Managing a healthy gut using acid based products

by Angela Riemensperger, Biomin Holding GmbH, Herzogenburg, Austria.
angela.riemensperger@biomin.net

The main function of the gut is no doubt the uptake of water and nutrients. However, the gut is not only about digestion it is also acting as a defence system. This defence system acts via three main routes.

First, the gut immune system produces specialised immune cells which can serve as a protection itself but can also produce antibodies. Secondly, the intestinal wall can serve as a protective barrier against harmful bacteria. Thirdly, the present microflora can protect against bacteria via the competition for nutrients and receptor sites on the gut wall.

Organic acids are known amongst other substances to alter the gut microflora. Organic acids have a specific antimicrobial activity. However, beneficial bacteria numbers seem to be not affected or may even be enhanced. This helps to promote eubiosis in the intestinal microflora in livestock. Even though organic acids have an antimicrobial activity, combating Gram-negative bacteria remains difficult due to their structure. Gram-negative bacteria possess an outer membrane, which provides the bacterial cell with an inherent resistance against antimicrobial substances. This outer membrane can be damaged by so called permeabilising substances.

Those substances make the outer membrane of the bacterial cell permeable to antimicrobial substances such as organic acids facilitating their entry into the bacterial cell. Once entering the cell the organic acids can exert their adverse effects on bacterial growth. The acids are exposed to near neutral intracellular pH which leads to the dissociation of the organic acids. While dissociating they liberate anions and protons into the cytoplasm, reducing pH. The attempt of bringing the pH back to a near neutral level consumes energy and can eventually stop the growth of the bacteria and may kill it. Furthermore, anions of organic acids remain trapped inside the bacterial cell and their accumulation becomes toxic to the bacteria as it inhibits metabolic reactions, reduces the synthesis of macromolecules and disrupts internal membranes.

Another substance having strong antimicrobial activity is cinnamaldehyde.

Cinnamaldehyde strongly targets the so called FtsZ protein responsible for the proliferation of pathogenic bacteria. Due to the presence of cinnamaldehyde the bacteria are not able to replicate resulting in a reduced bacterial load. Out of research it is known, that cinnamaldehyde targets only pathogenic bacteria, while sparing the beneficial bacteria, altering the microflora of the gastro-intestinal tract.

However, the combination of organic acids and cinnamaldehyde together with a permeabilising substance (Per4izer) was hypothesised to be a strong mixture more effectively combating pathogenic bacteria. This was shown in in vitro and in vivo studies.

Synergisms were found when combining an acid blend with cinnamaldehyde and also by combining this antimicrobial mixture of organic acids and cinnamaldehyde with the Per4izer.

This resulted in increased performance in livestock production due to enhancing the beneficial microflora and lowering the load of pathogenic bacteria.

The product consisting of a blend of organic acids, cinnamaldehyde and the Per4izer is adding a new natural growth promoter with strong antimicrobial effects to Biomin's product portfolio and was launched as Biotronic Top3.

Phytogenics: telling the story of performance

by Dr Ahmed Aufy, BIOMIN Holding GmbH, Herzogenburg, Austria
ahmed.aufy@biomin.net

It is no longer the story of antibiotics since phytogenic feed additives (PFAs) have proven themselves to be superior alternatives to the antibiotic growth promoters (AGPs) used in animal feed. However, it took far too long for producers to be practically convinced that PFAs can replace AGPs.

PFAs have been exposed to different challenges and each time, they showed a clear effect in improving growth performance as well as maintaining animal health. It is no exaggeration when we describe PFAs as coming to the rescue of animal producers after AGPs were banned, where PFAs have offered relief from different challenges after the AGP ban.

Instead of merely looking for a feed additive, producers have raised their expectations by looking for a solution(s). In the light of this, PFAs are required to improve performance by enhancing daily weight gain, improving feed conversion ratio and increasing livability. Furthermore, meat quality is a crucial factor that can influence production efficiency.

In reality, it is quite hard to offer PFAs as a package of solutions. But with increased knowledge about PFAs and their mode of actions, we are able to place the pullet right on target. In a recent experiment, a phytogenic feed additive (based on oregano, anise and citrus peel oil) was tested for its efficacy in improving growth performance as well as meat quality in broilers under highly optimised conditions.

In this trial, it was observed that the control group performed outstandingly, exceeding far above standards. Interestingly the PFA-fed group showed about 70g higher body weight than the control group in addition to a two-point improvement in FCR.

The problem of the high performing breeds is that they have an incredible metabolic rate which enables birds to achieve very high growth rates in short periods.

High metabolic rates always result in metabolic disorders like ascites and sudden death syndrome which gives rise to high mortality rates. Due to their fast growth, it was expected that birds will show high mortality rates (7.6% in the control group).

Not surprisingly, this high mortality was lowered by 50% in the PFA group which confirms their cardio-tonic effect. In addition, data on meat quality revealed that PFAs also improve muscle tenderness, juiciness and overall acceptance.

Now for the question that has never been answered: Do we really understand the term ‘optimal production’? Traditional feeding programs did not allow such brilliant ideas to flourish, thereby limiting production expectations.

With this new way of thinking, PFAs which have been used for thousands of years are finally put back on the track now that we have come to understand their mode of action. ■

One step ahead in multi-mycotoxin risk assessment

by Dr Radka Borutova, Product Manager Mycofix product line, Biomin Holding GmbH, Herzogenburg, Austria. radka.borutova@biomin.net

More than 50% of all 'free' mycotoxins (especially zearalenone and deoxynivalenol) are thought to exist in commodities in a masked form. Unfortunately, these conjugated mycotoxins are usually not detected by routine analysis.

Contrary to other approaches, an innovative multi-mycotoxin analyses method was recently developed at the 'hotspot of mycotoxin research' IFA-Tulln (Department for Agrobiotechnology, BOKU) to determine more than 320 mycotoxins and other metabolites simultaneously in one sample within 45 minutes! This is done through an accurate and validated analytical liquid chromatography–mass spectrometry (LC-MS/MS) method specifically developed for multi-toxin determination.

The issue of masked or conjugated mycotoxins in feedstuffs and their potential negative impacts on animal performance has been a much discussed topic among the scientific community.

Conjugated or masked mycotoxins first caught the attention of researchers because clinical observations in animals in some cases of mycotoxicoses did not correlate with the low mycotoxin content determined in the corresponding feed sample. Masked mycotoxins are mycotoxins with altered chemical structures. Proteins and glucosides, for example, can be bound to mycotoxins by plants growing in the field, a strategy that protects the plants from foreign compounds. In rare cases, some mycotoxin conjugates can be excreted directly by fungi (for example 3-acetyl-deoxynivalenol, 15-acetyl- deoxynivalenol or zearalenone-4-sulphate by Fusarium sp.). One of the most important advantages of the LC-MS/MS method is that it is capable of detecting normally undetected masked mycotoxins which may escape current methods of mycotoxin analyses. This technique, which covers a wide range of different mycotoxins, has already been successfully applied in practice and used to provide an insight into mycotoxin exposure through the analysis of samples submitted for more than 320 different mycotoxins and metabolites within two runs (45 mins in total). Up to now, about 35 different feed samples have been sent to the research lab by Biomin for analysis using this innovative method. More than 60% of these samples contained, among others, mycotoxins like nivalenol, deoxynivalenol-3-glucoside, aurofusarin, moniliformin, enniatins, zearalenone, beauvericin and deoxynivalenol. This leads to the question of the possible effects that 'exotic' mycotoxins and co-contamination of feedstuffs with more of these mycotoxins at the same time, might have on animals. It was recently concluded that attention should be paid to the toxicological impact of mycotoxin mixtures, including less researched fusarium mycotoxins like culmarin compounds and enniatins, as there are practically no data on their toxicity and modes of action.

The potential of LC-MS/MS for high throughput multi-mycotoxin analysis will have a strong impact in the future trends of mycotoxin analysis. Further research is necessary to gain more information on the occurrence, co-occurrence and possible correlations of lesser known mycotoxins in animal feeds. Moreover, further toxicity studies are required to gain sufficient data on the impact of these toxins on animals' health and performance, and to evaluate their possible effects in the field. ■

References available on requestt

The role of these mycotoxins in

Mouth lesions and black tongue in poultry

by Andrew Robertson, Poultry Technical Manager,
Biomin Holding GmbH, Herzogenburg, Austria.
andrew.robertson@biomin.net

The condition described as black tongue was first reported by field veterinarians working in South and Central America in 2001 (Gonzalez-Escobar, 2001).

The condition occurs with necrosis of the tongue to varying degree. It often affects the very tip of the tongue, but can be of varying sizes.

This new condition differs from niacin hypovitaminosis in that there is no inflammation of the oral cavity or oesophagus but affects just the anterior part of the tongue.

Trichothecenes implicated

Whilst the etiology of the condition has not been verified it has been suggested that type A trichothecene toxicosis could be implicated in this condition and where it occurs, mycotoxin analysis for this type of trichothecenes should be considered as part of the diagnosis.

The trichothecenes group of mycotoxins is the largest group of mycotoxins comprising more than 217 different molecules, many of which are yet to be studied for their toxicity and effects in poultry production.

They are 'field' mycotoxins produced on the growing grains prior to harvest mainly from Fusarium spp moulds which are prevalent on a worldwide basis. F. graminearum, F. culmorum and F. poae are the main cereal-based Fusarium spp to produce trichothecene mycotoxins, which are subdivided into type-A and type-B groups.

Type A trichothecenes are among the most toxic of the mycotoxins to affect chickens and the group comprises of T-2 toxin, HT-2 toxin, 4,15-diacetoxyscirpenol (DAS) and neosolaniol. Of these DAS is the most toxic with an LD50 of 2.0mg/kg in day-old chicks.

Diaz (2002) studied the effect of DAS on growing chickens at 1.0 and 2.0mg/kg inclusion rates and noted necrotic lesions on the tongues of the birds similar to those reported by field veterinarians at both levels of DAS inclusion.

In an earlier experiment in laying hens, with both DAS and T-2 toxin, lesions were reported in the buccal cavity and on the tongue but no mention was made of any necrosis of the tongue (Diaz et al 1994).

However, lesions were seen to develop in some birds after only 24 hours of being fed contaminated diets (8/30) and an additive effect with regards to beak/tongue lesions was seen between DAS and T-2 toxin.

Effects of toxin reduced

In the 2002 study, Diaz incorporated Biomin Mycofix into the experimental diets and found that it did reduce the effects of the toxin with regards to growth rate and feed efficiency especially at the lower contamination rate.

However, beak and tongue lesions were seen in all groups leading to the suggestion that the negative effects on growth are not caused by the lesions but by the systemic adsorption of the mycotoxin.

Finally, only accurate feeding of poultry in combination with continuous mycotoxin risk management is the key to managing the optimal performance of the livestock business. ■

Latest fumonisin worldwide survey results for 2012

by Karin Naehrer, BIOMIN Holding GmbH, Herzogenburg, Austria
karin.naehrer@biomin.net

According to the Biomin Mycotoxin Survey – conducted yearly since 2004 – more than 60% of all feed worldwide tested positive for the occurrence of mycotoxins with fumonisins (FUM) emerging as one of the most important.

As fumonisins are relevant feed contaminants worldwide, it is of great interest to survey their occurrence. Moreover, fumonisin awareness has increased over recent years due to the proven impact on livestock performance.

Fumonisin producing Fusarium proliferatum.

Climate in general is the main factor influencing the life cycle of all mycotoxin producing fungi. Therefore, there are regions in the world where fumonisins are occurring more frequently as well as at higher contamination levels than in others.

In the year 2012, 55% of all samples analysed tested positive for fumonisins which represented an increase of 5% in comparison to 2011. About 30% of all samples were contaminated with FUM levels above 750ppb and a maximum value of 42,120ppb was found in a corn sample from Malaysia.

Corn was the most extensively tested commodity and average levels found for the investigated mycotoxins were similar or higher than those observed in 2011. FUM was the most prevalent mycotoxin in 86% of the tested samples, a level which was remarkably higher than in the previous year (71%).

Not only was the percentage of positive samples higher, the average contamination level found in all samples analysed was observed to increase from 1,379 to 1,715ppb.

Fumonisins were also greatly prevalent and were found to occur in 68% of the investigated finished feed samples. In 50% of all cases more than one mycotoxin was found in the same ingredient or feed.

Fumonisins also frequently occur in combination with other mycotoxins like aflatoxins or also deoxynivalenol.

The high prevalence of fumonisins in feedstuff demonstrated the necessity of monitoring these mycotoxins on a regular basis.

Biomin has developed effective mycotoxin risk management tools to minimise the costs and losses associated with the presence of these toxins in animal feeds. ■

Fig. 1. Worldwide distribution of fumonisin contamination by risk levels in 2012: % of samples in different contamination categories (from < level of quantification (LOQ) to > 20,000ppb fumonisins).