Modulating the gut microflora to reduce antimicrobial usage in animals

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The average human or animal body harbours at least 10 times more bacterial cells than human/animal cells. However, relatively little is known about how these organisms contribute to health and disease. Moreover, bacteria are just part of this vast community, collectively known as the microflora. This community consists of up to 1500 species of microorganisms including bacteria, fungi, parasites and viruses. It has recently been hypothesised that this vast community may play an important role in regulating animal and human responses to infectious and non-infectious diseases, in addition to playing a pivotal role in nutritional status.

Infectious diseases are responsible for significant economic losses in the livestock industry and have implications with regard to animal welfare. Furthermore, a number of livestock pathogens are zoonotic. Traditionally infectious diseases in livestock have been controlled through the use of vaccination, biosecurity measures and antibiotics. However, with the increased awareness of the emergence of antimicrobial resistance, alternative control strategies are urgently required. One such alternative may be to use prebiotics and probiotics to modulate the gut microflora. Probiotics are classified as live microbial feed supplements; often members of the normal flora. *Lactobacillus*-based probiotics have been reported previously as protecting against infection with common enteric pathogens in livestock. Prebiotics are non-digestible in the upper gut however, they are fermented in the large intestine. Diets enriched with prebiotic oligosaccharides, such as galactooligosaccharide (GOS), have been shown to increase the number of lactic acid bacteria (LAB) such as bifidobacteria and lactobacilli and/or their fermentation products in the colon and thus may stimulate beneficial bacteria and therefore selectively modulate the gut microflora.

Despite the widespread use of prebiotics and probiotics in humans and animals the mechanisms of action of these novel interventions remain to be elucidated. Therefore, the studies described here aimed to evaluate the efficacy and mechanisms of action of the prebiotics and *Lactobacillus*-based probiotics in mitigating *Brachyspira pilosicoli* and *Salmonella Typhimurium* infection in livestock species. The studies utilised a number of novel *in vitro* and *in vivo* models including 3D cell culture, *In vitro* Organ Culture (IVOC) and whole animal studies to study how these interventions exerted their effect on the pathogens. Furthermore, the studies evaluated the host response to the prebiotics and probiotics, including evaluating effects on the normal gut microflora. The studies demonstrated that probiotic bacteria and prebiotics can antagonise aspects of the pathobiology of *Brachyspira*.
*pilosebaci* and *Salmonella* Typhimurium and modulate the gut microflora. Therefore, they may be effective in the control of bacterial pathogens in livestock.