

# The important role of antibiotic resistance



Antibiotic roles in food production have always been a point of contingency for many individuals. From the beginning, consumers have had fears of residual antibiotics left on food (The Science News-Letter). The first antibiotic used was Aureomycin. It was used as a food preservative for uncooked poultry (The Science News-Letter). When the U. S. Food and Drug Administration cleared Aureomycin to be used as a preservative, the original fear was human allergic reaction. When this was finally allowed in the early 1950s, the FDA had to be particular about the residual amounts that would possibly be left on the poultry, to ensure the consumers would not have adverse reactions. Through FDA research, it was determined that the amount of antibiotics left on the product was only trace amounts, at worst. This usage of Aureomycin stopped the growth of spoilage microbes that could potentially grow on the poultry. However, by 1999, seventy-seven percent of customers still assumed that products treated with antibiotics left drug residue on their meats – according to a customer survey (Donoghue). The FDA uses information provided by “ animal drug sponsors” to evaluate public health risk associated with specific antibiotics (Center for Veterinary Medicine). In addition, they will evaluate using the National Antimicrobial Resistance Monitoring System (NARMS) to help evaluate the risk of the proposed food production application of the antimicrobial agent (Center for Veterinary Medicine).

Since the 1950s, the use of antibiotics in all aspects of food production has exploded in popularity. With this popularity, the negative attributes have begun worrying producers, consumers, and have even made headlines in political news worldwide. Antibiotic and antimicrobial resistance has now

become a real issue in all aspects of life - from the health care industry to the food we eat every day.

The term antibiotic resistance gets the most play in conversations that affect our everyday lives. It simply means that bacteria that would normally be affected and killed by a given an antibiotic now have a resistance to that specific treatment. Antimicrobial resistance is just as important, but is used less often. The term encompasses a larger field of resistant organisms. It includes bacteria, parasites, and fungi resistance as well. Both of these terms cover aspects that are becoming a serious problem for all living things, including human kind (World Health Organization). Antibiotic resistance can occur in a variety of ways. Intrinsic resistant is a natural part of bacteria life, yet it has been sped up with the use of antibiotics (Rosenblatt-Farrell). It is when the weaker, more susceptible bacteria is killed off by the antibiotic, yet the variant of stronger, less susceptible bacteria is unaffected and continues to reproduce. This is compounded with the use of weak antibiotics that will not wipeout the stronger bacteria. The strongest survive and multiply (Rosenblatt-Farrell). It is the literal definition of the survival of the fittest. Resistance to antibiotics can also occur via spontaneous mutations, and even DNA - by exchanging conjugative plasmids that carry genes that encode for the resistance (Rosenblatt-Farrell). Many bacteria have responded to antibiotics by having multiple resistance mechanisms for different chemicals that could be used (Lawson).

Antimicrobial resistance has become one of the most serious health threats in today's society (Guo). Antibiotic use in agriculture is one of the most important factors contributing to the emergency and spread of resistant

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organisms (Guo). In production, the antibiotics are mainly used for growth and disease prevention of the animals. This constant exposure to low grade antibiotics has led to a high occurrence of antibiotic resistant bacteria in fowl, swine and other production animals. Within the human sector, resistant strains of bacteria have now sprung up (Guo). For many years, the dangers of livestock resistant bacteria was thought to not have a direct human consequence, but now livestock resistant strains have been found amongst the human population at an increasing rate (Guo). In these intensely farmed production areas, disease prevention and animal care are not ideal to reduce the occurrences of bacteria, and illness can quickly spread from animal to animal.

Since the awareness of the use of antibiotics in commercial farming and the dangers have become topics of discussion, politics have started to play a role. In 2006, the European Union made a decision to ban all non-medical antibiotic use on animals. They cited the concerns over human health hazards as the reasoning behind the decision. Closer to home, the United States of America initiated a voluntary relabeling of antibiotics in food production to help reduce antibiotic usage as growth promoters, and in 2014 the White House announced the creation of the National Strategy for Combating Antibiotic Resistant Bacteria (Center for Veterinary Medicine). While the United States took a softer stand on the issue, at least the issue was addressed, but leaving the decision to be antibiotic free to the producer comes with its own problems. Every producer, when given the choice, is not going to decide to become antibiotic free. Some may make that decision, but that does not guarantee that antibiotic resistant bacteria will not affect the

producers that ban antibiotics from their processes. Antibiotic resistant bacteria has been found on commercial farms that do not use antibiotics in their production (Hofacre). According to a study done by the University of Georgia, eighty percent of the bacteria in question was isolated from meat and bone meal (Hofacre). This means the majority of the bacteria could be traced back to the filled product in the feed being used. If the remains from a commercial farm are used to make feed, then anywhere that feed is sent has a potential of carrying that bacteria with it (Hofacre).

While some countries have implemented bans and regulations, the issue remains that the majority of the world has unrestricted laws for antibiotic usage - in production or otherwise. In developing nations, poultry farming has become adopted as a developmental strategy to economic growth. Antibiotic use in poultry commercial farming has been shown to enhance feed efficiency, reduce disease, and overall make production more efficient and lead to reasonable cost for the consumers (Donoghue). With the lures that antibiotic usage brings, the fear is real that as the demand for food increases the usage of antibiotics in food production will also increase. It has been estimated that the global usage of antibiotics in the food industry will increase sixty-seven percent between the years 2010-2030 (Guo). In 1986, Sweden banned all growth promoting antibiotics, which was followed by Denmark a decade later (Casewell). In the years after the ban, animal health and welfare seemed to decrease and some studies showed that some farmers struggled with economic hardships (Casewell). This particular ban was the complete removal of growth antibiotic additives, and Denmark was officially using zero antibiotics for growth by 2000 (Casewell). While there

were some issues with animal welfare and economics, the overall ban was successful. Studies showed that the total pool of antibiotic resistance genes in multiple strains of bacteria found in livestock fecal material had shrunk after the ban (Casewell).

Alexander Fleming, in 1945, gave an interview that all but predicted the issues we now face with antibiotics. The same year that he won the Nobel Peace Prize for his discovery of penicillin, he warned that misuse of the penicillin could lead us to a future of drug resistant bacteria via selection (Rosenblatt-Farrell). Fleming was spot on. The constant misuse and overuse of antibiotics has led to the emergence of antibiotic resistant bacteria. Instead of trying to medicate and pacify the issues, the underlying causes should be addressed. The conditions of mass commercial farming shouldn't be a breeding ground for bacteria to the extent of needing constant antibiotic treatment to make sure the supply is healthy. The food industry potentially will be harmed if the conditions stay the same, but the medication stops. Consumer safety should be the number one priority for all food producers, yet many overlook the safety issues in something that may not be directly linked to specific companies. Critical control points ensure the product is shipped in an acceptable state of safety, however the bacteria during the holding and rearing is causing the issues. The conditions animals are held in are not meant to be sanitary. Humans have decided that profit outweighs all other concerns. The concerns of public safety have been put on the back burner so production values increase. In 1951, when antibiotic food production was taking off, studies were conducted that showed that antibiotic additions to production would save approximately thirty to fifty

pounds of feed for every pound of pork produced- with an annual savings of two hundred million dollars (Ratcliff). In the nearly seventy years since then, prices have continued to increase and the economic downside to removing antibiotics from food production has increased (Donoghue). These economic issues are one of the main reasons antibiotic usage became so popular in the food industry and why governments are starting to make requests of the interest of public health. Since strict government bans can lead to adverse effects of food production, the fundamental issues in livestock need to be addressed and is just as important as antibiotic regulations. Without addressing what is causing the health issues, the food industry may always depend on antibiotics.

Food production is not solely to blame for antibiotic resistance. We have played a large role in the appearance of superbugs and resistant diseases. The overuse and misuse of antibiotics does not end with food production. The health care industry and everyday people across the globe have hindered the effectiveness of antibiotics on common ailments that once were easily treated. More varieties of antibiotics must be created to continue the never-ending arms race we started in 1945. The antibiotic misuse over decades has left us with no clear cut choice. Strict regulations and constant new varieties of antibiotics are the future of food production and health care. This alone will not cure the ever growing problems of resistance. With the health care industry, doctors are told to prescribe antibiotics only when necessary, as with the commercial farm industry all antibiotic use that is needed should be administered with veterinary approval and supervision (Nhung). The ease of access to antibiotics for commercial farmers has

escalated the antibiotic issue in food production (Nhung). Antibiotic usage has become so common place, many individuals do not see the dangers it can possess.

Both sectors encompass everyday life, the importance of successful new initiatives is truly becoming a top priority. The food industry has researched new alternatives to antibiotic usage. These include the use of probiotics to reduce intestinal contamination of bacteria that could contaminate the product, and the use of plant essential oils and their effects on bacterial infections - thyme, oregano, and garlic showing the most potential even if the results are inconclusive so far (Griggs). In 1945, the possible future of antibiotics was addressed. In 2018, it has started to become a very worrisome reality. The bottom line is that antibiotics are a double edged sword. They are wonderful when they work as intended, but have the potential of making food producers complacent and speeding up the natural evolution of bacteria. Cutting out antibiotics from food production could have unintended effects on animal welfare and the economy, so the solution cannot be singular. The issues of mass rearing and sanitation need to be addressed and tweaked to cut back on bacteria flourishing. Veterinary professionals need to take control of the antibiotic market to ensure misuse does not occur, and alternatives to antibiotics for food production need to be researched to help offset the economic drop that can occur when antibiotics are removed from facilities. Antibiotic resistance has become a reality in many aspects of our daily lives. Due to antibiotic misuse, we now find ourselves at a crucial moment in history - a moment Alexander Fleming saw coming in 1945 (Rosenblatt-Farrell). Nhung



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