

Finding the Balance by Harnessing the Power of Postbiotics

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Postbiotics can help maintain immune strength, alleviate environmental stress responses, modulate the gut microbiome, and can support gut integrity and nutrient absorption. Dietary inclusion of postbiotics can support the intestinal barrier contributing to highly productive, robust, and resilient animals (Zhao et al., 2024).

In modern swine farming, the pursuit of high productivity and efficiency has been a longstanding goal. However, this ambition is not without its challenges. Swine farmers face a delicate balancing act between maximizing production output and ensuring the long-term sustainability of their operations. This endeavor is further complicated by various factors such as changing consumer preferences, environmental concerns, disease pressures, and the demand to reduce reliance on antibiotics.

At the heart of this challenge lies the need to reconcile the demand for high-performance animals with the imperative for robustness and resilience within swine populations. While high productivity is essential for meeting the growing demand for pork, it must be achieved without compromising the health, welfare, and sustainability of swine-keeping systems. Striking this balance requires a holistic approach that considers not only short-term gains but also the long-term viability and resilience of the industry.

Achieving robustness in swine farming requires a shift away from traditional paradigms solely focused on maximizing productivity, shifting instead towards a more holistic and sustainable model. This model recognizes the interconnectedness of various factors influencing pig health and performance, including genetics, nutrition, management practices, and environmental conditions.

The future of the swine industry depends largely on the importance of reconciling high productivity and the strategies and technologies available to achieve this goal. Supporting gut health is key in that multifactorial approach to building sustainable production with more robust and resilient pigs facing challenges.

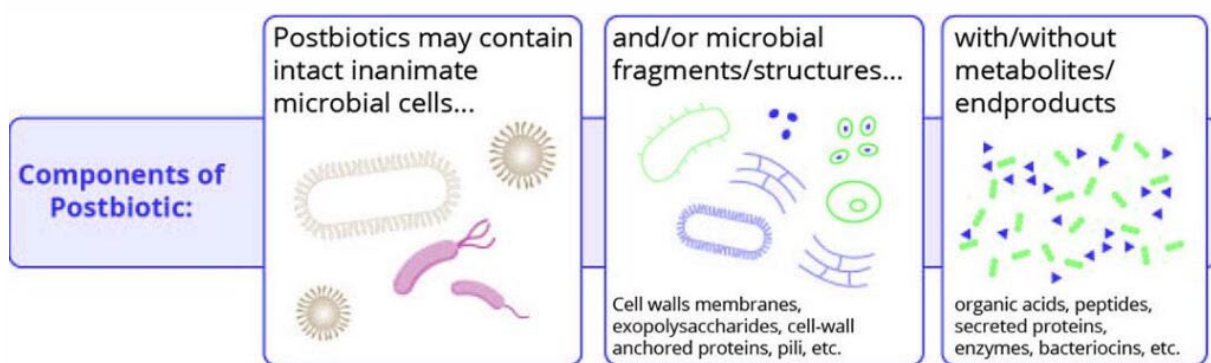
Importance of gut health and intestinal barrier

Gut health and the intestinal barrier are closely interconnected and crucial for pig efficacy and productivity. The gastrointestinal tract plays a role in digestion, nutrient absorption, and immune function. The degradation of feed into nutrients and their absorption is used to cover maintenance, growth or milk production, and immune system requirements. The gut barrier relates to the microbiota balance, which is composed of diverse beneficial bacteria and plays a role in maintaining the integrity of the intestinal barrier. These bacteria help regulate the immune response, support the production of mucus that protects the intestinal lining, and compete with harmful pathogens for nutrients and space. The intestinal barrier acts as a physical and immunological barrier, preventing the entry of harmful substances while allowing the absorption of essential nutrients. Tight junctions between epithelial cells regulate the permeability of the barrier. Their disruption, leading to increased intestinal permeability or “leaky gut,” can occur due to factors such as inflammation, environmental stress, poor diet, infections, and certain medications. Proper functioning of the barrier is essential for the gut-associated lymphoid tissue (GALT) including immune cells such as T cells, B cells, and macrophages which are responsible for appropriate immune responses against harmful substances or for maintaining immune tolerance.

Several dietary components are used to enhance gut health to support swine health. Amongst those, postbiotics appear as an innovative technology supporting gut health and host defense.

What are postbiotics

According to the International Scientific Association for Probiotics and Prebiotics (ISAPP), postbiotics are defined as a “preparation of inanimate microorganisms and/or their components that confers a health benefit on the host.” Postbiotics are widely known for their beneficial effects on various animals and humans. These are inanimate preparations from a controlled fermentation process that contain non-viable cells, various biologically active proteins, small peptides, oligosaccharides, vitamins, minerals, enzymes, and other unknown metabolites, conferring benefits to the host (*Figure 1*).



Source: The International Scientific Association of Probiotics and Prebiotics (ISAPP) consensus statement on the definition and scope of postbiotics. *Nat Rev Gastroenterol Hepatol* (2021).

Figure 1 – Illustration of different components of postbiotics.

Using postbiotics offers several advantages:

- **Stability:** they are stable as they do not require any storage precautions to maintain their effectiveness. They may be stored for years.
- **Safety:** composed of inanimate microorganisms, the sanitary risk of contamination of the plant/farm circuits is lowered.
- **Produced by highly controlled and standardized fermentation conditions,** their efficacy in the gut is independent of the intestinal environment.
- **Targeted effects:** they can be formulated to fit with the specific challenges animals are facing

Multiple benefits of using postbiotic compounds

Various postbiotic compounds have been demonstrated to alter multiple aspects of the local and systemic immune responses, the resident microbiota, the epithelial barrier functions, the systemic metabolic responses, and the systemic signaling via the nervous system in swine, poultry, ruminants, and even humans (*Salminen et al., 2021*). Many existing postbiotics are based on inanimate microorganisms belonging to bacteria or yeast. In livestock, the *Saccharomyces cerevisiae* fermentation product is the major one. When incorporated into the feed, postbiotics support health and may improve performance such as the growth, feed

conversion ratio of pigs, or sow productivity, increasing the number of born and/or weaned piglets and the individual or litter weight. During their farming cycle, the animals are exposed to multiple stress factors such as farrowing, weaning, dietary quality, feeding transition, heat stress, and infections. In those situations, postbiotics have been shown to address biological responses by modulating gut integrity, resulting in better nutrient digestibility and utilization. They are also beneficial in modulating the gut microbiome shift towards a more beneficial microbiota. Recently, one of our studies has shown the sow gut microbiota being more resilient facing the transition from gestation to lactation when fed with postbiotics. Directly and indirectly, because of their action on gut integrity, they may prime the innate immune response to have an effective accelerated adaptive immune response with a potentially improved humoral response to antigens and cellular immune responses to diseases (Figure 2). Consequently, the colostrum and milk quality are improved as well as the serum of piglets.



Figure 2 – Postbiotics – Benefits in Gut Health and Animal Production

Conclusion

Postbiotics can help maintain immune strength, alleviate environmental stress responses, modulate gut microbiome, and can support gut integrity and nutrient absorption. Dietary inclusion of postbiotics can support a sustainable swine industry promoting more robust, resilient pigs with performance and welfare.

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