Introduction

• Antimicrobials are generally used in poultry for therapeutic, prophylactic and growth enhancement purpose.

• Antimicrobials can be administered orally (feed, water) and parenterally (intramuscular, subcutaneous).
Examples of Antimicrobials

- Aminoglycosides (gentamycin, neomycin and kanamycin).
- Tetracyclines (oxytetracycline, chlortetracycline and doxycycline).
- Fluquinolones (enrofloxacin, ciprofloxacin and danofloxacin).
- Macrolides (erythromycin, tylosin and tilmicosin).
- Sulfonamides (sulfamethazine and sulfadimethoxine)
  - Beta lactams
    - Penicillins (penicillin and amoxycillin).
    - Cephalosporins (cefotaxime and ceftiofur).
Injectable antimicrobials

![Bar chart showing the usage of different antimicrobials](image)

Improper use of antimicrobials

<table>
<thead>
<tr>
<th>Subject</th>
<th>Yes</th>
<th>%</th>
<th>No</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>I use of antimicrobials without signs of sickness.</td>
<td>61</td>
<td>67.7</td>
<td>29</td>
<td>32.3</td>
</tr>
<tr>
<td>I accelerate healing by using a double dose of drugs.</td>
<td>49</td>
<td>54.4</td>
<td>41</td>
<td>45.6</td>
</tr>
<tr>
<td>I use more than one antimicrobial in a single treatment.</td>
<td>70</td>
<td>77.8</td>
<td>20</td>
<td>22.2</td>
</tr>
<tr>
<td>I do sell chickens during a treatment period.</td>
<td>41</td>
<td>45.5</td>
<td>49</td>
<td>54.5</td>
</tr>
</tbody>
</table>

- Toxicity
- Delay in healing (antagonism)
- Antimicrobial resistance
- Loss of money
- Antimicrobial residues

(Ministry of Agriculture)
Prohibition of some antimicrobials

1. MEDICAL REASONS
   - **Chloramphenicol**, a broad-spectrum antimicrobial, was previously widely used in veterinary and human medicine. Reports of aplastic anemia in humans arising from its use led to its ban in the USA and European Union (EU) in 1994.
   - **Nitrofurans**, particularly furazolidone, furaldione, nitrofurantoin and nitrofurazone for livestock production was completely prohibited in USA (1991) and in the EU (1995) due to concerns about the carcinogenicity of the drug residues and their potential harmful effects on human health.
   - **Nitroimidazoles** includes metronidazole, dimetridazole and ronidazole, have potential for carcinogenesis and there are currently no nitroimidazole products approved for use in food animals.

Prohibition of some antimicrobials

2. ANTIMICROBIAL RESISTANCE REASONS
   - Fluoroquinolones were banned by Food and Drug Administration (FDA) in 1997 but Sarafloxacin and enrofloxacin were permitted, after increasing the incidence of infection with fluoroquinolone-resistant Campylobacter spp. in human and this was linked to poultry, FDA in 2005 prohibited the usage of all fluoroquinolones in poultry.
   - Cephalosporins; due to emergence of third-generation cephalosporins resistance *E. coli* and in *Salmonella enterica*, FDA in 2012 prohibited the usage of cephalosporin in poultry except for ceftiofur which is not used in human medicine.
Antimicrobial resistance

• Causes:
  – Using antimicrobials as growth promoters.
  – Improper use of antibiotics.
  – Using poultry litter as fertilizer for crop production.
  – Unawareness of antimicrobial resistance problem.

Transmission of resistance from animals to humans

1. Food-borne route probably is the most important. *Salmonella enterica, Campylobacter coli/jejuni,* and *Yersinia enterocolitica.*

2. Direct contact between animal and humans may be the major route of transmission for other resistant pathogens (e.g., MRSA CC398).

3. Environmental contamination with bacteria as well as antibiotic residues from food-animal production are spread widely in the environment. (mainly by manure)
Avian Pathogenic *Escherichia coli* (APEC) in Palestine: Characterization of Virulence Factors and Antibiotic Resistance Profile

- Mohammad Qabajah, 2011, Palestine Polytechnic University and the Faculty of Science at Bethlehem University.

<table>
<thead>
<tr>
<th>Resistant level</th>
<th>Antimicrobial</th>
<th>Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>High level</td>
<td>Tetracycline</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Ampicillin</td>
<td>83.3%</td>
</tr>
<tr>
<td></td>
<td>Amoxicillin</td>
<td>83.3%</td>
</tr>
<tr>
<td></td>
<td>Kanamycin</td>
<td>80.3%</td>
</tr>
<tr>
<td></td>
<td>Ciprofloxacine</td>
<td>72.72%</td>
</tr>
<tr>
<td></td>
<td>Neomycin</td>
<td>69.7%</td>
</tr>
<tr>
<td>Moderate level</td>
<td>Gentamycin</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>Chloramphenicol</td>
<td>39.39%</td>
</tr>
<tr>
<td>Low level</td>
<td>Nitrofurantoin</td>
<td>18.18%</td>
</tr>
<tr>
<td></td>
<td>Cephalexin</td>
<td>12.12%</td>
</tr>
</tbody>
</table>
**E. coli isolates resistance for antibiotic screened**

Antimicrobial resistance in non-typhi *Salmonella enterica* isolated from humans and poultry in Palestine

- Rula AL-Dawodi, Mohammad A. Farraj and Tamer Essawi, 2012, University, Birzeit, Palestine

Antibiotic resistance among non-typhi *Salmonella enterica* spp. isolated from human and poultry.

<table>
<thead>
<tr>
<th>Source</th>
<th>AMP</th>
<th>CHL</th>
<th>CIP</th>
<th>CRO</th>
<th>GEN</th>
<th>NAL</th>
<th>SXT</th>
<th>TE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Isolates (n = 71)</td>
<td>59.1</td>
<td>8.4</td>
<td>29.6</td>
<td>0</td>
<td>30.9</td>
<td>59.1</td>
<td>9.9</td>
<td>59.1</td>
</tr>
<tr>
<td>Poultry Isolates (n = 80)</td>
<td>51.3</td>
<td>5</td>
<td>15</td>
<td>0</td>
<td>10</td>
<td>45</td>
<td>5</td>
<td>80</td>
</tr>
</tbody>
</table>

Ampicillin (AMP), Tetracycline (TE), Ciprofloxacin (CIP), Nalidixic acid (NAL), Gentamicin (GEN), Chloramphenicol (CHL), Trimethoprim/sulfa-methoxazole (SXT), Ceftriaxone (CRO).
International studies

- *E.coli*; fluoroquinolones, newer generation cephalosporins, multidrug resistance (MDR).
- *Salmonella* spp: fluoroquinolone and ampicillin.
- *Campylobacter jejuni/coli*: macrolide and fluoroquinolones.
- *Listeria monocytogenes*: aminoglycosides and fluoroquinolones.
- *Enterococcus*: cephalosporins, fluoroquinolones, clindamycin and vancomycin.
- *Staphylococcus spp*: macrolides.

Alternatives to antimicrobials

1. **Herd health and good management.**
   - Improve control of horizontally transmitted diseases.
   - Strict disease-control programs such as screening of hatcheries.
   - Good sanitation on farms further reduces the spread of certain diseases.
   - Maintain suitable ambient temperature and air and water quality for healthy animals.

2. **Host resistance and vaccines.**
   - Using available vaccines against viral and bacterial diseases.
   - Developing new vaccines against parasitic and other important diseases.
3. **Feeding systems.**
   - Probiotics, live beneficial bacteria (e.g., lactobacilli, propionibacteria), which are similar to antimicrobial growth promoters
   - Competitive-exclusion strategies; feeding chicks anaerobic cultures of normal intestinal adult fowl flora may prevent salmonella infections.

4. **Biosecurity**
   - Effective cleaning of sites and disinfection procedures.
   - All-in, all-out policy.
   - Controlling birds and rodents

---

**Recommendations**

1. Conducting researches about bacterial resistance in poultry specially that causes zoonotic diseases (e.g salmonellosis, colibacillosis).

2. Reducing antimicrobial usage
   - Importing hatching eggs free of vertical transmitted disease such as mycoplasma,
   - The effective prevention of infectious diseases and applying strict hygiene standards and rearing skills.
   - Avoid antibiotic use for the treatment of viral disease and reduce prophylactic antibiotic use.
3. Off-label use of antibiotics by breeders and some veterinarians should be stopped such as using oral preparations drugs parenterally.

4. Avoid using antimicrobials in the veterinary field without a veterinarian’s prescription.

5. Legislate laws to regulate antimicrobial use in animal especially in poultry to decrease the prevalence of antimicrobial resistance in animals.