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MINISTRY OF AGRICULTURE AND FOOD

Antibiotic Use For Growth Improvement - Controversy And Resolution

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Antibiotics are defined as any substance produced by a micro-organism that inhibits or kills other micro-organisms, primarily bacteria. Penicillin and oxytetracycline are well-known antibiotics. There are several non-antibiotic, synthetic agents available as well. Sulfonamides (such as sulfamethazine) and fluoroquinolones (such as enrofloxacin) are examples. Antibiotics and the synthetic non-antibiotic agents are both classified as antimicrobials.

Modern livestock production systems use antibiotics and other antimicro-bials to prevent or treat disease in animals. Some commodity groups also use antibiotics to improve growth and have done so since the 1950s. They have improved weight gain and feed utilization in broiler chickens and turkeys, pigs, calves, beef cattle and replacement dairy heifers.

So What Is The Controversy?

Continuous, low-dose administration of an antibiotic can increase the rate of growth and/or the efficient use of feed in livestock. Cost of production goes down. The administration of antibiotics for growth is partially responsible for the low meat prices we enjoy today in North America.

But this intensive, non-therapeutic use of antibiotics in agriculture leads to the development of antibiotic resistance, particularly in gut bacteria, such as a group of bacteria called the *Enterococci*. These resistant bacteria may infect people, or their resistance genes may spread to other bacteria that infect people. Antibiotic resistance limits treatment options, delays recovery and costs more. The most troubling aspect is that antibiotic resistance can increase with continued and widespread use of antibiotics to improve growth (World Health Organization, 2003).

What does intensive, non-therapeutic use of antibiotics mean? The use of antibiotics to improve growth in

animals represents a case of intensive use because it involves the simultaneous dosing of large numbers of animals, typically the entire flock or herd, and administration of the drug is for long periods of time, sometimes for the life of the animal.

Many consider using antibiotics for animal growth improvement a non-therapeutic treatment. Healthy animals receive antibiotics instead of sick ones, and dosing is well below standard treatment levels.

How Do Antibiotics Improve Growth?

Continuous, low-dose administration of an antibiotic can increase the rate and efficiency of weight gain in healthy livestock. The presence of antibiotics likely changes the composition of the gut flora to favour growth. Debate is ongoing as to how that gut flora are changed; change may simply be a reduction in numbers, a change in species composition or a combination of the two. For example, a low, continuous dose of antibiotic may:

- eliminate bacteria that steal essential nutrients required by the animal for growth
- reduce competition allowing beneficial bacteria that produce essential nutrients required by the animal for growth to multiply
- control growth of bacteria that cause low-grade infections or produce toxins, both of which result in thick intestines that do not absorb nutrients well.

Some antibiotics may also enhance feed consumption and growth by stimulating metabolic processes within the animal.

What Are The Benefits Of Using Antibiotics To Improve Growth?

The use of an antibiotic at low doses and for long periods of time can increase the rate of weight gain or efficiency of feed utilization. For example, in swine, researchers have measured a 3%-9% average improvement in weight gain and a 3%-7% average improvement in feed efficiency in pigs fed low doses of antibiotics, compared to those pigs not fed antibiotics.

The amount of improvement is dependent on a variety of factors, including feed composition, management practices and the health status of the animals. The greatest benefit is seen when these factors are not optimal. When these factors are optimal, no benefit is seen with the use of antibiotics to improve growth.

What Are The Consequences Of Using Antibiotics To Improve Growth?

Antibiotic use in livestock production systems may result in drug residues in meat if withdrawal times prior to slaughter are not followed. However, most antibiotics used to improve growth do not require a withdrawal period, as drug residues are below the maximum residue level set by Health Canada. A more significant consequence is the emergence of antibiotic resistance.

Use of antibiotics to improve growth in food animals can result in selection for antibiotic-resistant bacteria. Resistance can negatively impact both animal and human health. Single or multi-drug resistance can occur. Some of these resistant bacteria can directly cause disease in livestock, or they can pass their resistance traits to disease-causing bacteria. Humans can acquire these resistant bacteria either through direct contact with infected animals or through contaminated food or water. Veterinarians and physicians have fewer treatment options for infections caused by multi-drug-resistant bacteria, and treatment may fail. Infections involving resistant bacteria can be more severe and last longer. Global spread of resistant bacteria can occur quickly through trade and travel.

Evidence for the passage of resistance traits from animal to human bacteria was documented in Europe in the 1990s. The antibiotic avoparcin was used to improve growth characteristics in chicken and pig production. Researchers found that chickens and pigs harboured an increasing proportion of bacteria resistant to avoparcin. They also found an increased proportion of bacteria resistant to vancomycin in humans. Vancomycin is an important antibiotic in human medicine and is related to avoparcin. Resistance to avoparcin also results in resistance to vancomycin.

Is There Evidence Of Antibiotic Resistance From The Use Of Antibiotics For Growth Improvement In Ontario?

Any use of antibiotics in animal or human medicine increases the risk of emergence of resistant bacteria. The greatest risk occurs with certain administration practices, such as simultaneous administration to the entire flock or herd, prolonged administration or overuse of one antimicrobial. A direct link between antibiotic use to improve growth in Ontario livestock and the spread of resistance to people has not been established. But studies are under way to investigate this linkage.

The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) supports research that studies agricultural antibiotic use and antimicrobial resistance. OMAFRA also supports the development of the Public Health Agency of Canada's national surveillance programs on antibiotic use and resistance in agriculture and aquaculture. Data from these programs and from Ontario research will be used in risk assessments that investigate the impact of agricultural antibiotic use on human health.

How Frequent Is The Use Of Antibiotics To Improve Growth In Ontario Livestock?

The amount of antibiotics used to improve growth in Ontario livestock is unknown. Antibiotics to improve growth have more frequent use in poultry and swine production. Cattle receive antibiotics to improve growth less often, since beef producers tend to use hormone implants instead.

Governments and industry partners are working together to complete much-needed research and policies that promote the prudent use of antibiotics in livestock. The use of antibiotics to improve growth is not prudent if no benefit is realized. Little or no benefit is seen in herds or flocks with optimal health, nutrition and management practices. Research results also suggest that benefit may be limited to certain periods of time during the growth of the animal, such as the first 2 weeks after hatching for chicks or the first 2 weeks after weaning of piglets. Alternative products to antibiotics to improve growth are also available or are under investigation.

Are These Antibiotics Regulated?

Yes and no. Antibiotics used to improve growth are approved in Canada through the Food and Drugs Act and Regulations (Health Canada). Antibiotics are approved as drugs, not feed additives.

Growth improvement doses of antibiotics are typically administered either through the feed or water. Their use in commercially and on-farm-produced feed is further enforced by the Canadian Food Inspection Agency through the Feeds Act and Regulations.

However, both unapproved antibiotics imported for "own use" and some approved non-prescription antibiotics can be used in water to improve growth. Beyond the approval process, water medications for livestock are not further regulated.

The following antibiotics are approved by Health Canada for growth improvement in livestock:

- chlortetracycline
- virginiamycin
- bacitracin
- bambamycins
- lincomycin
- salinomycin
- penicillin
- monensin
- tylosin
- lasalocid

All drugs licensed to improve growth are available to producers without a veterinary prescription. *The Compendium of Medicating Ingredient Brochures* lists all feed antibiotics licensed in Canada to improve growth. The brochures specify type of livestock, age or body weight, dose and drug withdrawal times prior to slaughter. The new Medicated Feeds Regulations proposed under the federal Health of Animals Act are intended to ensure that medication dosages are correct and cross-contamination between feed batches does not occur in both

commercially produced and farm-produced medicated feed. These regulations will provide additional assurances that violations in drug withdrawal times will not occur.

Non-prescription approved antibiotics in Ontario are sold through licensed retail outlets. OMAFRA monitors these retail outlets under the Livestock Medicines Act. This ensures that medicines available for sale are stored correctly and are not expired. All the drugs listed above to improve growth, except for bambarmycins and the ionophores (lasalocid, monensin and salinomycin), can be purchased in Ontario through these licensed retail outlets.

Avoparcin and some other drugs used elsewhere in the world to improve growth are not currently approved for use in animals in Canada. However, unapproved antibiotics may be imported and used by producers for their "own use" on their livestock. The Veterinary Drugs Directorate (Health Canada) is proposing legislation to prohibit this activity. National on-farm food safety or quality assurance programs, such as the CQA® program for pork production, also prohibit this activity.

How Can The Development Of Antibiotic Resistance Be Controlled?

Antibiotic use increases the risk of the development of antibiotic resistance. So it follows that a reduction in unnecessary use is an effective control measure. Studies on the success of this measure (reduction in unnecessary use) are available in the Ontario medical community. For example, a decrease in antibiotic prescriptions for upper respiratory symptoms (most of which are caused by viruses) in humans resulted in a reduction in the number of resistant *Streptococcus pneumoniae* (a common cause of pneumonia).

Data from Europe show the value of this control measure in an agricultural setting. The European Union banned the use of avoparcin to improve growth in 1997. The amount of avoparcin-resistant bacteria in poultry and swine has since dropped to almost zero. Resistance to vancomycin (a drug related to avoparcin) in human bacteria has seen an identical drop in resistance levels since the avoparcin ban.

In Denmark, an investigation of the effects of growth promoter termination 4 years after the ban reported a 50% reduction in total use of antibiotics in the Danish broiler chicken and swine industries. A reduction was also seen in the number of days pigs and chickens were exposed to antibiotics (pigs: from 170 days to 8 days; chickens: from 42 days to 0.4 days). A greater than 50% decline in antimicrobial resistance was seen in Enterococci isolated from pigs and chickens and from pork and chicken. This group of bacteria is thought to be a reservoir for resistance genes for human bacteria. The impact on human health of this reduction in resistance in animals is still under investigation.

Resolution: What Can Ontario Producers Do?

By following these basic principles, you can limit antibiotic resistance on your farm:

- Periodically reevaluate any antibiotic use to improve growth to make sure it is still doing so in your production system. If no benefit is realized, don't use antibiotics for this purpose.
- Work towards best farm management practices: practices that encourage a reduction in antibiotic use.
- Ask your veterinarian for advice on strategies to optimize herd or flock health.
- Ask your nutritionist for advice on alternative feeds and feeding strategies for growth.
- Consider the use of approved alternative products that improve growth.

What Alternatives To Antibiotics Are Available To Improve Growth?

A number of alternatives are now available to improve growth in livestock. They range from chemical and biological products to various feed ingredients and alternative feeding strategies.

Copper and arsenic have a long history of use in livestock to improve growth. However, there are food safety and environmental concerns with the use of copper and arsenic. Their use in feed is not recommended above levels stipulated in the Feeds Act and Regulations.

There are a number of other promising alternatives available to improve growth in food animals. Some of these include direct-fed microbials, acidifiers, enzymes, oligosaccharides, co-products from manufacturing and distillation processes, and liquid feeds. More information on these products is available from OMAFRA.

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