NATURAL FEED ADDITIVES AS ALTERNATIVE TO IN-FEED MEDICATION

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Introduction
The use of antibiotics in livestock production is very common and widespread. The reason for their use can be very diverse. Examples are the treatment of clinically sick animals, the improvement of growth performance, as well as the prevention of common bacterial infections. However, the extensive use of such antimicrobials raised concerns of increasing the incidence of resistant pathogenic bacteria, which has a negative impact not only on livestock production, but also on human health. In the last years, many different substances have been investigated as suitable alternatives to the use of antibiotics as growth promoting agents and as prophylactic substances. Organic acids, blends of such acids and phytogenic feed additives have been accepted as possible alternatives with distinct mode of actions. Organic acids are strong antimicrobial substances proven to inhibit the growth of pathogenic bacteria in the gut and support a balanced gut microbiota (Suiryanrayna and Ramana, 2015), while selected phytogenic feed additives including essential oils proved to be able to reduce inflammation and oxidative stress in animals, improving herewith the nutrient digestibility. In this study the efficacy of an organic acid based feed additive (OA) alone and in combination with a phytogenic feed additive (PFA) as natural alternative to in-feed antibiotics on the performance of nursery pigs was evaluated.

Materials and methods
480 weaned piglets [PIC 280 x 1050 (average body weight 6.22 ± 1.4 kg, age 22 days)] were randomly assigned to 4 different treatments (12 pens per treatment and 10 animals per pen). Pigs were fed 2 phases of experimental corn-soybean meal-dry whey based diets (Phase 1: from day 0 to 8; Phase 2: from day 9 to 21). Diets were formulated to contain 4.35 and 4.10 g SID lysine/MCal ME for phase 1 and 2, respectively. Dietary treatments were: 1) basal diet with no additive (NC), 2) basal diet with 50 ppm carbadox in phase 1, and 50 ppm neomycin plus 50 ppm oxytetracycline in phase 2 (PC), 3) basal diet with 50 ppm carbadox in phase 1, and 1000 ppm OA in phase 2 (COA) and 4) basal diet with 1000 ppm OA and 125 ppm of PFA in both phases (OAEO). Body weight and feed intake were measured weekly. Average daily weight gain was calculated. Data were subject to statistical analyses using a mixed model. Weight block was used as the random effect, and multiple comparisons were evaluated using the t-test method.

Results and discussion
Body weight (BW) for PC group (11.19 kg, \(P=0.001\)) at the end of the trial was greater than NC (10.53 kg) but it did not differ from COA (11.03 kg, \(P=0.382\)) and OAEO (10.85 kg, \(P=0.074\)). BW difference between OAEO and NC (\(P=0.100\)) was not significant. Average daily weight gain (ADWG) for the total trial duration was higher in
PC (226 g/d) and COA (215 g/d) compared to NC (193 g/d, \( P \leq 0.024 \)), but did not differ from OAEO (210 g/d, \( P \geq 0.101 \)). Average daily feed intake (ADFI) did not differ among groups (\( P = 0.242 \)). Results are summarized in Table 1.

**Table 1.** Effect of in-feed antibiotics (PC), an organic acid based product (COA), and a combination of the organic acid based product with a phytogenic feed additive (OAEO) on growth performance parameters.

<table>
<thead>
<tr>
<th></th>
<th>BWG kg/animal</th>
<th>ADFI g/animal/day</th>
<th>ADWG g/animal/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>NC</td>
<td>10.53(^a)</td>
<td>267</td>
<td>193(^a)</td>
</tr>
<tr>
<td>PC</td>
<td>11.19(^b)</td>
<td>281</td>
<td>226(^b)</td>
</tr>
<tr>
<td>COA</td>
<td>11.03(^b)</td>
<td>279</td>
<td>215(^b)</td>
</tr>
<tr>
<td>OAEO</td>
<td>10.85(^a,b)</td>
<td>272</td>
<td>210(^a,b)</td>
</tr>
</tbody>
</table>

\(^a,b\) values with different superscripts differ significantly.

The use of antibiotics in animal production is a common procedure. However, this practice has increased the emergence of resistant pathogenic bacteria. The transmission of antimicrobial resistance between animals, environment and humans increased the pressure to find alternatives to the use of in-feed antibiotics used as growth promoters. The exact mode of action of antibiotics used at sub-therapeutic levels has not yet been clearly described in literature. However, it is clear that it can both positively influence the animals’ microbiota and exert an anti-inflammatory effect in the gut (Niewold, 2007; Lin, 2014). Organic acid based products and their combination with essential oils can be a powerful tool to be applied in a program that aims to reduce the usage of antibiotics as growth promoters. In fact, organic acids have a strong antibacterial efficacy and can be used to reduce pathogen pressure in swine production (Dibner and Buttin, 2002). Phytogenic feed additives have different properties depending on the substances used. Selected phytochemical substances can exert anti-oxidative and anti-inflammatory effects and are even able to improve digestibility (Windisch et al., 2008; Hafeez et al., 2015). Independently from their mode of action, alternatives to antibiotic growth promoters should aim to increase performance of the animals. The results of this experiment showed that it is possible to reduce or replace in-feed antibiotics with natural alternatives.

**Conclusion**

The reduction or elimination of the use of antibiotic growth promoters can be very difficult. When seeking for alternatives, a holistic approach needs to be considered. Solutions should be designed according to producers needs and biosecurity has to be one of the main factors to be taken into consideration. Organic acid based products and phytogenic feed additives can be considered as successful alternatives to antibiotics used at sub-therapeutic levels.
References


