# Probiotics, butyrate and gut health: part of the same system

The importance of managing gut health in animal production has increased immensely over the years. In tandem, the tools to do so have received extra attention as well, especially those focusing on supporting the microbiota. Probiotics are a good example thereof: viable micro-organisms which confer health benefits to the host, often via a multi-factorial mode of action.

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When opting for probiotics, it is essential to realise the specific characteristics of different segments of the gastro-intestinal tract (GIT). This includes understanding the corresponding microbiota at those different locations, as well as the specific characteristics required of probiotic strains intended to manage these.

To explain this further, the hindgut is a great example. In a normal situation, beneficial bacteria from the Clostridium IV and XIVa clusters heavily populate this distal part of the GIT. These bacteria affect immunity, gut health and overall production efficacy as they produce multiple metabolites, including butyrate.

This important short-chain fatty acid (SCFA) has a multifactorial function, and plays a big role in general animal health and development. It can be used as a primary source for energy production in colonocytes, whilst butyrate also acts as a cellular mediator in multiple processes, including gut tissue development, oxidative stress reduction and immune modulation.

However, making sure that there is sufficient butyrate in the hindgut is not always straightforward. The microbiota's butyric acid producing bacteria can rapidly diminish, especially when the animal is challenged during production. This change in microbiota can have multiple reasons, such as antibiotic treatments or an unwanted proliferation of pathogens.

Apart from disrupting natural processes that rely on butyrate, the absence of the SCFA also forms an indirect competitive advantage for multiple opportunistic pathogens.

An example of this has recently been described in peer-reviewed experimental research for salmonella, showing how the absence of butyrate can ultimately result in an accelerated salmonella proliferation.

## Different options of supplying butyrate

To counter and make up for the loss in butyric acid production, supplementing butyrate directly via the feed can provide some relief. However, recent research has indicated that regardless of which type of feed butyrate is supplemented, the majority of the butyrate usually does not reach the distal stages of the GIT. This is where Huvepharma's probiotic Clostridium butyricum comes into play, as the probiotic's characteristics and beneficial effects make it well-equipped for the task.

First of all, the C. butyricum strain is a spore former. A spore is a metabolically inactive form of the vegetative bacterial cell and extremely robust. In this form, the probiotic is able to pass the more hostile environment in the initial stages of the GIT, without loss of viability. Once the spore reaches a location with the right conditions, the spores germinate and yield active, vegetative cells.

Secondly, as C. butyricum is an obligate anaerobe, it will only germinate where oxygen concentrations are low enough for it to do so. Since the presence of oxygen decreases throughout the GIT, the conditions are just right in the hindgut for C. butyricum to germinate and exert its beneficial effect.

Last but not least, the unique probiotic strain is capable of producing significant amounts of butyric acid. In other words, the probiotic is capable of supplementing the animal with butyrate exactly where it is needed most, thanks to its unique characteristics.

The effectiveness of probiotic C. butyricum in regards to salmonella mitigation was recently confirmed on-farm. A commercial pig fattening farm in Germany historically experienced high salmonella titers at slaughter, despite using an all in/all out system with sanitation between batches.

Hogs arrived at 30kg (hybrids from the same origin farm), with blood analysis on 60 random samples of an initial group prior to slaughter showing 43 positive results.

The average salmonella titer was 54.81 OD and, as a result, the farm was classified as salmonella category III. This caused meat price deductions, negatively affecting the overall profitability of the operation.

To deal with the challenge, the next two consecutive batches of animals received dietary probiotic C. butyricum (Miya-Gold, $5x10^8$ CFU/g product, Huvepharma). The first batch received the probiotic at a level of 500g of product/mton of feed for the first week, with the dosage then reduced to 300g/mton of feed for the remainder of the fattening period. The second batch received again 500g/mton of feed, but only in the growing stage (30-50kg bodyweight). Before slaughter 60 blood samples were analysed from each batch, with samples considered to be positive if their titer exceeded a value of 40 OD.

Blood analysis of the first supplemented batch showed 21 positive samples, compared to the initial group's 43. The average salmonella titer was also lower, measuring 31.13 compared to the initial group's 54.81. This trend continued in the second supplemented batch, with only 16 positive samples. The average salmonella titer was 26.92, effectively bringing the farm down to a salmonella category II.

Supplementation with probiotic C. butyricum thus clearly mitigated salmonella prevalence, thereby confirming the probiotic's place in a wider salmonella programme.

## Versatile tools

The efficacy of feed additives to support animals during production has been well documented, especially for probiotics. When considering these versatile tools in a production system, it should be taken into consideration what the challenge is and if the probiotic at hand is equipped for the task.

Looking at salmonella mitigation with the help of probiotics, Huvepharma's Clostridium butyricum sticks out: its characteristics result in the probiotic being active at the right location, producing significant amounts of butyrate where it is needed.

Probiotics are by no means the one and only answer to reducing salmonella on-farm, but the right strain can offer a good and safe tool to fit in a holistic and sustainable programme. By doing so, both gut health and food safety can be supported, in a most effective and profitable way. ■