The benefits of eubiotics on the gut health of piglets

The early development of a balanced and diverse microbiota is linked to improvements in digestive processes, growth performance and general health.

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In pigs, the founding microbial population is provided by the sow during farrowing and suckling. This is expanded and modified over the following week by the environment and further sow and litter-mate interaction.

After this first week external stimuli become more significant in the microbial population development than the mother. Therefore, manipulating this process to limit potentially harmful bacteria and support beneficial flora may be a tool which helps us reduce the challenge on the gastrointestinal tract (GIT) at weaning.

The piglet's digestive system and microbiome is still immature at weaning, this process also hampers development due to stresses and fundamental diet change. Endogenous lipase, for instance, which is increasing in activity up to weaning is known to be reduced in the few days post-weaning.

At this time the microbial population also goes through a period of acute dysbiosis, which is a state of imbalance and allows for blooms of potentially pathogenic bacteria to cause enteric issues, such as post weaning diarrhoea (PWD).

Recently, the investigation into feed additives which may help us raise animals with fewer antimicrobials has been reinvigorated as we look to a future without therapeutic zinc oxide.

One such category of products are acid based eubiotics (ABEs); comprising of short chain fatty acids (SCFA) delivered in a solid form, these products have been used historically as alternatives to antibiotics. SCFA such as propionic and formic acid have been extensively researched and have shown numerous benefits in piglets. Their antimicrobial action is also well known.

How eubiotics improve pig health and performance

ABEs favour more acid tolerant bacterial species such as Lactobacillus spp. and Bifidobacterial spp. as they create localised pH changes making it more hospitable to some bacteria and more hostile to others.

Acid intolerant bacteria, such as Salmonella spp., Escherichia coli, as well as coliforms and listeria, find it difficult to proliferate in these conditions. Notably, E. coli spp. prefer higher pH environments and therefore struggle to colonise the more acidic environment of upper GIT in pigs fed with ABEs. This is particularly beneficial at weaning and during other stressful situations like moving pigs to finisher accommodation.

The bacterial action of ABE results in modification of the gut microbial population and is the first step in producing a more balanced gut, defined as eubiosis. Lactobacillus spp. are associated with high performing, healthy animals and are the focus of many prebiotics and probiotics.

It can therefore be suggested that an increased population of Lactobacillus in the gut can be used as a marker for good gut health, when used alongside performance and efficiency measures.

Fig. 1 shows the effect of feeding an ABE blend on the caecal microflora. The concentration of lactobacillus was significantly increased and E. coli significantly decreased ($P<0.05$), which correlated with an improvement in animal health and performance.

Through positive modification of the gut microflora we see a significant shift to a more balanced and mature bacterial population at a younger age which can be beneficial in lifetime performance and health. Eubiosis can also help to improve the action of endogenous and in-feed enzymes, improving protein and fat digestibility but also playing a role in enhancing phytase efficacy.

Recent studies supporting the use of ABE to replace current PWD management strategies after weaning have shown positive results.

Zinc oxide is one of these current strategies for managing gut health but following concerns over environmental pollution and reports of zinc-related antimicrobial resistance, the EU has introduced a ban on the therapeutic use of zinc oxide in piglets, which will come into effect by 2022.

Two eubiotics (ABE1 and ABE2) were evaluated in a zinc free diet and compared with a basal control (CON) and zinc oxide (ZnO). All piglets were orally challenged with E. coli (ETEC) eight days after weaning (28 days of age) to reflect the challenges seen in commercial practice.

Final body weight was significantly higher ($P<0.05$) with a difference of over 1.4kg in piglets receiving any of the three additives compared with the control, with both ABE

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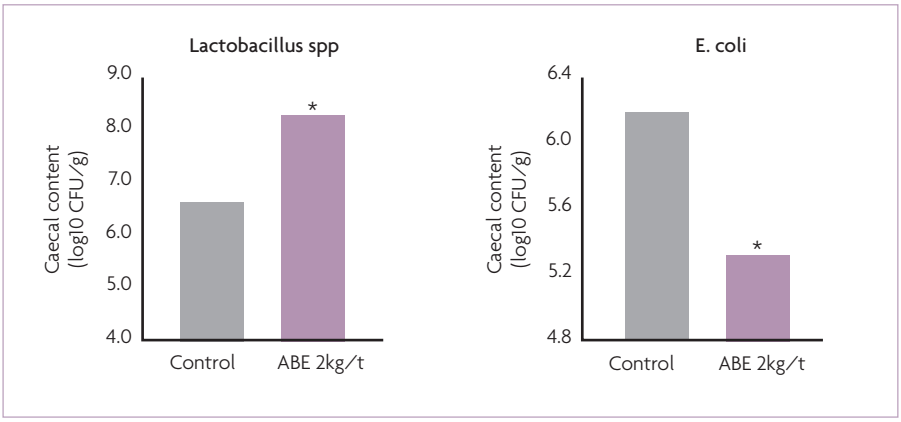
Fig. 1. Comparison of caecal bacterial content (*denotes significant difference at p<0.05) (unpublished, Anpario data).



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products giving numerically heavier pigs over the ZnO treatment.

Fig. 2 shows the average daily gain for the four treatments following 28 days on trial. ABE2 shows the highest daily gain, which is significantly higher than CON (P<0.05), while ABE1 and ZnO show similar performance.

These results show that the ABE blends tested can support optimum piglet weaning performance in the absence of zinc oxide.

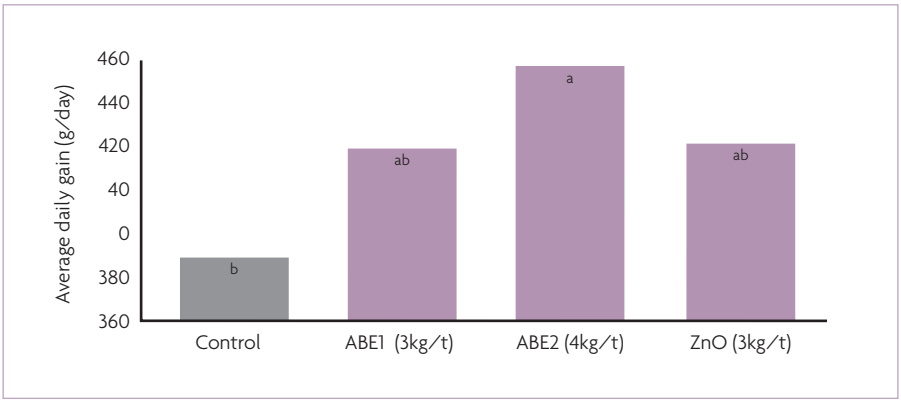

Fig. 2. Average daily gain day 1-28 following an E. coli challenge (different letters denote a significant difference at p<0.05) (unpublished, Anpario data).

Not all ABEs are created equal

ABEs need to be designed to withstand the temperatures and pressures of feed mill manufacturing, to this end liquid acids have little, if any, effect on the animal as they are highly active, volatile substances.

Unwanted binding with in-feed minerals and damage to valuable vitamins, as well as health and safety cautions renders liquid acids impractical for most commercial applications.

The choice of SCFAs also affects the solubility of the ABE and its effect on the pH of the GIT, furthermore, some SCFAs have unique features. Formic acid, for example, has antibacterial properties, making it a useful tool in young animals and warranting its EU feed additive registration as a feed bacterial decontamination agent.

How the acid is then delivered to the animal has profound effects on its mode of action. SCFA can be most effective when they are incorporated onto inert mineral carriers to ensure the acids remain active, yet are protected from damage and unwanted reactions during the mixing or pelleting process.

These ABE do not use fat coating which targets specific regions of the GIT for acid diffusion and activity. The downside is pigs can only benefit from these ABEs if they have sufficient lipases, which is limited in young and challenged animals.

Moving to an eubiotic system

ABE trigger gradual microbial changes and so it generally takes two to three weeks to create the balanced microbial community pigs need to cope with weaning and other challenge periods.

This means that pig producers need to be planning ahead, helping sows to farrow and wean healthier and more robust piglets. ■

References are available from the author on request