Gut health for a brighter future

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A balanced gut microflora protects poultry of all ages from colonisation by pathogenic bacteria. With the phasing out of antibiotic growth promoters, the synergistic action of probiotics and prebiotics in a multi-species, host-specific feed additive has proven to be efficacious in improving poultry health and performance, and increasing producer profits.
For decades, antibiotic growth promoters (AGPs) have been used in livestock production to prevent poultry diseases and improve production performance in many parts of the world. Nevertheless, the use of antibiotics in sub-therapeutic or therapeutic doses, arguably, has led to an increase in antimicrobial resistance in birds. In addition, AGPs disturb the microflora balance within the birds’ gastrointestinal tract (GIT) and as a result, performance may not match producer expectations. Moreover, public health concerns and demands for drug residue-free products have led to a complete ban on AGPs in the European Union since 2006. The demand for alternative feed ingredients, especially in the EU, has increased.

**Probiotics that protect**

One of these alternatives is the use of probiotics, which can be defined as a live microbial feed supplement that beneficially affects the host animal by improving its microbial intestinal balance. The efficacy of probiotics in stabilising the GIT microflora and increasing broiler growth performance has been well documented. Probiotics could exert this beneficial action by competitively excluding pathogens, enhancing feed intake and digestion, producing antimicrobial substances and reducing the GIT pH, in addition to having immune modulating and anti-inflammatory effects.

The protective ability of probiotic bacteria, commonly known as competitive exclusion (CE), was first described by Nurmi and Rantala who demonstrated that introducing mixed bacterial preparations from the caecal contents of healthy adult chickens can protect young birds from *Salmonella* infection. Some probiotic species such as *Lactobacilli*, *Bifidobacterium* and *Enterococcus* are found to increase the jejunal villi height-crypt depth ratio. This increases the absorption surface of the intestinal tract and subsequently improves feed efficiency and growth performance.

The effect of probiotics in growth promotion can also be explained by their ability to reduce the challenge posed by pathogenic bacteria and their toxins within the birds’ GIT. Consequently, energy is preserved as immune cells are not mobilised to fight pathogens and fewer resources are needed to repair damaged tissue.

There are many ways to further improve the efficacy of probiotics. These include the selection of several efficient strains that work synergistically together and the inclusion of prebiotics. Prebiotics are defined as non-digestible food ingredients that beneficially affect the host by selectively stimulating the growth or activity, or both, of one or several beneficial bacteria in the GIT.

**Suitable strains for PoultryStar®**

The product development process started with the isolation of intestinal bacteria taken from the gut of several healthy chickens. This provides a rationale for their safe use as a feed additive for poultry. To obtain the most efficient strains, different strains were selected from different parts of the GIT from chickens of different ages and genotypes.

A pool of diverse aerobic, facultative anaerobic and obligate anaerobic gut bacteria was isolated out of four main intestinal compartments—the crop, jejunum, ileum and the cecum—using a wide variety of conventional microbiological cultivation techniques. Pure cultures of isolates were stored for further investigations and thoroughly characterised with regard to their metabolic properties, growth and fermentation performance, adaptability to industrial processes, stability in the end product and inhibitory activities.

**Evaluating suitable strains for PoultryStar®**

The most promising strains were evaluated for important probiotic criteria such as adhesion to intestinal cell walls, inhibition of pathogens, range of metabolic
end-products, fermentation performance, stability against acids and bile salts, storage stability and safety status.

In order to investigate the adhesion ability of various isolates to intestinal cells, a tissue culture test system was used. The results clearly showed the ability of several isolates to attach to intestinal cells in vitro. A co-cultivation agar plate assay was used to test the isolates for their ability to inhibit the growth of pathogens like *Salmonella Enteritidis*, *Salmonella Typhimurium*, *Salmonella choleraesuis*, *Campylobacter jejuni*, *E. coli* and *Clostridium perfringens*.

Several isolates had the ability to inhibit pathogenic strains and the results showed that the inhibition potential of single strains against the pathogens was quite different. Based on these results, it was decided to combine a number of very promising chicken strains from different parts of the birds’ GIT to design a multi-species product. Besides the probiotic strains, PoultryStar® contains the prebiotic inulin which selectively stimulates the growth of beneficial strains.

**Critical appraisal**

Safety assessments were an essential phase in the development of the probiotic feed additive for BIOMIN. Each single strain of the final product was carefully evaluated for safety. Furthermore, an economic fermentation process with the highest quality standards for the production of the selected product strains was developed.

The efficacy of PoultryStar® in preventing a wide range of pathogenic conditions such as coccidiosis, necrotic enteritis, bacterial lameness, salmonellosis, in addition to improving performance parameters, have already been confirmed in several feeding trials worldwide.