Metabolites and gut maturation in newly weaned piglets

More than 9,000 researchers, veterinarians, swine nutritionists, and pig farmers gathered digitally or in person at Wageningen University in February 2023 for the ArMoR Healthy Livestock research presentations.

by Yvonne van der Horst, Selko Global Product Manager Presan and Tetske Hulshof, Trouw Nutrition Swine Researcher. www.selko.com

The robust attendance reflects the urgency of identifying effective strategies for supporting the enteric health of piglets.

Below, we share a snapshot of a study researchers shared at the event that looks at the mode of action a blended feed additive relies on and the pathways it influences in the animal.

Stressors

Newly weaned piglets face a range of stressors that can interrupt weight gain and development including declining feed intake and illnesses like diarrhoea.

Long-relied on interventions used to deal with these challenges – such as including antibiotic growth promoters in the diet or feeding high levels of some trace minerals – are facing restrictions, and being phased out in some production regions.

The situation spotlights the urgency of identifying and validating new approaches to foster piglets' gut health. Blended feed additives are among the alternatives being explored to steer and nurture the maturation of piglets' digestive tracts.

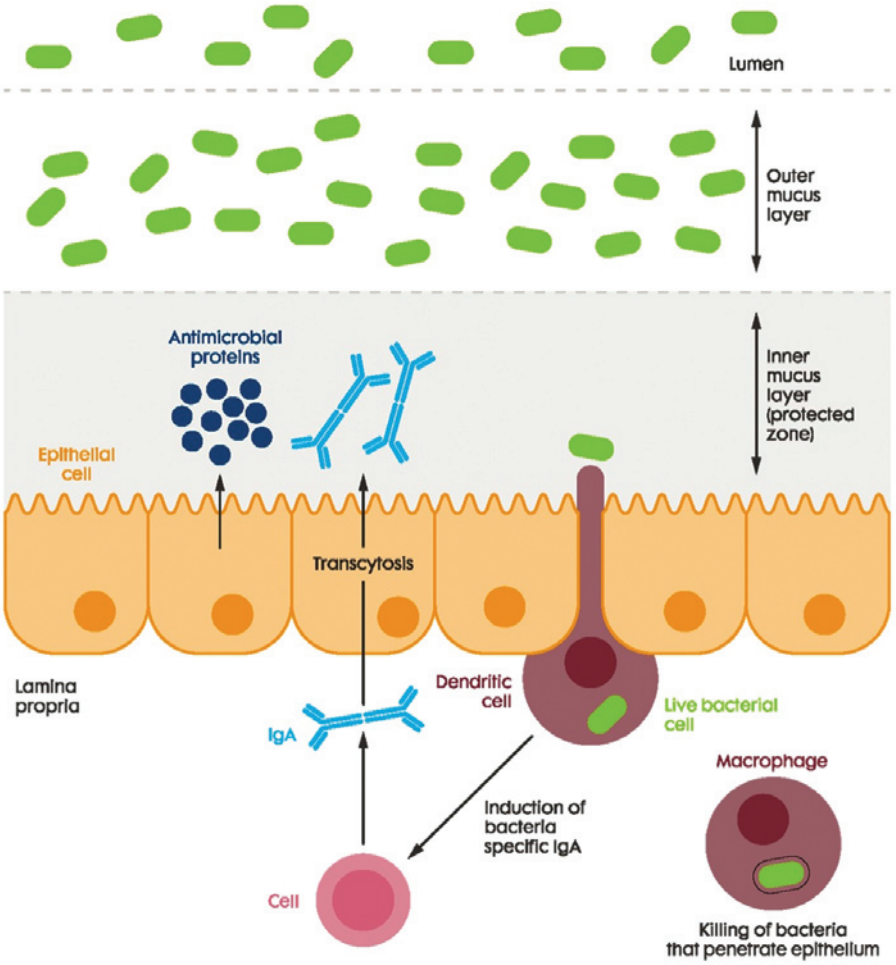

Fig. 1. Supporting gut health helps internal processes protect themselves from unwanted bacteria.

Combining specially selected organic acids, medium-chain fatty acids, slow release C12, butyrates and phenolic compounds has been found to support gut health and animal development.

Use of these types of ingredients also has been demonstrated to support overall performance and limit enteric upset.

Additionally, these blends are known to support an altered microbiota helping to increase the presence of Firmicutes and specifically the Lactobacilli genus while reducing the presence of unwanted bacteria.

In a study shared at the ArMoR event, researchers sought to learn more about what physiological changes might be occurring and which metabolic pathways might be involved in using blended feed additives to manage piglets' gut health.

Tracking when and where feed additives prompt change within the animal supports future generational development and contributes to the efforts of producers using an antibiotic-free production system. Additionally, having a more complete picture of the mode of action can allow for improved precision of use.

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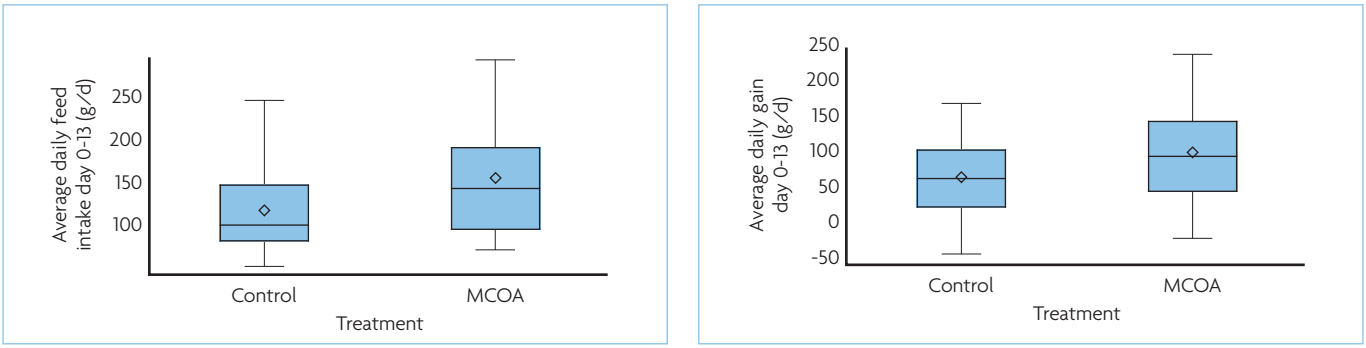

Fig. 2. Supporting gut health and development may have allowed piglets to get more nutrition from the same amount of feed as control group pigs.

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Studying mode of action

The study explored the mode of action for a blended feed ingredient comprised of organic acids, medium-chain fatty acids, slow release C12, butyrates and phenolic compounds (Presan-FX). A total of 108 weaned piglets were given one of two diets for a period of 14 days. The diets included one with a blended feed additive and a control. Piglets were tracked for body weight gain and feed intake.

Additionally, blood and intestinal samples were collected pre-weaning and throughout the trial. Samples were examined to determine microbiota present and metabolomics.

Results and producer implications

Overall, piglets receiving the supplemented feed had a similar feed intake to piglets on the control diet. However, piglets receiving the feed additive had an improved average daily gain (Fig. 2).

The difference in weight gain is thought to stem from a change in fatty acid use and digestion meaning that piglets receiving the feed additive were better able to access the nutrition provided.

Internally, researchers observed a shift in response of a range of metabolites such as cholic acid, choline and taurine levels in the feed additive-supplemented feed piglets. Cholic acid levels increased in samples collected from both plasma and the small intestine during the trial. However, levels of both choline and taurine in plasma declined on days 7 and 14.

These changes indicated a shift in bile metabolism and potential increase in bile production and secretion, which supports the development of a microbiome that is more bile tolerant.

Higher levels of cholic acid may improve nutrient digestion and support the growth of beneficial bacteria as it has an antimicrobial effect and may help protect gut function against the colonisation of pathogenic bacteria. Piglets on the supplemented diets also demonstrated an increased indole-3-propionic acid (IPA) level in plasma compared to control group pigs. The boost to IPA production helps support gut barrier function and indicates a more mature microbiota. IPA and other metabolites also help regulate gut barrier function.

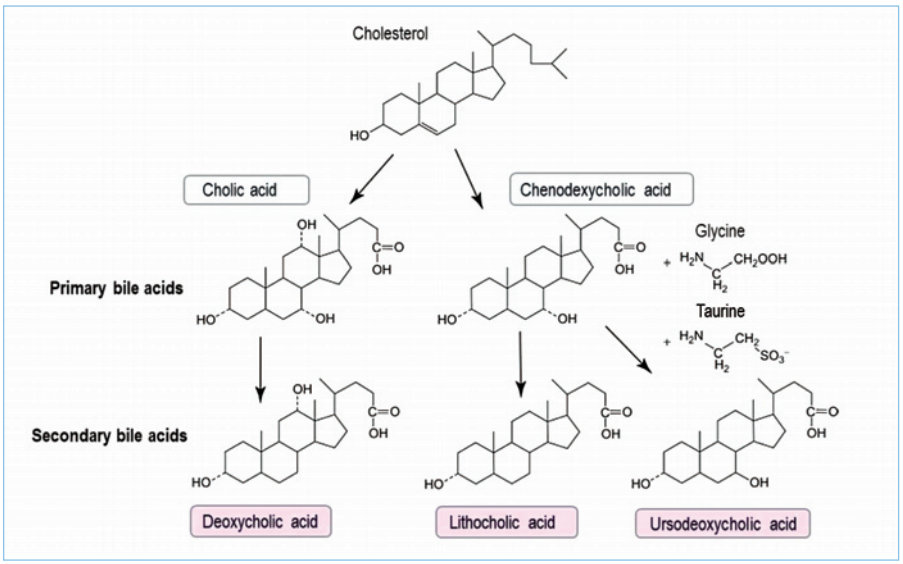
At the intestinal level, piglets receiving the supplemented feeds showed a higher abundance of Lactobacillus in the small intestine. These bacteria help with the fermentation of tryptophan into IPA, again supporting gut barrier function.

Along with the increased amount of Lactobacillus bacteria, there also was a decline in variation of opportunistic bacterial species not typically native to the gut, suggesting a more stable microbiota population had been established. This shift in bacterial population likely stemmed from a change in conditions that supported the growth of Lactobacillus, allowing it to outcompete other bacteria.

Multiple elements were tracked during the study not just cholic acid, choline, taurine and IPA levels. However, changes in these areas were found during the data analysis. The alterations noted between the supplemented and control-group piglets were not surprising as the movement makes sense given past behaviour of the feed additive used.

The mode of action findings indicate that the blended feed additive can support piglet gut health, development and maturation in antibiotic-free production systems.

Fig. 3. Changes to the expression of certain metabolites inform the production of acid in the gut. (Source: A. Kriaa et al., 2022).



Conclusion

Piglets continue to face multiple challenges and stressors around weaning, which can lead to reduced performance and negative side effects including diarrhoea. Restrictions have continued to curb the types of ingredients, such as antibiotics and high levels of some minerals, that farmers can use to address these concerns and mitigate instances of diarrhoea.

However, feed additive blends can be an economically viable alternative as the combination of ingredients supports gut maturation helping maintain gut health and piglet growth and development.

Understanding the pathways influenced by the ingredients helps verify usage-based results and informs precision of use. ■

References are available from the authors on request