



# Tributylin: Healthy gut, happy piglet

Butyric acid has been shown to be beneficial to gut health and enhances digestibility in piglets. As the compound is malodourous, there have been many initiatives to overcome this problem with coating. What about presenting it as tributyrin?

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The definition of a healthy piglet has changed over time. In the past, health was defined as 'the absence of disease'. When talking about severe infectious diseases like Aujeszky's Disease (pseudorabies) and Classical Swine Fever, this definition can still be used. For other pathogens, however, this definition is less optimal, because they are present on most farms and in most cases pigs will be in contact with them anyway. Viruses such as Porcine Circovirus, type 2 (PCV2) and PRRS are omnipresent and the same goes for bacteria such as *E. coli* and *L. intracellularis*. Eliminating these diseases is impossible in most cases. Nowadays health is defined as the balance between the infection pressure on the pig and its ability to fight them with its own immune system. Therefore optimising health in pigs requires a multifactorial approach. On the one side it is necessary to reduce the pathogenic load in the pig facilities by using proper cleaning and disinfection protocols and biosecurity measures. On the other we need to enhance the

resilience of the animals. For many years this has been done by protecting animals against specific pathogens via vaccination. With vaccination the specific immunity is improved against one particular pathogen. For some diseases such as PCV2 and parvovirus this has been very effective. For others such as *Streptococcus suis* and brachyspira there is no good vaccine available. Other ways to improve the defence system of animals are needed for that reason. Ways that do not focus on specific immunity but on a-specific immunity and first line defence.

## Gut health

Within the feed additive industry there is growing attention for immune competence improving additives. The research on ways to influence gut health has yielded a lot of information. The developments of newer molecular tools for the global assessment of the gut microbiota and insights in interactions between microbiota and the immune system have exponentially increased the understanding of gut health. Despite the growing knowledge of what gut health is, there are still many questions unanswered. This is understandable because next to the exploration of

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the galaxy and our oceans, the mammalian gut is one of the most complicated and challenging research domains science is focusing on.

### Butyric acid

One of the more remarkable molecules affecting gut health is butyric acid. Its effects have been studied extensively and it has been proven to affect animal performance in physiological conditions. The effect can be explained by the increased nutrient digestibility, the stimulation of the secretion of digestive enzymes, a modification of intestinal microbiota and an improvement of the epithelial integrity and defence systems. In the digestive tract, butyric acid can act directly (upper gastrointestinal tract or hindgut) or indirectly (small intestine) on the repair and development of the gut wall cells. Butyric acid also effects bacterial virulence, both by direct effects on virulence gene expression and by acting on cell proliferation of the host cells. Applying butyric acid as a feed additive is especially beneficial when given to young animals, as it enhances performance and controls gut health disorders caused by bacterial pathogens.

### Sources within the animal

There are two important sources of butyric acid for piglets. The first is sow milk, which contains a lot of fat. Butyric acid is present in the form of triglycerides from which butyric acid is released in the small intestine. The second source is butyric acid produced by bacteria in the gut of animals. In older animals, where the microbiota is mature, the production of butyric acid is high. In young animals, however, the microbiota is less diverse and the butyric acid producing bacteria form only a small fraction of the total microbiota. The weaning of piglets combined with an immature microbiota creates a situation of low butyric acid availability in the nursing period. Supplementation of a butyric acid source at intestinal level could therefore help improve gut health in young animals.

Butyric acid has a long and strong reputation as a health stimulating molecule. Both in human and in veterinary science a large amount of research has been done on its anti-inflammatory and anti-

tumour effects. The problem however has always been the fact that it has a bad smell and that the product is rapidly absorbed in the stomach. To be able to work with the product in feed mills and to make the product available in the intestine of animals, the solution of a fat coating was invented in the 1990s. Since then, many products based on sodium butyrate and calcium butyrate with a fat coating up to 70% of the total product weight have entered the market. This technique deals with the smell issues and makes the product available in the small intestine. The downside is that the actual amount of butyric acid in these products is low, which has its effects on the price of these products when looking at the actual butyric acid content.

### Tributyryn

A new development in the field of butyric acid solutions is the triglycerin form: Tributyrin. Like the butyric acid present in sow milk, techniques have been developed to attach butyric acid to a glycerol molecule which makes it into a fat. Glycerol has room to have three butyric acid molecules attached to it through so called 'ester bonds'. These powerful connections are present in all triglycerols and they can only be broken by specific enzymes (lipase). In the stomach the tributyrin stays intact and in the intestine where pancreatic lipase is readily available the butyric acid is released (Figure 1).

As a result of the lipase action, two free butyric acid molecules and one monobutyryn molecule are formed. They are used in the intestine and taken up by the enterocytes. After transportation through the portal vein they are metabolised in the liver.

The tributyrin technique makes it possible to use butyric acid in an odourless way with the specific release at intestinal level. The butyric acid content compared to the coated salts is around 200% and the product is therefore much more concentrated than the coated salts. The formation of monobutyryn even adds extra gut modulating effects.

### Trial results

Swedish multinational Perstorp is a producer of tributyrin products, marketed under the name ProPhorce SR. The company has noticed an improvement in

Table 1 - Trial overview with tributyrin in piglets.

Spain, IRTA	Improved performance
ADG	3%
FCR	3.6%
<b>Germany, Farm trial 1</b>	
ADG	6%
FCR	3%
<b>Germany, Farm trial 2</b>	
ADG	4%
FCR	3.5%
<b>Brazil, Jaboticabal</b>	
ADG	7%
FCR	8.5%

various trials on the performance of weaned piglets receiving tributyrin. Outcomes from performance trials differ based on the situation in specific countries and farm circumstances, but in all cases the tributyrin supplementation has shown a positive effect on piglet performance (Figure 2).

Optimising gut health will be one of the biggest topics for the next years. It is known that use of Short Chain Fatty Acids (SCFA) can have a big impact on gut health, getting them past the stomach is what needs to happen. The technique of esterifying SCFA is an excellent tool to optimise gut health in a cost-effective way. **PP**

Figure 1 - Breakdown of butyric esters in the small intestine under influence of lipase.

