Early intervention makes a real difference

MATHIEU CORTYL* explains that an isotonic protein drink nourishes the piglet's gut from the very start – to build a better gut, helping pigs through the weaning period.

What is gut health?

Almost every day, we hear or read about 'gut health' in animal husbandry, and in particular swine production. However, it is still unclear what gut health means, how it can be defined, and how it can be measured. Ask any veterinarian, and they will probably tell you that a healthy gut is related to the absence of disease, while a producer will certainly focus on how gut health positively impacts performance.

In reality, the concept of gut health covers several aspects of the gastrointestinal tract, such as the effective digestion of feed associated with the fast absorption of nutrients, the absence of diseases at an intestinal level, "good" and stable intestinal microbiota and a well-established immune status. Each of these contribute to a state of well-being for the animal and better performance observed by the producer.

Intestinal mucosa development

The intestinal mucosa – especially the small intestine - serves two crucial functions – to absorb nutrients and act as a barrier to pathogens. Any damage or malfunction in the intestinal mucosa will be associated with an increased risk of infection, as well as immune-mediated illness. The first opportunity for developing a robust intestinal mucosa and good gut health starts at birth. However, the modern piglet faces many challenges in the first weeks of life. Piglets are born with a relatively undeveloped gut, which grows rapidly immediately after birth. A piglet's intestine must develop in 3-4 weeks as much as a

foal, calf or human intestine would ordinarily develop in 6 months. Studies have shown that the total surface area of a piglet's small intestine doubles by day 10, and the number of enterocyte cells (absorptive cells that line the villi of the small intestine) doubles in the first 3 days. This growth requires substantial amounts of nutrition and energy that are not always available from the sow in modern production systems. Piglets do not always get access to (or do not consume) enough colostrum or milk in the farrowing house. Even during short periods of starvation that occur during weaning and transportation, the small intestinal mucosa quickly atrophies, with negative effects being visible within hours of food withdrawal. The lack of nutrients in the intestine can disrupt the barrier functions of the gastrointestinal tract, resulting in gut atrophy, luminal starvation, bacterial translocation, and impaired immune functions. By feeding the intestinal cells, it is possible to preserve the integrity of the intestinal barrier, which is key to maintaining gut health.

Isotonic protein drink

By fine tuning previous knowledge in both human and canine nutrition, a new way of targeting the intestinal cells and boosting the survival of all piglets has been found. It comes from offering a pleasant-tasting isotonic protein drink Tonisity Px to the pigs from an early age. The drink is made from a protein-rich proprietary powder, mixed with clean water. Detailed studies, in more than 30 countries and on around 100,000 piglets, have demonstrated its booster effect in piglets given access to the solution out of an open bowl from the second day of life until Day 8, with a further benefit to their growth when given during a six-day period around weaning time.

Positive effects on gut health…

In initial trials, the Tonisity R&D team wanted to demonstrate the effects of this new and unique approach at the intestinal level. Several trials indicated that with this strategy, it is possible to significantly increase the size of intestinal villi, and, more importantly, further increase their surface area after weaning. In a series of recent studies conducted at both Universities of Minnesota (USA) and Lavras (Brazil), it was shown that the administration of Tonisity Px between days 2 and 8 of life improved the intestinal microbial profile in piglets, by increasing the abundance of beneficial bacterial populations (*Lactobacillus, Bacteroides, Veilonella, Oscillospira and Ruminococcus*) and reducing potentially-pathogenic bacterial populations (*E. Coli, Clostridiales, Helicobacter, Spirochaetaceae*) and bacteria with variable roles (*Prevotellaceae*). Development of a healthy microbiome in early life can modulate the immune system and provide lifelong benefits, and this study showed the favourable effects of Tonisity Px on the microbiome.

Table 1: Piglet performance – Taiwan.

	Control	Tonisity Px	Difference (%)
Number of piglets alive at Day 2	181	187	
Number of piglets per litter at Day 2	13.92	14.38	3.3%
Number of piglets per litter at weaning	11.69	12.85	9.9%
Mortality, %	16.0%	10.7%	-33.2%
Average weaning weight per litter, kg	76.08	83.77	10.1%
Average weaning weight per piglet, kg	6.51	6.52	0.2%

… that translate into improved production parameters

Extensive data from both producer and research trials across Europe, Asia, and both South and North America showed that an early intervention, during the first week of life, results in a significant reduction in pre-weaning mortality (PWM). On average, the PWM is reduced by 30%, which resulted in an extra 1-2 piglets weaned per sow per year. In individual herds, the improvement could be much more.

Decreased mortality seen across all birth weights

The data from the various studies show that all pigs benefit, not just the weaker ones or those that are runts or sick. A consistent finding of better piglet survival has been documented in all sizes of litters and across all birth weights.

In an independent trial conducted on a 2,500-sow commercial farm in Brazil involving 90 litters (1,080 piglets), the use of Tonisity Px between day 2 and day 8 led to PWM improvements from 11.8% to 8.5%, or a difference of 28.2% ($p = 0.02$). Mortality was also tracked according to the pigs' birth weight. The heaviest pigs, those weighing over 1.6kg at birth had the largest decrease in mortality – a remarkable 54% (2.6% vs. 5.6%, $p = 0.05$). Pigs in the mid-range of 1.2 - 1.6kg birthweight had a 29% reduction in PWM (8.7% vs. 12.3%, $p = 0.04$). These medium and heavy-birthweight pigs account for about 90% of all pigs born, so reducing their mortality has a great impact on productivity (Figure 1). Assuming a piglet value of €30 per head, the return on investment in this trial was more than 3:1. Several other large-scale trials have led to the same conclusions: the beneficial effects of Tonisity Px are not limited to low-birth weight pigs. Tonisity Px can help piglets of all weight classes.

How and why?

Accepting that Tonisity Px can have a significant impact on the pre-weaning mortality when given during the first week of life, the logical question is: why?

For answers, we can start with uptake. Widespread testing and farm use have confirmed that the solution is definitely consumed. Tonisity Px has a sweet-and-tangy taste that appeals to small pigs. Delivery in an open pan also helps because their natural curiosity draws them to it.

The pigs tend to drink the solution quickly so there is little to attract flies to the bowl. This is reinforced by the fact that the solution is less attractive to insects when compared with milk replacers, because it is more diluted.

Asian success story

"Tonisity Px is now available in several countries from the Asia Pacific region (Hong Kong, Japan, Korea, Malaysia, Thailand, The Philippines, and Taiwan) while the registration process is under way in other markets (Australia, China, Indonesia, and Vietnam) explains Mathieu Cortyl. We already received a lot of positive testimonials including trial data. As an example, Table 2. reports the results from a trial performed at Jhon & Jhon Inc., a breeding farm in the Philippines. They observed significantly less mortality (-32.7%), heavier piglets at weaning (+ 840 grams for the weight adjusted at 30 days) and a reduction of 53% in scouring incidence. Also, in Thailand, one of our customers has been testing Tonisity Px from days 2 to 8 of life on 226 litters (3,093 piglets). Because the litters are large, the farm manager usually gives a milk replacer supplement and they frequently experience diarrhoea issues after day 7. Their feedback is that after using Tonisity Px, there were just a few piglets with diarrhea, and they could reduce the medication costs. They also observed that Tonisity Px works well with piglets infected with porcine epidemic diarrhea (PED) virus. During a PED outbreak, the pre-weaning mortality was reduced from about 50%, down to 10%. In addition, the piglets recovered from PED in about 3 days. Previously, it took them a minimum 1-2 weeks to recover. In this farm, the isotonic solution has clearly improved the performance in the farrowing house, by reducing the pre-weaning mortality and increasing weaning weights. They recorded an extra 140 grams per piglet at weaning."

Figure 1: Number of extra pigs weaned per 1000 pigs born, per class of weight at birth (Total = 33 extra pigs/1000): Tonisity Px vs. control group.

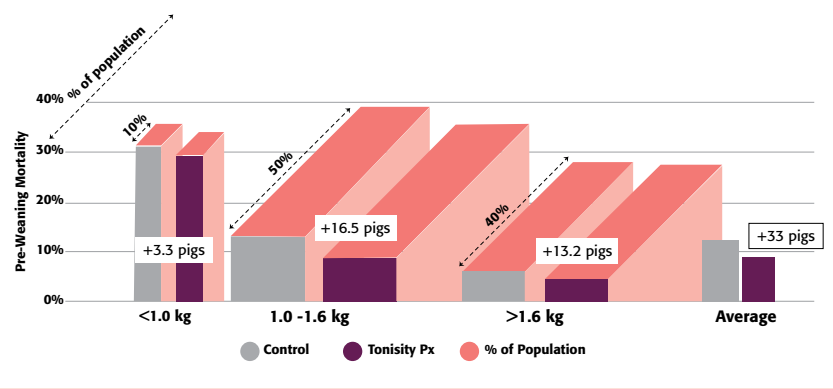

Table 2: Piglet performance - the Philippines.

	Control	Tonisity Px	Difference (%)
Number of litters	17	17	
Number of piglets born alive (total)	202	200	- 1.0%
Number of piglets born alive (per litter)	11.88	11.76	- 1.0%
Number of piglets weaned (total)	187	190	+ 1.6%
Number of piglets weaned (per litter)	11.00	11.18	+ 1.6%
Pre-weaning mortality, %	7.43%	5.00%	- 32.7%
Adjusted 30 days weaning weight (kg)	7.20	8.04	+ 11.7%
Litter weaning weight (kg)	79.2	89.9	+ 13.5%
Scouring incidence (cases)	41	19	- 53.7%
Scouring incidence (%)	20.3%	9.5%	- 53.2%

Possible mechanisms examined

In theory, the reduced pre-weaning mortality in the supplemented pigs could be explained by several different mechanisms. Could the extra intake of energy provide a likely explanation? Not here, because the standard 3% Tonisity Px solution does not have a high calorie content. Perhaps, then, Tonisity Px achieves its effect by correcting dehydration in the baby pigs? This too can be ruled out as a probable primary mode of action, because the quantities consumed per piglet equate to just 3-5% of the bodyweight of a 1-kilogram pig, although we should allow the small possibility that some piglets may be sub-clinically dehydrated and therefore could be helped by drinking.

The real explanation is that the effect seen is primarily due to the ingredient profile of Tonisity Px. This powder contains key amino acids and energy sources which start nutrition from the inside working out, helping the intestine work more efficiently. Tonisity Px is formulated to achieve what is known as an isotonic balance - meaning an equalised osmotic pressure between the solution and body cells, to ensure the ready absorption of nutrients and fluids. Many sports drinks for human consumption are formulated on a similar basis.

It is why we emphasise that Tonisity Px is the first isotonic protein drink for piglets, containing selected ingredients which nourish the intestinal cells (enterocytes) and support their efficient function. Indeed, Tonisity Px feeds the intestinal cells that are responsible for the absorption of nutrients.

Positive effects until slaughter

Maintaining feed intake around weaning is also a key step in preserving gut health. Besides a clear reduction in pre-weaning mortality when given during the first week of life, the Tonisity Px solution encourages feed intake by the piglet, especially when it is given around weaning. This facilitates the transition during this stressful period, with positive effects that persist up to slaughter.

This was demonstrated in an independent trial from Krakow Agriculture University in Poland. The

Tonisity Px solution was given from day 2 to day 8 of life (500 mL per litter and per day) and as a gruel before and after weaning. While the average number of piglets per litter and the average body weight at day 2 were the same in both experimental and control groups, it was observed that the piglets receiving the Tonisity Px solution were 290 grams heavier at weaning ($p< 0.001$) and increased their advantage up to slaughter, reaching the target weight one week earlier than the control group. Their feed conversion rate during the fattening period was also significantly better (2.74 vs. 2.79, $p=0.02$).

Furthermore, in a recent trial where more than 2,200 pigs were individually monitored and weighed, it was demonstrated that all pigs, small, medium, or heavy at birth, were heavier at slaughter (when compared to the respective control groups), if they consumed Tonisity Px in the farrowing house.

Taiwan trial

Another trial involving a total of 26 litters was conducted in a commercial 200 sow farm in Chiayi, southwestern Taiwan. During the first week, piglets from the control group received a milk replacer while those from the experimental group has access to Tonisity Px (500 mL per litter and per day on days 2-8). After the first week, both groups had access to a creep feed until weaning at 25 days of age. There was a clear effect on pre-weaning mortality which was reduced by 33.2% (10.7% vs. 16.0%). The average weaning weight per piglet was comparable for both groups which indicates no benefit for the milk replacer. As a result, the average weaning weight per litter was 10% higher with Tonisity Px.

Conclusions

By applying the concept of micro-enteral nutrition to pigs, Tonisity Px improves gut health, especially in pre-weaning pigs. This novel isotonic protein drink delivers key energy-producing substrates to the enterocytes, leading to a positive impact on nutrient absorption and intestinal morphology and, as a consequence, pre-weaning mortality is significantly reduced. Another benefit of the micro-enteral nutrition approach is the increase of feed intake and weight gain around weaning and during other stressful events, leading to faster growth up to slaughter, and resulting in a clear and positive impact on the economic performance of the operation. Ensuring gut health is a multi-faceted challenge which needs to start in the farrowing house. AP

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