

The current state of AMR research activities including Alternative to antimicrobials (ATA) and collaboration opportunities in Republic of Korea

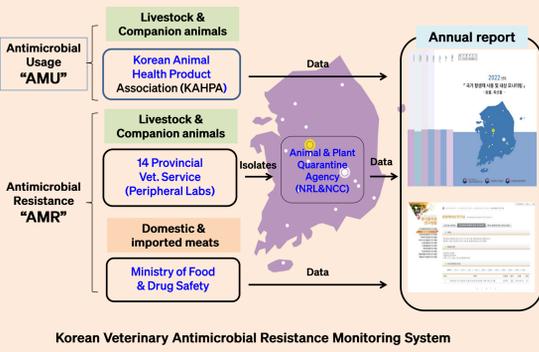
YOU Juyeon/Veterinary researcher



Background on AMR research in ROK

AMU/AMR Monitoring (2008 -)

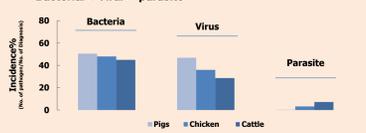
Organization



Current status of AMU/AMR

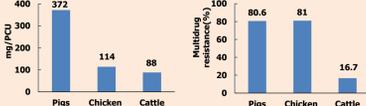
Livestock

Infectious disease
Bacterial > Viral > parasite



AMU (mg/PCU)
Pigs > Chicken > cattle

Antimicrobial consumption (2022)



AMR (MDR, E. coli)
Pigs, Chicken > cattle

Multidrug resistance (2022)

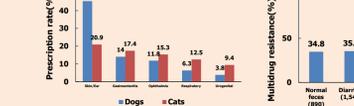
Companion animal

Bacterial disease
Skin/Ear > Diarrhea > Urine > Respiratory



AMU (Prescription)
Skin/Ear > Diarrhea > Urine > Respiratory

AMR (MDR, E. coli)
Skin > Urine > Diarrhea > Normal



Regulation

- Ban on antibiotics for feed additives (middle of 1990 - 2011)
- Prescription requirement to use antibiotics in animals (2013 - present)
- Restriction use of HP CIAs (fluoroquinolones & 3rd G. cephalosporins) in chicken (2021-present)

Key stakeholder

Stakeholder	Role
Government	<ul style="list-style-type: none"> Establish and enforce regulations Invest in surveillance programs Support research and development
Academia	<ul style="list-style-type: none"> Conduct research Educate future professionals Provide expert advice
Industry	<ul style="list-style-type: none"> Responsible antibiotic use Develop alternatives Transparency and data sharing

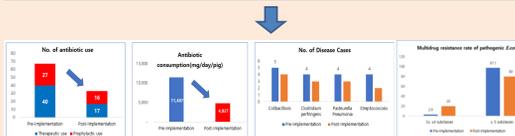


AMR/ATA Research Focus

Prudential use

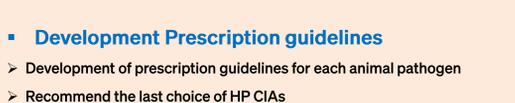
Development of prudential use model in pigs

- Antibiotic reduction Model**
 - Implementation of the veterinary advisory service contracts
 - Conduct antibiotic susceptibility testing before antibiotic administration
 - Reduction of prophylactic antibiotic use
 - Application of medicated water system for precise antibiotic administration
- Environmental Residual Resistant Bacteria Prevention Model**
 - Applying All-in/All-out system
- Disease Reduction Model**
 - Strengthening biosecurity measures and upgrading farm facilities



Development Prescription guidelines

- Development of prescription guidelines for each animal pathogen
- Recommend the last choice of HP CIAs



Raising awareness



One health approach research

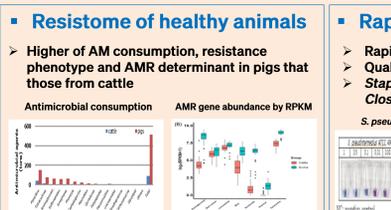
ESBL-producing Enterobacteriaceae

- Prevalence**
 - ESBL-producing Enterobacteriaceae are highly isolated from chickens than pigs and cattle
 - < E. coli >
- Genotype**
 - E. coli: CTX-M-55, Salmonella: CTX-M15 in chicken
- Plasmid type**
 - Nationwide spread of E. coli carrying a 380Kb mega plasmid with bla_{CTX-M-55}
- Transmission**
 - Pig & farm environment : ST457, IncFIC-InfIB
 - Farm worker : ST69, InfIB



Colistin resistant Enterobacteriaceae

- Prevalence of the mcr gene from livestock**
- Comparisons of CRE isolates from humans and pigs**



Resistome of healthy animals

- Higher of AM consumption, resistance phenotype and AMR determinant in pigs that those from cattle



Development ATA

Probiotic/Prebiotic

- Improve gut health, enhance immunity, resistance to disease
- Feed additive as growth promoter
- Method for preparing a probiotic composition for feed to improve body weight gain or immunity
- Complex feed supplement and method for making fermented green tea probiotics
- Manufacturing method of probiotics for feed additives and probiotics manufactured by the method
- New Bifidobacterium strain and nutraceutical composition for improving growth comprising the same
- Composition for treating irritable bowel syndrome of companion animals comprising novel Lactobacillus ruteri lbr_c1 strain and novel Lactobacillus acidophilus lba_c5 strain
- Novel Pediococcus pentosaceus SMFM2016-GK1 strain and method for producing fermented meat using the same

Phytochemical

- Targets bacteria
- Growth promoter and disease prevention
- Animal feed composition comprising an extract of Diospyros kaki
- Antimicrobial composition containing the essential oil of Rosmarinus officinalis L. and the conventional antibiotics
- Chicken feed composition and preparing method thereof
- Method for manufacturing subsidiary feeder for livestock containing coffee
- α-Mangostin: A potential antimicrobial agent against Staphylococcus spp. in dogs and cats

Organic acid

- Targets bacteria
- Growth promoter and disease prevention
- Coated organic acid for feed additive composition, coating method of the organic acid and feed containing thereof
- Poultry fermented additive feed composition containing the novel lactic acid bacteria having anti-pathogenic microorganism and organic matter decomposition activity microorganism
- Eco-friendly feed additive for producing meat with low fat content in livestock meat and rich in essential fatty acid and omega-3 fatty acid among unsaturated fatty acids and manufacturing method thereof

* List of patents for livestock and companion animals in Korea

Immune modulator

- Stimulates and enhance host immune response
- Disease prevention
- A composition for modulating the innate immune response of chickens comprising gga-mir-200a-3p, mimics thereof or inhibitors of gga-mir-200a-3p
- Composition for immune enhancement comprising chicken interleukin-26
- Novel Lactobacillus reuteri PSC102 strain and use thereof

Bacteriophage

- Targets bacteria
- Disease prevention and treatment
- Novel Bacteriophage Having Killing Activity Specific to Salmonella selected from Infectious Bacteriophages of Salmonella Gallinarum
- Novel Bacteriophage Having Killing Activity Specific to Salmonella selected from Infectious Bacteriophages of Salmonella Enteritidis
- Method for prevention and treatment of infection of Salmonella choleraesuis or Salmonella Dublin
- Novel Clostridium perfringens specific bacteriophage CP5 and antibacterial composition comprising the same
- Novel Campylobacter specific bacteriophage OPT-CJ1 and antibacterial composition comprising the same
- Novel Vibrio specific bacteriophage VP4 and antibacterial composition comprising the same
- Novel Proteus mirabilis specific bacteriophage PM2 and antibacterial composition comprising the same
- Avirulent modified Salmonella Gallinarum strains and pharmaceutical composition using the same

Challenges & Solutions of AMR/ATA research

- Challenge : AMR research**
 - Ensuring Sustainable AMR Research & Financial Issues
 - To maintain research continuity, securing continuous funding is essential.
 - Systematic Data Collection
 - AMR data must be collected across humans, animals, and the environment, but current systems are insufficient to provide the AMR information for research.
 - Lack of multi-sectoral & International Cooperation
 - AMR is a cross-border issue, yet collaboration remains limited.
- Challenge : ATA research**
 - Safety & Efficacy Issue**
 - Alternatives must demonstrate efficacy and safety comparable to existing antibiotics.
 - Innovative techniques**
 - A variety of ATAs are currently used in veterinary medicine, but the development of new ATAs requires innovative technologies.
 - Cost Issues**
 - The price of ATAs is typically higher than existing antibiotics due to development costs, making farmers reluctant to choose them.
 - Regulatory challenges**
 - The lack of regulation and lengthy approval process for new alternatives increase time and costs.

- Solution : AMR research**
 - Securing Sustainable Research Funding
 - Develop policies to ensure continuous financial support for AMR research.
 - * Multi-sectoral one health research project (2019- 2023, \$ 50 million)
 - Establishing a Systematic Data Collection
 - Develop an integrated, standardized AMR data system.
 - * One Health Portal: AMU/AMR data sharing & research exchange
 - Enhancing Multi-Sectoral & International Cooperation
 - Build an multi-sectoral and international network to encourage collaboration.
 - * Facilitate personnel exchange between different sectors.
- Solution : ATA research**
 - Collaborative Research**
 - Validate safety and efficacy through partnerships with universities, institutions, and industry.
 - Technological Solutions**
 - Invest budgets and personnel to develop new targets.
 - Cost Issues**
 - Develop scalable production technologies to reduce ATA costs.
 - Governments can offer financial incentives, subsidies, or grants to farmers.
 - Regulatory Issues**
 - Governments should create approval documents for ATAs.
 - Develop standardized protocols to test ATA efficacy and safety.

Collaboration opportunities

- Establish regular international ATA conference**
 - Global information exchange
 - Sharing research and technological advancements in ATA
 - Regulatory Harmonization & Policy Alignment
 - Standardizing ATA approval processes across countries can facilitate smoother market entry
- Asia-Pacific ATA Development project**
 - Research & Innovation Collaboration
 - Strengthening global R&D efforts on ATA
 - Shared expertise and resources can speed up R&D on ATA
 - Cross-border research enhances scientific validation and applicability

