Strategic feed and water applications that emphasise prevention can limit the need for, or wholly replace, antibiotics in the poultry sector.

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The advent of antibiotics revolutionised the world by controlling diseases and reducing their impact on both human and animal health. However, the overuse or misuse of antibiotics has been linked to the emergence and spread of drug-resistant bacteria – a phenomenon that threatens to make treatments ineffective and poses a serious risk to public health.

Currently accepted reasons for increasing resistance to antibiotics include poor waste management in pharmaceutical production, human errors in application, as well as the use of antibiotics deemed important for human health in animal production.

The primary challenge surrounding antibiotics is understanding how to use these tools in a way that supports animal health and well-being, meets consumer needs and preserves the treatment value of antibiotics – all while keeping production economical. Successfully facing this challenge is crucial, as it offers the only way to avoid pushing human and veterinary medicine back to the pre-antibiotic era when common bacterial infections were often lethal.

Reasons for antimicrobial use

Antimicrobials, or antibiotics, are substances used therapeutically to kill microbes or to stop them from growing and multiplying. However, antibiotics have also historically been used for growth promotion or prevention (prophylactic/metaphylactic) purposes.

Aspects of modern production such as intensive housing and fast growth are also associated with frequent dysbiosis and gut infections that are conventionally controlled with antibiotic application.

Contributing factors

The overuse or misuse of antibiotics has been linked to the emergence and spread of micro-organisms which are resistant to them, making treatments ineffective and posing a serious risk to human and animal health.

The prospect of multi-drug resistant bacteria threatens the future of public and veterinary medicine, setting the discipline back to a new, pre-antibiotic era where common bacterial infections quickly become lethal.

Resistance develops in several ways

First, the misuse of antibiotics and the use of sub-therapeutic doses for prevention may contribute to the development of resistance.

Second, some antimicrobials which target bacterial DNA, like quinolones, easily lead to mutations that make these microbes increasingly drug-resistant. Their use can leave highly antimicrobial resistant metabolites in poultry houses, making them a reservoir for the spread of antibiotic resistance nearby and through the food and feed chain. Those bacteria that mutate will survive and live to proliferate and generate other bacteria that may also be highly resistant.

So, in a short time disinfectants and other prophylactic procedures will be costly and ultimately ineffective for treatment.

Third, beta-lactam antibiotics (including carbapenems) such as penicillin and amoxicillin are often used to treat a broad spectrum of Gram-positive and Gram-negative bacteria. These antibiotics all have a common element in their molecular structure: a four-atom ring known as a β-lactam.

This common element is a strategic weakness, in the sense that bacteria can secrete enzymes (β-lactamases), and through hydrolysis, the lactamase enzyme breaks the β-lactam ring open. As a consequence, the molecule’s structure is broken and its antibacterial properties are deactivated – thereby reducing the drug’s efficacy.

There are currently no new antibiotics developed in the market to fight bacteria resistant to carbapenems, and worldwide spread of the resistance gene is considered a potential nightmare scenario.

Fig. 1. How antibiotic resistance happens (www.CDC.gov).
Negative effects of antibiotics

Aside from the concern regarding antibiotic resistance, the use and abuse of antibiotics can have some negative effects on birds:

- Prolonged treatment with tetracyclines may have catabolic and immunosuppressive effects, reduce normal gut microbiota and render the bird more susceptible to opportunistic infections.
- Endotoxins (also called lipopolysaccharides) are part of the outer membrane of the cell membrane of all Gram-negative bacteria (for example E. coli, Salmonella spp., Shigella spp., Pseudomonas spp.) that are released from bacterial cell walls by shedding or through bacterial lysis. The destruction of large amounts of Gram-negative bacteria and subsequent releases of endotoxins can elicit strong immune responses and weaken the immune system, compromising liver function and impairing performance.
- Antibiotics destroy beneficial and harmful gut microbiota alike. The former constitutes a first line of defence preventing the establishment of potential pathogens. A bird’s intestinal microbiota are able to produce natural antimicrobial agents such bacteriocins. In young birds particularly, destruction of commensal gut microbes leaves the door open to the development of harmful bacteria and coccidia.
- Some antibiotics like aminoglycosides and sulphonamides can compromise kidney function and impair mineral absorption, especially in dehydrated and young birds. Chronic renal dysfunction occurs when high-dose or prolonged therapy is attempted.
- Continuous and prolonged use of fluoroquinolones in poultry might cause the development of fluoroquinolone-resistant campylobacter. Used above the prescribed dosage, they might also harm cartilaginous tissue (chondrotoxicity).
- Careful, prudent use of antibiotics is needed to preserve their value for treatment, while minimising any negative consequences for animals, the industry and society.

Alternatives to antibiotics

Our scientific understanding has evolved in recent years, proving new, non-antibiotic solutions for prophylaxis and metaphylaxis in flocks through, for example, immune support and gut performance management. Novel feed additives allow for veterinarians and producers to apply preventive strategies that avoid the need for treatment.

They include a variety of tactics that stimulate the immune system, protect gut integrity, create a difficult environment for harmful bacteria to take hold, control harmful bacteria without deleterious effects on host systems and without producing resistance, and allow the bird’s own natural defences to function fully.

Biomin have developed a toolkit of solutions spanning mycotoxin risk management and gut performance. Their use, either alone or in combination, supports animal health, performance and profitability objectives in a variety of production systems, while allowing for antibiotic reduction.

Where to start

Biomin suggest establishing priorities for prevention, including:

- Implementing a trustful and continuous mycotoxin risk management program, which entails regular monitoring of feed ingredients.
- A proactive application of a feed additive proven for mycotoxin deactivation and to promote immune protection, gut integrity, and liver and kidney function.
- Establishing a beneficial gut microbiota early with a poultry-specific probiotic in order to promote eubiosis and optimal intestinal and immune system development.
- Supporting gut integrity with a phytogenic feed additive shown to have anti-inflammatory, antimicrobial and anti-protozoal properties, thus reducing the risk caused by many pathogens such as Eimeria and Clostridium spp.
- Assuring water and feed hygiene through application of an organic acid-based product that can reduce the load of Gram-negative pathogens in the gut.

The good news

Antibiotic resistance enables bacteria to survive and continue to grow instead of being killed or inhibited by therapeutic doses of the drug. The rise of antibiotic resistance puts one of the great medical findings of all time at risk. Fortunately, innovative tools shown to be safe, effective and profitable for the industry are available that can enable the industry to reduce antibiotic usage – preserving the value of antibiotics for treatment.