolates are more resistant to antimicrobials compared to C. jejuni. In concurrence to the present findings, Thakur et al. (2010) also reported ciprofloxacin-resistance among C. jejuni and ciprofloxacin and erythromycin resistance among C. coli isolates obtained from humans and poultry. In the present study 28.6% and 4.5% of C. jejuni and C. coli isolates, respectively, were found to be resistant against ciprofloxacin. Prevalence of ciprofloxacin resistance among campylobacters has also been reported by several workers (Han et al., 2007; Rozynek et al., 2008; Rahimi et al., 2010). Recently, the erythromycin resistance among campylobacters has also been reported to be increasing worldwide (Luangtongkum et al., 2009) and Perez-Boto et al. (2010) reported a global resistance rate of 3.8% against erythromycin amongst campylobacters, with 93% of the resistant isolate being C. coli and 7% to be C. jejuni. Interestingly, all the 7 C. jejuni isolates tested were found to be susceptible to erythromycin, but only a single C. coli isolate exhibited resistance against it. Prevalence of erythromycin resistance among C. coli isolates was also reported by Boonmar et al. (2005) and Kurincic et al. (2005). In contradiction to the
Table 1. Antibiogram of *Campylobacter jejuni* and *Campylobacter coli* isolates

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Antibiotics</th>
<th>No. of <em>C. jejuni</em> isolates</th>
<th>No. of <em>C. coli</em> isolates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>R   I    S</td>
<td>R   I    S</td>
</tr>
<tr>
<td>1</td>
<td>Gentamicin</td>
<td>0(0 %)</td>
<td>0(0 %)</td>
</tr>
<tr>
<td>2</td>
<td>Nalidixic acid</td>
<td>0(0 %)</td>
<td>2 (28.6 %)</td>
</tr>
<tr>
<td>3</td>
<td>Cephalothin</td>
<td>7 (100 %)</td>
<td>0 (0 %)</td>
</tr>
<tr>
<td>4</td>
<td>Ciprofloxacin</td>
<td>2 (28.6 %)</td>
<td>5 (71.4 %)</td>
</tr>
<tr>
<td>5</td>
<td>Ampicillin</td>
<td>0 (0 %)</td>
<td>0 (0 %)</td>
</tr>
<tr>
<td>6</td>
<td>Co-Ttrimoxazole</td>
<td>7 (100 %)</td>
<td>0 (0 %)</td>
</tr>
<tr>
<td>7</td>
<td>Erythromycin</td>
<td>0 (0 %)</td>
<td>0 (0 %)</td>
</tr>
<tr>
<td>8</td>
<td>Ceftriaxone</td>
<td>0 (0 %)</td>
<td>5 (71.4 %)</td>
</tr>
</tbody>
</table>

R – Resistant; I – Intermediate; S – Sensitive

Table 2. Details of source of isolation of *C. jejuni* and their sensitivity pattern

<table>
<thead>
<tr>
<th>Isolate No.</th>
<th>Species</th>
<th>Source of isolation</th>
<th>Gentamicin</th>
<th>Nalidixic acid</th>
<th>Cephalothin</th>
<th>Ciprofloxacin</th>
<th>Ampicillin</th>
<th>Co-trimoxazole</th>
<th>Erythromycin</th>
<th>Ceftriaxone</th>
</tr>
</thead>
<tbody>
<tr>
<td>PNC 1</td>
<td><em>C. jejuni</em> Human</td>
<td>S</td>
<td>S</td>
<td>R</td>
<td>R</td>
<td>S</td>
<td>R</td>
<td>S</td>
<td>I</td>
<td></td>
</tr>
<tr>
<td>PNC 2</td>
<td><em>C. jejuni</em> Human</td>
<td>S</td>
<td>S</td>
<td>R</td>
<td>I</td>
<td>S</td>
<td>R</td>
<td>S</td>
<td>S</td>
<td>I</td>
</tr>
<tr>
<td>PNC 19</td>
<td><em>C. jejuni</em> Human</td>
<td>S</td>
<td>S</td>
<td>R</td>
<td>R</td>
<td>S</td>
<td>R</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>PNC 4</td>
<td><em>C. jejuni</em> Poultry</td>
<td>S</td>
<td>S</td>
<td>R</td>
<td>I</td>
<td>S</td>
<td>R</td>
<td>S</td>
<td>S</td>
<td>I</td>
</tr>
<tr>
<td>PNC 6</td>
<td><em>C. jejuni</em> Poultry</td>
<td>S</td>
<td>I</td>
<td>R</td>
<td>I</td>
<td>S</td>
<td>R</td>
<td>S</td>
<td>I</td>
<td></td>
</tr>
<tr>
<td>PNC 42</td>
<td><em>C. jejuni</em> Poultry</td>
<td>S</td>
<td>I</td>
<td>R</td>
<td>I</td>
<td>S</td>
<td>R</td>
<td>S</td>
<td>I</td>
<td>S</td>
</tr>
<tr>
<td>PNC 7</td>
<td><em>C. jejuni</em> Cattle</td>
<td>S</td>
<td>S</td>
<td>R</td>
<td>I</td>
<td>S</td>
<td>R</td>
<td>S</td>
<td>S</td>
<td></td>
</tr>
</tbody>
</table>

R – Resistant; I – Intermediate; S – Sensitive

The observed differences in the resistance pattern between poultry and human isolates of *C. jejuni* indicates that the *Campylobacter* infection could be acquired from varied sources although poultry act as the major reservoir of the organism. Further studies employing novel molecular typing techniques need to be carried out to trace the sources of infection. The increased prevalence of multidrug resistance in campylobacter species also suggests that the antibiotic sensitivity testing needs to be carried out regularly in routine clinical practice and the antibiotics should also be used judiciously in food animals for ensuring food safety.

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References


