Probiotics as an alternative for antibiotics in broiler nutrition

In order to guarantee the sustainable long-term availability of therapeutics, the use of antibiotics is restricted in animal feed, leading feed manufacturers to search for alternatives to enhance their product quality.

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Probiotics are defined as 'live micro-organisms that, when administered in adequate amounts, confer a health benefit to the host'. The use of probiotics to improve gastrointestinal health and to prevent various infections has been investigated for many years.

Although their mode of action is not always completely understood, it has been demonstrated that the use of probiotics has several health benefits such as:

- Balancing the microbial gut flora via competitive exclusion.
- Preventing infections with pathogens via secretion of antimicrobial substances, enhancement of the intestinal barrier and immunomodulation.
- Protecting protein and lipids from oxidative destruction.

Clearly, these properties make probiotics a willing alternative for antibiotics.

Currently, various strains of probiotics are available for use as feed additives. When selecting a probiotic, one has to take into account the fact that strains of the same probiotic species, and therefore their activity, can be different due to genetic variations. These characteristics make choosing the right probiotic for each specific situation quite challenging.

Spore forming bacteria

Dysbacteriosis is characterised by intestinal inflammation and shortening of the small intestinal villi, resulting in clinical signs and/or a reduction of production parameters.

Currently, the list of micro-organisms used in the prevention of dysbacteriosis is varied and long. However, not all are as effective as initially anticipated.

The key characteristics of probiotics used for this purpose in particular, and in the feed industry in general, include:

- Heat-resistant during the feed pelleting process.
- Stable during the digestive process.

This was not the case for the first generation of probiotics such as certain lactobacilli. However, second generation probiotics, such as Bacillus licheniformis are incorporated in the feed as spores which makes them an interesting candidate for dysbacteriosis prevention.

Unique feed additive

B-Act is a probiotic feed additive containing viable spores of a unique strain of Bacillus licheniformis producing bacteriocins: peptides with inhibitory effects on specific bacteria.

B-Act has a proven suppressing effect on dysbacteriosis in broilers by stabilising the gut flora, reducing gut damage and thus increasing the length of the small intestinal villi.

In a trial carried out in 50 birds, supplementation of $1.6*10^{12}$ cfu Bacillus licheniformis/mton of feed from start to finish, resulted in a lower dysbacteriosis score compared to the control group not receiving B-Act (Table 1).

	Control	B-Act
Day 24	1.24	0.57
Day 31	1.13	0.48

Table 1. Dysbacteriosis score in commercial broilers on day 24 and 31.

Furthermore, B-Act inhibits the growth of Clostridium perfringens, the direct causal agent of necrotic enteritis.

This was demonstrated in a trial carried out in 400 coccidiosis vaccinated birds, which were challenged with 10^8 cfu/bird of Clostridium perfringens at day 19, 20 and 21.

Results indicated a significantly lower necrotic enteritis score in B-Act-supplemented birds (dosage $1.6*10^{12}$ cfu Bacillus licheniformis/mton of feed) compared to the control group.

	Control	B-Act
Average weight (kg)	0.71^a	1.01^b
Feed conversion ratio	1.529^a	1.413^b
Mortality (%)	14.00^a	4.00^b
Average necrotic enteritis lesion score	0.45^a	0.22^b

Table 2. Average weight (kg), feed conversion ratio, mortality (%) and average necrotic enteritis lesion score in the control and B-Act group on day 22 (^{a,b} values with different superscripts within a row differ significantly, $p<0.05$).

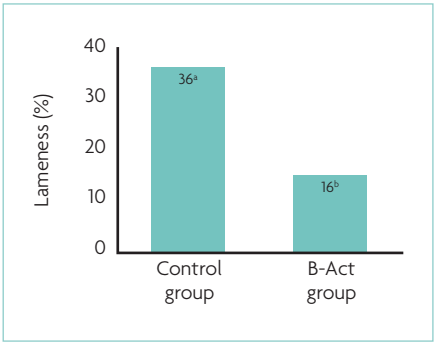
Additionally, in this trial, mortality was significantly reduced in the probiotic group. Being able to influence necrotic enteritis in a positive way, supplementation of B-Act also resulted in an improved average weight and feed conversion ratio (Table 2).

Besides the positive effects on dysbacteriosis and necrotic enteritis, B-Act has also been proven to reduce the percentage of lameness in bacterial chondronecrosis with osteomyelitis (BCO – Fig. 1).

In a trial, conducted in 308 broilers, feed supplementation with B-Act at $1.6*10^{12}$ cfu Bacillus licheniformis/mton of feed from start to finish, resulted in a relative decrease of 66% lame birds (Fig. 1).

Continued on page 38

Fig. 1. Lameness percentage of control and B-Act group at day 53.



Lame birds in commercial broiler production.

Continued from page 37

Avian health and performance platform

Evaluating all of this scientific data in daily operations is not always quick and simple. To help overcome this problem, Huvepharma has created the Avian Performance Platform, or Aviapp. The Aviapp platform allows the comparison of 47 health parameters with performance data and the benchmarking of data with other users on the platform in a specific region, country or at a global level.

By using Aviapp, we evaluated the aforementioned scientific findings with data from the field.

An anonymous dataset from Aviapp, containing 4042 individual birds' data from across the UK, was selected and the association between dysbacteriosis (gut health) and femoral head necrosis (lameness) was investigated.

The results confirm the trial results and show a positive correlation between a femoral head necrosis score and the dysbacteriosis score. However, no dose-response effect of increasing dysbacteriosis severity is observed (Table 3).

Globally, Aviapp demonstrates the positive effect of B-Act use on gut health via the dysbacteriosis follow up.

Table 3. Contingency table with odds ratio and 95% confidence intervals, showing association between dysbacteriosis class and femoral head necrosis class.

Dysbacteriosis	Femoral head necrosis		Odds ratio (95% confidence interval)	P-value
	Class 0	Class 1		
Class 0	2253 (99.6%)	9 (0.4%)	1.00	Na
Class 1	599 (91.5%)	56 (8.5%)	23.40 (11.51-47.58)	<0.001
Class 2	975 (91.3%)	93 (8.7%)	23.88 (12.00-47.53)	<0.001
Class 3	54 (94.7%)	3 (5.3%)	13.91 (3.66-52.81)	<0.001
Total No. of birds	3881	161		

Data for femoral head necrosis is regrouped: Class 0, no femoral head necrosis and Class 1, birds with positive femoral head necrosis scores were created. Dysbacteriosis scores were grouped into 4 classes, with severity increasing from no dysbacteriosis to the most severe: Class 0: scores of 0; Class 1: scores of 1 and 2; Class 2: scores of 3, 4 and 5; Class 3: scores of 6 and 7; Class 4: scores of 8, 9 and 10. No birds were found to have a score of 8, 9 or 10 therefore class 4 contained no entries.

Conclusion

In summary, there is strong evidence in literature and also from commercial trials, that probiotics such as B-Act boost performance and help control pathogenic bacteria, and so various diseases, in animal nutrition. These findings are also confirmed when analysing large datasets from the Aviapp platform, which is a very effective tool to follow up on health parameters and performance in poultry operations. ■

For references and more information on Aviapp, contact aviapp@huvepharma.com