Nutrimicrobiotic: from piglet nutrition to piglet microbiota nutrition

Usually, micro-organisms are considered as pathogens against which we have to fight in order to destroy them: the systematic use of antibiotics in order to deal with diseases derives from this logic. Current bacteria have adjusted to this reality through genetic adaptation and they have gradually built resilience against these molecules: known as 'antibiotic resistance'.

by Florence Malécot, Groupe Techna, France. www.groupe-techna.com

It is important to manage the piglet's microbiota from an early stage (Fotolia).

Bacteria resilience has become a major social issue. A huge part of these molecules are similar whether they are used for human or animal medication.

A European law passed in 2011 aims to reduce the use of antibiotics in order to limit overall antibiotic resistance. To enter in a post antibiotic era, this law also intends to foster social change in the way we use antibiotics: that is no longer curatively but preventively.

To minimise the use of antibiotics, many studies have been undertaken in order to try to better understand and characterise the relationships between micro-organisms and microbiota. In fact, living species are an ecosystem composed of microbes.

This system needs to be well-balanced and treated in order to maintain a good host health. To achieve this aim, the microbiota is designed to fulfill the useful and essential specific functions enabling the host to survive.

Antibiotic alternatives: additives

There are several alternative solutions to antibiotics: that is to say a wide and varied range of solutions with different mechanisms and of various chemical nature are available such as organic acids, probiotics, prebiotics, antioxidants and essential oils.

Probiotics are live micro-organisms. When administered in adequate amounts, they provide the host with obvious health benefits. They act in a specific way on the digestive system and immune system and they also maintain a constant interaction with microbiota.

Prebiotics are nutrients used by micro-organisms in the intestine. They allow the beneficial bacteria population to develop and multiply.

This phenomenon also helps to prevent pathogenic bacteria from developing in the intestine. This action may be enforced by the use of organic acids, medium chain fatty acids and essential oils. Vegetal extracts, essential oils, antioxidants or beta glucans are also known to have a positive impact on the immune and oxidative status of the animals. The main challenge to make them easier to use and to be less dependent on in-feed antibiotics lies in understanding their patterns of action and evaluating their efficiency. What matters most is to choose the best technical and cost-saving combinations in order to fulfill these objectives depending on the context (sanitary, regulatory).

Environmental and nutritional factors

Intestinal microbiota can be modulated and influenced by genetic, environmental and nutritional factors, other than additives. It is important to control the use of additives in order to allow this utilisation with a nutritional strategy.

This feeding strategy, which is based on protein level, energy input and amino acid ratios, has a major impact on microbiota and also on digestive security.

When it is well-balanced, the piglet's intestinal microbiota highly contributes to improve its growth performance. It is important to remember that a newborn piglet has an immature digestive tract, which soon ends up being contaminated by the environment.

The main nutrients reaching the hindgut are fibres and the indigestible fraction of protein. Microbiota is directly involved in fibres digestion: the fermentation of fibres by the microbiota produces volatile fatty acids (butyrate acid, propionate acid, acetate acid).

These acids foster the growth of epithelial cells and the area of absorption, which, in turn, improves the nutrients digestion in the intestinal tract. In addition, the production of volatile fatty acids decreases the intestinal environment pH, which limits the development of pathogenic bacteria.

Therefore the fermentation of fibres has a positive action on the intestinal metabolism. At the same time, the fermentation of indigestible protein by microbiota releases toxics compounds (biogenic amines, ammoniac).

When there is a substantial quantity of protein, the indigestible part of protein increases and this, in turn, alters the

Continued on page 10

Continued from page 9
intestinal mucosal membrane. This phenomenon leads to malabsorption and increases fluids, causing diarrhoea.

To formulate a secured feed, we increase protein quality and decrease protein quantity and also control fibre nature (solubility, fermentability, viscosity, water holding capacity). When combined with additives, the feeding strategy contributes to well balanced microbiota: this means promoting beneficial bacteria and reducing damaging bacteria. All these factors end up having an immune action on piglets by containing digestive troubles.

Nutritional impact on microbiota diversity

Nowadays, scientists are studying closely the various populations of micro-organisms forming the animal's digestive tract.

Nutritionists continue to evaluate nutritional modulation responses on performance, but they also analyse their impact on the microbiota nature, piglet health and performance.

Characterising microbiota starts by qualifying its diversity. When referring to the fact that the microbiota diversity of each piglet increases with age, we talk about alpha diversity. On the other hand, inter-piglet heterogeneity decreases as piglets get older: this is called beta diversity.

The key is to manage these diversities: for example using exogenous enzymes improves hydrolyses of undigestible fractions and favours well balanced microbiota.

Eubiosis refers to the state of good balance which contributes to the homeostasis and good health of the host.

On the other hand, dysbiosis refers to qualitative or quantitative states of imbalanced microbiota which are a source of pathologies. To maintain this balance, one must examine the nutritional modulation, depending on the initial situation, which affects this diversity.

For example, the use of high level of zinc oxide in piglet feed prevents the natural diversification of microbiota after weaning and this generally leads to lower performances during the fattening period. Indeed piglets are more sensitive and more heterogeneous in the same group: zinc oxide changes the natural evolution of the microbiota diversity.

Medications result in weaker and less robust piglets because of their impact on the microbiota, which increases hygiene issues. Also, without this utilisation of zinc oxide and medication, new feeding strategies have been designed to ensure good piglet growth from birth: it needs to be more robust at the beginning of its life.

Sow feed impacts piglet microbiota, piglet health and performance

To improve piglet robustness, we have to study the impact of the sow on the progeny's microbiota and also on growth performance during the post-weaning period.

First results show that acting on sow feeding programs can change the piglet's microbiota, but that it is also possible to improve piglet feed efficiency by submitting sows to specific feeding programs.

This confirms the existence of a special link between the sow and piglets and also the importance of implementing a proper nutritional strategy for sows when aiming to improve piglet growth performance.

Microbiota has a notable role in nutrients absorption, in metabolic functions and in the immunity response. All these factors impact piglet feed efficiency.

So far, some studies and trials have demonstrated that is extremely important to manage the piglet's microbiota from an early stage.

Neglecting this aspect could penalise its growth performance. From now on, the new challenge is to contain the intestinal microbiota of piglets from birth and particularly if we consider the special link between the sow and the piglet. ■