

Improving intestinal resilience (gut health) in piglets

The concept of gut health in livestock has been developed so extensively that it has become a challenge to translate it into a practical set of targets in animal production. To re-establish the practical focus, we can narrow the extremely wide concept of gut health to intestinal resilience.

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Various stress factors inevitable in production cycles can trigger stress-induced inflammatory conditions. Given it is not possible to eliminate all the stress factors affecting the gastrointestinal tract (GIT) of animals in commercial growing conditions, the crucial question is how to ensure the animal's ability to regain the functional balance (homeostasis) in the intestine.

Resin acids to support intestinal integrity

When dealing with such common challenges in pig production as neonatal mortality and post-weaning diarrhoea (PWD), efforts are made to reduce the impact of stress factors resulting in these challenges, but not all stressors can be removed.

However, in this situation, we can help piglets to better cope with those stressors by ensuring intestinal integrity.

This is because:

- Keeping the intestinal barrier intact will prevent pathogens and harmful substances from entering the bloodstream.
- Integer epithelium and proper gut morphology are a prerequisite for optimal nutrient absorption.
- Supporting epithelial integrity will positively impact immune functions, preventing energy losses.

Collagen is the very basis of intestinal integrity, so ensuring it is protected is key. This is where natural resin acids – which can be used in animal feeding – can help; they reduce the inflammation-associated collagen breakdown (caused by the increased activity of specific matrix metalloproteinase enzymes) in the intestinal epithelium.

When tissue is inflamed, it starts to produce increased amounts of matrix metalloproteinases. These enzymes break down collagen fibres that support epithelial

cells; the same happens to the tight junctions which hold the cells together.

Collagen degradation compromises the epithelial barrier function and deforms the villi structure. This reduces nutrient absorption and opens an entrance for harmful bacteria, which in turn leads to further inflammation – with a resultant effect on animal wellbeing and performance.

However, natural resin acids break this vicious cycle and drive a beneficial chain reaction. They act on the origin of inflammatory damage by decreasing the production of matrix metalloproteinases, to improve intestinal integrity.

This, in turn, encourages the growth of beneficial gut bacteria, which keep pathogens in check. This forms the foundation for healthy and productive animals.

Performance improvements linked to mechanism of action

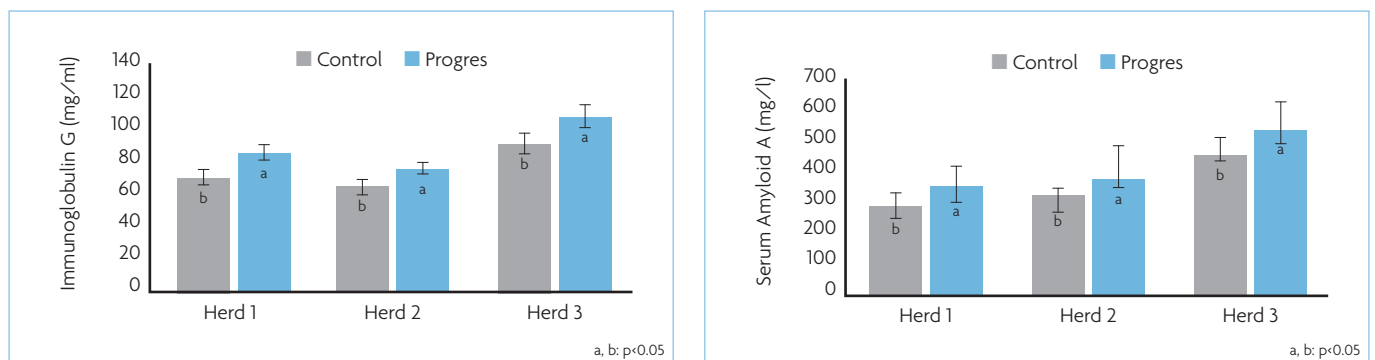
This unique mode of action explains the multiple beneficial effects of resin acids in pig production.

In the studies summarised below, a resin acids supplement (Progres, AB Vista) fed to sows and piglets was shown to:

- Improve sow colostrum yield and IgG content.
- Beneficially modulate the gut microbiota of sows and piglets.
- Positively modulate immunity in piglets.
- Improve piglet performance and reduce the risk of post-weaning diarrhoea.

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Fig. 1. Levels of Immunoglobulin G and Serum Amyloid A (SAA) in the colostrum.



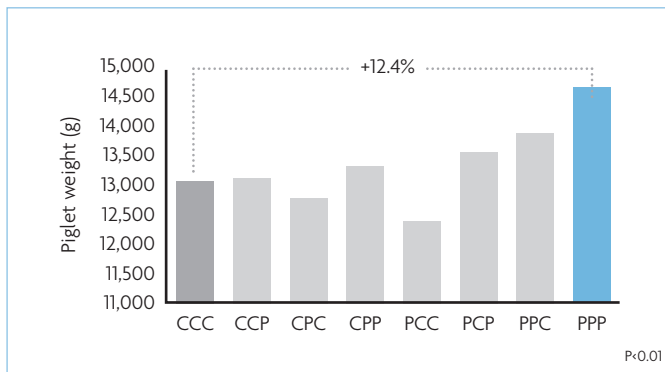


Fig. 2. Piglet weight at seven weeks of age.

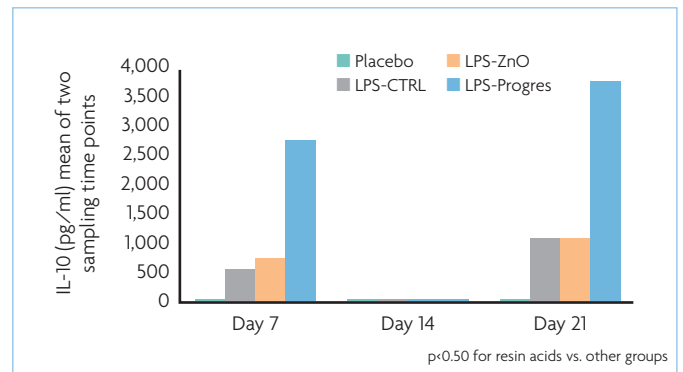


Fig 3. The level of anti-inflammatory cytokine IL-10 at 1.5 and 3 hours after an intramuscular LPS-injection (days 7 and 21); at day 14 the LPS challenge was not given.

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Start early: ensure sufficient colostrum intake and quality

One of the major causes of pre-weaning mortality is insufficient colostrum intake; approximately 31% of modern hyperprolific sows do not produce enough colostrum for their litters, and 36% of piglets do not receive sufficient colostrum for proper growth and survival.

Colostrum shortage not only directly affects piglets' survivability due to hypoglycaemia, but it also means that piglets receive less immunoglobulins – especially IgG – from the sow. Lower immunoglobulins decrease piglets' protection against pathogen pressure, with a long-lasting effect on weight gain and survival even after weaning.

That is why a proactive approach to improving the survivability of piglets should start with the sow.

In a study by Hasan et al. 2018, Progres supplementation at 1.5kg/t during the last week of gestation until farrowing, significantly increased colostrum yield, colostrum IgG and serum amyloid A (SAA). In this way, resin acids help to ensure more energy and strengthen immune protection in neonate piglets.

The increase of acute phase protein in colostrum (SAA) has beneficial effects on the neonatal gut development. The supplement also improved the abundance of beneficial microbiota and decreased the number of opportunistic pathogens in sow faeces. Based on this study, the supplement fed to sows not only improved the protection of piglets at birth but also the quality of colostrum, reducing any deficiency that may be driven by the limited colostrum intake.

Dual impact of resin acids in piglets: indirect maternal and direct dietary effects

Another study explored the indirect maternal effects and the direct dietary effects of resin acids fed to piglets. 40 sows (Yorkshire × Landrace) were allocated to Control (C) and Progres (P) treatments.

Sows in the test treatment (P) received Progres, 1.5kg/ton of feed in their diet from six weeks before the expected date of farrowing until weaning at four weeks.

Litters from both sow groups were allocated to Control and Progres creep feed treatments (n=10) creating treatments PP, PV, CP and CC.

At weaning, piglets were again allocated to Progres (P) or Control (C) weaning feed treatments creating eight different treatments.

Progres inclusion in the piglet diets was 1.0kg/ton and the trial continued until the piglets were seven weeks of age. The results showed that the supplement significantly increased the total number of piglets born and the piglets' weight at seven weeks, while reducing piglet mortality, PWD incidence and faecal myeloperoxidase (MPO), a biomarker of intestinal inflammation.

The best-performing piglets were those from sows fed the resin acids supplement and piglets which were constantly fed with the supplement (trial ended at seven weeks of age).

Resin acids in ZnO replacement

The studies presented above establish a link between the proven mechanism of action of resin acids and the desired performance parameters of sows and piglets.

They also illustrate the beneficial modulation of microbiota and inflammatory status.

In the context of the recent zinc oxide (ZnO) ban in the EU, a study by Guan et al. 2021 explored whether resin acids would make a feasible alternative to ZnO.

In the study, a direct comparison of resin acids-enriched composition administration (1.0kg/t) against 2,500mg/kg ZnO showed the effects of resin acids on the immune response of challenged piglets lipopolysaccharide (LPS) from *E. coli* injection on days 7 and 21 post-weaning.

The effect of resin acids was demonstrated by the highest levels of IL-10

and IL-8 in the blood serum of the resin acids-enriched composition treated group compared to the other treatments.

Elevated levels of IL-10 have been associated with improved intestinal barrier function and have a specific anti-inflammatory role.

Performance was equal in all treatments in the study.

When compared to the control group, zinc and resin acids supplementation increased serum levels of IL-6, IL-8, IL-10 and TNF- α , post-LPS-challenge. However, this did not affect these cytokines between challenges.

The levels of the anti-inflammatory cytokine interleukin-10 were found to be highest in the resin acids-fed group.

The results of this trial therefore suggest that resin acids supplementation can be an integral part of piglet production without medical ZnO, and it can reduce normal inflammatory status even when such a challenge is not directly affecting animal performance.

Summary

In conclusion, resin acids supplementation in sows and piglets has been proven to have a multitude of benefits, including improved sow and piglet performance (studies 1 and 2), reduced PWD incidence and increased colostrum yield.

The concentration of IgG and SAA concentration in colostrum (study 1) and lower faecal MPO (study 2) suggest improved immune functions in piglets of resin acids-fed sows.

A similar modulation of cytokine profiles after LPS challenge by the supplement and a high dose of ZnO, suggests positive immunomodulation in piglets (study 3).

Based on natural resin acids, Progres provides tangible benefits in pig production, helping producers to introduce sustainable production strategies with less reliance on medication. ■

References are available from the author on request