The path of least resistance

Globally, it is recognised that there is no so-called 'silver bullet' to replace antibiotic use in animal production and producers will also have to focus on incremental improvements in hygiene and husbandry to address the issue.

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Antibiotic resistance has the potential to become one of the most significant problems of our generation, given the ever-increasing rise in bacterial strains that are becoming less and less sensitive to existing treatments. Currently, there is political pressure worldwide to restrict the use of antibiotics in animals to therapeutic use only. This follows the 2006 EU ban on the use of antibiotics for all non-therapeutic use as antibiotic growth promoters (AGPs). The public is also aware of the increasing problem of antibiotic resistance, and this has led to heightened awareness regarding bacterial prevalence in meat products.

Impact of resistance on public health

The statistics behind the rise in resistance are startling, with almost 23,000 people dying in the US each year due to infections caused by antibiotic-resistant bacteria. Even more alarming is that since 1998, the US Food and Drug Administration (FDA) has only approved two new classes of antibiotics and the fact that most of today's antibiotics were developed before the 1970s.

Antimicrobial resistance arising in agriculture can negatively impact public health. Treatment of animals with antimicrobials important in human medicine, or drugs of the same family or class, can result in drug resistance in zoonotic pathogens (e.g., *Salmonella, Campylobacter*). These can then be transmitted to humans through direct contact or indirectly through food or water. Resistant bacteria from animals or plants are part of a broader antimicrobial resistance ecosystem, and their resistance genes could find their way through a variety of poorly understood indirect pathways to human pathogens. Bacteria from animals can spread to food products during slaughter and processing. There is extensive research regarding the spread of conventional foodborne pathogens such as *Salmonella, Campylobacter* and *E.coli*. More recent studies indicate the emergence of enterococci resistant to antimicrobials. They also identify the direct transmission of resistant enterococci between animals and farmworkers. More importantly, these studies have found identical or closely related subtypes in animals, food and humans, supporting the hypothesis that the foodborne route of antibiotic resistance transmission is significant.

Increase in food safety concerns

As meat free from antibiotics and disease has become a requirement within the European Union, food safety concerns have increased. This has created challenges for the poultry and livestock industries in recent years. Consumer demand for antibiotic-free meat has also increased within the US and other antibiotic-using countries as a result of concerns about the rise in antibiotic resistance. This has made it necessary for producers to find suitable replacements for antibiotic growth promoters.

Drawbacks of the use of antibiotics are their non-specific effects on the gut microbiome and the reduction in overall gut microfloral diversity noted with their use. Without intervention, the use of antibiotics can lead to a vicious cycle, whereby their use can reduce overall microfloral diversity,

allowing for the expansion of resistant species to the detriment of non-resistant commensal strains. This reduced diversity allows for the continued proliferation of resistant species, which, without intervention, can have negative impacts on health and performance.

One strategy to combat the negative consequence of antibiotic use is to repair and rehabilitate the microfloral diversity after their administration. This may be accomplished by dietary supplementation with the mannan rich fraction (MRF) of the yeast cell wall. Given the ability of MRF to enhance the overall gut microfloral diversity, it is an ideal solution to combat the negative consequences of diversity reduction. While there is still much to learn - particularly the mode of action - in the long term, such findings will have significant practical value in commercial production settings and also benefit consumer health and well-being.

Furthermore, there are other factors that can influence gut health and microfloral diversity. Mycotoxins, or toxic chemical compounds produced by moulds found in feedstuffs and feed, are one such challenge. The gastrointestinal tract is generally the first organ to encounter mycotoxins. Not only will the intestines serve as an entry route for mycotoxins into the rest of the body, but the direct effects of mycotoxins on the digestive system can have significant effects on animal health. Upon consumption of mycotoxins, there may be inflammation and necrosis of the gastrointestinal tract, changes to intestinal enterocyte functions, altered gut-level immune responses and adverse effects on the intestinal microflora. Several Fusarium mycotoxins can be linked to altered microflora and an increase in gut pathogens. With the ever-increasing concern about antibiotic use, mycotoxins could play an even greater role in gut health. As a result, an effective mycotoxin mitigation product, such as Alltech's Mycosorb A+, should be utilised to minimise additional risk to antibiotic reduction programs.

A consistently healthy herd

In response to the issues surrounding antibiotic resistance, the Alltech Antibiotic Reduction program aims to create a consistently healthy animal, while reducing prophylactic and metaphylactic antibiotic use through focusing on gut health. By making changes in the overall microbial diversity within the gut and reducing risk from additional mycotoxin challenges, the program aims to repair and rehabilitate the gut microflora. This can lead to reductions in pathogen load and enhance the gut's resistance to pathogen colonisation. Such changes can lead to reduced reliance on antibiotics, thereby reducing the risk of antibiotic-resistant strain proliferation. The program can assist the farmer in developing an action plan, including holistic nutrition and management practices across all stages of production. The successful implementation of the full Alltech Antibiotic Reduction program can achieve:

- Increased productivity
- Lower treatment cost
- Improved animal welfare
- Improved biosecurity
- Sustainable profit.