A two-year comparison of β-lactam resistance phenotypes at the
disk diffusion assay of *Escherichia coli* from young calves in
Wallonia, Belgium

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The most frequent β-lactam resistance mechanism is the production of β-lactamase enzymes
(BLA) that inactivate the antibiotics. Their actual classification is highly complex, but 4 classes
can be summarised: classical BLA (C), extended-spectrum BLA (ESBL), cephalosporinases
(AmpC) and carbapenemases (CPE). A fifth class was defined according to the results of the disk
diffusion assay (DDA) performed with 8 β-lactams: C associated with a cefoxitin resistance
(C_FOX) (Table I). Since 2012, a decrease of β-lactam resistance of *Escherichia (E.) coli* from
calves has been observed at ARSIA [1]. This maybe a consequence of the recommendation,
followed in 2016 by a regulation, of the use of human critical antibiotics in livestock, like 3rd/4th
generation cephalosporins. Nevertheless, the evolution of each β-lactamase family is unknown.
The aim of this study was therefore to compare the resistance phenotypes observed at the DDA
of pathogenic *E. coli* isolated from young diarrheic or septicemic calves over two calving seasons

Table I – Resistance phenotypes observed at the disk
diffusion assay for the 8 tested β-lactams

<table>
<thead>
<tr>
<th>Antibiotics</th>
<th>AMX</th>
<th>AMC</th>
<th>XNL</th>
<th>CFQ</th>
<th>CTX</th>
<th>CTC</th>
<th>FOX</th>
<th>MER</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>5/1</td>
<td>5/1</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>C_FOX</td>
<td>5/1</td>
<td>5/1</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5/1</td>
<td>5</td>
</tr>
<tr>
<td>ESBL</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>AmpC</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5/1</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>CPE</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

AMX: amoxicillin; AMC: amoxicillin + clavulanic acid; XNL: ceftiofur; CFQ: cefquinome; CTX:
cefotaxime; CTC: cefotaxime + clavulanic acid; FOX: cefoxitin; MER: meropenem

After initial growth on Gassner agar plates, 3 colonies from faeces or intestinal contents were
tested by agglutination to identify the production of F5 or F17a fimbrial and of CS31A capsular-
like antigens. One positive isolate per calf was tested by the DDA. When pure culture was
obtained from the internal organs, one *E. coli* colony was also tested.

The comparison between these two years showed a stable rate of β-lactam resistant calf *E. coli*
(Table II). Similarly the different resistance profiles within the β-lactam resistant *E. coli* do not
much differ. The majority of resistance were a C profile, followed by ESBL and C_FOX profiles.
Conversely, very few AmpC profile were detected and no CPE resistance profile was identified.
These results will be compared with those of previous years and of the 2019-2020 calving season.

Table II – Resistance profiles of isolates collected
during two calving seasons

<table>
<thead>
<tr>
<th>Resistance profiles</th>
<th>C</th>
<th>C_FOX</th>
<th>ESBL</th>
<th>ESBL + C</th>
<th>ESBL + C_FOX</th>
<th>AmpC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calving season</td>
<td>Total isolates tested</td>
<td>Total R</td>
<td>% R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>536</td>
<td>425</td>
<td>82.36</td>
<td>333</td>
<td>29</td>
<td>37</td>
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<tr>
<td>2018</td>
<td>447</td>
<td>371</td>
<td>83.00</td>
<td>283</td>
<td>31</td>
<td>39</td>
</tr>
</tbody>
</table>

Reference: