Effective strategies in the control of antibiotic resistance in poultry

The discovery of antibiotics and their modifications were very important achievements of the last century. Besides being used for treatment, antibiotics are also used for prophylaxis and for growth promotion of livestock. Antibiotics usage in animal production has led to concerns in public, regulatory, and scientific arenas about resistant bacteria in farm animals.

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PoultryStar gel droplet hatchery application provides day-old chicks with a head start against multiple drug resistant enteric pathogens before leaving the hatchery.

There is a period of time between the start of an antibiotic usage and the identification of antimicrobial resistance (AMR) to this antibiotic, which is related to the pattern of usage, the amount used and the bacterial species involved.

Understanding the prevalence of AMR and the factors that drive development and spread of resistant bacteria will lead to effective strategies to control the problem.

Monitoring programs on international and national levels provide information about AMR of human and animal isolates of commensal and pathogenic bacteria.

The global emergence of multiple resistant pathogenic bacteria has become a serious concern of the new millennium. It is unlikely that new antibiotic agents will be developed at a sufficient rate to combat the increasing number of multiple drug resistant pathogens, mainly due to time and expense requirements.

Interventions required

Research has shown that livestock may serve as a reservoir of resistant bacteria that may transfer to humans, some of zoonotic concern, and subsequently decrease the effectiveness of the antibiotic compounds. Therefore, in order to increase the effectiveness of antibiotics for human and animal use, interventions are needed to reduce this reservoir of resistance genes in food animals.

For these reasons, international public health organisations and many governments worldwide have recommended stopping the use of antibiotic growth promoters (AGPs) and limiting the use of therapeutic antibiotics.

Alternative methods are needed to control diseases and at the same time reduce the dependence on antibiotics, including improved biosecurity and disease management on farm level, vaccination programs and sustainable prophylactics intervention such as probiotics, prebiotics and organic acids.

Probiotics

Early development of a well-balanced gut microbiota is important for adequate health and high performance. Therefore, feeding strategies have been directed towards controlling the microbial environment of the gastrointestinal tract (GIT) through nutrition. In particular, the use of probiotics and prebiotics has shown to be an effective means of managing the composition of the enteric microbial population, thus protecting young animals from colonisation by harmful resistant bacteria.

Probiotics also promote rapid maturation of the immune system, which help birds to respond better to vaccines and defend themselves against infections.

Under commercial conditions, probiotics can be applied to drinking water, mixed with feed, or sprayed in hatcheries. Applying probiotics in hatcheries during the early stages of chick growth is very important.

Continued application at the farm level is equally important because of frequent changes in the GIT microbial profile due to feed changes, infection or stress. In the hatchery, probiotics can be applied via the gel droplet method which uses a nutritive gel as a carrier for the probiotic bacteria. This has several benefits over probiotics water spray.

Biomin's PoultryStar, based on bifido-bacteria and lactic acid bacteria (LAB), has demonstrated accelerated development of normal microbiota in chickens, providing increased resistance to salmonella, campylobacter and E. coli infections.

Moreover, a recent study showed the protective effect of PoultryStar against bacterial chondronecrosis with osteomyelitis (BCO) lameness in comparison to enrofloxacin and how, by the use of probiotics, antibiotics usage can be reduced.

Prebiotics

Several research studies showed that prebiotics such as mannan-oligosaccharides (MOS) and fructo-oligosaccharides (FOS) have a beneficial effect on host health and performance.

FOS selectively support the growth of beneficial bacteria in the gut such as LAB

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and subsequently inhibit the growth of pathogens, improving the host's microbial balance and enhancing performance.

Acids

Several studies suggest using organic acids as an alternative to antibiotics. Sorbic acid increases the permeability of the bacterial cell as well as causing interference with membrane proteins.

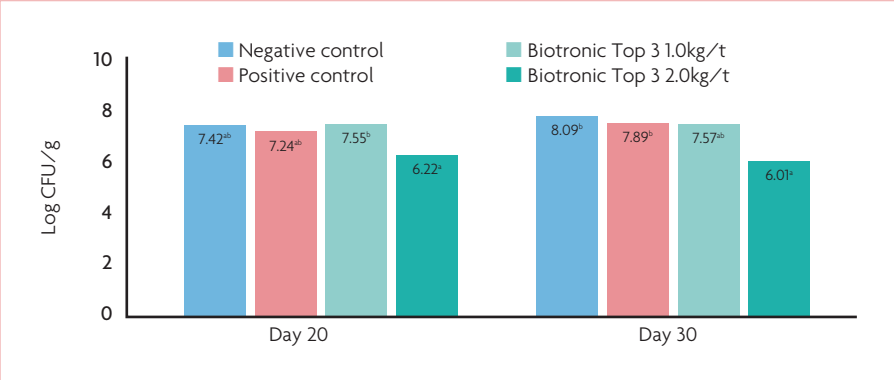
N-heterocyclic dicarboxylic acids and pyridylmercaptothiadiazoles are good scaffolds for future broad-spectrum inhibitors of the metallo-b-lactamases (MbLs) which can be optimised and given in combination with existing b-lactam containing antibiotics as a treatment for infections caused by antibiotic resistant bacteria.

A recent study looked at the effect of a natural growth promoter based on a permeabilising complex, phytochemical and organic acids (Biotronic Top3 from Biomin GmbH, Austria) on E. coli in challenged turkeys. The feed of the negative control group was a standard diet which contained no antibiotic or natural growth promoter.

The positive control group was fed a standard diet and water was supplemented with enrofloxacin at 0.5ml/l of water from day 11-20. Diets of the trial groups I and II were supplemented with Biotronic Top3 at an inclusion rate of 1.0 and 2.0kg/ton of feed respectively from day 0-30. On day 10, all groups were orally challenged with E. coli O78 (1.38x10^8 CFU/mL), tested to be resistant to enrofloxacin in vitro.

The results of the study showed that supplementation of the diet with the natural growth promoter reduced E. coli counts in turkeys' intestinal tract (Fig. 1).

Fig. 1. E. coli count in the intestinal tract at day 20 and 30 in negative, positive and Biotronic Top3 groups (^{a,b}values with different superscripts differ significantly ($p<0.05$)).



Conclusion

In conjunction with good biosecurity and enhanced management practices, application of feed additives that possess antimicrobial properties and support natural growth promotion may help to reduce the incidence of various diseases and the amount of antibiotics used in livestock production and prevent further increases in antibiotic resistance on farms. This may in turn protect the efficacy of antibiotics in treating diseases in animals and humans in the future. ■

References are available on request from the author