

Butyrate: An effective molecule for young birds

When chicks are hatched, they have an extremely challenging start. From this moment, the microflora should be in balance, to make sure a healthy and productive chicken can be raised. Butyrate has confirmed its value in achieving this.

By Stephan Bauwens, Innovad, Belgium

Today's livestock industry is known for its animals with high genetic potential. However, the potential is often not achieved due to different and complex challenges during the animal's lifecycle. One of the critical points is found at the border of the intestinal tube. This area is pivotal in selecting what can be absorbed and what should remain outside the animal's body. At the same time, the surface of the intestinal tract (300 times the size of the surface of the skin) is there to absorb nutrients. Keeping the intestinal tract healthy is therefore very important. Its relation with animal nutrition might be one of the most complex ones. But once you know how to positively influence the gut health, especially in young animals, the pay-off can be significant.

Understanding how the gut works

In order to obtain a high intestinal health status, possibly in combination with a reduced use of antibiotics, it is first of all important to understand how the intestinal system works. The intestinal barrier consists of different types of cells, of which

the enterocytes are the most abundant ones. These enterocytes are linked to each other by means of complex protein structures called 'tight junctions'. These structures have the major task of closing the cell lines and avoiding paracellular passage of bacteria, toxins and other undesired substances from the lumen to the inside of the body. The intestinal lumen is folded into villi and microvilli in order to increase the absorption area for digested nutrients. The length and the structure of these villi are key to assure optimal feed usage and obtain excellent feed conversion ratio (FCR). The intestinal microbiota consists of more than 500 different species, which live in direct symbiosis with the host. They provide energy to the intestinal wall, prevent colonisation by pathogenic bacteria and help to maintain the intestinal immune system. It has often been demonstrated that the status of the immune system is (partly) defined by the presence and the type of microbiota in the intestine.

Challenging start for young birds

Young birds, at the moment of birth, have an extremely challenging start. The digestive tract, including the gastrointestinal immunity, and the whole digestive process are immature. The microbial flora, and by consequence the production of volatile fatty acids, are inexistent and the environment is extremely challenging due to the immediate need for high performance and the presence of pathogenic bacteria. Straight after hatching, everything should be done in order to start the digestive engine and build in safety precautions as the birds will have only one chance to make a good start. A failure, such as retarded performance or development of imbalanced microflora is unacceptable as this will show off at the end of the production cycle.

Using coated butyrate in the diet

So what can be done to make sure the young birds get a good start? One solution is adding butyrate to the feed. Butyrate is an amazing molecule which has been used intensively for more than a decade in animal nutrition. Benefits of butyric acid include the anti-inflammatory effects, the support of long slender villi, the enforcement of tight junctions and much more. More confusion exists about the form in which butyric acid is added to the diet, referring to the place where butyric acid is

Table 1 - The effect of product 1 and product 2, Tylosin and sodium butyrate on the growth performance of the chickens.

Items	Treatments:					SEM	P-value
	Control	Tylosin	Product 1	Product 2	Sodium butyrate		
BW, g							
0 d	41.68	41.79	42.10	41.89	41.86	1.30	0.965
7 d	154.28b	150.32bc	151.23bc	166.39a	140.61c	10.90	<0.001
14 d	334.24c	412.90ab	423.33ab	436.10a	372.46bc	53.15	<0.001
21 d	697.53c	875.88ab	905.23a	875.33ab	764.22bc	117.02	<0.001
FCR, g/g							
0-7 d	2.20ab	2.66a	1.99b	1.92b	2.60a	0.46	0.001
7-14 d	3.64a	2.25b	2.03b	1.75b	1.78b	0.93	<0.001
14-21 d	1.65a	1.31b	1.34b	1.36b	1.39b	0.24	0.020
0-21 d	1.97a	1.61b	1.47b	1.40b	1.53b	0.49	<0.0001

released in the intestinal tract. We can all agree that the supplementation of pure sodium butyrate, which has a persistent and unpleasant smell, does not really have a major impact on the intestinal environment, as it is a water soluble component. A coated version is needed in order to reach the lower part of the digestive tract. Coating quality is an extremely important feature of the product and nutritionists should distinguish an 'odour control'- coating from a real functional protection. The first group of products is mostly characterised by a high concentration of salts of butyrate (>50%), where the only function of the coating is the elimination of the butyric acid smell. Within the products at lower concentrations, it is more difficult to distinguish the real functional coatings and more sophisticated tests are needed to evaluate the target release properties. An optimal coating is found when not more than 20% of the present butyrate is released in the first step of a validated simulation test. At the end of the test, it is important that all butyrate is released from its coating in order to avoid excretion of the active ingredient in the faeces (Figure 1).

Esterified forms of butyric acid

More recently, attention goes to esterified forms of butyric acid. Mono-, di- and tri-esters of butyric acid are chemically produced and are composed of a glycerol molecule and respectively 1, 2 or 3 butyrate molecules. Due to their similarity with triglycerides, they will automatically bypass the stomach during the digestive process, while the butyric acid molecules will be enzymatically released by lipase into the small intestine. Extremely important to guarantee the efficiency of the product are the type of esters provided, their stability and the know-how and the control of the esterification process. Free fatty acids, moisture and the typical smell of butyric acid can give a clear indication of whether the esterification process is complete and irreversible. One can easily understand the complexity of the intestinal system. Many scientists and veterinarians agree that one single non-antibiotic molecule will have its limits in order to control the overall situation.

Trials in poultry

Innovad has developed a concept and a synergistic approach to ensure a high intestinal health status. The product (Lumance®,



To make sure young birds get a good start, butyrate can be added to the feed.

hereafter called product 1) is a combination of esterified butyrins with medium chain fatty acids and plant extracts. A trial (May 2015) carried out at the Department of Animal Science of the Oklahoma State University looked at the value of this product in the early stage of broiler (Cobb) production. The birds received 1) an antibiotic free control diet, 2) Tylosin as an alternative growth promoter, 3) product 1, 4) a coated butyrate product (Novyrate®C, hereafter called product 2), or 5) an unprotected sodium butyrate product. As shown in Table 1, products 1 and 2 show significantly higher body weights compared to other treatments at the age of 7 days. Knowing that natural production of butyric acid in the GIT is only significant after 10 days of life, it clearly demonstrates the benefit of butyrate supplementation during this period. At the age of 21 days, product 1 and 2 showed the best performance results in terms of body weight and FCR. Regarding body weight, product 1 performed best numerically, which confirms the effective combination with the other active components in the formulation. The uncoated sodium butyrate performed inferior to products 1 and 2, which confirms the need for proven target released properties for butyrate based additives.

Multifunctional molecule with real benefits

The high genetic potential of today's production animals, combined with a clear and inevitable tendency to reduce the use of antibiotics, may result in an increased risk of enteric problems. This is a complex situation to manage. Butyrate, as a single component or in a synergistic blend, is a multifunctional molecule which can bring real benefits. The critical factor is the form in which the butyrate is supplied, as this will determine the indispensable intestinal release properties. It is clear that young animals benefit from such supplementation from the start and carry the effect till the end of the rearing period.

Figure 1 - The % of active ingredient loss at different stages is less when a coated product is used.

