EFFECTS OF ENHANCED ACIDIFIERS ON THE REDUCTION OF E. COLI IN CHALLENGED TURKEYS

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Abstract

A combination of synergistically acting organic acids and a permeabilizing substance in water application can reduce the microbial contamination in turkeys. An experiment was conducted to confirm these effects using water application with a blend of formic, acetic and propionic acid and a permeabilizing substance (Biotronic® Top liquid, BIOMIN, Austria). 60 day-old female turkey poultls were randomly assigned to three groups with 20 turkeys each. A control group (NC) received a commercial diet with no antibiotic or NGP, trial group (NGP) received water supplemented with Biotronic® Top liquid 1.25 ml/l of water and positive control group (PC) received water supplemented with Enrofloxacin 0.5 ml/l of water. On day 10 the animals in all groups were challenged with E. coli O78. The trial lasted for 30 days. Bacterial counts of the intestinal tract were recorded on day 20 and 30. On day 20, E. coli counts of NGP group (5.42 ± 0.78) were significantly (p<0.05) lower than NC (7.42 ± 0.78) and PC group (7.24 ± 1.18). On day 30, E. coli counts of NGP group (5.12 ± 0.44) were as well significantly (p<0.05) lower compared to NC (8.09 ± 0.21) and PC group (7.89 ± 0.31). The results of the NGP group showed a significant (p<0.05) reduction of E. coli counts in the intestinal tract compared to NC and PC group.

Introduction

Antibiotic growth promoters (AGP) are antibiotics which are added to animal feed or water at subtherapeutic levels to improve the growth performance of the animals and to decrease the incidence of diseases (Khachatourians, 1998). AGP’s have been used in animal production worldwide since 1946 (Moore et al., 1946). Nowadays antibiotic resistance has become a hot topic, as the use of antibiotics over time in animal health and growth promotion has resulted in bacterial resistance to antibiotics (Smith et al., 2010, Van de Bogaard and STOBBERRING, 1999). The problem of bacterial resistance has resulted in banning and/or regulating the use of AGP for growth promoting issues by a number of countries (Council regulation 98/2821/CEE, 1998; WHO, 2001). This led to the development of alternative products, which can be used instead of AGP’s for growth promoting issues of the animals.

Organic acids (OA) as alternatvies to AGP have increasingly and successfully been supplemented in poultry feed. It is generally known that acidifiers improve poultry performance. Acids reduce the microbial load, aid the buffering capacity and reduce the pH in the feed and in the gastrointestinal tract, which enhances protein digestion (Eidelsburger and Kirchgessner, 1994, Overland et al., 2000). With the reduction of gastric pH, pepsinogen is activated into pepsine and besides that, the pH of the stomach is also brought closer to the optimum for pepsin activity (Mroz, 2000).

Despite the fact that natural replacements for AGPs are known, fighting Gram-negative bacteria is still a challenge. The outer membrane of Gram-negative bacteria acts as a barrier that prevents antimicrobial compounds from entering the cell and destroying vital functions (Canovas et al., 2005). This outer membrane can be destabilized by a permeabilizing substance (PS), which makes the bacterial cell more susceptible to antimicrobial compounds (Alakomi, 2007). The Biomin® Permabilizing Complex, is a PS, which boosts the anitmicrobial effectivity of the organic acids.

Material and Methods

The trial was carried out at IZSLER, Italy, using 60 1-day old female turkeys (Big 6 Aviagen®), which were housed in 3 isolators. Turkeys were assigned to 3 treatments. The negative control group received a standard diet with no natural or antibiotic growth promoter, positive control group was fed a standard diet and water was supplemented with Enrofloxacin at 0.5 ml/l of water from day 11 to 20 and trial group was fed a standard diet and water supplemented with Biotronic® Top liquid at 1.25 ml/l of water (pH 4.5) from day 0 to 30.

The duration of the trial was 30 days. On day 10 the birds in all groups were orally challenged with E. coli O78 (1.38x10⁸ CFU/ml). 10 birds from each isolator were sacrificed 10 days post infection (dpi) and the rest of the birds
were sacrificed 20 dpi at the end of the trial. Bacterial counts (E. coli) of the intestinal tract posterior to duodenal loop were recorded on day 20 (10 dpi) and 30 (20 dpi) of the trial.

Bacteriological analysis: The samples were diluted 10-fold in Buffered Peptone Water (BPW). All samples were serially diluted to appropriate levels for plating. An aliquot from each sample (100 μL) was spiral plated on the following: Tryptone Bile X-Glucuronide (TBX) agar for the isolation and counting of E. coli. Any TBX plate containing isolated E. coli colonies were subcultured and sent to IZSLER headquarter laboratories for “O” serotyping to see if the isolated serotype matched the E. coli serotype used in the challenge.

Results
The results of the present study showed that water supplementation with Biotronic® Top liquid reduced E. coli counts in turkeys’ intestinal tract. E. coli counts in the intestinal tract on day 20 and 30 of the experiment, in the trial group were significantly (p<0.05) reduced compared to NC and PC. On day 20, E. coli counts of the trial group were 27.0 % lower than NC and 25.1 % lower than PC. On day 30, E. coli counts of trial group were decreased by 36.7 % and 35.1 % in comparison to NC and PC.

Table 1. Bacterial counts intestinal tract of control and trial groups at day 20 and 30 of the experiment (log CFU/g)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>NC</th>
<th>PC</th>
<th>NGP</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of animals</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>E. coli count day 20</td>
<td>7.42b ± 0.78</td>
<td>7.24b ± 1.18</td>
<td>5.42a ± 1.07</td>
</tr>
<tr>
<td>E. coli count day 30</td>
<td>8.09b ± 0.21</td>
<td>7.89b ± 0.31</td>
<td>5.12a ± 0.44</td>
</tr>
</tbody>
</table>

Conclusions
Supplementation of water with Biotronic® Top liquid reduced the number of E. coli in the intestinal tract of challenged turkeys. Based on this result it might be assumed that a healthy gut of the animals from first day of life is maintained, which protects against intestinal infections (Goren et al., 1988, Goren et al., 1984, Nurmi and Rantala, 1973). Potentially harmful bacteria, like E. coli can cause infections (Jeurnissen et al., 2002), compete with the host for nutrients, stimulate the turnover of epithelial cells, secrete toxic compounds and increase the inflammatory processes in the animal. In this case the animals lose energy to the microflora and growth performance is reduced (Drew et al., 2003, Lan et al., 2005, Richards et al., 2005).

Based on the results of this experiment, the trial group outperformed the PC group, showing that Biotronic® Top liquid was more effective than Enrofloxacin in terms of antimicrobial efficacy, which confirms that NGP’s can easily be replaced by AGP’s.

Literature


