Positive effects of an isotonic protein drink on gut health & performance

Thanks to improvements in genetic selection and sow management, an average extra 0.2 piglet per litter can be achieved year-on-year. However, it has been demonstrated in numerous experiments or surveys that an increase in litter size is usually associated with reduced weight at birth, increased pre-weaning mortality (PWM), and reduced growth post-weaning, resulting in decreased economic performance of the farm

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Data from 260 farms and a total of 255,386 sows in Spain collected between 2009 and 2018 have shown that while the number of total born alive increased from 11.4 to 13.7 piglets per litter, this was counter balanced by an increase in PWM from 11.5 to 13.2% for the same period.

Typically, the PWM rate recorded in commercial swine herds is ranging between 10-20%. For instance, the most recent reports indicate an average piglet PWM rate of 13% in the European Union. In Thailand, a survey made on 199,918 litters from 74,088 sows indicated an average 10.8 piglets born alive per litter and a PWM of 11.2%.

In this study, piglet pre-weaning mortality was almost doubled when the number of piglets per litter increased from 11-12 to 13-16. The litters with 13-16 piglets born alive had an average piglet PWM of 20.8%.

Most of the PWM occurs in the first week of life, and it also appears from many studies that crushing is the principal cause of piglet PWM.

In a study performed on 30 Danish farms, Frandsen and Haugegaard (2017) have observed that the main reasons for mortality in the first four days were crushing (46.6%), weak born piglets (18.5%), and hunger (17.7%). However, crushing is often simply the final outcome of various factors related to the piglet, the sow and their environment.

In the first hours of life, piglets must recover from the stress of birth, adjust to environmental temperatures, and compete with their littermates. They are prone to chilling and starvation, especially because they are born physiologically and immunologically immature. Piglets with lower vitality, especially the smaller ones, usually do not get enough nutrients and immunoglobulins from the colostrum. The reduced intake of colostrum is one of the main factors for increased PWM of piglets.

A reduced weight at birth also increases the risk for high PWM. For instance, data from two studies on four commercial farms, involving a total of 4,068 piglets from 394 litters, indicated an overall PWM of 12.2%, while the PWM for the piglets weighing less than 1.11kg at birth was 34.4%.

Depending on the number of litters per sow per year and the number of piglets born alive per litter, a reduction of only one percentage point in PWM means that an extra 0.20-0.50 piglet can be weaned per sow per year. Therefore, PWM remains a major welfare and economic concern in swine production, which needs to be properly addressed.

Weaning, the second big challenge for the piglets

For the piglets that survived through the first weeks of life, separation from the sow is probably the most traumatic event in their life. Weaning typically results in reduced feed intake, and consequently has a negative impact on gut health and performance of the weaned piglets.

Compromised gut health is generally associated with malfunction of the immune system and disease outbreaks can be observed, particularly during the first week after weaning. Additionally, transport of piglets right after weaning can exacerbate the effects of weaning stress, especially because a long transport increases the risk of dehydration.

Consequences at the intestinal level

When piglets undergo stress in their early life (right after birth, at weaning, or during transport) they may not consume enough quantities of colostrum, milk or feed. The shortage in nutrients rapidly results in an atrophy of the intestinal mucosa which can be visible within hours of food withdrawal.

It is known that stresses associated with weaning result in significant changes in the structure of the small intestine, with the most visible modifications being a reduction in villus height and an increase in crypt depth.

Hampson (1986) observed that on the first day right after weaning at 21 days of age, the villus height was reduced by 75% when compared to pre-weaning value. The villi were still 50% shorter than before weaning when measurements were performed five days after weaning.

The presence of shorter villi at weaning means that the absorptive capacity of the small intestine is reduced, which helps explain the increased predisposition of pigs to diarrhoea and growth checks in the post-weaning period.

The lack of nutrients in the intestine can also lead to interruption of the barrier functions of the digestive tract, resulting in gut atrophy, luminal starvation, bacterial translocation, and impaired immune functions. Especially, the stress associated with early weaning can alter the immune and physiology responses to infectious pathogen challenges.

Additionally, it has been shown that the quality of the intestine is related to birth weight. Indeed, the height of the intestinal mucosa is reduced for piglets which are lighter at birth.

Feeding the enterocytes to help the piglet

To address these different challenges and maintain a good quality of the intestine, a focused approach, called micro-enteral nutrition, consists of feeding the intestinal cells (the so-called enterocytes) and help them to do the best job they can of absorbing nutrients.

Micro-enteral nutrition consists of supplying adequate amounts of water, electrolytes, and easily absorbed nutrients (glucose, amino acids, and small peptides) directly to the gastrointestinal tract.

Those simple nutrients are directly absorbed and utilised by the intestinal absorptive cells, or enterocytes.

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The application of the concept of micro-enteral nutrition to swine has resulted in the development of Tonisity Px – an isotonic protein drink, especially useful for piglets.

This solution, obtained by mixing a powder with fresh water, is very attractive to swine and consumed in significant volumes, even by piglets less than one week old.

To date, more than 100 scientific studies and field trials have demonstrated that the isotonic protein drink, when given during the first week of life, has a significant and positive impact on various performance parameters of pigs.

Meta-analysis of 40 trials

A recent meta-analysis, performed on 40 different trials and involving a total of 74,425 piglets, showed a highly significant reduction in pre-weaning mortality which allowed weaning, on average, an extra 33 pigs per each 1,000 pigs born (see Table 1).

This reduction in mortality is most likely due to the fact that the protein and amino acid profile of this isotonic protein drink delivers key energy-producing substrates to the enterocytes, leading to a positive impact on intestinal morphology.

Indeed, histopathology analysis revealed that piglets receiving the drink from day 2-8 of age had significantly greater villus height, villus density, and crypt density that persisted until at least 28 days of age, regardless of what creep feed they were given.

Those pigs also tended to have superior intestinal mucosal thickness.

It was also demonstrated that the administration of the isotonic protein solution early in life stimulated beneficial bacteria such as Lactobacilli, while reducing potential pathogens and reducing the number of E. coli-positive pigs.

Since most of the intestinal pathology around weaning is linked to E. coli, administration of this solution can provide an alternative to antimicrobials.

Table 1. Positive impact of an isotonic protein drink for swine (Tonisity Px) on pre-weaning mortality. Meta-analysis of 40 trials involving 5,404 litters and 74,425 piglets in 17 different countries

Number of piglets	74,425
Pre-weaning mortality control group	14.5%
Pre-weaning mortality isotonic protein drink	11.2%
Difference	-3.3%
% Difference	-22.8%
Extra pigs weaned per 1,000 born	33
P value	<0.0001

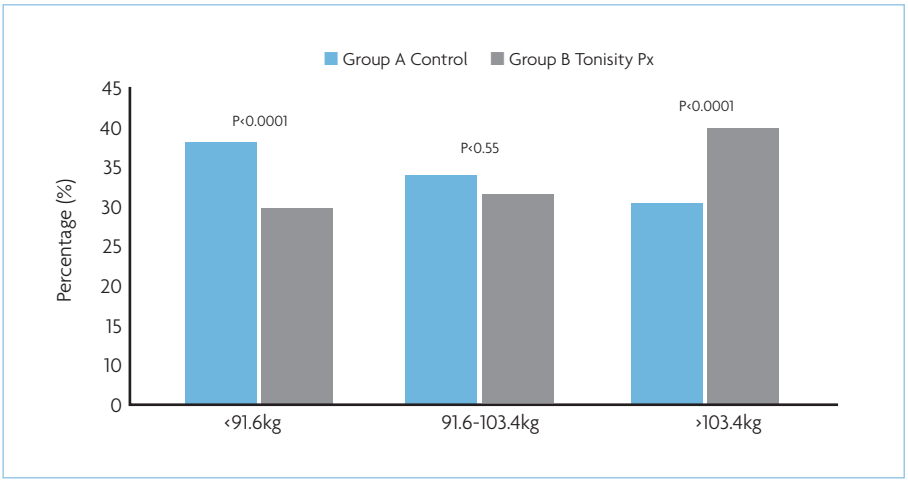

Fig. 1. Comparison of pig finishing weight.

The isotonic protein drink for swine can also be used at weaning to facilitate the transition and feed intake, by mixing it with feed, to obtain a gruel.

Feeding this gruel in the peri-weaning period has a positive impact on intake and weight gain, especially for medium-weight and light-weight pigs.

In a recent study involving 3,862 piglets, litters were allocated to one of two groups, control (Group A: 1,969 piglets) or supplementation with an isotonic protein drink (Group B: 1,893 piglets).

Group A litters received only pelleted creep feed from birth to weaning. Group B litters received the isotonic protein solution from days 2-8 of age, then three days before weaning, and finally for the first three days post weaning, mixed with feed.

All piglets were identified at day two with individual ear tags, and individual weights were recorded at birth, weaning, end of nursery and at 168 days of life.

The pre-weaning mortality was reduced from 14.2% in Group A to 10.9% in Group B, a 22.8% reduction consistent with results observed in multiple previous studies.

The mean weaning weight was not significantly different between groups. At the end of nursery, Group B pigs were 0.41kg (1.7%) heavier than Group A pigs (P= 0.10), and at 168 days of age, pigs from Group B were 3.08kg (3.2%) heavier than Control pigs. This difference was highly significant at P = 0.002.

A further analysis, evaluating how low (below 1kg), medium (1-1.6kg) and high (above 1.6kg) birthweight pigs, responded to the supplementation with the isotonic protein drink, demonstrated that all classes of pigs benefited from the treatment.

What is interesting is that this study does not concur with the commonly accepted theory that small pigs rarely catch up.

The results here show that they do. Group B also had less pigs finishing at <91.6kg, and more pigs finishing at >103.4kg (Fig. 1).

This confirms that all piglets, not just small and lightweight at birth, benefit from the specific nutritional support provided by the isotonic protein drink.

An economical analysis performed in this trial also demonstrated how the return on investment (ROI) when using a nutritional supplement in the farrowing house should not be gauged on the outcomes purely achieved at weaning, or by the performance improvements seen in small piglets.

In this case, the ROI was above 3:1 when considering pre-weaning mortality reduction only, and 5.9:1 when both reduced mortality and increased final weights were taken into account.

Conclusion

One of the challenges faced by the swine industry is the rise in pre-weaning mortality, which is mostly due to the increase in litter size leading to smaller piglets and less availability of colostrum.

By applying the concept of micro-enteral nutrition to pigs, an isotonic protein drink was developed.

This drink, Tonisity Px, delivers key energy-producing substrates to the enterocytes, leading to a positive impact on intestinal morphology and intestinal microbiota.

Another benefit of this novel approach is the possibility to stimulate feed intake around weaning, especially in smaller piglets, by using a gruel obtained by mixing the solution with feed.

Extensive research has shown the ability of the isotonic solution to stimulate the intestine in that early life window of opportunity and to provide the potential for reduced pre-weaning mortality and accelerated growth in the post-weaning and fattening stages. ■

References are available from the author on request