Antibiotic and Hormone Use in Livestock Production

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Presentation Outline
• Antibiotics and Hormones
  a. How they are used
  b. Quantities used
  c. How they work
  d. Effects

1a. How are antibiotics used in livestock production?
  – Therapeutically
    • Higher doses, shorter periods
    • Used to treat specific diseases
  – Subtherapeutically
    • Lower doses, longer periods (usually)
    • Used to prevent infections, limit subclinical infections, improve growth rates
    • Been in practice since the 1950’s

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1b. Quantities of antibiotics used in livestock production

- ~25 antibiotics are approved for use in livestock
- How much?
    - 18 million pounds used in beef, dairy, swine, and poultry production
    - 83% for the treatment of specific diseases
  - Union of Concerned Scientists (2001)
    - 25 million pounds for subtherapeutic uses alone
    - 21 million pounds used in swine and poultry production

1c. How they work

Benefits of subtherapeutic antibiotic use:

1. Disease Prevention
   a. Prevent clinical disease
   b. Prevent subclinical disease

2. Other Health Benefits
   a. Improve gut health
   b. Improve microbiological populations
      - Increase nutrient absorption

Result: increased feed efficiency and increased average daily gain = more rapid and efficient growth

1d. Effects of in-feed antibiotic use

<table>
<thead>
<tr>
<th>Swine</th>
<th>Ab-</th>
<th>Ab+</th>
<th>%diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starter Phase (&lt;25Kg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily gain (Kg)</td>
<td>0.39</td>
<td>0.35</td>
<td>+16.4</td>
</tr>
<tr>
<td>Feed/gain</td>
<td>2.28</td>
<td>2.13</td>
<td>-6.9</td>
</tr>
<tr>
<td>Growing Phase (17-49Kg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily gain (Kg)</td>
<td>0.59</td>
<td>0.66</td>
<td>+10.6</td>
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<tr>
<td>Feed/gain</td>
<td>2.91</td>
<td>2.78</td>
<td>-4.5</td>
</tr>
<tr>
<td>Growing/Finishing Phase (24-89Kg)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Daily gain (Kg)</td>
<td>0.69</td>
<td>0.72</td>
<td>+4.2</td>
</tr>
<tr>
<td>Feed/gain</td>
<td>1.5</td>
<td>1.47</td>
<td>-2.2</td>
</tr>
</tbody>
</table>

Adapted from Cromwell et al., 1999

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1d. Effects of in-feed antibiotic use

<table>
<thead>
<tr>
<th>Livestock Species</th>
<th>Growth Rate (% Improvement)</th>
<th>Feed Efficiency (% Improvement)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piglets</td>
<td>16</td>
<td>7</td>
</tr>
<tr>
<td>Growing Pigs</td>
<td>9</td>
<td>5.5</td>
</tr>
<tr>
<td>Broiler Chickens</td>
<td>3-10</td>
<td>3-5</td>
</tr>
<tr>
<td>Laying Hens</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Veal Calves</td>
<td>7-10</td>
<td>4-5</td>
</tr>
</tbody>
</table>

Adapted from Avcare 2003

1a. How are hormones used in livestock production?

- Reproductive hormones
  - Synchronize estrus
  - Induce parturition
  - Used in beef, dairy, pork production
- Growth promoting hormones
  - Beef cattle
    - Mostly implants
    - Growth stimulants slowly released over time
  - Dairy cattle
    - rBST
  Growth promoting hormones are not used in pork and poultry production

1b. Quantities of hormones used in livestock production?

- Beef cattle
  - Estrogenic: estradiol*, zeranol
  - Androgenic: testosterone*, trenbolone acetate
  - Progestins: progesterone*, melengestrol acetate (MGA)
  - >90% of all conventionally raised beef cattle are implanted at least once during their lives
- Dairy cattle
  - rBST
  - ~22% of all dairy cows receive rBST (2000)
  - THIS NUMBER IS DECREASING – growing demand for rBST-free milk

Supplemented vs. natural

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1c. How they work

- Growth promoting hormones
  • Increase feed intake
  • Increase circulating IGF-1 and ST
  • Direct effect on protein accretion
  • Interfere with anti-anabolic effects of corticosteroids

  Result:
  • Increase feed efficiency
  • Increase lean muscle mass

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1c. How they work

- rBST
  • Changes metabolism of other systems such that more nutrients are available for milk synthesis
  • Increases blood flow/nutrients to the udder
  • Increases uptake of milk precursors by the mammary gland

  Result
  • Partitioning energy towards milk production increases milk production-no drop in quality

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1d. Effects of hormone use

- Growth promoting hormones (beef)
  • Depends upon stage of growth
  • Nursing calves: ↑5%
  • Stocker calves: ↑10%
  • Feedlot calves: ↑15%
  • $5-$10 return for every $1 invested
1d. Effects of hormone use

- rBST (dairy)
  - Production cows:
    - Increases of ~10%
    - Increase 8-12 lbs milk /day (1-1.5 gallons/day)

Summary

Antibiotics

- Antibiotics are used in livestock production both therapeutically and subtherapeutically
- In-feed antibiotics improve animal health which translates to more rapid and efficient growth
- Antibiotic use has demonstrated economic benefits for livestock producers

Summary

Hormones

- Six hormones are approved for growth promotion in beef production
- rBST is approved for dairy production but its use is decreasing
- Growth promoting hormones are not used in poultry or pork production
- The use of implants in beef and rBST in dairy dramatically improves growth rates and milk production
- Each is considered among the most cost-effective management practices available to producers

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