Standard Treatment Guidelines (STG) for Poultry, Bangladesh

A guideline for the prevention, control and treatment of important bacterial diseases in poultry

First Edition, 2022

Department of Livestock Service (DLS)
Ministry of Fisheries and Livestock (MoFL), Bangladesh

Food and Agriculture Organization of the United Nations
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USAID FROM THE AMERICAN PEOPLE

Director General
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Message from Director General (DG), DLS

Antimicrobial resistance (AMR) is a silent threat to humans, animals, plants and the environment. Scientists considering it as another pandemic after COVID-19 and will affects us all. To curb it effectively, all sectors must work together and to encourage the prudent use of antimicrobials, with a focus on preventive measures. Strengthening biosecurity in animal farms and food industry premises, ensuring access to quality vaccines, clean water, sanitation and hygiene, implementing best practices in food and agriculture production including marketing systems, and ensuring the proper waste management in animal farms are crucial to reducing the need for antimicrobial usage (AMU) and minimizing the emergence and transmission of AMR.

I am proud to share that Bangladesh is a pioneer country where One Health (OH) in action on AMR and AMU is evident. The DLS, DoF, DGHS, DGDA with the Technical Assistance Services (TAS) from the FAO and WHO have been working together since last 6 years to carry out activities under the National AMR Containment Plan. A Standard Treatment Guidelines (STG) on antibiotic use on important infectious diseases of Bangladesh has been formulated by the Communicable Disease Control (CDC), Directorate General of Health Services, Ministry of Health and Family Welfare. The Department of Livestock Services (DLS) has been working with the FAO and the Bangladesh AMR Response Alliance (BARA) to develop a similar treatment guideline for poultry. Moreover, the poultry experts have updated BARA *"Murgi"* AMU guidelines for poultry treatment during the technical consultative workshop on 29-30 August 2022.

Then, the DLS formed a national review committee to review that draft document. The committee with the FAO team has finalized the document, and now, I am proud to endorse the **"Standard Treatment Guidelines (STG) for Poultry, Bangladesh".** Hence, I appreciate and thank to the members of the DLS National Review Committee, FAO Country Team Lead and his team working on AMR and the BARA members for contributing in the STG. The DLS is again acknowledging the generous financial support from the Fleming Fund and USAID on AMR and AMU in Bangladesh.

I do strongly believe that this book will be a guiding document for the poultry practitioners of the country for safe and sustainable production of food of poultry-origin and a reduced risk of developing AMR.

I feel proud to be a part of this wonderful document and wish its well circulation.

Dr. Md. Emdadul Haque Talukder
Director General

Preamble

These guidelines have been prepared through several processes and technical consultative workshops among DLS, DGHS, FAO and WHO.

The FAO organized a One Health AMU guideline development workshop on 13-14 August 2017 in collaboration with the Department of Livestock Services (DLS) and Communicable Disease Control (CDC), Directorate General of Health Services (DGHS). Collectively, the five participating microbiology laboratories shared culture and sensitivity results from over 10,500 recent clinical samples to a common database. Using a tool (algorithm for guiding antimicrobial usage in veterinary medicine) an antibiogram was developed. Antibiotics were then evaluated by the overall likelihood of sensitivity pattern to the pathogens captured in each body system based on the culture and sensitivity test results.

In parallel, a group of veterinarians specializing in poultry medicine and AMR, extracted data from published articles on AMR in poultry in Bangladesh to determine the status of resistance against common poultry pathogens, and reviewed the literature of recommended treatment guidelines for important bacterial infections in poultry. They also prioritized 10 important bacterial poultry diseases is mentioned below on which the recommended guidelines to be produced:

- Colibacillosis
- Mycoplasmosis
- Fowl Cholera
- Infectious Coryza
- Pullorum Disease
- Fowl Typhoid
- Necrotic Enteritis
- Ulcerative Enteritis
- Coccidiosis
- Gangrenous Dermatitis

The information generated was then further tailored by an international FAO poultry health expert to develop the draft AMU guidelines for poultry treatment which was also reviewed by the FAO HQ experts.

Then, two consecutive workshops were conducted to finalize the One Health AMU guidelines for both human medicine and poultry medicine. The workshop was held on 20-21 January 2018 with leading human health clinical practitioners and microbiologists, an infectious disease clinical specialist from WHO HQ, and facilitation from FAO Bangladesh. The first workshop on 20 January 2018 resulted in a finalization of AMU guidelines (BARA *"Manush"*) for common human infections modeled on the AWaRe-based usage guidelines developed under the WHO Essential Medicines List programme as well as a harmonized

SOPs for conducting culture and sensitivity testing and reporting results at microbiology laboratories. On the next day, FAO with the poultry veterinarians from both public and private sectors finalized the poultry AMU guidelines (BARA *"Murgi"*) for Bangladesh. The two AMU guidelines were prepared by BARA community and served as the basis for subsequent training and outreach.

After COVID-19 pandemics, one National Technical Advisor-Antimicrobial stewardship was recruited. He collected recent local AST data from different public and private microbiology labs from all over Bangladesh, and AST data from some big poultry entrepreneurs including other research projects. Based on these data, finally two antibiograms; one for human health and other for poultry were updated to forge revision of BARA AMU guidelines. Accordingly, BARA AMU guidelines (BARA *"Murgi"* and *"Manush"*) were revised via a technical consultative workshop held on 29-30 August 2022.

During the last AMR multisectoral livestock meeting, it was decided that the DLS will form a committee to review the updated BARA *"Murgi"*. In collaboration with the FAO, the committee reviewed and then recommended to be endorsed by the DLS. Finally, the **"Standard Treatment Guidelines (STG) for poultry, Bangladesh"** has been endorsed.

This is a living document that will be updated time to time based on user's feedback, recent antibiogram and other necessities.

Acknowledgements

The Department of Livestock Services (DLS) greatly appreciate the technical support services (TAS) of the Food and Agriculture Organization (FAO) of the United Nations, Bangladesh AMR Response Alliance (BARA) and the private sector poultry experts during the development of the Standard Treatment Guidelines (STGs) for poultry. The DLS expresses gratitude to the Fleming Fund and USAID for the financial support. It is anticipated that, the guidelines will be very useful as tools for veterinary professionals towards prudent use of antibiotics in poultry practice.

We would like to give special thanks to Dr. Eric Brum, Country Team Lead, FAO ECTAD for technical overview, Dr. Shankar Mondal, former international poultry consultant, FAO for contributing in the initial guidelines in 2018, and Dr. Md. Habibur Rahman, National Technical Advisor-One Health Training and Outreach, FAO Bangladesh for both technical and editorial support in the document. It is also mentioned that FAO will print these guidelines for the veterinary prescribers of the country and the DLS offices as a reference copy.

The DLS also wishes to acknowledge the members of the National Review Committee for their valuable inputs and guidance to the document.

Table-1: National Review Committee (Not according to seniority)

Sl #	**Name**	**Designation**
1	Dr. Md. Abu Sufian	Director, Accounts, Budget and Audit, Dhaka, DLS
2	Dr. Md. Shahinur Alam	Deputy Director, Animal Health, Dhaka, DLS
3	Dr. Pallab Kumar Dutta	Deputy Director (HRD), Dhaka, DLS
4	Dr. TABM Muzaffar Goni Osmani	Deputy Director, Epidemiology Unit, Dhaka, DLS
5	Dr. Sk Shaheenur Islam	Deputy Chief Epidemiologist, Divisional Livestock Office, Dhaka, DLS

Table-2: Contributors of BARA AMU guidelines revision workshop on 29-30 August 2022 (Not according to seniority)

Sl #	Name	Designation
1	Dr. Md. Abu Sufian	Director, Accounts, Budget and Audit, Dhaka, DLS
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Disclaimer

These guidelines form an acceptable basis for management of poultry diseases, but there may be sound clinical reasons for different therapy in specific situations. The complexity of clinical practice requires that, in all cases, users understand the individual clinical situation and exercise independent professional judgement. Particularly in complicated situations, these guidelines are not a substitute for seeking appropriate advice.

These guidelines do not include comprehensive information about medicines, some of which may be important: usually contraindications and precautions for the recommended medicines are not included. Responsible use requires that the prescriber is familiar with these matters.

Guiding principles

The following document lists some of the commonly occurring bacterial diseases in poultry in Bangladesh with guidelines for prevention, control and treatment. Many of these diseases are the result of a bacterial infection overcoming the host's natural defenses in part as a consequence of poor management practices. Poor management practices can include poor hygiene, insufficient biosecurity, inadequate nutrition and poor environmental management.

Antimicrobials should be used only when there is a confirmed disease and when the use is narrowly focused to the disease agent. Use of broad-spectrum antibiotics may give short-term gains but only lead to problems further down the track. Some diseases can only be controlled by management changes as antibiotics will only give a short-term reprieve by antibiotic and the problem may well return once the antimicrobials are discontinued.

Any treatment of disease in poultry should be accompanied by an exhaustive problem analysis and examination of farm hygiene and biosecurity. Advice should include suggestions for improvements of hygiene and biosecurity that are then monitored.

The issues of correct diagnosis, disease prevention, prophylactic use of antimicrobials and withdrawal periods must be taken into account by the veterinarian.

1. DIAGNOSIS
   a. <u>Correct history taking and diagnosis</u>
      Diagnosis should follow a logical process of information collection and analysis. If the clinical signs are not clear, do not give broad spectrum in the hope that by killing everything you will solve the problem. Take a sample, send it to the lab and find out what the causative agent is; if there is a delay in the result, start using the narrow spectrum antibiotic for the most likely pathogen.
   b. The choice of the correct antimicrobial is an important part of being a veterinarian. The ideal drug is one to which the pathogen is susceptible, reaches effective concentration at the site of infection, is non-toxic to the host, requires minimal stress to the animal, and is inexpensive. Therefore, use the AWaRE classification and suggestions in this guideline. Drugs in the ACCESS group should be the first attempt to be used for livestock and when there is clear evidence of situation demands, use the WATCH group of drugs sparingly and according to the recommendation. But remember, Ciprofloxacin should never be used in livestock as it is broad spectrum and critically important human drug and remains unchanged in the environment for long periods resulting in increased AMR in environmental organisms. Follow up visits to the farm ensure that the antibiotic is working (or not) shows the farmer that you are professional and that you have his interests at heart. In general, aminoglycosides and tetracyclines are available for use in livestock.

2. PREVENTION OF DISEASE
   a. <u>DOC quality and management</u>
      Several diseases, such as *E.coli, Mycoplasma gallisepticum and Salmonella,* can enter the poultry farm with the DOCs. Once in the farm, these pathogens are difficult to eradicate. It is

important to ensure that no disease enters via the DOC by sharing information on infected hatcheries and refusing to buy DOCs from them until they sort out the problem.

Correct care of DOCs during the first weeks of life is essential for the prevention of opportunistic organisms such as *E.coli.* This includes careful preparation of the brooding area and turning on the heaters 2 hours before the DOCs arrive to ensure that the brooding area is warm enough. Care should be taken to ensure that the DOCs drink and eat quickly, that the temperature is correct for the age of the bird, and that rehydration (electrolytes) is available if needed. Build-up of ammonia should be prevented by good ventilation and letter care to removed damp and caked litter. Low brooding temperature, poor hygiene, ammonia, dust and respiratory diseases all predispose chicks to *E.coli.* Workers should have dedicated shoes for the brooding area and young birds should be visited first if the worker needs to visit older birds. Staff should never move from older birds to DOCs.

b. <u>Bio-security and hygiene</u>

Many farms have poor biosecurity. The movement of equipment, personnel and vermin must be controlled if diseases are to be avoided. Minimum biosecurity would include:

Movement control – with signposts preventing entry of unauthorised people:

- Fencing the farm to control movement of people and animals;
- An office at the entrance to the farm to control movement and remove the need for people to go into the productive part of the farm;
- Preventing of feed and manure trucks from entering the production area, disinfection of trucks.
- Dedicated footwear for the productive areas.
- Cleaning and disinfection and control of movement of equipment around the farm and between sheds

Hygiene:

- Foot baths or designated footwear at the entrance to each shed
- Regular cleaning of all farm equipment with dry and wet cleaning and disinfection – in particular cleaning feeders and drinkers daily.
- Practice “all in – all out” systems
- Thoroughly clean and disinfect sheds and equipment between batches and respect rest periods.
- Burn or bury carcasses of dead birds

Management:

- Buildup of ammonia predisposes birds to *E.coli* and respiratory diseases and sheds should prevent build up through ventilation and removal of wet and caked litter.
- All hygiene and movement control activities should be well signposted and enforeced by management
- Farm records, especially daily mortality, will alert the farmer to a developing problem.

c. VACCINATION

Prevent diseases through a vaccination programme

3. Use of prophylactics

   Prophylactic use of antimicrobials is not recommended as it is an excuse for poor farm management. Do not give antimicrobials as preventative treatment “just in case” a problem occurs. There are, however, some instances when they can be used such as the control of Coccidiosis. Birds kept on litter are susceptible to coccidiosis and need to be given cocciostat daily either in feed or water. This should be carried out along with good litter management. The drug should be withdrawn before sale according to the product used.

4. Withdrawal period

   Withdrawal periods are required so that eggs, meat and milk are not sold during the treatment period when levels of antibiotics are high. The withdrawal period is different for each antibiotic and this needs to be checked by the veterinarian and discussed with the farmer.

The litter will have high levels of antibiotics following treatment and this should be considered before it is used for other agricultural activities. Breakdown of some antibiotics in the litter, such as Ciprofloxacin, can be very slow.

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A1 Common bacterial diseases of the respiratory system

A1.1 Colibacillosis

- A common disease of economic importance in poultry occurs as an acute fatal septicemia or subacute form (eg, airsacculitis) and is seen worldwide

Etiology

- Bacterium *Escherichia coli, a* gram-negative, motile, coliform in the family Enterobacteriaceae
- Most common avian pathogenic *E coli* (APEC) strains are 01, 02, and 078 serogroups
- Normally found in the intestine of poultry and most other animals

Epidemiology

- Ubiquitous organism, high numbers in poultry house environment through fecal contamination
- Environmental factors (humidity, poor air quality, high ammonia and dust) and the stress of other diseases (IBV, NDV, *Mycoplasma*) are major predisposing factors for systemic infection

Transmission

- Horizontal and vertical through eggs (fecal contamination, shell penetration during incubation)
- Systemic infection occurs when large numbers of APEC invade bloodstream from respiratory system or gastro-intestinal tract, and young birds may also get infection through unhealed naval

Clinical signs and lesions

- Variable depending upon age, systems or organs involved and concurrent infection
- Respiratory – airsacculitis (Fig. 1a) along with mycoplasma or virus infection. Virus may be vaccinal. Without *E. coli*, the mycoplasma infections would be less significant.
- Gastrointestinal – enteritis common in turkeys and is usually primary but predisposed by contaminated feed, water or crowding.
- Omphalitis (Fig. 1b)- (embryo and early chick mortality) egg transmitted due to penetration from contact with contaminated environment (dirty nest, floor eggs, egg washing, sweating after refrigeration, and dirty hatching equipment). This is a major chick quality problem. Other bacteria often involved are *Staphylococci aureus*, *Pseudomonas* spp, and *Proteus* spp.
- Colisepticaemia - when *E. coli* reaches bloodstream, the internal organs and the heart are infected, and occasionally leads to synovitis and osteomyelitis, or infectious process
- Coligranuloma – nodular lesions in liver, intestine and uterus in layers, enlarged congested liver
- Reproductive- salpingitis results of ascending infection from cloaca or infection of left abdominal air sac, which leads to caseous mass in dilated oviduct, egg yolk peritonitis (Fig. 1c), omphoritis, decrease in egg production, oviduct impaction, and death

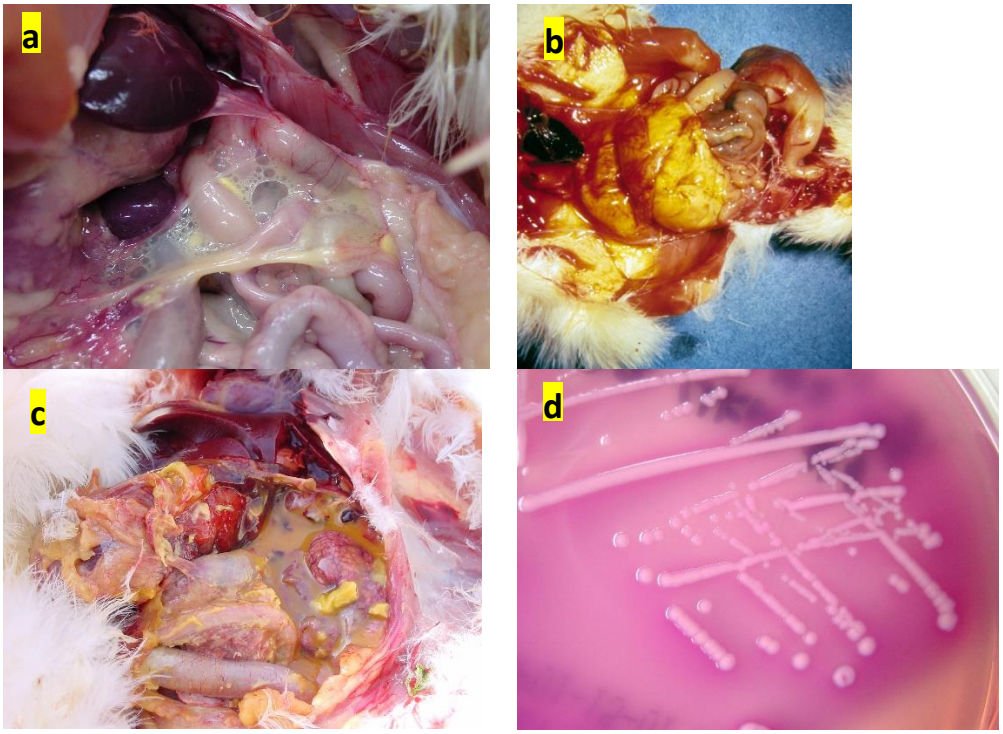


Figure 1: *E. coli* infection, a) airsacculitis (hen), b) omphalitis (chicks), c) egg yolk peritonitis (hen), d) *E. coli* colonies on MacConkey's agar (pink). Courtesy: University of Georgia College of Veterinary Medicine

Diagnosis

- Tentative diagnosis based on history, clinical signs and lesions
- Confirmation by isolation and identification from cardiac blood, liver or typical visceral lesions on selective media like MacConkey's agar (Fig. 1d)
- Multiplex PCR panels for plasmid-mediated virulence genes to establish pathogenicity
- Young chicks or 12-days-old chicken embryo inoculation for typical lesions
- Differential- mycoplasmosis, Newcastle disease, infectious bronchitis, fowl cholera, staph infection, salmonella, erysipelas

Treatment

- Strategies should include controlling predisposing infections or environmental factors
- Run sensitivity test, *E. coli* are resistant to most drugs available for use in poultry, 90% of clinical isolates are resistant to tetracycline, with 60% of isolates resistant to five or more antibiotics
- Therapeutic success sometimes be achieved by with tetracycline and other higher antibiotics
- Fluoroquinolone use is now banned in many countries, including the USA

Medication

First choice

- Florfenicol 30mg per kg body weight in water once daily for 3 days. Withdrawal period: data not available
  OR
- Neomycin 10mg per kg body weight in water twice or thrice daily for 5-7 days. Withdrawal period: meat-5 days; egg-nil.

Second choice

- Norfloxacin 15mg per kg body weight mixed with water once daily for 3-5 days. Withdrawal period: data not available
- Acidifier may be added if necessary

Prevention and control

- Management procedures
  - Good management and sanitation practices are the best way to avoid colibacillosis
  - Obtain new birds from well managed breeding flocks and hatcheries
  - Reduce all stress factors (ventilation, density, dust and ammonia), and other disease agents
- Commercial vaccination if available

A1.2 Mycoplasmosis (*M. gallisepticum* infection, chronic respiratory disease, CRD)

- A respiratory disease primarily of chickens (CRD) and turkeys (infectious sinusitis) worldwide, with a prolonged course. it is one of the costly diseases of commercial poultry

Etiology

- Bacterium *Mycoplasma gallisepticum* that lack a cell wall (resistant to penicillin), the smallest prokaryotes (0.2-0.5 µm in diameter), have complex nutritional requirements for growth
- It survives only few days outside the host but easily destroyed by common disinfectants
- Often associated with other organisms (IBV, NDV, *E. coli* etc.) and pathogenicity is enhanced

Epidemiology

- Once infected, birds may remain carriers for life
- Cold weather, dust, poor air quality (ammonia) or crowding may facilitate infection
- Incubation period- usually 4-21 days, disease duration- weeks to months, but become chronic

Transmission

- Transmits vertically (transovarian) from infected breeders, and horizontally by aerosol from infected progeny and contaminated feed, water and the environment, and by human activity on fomites (shoes, equipment, etc).
- Backyard flocks, multiple-age layer flocks, and some free-range birds are potential reservoirs

Clinical signs

- Inapparent to different degrees of respiratory signs- mild to marked rales, difficult breathing, sneezing or coughing, nasal discharge and conjunctivitis with frothiness (Fig. 2a)
- Reduced feed efficiency and weight gains, high condemnation due to airsacculitis in broiler, lower egg production in hens

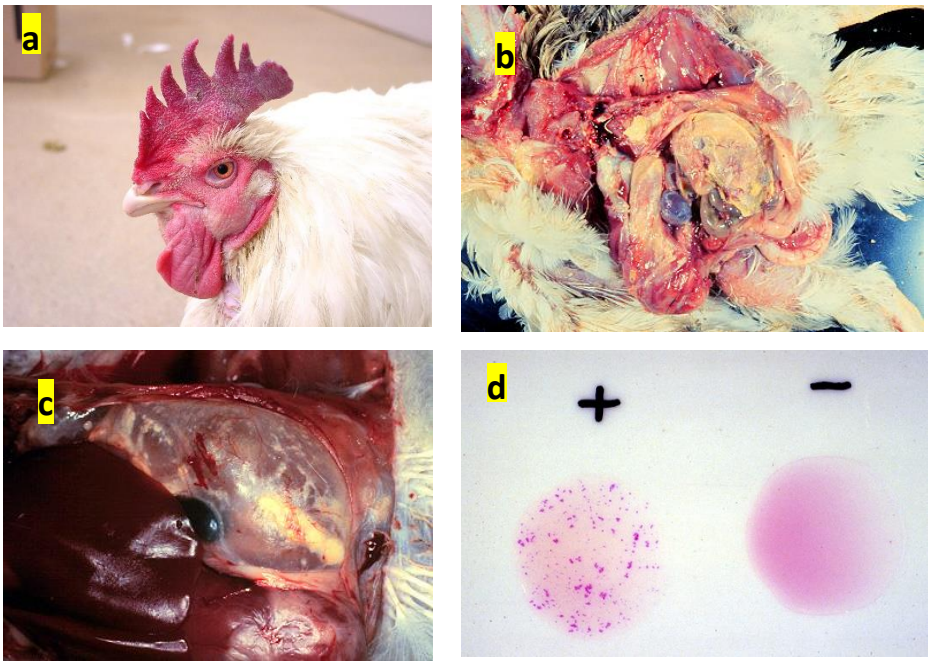


Figure 2: *Mycoplasma gallisepticum* infections, a) swollen face (hen), b) airsacculitis (hen), c) chronic respiratory disease, CDR (hen), d) Agglutination test. Courtesy: University of Georgia College of Veterinary Medicine

Necropsy findings

- Mucoid or catarrhal exudate in respiratory passages
- Early cloudiness of the air sac with soapy exudate, later becomes caseous and yellow (Fig. 2b)
- Pericarditis and perihepatitis are often a sequelae when complicated with *E. coli* (Fig. 2c)

Diagnosis

- History of chronic respiratory disease accompanied by lowered feed consumption, poor gains, or lowered egg production with typical gross lesions
- Isolation and identification of the agent is difficult and time consuming
- Serology- positive plate agglutination (Fig. 2d), which may need confirmation by HI test
- A PCR test is available- use swabs from infected sites (sinuses, trachea, air sacs)
- Differential- infectious bronchitis, Newcastle disease, *E. coli*, and infectious coryza

Treatment

- Marketing an infected flock with a low incidence of disease may be more economical than treatment because treatment can be very expensive
- A number of broad-spectrum antibiotics can be used which may suppress losses, but not those (eg., penicillin) that act on cell wall
- Antimicrobial resistant may be developed, and relapses may recur when medication is discontinued
- Most antibiotics are given in feed or water, preferably in water

Medication

First choice

- Tilmicosin 30mg per kg body weight per day in water for 5 days. Withdrawal period: meat- 9 days.

Second choice

- Tiamulin fumarate 25-50mg per kg body weight in water once daily for 3-5 days (contraindicated with monensin, salinomycin and maduramycin). Withdrawal period: meat-5 days; egg-nil.
  OR
- Tylosin 50mg per kg body weight in water once daily for 3-5 days. Withdrawal period: meat- upto 2 days; egg-nil.

Prevention and control

- Management procedures
  - Obtain new birds from *M gallisepticum*–free breeder flocks
  - Establish MG-free breeder flocks, maintain good biosecurity and monitor by serology
  - Depopulate infected flock followed by thorough C&D, remain vacant for 2 to 3 weeks before restocking, good management and sanitation must be practiced at all time
  - Management of incubating eggs- egg dipping in tylosin or erythromycin 400-1000 ppm solution after 2 hours of laying for 10-20 min, OR heat sterilization by warming up to room temperature first, then incubate for 12-14 hours to just reach an internal temp of 115F
- Vaccination if available
  - Inactivated, oil-emulsion bacterins are used in layer birds, and help prevent egg production losses but not infection
  - Live vaccines (F1, TS-11, and 6/85) are also available in some countries- F strain is pathogenic in turkeys
  - Bacterins and F strain live MG are being used on multiple-age commercial layer farms with great success

A1.3 Fowl cholera

- A contagious, bacterial disease usually occurs as sudden onset with high morbidity and mortality that affects domestic and wild birds worldwide

Etiology

- Bacterium *Pasteurella multocida,* a small, gram-negative, bipolar with Wright's stain
- Different strains occur, most common serotypes are 1, 4, 3x4 in chickens and turkeys
- The organism survives 3 months in carcass but easily destroyed by sunlight, heat, drying and ordinary disinfectants

Epidemiology

- Turkeys are more susceptible than chickens, older chickens are more susceptible than young
- Chronically ill or healthy carrier birds are the reservoir of infection, and shed large number of organisms in the environment and contaminate feed and water
- Wild birds, insects (flies) and mammals (rodents and cats) are suspected to carry the infection
- The incubation period is 4-9 days, the disease duration is about 2 weeks, but becomes chronic and may continue killing birds for several months

Transmission

- Direct contact, ingestion of contaminated feed and water, consumption of diseased carcasses
- Contaminated crates, feed bags, shoes, other equipment and service vehicles

Clinical signs

- In acute cases, increased mortality, depression, anorexia, fever, diarrhea, rapid breathing
- In chronic cases, localized infection with swollen wattles (Fig. 3a), swollen joints, torticollis

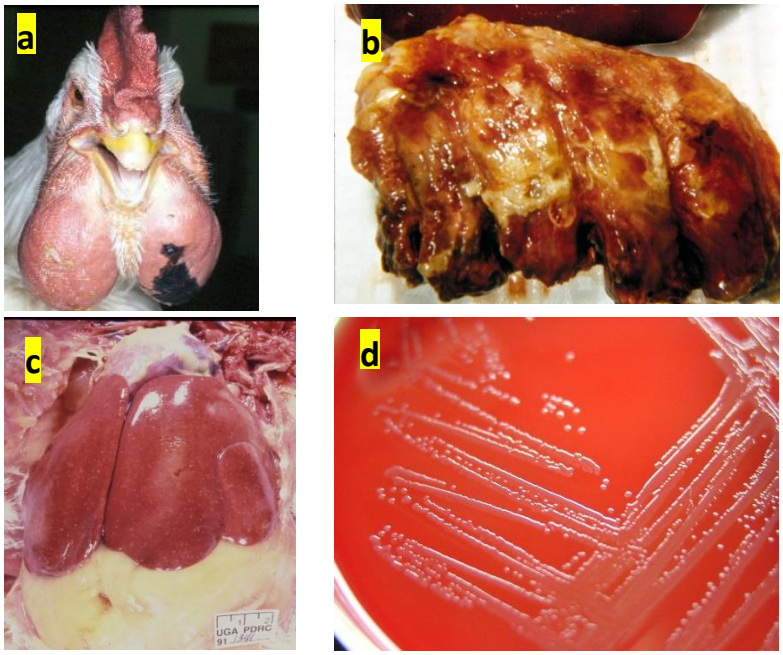


Figure 3: Fowl cholera, a) swollen wattles (hen), b) pneumonic lung (hen), c) liver with necrotic foci (hen), d) *P. multocida* colonies on blood agar. Courtesy: University of Georgia College of Veterinary Medicine

Necropsy findings

- Acute- hemorrhages on heart surfaces, gizzard and abdominal fat; consolidation of lungs (Fig. 3b); egg yolk peritonitis; oophoritis with hyperemic follicles; liver congested or yellow brown with or without white necrotic foci (Fig. 3c)
- Chronic- caseous exudate in swollen wattles in chickens, suppurative exudate in swollen joints and tendon sheaths

Diagnosis

- Tentative diagnosis based on flock history, clinical signs and lesions
- Definitive diagnosis by isolation and identification of the organism- the most suitable tissues are heart, blood, liver, and bone marrow
- Wright's or Giemsa stain of liver impression smear to demonstrate bipolar organisms
- A PCR test and a multiplex PCR is developed for the detection of *P. multocida* in clinical samples
- Serology- rapid whole blood agglutination, serum plate agglutination, agar diffusion and ELISA
- Differential- Fowl typhoid, Colibacillosis, Systemic Staphylococcus, and Erysipelas (in turkeys) in acute cases; Infectious synovitis, localized Staphylococcus, Salmonella in joints in chronic cases

Treatment

- A number of drugs will lower mortality, but deaths may resume when medication is discontinued
- This may necessitate prolonged treatment with drugs added in feed and water
- Antibiotic sensitivity testing is important for drug selection because of the emergence of multi-drug resistant strains

Medication

First choice

- Florfenicol 30mg per kg body weight in water once daily for 3 days. Withdrawal period: data not available

OR

- Norfloxacin 15mg per kg body weight mixed with water once daily for 3-5 days. Withdrawal period: data not available

Note: Add liver protector in drinking water

Prevention and control

- Management procedures
  - Good management including biosecurity and sanitation are essential for prevention
  - Rodents, wild birds, pets, and other animals that may be carriers must be excluded from poultry houses
  - Depopulate infected flock followed by thorough C&D, remain vacant for 2 to 3 weeks before restocking

- Vaccination
  - Killed vaccines are used in layer or breeder chickens- inoculated i/m or s/c at 10 weeks or older and boost from 3 to 10 weeks later
  - Killed vaccines are used in layer or breeder ducks - inoculated i/m or s/ after c at 45 to 60 days. Booster dose will be given after 15 days of the first dose. Then, in every 6 months interval.

A1.4 Infectious coryza

- Rapidly spreading upper respiratory disease found primarily in chicken worldwide

Etiology

- Bacterium *Avibacterium paragallinarum,* a gram-negative, catalase-negative, bipolar rod that requires nicotinamide adenine dinucleotide (V-factor) for *in vitro* growth
- There are three antigenic types (A, B, and C), although all types share certain antigens
- The organism survives 2 to 3 days outside the birds but easily destroyed by heat, drying and disinfectants, the route of infection is conjunctival or nasal

Epidemiology

- In developing countries, the disease often seen in young chicks, like 3 week old broilers. Poor biosecurity, poor environment, and the stress of other diseases are major predisposing factors.
- In developed countries, the disease is seen primarily in pullets and layers, and rarely in broilers
- The incubation period is 1-3 days, the disease duration is usually 2-3 weeks, but may be longer in presence of concurrent infections, eg. Mycoplasmosis

Transmission

- Direct contact, airborne droplets, and contaminated drinking water
- Chronically ill or healthy carrier birds are the reservoir of infection

Clinical signs

- Clear nasal discharge that becomes think and purulent (Fig. 4a), and foul smelling
- Severe unilateral or bilateral swelling of infraorbital sinuses, with eyes closed (Fig. 4b)
- Dyspnea, loss of condition and high condemnation in broiler, 10-40% drop in egg production

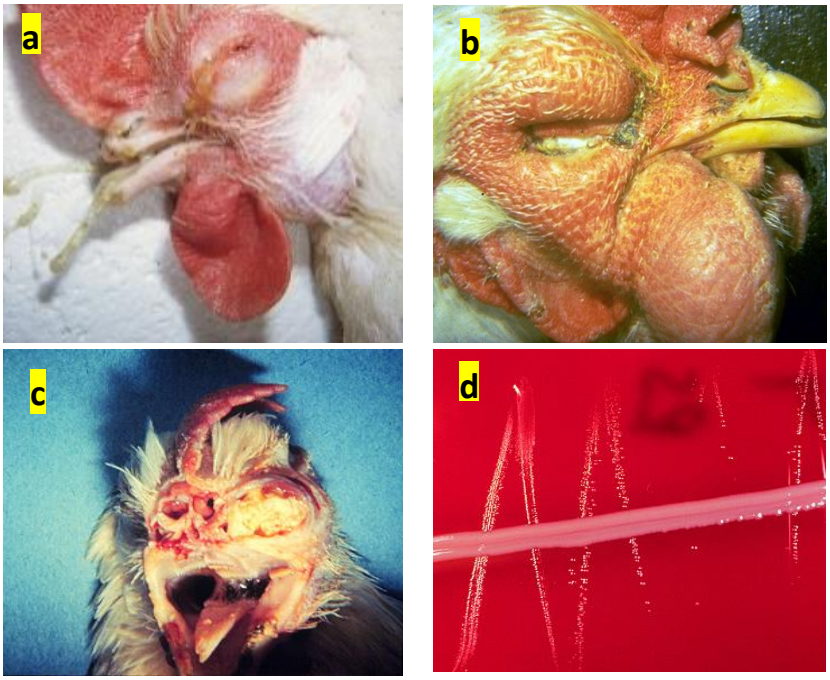


Figure 4: Infectious coryza, a) nasal and eye exudates (hen), b) sinusitis, conjunctivitis and nasal discharge (hen), c) chronic sinusitis, cross-section (hen), d) *Avibacterium* colonies with nurse cultures. Courtesy: University of Georgia College of Veterinary Medicine

Necropsy findings

- Tenacious, white to yellow pus and mucus accumulation in the infraorbital sinus (Fig. 4c)
- Subcutaneous edema of the face and wattles
- Catarrhal conjunctivitis, tracheitis, pneumonia and airsacculitis is chronic cases

Diagnosis

- History of a rapidly spreading coryza with foul smelling exudates
- Culture swabs from the infraorbital sinus with aseptic measures, OR inject sinus exudate in susceptible chicks and get typical lesions in 2 or 3 days, then culture this sinuses for pure Coryza
- Cross streak blood agar culture with *Staphylococcus* nurse colony that provides V factor (NAD), incubate in a candle jar, the satellite colonies appear as dewdrops next to the nurse colony (Fig. 4d)
- A PCR test and a real-time PCR is available those are superior to culture, even in developing countries
- Serology- hemagglutination inhibition
- Differential-fowl cholera, mycoplasmosis, laryngotracheitis, Newcastle disease, infectious bronchitis, avian influenza, and vitamin A deficiency

Treatment

- Early treatment is important- water medication is recommended until medicated feed is available
- Infectious coryza is primarily a management disease. Antibiotics play a minor role in prevention and control
- Drug resistance does develop, and hence the performance of antimicrobial sensitivity tests is recommended
- Although treatment may result improvement, the disease may recur when medication is discontinued

Medication

First choice

- Trimethoprim/sulfamethoxazole 100mg per kg body weight in water twice daily for 4-7 days. Withdrawal period: meat-14 days; egg- nil.

Second choice

- Chlortetracycline 2500 mg/L drinking water for 5-7 days. Withdrawal period: meat-upto 7 days; egg-nil.
  OR
- Erythromycin 10-20mg per kg body weight in water twice daily for 3-5 days. Withdrawal period: meat- 7 days; egg-nil.

Prevention and control

- Management procedures
  - Good management and sanitation are the best way to avoid infectious coryza
  - Obtain new birds from 'coryza-free' clean flock
  - Segregate pullets from mature birds, and practice all-in/all-out farming
  - Remove any carrier or recovered birds
  - Depopulate infected flock followed by thorough C&D, remain vacant for 2 to 3 weeks before restocking
- Vaccination
  - Commercial coryza becterins are widely available in many countries, which can only protect against homologous strains (A, B, C)

A2 Common bacterial diseases of the digestive system

A2.1 Pullorum disease

- An infectious, egg-transmitted, highly host-adapted bacterial disease of young chicks and turkey poults worldwide

Etiology

- Bacterium *Salmonella pullorum,* a non-motile, gram-negative rod in the family Enterobacteriaceae (serogroup D)
- *S. pullorum* closely resembles to *S. gallinarum*, the cause of fowl typhoid
- The organism survives for months under modern climatic condition, but easily destroyed by thorough cleaning and disinfection, and by formaldehyde gas fumigation

Epidemiology

- Egg or hatchery contamination usually results in high mortality (up to 100%) during the first few days of life up to 2–3 week of age
- Eradicated from most commercial chicken stocks in the USA through the USDA-administered National Poultry Improvement Plan (NPIP) testing and control program

Transmission

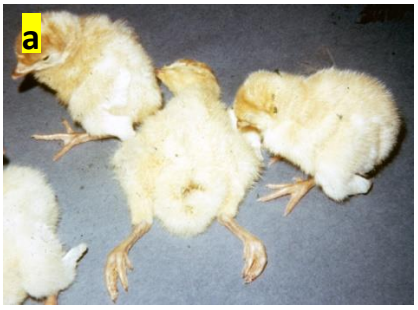
- Vertical (transovarian) through "carrier" breeders – this allows eradication
- Horizontal via direct or indirect contact with infected birds (respiratory or fecal) or contaminated feed, water, or litter, and spreads between farms is due to poor biosecurity
- Small backyard or hobby flocks are the largest threat in many countries including USA

Clinical signs

- Some chicks may be moribund (at point of death) (Fig. 5a) or dead soon after hatch, mortality starts at 5-10 days old and peaks at 2-3 weeks of life
- Birds appear huddling near heat source, anorexia, whitish diarrhea that causes pasted vent
- Survivors frequently become asymptomatic "carrier" with localized infection in the ovary, and produce infected progeny

Necropsy findings

- Young birds- unabsorbed yolk sacs and classic gray nodules in the liver, spleen, lungs, heart, gizzard, and intestine, cecal core, omphalitis (Fig. 5b), swollen joints
- Adult birds- usually no lesions but may have nodular pericarditis; fibrinous peritonitis; misshapen, discolored, caseous ovaries, or testicular abscesses



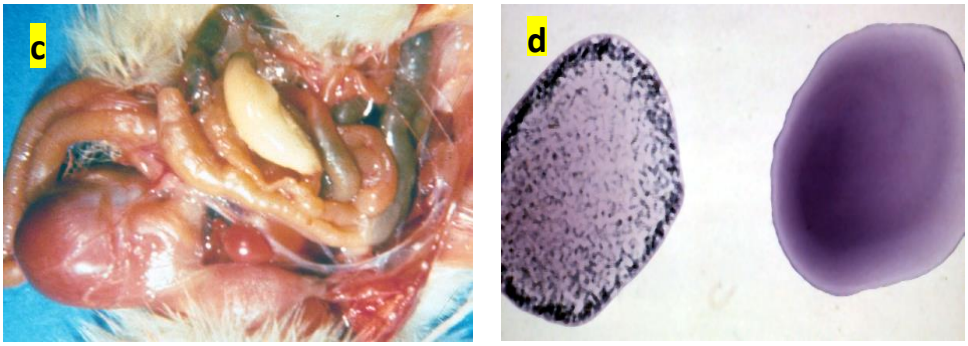


Figure 5: Pullorum disease, a) moribund chicks, b) omphalitis (chicks), c) cecal core (chicks), d) blood agglutination test. Courtesy: University of Georgia College of Veterinary Medicine

Diagnosis

- Suggestive diagnosis based on flock history, clinical signs and lesions
- Definitive diagnosis by isolation and identification – culture the yolk sac and gut
- Serology- whole blood agglutination test (Fig. 5d), positive test results indicated infected breeder flock. False positive can occur caused by common cross-reactive antigens. *S. enteritidis* has a similar antigen to *S. pullorum* and *S. gallinarum*
- Differential-chilling- often associated with white diarrhea; typhoid, paratyphoid, arizonosis and colibacillosis- isolate and identify the etiologic agent to separate these infections

Treatment

- Drugs will not eliminate infection from a treated flock, and will perpetuate the carrier state

Medication

First choice

- Florfenicol 30mg per kg body weight in water once daily for 3 days. Withdrawal period: data not available

Second choice

- Neomycin 10mg per kg body weight in water twice or thrice daily for 5-7 days. Withdrawal period: meat-5 days; egg-nil.

Prevention and control

- Management procedures (biosecurity)
  - Establish and maintain Pullorum-free breeder flocks by serologic testing and other measures
  - Purchase chicks from hatcheries that is Pullorum-free
  - Organism in hatchery can be killed by formaldehyde fumigation
  - Exposure of flock to carriers (rodents, insects, wild birds, people) and a contaminated environment (feed, water) must be avoided
- Vaccination
  - Not normally used as they interfere with serological testing and elimination of carriers

A2.2 Fowl typhoid

- A septicemia, primarily seen in chickens worldwide, looks very similar to pullorum disease

Etiology

- Bacteria, *Salmonella gallinarum*
- Closely related to *S. pullorum*, but biochemically different
- *S. pullorum & S. gallinarum* antigenically identical (complete cross agglutination) (*S. enteritidis* also cross-agglutinates)

Epidemiology

- Incidence is much higher in developing countries
- Greater tendency to spread among growing or mature flocks
- Mortality in young birds is similar to that of pullorum disease but may be higher in older birds

Transmission

- Vertical (transovarian) through "carrier" breeders
- Horizontal from careers, human traffic, rats and feral birds
- Infection through eggshell contamination is of greater importance than with pullorum disease

Clinical signs

- **Chicks and poults (a young chicken)** - similar to pullorum, moribund (at the point of death) and dead chicks from infected eggs, whitish pasty vents, anorexia, labored breathing
- **Growing and mature birds** - drop in feed consumption, depressed and pale (Fig. 6a), dehydration, high fever (up to 112ºF), greenish diarrhea – catarrhal enteritis, death in 4 to 10 days after exposure

Necropsy findings

- **Young birds** - similar to pullorum that is unabsorbed yolk sacs and classic gray nodules in the liver, spleen, lungs, heart, gizzard, and intestine, cecal core, omphalitis, swollen joints.
- **Older birds** - swollen, friable, often bile-stained liver with or without focal necrosis (Fig. 6b), enlarged dark spleen (Fig. 6b) and kidneys, anemia, enteritis in upper small intestine often with ulceration

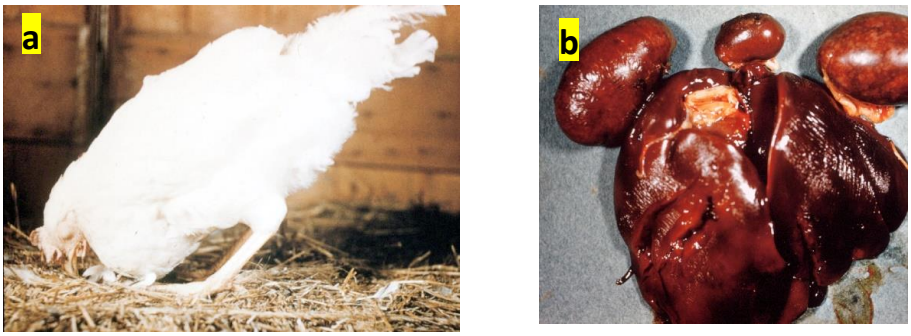


Figure 6: Fowl typhoid, a) paleness and depression, b) liver and spleen lesions. Courtesy: University of Georgia College of Veterinary Medicine

Diagnosis

- Confirmation by isolation and identification, differentiated from other salmonella
- Standard serologic tests for pullorum disease are equally effective in detecting fowl typhoid

Medication

First choice

- Florfenicol 30mg per kg body weight in water once daily for 3 days. Withdrawal period: data not available

Second choice

- Neomycin 10mg per kg body weight in water twice or thrice daily for 5-7 days. Withdrawal period: meat-5 days; egg-nil.

Prevention and control

- Vaccination
  - Vaccines are used in chickens in some countries where the disease is endemic and do not have successful eradication programs
  - Fowl typhoid vaccine (Bangladesh) - attenuated field strain and vaccine strain 9R of *S. gallinarum*, 0.5 ml/ bird above 6-week-old and booster after 30 days

A2.3 Necrotic enteritis

- An acute or chronic enterotoxemia in poultry

Etiology

- Toxins produced by *Clostridium perfringens* (types, A and C)
- Gram-positive bacterium grows in anaerobic condition and produces spores that are highly resistant
- Will re-occur in infected premises

Epidemiology

- A problem in broiler, majority in 2 to 5 weeks old
- Outbreaks in 3 to 6 months commercial layers raised in floor pens

Transmission

- Occurs by feco-oral route
- Contaminated feed and litter are the main sources of infection
- High dietary level of animal byproducts (eg. fish meal), wheat, barley, or rye, overcrowd, poor sanitation, immunosuppression, and intestinal damage (coccidian) are pre-disposing conditions

Clinical signs

- Affected birds die quickly, if untreated mortality up to 20%
- Symptoms include depression, inappetance, emaciation, immobility (Fig. 7a), dark color diarrhea

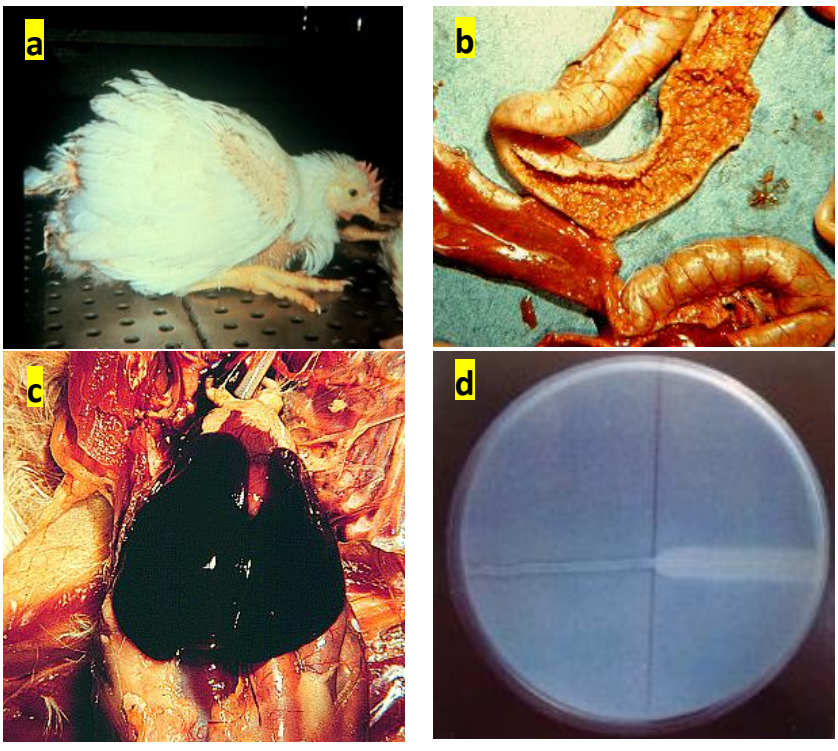


Figure 7: Necrotic enteritis, a) ataxia, water filled crop, b) mucosal lesions, c) congested liver, d) bacterial culture with a wide zone of inhibition. Courtesy: University of Georgia College of Veterinary Medicine

Necropsy findings

- Extreme dehydration, water in crop
- Intestines are ballooned with gas, and contain foul smelling brown fluid
- Mucosa contain ulcers (Fig. 7b) and light yellow spots (early stage), and resemble a 'Turkish towel' (later)
- Dark congested liver (Fig. 7c)

Diagnosis

- Presumptive diagnosis by history, signs & lesions,
- Confirmatory diagnosis by anaerobic culture of intestinal contents or scrapings of intestinal wall
- Colonies on blood agar-inner zone of complete hemolysis and an outer incomplete hemolysis
- Differential-Ulcerative enteritis, coccidiosis (*E. brunette*)
- Addition of *Streptococcus faecium* to the culture results in a wide zone of inhibition (Fig. 7d)

Treatment

- NE can be treated effectively with a course of antibiotics via drinking water, however re-occurrence is likely without changes to C&D and feed management

Medication

First choice

- Lincomycin 50mg per kg body weight in water twice daily for 3-5 days. Withdrawal period: egg-upto 10 days.

Second choice

- Amoxicillin trihydrate 200mg per kg body weight in water twice daily for 3-5 days. Withdrawal period: meat-upto 2 days; egg;nil.

Prevention and control

- As *Cl. perfringens* is nearly ubiquitous, it's extremely important to prevent coccidiosis. This is traditionally done by adding antibiotics or ionophores in the feed, such as:
  - Bacitracin 50-100g/ton of feed for chickens, continuously

  OR
  - Lincomycin (2 g/ton of feed) or virginiamycin (20 g/ton of feed) can be added

  OR
  - Ionophore coccidiostats such as Monensin (0.01-0.0121% in feed) have some effect and much reduce the occurrence of NE
- Control of predisposing factors
  - Minimize the level of fishmeal and wheat in the diet
  - Minimize all stress that can alter intestinal environment
  - Properly maintain good hygiene and storage of feed to prevent mould forming. Do not use old feed
  - Control vermin such as rodents and wild birds
- **Good management practices, particularly litter management**
  - Thorough C&D of premises prior to birds placement
  - Applying cheap grade feed salt to flooring at 60 lbs. (27.2155 kg)/1000 sq.ft.
  - Regular collection and proper disposal of dead birds
- Probiotics
  - **Probiotics such as *Lactobacillus acidophilus* and *Streptococcus faecium* reduce the severity of NE**

A2.4 Ulcerative enteritis

- An acute, highly contagious disease of bobwhite quail and chickens and occurs worldwide

Etiology

- Bacterium *Clostridium colinum,* gram-positive, anaerobic, fastidious to culture, spore-forming rod
- The spores can survive in the premises for months, ground raised quails are mostly infected
- In chickens, the disease is linked to stress, coccidiosis (*Eimeria brunetti*, *E. tenella* or *E. necatrix)*, infectious bursal disease, and other predisposing factors
- The disease is rare in broilers because of the good coccidiostat program, most often in leghorn pullets because of weak coccidiostat program

Epidemiology, Transmission and Pathogenesis

- Chronically ill or recovered birds remain carriers
- Infected birds shed bacteria in droppings, contaminate feed and water, bacteria builds up in the litter, carried over in the infected ground and equipment
- Infection can be spread by flies that feed on infectious droppings
- After oral infection, the bacteria adhere to the intestinal villi, producing enteritis and ulcers, then migrate to the liver via portal circulation, producing necrotic foci and hepatic necrosis

Clinical signs

- Acute form-sudden mortality in good flesh; in chronic form-listless, ruffled feathers (Fig. 8a and 8 c), whitish diarrhea, extreme emaciation and death
- Disease course usually lasts about 3 weeks with peak mortality between 5-14 days
- Mortality as high as 100% in quail and 10% in chickens

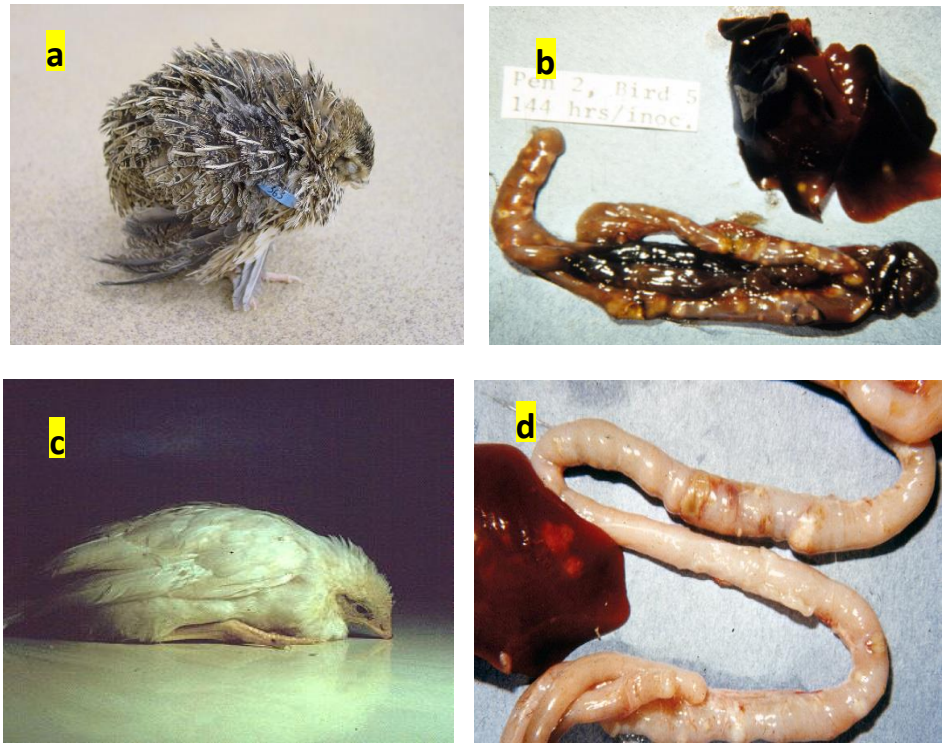


Figure 8: Ulcerative enteritis, a) sick quail, b) quail intestinal serosa and liver lesions, c) sick chicken, d) chicken intestinal serosa and liver lesions. Courtesy: University of Georgia College of Veterinary Medicine

Necropsy findings

- Healthy quail, water in crop, small, round ulcers surrounded by hemorrhages in the smallintestine, ceca, and upper large intestine (Fig. 8b and 8d), later coalesce and perforate resulting in peritonitis
- Characteristic yellow to gray necrotic foci in the liver (Fig. 8b and 8d)
- Lesions in chickens same as quail, but are usually where previous coccidiosis lesions were, and not as distinct as quail. Liver lesions alone frequently.

Diagnosis

- Presumptive diagnosis by history, signs & lesions (intestinal ulcers, necrotic foci in the liver)
- Confirmatory diagnosis by isolation from liver samples cultured in strict anaerobic conditions
- Gram stained impression smear of the liver and intestinal lesions
- In chickens, hepatic lesions of UE help differentiating it from coccidiosis, NE and histomoniasis
- A fluorescent antibody test and a PCR test are also available as effective diagnostic methods

Treatment

First choice

- Lincomycin 25-50mg per kg body weight in water twice daily for 3-5 days. Withdrawal period: egg-upto 10 days.

Second choice

- Amoxicillin trihydrate 200mg per kg body weight in water twice daily for 3-5 days. Withdrawal period: meat-upto 2 days; egg; nil.

Prevention and control

- Good management practices (biosecurity)
  - Keep water trough clean or use nipple drinker, treat water with chlorine or innocuous chemicals that dissolve mineral and or biofilm build-up
  - Do not allow visitors into the bird rearing area
  - Wear clean cloth and disinfect footwear before entering quail house
  - Thorough C&D of premises prior to birds placement
  - Applying cheap grade feed salt to flooring at 6 to 10 lbs. (2.7216 to 4.5359 kg)/100 sq.ft litter or growing area
  - Sick and dead birds should be removed promptly
  - Maintain a good rodent and insect pest control program
- Prevention of *Cl. colinum* can also be done by adding antibiotics in the feed, such as:
  - Chloromycetin 500g/ton of mesh feed give complete protection
  - Rising birds on wire and/or feeding bacitracin 50-100g/ton of feed prevent disease
- Probiotics
  - Probiotics such as *Lactobacillus acidophilus* and *Streptococcus faecium* reduce the severity of NE

A2.5 Coccidiosis

- One of the most potentially destructive and costly diseases in domestic poultry

Etiology

- Protozoa - genus *Eimeria*
- Distributed worldwide, usually occurs in young birds (chickens and turkeys)
- Host-specific, *E. necatrix* and *E. tenella* are the most pathogenic in chickens
- Rapid infectious process (4-7 days), direct but complex life cycle (sexual and asexual)
- A single sporulated oocyst can produce as many as 1,500,000 oocysts

Epidemiology and Transmission

- Infected and recovered birds shed oocysts in their droppings- contaminate feed, water, litter
- Spread mechanically by equipment, clothing, insects, farm workers, and other animals
- Sporulated oocysts survive for long periods, they are resistant to common disinfectants
- Conditions for sporulation- warmth and high humidity, wet litter
- Disease occurs after ingestion of large numbers of sporulated oocysts
- Self-limiting disease, older birds are usually resistant because of earlier exposure

Clinical signs

- Typical "sick bird" (Fig. 9a)- depressed and ruffled feathers, dehydration, weight loss
- Mucoid or bloody diarrhea, and high mortality depending on species of Coccidia
- Depigmentation of the skin, and drop in egg production in laying hens

Necropsy findings (chickens)

- *E. tenella*- cecal coccidiosis, erosion of cecal wall with free blood and bloody core (Fig. 9b)
- *E. necatrix*- mid gut, small white or dull-red spots on serosa (Fig. 9c) with "salt and pepper" appearance, in severe cases- ballooning in mid gut, lumen filled with bloody mucoid exudate

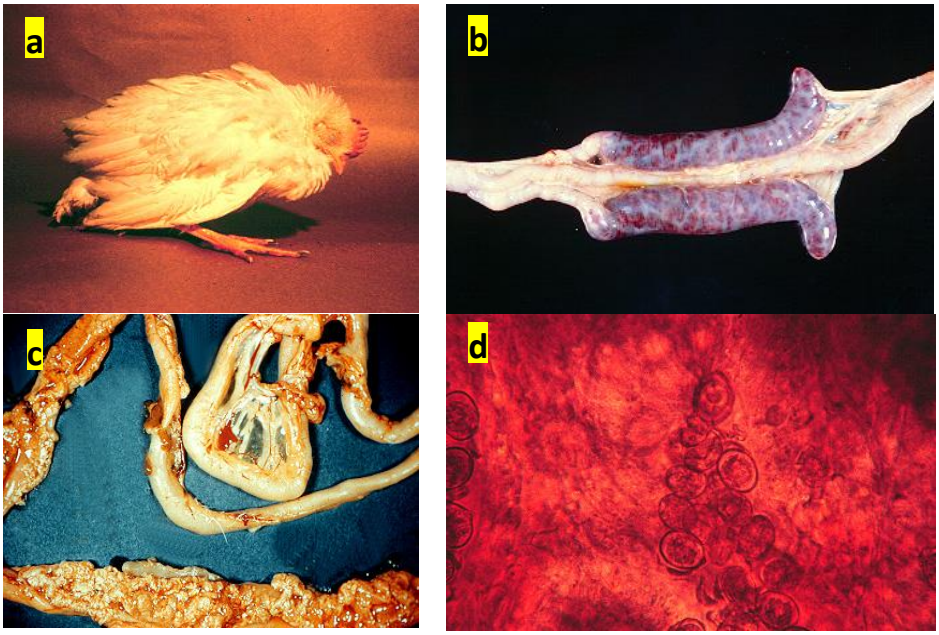


Figure 9: Coccidiosis, a) typical sick chicken, b) *E. tenella* lesions in ceca, c) *E. necatrix* lesions in small intestine, d) *E. Tenella* oocysts. Courtesy: University of Georgia College of Veterinary Medicine

Diagnosis

- Gross intestinal lesions, can speciate by location, need to look at both live and dead birds
- Must use light microscope to confirm by type and size of oocyst.
- The gut is opened and the mucosa of the affected area is scraped off with a spatula and placed on a microscopic slide, a cover-slip is applied to the scraping and mashed to produce a thin smear, then examined with a light microscope (100x) (Fig. 9d).
- Other enteritis problems similar to coccidiosis can be differentiated by microscopic examination

Treatment

- Usually in water. Overtreatment can cause drug toxicity (Sulfas), especially in high temperature
- Some drugs can be used for both treatment and control
- Antibiotics and increased levels of vitamins A and K are sometimes used for better results
- Continuous use of anticoccidial drugs promotes drug-resistant strains of coccidia

Medication

First choice

- Toltrazuril 7mg per kg body weight in water once daily for two consecutive days. Withdrawal period: meat- 14 days; egg:DNU – do not use in egg laying birds
  OR
- Diclazuril 2.5% solution provides a 1ml solution per 1 litre water for 3- 5 days. Withdrawal period: meat and egg-nill

Second choice

- Sulfaquinoxaline 13.2mg per kg body weight in water once daily for 5 days. Withdrawal period: meat-14 days; egg-DNU – do not use in egg laying birds.
  AND
- Amprolium 10mg per kg body weight in water once daily for 5 days. Withdrawal period: nil.

Note: Always advice for more water consumption by birds to avoid kidney damage in case of using sulfar drugs.

Prevention and control

- Good management practices
  - Maintain dry litter condition, clean feeding and watering utensils and good ventilation
  - 14% lime mixed with litter
  - Use disinfectant as per FAO SoP attached in A9.
- Chemoprophylaxis by using anticoccidials
- Immunization
  - Live unattenuated and live attenuated vaccines

A3 Bacterial diseases of skin

A3.1 Gangrenous dermatitis

- A disease of young chickens characterized by necrotic areas of the skin and a severe, underlying, infectious cellulitis

Etiology

- Primary skin lesions secondarily invaded by various gram-positive bacteria including *Clostridium septicum, Cl. perfringens* type A, and *Staphylococcus aureus, as well as gram-negative E. coli*

Epidemiology

- Other contributing factors paly major role in the development of GD, for example:
  - Immunosuppressive diseases such as infectious bursal disease, chicken infectious anemia, reticuloendotheliosis, reovirus, and inclusion body hepatitis
  - Environmental conditions that promote poor litter conditions
  - Failing to remove moribund or dead birds that serve as reservoir of bacteria
  - Management practices that lead to scratching, such as overcrowding, feed outages, mealtime feeding, and bird migration in tunnel-ventilated houses
  - Aflatoxicosis, nutritional deficiency or imbalance, or poor sanitation

Clinical signs

- The incubation period is relatively short (12–24 hr), death occurs in well-fleshed birds
- Symptoms include depression, incoordination, inappetence, leg weakness, ataxia, and high fever

Figure 10: Gangrenous dermatitis, a) necrotic skin (chicken), b) subcutaneous edema and gas bubbles (chicken). Courtesy: University of Georgia College of Veterinary Medicine

Necropsy findings

- Dark reddish purple to green, weepy areas of the skin (Fig. 10a)- affected areas usually include abdomen, breast, wings, or legs
- Necrotic areas are hemorrhagic, with presence of considerable edema and gas (Fig. 10b)

Diagnosis

- Presumptive diagnosis based on acute increase mortality and characteristic gross lesions
- For confirmation, Gram's stained smear or histologic section of affected tissues
- Culture of samples- aerobic media for Clostridia and aerobic media for non-clostridia

Treatment

Note:

- Broad-spectrum antibiotics like chlortetracycline/oxytetracycline/erythromycin should be added in the ration
- Valuable birds treated individually with penicillin/tetracycline or other broad-spectrum antibiotics
- Supply iodine solution in water-1 gal of 1.7% solution of iodine is mixed with 6 gal water to make stock solution, which is then given to the birds at 1 oz/gal water of consumed

Medication

First choice

- Cephalexin 50-125mg per kg body weight in water 2-4 times a day for 5-7 days. Withdrawal period: egg-nil.

Second choice

- Amoxicillin-clavulanic acid 125-250mg per kg body weight in water 2-3 times a day for 5-7 days. Withdrawal period: meat- upto 2 days; egg-nil

Prevention and control

- Control of predisposing factors and apply good management practices
  - Find out and eliminate the cause of trauma. If it's cannibalism then beak trimming may be necessary, also carefully examine mechanical feeder
  - Total cleanout and disinfection of affected premises
  - Regular collection and proper disposal of dead birds
  - Reduce excessive moisture and microbial levels in the litter
  - Applying cheap grade feed salt to flooring at 60 lbs. (27.2155 kg)/1000 sq.ft.
  - Vaccine programs directed at immunosuppressive agents
  - Eliminate other stresses on the birds- parasitism, malnutrition, coccidiosis etc.

A4 References

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6. https://www.researchgate.net/publication/269930830_Evaluation_of_the_Therapeutic_Efficacy_of_Pefloxacin_and_Florfenicol_Combination_in_Broilers_Experimentally_Challenged_by_Escherichia_coli

A5 References table for antibiotic dose and withdrawal period (WP) of drugs

Antibiotics	Reference link for dose	Reference link for WP
Amoxicillin-clavulanic acid	Current therapy in avian medicine and surgery by Speer, Brian. Elsevier Health Sciences (2015) p.810	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8251962/table/avj13034-tbl-0002/
Amoxicillin trihydrate	Current therapy in avian medicine and surgery by Speer, Brian. Elsevier Health Sciences (2015) p.810	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8251962/table/avj13034-tbl-0002/
Amprolium	https://www.sciencedirect.com/topics/veterinary-science-and-veterinary-medicine/sulfaquinoxaline	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8251962/table/avj13034-tbl-0002/
Cephalexin	Current therapy in avian medicine and surgery by Speer, Brian. Elsevier Health Sciences (2015) p.811	http://www.poultrydvm.com/drugs/cephalexin
Chlortetracycline	Current therapy in avian medicine and surgery by Speer, Brian. Elsevier Health Sciences (2015) p.811	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8251962/table/avj13034-tbl-0002/
Diclazuril	https://poultrymania.com/diclazuril-the-ultimate-coccidiosis-treatment/	https://poultrymania.com/diclazuril-the-ultimate-coccidiosis-treatment/
Erythromycin	Current therapy in avian medicine and surgery by Speer, Brian. Elsevier Health Sciences (2015) p.812	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8251962/table/avj13034-tbl-0002/
Florfenicol	https://www.ema.europa.eu/en/documents/mrl-report/florfenicol-extension-chicken-summary-report-3-committee-veterinary-medicinal-products_en.pdf#:~:text=In%20a%20radiometric%20study%2C%20chicken%20received14C-florfenicol%20by%20oral,days%20%28i.e.%2040%20mg%2Fkg%20bw%2Fday%20for%20three%20days%29	Data not available
Lincomycin	Current therapy in avian medicine and surgery by Speer, Brian. Elsevier Health Sciences (2015) p.813	http://www.poultrydvm.com/drugs/lincomycin
Neomycin	Current therapy in avian medicine and surgery by Speer, Brian. Elsevier Health Sciences (2015) p.813	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8251962/table/avj13034-tbl-0002/
Norfloxacin	https://www.sciencedirect.com/science/article/abs/pii/S1090023303001849#:~:text=Norfloxacin%20was%20administered%20orally%20to%20chickens%20and%20turkeys,norfloxacin%20concentrations%20were%20determined%20by%20high-performance%20liquid%20chromatography	Data not available

Antibiotics	Reference link for dose	Reference link for WP
Sulfaquinoxaline	https://www.sciencedirect.com/topics/veterinary-science-and-veterinary-medicine/sulfaquinoxaline ***please put 13.2 in the find option then you can find the dose in the document.***	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8251962/table/avj13034-tbl-0002/
Tiamulin fumarate	Current therapy in avian medicine and surgery by Speer, Brian. Elsevier Health Sciences (2015) p.814	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8251962/table/avj13034-tbl-0002/
Tilmicosin	http://www.poultrydvm.com/drugs/tilmicosin	https://pubs.acs.org/doi/pdf/10.1021/jf035515z
Toltrazuril	https://www.ema.europa.eu/en/medicines/veterinary/referrals/toltrazuril	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8251962/table/avj13034-tbl-0002/
Trimethoprim/ sulfamethoxazole	Current therapy in avian medicine and surgery by Speer, Brian. Elsevier Health Sciences (2015) p.814	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8251962/table/avj13034-tbl-0002/
Tylosin	http://www.poultrydvm.com/drugs/tylosin	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8251962/table/avj13034-tbl-0002/

A6: Antibiograms 2022

Poultry

Pathogen	*Ehericbia coli*		*Staphylococci spp*		*Salmonella spp*		*Pseudomonas spp*	
	n	%	n	%	n	%	n	%
Total number of isolates	25	2%	10	1%	35	2%	25	2%
amikacin	132	91%	82	95%	0	--	25	100%
amoxicillin	173	19%	92	41%	0	--	25	32%
ampicillin	25	32%	216	13%	155	6%	25	20%
azithromycin	314	31%	89	2%	35	9%	0	--
cefotaxime	82	0%	89	0%	35	0%	0	--
cefoxitin	232	76%	0	--	0	--	0	--
ceftazidime	82	0%	89	0%	35	0%	0	--
ceftriaxone	314	61%	89	46%	35	43%	0	--
cephalexin	132	67%	82	90%	0	--	25	52%
ciprofloxacin	941	24%	181	54%	190	36%	25	76%
co-trimoxazole	561	27%	305	41%	190	41%	25	52%
doxycycline	173	26%	285	42%	155	14%	25	96%
enrofloxacin	602	11%	262	37%	155	24%	0	--
erythromycin	561	5%	305	14%	190	24%	25	40%
gentamycin	941	61%	374	60%	190	76%	25	92%
levofloxacin	66	44%	226	47%	155	53%	25	80%
neomycin	132	60%	275	49%	0	--	25	96%
nitrofurantoin	232	87%	0	--	0	--	0	--
norfloxacin	25	80%	23	48%	0	--	25	76%
oxytetracycline	627	14%	285	34%	155	11%	25	52%
streptomycin	82	52%	89	40%	35	51%	0	--
tetracycline	536	29%	282	20%	190	15%	0	--

90% and above
75% to below 90%
50% to below 75%
Below 50%

1

A7: WHO AWaRe categorization

Access – first- and second-choice antibiotics for the empirical treatment of most common infectious syndromes
Watch – antibiotics with higher resistance potential. Use as 1.- and 2.-choice treatment should be limited to few syndromes or patient groups.
Includes the highest priority agents on *Critically important antimicrobials for human medicine* (CIA List) which ranks antimicrobials according to their relative importance in human medicine. Apply for risk management strategies for the use of antimicrobials in food-production animals.
Reserve – antibiotics to be used mainly as "last-resort" treatment options

ACCESS	WATCH	RESERVE
Penicillins	**Ureidopenicillin with beta-lactamase inhibitor**	**3rd Generation Cephalosporins**
benzathine benzylpenicillin	piperacillin + tazobactam	ceftazidime/avibactam
benzylpenicillin	**2nd-generation Cephalosporins**	**4th-generation Cephalosporins**
phenoxymethylpenicillin	cefuroxime	cefepime
procaine benzyl penicillin	**3rd-generation Cephalosporins**	**5th-generation Cephalosporins**
amoxicillin	cefixime	ceftaroline
ampicillin	cefotaxime	**Polymyxins**
Penicillinase-resistant penicillins	ceftazidime	colistin,
cloxacillin	ceftriaxone	polymyxin B
flucloxacillin	**Quinolones/Fluoroquinolones**	**Oxazolidinones**
Beta Lactamase Inhibitor	ciprofloxacin	linezolid
amoxicillin + clavulanic acid	levofloxacin	tedizolid
1st-generation Cephalosporins	moxifloxacin	**Carbapenems**
cefazolin	Pefloxacin	ertapenem
cefalexin	norfloxacin (vet)	meropenem
cephradine	enrofloxacin (vet)	meropenem/vaborbactam
Aminoglycosides	marbofloxacin (vet)	imipenem + cilastatin
amikacin	**Macrolides**	**Monobactams**
gentamycin	azithromycin	aztreonam
streptomycin	clarithromycin	**Phosphonics**
neomycin	erythromycin	fosfomycin (IV)
Lincosamides	tylosin (vet)	**Penems**
clindamycin	tilmicosin (vet)	faropenem
lincomycin (vet)	**Glycopeptides**	**Other**
Tetracyclines	vancomycin (oral)	tigecycline
doxycycline	vancomycin (parental)	daptomycin
tetracycline	teicoplanin	
oxytetracycline		
Sulfonamides-Trimethoprim		
sulfamethoxzole/Trimethoprim		
Sulfonamides (vet)		
sulfadimethoxine,		
sulfamerazine		
sulfamethazine,		
sulfaquinoxaline		
sulfathiazole		
Sulphadiazine		
Amphenicols		
chloramphenicol **(vet but banned in BD)**		
florfenicol (vet)		
Imidazoles		
metronidazole		
Nitrofuran Derivatives		
nitrofurantoin		
Aminocyclitols		
spectinomycin		
Other		
fusidic acid		
pleuromutilins (vet)		
polypeptides (vet)		
pyrimidine (vet)		

A8: Upazila to Community (U2C) Biosecurity 16 points

A. Access control at farm entrance

A.1 Outside vehicles do not enter farm, only essential vehicles (e.g. feed, egg)
A.2 Only workers and approved visitors enter farm
A.3 No manure collectors enter farm
A.4 Farm area is fully fenced and duck/chicken proof
A.5 Dead birds disposed safely
A.6 Signs posted

B. Access control between loading area and production area

B.1 No movement of vehicles in and out the production area
B.2 Only workers enter production area
B.3 Only visitors enter production area if accompanied by farm manager
B.4 Signs posted

C. Personnel management

C.1 Outside footwear left outside farm
C.2 Workers and visitors change clothes upon entering farm
C.3 Workers and visitors use only dedicated footwear in production area
C.4 Worker and visitors shower upon entering farm

D. Equipment management

D.1 Materials returning from market or other farm cleaned before entering the farm
D.2 Materials returning from market or other farm disinfecting materials before entering the farm

A9: Upazila to Community (U2C) SOPs

Protocol for cleaning poultry trough (drinkers for broiler)
Standard Operating Procedures

Objective

To reduce bacterial contamination on the drinkers thus improving production. *This procedure is used only for open metal or plastic drinker troughs but can be adapted to individual drinkers used for growers.*

Background

Drinkers should be cleaned on daily basis to prevent the formation of slime and biofilm that can host a wide range of disease agents that can have detrimental effect on poultry health and affect the production significantly. The need to clean drinkers for pullets and broilers is the same, but the equipment is different. A bucket will be needed to collect the dirty water and to avoid wetting the litter.

Before drinkers can be cleaned regularly (daily and weekly), they have to be brought into an initial clean condition, hence an initial deep cleaning procedure (point A) must be performed. This is a onetime activity, provided that the poultry house operator performs the daily and weekly cleaning procedure regularly.

The initial clean condition can vary depending on the material from which the drinkers are made. In general, it can be said that initial clean condition has been reached when we can see the real colour of the drinker material (metallic shine if it is made of stainless steel or light grey if it is made of PVC), no dirt is seen on the surface; and there is no slimy or greasy lining on the surface of the drinkers.

After the initial clean condition is obtained, the regular cleaning procedure may be implemented. This way the farm operator becomes familiar with the clean condition and can ensure that it is achieved after each cleaning.

If the trough is too long to be cleaned at once and divided into several segments, make sure the outflow end opens when trough is rinsed after a segment cleaning ends so no dirty water left in trough to be drunk by birds.

For individual drinkers, these can be cleaned when removed from the shed for refilling each morning.

When preparing to vaccinate in the drinking water do not use detergent and/or disinfectant 48 hours before and at least 12 hours after vaccination. Follow daily cleaning procedure steps 1 to 4, then 10 to 11.

Equipment required

- 1 dark-coloured cloth for cleaning
- 1 light-coloured cloth for disinfection
- Scraper and scourer for cleaning
- Rubber gloves

- Clean water
- Detergent
- 1 bottle of QAC disinfectant
- 1 five or ten litre bucket for cleaning
- 1 five or ten litre bucket for disinfection, different colour or distinctly marked from the cleaning bucket

Procedures

A. DEEP CLEANING -initial cleaning of the drinker trough (the first time you clean the drinker)

This is the most important step in the drinker cleaning procedure. The objective is to bring back the drinker cleanliness to as close as possible to the condition when it was newly assembled in the poultry house. This procedure will be quite difficult and takes time to complete; therefore, it has to be done gradually, according to the time availability. Remember, the objective is to achieve the initial clean condition. The initial cleaning procedure is as follow:

1. Open the drinker stopper and flush the water out. For separate drinkers, empty the water.
2. Fill one of the buckets with clean water and detergent. Soak the dark cleaning cloth in the water in the cleaning bucket and squeeze lightly to avoid dripping
3. Starting at the front (tap end) to the back (outflow end) of the drinker scrubbing inside and outside. Scrub the drinker using the scourer or scraper to remove any slime and/or crust on the inside and outside of the drinker.
4. Then follow with the dark cleaning cloth until clean (no stain, no bio-filmRinse the cleaning cloth in the bucket when it gets dirty and empty the bucket and replace with clean water if it gets too dirty.
5. Please follow steps 5 to 11 of the "Daily Cleaning Procedure" below for the next steps.

For individual drinkers: the same procedure is used; the drinker should be emptied into a bucket. It is possible to soak the drinker in clean water before cleaning.

B. Daily Cleaning Procedure (to be done once every day in the morning) – no detergent, use disinfectant.

Cleaning

1. Open the drinker stopper and flush the out water; or empty the water into a bucket.
2. Fill one of the buckets with clean water. Soak the cleaning cloth into the water in the cleaning bucket and squeeze lightly to avoid dripping water onto the food below.
3. Scrub the drinker using the cleaning cloth until clean (no stain, no bio-film). Start from the front (tap end) to the back (outflow end) of the drinker scrubbing inside and outside.
4. Rinse the cleaning cloth in the bucket when it gets dirty.

Disinfection

5. Dilute the disinfectant into the disinfection bucket (follow the dilution instructions on the label and use protective clothing such as rubber gloves).
6. Soak the disinfection cloth into the diluted disinfectant.
7. Apply the disinfectant on to the drinker by wiping the disinfectant cloth on the drinker's inside and outside beginning from the front (tap end) to the back (outflow end). Use rubber gloves when working with disinfectant.
8. Let the drinker air dry (also to allow contact time for disinfectant to work).
9. Close the drinker stopper and open the tap to allow the drinker to fill with fresh water.

For individual drinkers: the same procedure is used. To allow the drinkers to air dry, there should be an extra drinker, dedicated to the shed, which are used while the others are cleaned and dried. The deep cleaning should only be carried out between batches.

Cleaning of the cleaning tools

10. When finished, wash the buckets and cloths using detergent and water, then leave under the sun to dry.
11. Store in a clean and dry place.

C. Weekly cleaning procedures (to be done regularly once a week replacing one of daily cleaning) use detergent and disinfectant

Weekly cleaning procedures are almost the same as the daily cleaning procedures, the only difference is that the cleaning steps use detergent and water instead of only water to clean the trough (in steps 1- 4). *Weekly cleaning procedures must be done regularly, meaning that operators are expected to do this on the same day every week.*

Protocol for cleaning trough (feeders for broiler)
Standard Operating Procedures

Objective

To reduce the bacterial contamination on the feeder that will prevent the birds from getting sick thus improving production. This procedure is used only for open metal or plastic feeder but can be adapted to individual drinkers used for growers.

Background

Feeders should be cleaned on daily basis to prevent the formation of lumps and crusts that can host a wide range of disease agents and which have a detrimental effect to poultry health and can significantly affect the egg production.

Before feeders can be cleaned regularly (daily and weekly), they have to be brought into an initial clean condition, hence an initial cleaning procedure (point A) must be performed. This is a one time activity, provided that the chicken house operator performs the daily and weekly cleaning procedure regularly.

The initial clean condition can vary depending on the material from which the feeders are made. In general it can be said that initial clean condition has been reached if, we can see the real color of the feeder materials (metallic shine if it is made of stainless steel or light grey if it is made of PVC) and there is no dirt on its surface and there is no no slimy or greasy lining on the surface.

Only once the initial clean condition is obtained, the regular cleaning procedure may be implemented. In this way, the farm operator can recognize the clean condition that should be maintained with regular cleaning procedures.

The procedure can be used for individual tube feeders

Equipment required

- 1 dark-colored cloth for cleaning
- 1 light–colored cloth for disinfection
- 1 scraper and scourer
- 1 bottle of QAC disinfectant
- Clean water
- Rubber gloves
- detergent
- 1 five or ten -liter bucket for cleaning
- 1 five or ten -liter bucket for disinfection, different color from cleaning bucket
- Scoop for removing uneaten feed
- Bucket for storing remaining feed

Procedures

DEEP CLEANING -initial cleaning of the feeder (the first time you clean the drinker) This is the most important step in the feeder cleaning procedure. The objective is to bring the feeder back to the cleanliness level of when it was assembled in the poultry house. This procedure will be quite difficult and takes time to complete, therefore it has to be done gradually, according to the time availability, but avoiding procastination. Remember, the objective is not to be able to do this in one go, but to achieve the initial clean condition. The initial cleaning procedure is as follows:

1. Remove remaining feed from the feeder with a scoop and place in a bucket, use a scraper to remove any hard-to-clean crusts or lumps. Discard the lumps and crusts in garbage disposal. Note that you can weigh this and show the wastage to the farmer.
2. Brush excess dust out of the feeder
3. Fill one of the buckets with clean water and detergent. Soak the cleaning cloth in this bucket and squeeze lightly to avoid dripping
4. Beginning from one end and moving towards the other end, scrub the feeder inside and outside using the cleaning cloth until the feeder is clean (no stain, no bio-film and no feed left).
5. Use the scourer or scraper to remove any slime and/or crust on the inside and outside of the feeder.
6. Please follow steps 4 to 11 of the "Daily Cleaning Procedure" below

The farmer needs two sets of feeders so that one is in use while the other is being cleaned and dried. For tube feeders, these can be cleaned by removing the feed, and placing it in a bucket while cleaning takes place. The feed can be placed into the clean replacement feeder. The feeders can be briefly soaked in clean water to soften the crusted feed. The thorough deep cleaning should only be carried out between batches.

B. Daily Cleaning Procedure (once every day in the morning) – only water and disinfectant

Cleaning

1. Remove the remaining feed from the feeder and place in a bucket. Use a scraper to remove any feed sticking to the feeder.
2. Soak the cleaning cloth in the clean water in the cleaning bucket and squeeze lightly to avoid dripping
3. Scrub the feeder using the cleaning cloth until the feeder is clean (no stain, no bio-film and no feed left). Start from one end of the feeder, scrubbing inside and outside.
4. Rinse the cleaning cloth in the bucket when it gets dirty. Replace the water if it gets dirty.

Disinfection

5. Dilute the disinfectant (QAC) into the disinfection bucket (follow the diluting instructions on the label and use protective clothing such as rubber gloves).
6. Soak the clean disinfection cloth (light coloured) with the diluted disinfectant above and squeeze lightly to avoid dripping.
7. Apply the disinfectant on to the feeder by wiping the disinfectant cloth starting from one end to the other of the feeders inside and outside. Use rubber gloves while using disinfectant. If the cloth becomes dirty very quickly, then the feeder is not clean enough (the cleaning procedure (steps 1 to 4) were not doing properly and should be repeated.
8. Let the feeder air dry (also to allow contact time for disinfectant to work).
9. Refill the feeders, mixing in the uneaten feed with new feed.

Cleaning of the cleaning tools

10. When finished, wash the bucket and cloths with the detergent and leave to dry.
11. Store in a clean dry place.

C. **Weekly cleaning procedures (to be done regularly once a week replacing one of daily cleaning) uses water, detergent and disinfectant**

Weekly cleaning procedures are almost the same as the daily cleaning procedures, the only difference is that the cleaning steps use detergent and water instead of only water to clean the trough (in steps 1- 4). *Weekly cleaning procedures must be done regularly, meaning that operators are expected to do this on the same day every week.*

Protocol for cleaning poultry trough (drinkers for layer)
Standard Operating Procedures

Objective

To reduce bacterial contamination on the drinkers thus improving egg production. *This procedure is used only for open metal or plastic drinker troughs but can be adapted to individual waterers.*

Background

Drinkers should be cleaned on daily basis to prevent the formation of slime and biofilm that can host a wide range of disease agents that can have detrimental effect on poultry health and affect the egg production significantly. The need to clean drinkers for pullets and broilers is the same, but the equipment is different. A bucket will be needed to collect the dirty water and to avoid wetting the litter.

Before drinkers can be cleaned regularly (daily and weekly), they have to be brought into an initial clean condition, hence an initial deep cleaning procedure (point A) must be performed. This is a onetime activity, provided that the poultry house operator performs the daily and weekly cleaning procedure regularly.

The initial clean condition can vary depending on the material from which the drinkers are made. In general, it can be said that initial clean condition has been reached when we can see the real colour of the drinker material (metallic shine if it is made of stainless steel or light grey if it is made of PVC), no dirt is seen on the surface; and there is no slimy or greasy lining on the surface of the drinkers.

After the initial clean condition is obtained, the regular cleaning procedure may be implemented. This way the farm operator becomes familiar with the clean condition and can ensure that it is achieved after each cleaning.

If the trough is too long to be cleaned at once and divided into several segments, make sure the outflow end opens when trough is rinsed after a segment cleaning ends so no dirty water left in trough to be drunk by birds..

When preparing to vaccinate in the drinking water do not use detergent and/or disinfectant 48 hours before and at least 12 hours after vaccination. Follow daily cleaning procedure steps 1 to 4, then 10 to 11.

Equipment required

- 1 dark-coloured cloth for cleaning
- 1 light-coloured cloth for disinfection
- Rubber or scourer for cleaning
- Rubber gloves
- Clean water
- Detergent
- 1 bottle of QAC disinfectant
- 1 five or ten litre bucket for cleaning
- 1 five or ten litre bucket for disinfection, different colour or distinctly marked from the cleaning bucket

Procedures

B. Initial cleaning of the drinker trough

This is the most important step in the drinker cleaning procedure. The objective is to bring back the drinker cleanliness to as close as possible to the condition when it was newly assembled in the poultry house. This procedure will be quite difficult and takes time to complete; therefore, it has to be done gradually, according to the time availability. Remember, the objective is to achieve the initial clean condition. The initial cleaning procedure is as follow:

1. Open the drinker stopper and flush the water out. For separate drinkers, empty the water.
2. Fill one of the buckets with clean water and detergent. Soak the dark cleaning cloth in the water in the cleaning bucket and squeeze lightly to avoid dripping
3. Starting at the tap end, scrubs the drinker using the cleaning cloth until clean (no stain, no bio-film and no feed left). Start from the front (tap end) to the back (outflow end) of the drinker scrubbing inside and outside.
4. Use the scourer or scraper to remove any slime and/or crust on the inside and outside of the drinker.
5. Rinse the cleaning cloth in the bucket when it gets dirty and empty the bucket and replace with clean water if it gets too dirty.
6. Please follow steps 5 to 11 of the "Daily Cleaning Procedure" below for the next steps.

D. Daily Cleaning Procedure (to be done once every day in the morning)

Cleaning

1. Open the drinker stopper and flush the out water; or empty the water into a bucket.
2. Fill one of the buckets with clean water. Soak the cleaning cloth into the water in the cleaning bucket and squeeze lightly to avoid dripping water onto the food below.
3. Scrub the drinker using the cleaning cloth until clean (no stain, no bio-film). Start from the front (tap end) to the back (outflow end) of the drinker scrubbing inside and outside.
4. Rinse the cleaning cloth in the bucket when it gets dirty.

Disinfection

5. Dilute the disinfectant into the disinfection bucket (follow the dilution instructions on the label and use protective clothing such as rubber gloves).
6. Soak the disinfection cloth into the diluted disinfectant.
7. Apply the disinfectant on to the drinker by wiping the disinfectant cloth on the drinker's inside and outside beginning from the front (tap end) to the back (outflow end). Use rubber gloves when working with disinfectant.
8. Let the drinker air dry (also to allow contact time for disinfectant to work).
9. Close the drinker stopper and open the tap to allow the drinker to fill with fresh water.

Cleaning of the cleaning tools

10. When finished, wash the buckets and cloths using detergent and water, then leave under the sun to dry.
11. Store in a clean and dry place.

E. Weekly cleaning procedures (to be done regularly once a week replacing one of daily cleaning)

Weekly cleaning procedures are almost the same as the daily cleaning procedures, the only difference is that the cleaning steps use detergent and water instead of only water to clean the trough (in steps 1- 4). *Weekly cleaning procedures must be done regularly, meaning that operators are expected to do this on the same day every week.*

Protocol for cleaning trough (feeders for layer)
Standard Operating Procedures

Objective
To reduce the bacterial contamination on the feeder that will prevent the birds from getting sick thus improving egg production. This procedure is used only for open metal or plastic feeder.

Background
Feeders should be cleaned on daily basis to prevent the formation of lumps and crusts that can host a wide range of disease agents and which have a detrimental effect to poultry health and can significantly affect the egg production.

Before feeders can be cleaned regularly (daily and weekly), they have to be brought into an initial clean condition, hence an initial cleaning procedure (point A) must be performed. This is a one time activity, provided that the chicken house operator performs the daily and weekly cleaning procedure regularly.

The initial clean condition can vary depending on the material from which the feeders are made. In general it can be said that initial clean condition has been reached if, we can see the real color of the feeder materials (metallic shine if it is made of stainless steel or light grey if it is made of PVC) andthere is no dirt on its surface and there is no no slimy or greasy lining on the surface.

Only once the initial clean condition is obtained, the regular cleaning procedure may be implemented. In this way, the farm operator can recognize the clean condition that should be maintained with regular cleaning procedures.

Equipment required
- 1 dark-colored cloth for cleaning
- 1 light–colored cloth for disinfection
- 1 scraper and scourer
- 1 bottle of QAC disinfectant
- Clean water
- Rubber gloves
- detergent
- 1 five or ten -liter bucket for cleaning
- 1 five or ten -liter bucket for disinfection, different color from cleaning bucket
- Scoop for removing uneaten feed
- Bucket for storing remaining feed

Procedures
D. Initial cleaning of the feeder trough

This is the most important step in the feeder cleaning procedure. The objective is to bring the feeder back to the cleanliness level of when it was assembled in the poultry house. This procedure will be quite difficult and takes time to complete, therefore it has to be done gradually, according to the time availability, but avoiding procastination. Remember, the

objective is not to be able to do this in one go, but to achieve the initial clean condition. The initial cleaning procedure is as follows:

1. Remove remaining feed from the feeder and place in a bucket, use a scraper to remove any hard-to-clean crusts or lumps. Discard the lumps and crusts in garbage disposal.
2. Fill one of the buckets with clean water and detergent. Soak the cleaning cloth in this bucket and squeeze lightly to avoid dripping
3. Beginning from one end and moving towards the other end, scrub the feeder inside and outside using the cleaning cloth until the feeder is clean (no stain, no bio-film and no feed left).
4. Use the scourer or scraper to remove any slime and/or crust on the inside and outside of the feeder.
5. Please follow steps 4 to 11 of the "Daily Cleaning Procedure" below

E. Daily Cleaning Procedure (once every day in the morning)

Cleaning

1. Remove the remaining feed from the feeder and place in a bucket. Use a scraper to remove any feed sticking to the feeder.
2. Soak the cleaning cloth in the clean water in the cleaning bucket and squeeze lightly to avoid dripping
3. Scrub the feeder using the cleaning cloth until the feeder is clean (no stain, no bio-film and no feed left). Start from one end of the feeder, scrubbing inside and outside.
4. Rinse the cleaning cloth in the bucket when it gets dirty. Replace the water if it gets dirty.

Disinfection

5. Dilute the disinfectant (QAC) into the disinfection bucket (follow the diluting instructions on the label and use protective clothing such as rubber gloves).
6. Soak the clean disinfection cloth (light coloured) with the diluted disinfectant above and squeeze lightly to avoid dripping.
7. Apply the disinfectant on to the feeder by wiping the disinfectant cloth starting from one end to the other of the feeders inside and outside. Use rubber gloves while using disinfectant. If the cloth becomes dirty very quickly, then the feeder is not clean enough (the cleaning procedure (steps 1 to 4) were not doing properly and should be repeated.
8. Let the feeder air dry (also to allow contact time for disinfectant to work).
9. Refill the feeders, mixing in the uneaten feed with new feed.

Cleaning of the cleaning tools

10. When finished, wash the bucket and cloths with the detergent and leave to dry.
11. Store in a clean dry place.

F. **Weekly cleaning procedures (to be done regularly once a week replacing one of daily cleaning)**

Weekly cleaning procedures are almost the same as the daily cleaning procedures, the only difference is that the cleaning steps use detergent and water instead of only water to clean the trough (in steps 1- 4). *Weekly cleaning procedures must be done regularly, meaning that operators are expected to do this on the same day every week.*

A10: Chart of withdrawal periods of selected antibiotics								
Antimicrobial agent	Class	Route of administration	Withholding period (WHP) (Meat and Eggs) (the WHP is product specific so always review product label carefully to confirm WHP)					
Antimicrobial agent	Class	Route of administration	Broilers a	Layer hens	Layer Pullets	Eggs b	Turkeys	Other
Amoxicillin	Penicillin	Water	1-2D	Nil or DNU	NIL or 8D	NIL or DNU*	1-2D	Ducks 1-2D
Amprolium	Anticoccidial	Water	NIL	Hen NIL	NIL	NIL	NIL	Ducks NIL, Pigeons NIL
Apramycin	Aminoglycoside	Water	14D	DNU	DNU	DNU	DNU	
Avilamycin	Orthosomycin	Feed	NIL	DNU	DNU	DNU	DNU	
Bacitracin	Polypeptide	Feed	NIL	NIL	NIL	NIL	NIL	Ducks NIL
Chlortetracycline	Tetracycline	Feed, Water	2, 4 or 7D	2, 4 or 7D	2, 4 or 7D	NIL	2, 4 or 7D	Ducks 2, 4 or 7D
Decoquinate	Anticoccidial	Feed	NIL	DNU	DNU	DNU	DNU	
Dinitolmide	Anticoccidial	Feed	NIL	DNU	DNU >14wk	DNU	NIL	
Erythromycin	Macrolide	Water	7D	DNU	DNU	DNU	7D	Ducks 7D
Ethopabate + Amprolium	Anticoccidial	Feed, water	NIL	DNU	DNU	DNU	NIL	Ducks NIL
Flavophospholipol	Glycophospholipid	Feed	NIL	NIL	NIL	NIL	NIL	
Flubendazole	Anthelmintic	feed	7D	eNIL	eNIL	NIL	DNU	
Lasalocid	Anticoccidial Ionophore	Feed	3D	DNU	DNU <14D	DNU	NIL	
Levamisole	Anthelmintic	Water	7D	Hens eNIL	eNIL	NIL	7D	Ducks 7D
Maduramicin	Anticoccidial Ionophore	Feed	NIL	DNU	DNU	DNU	DNU	
Methylbenzoquate + clopidol	Anticoccidial [anthelmintic]	Feed	NIL	DNU	DNU	DNU	DNU	
Monensin	Anticoccidial Ionophore	Feed	NIL		NIL	DNU	DNU	

Narasin	Anticoccidial Ionophore	Feed	NIL	DNU	DNU	DNY	DNU	
Neomycin (feed)	Aminoglycoside	Feed Water	5D 5D	14D DNU	14D e>14D	NIL DNU	14D 5D	Ducks 5D
Nicarbazin c	Anticoccidial	Feed	1D	DNU	DNU	DNU	DNU	
Oxytetracycline	Tetracycline	Feed, Water	7or 21D	DNU	DNU	DNU	7or 21D	Ducks 7 or 21D
Piperazine	Anthelmintic	water	NIL	NIL	NIL	NIL	NIL	Ducks NIL
Robenidine	Anticoccidial	Feed	5D	DNU	DNU	DNU	DNU	
Salinomycin	Anticoccidial Ionophore	Feed	NIL	DNU	e>7d	DNU	DNU	
Semduramicin	Anticoccidial Ionophore	Feed	NIL	DNU	DNU	DNU	DNU	
Spectinomycin + Lincomycin	Aminocyclitol, Lincosamide	Water, Injection	10D 10D	10D DNU	10D DNU	NIL DNU	10D DNU	Ducks 10D DNU
Sulfadimidine	Sulphonamide	Water	15D	DNU	DNU	DNU	15D	Ducks 15D
Sulfaquinoxaline c	Anticoccidial Sulphonamide	Water	14D	DNU	DNU	DNU	14D	Ducks 14D
Tiamulin c	Pleuromutilin	Feed, Water	5D	DNU	DNU	DNU	5D	Duck 5D
Toltrazuril	Anticoccidial	Water	14D	DNU	E>8w	DNU	DNU	
Trimethoprim + Sulfadiazine	Diaminopyrimidine + Sulphonamide	Water	14D	DNU	DNU or e>14D	DNU	14D	
Trimethoprim + Sulfadimidine	Diaminopyrimidine + Sulphonamide	Water	14D	DNU	e>14D	DNU	14D	Ducks 14D
Tylosin	Macrolide	Feed Water	NIL NIL, 2D	NIL DNU	NIL DNU	NIL DNU, e>7D	NIL 5D	Ducks NIL
Virginiamycin	Streptogramin	Feed	NIL	DNU	DNU	DNU	DNU	
Source:	Antimicrobial prescribing guidelines for poultry							
	P Gray, R Jenner, J Norris, S Page, G Browning and the Australian Veterinary Association Ltd and Animal Medicines Australia							
	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8251962/table/avj13034-tbl-0002/							
	DNU: Do not use in layer, DNU*: withdrawal period in pullets is product specific							