Antibiotic Stewardship in Intensive Livestock Production

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The discovery of penicillin in 1928 followed by the discovery of other antibiotics revolutionised human and veterinary health care. Previously deadly bacterial diseases were easily treated with antibiotics. The excessive and inappropriate use of antibiotics has however resulted in the emergence and spread of antibiotic resistant bacteria which is threatening to undo the advances made to health care as a result of antibiotics[3].

Antibiotic resistance occurs when previously treatable bacterial infections do not respond to standard antibiotic treatments, requiring the use of last resort antibiotics. An example of a last resort antibiotic is Colistin, a polymyxin antibiotic that has been used for many years in veterinary medicine for the treatment of gram-negative enteric infections (*Salmonella* & *E coli*). The emergence of multi drug resistant gram-negative bacterial infections has resulted in Colistin being classified as an antibiotic of last resort for the treatment of multi drug resistant gram-negative bacterial infections in humans. The discovery of colistin resistant *E coli* isolated from humans and animals in many countries worldwide is thus of great concern[1].

Bacterial antibiotic resistance predates the discovery and widespread use of antibiotics. The ancient origins of antibiotic resistance were illustrated by the isolation of bacteria resistant to β-lactamase antibiotics *(penicillin and cyclosporin*), tetracycline and vancomycin in 30 000-year-old permafrost core samples collected in Alaska[2]. This discovery shows that the use of antibiotics did not stimulate genetic mutations in bacteria and thus did not stimulate the development of antibiotic resistance.

The widespread use of antibiotics rather created an environment that was conducive for the survival of pre-existing antibiotic resistant bacteria. Most antibiotics used in human and veterinary medicine are either natural antibiotics produced by fungi and bacteria or are derivatives of natural antibiotics compounds isolated from fungi and bacteria.

Bacteria and fungi have used these naturally produced antibiotics for millennia to ensure survival in an environment saturated with other bacteria. The reliance on natural sources of antibiotics has limited the discovery of new antibiotics[2].

Safeguarding the efficacy of antibiotics requires the implementation of antibiotic stewardship programs. Antibiotic stewardship is a systematic approach for optimising the appropriate use of all antibiotics to improve the health of humans and livestock and limit the emergence of resistant pathogens. The application of antibiotic stewardship in livestock production involves moving away from using antibiotics as a management tool i.e., to enhance growth and for the prevention of disease (prophylaxis), to only use antibiotics for the treatment of disease[4].

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The decrease in the use of in-feed antibiotics has led to the development of a wide range of antibiotic alternatives especially for the maintenance of intestinal health. These alternatives can be classified into three categories[5].

- Products with antibacterial activity against enteric pathogens and for the maintenance of the intestinal microbiome.
  - Probiotics,
    - CLOSTAT™
- Organic Acids
  - FormaXOL™, Formyl™ 2B and CitriLAC™
- Essential Oils
  - FormaXOL™ and Orsential™
- Products that maintain intestinal integrity
  - ButiPEARL™
- Products that modulate intestinal immunity.
  - Aleta™

Using antibiotic alternatives for the maintenance of intestinal health is however only one part of a larger holistic approach that is needed to maintain the health of production animals, lowering the need for antibiotics and thus safeguard the efficacy of antibiotics. Other aspects to consider for keeping production animals healthy to maintain production include:

- Ensuring the supply of clean healthy water. Water is often the forgotten nutrient despite the fact that animals will drink 2-3 times more water than feed. Contaminated water can thus be a major source of pathogens to production animals.
  - Water lines need to be cleaned between cycles
    - KEM SAN™ at 12ml/l water
  - Drinking water needs to be treated to lower the pathogen load in drinking water
    - KEM SAN™ at 2.5 ml/l drinking water
- Feeding of safe and clean feed to lower bacterial challenge to production animals
- Adding toxin binders, for example Toxfin™, to the feed to bind mycotoxins
- Increasing the digestibility of the feed by using high quality feed ingredients and using exogenous enzymes.
  - Using the KEMZYME® range of exogenous enzymes
    - Increases the availability of nutrients for better growth
    - And decreases the passage of undigested nutrients especially protein to the lower intestine, thus preventing the over growth of pathogenic enteric bacteria for example *Clostridium perfringens* and *E coli*.
- Using an effective house clean out program along with adequate down time between cycles to decrease the pathogen load in the houses
- Implementing an effective vaccination program to prevent disease
- Controlling coccidiosis especially in poultry
  - including COZANTE™ into a coccidia control program.

Antibiotic resistant bacterial infections have been identified as a global risk to public health. It is estimated that globally 700 000 people die each year from infections with antibiotic resistant organisms. It is estimated that by 2050 10 million people will die from infections with antibiotic resistant organisms[3]. Safeguarding the efficacy of antibiotics is therefore of vital importance to prevent humanity returning to the pre antibiotic era where simple wounds and infections could lead to life threatening bacterial infections and routine medical procedures become very risky. The livestock industry needs to play their part in safeguarding antibiotic efficacy by practising antibiotic stewardship as part of a one-health approach.

REFERENCES
Available on request.

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