Antibiotic-free
The European experience

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The EU has firmly established itself in a “post-antibiotic” era where antibiotics are administered only therapeutically. The process of banning antibiotics in the EU took place in stages over 30 years, before the complete ban in 2006.

The number of large animal-feeding operations in swine, poultry, and cattle has been increasing across Europe. With the growth in farm size come disease challenges that impact animal health and production.

As antibiotics enable animals to grow faster and gain weight more efficiently, their use in growth promotion became a common practice in animal husbandry. Different studies have shown the effects in the past of these antimicrobials on different species (Table 1). In the US, approximately 80 percent of total antibiotic usage is in food producing animals. The use of certain antibiotics as growth promoters is regulated regionally and/or by country.

**Table 1.** Effects of in-feed antimicrobial additives in various species (n=12,153).

<table>
<thead>
<tr>
<th>Species</th>
<th>Weight gain (%)</th>
<th>FCR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broiler</td>
<td>+3.6</td>
<td>-3.4</td>
</tr>
<tr>
<td>Layer</td>
<td>+2.8</td>
<td>-2.7</td>
</tr>
<tr>
<td>Turkeys</td>
<td>+3.1</td>
<td>-2.2</td>
</tr>
<tr>
<td>Pigs</td>
<td>+8.1</td>
<td>-4.8</td>
</tr>
<tr>
<td>Fattening pigs</td>
<td>+3.2</td>
<td>-2.0</td>
</tr>
<tr>
<td>Piglets</td>
<td>+15.7</td>
<td>-8.6</td>
</tr>
</tbody>
</table>

**Source:** Rosen, 1995

**Antibiotics in livestock**

Antibiotics in livestock production can be used in two ways—therapeutically and sub-therapeutically. Therapeutic usage

**Figure 1.** Mechanisms of antibiotic resistance and their effects at the cellular level.

**Source:** Jen Philpott, 2012

**The ban**

Beginning in 1972, countries in the EU began their ban on different antimicrobials locally. This sequential ban ended in 2006 with the complete ban on AGPs in the EU.

1972

European countries ban the use of Tetracycline, Penicillin and Streptomycin as AGPs

1986

Sweden bans the use of AGPs

1996/97

Germany and subsequently, the EU ban the use of Avoparcin

1998

Denmark bans the use of virginiamycin and sub-therapeutic use of AGPs

1999

The EU bans olaquindox and carbadox; suspends authorization of bacitracin, tylosin, spiramycin and virginiamycin

2006

The EU bans all AGPs

**Source:** Cogliani et al., 2011
involves a higher dosage over a shorter period in order to treat a specific disease. Sub-therapeutic usage requires a lower dosage over a longer period to prevent diseases, limit subclinical infections and improve growth rates. Until bacteria become antibiotic resistant, the use of antibiotics would limit subclinical diseases and improve performance.

However, with antibiotic resistance, the farmer is faced with no other option but to increase the use of pharmaceuticals. Increased mortality, decreased body weight gain, and worsened feed conversion are further outcomes that would trigger an increase in production costs. In addition, bacterial resistance in animals may affect human disease control. The World Health Organization observed resistance among *Enterococcus faecalis* and *Enterococcus faecium* isolated from pigs at slaughter after long-term tylosin use for growth promotion (Figure 2).

**Early responses**

Resistance genes disseminated via the food chain, both from meat consumed and through the dispersion of antibiotics into soil and water, and can make their way into the digestive tract of humans. Therefore in 1986, Sweden became the first country in Europe to address the problem of antibiotic resistance and regulate the use of antibiotics in food-producing animals. Consequently, Swedish sales of in-feed antibiotics were reduced to one third, from 45 tonnes in 1986 to 15 tonnes by 2009.

Soon after, the Swedish agriculture ministry reported significant clinical problems emerging in piglets after the withdrawal of antibiotic growth promoters (AGPs). Post-weaning mortality increased by 1.5 percent and chickens took 5-6 days longer to reach 2.5 kg.

Despite these drastic consequences, other countries like Denmark, the United Kingdom, and the Netherlands soon followed the Swedish example. In Denmark, the use of AGPs fell from over 105 tonnes in 1996 to nil by 2000.

The European regulation also started to follow the Swedish and Danish examples. In 1997, the EU banned the use of avoparcin and remaining AGPs on the basis of the “precautionary principle”. In 1999, the EU put a ban on olaquindox and carbadox and suspended authorization of bacitracin, tylosin, spiramycin, and virginiamycin. From 2006, the EU enforced a complete ban on all AGPs.

**The Danish experience**

Globally, there are only limited studies that take into consideration antibiotic usage and their effect on the productivity of animals. Aarestrup et al. (2010) prepared a detailed study on the changes in anti

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*Figure 2. Tylosin use for growth promotion and erythromycin resistance among *Enterococcus faecalis* and *Enterococcus faecium* isolated from pigs at slaughter from 1995 to 2001 in Denmark.*

*Source: World Health Organization, 2002*

*Figure 3. Swine production trend in Denmark after the AGP ban.*

*Source: Aarestrup et al., 2010*
microbial consumption and productivity of Danish swine between 1992 and 2008.

According to their study, Danish pig production increased from 18.4 to 27.1 million head between 1992 and 2008. The average number of finishing pigs per sow per year also rose from 21.5 to 25 within 16 years (Figure 3). In 2008, the average consumption of antimicrobials was 49 mg/kg per hog, from 100 mg/kg in 1996. This decline was mainly due to the ban on the sub-therapeutic use of AGPs.

The average daily gain (ADG) of weaners (<35 kg) decreased from 1992 until shortly after the ban in 2000, and increased thereafter. In 2008, ADG was about 8% higher than before the AGP ban in 1992 (Figure 4). Average mortality of weaning pigs increased slightly from 1992 until 2004 when it reached its peak at almost 5% before falling back to 2.5% in 2008 which is close to the 1992 level. The mortalities were most probably influenced by porcine reproductive and respiratory syndrome (PRRS) and post-weaning multisystemic wasting syndrome (PMWS) which occurred in 1996 and 2001, respectively.

The ADG for finishing pigs (>35 kg) was higher (around +25%) in 2008 than in 1992, but mortality rates for weaning and finishing pigs were similar in both years (Figure 5). AGP consumption per kilogram of pig produced in Denmark fell by more than 50% between 1992 and 2008. With productivity showing improvements, the ban on AGPs is not seen to negatively impact swine production in the long term.

Life after AGPs

The Danish experience shows that there is life after AGPs but several measures have to be implemented. These include management, biosecurity, a well-balanced diet to reduce stress factors and mycotoxin risk management.

Over the last ten years, the ban on AGPs led to the need for a change in feed formulations. Today, there is greater knowledge on the use of additives in the different feed formulations. Alternatives to antibiotics, such as the use of phytotherapics in combination with probiotics and acidifiers have become better accepted.

Trials conducted with the Biomin phytogenic line Digestarom® showed that performance gains were comparable to gains achieved by AGPs but without any danger of antimicrobial resistance developing. Continual investments in research on non-antibiotic growth promoters can help overcome new challenges in animal production, and allow the industry to adapt to changing trends.

References are available on request.

**Figure 4.** Danish productivity trends in weaners after the AGP ban.

**Figure 5.** Danish productivity trends in finishers after the AGP ban.