



Gut Health Get It Right from the Start

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Over the past few years, the term ‘Gut Health’ has been increasingly used in animal husbandry, 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 he or she 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.

The intestinal mucosa – especially the small intestine – serves two crucial functions – to absorb nutrients and serve 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 even in the first week of life. Piglets are born with a relatively undeveloped intestine which grows tremendously right after birth. A piglet’s intestine must develop as much 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) sufficient amounts of 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 (*Jenkins and Thompson, 1994*). 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 (*Strodtbeck, 2003*).

Various strategies are used to try to overcome the key stress points of production – pre-weaning mortality, post-weaning diarrhoea and long-distance transportation.

Milk replacer, electrolyte solutions, and quick-start drenches are all used by producers to give extra energy and fluids to piglets. Antibiotics, probiotics, prebiotics and plant extracts are all used in an attempt to modify the intestinal microflora. However, none of these strategies actually improve the essential function of the enterocytes, which are the engines responsible for absorbing nutrients. A more focused approach called ‘micro-enteral nutrition’ aims to feed the intestinal cells themselves and help those cells to do a better job of absorbing any available nutrients (*Firth, 2016*).

By feeding the intestinal cells, the integrity of the intestinal barrier is also maintained which is key to maintaining gut health. Micro-ental nutrition is the delivery of small amounts of water, electrolytes, and readily absorbed nutrients (glucose, amino acids, and small peptides) directly to the gastrointestinal tract. (Devey, 2010).

These simple nutrients are delivered in solutions that are absorbed, and utilized directly, by the enterocytes to do their essential work – which is to absorb all of the other nutrients that the body needs. Micro-ental solutions generally contain very simple sugars and single amino acids or small peptides and are also typically isotonic, with an osmolarity of about 300 mOsm/l. This ensures that they are quickly absorbed without creating further sodium or water loss (Firth and Howie, 2012). Such solutions have been successfully used to manage sick animals, particularly in the

One of the most visible impacts is the reduction of pre-weaning mortality

case of diarrhoea or other digestive disorders in dogs. A novel approach, combining previous knowledge in both human and canine micro-ental nutrition, has resulted in the development of an isotonic protein drink for swine, “Tonisity Px”. This innovative solution is preferably delivered in open pans to facilitate the pigs’ natural curiosity and remove the learning and tactile barriers to drinking caused by mechanical nipple drinkers.

Furthermore, this drink, being very attractive, is consumed in significant volumes, even by piglets less than one week old (Firth *et al.*, 2017 a). By feeding the enterocytes,

Tonisity Px has a positive effect on gut health and brings several clear benefits to the swine producer.

One of the most visible impacts is the reduction of pre-weaning mortality.

A recent meta-analysis of 21 trials across Europe, Asia and the USA, involving 17,725 piglets, showed the positive impact of the Tonisity Px solution on pre-weaning mortality, when given to piglets from day 2 to day 8 of life, at a rate of 500 ml per litter each day. On average, a 27.5% reduction

in pre-weaning mortality vs. controls (8.80% vs. 12.14%) was observed, which equals +0.5 pigs per litter or +1.2 piglets per sow per year. The reduction of mortality was most likely due to the fact that the protein and amino acid profile of this isotonic protein drink delivered key energy-producing substrates to the enterocytes, leading to a positive impact on intestinal morphology and nutrient absorption. Indeed, histopathology analysis revealed that piglets receiving the drink from Days 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 (see Figures 1 and 2). Those pigs also tended to have superior intestinal mucosal thickness (Firth *et al.*, 2017 b).

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 if it is distributed around weaning. Maintaining feed intake around weaning is also a key step in preserving gut health.

By encouraging feed consumption around weaning, Tonisity Px facilitates the transition during this stressful period, with positive effects that persist up to slaughter.

This was recently demonstrated in an independent trial using a total of 1,034 piglets from 78 litters, which was supervised by Dr Tomasz Schwarz from Krakow Agriculture University, Zootechnics Department in Poland (Schwarz *et al.* 2017). In the experimental group, 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 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, $P = 0.02$).



Conclusion

By applying the concept of micro-enteral nutrition to pigs, Tonisity Px was developed to improve 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.

Development of good gut health is a multi-faceted challenge which needs to start in the farrowing house.

Figure 1:
Intestinal Villi in the Pre-Weaning Phase

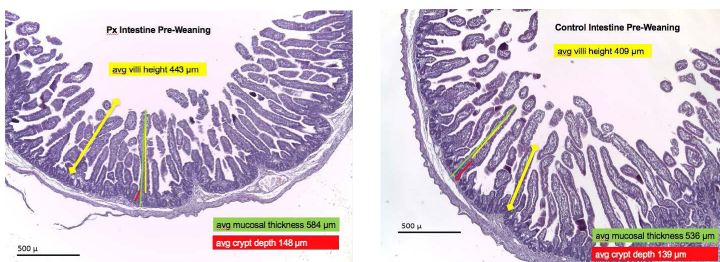
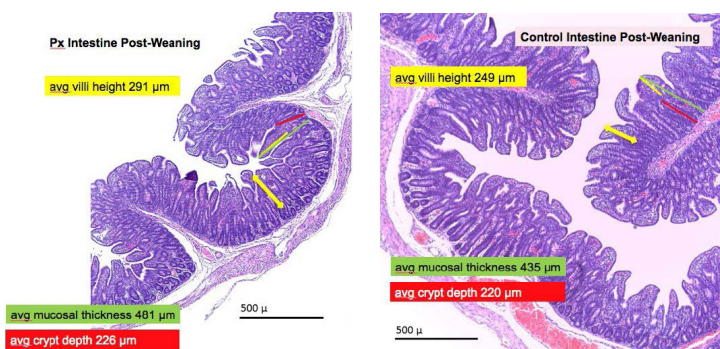


Figure 2:
Intestinal Growth of Villi in the Post-Weaning Phase



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