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Formaldehyde and organic acids based formulations on the reduction of *Salmonella* in feed and its impact in nursery

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Introduction

Salmonellosis is one of the most common food-borne diseases and pork is the third source of human contamination among animal foods (1). Several factors are related with the *Salmonella* infection in the farm and feed plays an important role. Brazilian feed mills produce a large amount of feed, which supply many farms; therefore, a contaminated batch has a potential impact of reaching many herds (3). Once infected, pigs shed high concentrations of *Salmonella* through feces contaminating the environment and other pigs. Thus, the aim was to evaluate the control of *Salmonella* by including formaldehyde and organic acid based products in the diet and its performance in nursery.

Materials and Methods

Four different commercial products based on formaldehyde and blends of organic acids were tested against feed contaminated with *Salmonella* Senftenberg. The product D (Table 1) presented the best performance (3 log₁₀ reduction and the lowest concentration) and was selected for inclusion in an experimental field trial in a nursery farm. In this study, 336 male pigs of the same genetic, with 21± 2 days-old and body weight of 6,2± 0,37 kg, were distributed in 28 pens through a complete randomized blocks design. Seven replicates were performed with 12 piglets per pen, for each treatment (0%, 1%, 2% and 3% of in feed inclusion by liquid spray). Animals and the leftover feed were weighed on the placement day and at each feeding change at 7, 18, 27 and 43 days. Weight gain, daily weight gain, feed intake and feed conversion of pigs were evaluated in the same sampling events.

Results

The results are presented in Table 1 and Table 2.

Discussion and Conclusion

The commercial formulas composed of formaldehyde and organic acids presented better performance in the control of *Salmonella* than the products only constituted by organic acids. These results can be explained by the high level of disinfectant activity of formaldehyde, as well as by not being affected by organic matter. Although the selected product presented a good magnitude of *Salmonella* reduction in vitro, the higher the inclusion level, the worse the pig performance in the farm. After 7 days of treatment, a significant difference (p<0.05) was observed only in feed conversion. However, at the end of the nursery phase (43 days of placement), feed intake, feed conversion, daily weight gain and weight gain were significantly (p<0.05) influenced by diet. This can be explained by the fact that formaldehyde has a negative impact on the proteins availability in treated feed and food (2).

Table 1. Percentage of feed samples positive for *S. Senftenberg*, according to treatment and contact time (h).

| Treatment | Composition | Contact time (h) | | | |
|-------------------|--------------------------------|------------------|-----|-----|-----|
| | | 4 | 24 | 168 | 360 |
| Product A 0,2% | 30% F, 10,8% PA | 0 | 0 | 0 | 0 |
| Product B 0,8% | 6,8% LA, 9,3% PA, 48% FA | 100 | 100 | 0 | 0 |
| Product C 0,2% | 30 % F, 3% SA, 6% CP ,1% PS | 10 | 0 | 0 | 0 |
| Product D 0,1% | 30% F and 5% OA | 20 | 0 | 0 | 0 |

F – Formaldehyde; PA - Propionic Acid; LA - Lactic Acid; FA - Formic Acid; SA - Sodium Acetate; CP - Calcium Propionate and PS - Potassium Sorbate; OA – Organic Acids.

Table 2. Adjusted means for performance variables as a function of treatments and length of stay.

| Time (days) | Treatment | | | | P>F |
|----------------------------------|-------------------------------|--------------------------------|--------------------------------|-------------------------------|--------|
| | 1 | 2 | 3 | 4 | |
| Daily weight gain - DWG (kg/day) | | | | | |
| 7 | 0.050± 0.0045 ^a | 0.042± 0.0045 ^{ab} | 0.033± 0.0045 ^{bc} | 0.024± 0.0045 ^c | 0.008 |
| 18 | 0.237± 0.0053 ^a | 0.227± 0.0053 ^{ab} | 0.216± 0.0053 ^{bc} | 0.205± 0.0053 ^c | 0.004 |
| 27 | 0.335± 0.0054 ^a | 0.323± 0.0054 ^{ab} | 0.311± 0.0054 ^{bc} | 0.299± 0.0054 ^c | 0.001 |
| 43 | 0.420± 0.0053 ^a | 0.409± 0.0053 ^{ab} | 0.399± 0.0053 ^{bc} | 0.389± 0.0053 ^c | 0.005 |
| Feed conversion | | | | | |
| 7 | 1.108± 0.0559 ^a | 1.288± 0.0559 ^b | 1.404± 0.0559 ^b | 1.693± 0.0559 ^c | <.0001 |
| 18 | 1.041± 0.0109 ^a | 1.065± 0.0109 ^{ab} | 1.073± 0.0109 ^b | 1.094± 0.0109 ^b | 0.021 |
| 27 | 1.083± 0.0056 ^a | 1.099± 0.0056 ^a | 1.116± 0.0056 ^b | 1.135± 0.0056 ^c | <.0001 |
| 43 | 1.307± 0.004 ^a | 1.319± 0.0044 ^a | 1.335± 0.0044 ^b | 1.350± 0.004 ^c | <.0001 |

* Means followed by distinct letters in the lines differ significantly by the t test (p≤0.05).

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