

# Department of Animal Science

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## ANTIBIOTIC ALTERNATIVES IN POULTRY PRODUCTION: AN AFRICAN VIEWPOINT

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Poultry is the most consumed animal protein source in the world, with a world production of 111.7 million tons in 2016 (FAO, 2017). Antibiotics have been commonly used in animal and poultry production for many years to treat and prevent infections and avoid the spread of diseases or as antibiotic growth promoters (AGPs) (Tarradas et al., 2020). Livestock production is currently considered one of the main sources of antimicrobial resistance (AMR); thus, research on alternatives to the use of antibiotics in poultry is essential to combat the emergence of AMR. The emergence and spread of AMR compromise the nutritional and economic potential of poultry and other food-producing animals. Antimicrobial resistance threatens food security, animal welfare and human health worldwide (Selaledi et al., 2020). Although reduction of antibiotic use is essential to avoid AMR, its withdrawal in poultry production will likely result in an increased prevalence of bacteria such as *Salmonella* or *Campylobacter* on the carcass (Tarradas et al., 2020). The situation is particularly critical in Africa, where it is difficult to estimate the exact prevalence of AMR due to the low number of AMR surveillance programs (Medina et al., 2020).

### Education is critical

Emergence of antibiotic-resistant bacteria in the environment is a global threat. New antibiotics take years to develop and millions of dollars to bring to market and, as a result, there is little incentive for drug manufacturers to invest in such an endeavor. However, the rapid spread of multiple antibiotic-resistant microbes in the environment is a major concern of health officials. The One Health approach emphasizes that the health of the environment, animals and humans are all interrelated, and this approach can be used to manage AMR and food safety concerns. However, education at the smallholder farmer level is critical for the approach to be successful. Unfortunately, developing regions of the world often lack poultry educational and training opportunities for smallholder farmers and do not have adequate numbers of qualified extension personnel (particularly women) to deliver the training (Fig. 1). There are success stories, however, such as the United Nations' 2030 Agenda for Sustainable Development. This and other programs, often led by international aid agencies, developmental agencies and nongovernmental organizations, have stimulated increased development of poultry programs, many of which fit well with smallholder farming systems.



Figure 1

## AMR in Africa

Animal agriculture is of vital importance in developing countries. As these countries transition to more intensive farming practices, increased antibiotic use can result in greater risk of AMR in animals and humans. Antibiotic use in many low- to middle-income countries has reached levels that now exceed those observed in high-income countries. Africa is no exception and like other developing regions, use of antimicrobials in many African countries remains largely unregulated. While Africa produces fewer antibiotics as compared to other continents (Gelband et al., 2015), numerous antibiotics can be bought over the counter in many African countries and this practice could play a key role in increasing AMR. Many smallholder farmers across Africa choose to purchase and administer antimicrobial products without consulting an extension or animal health professional because they are not available, or farmers do not have access to or cannot afford them. While antibiotic use in food-producing animals can enhance overall health and promote their general output, the practice can also create emergence and dissemination of AMR traits and antimicrobial-resistant bacteria into the environment. Therefore, promotion of alternatives to antibiotics in poultry production should be at the heart of any antimicrobial campaign.

### Antibiotic alternatives available in Africa

Some researchers argue that antibiotic use reduces the cost of meat and eggs and that banning antibiotic use in animals will increase the cost of these items. As a result, numerous researchers are searching for alternatives to antibiotics in poultry production. Presently, the most popular alternatives appear to be probiotics, prebiotics, essential oils/plant extracts, enzymes and organic acids, which are found to have the ability, to some extent, to replace antibiotics. Popular probiotics today are bacteria such as *bifidobacteria* and *lactobacilli*. Nutrients that are popular prebiotics include pectin, fructans, inulin, oligofructose, fructooligosaccharides and fiber components. Probiotics have a beneficial effect on the health of the animal (stimulate growth and improve immunity). Prebiotics help prevent the colonization of the digestive tract with pathogens by creating an unfavorable environment.

Enzymes are produced from fungi and bacteria fermentation and are used to maximize feed conversion. Like many other antibiotic alternatives, results on their usage have been mixed. In

some cases, enzyme use in poultry diets have shown a reduction in digesta viscosity, enhanced digestion and absorption of nutrients. However, in cases when the diet was a low-quality feed, no positive effect of feeding enzymes was observed.

Plant extracts may be the most popular of the antibiotic alternatives in many African countries because of their antimicrobial, anti-inflammatory, antioxidant and antiparasitic properties, and because they have been used successfully in traditional smallholder poultry production for many years. In numerous African countries, plant extracts from aromatic spices (cinnamon, clove, etc.), pungent spices (pepper, garlic and ginger) and herb spices (rosemary, thyme, mint, etc.) have received increasing attention over antibiotics because they are less expensive and naturally available, and they are shown to improve poultry production and health status (Selaledi et al., 2020). Coriander, licorice and aloe vera are other examples of plant extracts used in traditional smallholder settings to improve health and performance of poultry.

Organic acids have received attention because of their ability to reduce pH in the gut of poultry. Organic acids can acidify the gastrointestinal environment, increasing the activeness of protease enzymes. They are also able to reduce colonization of intestinal wall pathogens such as *Salmonella* and *E. coli* (Hermans and De Laet, 2014). Use of organic acids has been shown to play an important role in digestion, particularly in poultry diets with poor-quality protein. The most used organic acids are acetic, formic, butyric and propionic acid (monocarboxylic acids), and malic, lactic and tartaric acids (carboxylic acids carrying a hydroxyl group).

### Management practices

Currently, several possible alternatives to AGPs are used in many African countries. However, every single alternative has limitations. No single alternative can act as an AGP alternative for sustainable growth, health and performance of birds on a consistent basis. Although alternatives to AGPs may compensate for some of the reduction or elimination of AGPs in feed, changes in poultry management practices are also important. Evidence indicates that the application of AGPs or alternatives is most effective when provided to animals raised in unsanitary environmental conditions. Good sanitation, a strong vaccination program, sound rodent and pest control, strict biosecurity and proper waste management practices are necessary to reduce pathogen load/exposure and limit the need for antimicrobial or alternative therapy. A clean water supply must always be provided, and feeders and drinkers must be properly maintained. Commercial flocks must have proper temperature, lighting and ventilation programs. Smallholder farmers must have access to information (publications, extension personnel) that can aid in areas such as nutrition, vaccinations, biosecurity, flock management, marketing and financial assistance.

The lack of information to smallholder farmers and the absence of assistance from extension personnel or animal health professionals who are often nonexistent or inaccessible due to distance, logistical or financial constraints underscores the importance and critical need to train additional extension personnel (particularly women) and develop/disseminate outreach and educational opportunities. Women smallholder farmers play a major role in poultry production across Africa and poultry contributes substantially to household food security and the well-being of children. Outreach programs and agricultural extension services are designed to disseminate research findings to women smallholder farmers and others. Unfortunately, however, women rarely receive these services and programs because of a severe shortage of extension workers.

This results in poultry extension messages, especially in rural isolated areas, never reaching the very women smallholder farmers managing poultry flocks that the programs were designed for.

Antimicrobial resistance is a major issue in poultry production around the world today, and Africa is no exception. However, the situation is somewhat different in Africa. Many African farmers have little to no access, either in written form or from knowledgeable extension personnel or animal health professionals to information on AMR or AGPs. A variety of antibiotic alternatives are available today; however, many smallholders are unaware of how best to take advantage of these alternatives or their potential. Education at the smallholder level is critical for poultry production across Africa to take full advantage of antibiotic alternatives. This highlights a critical need for more extension personnel and increased outreach programs to assist both commercial and smallholder poultry farmers in their efforts to reduce antibiotic use and transition to increased use of antibiotic alternatives in their poultry production systems.

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