



Building a wall of defense against antibiotic resistance for animals

What role do phytochemicals play?

November 12, 2018 – An acute threat for the future of global health is the rising appearance of antibiotic resistant bacterial pathogens. To increase awareness of this immense challenge, World Health Organization (WHO) has organized World Antibiotic Awareness Week. As antibiotic growth promoters (AGPs) have been historically used in animal feed, agriculture also must take responsibilities to combat antibiotic resistance development. Luckily, alternatives are available for livestock producers to reduce the use of antibiotics and therefore the risk of resistance development. One of these options is the use of phytochemical feed additives. These unfold a multitude of different mechanisms to support animals' health and growth and to which bacteria can't develop simple answers.

Antibiotic resistance occurs due to a strong selection pressure on bacteria when faced with antibiotics, resulting in a “die or become resistant” situation. Especially problematic are multi-resistant “superbugs” that can withstand several different antibiotics, making treatment against those highly difficult and inefficient. These resistant bacteria are a major concern, as the resistance traits may spread in bacterial populations and infected patients may even die to otherwise harmless infections, if antibiotics fail to work.

The challenge of antibiotic resistance

According to the WHO, the overuse and misuse of antibiotics in both animals and humans contribute to the rising threat of antibiotic resistance. Every time an animal or person receives antibiotics, sensitive bacteria that are vulnerable to the antibiotic are killed while any bacteria not vulnerable to that antibiotic remain to grow and multiply. An increasing list of bacterial pathogens are becoming more resistant and sometimes impossible to treat with antibiotics. Therefore, available treatments lose their efficacy.

A focus on disease prevention

Reducing the use of antibiotics in livestock production requires a focus on preventing diseases, rather than only curing. Ideally, animals will not encounter disease challenges. However, just as cities like Carcassonne built large, secure walls of defense to keep enemies at bay, livestock producers need tools to support an animal's natural defenses when challenging conditions may arise. Consequently, pathogens are less likely to cause health problems.

Phytochemical feed additives are comprised of plant-derived products like herbs, spices, essential oils and oleoresins. Their many effects include influencing sensorial stimulation, palatability, increased intestinal tract enzymatic activity, nutrient absorption and utilization, antimicrobial and antioxidant effects and reduced bacterial pathogenicity. These effects work together synergistically to help optimize gut health. A healthy gut is better able to respond to stress and can help build that strong wall of defense.

Phytochemicals accomplish these effects by multiple different modes of action, interacting with both the host and its microbial communities. Due to this, it is much harder for bacteria to develop resistances



against phytochemicals when compared to the highly specific mechanisms by which antibiotics affect bacterial growth and reproduction. In addition, as phytochemicals are not necessarily killing bacteria directly, there is much less stress for adaptation to these substances. Instead, they can influence bacterial pathogenicity for example via quorum sensing inhibition, resulting in reduced production of toxins or other virulence related factors. Concepts such as quorum sensing inhibition are therefore key in the battle against development of antimicrobial resistances.