Trust the Gut and get a healthy start with piglet

By Mashilo Phosa (Chemuniqué RSA)

Protecting the pig starts with the gut. The development of the gut immunity can dictate the response of the pig to future pathogens. For pig producers, there are several ways to reduce the stress load of the young pig, including starting with a better understanding of the dynamics of the gut and its essential role to the immune system. The gut wall can be considered as a "first line of defence" for bacteria, toxins and endotoxins. If this defence is reduced, piglets are more susceptible to infections, which may lead to a leaky gut and consequently diarrhoea, as well as other gut health related problems.

Producers and veterinarians alike are being challenged to reduce antibiotic use in pig production. There will be health challenges at times in which the welfare of the animal will be dependent upon antibiotic treatment.

One important component in setting a piglet up to thrive in the nursery is managing gut health. This starts as early as day 1 in the farrowing house as the piglet suckles for the first time. This is when the microflora of the gut are being established. The good bacteria in the gut play an important role in the development and function of the immune system. It is worth considering if your management strategies are facilitating or disrupting that process.

Part of gut integrity or gut health refers to the ability of the gut to remain impermeable to bacteria. Tight junctions present in the small intestine play a role in maintaining gut integrity. When compromised, bacteria are able to pass from the lumen of the intestine and into the bloodstream, which opens the pig up to infection. Dr. Adam Moeser of Michigan State University has done research comparing the gut health of piglets weaned on day 28 vs. day 18. His data would suggest that the 28 day weaned piglets maintained better tight junction function and gut integrity. These piglets had a less severe response to an *E. coli* challenge and a more robust immune response post-weaning. An 18-day old piglet will have more mast cells present in intestinal tissue. When activated, these cells can cause changes in gut integrity which opens the door to infection.

It is no secret that the key to nursery performance and health is getting piglets started on feed at placement. Cattle veterinarians will talk about the importance of keeping cattle on feed, not only from a performance standpoint but also from a health standpoint. Any stress, whether it be environmental or nutritional, will cause an animal to be susceptible to infection. Some bacteria have a mechanism of sensing the onset of stress and have the ability to release toxins or shed a capsule exerting pathogenicity in response to that stress.

In summary, the establishment of gut health begins on day 1. Wean age plays a very significant role in maintaining gut integrity, immune robustness and the ability to withstand health challenges post weaning. And as already very well understood, the ability to start and stay on feed is necessary to maintain health.

The mucosal immune system provides the first immune defence barrier for more than 90% of potential pathogens in the gastrointestinal tract. It not only protects against harmful pathogens, but also helps tolerize (makes it so the body doesn't react) the immune system to dietary antigens and normal

microbial flora, which are essential for growth and development. The mucosal immune system develops in the first six weeks of life of the newborn pig (refer to Table 1).

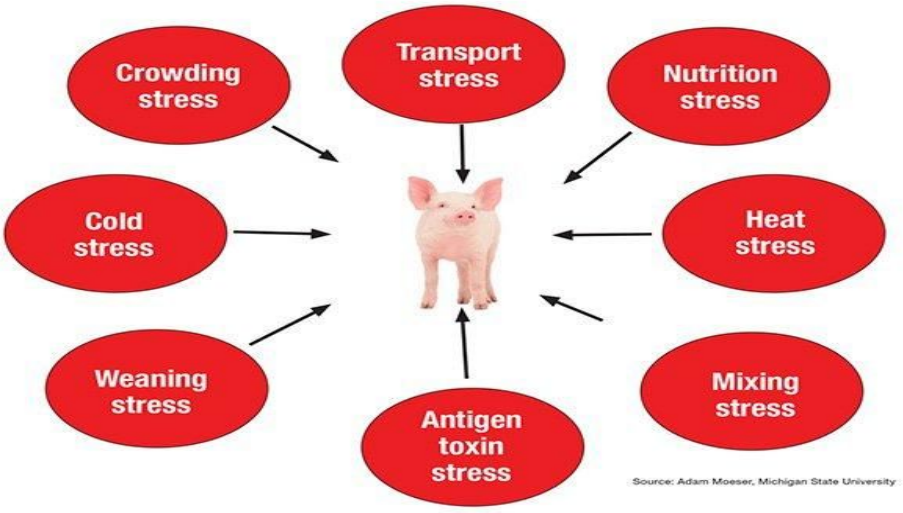
Table 1. The development of the mucosal immune system in the first six weeks of life of the newborn pig

Stage	Pig age	Immune status
1	Newborn	Rudimentary Peyer's patches Small numbers of muscosal APCs and T-cells
2	1 day to 2 weeks	Non-specific expansion of Peyer's paches and B-cells Appearance of some conventional, activated, helper T-cells Influx of MHCII + cells in lamina propria
3	2 to 4 weeks	Appearance of mature helper T-cells in lamina propria IgM+ B cells in intestinal crypt areas
4	4 to 6 weeks	Expansion of B-cell repertoire to IgA+ B cells in epithelium (intraepithelial T cells) and in lamina propria

Source: Christopher Chase, South Dakota State University

In order to understand how stress impairs the intestine's ability to defend us against pathogens and other potentially harmful factors residing within the intestinal lumen, it is necessary to have a basic understanding of intestinal defense mechanisms. The surface area of the intestinal tract represents the largest interface between the external environment and body. The lining of the intestine is composed of a single layer of epithelial cells called enterocytes. This lining of enterocytes or epithelium plays a critical but paradoxical role in intestinal health and function. The intestinal epithelium facilitates digestion and uptake of luminal nutrients and the absorption of large volumes of water on a daily basis. At the same time, the intestinal epithelium provides a restrictive barrier that prevents pathogens, acids, antigens, and toxins that are present in the lumen from crossing the epithelium and gaining access to body and the blood system. This important function is referred to as the barrier function of the intestinal epithelium.

Figure 1. Stressors in animal production



Source: Adam Moeser, Michigan State University

By understanding how stress causes intestinal disorders, we will know better the pathogenesis of important veterinary diseases. Whether it relates to food animals or companion animals, stress is an important component of intestinal disease that can result in economic losses and reductions in quality of life for these patients. In the pig, enteric disorders can often be linked to a previous production stress such as weaning, transport, and temperature changes of overheating or chilling.

Regardless of species, disease requires interactions between the pathogen, host, and environment—a concept referred to as the disease triangle. Intestinal disease research has focused on the interactions between pathogen and host but, thanks to the innate intestinal defense barriers of the host, the pathogenic agent alone is often incapable of causing disease. When these defense barriers are broken down, such as when an individual is undergoing stress—an environmental factor—disease results. The relationship between stress and intestinal disease appears simple, but the mechanisms are complex, involving signalling pathways from the central nervous system to the gut, which then alters gut defense properties. The signalling pathways between brain and gut are termed the brain-gut axis. In order to understand how stress impairs the intestine's ability to defend us against pathogens and other potentially harmful factors residing within the intestinal lumen, it is necessary to have a basic understanding of intestinal defense mechanisms. The surface area of the intestinal tract represents the largest interface between the external environment and body. The lining of the intestine is composed of a single layer of epithelial cells called enterocytes. This lining of enterocytes or epithelium plays a critical but paradoxical role in intestinal health and function. The intestinal epithelium facilitates digestion and uptake of luminal nutrients and the absorption of large volumes of water on a daily basis. At the same time, the intestinal epithelium provides a restrictive barrier that prevents pathogens, acids, antigens, and toxins that are present in the lumen from crossing the epithelium and gaining access to body and the blood system. This important function is referred to as the barrier function of the intestinal epithelium.

Zinc for example, is essential for normal intestinal barrier function and the regeneration of damaged gut epithelium dietary zinc effectively prevents or improves the loss of intestinal integrity during malnutrition ethanol-induced intestinal damage, chronic inflammatory bowel diseases and infectious diarrhoea supplemental zinc also reduces intestinal permeability of piglets during weaning. Therefore, a nutritional approach can be part of the solution in improving gut health in the wake of a ban on antibiotics.

References available on request.