The role of gut health and nutrition in successful weaning

Abrupt weaning at a relatively young age is challenging because the piglet's gut is not well developed to change from highly digestible sow milk to a dry piglet feed based on plant proteins, starch, and complex carbohydrates.

by Jannes Doppenberg, Pig Nutrition Consultant, Doppenberg Nutritional Consultancy and Services.

Furthermore, the additional stress of removing the piglet from its mother and mixing it with other piglets from different litters increases the risk for gut disorders.

In the past, bacterial dysbiosis could be controlled with in-feed or therapeutic antibiotics or pharmaceutical levels of ZnO, but current regulation bans this.

Therefore other management and nutritional measures are needed to ease the weaning process. These include increasing piglet vitality from birth and the sow's milk production to improve weaning weight.

Farrowing and suckling

The farrowing process is longer with increasing litter size and decreasing sow and piglet vitality. Moreover, Intra Uterine Growth Restriction (IUGR) leads to a high number of small piglets (<1.1kg): a recent study from 12 sow farms in Denmark showed that 75.5% of the piglets were, on average, 1.357kg, 11.8% were 905g, and 10.9% were only 699g at birth.

These low birth weight piglets can result in more than one-third of pre-weaning mortality. When cross-fostering, as is needed with these large litters, keeping piglets with a low birth weight together improves average daily gain (ADG) and reduces mortality. On the other hand, heavy piglets do best in mixed litters with light, medium, and heavy piglets.

It has been reported that IUGR piglets have less developed organs, the small intestinal weight to length ratio is severely reduced, microvilli numbers are reduced, height is shorter, and mucosal immunity is compromised. In addition, the low vitality of the piglet can reduce colostrum intake. Combining these factors can lead to low growth rates and high mortality levels.

However, contrary to this, studies have also shown that the relative growth (ADG/kg BW) of IUGR piglets during suckling is considerably higher than normal-birth weight piglets. A meta-analysis from the Netherlands showed that 29% of the piglets were below 6kg at 25-27 days of weaning and 8% less than 5kg.

The relative growth of both light and normal-weight piglets decreases sharply after weaning. Therefore, the window of opportunity for IUGR piglets to improve weaning success is in the lactation period. Up to 32-35 days should be considered for light piglets to extend the suckling period.

From a societal and economic perspective, a strong focus on decreasing IUGR, mortality, and increasing weaning weight via genetics, management practices, and sow nutrition, especially in the transition and lactation period, is needed.

Weaning

The optimal weaning age is 25-27 days, with a weaning weight of between 6-7kg. Feed intake in the preweaning phase and the first week after weaning should be 250g/piglet/day. For every day weaned before this recommendation, it has been estimated that an additional 1.07 days are required to reach market weight.

One trial showed that ADG in the growing/finishing period was reduced by 50g/d when weaning was six days earlier. Very early (<22 days) or light weaning (5-6kg BW) increases the weaning stress, mortality, and incidence of runts, ultimately rising production costs.

When comparing the extra sow feed required in the farrowing room versus the extra pig feed needed for the finishing period, the ROI is approximately four, showing it is always cost-effective to invest in additional sow feed (and milk production) than in pig feed.

Piglet feed formulation

Protein digestion is compromised in weaned piglets due to the relatively high pH in the stomach. Therefore, highly digestible plant and animal proteins are preferred.

By using high quality (SID AA profile) and high ileal digestible (low ANF) protein sources, the amount of undigested protein (an N-source for pathogenic bacteria) reaching the large intestine can be reduced. In the first and second phases after weaning (6-15kg BW), low crude protein feed minimises the risk for diarrhoea without negatively impacting ADG under AGP-free and low ZnO regimes.

A 15% reduction in dietary crude protein (from 20 to 17%) can reduce the amount of undigested protein reaching the hindgut and can have a similar effect as increasing the crude protein digestibility by 3%; however, this can only be obtained by using minimal expensive feedstuffs.

For farms with a low risk for diarrhoea (high hygiene status), piglet feeds can be formulated for optimal growth with approximately 1.25% SID lysine resulting in

Continued on page 8

Continued from page 7
19-20% crude protein in the diet. Diets formulated to 17% crude protein will only contain 1.05% SID lysine when balanced for essential ileal digestible amino acids, which can maximise gut health.

Starch and sugars (glucogenic energy sources) are preferred over lipogenic energy sources. Grain by-products inevitably increase the risk of mycotoxin contamination. Therefore cleaning grains to remove mycotoxins is recommended, and expanding/extruding part of the grains increases stomach retention time and ileal (starch) digestibility.

Fat and oil addition should be minimal, so the Net Energy (NE) is 9.5-10 MJ/kg. Gut disorders severely decrease fat absorption; therefore, as a consequence, nutrient-dense piglet feeds increase the risk of diarrhoea. On the other hand, n-3 fatty acid sources, especially n-3 LC-PUFA sources, are highly digestible and anti-inflammatory. MCFA/T fat sources are easily absorbed and can improve gut health.

Fermentable carbohydrates (FCHO), including fermentable sugars, serve as an energy source for microbes and can lead to microbial overgrowth. Inert carbohydrates (iCHO) can help detoxify the gut, and coarse particle size can increase the retention time of the feed in the stomach.

A low FCHO content (<9%) and low FCHO/iCHO ratio of 1.0 are preferred. The functionality of iCHO is decreased when the feed is pelleted. The NE content needs to be reduced when adding iCHO sources to avoid the need for (high) fat and oil addition.

Although piglet feeds are mostly pelleted in practice, mash feed enhances feed intake pre-and post-weaning, as the high addition of soluble sugars, proteins, and pellet hardness can be a problem. With a small pellet diameter crumbling is recommended. Feeding it as a porridge increases early feed intake but requires a high discipline for hygiene.

Functional feed additives

Weaning stress decreases IGF-1 levels, decreasing gut endothelial growth, differentiation, and mRNA expression for tight junction proteins (occludins zone). This increases pro-inflammatory cytokine production and leads to 'leaky gut syndrome'.

When looking for alternatives for (pharmaceutical levels of) ZnO, it is crucial to consider the functionality in improving gut health. This will reduce the risk for diarrhoea and enhance feed intake and ADG due to improved gut barrier function.

Therefore, the choice of feed additives should depend on additional cost/T feed and the functionality in improving gut health. Due to the relatively high stomach pH and high buffering capacity (ABC-4) of piglet feeds, organic acids are effective as antibiotics and improve protein digestion. However, high additions can reduce feed intake. A maximum ABC-4 of 250-300 meq/kg is preferred. Since the ABC-4 of limestone is very high, phytase and calcium formate are recommended. Likewise, NaHCO3 should not be added.

Instead of using pro- or prebiotics, it is better to use fermented feedstuffs (grains or protein sources) since they are 'natural' lactic acid and Lactobacillus.

Phytogenics offer immense opportunities to improve gut health under AGP-free and low/zero ZnO circumstances. Moreover, they work synergistically with organic acids and MCFA/T.

They improve growth performance by stimulating feed intake and nutrient digestion because their antioxidant and anti-inflammatory properties lead to increased gut barrier function.

Conclusion

A new playing field has emerged, offering new opportunities for nutritional intervention in gut functionality. ■

References are available from the author on request