Korea’s experience of total ban of antibiotics in animal feed

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Ministry of Agriculture, Food and Rural Affairs, KOREA
Contents

• Background

• Consequence of total Ban
  - Antimicrobial consumption
  - Antibiotic resistance
  - Animal and Human health
  - Animal productivity

• Summary
Background
Republic of Korea

- **Population** (x1,000 people): 51,270

- **Number of livestock** (x1000 head)

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<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Beef cattle</td>
<td>1,959</td>
<td>2,705</td>
<td>38.1</td>
</tr>
<tr>
<td>Dairy cattle</td>
<td>471</td>
<td>406</td>
<td>-13.9</td>
</tr>
<tr>
<td>Pigs</td>
<td>9,198</td>
<td>10,426</td>
<td>13.4</td>
</tr>
<tr>
<td>Chicken</td>
<td>126,668</td>
<td>168,642</td>
<td>33.1</td>
</tr>
</tbody>
</table>

(source: Statistics Korea)
Major Regulations for antimicrobial use in livestock

- Pharmaceutical Affairs Act
  (Ministry of Health and Welfare, Ministry of Food and Drug Safety)

- Handling Rules of Animal Medicines and Others
  (Minister of Agriculture, Food and Rural Affairs)

- Regulatory Guidelines on use of Animal Medicines for Formula Feed (MAFRA)
- Regulatory Guidelines of designation for Prescription Animal Medicines (MAFRA)
- Guidelines on safe use of Animal Medicines (QIA under MAFRA)
Heavy contamination of Multi-Drug Resistant bacteria in 18 major food items including beef, pork, and fisheries

- 100% of *Salmonella* isolates showed resistance to one more antimicrobial
- Furthermore, 63% of *Salmonella* isolates showed resistance to four more antimicrobials
Press release of heavy use in animals and AMR contamination in animal products

[문제의 맥락] 6. 항생제 범벅된 가축 사료


유류 1당 항생제 사용량
(단위: kg)

<table>
<thead>
<tr>
<th>국가</th>
<th>항생제 사용량</th>
</tr>
</thead>
<tbody>
<tr>
<td>한국</td>
<td>0.77</td>
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<tr>
<td>미국</td>
<td>0.29</td>
</tr>
<tr>
<td>덴마크</td>
<td>0.06</td>
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</tbody>
</table>


식품 속 세균의 항생제 내성률

<table>
<thead>
<tr>
<th>세균</th>
<th>항생제</th>
<th>내성률(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>대장균</td>
<td>테트라사이클린</td>
<td>81.2</td>
</tr>
<tr>
<td></td>
<td>스톨른티아민</td>
<td>63.8</td>
</tr>
<tr>
<td></td>
<td>페이나실린</td>
<td>56.0</td>
</tr>
<tr>
<td>함석포도상구균</td>
<td>페이나실린</td>
<td>75.0</td>
</tr>
<tr>
<td></td>
<td>테트라사이클린</td>
<td>41.3</td>
</tr>
<tr>
<td></td>
<td>펜실실린</td>
<td>2.5</td>
</tr>
<tr>
<td>장구균</td>
<td>테트라사이클린</td>
<td>40-60</td>
</tr>
</tbody>
</table>

(2002. CBS)

소재고기 항생제 범벅...외국의 3~24배

소재고기 항생제 범벅...외국의 3~24배

(2006. CBS)
Launch the National Antimicrobial Resistance Management Program - Relevant government ministry & academia

**Non-human sector**

- **Ministry of Agriculture, Food and Rural Affairs**
  - Develop AR Management System in Livestock Farming
- **Ministry of Marine Affairs & Fisheries (NFRDI)**
  - Develop AR Management System in Aquaculture
- **KFDA**
  - Food Microbiology Division
  - Monitoring Antimicrobial Resistant Foodborne Bacteria
- **Dong Guk University**
  - Monitoring of Antibiotic Residue in Foods
- **Ministry of Finance and Economy**
  - Korea Consumer Protection Board
  - Surveillance of AR in Environment

**Human sector**

- **Ministry of Health & Welfare (KCDC)**
  - Monitoring of AR in Community, Prevalence Study of Antimicrobial Resistance from Diarrhea Patients
- **Research Institute of Health & Environment**
  - Prevalence Study of Antimicrobial Resistance from Diarrhea Patients
- **Chonnam National/Kosin University**
  - College of Medicine
  - Monitoring Antimicrobial Resistance in public Society/
    Construction of Roadmap for Overcoming AR in Medical Area
- **Ministry of Health & Welfare**
  - National Health Insurance Corporation
  - Surveillance of Clinical Antibiotic Usage

**Ministry of Food & Drug Safety**

- Overall Management
- Networking
- Information Refining
- Advisory Committee
- Public Campaign
- International Activities
- Monitoring AR in Foods

**Ministry of Science & Technology**

- Culture Collection of Antimicrobial Resistant Microbes
- Educate National Standard AR Inspection Method

(source: KFDA)
Main activities of national project on AMR (2003 – 2012)

- Organizing an Advisory Committee ‘Board of National Antimicrobial Resistance Experts’(35)

- Developing of monitoring program on antimicrobial consumption and resistance in clinical, livestock & fishery sectors

- **Implementing of risk management measures** on antimicrobial resistance in livestock & fishery sectors

- Investigating antimicrobial resistance in Foods

- Establishing the national surveillance network

- Education and training for prudent use of antibiotics in both humans and animals
Early warnings and actions

• 1969 Swann Committee recommends restrictions on antimicrobials in animal feed

• 1997 WHO scientific meeting concludes that it is ‘essential to replace growth promoting antimicrobials’

• 1998 EU bans four antimicrobials in animal feed as ‘precautionary’ measure.

• 1999 EU Scientific Steering Committee recommends phase-out of antimicrobials that may be used in human/animal therapy

• 2000 WHO recommends ban on antimicrobials as growth promoters if used in human therapy and in absence of risk-based evaluation

• 2006 Total ban on antibiotics as growth promoters in EU

(Source: “Late lessons from early warnings: the precautionary principle 1896–2000 “: Antimicrobials as growth promoters: resistance to common sense, LE Edqvist&KB Pedersen, 93-100)
Actions of AMR management in Livestock

1. Establishing the national monitoring program
   - Korean Veterinary Antimicrobial Resistance Monitoring System

2. Implementation of regulation on antimicrobial use
   - Regulatory Guidelines on use of Animal Medicines for Formula Feed
     - Antimicrobial resistance committee decided the ban of antibiotic addition in animal feed according to international guidelines
     * Antimicrobial resistance committee was comprised of academics, government officials, and producers' groups
   - Regulatory Guidelines of designation for Prescription Animal Medicines
   - Guidelines on safe use of Animal Medicines
KVARMS
(Korean Veterinary Antimicrobial Resistance System)

Consumption
- Korean Animal Health Product Association

Animals
- 14 Provincial Vet. Service

Carcasses
- 14 Provincial Vet. Service

Retail meats
- Ministry of Food & Drug Safety

Imported meats
- Ministry of Food & Drug Safety

Animal & Plant Quarantine Agency

Distribution
- Annual report

Data
- Isolates

Homepage

Ministry of Agriculture, Food and Rural Affairs
Banned antibiotics in animal feed

• 1997-2003
  : avoparcin, spiramycin, olaquindox, spectinomycin, flubendazol etc

• 2005. 05 (53→25)
  : Oxytetracycline HCl, Erythromycin, Sulfadimethoxine etc

• 2009.01 (25→18)
  : Oxytetracycline, Chlortetracycline, Bacitracin zinc, Colistin sulfate, Lincomycin hydrochloride, Neomycin sulfate, Penicillin

• 2011. 07 (18→9 inophores)
  : apramycin, avilamycin, bambermycin, bacitracin methylene disalicylate , enramycin, tiamulin, tylosin, virginiamycin, sulfathiazole

* Nine inophores : Narasin, Diclazuril, Lasalocid, Madurmycin, Monensin, Salinomycin, Semduramycin, Clopidol, Fenbendazole
Consequence of Banning of antibiotics in animal feed
Consumption of antimicrobials

(Source: Korea Animal Health Products Association)

No. of livestock(x1,000 head)

(Source: Statistics Korea)
Consumption by antimicrobial classes

(Source: Korea Animal Health Products Association)
Prevalence of multiple drug resistance in indicator bacteria from healthy animals

* Multiple drug resistance : ≥3 subclasses

(Source : KVARMS)
Comparison of consumption and resistance

**Tetracyclines**
*(E. faecium)*

**Sulfonamides**
*(E. coli)*

(Source: KAKPA, KVARMS)
Comparison of consumption and resistance

**Macrolides**

*E. faecium*

**Fluoroquinolones**

*E. coli*

(Source: KAKPA, KVARMS)
Diagnostic submission

Number of submission

Etiology of diagnosis

(Source : Korea Animal Health Integrated System)
Impacts on livestock production

**Pig**

- **Raising cost of hog per head**
  - Source: Statistics Korea

- **Veterinary & medicine cost**

**Broiler**

- **Raising cost of broiler per 10 head**

- **Veterinary & medicine cost**

(source: Statistics Korea)
Pig farm productivity after banning of antibiotics

Table 8. Comparisons of productivity between pre- and post-ban on use of antibiotic growth promoters.

<table>
<thead>
<tr>
<th>Item</th>
<th>Citation data a)</th>
<th>Present study 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2003</td>
<td>2010</td>
</tr>
<tr>
<td>Live pig born per litter, head</td>
<td>10.1</td>
<td>10.6</td>
</tr>
<tr>
<td>Weaning piglet, head</td>
<td>9.1</td>
<td>9.5</td>
</tr>
<tr>
<td>Pre-weaning mortality, %</td>
<td>7.0</td>
<td>9.7</td>
</tr>
<tr>
<td>Post-weaning mortality, %</td>
<td>10.3</td>
<td>15</td>
</tr>
<tr>
<td>Sow turnover rate</td>
<td>2.32</td>
<td>2.26</td>
</tr>
<tr>
<td>MSY, head</td>
<td>19.6</td>
<td>18.5</td>
</tr>
</tbody>
</table>

a)Data were quoted from Korea pork producers association (2013). The numbers of survey farm on citation data, except for MSY, are 142 farmers in 2003, 428 farmers in 2010, and 74 farmers in 2012. The survey farms on MSY are 35, 99, and 89 in 2003, 2010, and 2012, respectively.

(MSY, marketing per sow per year)  
(Source : Kim et al., CNJ Journal of Agriculture Science, 2015)
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</thead>
<tbody>
<tr>
<td>Growth rate</td>
<td>62.3</td>
<td>93.8</td>
<td>92.7</td>
<td>92.7</td>
<td>95.1</td>
<td>95.1</td>
</tr>
<tr>
<td>Raising days</td>
<td>38.8</td>
<td>37.6</td>
<td>33.13</td>
<td>33.58</td>
<td>32.67</td>
<td>32.7</td>
</tr>
<tr>
<td>Slaughtering weight</td>
<td>1.53</td>
<td>1.38</td>
<td>1.44</td>
<td>1.45</td>
<td>1.45</td>
<td>1.45</td>
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<tr>
<td>Feed conversion</td>
<td>1.78</td>
<td>1.58</td>
<td>1.6</td>
<td>1.6</td>
<td>1.57</td>
<td>1.55</td>
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<tr>
<td>Weight gained per day</td>
<td>39.4</td>
<td>37.6</td>
<td>43.5</td>
<td>43.2</td>
<td>44.4</td>
<td>44.3</td>
</tr>
</tbody>
</table>

**Productivity index***  

|                          | 204.2 | 218.4 | 252.1 | 250.9 | 268.1 | 272.2 |

* Productivity index : Growth rate x slaughtering weight x raising days x feed conversion

(Source: Korea Rural Economic Institute)
Number of slaughter animals

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**Cattle**

- No. of slaughter cattle
- Average weight of slaughter cattle (kg)

**Pigs**

- No. of slaughter pigs
- Average weight of slaughter pig (kg)

(Source: Animal and Plant Quarantine Agency)
Trends of incidence of *Salmonella* & *Campylobacter* in humans

(Source: KFDA)

(Source: Ministry of Agriculture, Food and Rural Affairs)
Antibiotic resistance of *C. jejuni*

### Chicken

- Gentamicin
- Erythromycin
- Ciprofloxacin
- Tetracycline
- Florfenicol

Year and number of isolates:

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
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<tr>
<td>43</td>
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</tbody>
</table>

### Chicken carcasses

- Gentamicin
- Erythromycin
- Ciprofloxacin
- Tetracycline
- Florfenicol

Year and number of isolates:

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
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</thead>
<tbody>
<tr>
<td>30</td>
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<td>103</td>
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<td>19</td>
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<td>44</td>
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<tr>
<td>40</td>
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</tr>
</tbody>
</table>

### Humans

- Gentamicin
- Erythromycin
- Ciprofloxacin
- Tetracycline
- Florfenicol

Year and number of isolates:

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
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<td>123</td>
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<tr>
<td>120</td>
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</tr>
</tbody>
</table>

(Source: KVARMS 2016, KARMS 2015)
# National Action Plan on Antimicrobial Resistance

## Vision
Decrease the misuse or overuse of antibiotics, use them appropriately, and prevent antibiotic-resistant bacteria transmission

⇒ **Protect citizens from the harm of antimicrobial resistance**

## Goals

<table>
<thead>
<tr>
<th>In humans</th>
<th>In non-humans</th>
</tr>
</thead>
<tbody>
<tr>
<td>✈️ Reduce the antibiotic use by 20%</td>
<td>✈️ Double the number of antibiotics needed to be prescribed by veterinarian</td>
</tr>
<tr>
<td>✈️ Reduce the antibiotic prescription for acute</td>
<td>✈️ Reduce fluoroquinolone-resistant <em>E. coli</em> in poultry by 10%</td>
</tr>
<tr>
<td>upper respiratory infection by 50%</td>
<td></td>
</tr>
<tr>
<td>✈️ Reduce the antibiotic prescription for respiratory diseases by 20%</td>
<td></td>
</tr>
<tr>
<td>✈️ Reduce the prevalence of methicillin- resistant <em>S. aureus</em> by 20%</td>
<td></td>
</tr>
</tbody>
</table>
Six area strategies to achieve the vision

1. Use antibiotics appropriately
2. Prevent the spread of antibiotic-resistant bacteria
3. Strengthen the surveillance system
4. Raise awareness
5. Enhance infrastructure and R&D support
6. Accelerate international collaboration
Detailed action plans in non-humans

1. Use antibiotics appropriately
   • Appropriately Use of Antibiotics for Agriculture, Livestock, and Fisheries: implementation of prescription, sales management, reevaluation of drugs, developed guidelines

2. Prevent the Spread of Antibiotic-Resistant Bacteria
   • Prevent the spread of AMR in agriculture, livestock, and fisheries: Improvement of Breeding Environment, Integrated Information System for Infection Prevention in Fisheries
Detailed action plans in non-humans

3. Strengthen the Surveillance System
   • Frame for surveillance: monitoring on duck and pet will be added
   • Laboratories: testing capacities for antimicrobial-resistant pathogens will be enhanced, and a national standard laboratory will be established.
   • Residue Test: the scope of the national residue program (NRP) on agriculture, livestock, and fisheries products will be expanded.

4. Improve Awareness
   • Raise awareness of the general public
   • Enhance the understanding of antibiotic users (professionals)
   • Perform periodical surveys on public understanding on antibiotics
5. Enhance Infrastructure and R&D Support

- Interministerial framework for actions
- Web-based portal system for antibiotics
- Increase strategic investment in R&D for tackling AMR
  - One health concept monitoring on antimicrobial use and resistance
  - Rapid diagnostic test, new antibiotics and alternative therapeutics

6. Accelerate International Collaboration

- Enhance global partnership to combat AMR
- Seek funding opportunities globally
Conclusion

• The banning of antibiotics in animal feeds was done without major consequences in Korea
  - No significant impact on decrease of productivity, animal and human health

• Negative impacts of banning of antibiotics are
  - Increase of consumption and resistance of therapeutic antibiotics and cost for veterinary and medicine both in pigs and chicken

• Advance planning should be conducted to create of environment that need for antibiotics
  - Expanding the environment-friendly farming systems
  - Implementing effective infection prevention and control measures
  - Developing new vaccines associated with outbreaks of animal diseases
Thank you for your attention