SWINE MICROBIOTA

An adult pig's gut harbours 2kg of microorganisms. Find out more about the key role of these microorganisms in livestock performance and health in this series of short articles.

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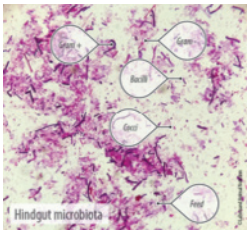
Meet the Microbes



The intestinal microbiota is defined as a complex community of micro-organisms of various species living in the digestive tract of animals. These microorganisms represent the largest reservoir of mutual microorganisms. They are able to interact with each other, with the external environment, and with their host. They play a key role in the host's digestion and defences.

• A complex ecosystem

▪ The swine gut microbiota encompasses a large and diverse population of bacteria.

▪ Recent studies have shown a common 'core' microbiota in pigs comprised of bacteria genera such as *Prevotella, Clostridium, Alloprevotella,* and *Ruminococcus*.

▪ This microbiota is established from the first days of the piglet's life from microorganisms present in the environment and through contact with the mother.

▪ Microbial diversity increases along the gastrointestinal tract. Different parts of the gut have specific roles in nutrient digestion and they host very specific microbial communities adapted to their micro-environment. For instance, major fermentation processes take place in the hindgut with a large population of bacteria species (Table 1).

Compartment	pH	Microbiota
Stomach	<3	10^4-10^5 bacteria/g
Duodenum-Jejunum	6.0-8.5	Up to 10^8/g after meals (10^4-10^5 between meals)
Ileum	7.0-7.5	10^7-10^8/g
Hindgut	6.7-9.0	10^9-10^{11} anaerobic bacteria and archae

Table 1. The estimated pH and microbiota content along the pig's digestive tract.

• A system opened to the external environment

The microbiota is influenced by numerous factors: diet, microbiological quality of the feed, physiological stress, use of antibiotics and farming management practices – to name just a few.

• A community in a relationship with the host

▪ A mutual relationship, or synbiosis, exists between the microbiota and the host: each individual benefits from the activity of the other.

▪ The microbiota acts on several digestive, metabolic and immune functions of the animal and can even mitigate the expression of some genes of the host.

▪ The swine gut microbiota plays a key role in digestion and host defences, and consequently on health and performance.

▪ It is a complex microbial ecosystem, adapted to the diet, physiological factors and site of the gut.

▪ This ecosystem tends to remain close to an equilibrium state, but can be disturbed by different internal and external factors, such as diet, environment or farming practices.

For a complete list of references and more information on gut health contact us on: **www.lallemandanimalnutrition.com**

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Key role in digestion

In swine, as in other monogastric animals, most nutrients are chemically digested and absorbed in the small intestine: proteins, lipids, and digestible carbohydrates. However, a big portion of the non-digestible carbohydrates will reach the hindgut untouched: this is when the microbiota comes into action. This is the fermentative digestion, or microbial digestion.

Potentially, 5-20% of the nutrients can be digested in the colon. In fact, the swine hindgut, especially in adult animals, could be compared to a fermenter, in the same way as a cow's rumen. Actually, we now know that many of the fibrolytic microbiota that are located in the rumen of a cow, such as *Fibrobacter, Rinococcus, Butyvibrio,* or *Prevotella* can also be found in the colon of pigs.

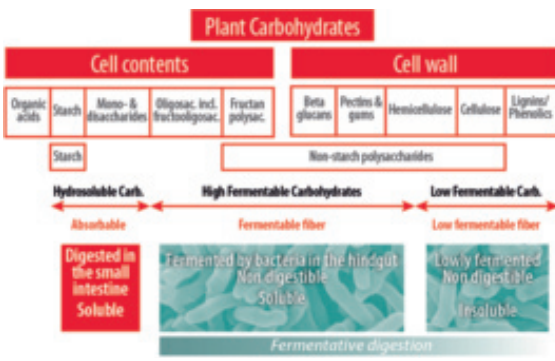
• A source of energy and nutrients

The microbial digestion represents a source of energy and essential nutrients for the animal:

- Fibre degradation leads to the production of Short Chain Fatty Acids (SCFA) that can be absorbed locally by the enterocytes and used as a source of energy for both the intestine and the pig.
- Certain carbohydrates (β-glucans, pectins) are fermented into lactic acid by *Lactobacilli*.
- *De novo* synthesis of some vitamins (group B and vitamin C), essential for the healthy functioning of the body.

• Even greater role in sows

When compared to piglets or fattening pigs, sows are even more adapted to benefit from microbial digestion. They are equipped with a more voluminous large intestine, and the digesta remains in the large intestine for 70-85% of the digestion time. This particularity confers sows with a much higher cellulolytic activity than young pigs for example. This explains why the digestibility of various components differs between growing pigs and sows, but it can also differ between individual sows depending on their microbiota composition and balance.



Digestion in the hindgut mainly relies on the microbiota: this is the fermentative digestion. A well balanced microbiota contributes to optimal fibre degradation and to the production of short chain fatty acids which are an important source of energy for the animal.

It also supports the good reabsorption of liquids in the hindgut and adequate digestive transit. It is key to optimal feed efficiency and performance.

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The guardian of pigs' immunity

The digestive tract is the pig's major site of exchange with its environment through feed and water consumption. It is also a major entry route for undesired microorganisms, such as enteric pathogens. This is why the gut is also a major site of immune surveillance: it is estimated that 70% of the immune cells of the body are found in the gastrointestinal tract.

The gut microbiota plays an important role at three levels of the gut barrier:

• Integrity of the gut lining

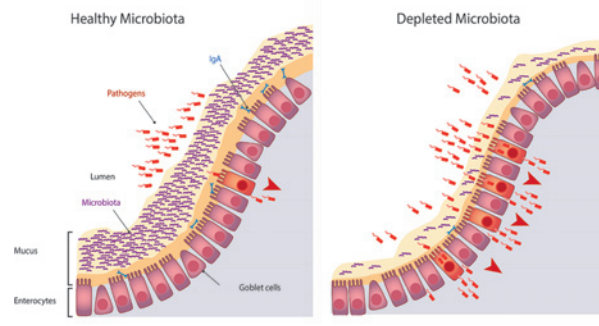
- Maintenance of gut villi and crypt.
- Protection of the epithelium, maintenance of the tight junctions.
- Modulation of the production of mucus by the epithelium.

• Competition with pathogens

- Establishment of a non-favourable environment for pathogen (acidification through lactic acid production, production of bacteriostatins).
- Competition with some undesirable microorganisms for nutrients and attachment sites.

• Immune system modulation

- Regulation of the pro- and anti-inflammatory responses.



A well balanced, healthy microbiota is a key to preserving gut health at each stage of the production cycle: the sow, the piglet (prevention of neonatal diarrhoeas), the weanling piglet, and the fattening pig.

Supplementation of the pig diet with selected probiotic micro-organisms, such as *Saccharomyces cerevisiae boulardii*, has proven benefits on each level of the gut barrier.

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