The importance of post-weaning feeding to reach market weight

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Studies have shown that, besides birth and weaning weight, the daily gain early post-weaning is not only a predictor for weight at slaughter but also for the days needed to reach the required slaughter weight.

Studies have shown that a 5% increase in average daily gain in the 20 days post-weaning makes it possible to achieve 1kg increased slaughter weight. Furthermore, it has been reported that a 1kg increase in weight after the grower period leads to a 2-4kg increase in slaughter weight.

In general, it was reported, that the industry equates a 1kg increase in weight at the end of the grower period to a 2.5kg increase in slaughter weight or a 2.5-3.5 days reduced period to reach the slaughter weight.

Thus, even if the more complex diets fed after weaning are more expensive per kg compared to the diets fed to finisher pigs, the average daily feed intake of a finisher pig is significantly higher compared to the daily feed intake of a pig in the early post-weaning period. Therefore, a 2.5-3.5 reduction in days to reach slaughter weight represents an economical benefit to the producer.

However, what producers often experience in the period after weaning is a decrease in feed intake and therefore a reduced average daily gain.

Pigs undergo a lot of stress after weaning. They change from liquid to solid feed and suffer from being relocated and mixed with unfamiliar pen mates. This leads to a greater susceptibility to diarrhoea.

In this regard, and keeping the importance of the post-weaning daily gain to reach market weight in an adequate time in mind, producers should make sure to combat bacteria especially post-weaning, to avoid economical losses.

Combat harmful bacteria

For a long time organic acids have been known to have antimicrobial effects. Often organic acids were combined with other naturally derived products such as essential oils in an attempt to use possible synergisms to more powerfully combat pathogenic bacteria. Essential oils, in general, serve as antioxidants, stimulate the immune system, suppress harmful micro-organisms on one side, but stimulate beneficial microbes on the other.

They regulate the activity of enzymes, especially lipase, are known to protect the gut villi and to interfere with the DNA replication of bacterial cells and therefore have antibacterial effects.

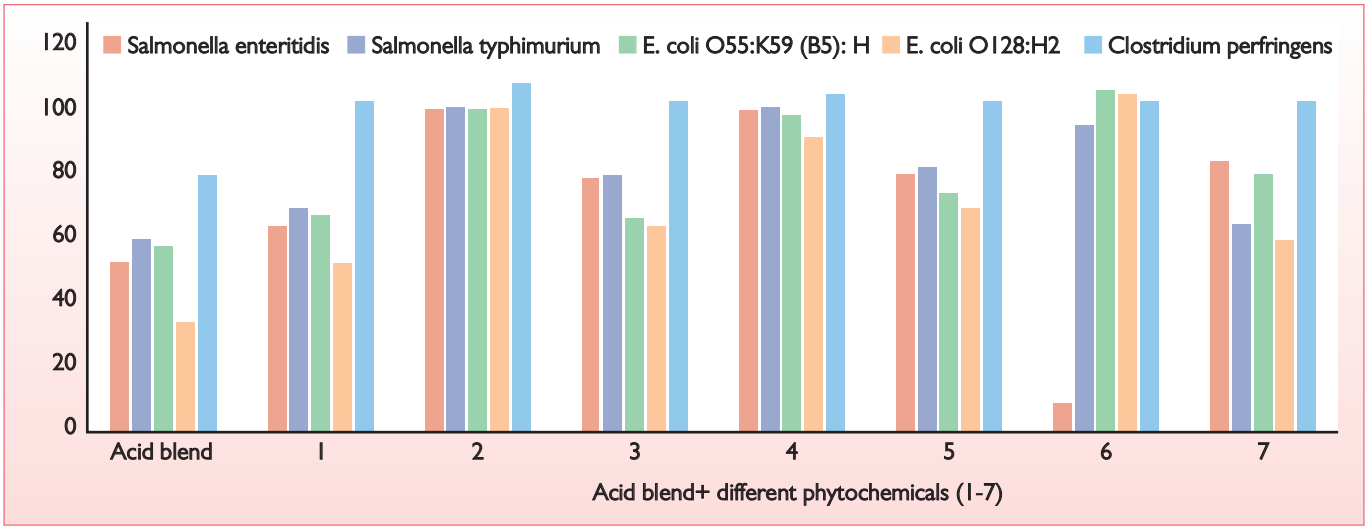
However, the mode of action of different phytochemicals varies a lot. So, for example, cinnamaldehyde, which is a phytochemical derived from cinnamon bark oil, has an even more complex mode of action as it targets the FtsZ protein, which is playing a major role in the cell division of potentially harmful bacteria. FtsZ polymerises into filaments, which assemble at the place within the cell, where the cell division takes place. There they form into a polymeric structure known as the Z-ring on the inner membrane in the mid of the cell, which is responsible for the division of the cell.

Cinnamaldehyde inhibits not only the formation of FtsZ into filaments, but also inhibits essential processes involved in the Z-ring formation and its function and thus the cell division. This results in a reduction of the bacterial load within the gastro-intestinal tract.

To effectively combat possibly harmful bacteria structural differences of Gram positive and Gram negative bacteria have to be taken into account. The cytoplasm of the cell is surrounded by the cytoplasmic membrane, which is covered by a thick cell wall layer. This layer is significantly thinner in

Continued on page 15

Fig. 1. Effect of an acid blend and phytochemicals on the inhibition of bacteria.



Continued from page 13
Gram negative bacteria compared to Gram positive bacteria. However, Gram negative bacteria are surrounded by an additional outer membrane.

This outer membrane provides the bacteria with an inherent resistance to hydrophobic antibiotics and detergents due to the presence and features of lipopolysaccharides in the outer membrane.

Even if the outer membrane of the Gram negative cell is acting as a protective barrier for external agents it is possible to weaken the outer membrane by agents commonly characterised as permeabilisers.

Permeabilising substances

All the permeabilising substances act quite differently. Some of them remove stabilising cations from the outer membrane, while others bind to the outer membrane resulting in the loss of barrier function.

Others destabilise or disintegrate the outer membrane or displace cations from the outer membrane causing membrane damage.

However, when it comes to combining organic acids and permeabilising substances it is of high importance to find the appropriate substances to combine with each other.

When permeabilising substances weaken the outer membrane of Gram negative bacteria, the activity of other antimicrobials is increased by facilitating external substances capable of inhibiting or destroying cellular functions when entering into the cells.

This leads to synergistic effects when a permeabilising substance is added to a mixture of organic acids. However, if a synergism can be found highly depends on the right combination of organic acids and permeabilising substances. A synergism will not be found with each combination.

In vitro inhibition

Fig. 1 shows the effects of an acid blend and an acid blend combined with different phytochemicals on the inhibition of different bacteria. In general, the combination of an acid blend with a phytochemical seemed to improve the inhibition of bacteria.

However, the inclusion level of phytochemicals 3 to 5 was twice as high compared to phytochemicals 1 and 2, while the inclusion level of phytochemicals 7 and 8 were even eight times higher compared to phytochemicals 1 and 2.

As a higher inclusion level is mostly associated with an increase in cost the combination of the acid blend with phytochemicals 1 and 2 turn out to be the most attractive.

Phytochemical 2, which was cinnamaldehyde combined with the acid blend, showed persistently good inhibition on all bacterial strains and represented, therefore, the most attractive combination to further work on more effectively combating possibly harmful

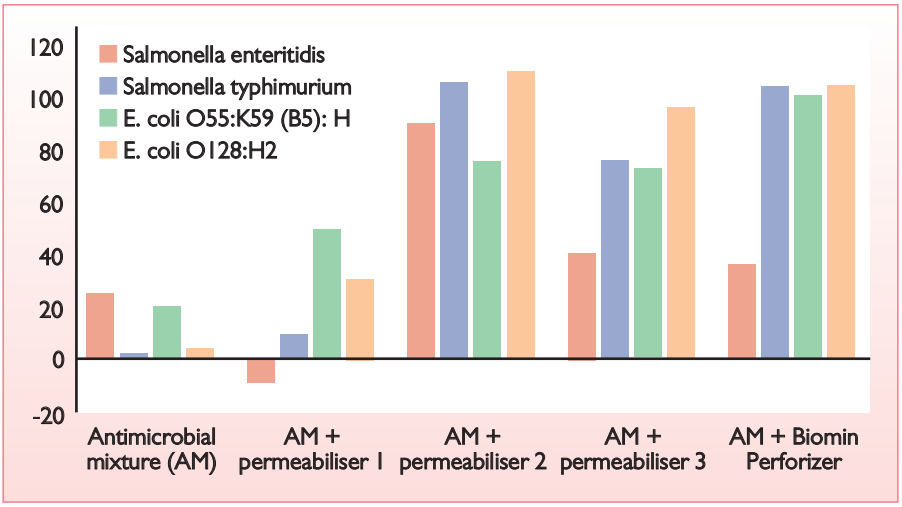


Fig. 2. Effect of an antimicrobial mixture (acid blend and phytochemical) combined with different permeabilising substances on the inhibition of bacteria.

bacteria. As it was hypothesised that the permeabilisation of the outer membrane of Gram negative bacteria would boost the effects of an antimicrobial mixture combining an acid blend and a phytochemical, further in vitro tests testing different permeabilising substances were carried out.

In Fig. 2 the inhibition of an antimicrobial mixture alone and in combination with different permeabilising substances is shown.

This figure clearly shows the synergism between an antimicrobial mixture of organic acids and a phytochemical and most of the tested permeabilising substances.

However, the most persistent effect on the inhibition of the tested bacteria was seen by combining the antimicrobial mixture with the Biomin Perforizer.

This was also shown in in-vitro tests done with a Scandinavian research centre, in which the susceptibility of Gram negative bacteria to an antimicrobial mixture consisting of an organic acid blend and a phytochemical, the Biomin Perforizer alone, and at different inclusion levels combined with the antimicrobial mixture was tested.

This research clearly indicates that the growth of Gram negative bacteria was only diminished when the antimicrobial mixture was combined with the Biomin Perforizer in the higher inclusion levels. So, the research done overall on more effectively combating pathogens showed that the effectiveness with which bacteria are inhibited can be improved by combining an acid blend, a phytochemical and the Biomin Perforizer.

However, to which extent the effectiveness can be improved strongly depends on which acid blend, which phytochemical and which permeabilising substance is used as well as at which inclusion level the active ingredients are used.

Effects on performance

A trial was carried out at the Centre of Applied Animal Nutrition in Mank, Austria, using 60 weaning pigs [(Landrace x Large White) x Pietrain]. Pigs were assigned to two treatments with three replicate pens per treatment and 10 pigs per pen.

Pigs were fed a cereal based starter diet between day 1 to 14 (13.7 MJ ME, 17.27% crude protein, 1.37% lysine) and a cereal based grower diet (13.0 MJ ME, 19.7% crude protein, 1.18% lysine) from day 15 until the end of the trial.

Body weight at day 56 post-weaning, average daily gain and also feed conversion ratio were improved in pigs if fed a cereal based starter diet supplemented with 1kg of an organic acid blend, phytochemical and Biomin Perforizer mixture per ton of feed, compared to pigs fed the same diet without any supplementation.

Body weight at day 56 was 6% ($P<0.05$) higher in the trial group compared to the control group.

Average daily gain was improved by 8% in the experimental group compared to the group with no natural growth promoter (NGP) added and also feed conversion ratio was improved by 3% ($P>0.05$) in the experimental group compared to the control group.

Thus, results clearly indicate that the presence of bacteria within the animals' gastrointestinal tract highly influence their growth performance as less energy is lost to immune responses and less nutrients are lost to bacteria.

This may also lead to beneficial effects regarding the time to reach market weight.

As research has shown, it can be expected that a 5% increase in daily gain in the first 20 days post-weaning made it possible to achieve a 1kg increased slaughter weight and in the study described above resulted in an 8% increase in average daily gain.

However, the synergy caused by the inclusion of the permeabilising substance allows a reduction in inclusion level, resulting in economical benefits for the end user.

Therefore, it presents a different strategy to act against bacteria.

The company has launched the NGP as Biotronic Top3. ■