EFFECT OF CITRIC ACID AS FEED ADDITIVE IN SWINE STARTER DIET

Rita Narayanan, B.S.M. Ronald, N. Krishnakumar, P. Gopu, A. Bharathidasan and R. Prabhakaran

University Research Farm, Centre for Animal Health Studies, Tamil Nadu Veterinary and Animal Sciences University, Chennai-600 051, India

ABSTRACT

Swine producers use feed additives because of most of the studies demonstrated their ability to increase growth rate, improve feed utilization, and reduce mortality and morbidity in weaned pigs. This study was undertaken to evaluate the effect of organic acid (Citric acid) as feed additive in swine starter diet. One group of Large White Yorkshire piglets were fed with swine starter feed supplemented with 2% citric acid and the other group was kept as control. The E.coli count was found to reduce from 8.8x10^8+4.301 cfu/ml during first week to 4.78x10^6+0.575 cfu/ml by 28 days of weaning in the citric acid fed group with no mortality due to piglet scour. Hence it was concluded that citric acid supplementation to starter diet in piglets before weaning had a positive effect in reducing the E.coli count with improved weight gain and reduced mortality.

Feed additives have been used extensively in swine diets. Most swine producers use them because their demonstrated ability to increase growth rate, improve feed utilization, and reduce mortality and morbidity from clinical and subclinical infections. In general, additives available for swine producers fall into several groups that include animal drugs (antibiotics, chemotherapeutics, anthelmintics or dewormers), growth-promoting minerals, enzymes, organic acids and probiotics. There are many feed additives in the market and they differ widely in chemical composition and mode of action. Selection of a specific feed additive and the level for optimal response will vary with the existing farm environment, management conditions and the stage of the production cycle. Most of the studies have been conducted in weaned piglets with organic acids but piglet mortality due to piglet scour were noticed in piglets upto weaning. Hence, this study was undertaken to evaluate the effect of organic acid (Citric acid) as feed additive in swine starter diet since use of antibiotics may lead to antibiotic resistance in food borne pathogens.

Eighteen Large White Yorkshire piglets of both sexes (13 males and 5 females) were housed into one group and fed with swine starter feed with 2% citric acid as feed additive. Similarly another group containing 20 piglets (11 males and 9 females) were housed and fed with swine starter feed without citric acid as additive. The starter ration contained 17.91% crude protein, 11.36% crude fibre, 3.16% ether extract, 9.55% total ash, 3.48% AIA and 47.48% NFE. The initial birth weights were recorded of all the piglets. Diluting in water and oral feeding ensured the citric acid intake in piglets before two weeks. The Escherichia coli count was estimated for all the piglets by pour plate method using MacConkey agar every week up to weaning in fecal samples collected from piglets. The weaning weight was recorded on 28th day. The results were statistically analyzed to assess the effect of citric acid in swine starter diet. The birth weight of citric acid and starter feed groups weighed 1.33+0.04 and 1.33+0.05 Kg, respectively. There was no significant difference between the groups. The piglets were weaned at 28 days post farrowing and weighed 10.71+0.41 and 8.69+0.34 for citric acid group and starter group, respectively. The E.coli count was assessed by pour plate method and are tabulated in Table 1. The potentially pathogenic bacteria such as Escherichia coli can be inhibited in the GI tract if the pH is acidic (Wolin, 1969). Feeding
organic acids to farm animals, especially pigs, has become widespread. As the piglets start feeding solid ration along with the sow’s milk, the gut microbes have to adapt very quickly. The change of diet usually results in reduced feed intake, below the maintenance requirement, during the first week. This low level of intake has a negative impact on the structure of the small intestine, resulting in shortening of the villi (Piva et al., 2002). The degeneration of the villi in the small intestine is considered a predisposing factor for health problems like colibacillosis, swine dysentery, salmonellosis, porcine proliferative enteropathies, gastric ulcer and endo parasitic infections. The organic acids have a negative impact on bacteria along the GI tract while growth performance is positively affected, with variable results.

In this study, the E. coli count assessed by pour plate method was found to reduce from $88 \times 10^{10} + 4.301 \text{ cfu/ml}$ during the first week after birth to $4.78 \times 10^{6} + 0.575 \text{ cfu/ml}$ by 28 days of age. This clearly indicates, the reduction in E. coli due to feeding of citric acid at 2% level in the feed. The E. coli count of the piglets fed with starter diet without citric acid was found to be increasing from $87.25 \times 10^{18} + 3.943 \text{ cfu/ml}$ by 28 days of age. This clearly indicates, the reduction in bacterial content could be due to the specific antimicrobial activity of citric acid as it is pH dependent (Dibner and Buttin, 2002). The undissociated form of citric acid can penetrate the cell membrane of bacteria quite easily. Once inside the bacteria, the organic acids dissociate to protons and anions. Protons acidify the interior of bacteria and must be extruded to the exterior using energy in the form of ATP. The constant influx of these protons will eventually deplete cellular energy, leaving bacteria no energy for growth. Meanwhile, the dissociated anions accumulate inside bacteria, interrupt the DNA synthesis, which is responsible for cellular proliferation, and impairs protein synthesis. The results obtained was in contradiction to the report of Risley et al., (1992) that feeding organic acid did not affect E. coli and clostridial count in the intestine of piglets. Further it was observed that under uniform managemental conditions the incidence of colibacillosis was nil in citric acid supplemented group whereas in the control group nine piglets had colibacillosis with mortality of two piglets. The weaning weight of the piglets supplemented with citric acid up to 28 days of age showed significant difference. This could be attributed to the effects of citric acid which improve protein and energy digestibilities by reducing microbial competition with the host for nutrients and endogenous nitrogen losses, lowering the incidence of sub clinical infections. Organic acids have several additional effects, which include reduction in digesta pH, increased pancreatic secretion, and trophic effects on the gastrointestinal mucosa (Dibner and Buttin, 2002).

In conclusion, the citric acid supplementation to starter diet in piglets before weaning had a positive effect in reducing the E. coli count in the fecal content with improved weight gain and reduced mortality due to enteropathogen up to weaning.

**REFERENCES**