Antibiotics: What Happens if They're Banned?

by: Gary L. Cromwell
Professor, Swine Nutrition

Antibiotics have been widely used as additives in swine feed since their discovery 50 years ago. They represent an extremely important tool in the efficient production of pork. Over 90% of antibiotic usage in feeds is at low (subtherapeutic) levels where they improve growth rate and efficiency of feed utilization, reduce mortality and morbidity, and improve reproductive performance in swine. Antibiotics also are used at high levels to prevent disease in exposed animals (prophylaxis) and to treat diseases (therapeutic). Currently, 12 antibiotics and 5 chemotherapeutics (chemically synthesized antimicrobial agents) are approved by the Food and Drug Administration (FDA) for feed additive use in swine feeds.

The use of antibiotics in animal agriculture has again come under fire with questions being raised on whether they represent a potential threat to human health. Consumer protection groups are pressuring regulatory agencies to reconsider the safety issues associated with antibiotic usage. There is concern in the livestock and poultry industries that antibiotics may be further restricted or even completely banned such as was recently implemented in the European Union (EU). This past January, the EU banned the use of six major antibiotics that had been used for years - tylosin, virginiamycin, spiromycin, zinc bacitracin, carbadox, and olaquindox. In the opinion of many scientists, that decision was not based on science; instead, it was purely a political decision.

Questions about safety of antibiotics are by no means new. Ever since antibiotics were first discovered and widely accepted into feeding programs for livestock and poultry, safety questions have been raised. The major concern has been and continues to be whether the subtherapeutic use of antibiotics in animal feeds contributes to a greater number of antibiotic-resistant intestinal bacteria that are capable of transferring their resistance to pathogenic bacteria (salmonella, campylobacter, etc.) thereby causing a potential health risk in people. The greatest concern has been in regard to penicillin and tetracyclines because they are also used in human medicine.

The first major action on the restriction of antibiotics occurred in Great Britain in the early 1970's. This action, based on the "Swann Report", involved antibiotics that were used in human medicine or that were capable of cross-resisting with drugs used in human medicine, restricting them on a prescription basis. Incidently, this action solved nothing; 10 years later, antibiotic usage and resistance levels had not declined. A similar plan was proposed in this country by the FDA in the mid-1970s, but was never implemented. Later, the National Resources Defense Council filed a petition to FDA to immediately ban penicillin and tetracyclines. Following extensive hearings, the petition was denied.

Over the years, several task forces have studied the safety issue of antibiotics and have basically concluded that there is no direct link between antibiotic usage in animals and human health. In 1987, one of the most prestigious scientific bodies in medicine, the Institute of Medicine of the National Academy of Sciences, conducted an independent review for the FDA and found no definite health hazard in humans associated with subtherapeutic use of antibiotics in animal feeds. Early this year, the National Research Council reported on a thorough review of the literature and concluded that antibiotic feeding to animals does not constitute an immediate public health concern.

Yet, in spite of these extensive studies and reviews, public safety concerns associated with antibiotic usage in food animals still continue to surface. The FDA is attempting to address this issue in a proposed "framework document" that adds additional steps to the approval process for new drugs and

involves extensive monitoring of drug resistance. The Center for Science in the Public Interest (CSPI), has called for an immediate ban on all antibiotic use for food animals and has requested that the FDA impose similar testing, as outlined in their framework document for new drugs, on those antibiotics that are already approved and being used.

What would happen if there was a total ban on antibiotic usage in the swine industry such as has occurred in Denmark and Sweden and appears to be happening in the EU? Would the antibiotic resistance problem disappear and would pork be safer for consumers?

A good model that might help to shed light on that question is a long term study that we initiated at the University of Kentucky in 1972. A closed, isolated herd at the UK Research and Education Center at Princeton, Kentucky that was previously fed subtherapeutic antibiotics has not been exposed to antibiotics for over 25 years. During the first several years following antibiotic withdrawal, antibiotic resistance (as measured by the percentage of fecal coliforms that were resistant to tetracycline) decreased from over 90% (initially) to about 50% (Figure 1). Since that time, 30 to 70% of the fecal coliforms continue to be resistant to tetracycline, even though the pigs have received no antibiotics in their feed or for treatment purposes for over 25 years. In fact, we find that age of the pigs, type of housing, and moving stress had as much (or more) of an effect on the shedding of antibiotic-resistant fecal bacteria than does the presence of antibiotics in the diet (Table 1). So, it appears that even if antibiotics were banned, it will not completely eliminate the problem of antibiotic resistance.

Interestingly, our swine herd at Lexington has been fed tetracyclines (aureomycin) continuously since 1972, and when we test for resistance, nearly 100% of the fecal bacteria are resistant to tetracyclines (Figure 1). Yet, when we conduct antibiotic efficacy experiments, the pigs with resistant bacteria still respond to the antibiotic in terms of enhanced growth rate and improved feed efficiency.

So why is antibiotic resistance in the human population so high and does feeding of antibiotics to animals contribute to the problem? Several points can be made here. First, according to a survey of patients in hospitals in the Northeast several years ago (1986), antibiotic resistance was quite high and resistance patterns had not changed over the previous 10-year period. Many believe that antibiotic resistance problems in humans is simply due to the high use of antibiotics prescribed directly to humans by doctors, because well over half of the antibiotics produced in the United States is used in human medicine.

Would a ban on subtherapeutic use of antibiotics have a negative impact on the wholesomeness of the meat supply? Many experiments show that pigs fed subtherapeutic levels of antibiotics are healthier than those not fed antibiotics. Disease levels are less and mortality and morbidity, especially in young pigs, is reduced when antibiotics are fed to pigs. It is only reasonable that healthier animals with less subclinical disease at slaughter plants will result in a more healthful food supply.

Two other important issues that animal agriculture is facing are animal welfare and environmental issues. Antibiotics play a positive role with respect to these issues. Animal well- being is definitely improved in animals that are healthier due to the disease suppressing effects of antibiotics. Also, the improved utilization of dietary nutrients means that less quantities of
nitrogen, phosphorus, and other nutrients are excreted into the environment.

In summary, published research data clearly show that the use of antibiotics during all phases of growth benefits the rate and efficiency of body weight gain, reduces mortality and morbidity, reduces subclinical disease, and improves health in pigs. Also, antibiotics at breeding and during lactation benefits reproductive and lactational performance in sows. Monitoring and surveillance of microbial

resistance in animals and humans has continued, with no animal-to-human infection path being clearly delineated. Even though antibiotics have been fed for nearly 50 years to literally billions of animals, there is still no convincing evidence of unfavorable health effects in humans that can be directly linked to the feeding of subtherapeutic levels of antibiotics to pigs or other animals.

We need to be reminded that important legislative decisions such as the recent ban on antibiotics in the EC, the ban on growth hormone-treated beef in the EC, the proposed ban on genetically engineered crops, and other similar actions that impact the food supply and other agricultural products are not usually based on science. Therefore, personal and collective lobbying may be required for the pork industry to continue the use of subtherapeutic antibiotics and other time-proven technologies.

The next two columns of UK Swine Research Update will review the economic advantages from using subtherapeutic levels of antibiotics in starting, growing, and finishing diets and from using antibiotics in diets on reproductive efficiency in sows.

Table 1. Percentage of fecal coliforms resistant to tetracycline in pigs with no exposure to antibiotics[a]

Item	No. of Samples	Resistant Bacteria[b] (% of total)
Age of pig (months)		
less than 2	1,069	70
2-6	1,110	64
7-11	719	24
12-23	1,648	33
24 or more	340	29
Housing		
Farrowing house	464	50
Feeding floor	1,326	69
Pasture	2,421	29
Moving stress		
Unmoved	4,886	46
After moving 180 miles	696	82

[a]University of Kentucky herd that has not received antibiotics since 1972. These samples were taken during the first 13 years of the study.

[b]Percent of the fecal coliform colonies that were resistant to tetracycline.

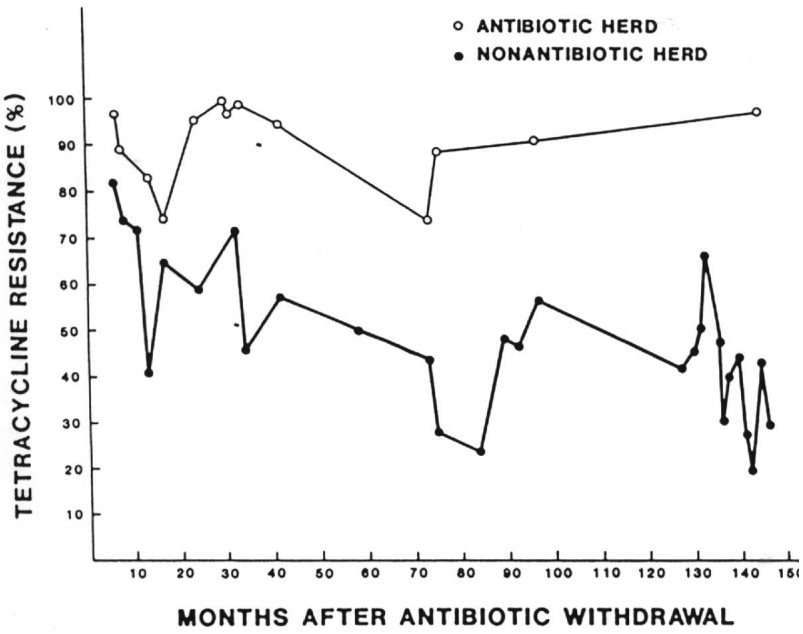

Figure 1. Tetracycline resistance of fecal coliforms from pigs in a herd at the University of Kentucky Research and Education Center, Princeton, KY that has not been exposed to antibiotics since 1972 (nonantibiotic herd) and in a herd on the Coldstream Farm at the University of Kentucky, Lexington, KY that that has been fed tetracycline (aureomycin) continuously since 1972 (antibiotic herd).

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