



REPUBLIC OF ZAMBIA

MINISTRY OF FISHERIES AND LIVESTOCK
DEPARTMENT OF VETERINARY SERVICES

STANDARD TREATMENT GUIDELINES FOR POULTRY



First Edition - 2025




ZNPHI
ZAMBIA NATIONAL
PUBLIC HEALTH INSTITUTE



INTERNATIONAL CENTRE FOR
ANTIMICROBIAL RESISTANCE
SOLUTIONS



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DISCLAIMER

These treatment guidelines conform to the current evidence-based practice in Zambia. Contributors, reviewers and editors cannot be held responsible for omissions and other consequences. The guidelines are intended solely as reference and should be used as a general guide for veterinarians and veterinary paraprofessionals. The veterinarian is responsible for the selection and implementation of the appropriate treatment based on their professional judgment. All efforts shall be taken in the best interest of the animal's health and welfare taking into consideration the specific circumstances of each case.

The views expressed herein do not necessarily represent the views of the Ministry of Fisheries and Livestock, - Combating Antimicrobial Resistance and Antimicrobial Residues in the Zambian Poultry sector Project and other cooperating partners that supported the production of these guidelines.

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ABBREVIATIONS AND ACRONYMS

ABF	Antibiotic-Free
AGREE II Tool	Appraisal of Guidelines for Research and Evaluation II
AMP	Antimicrobial Peptides
AMR	Antimicrobial Resistance
API	Active Pharmaceutical Ingredient
AST	Antimicrobial Susceptibility Testing
AU	Arbitrary Units
AU-IBAR	African Union – Inter-African Bureau for Animal Resources
BAI	Bacterial Activity Index
CFM	Chloramphenicol
CLSI	Clinical and Laboratory Standards Institute
DANIDA	Danish International Development Agency
DVO	District Veterinary Officer
FAO	Food and Agriculture Organization
FBO	Feed-Based Organisation
GMP	Good Manufacturing Practice
HACCP	Hazard Analysis and Critical Control Points
IB	Infectious Bronchitis
IBD	Infectious Bursal Disease
ILRI	International Livestock Research Institute
IM	Intramuscular
IU	International Units
IV	Intravenous
MA	Marketing Authorisation
MFL	Ministry of Fisheries and Livestock
MRL	Maximum Residue Limit
NA	Not Applicable
ND	Newcastle Disease
NGO	Non-Governmental Organisation
OTC	Over The Counter
PAZ	Poultry Association of Zambia
PO	Per Os (by mouth/oral administration)

R&D	Research and Development
RUMA	Responsible Use of Medicines in Agriculture Alliance
SOP	Standard Operating Procedure
SPC	Summary of Product Characteristics
SQP	Suitably Qualified Person
STG	Standard Treatment Guidelines
USAID	United States Agency for International Development
WHO	World Health Organization
WHP	Withholding Periods
WOAH	World Organisation for Animal Health (formerly OIE)
ZDA	Zambia Development Agency
ZEMA	Zambia Environmental Management Agency
ZNS	Zambia National Service

FOREWORD

Poultry products in Zambia form an integral part of the human diet in many households, as they are cheap and easy to produce. The burden of poultry diseases has however remained a major challenge. Growing consumer demand for poultry products in Zambia has resulted in non-prudent antimicrobial use on farms, with the intent to prevent and treat poultry diseases for growth optimization and maximizing profits. While Zambia has made progress against antimicrobial resistance (AMR) through implementing the One Health National Action Plan (NAP), some gaps still remain. Limited actions have been implemented to encourage farmers and veterinary personnel to use antimicrobials in a more prudent manner and there are no treatment guidelines for poultry diseases in Zambia. Therefore, this project Combating Antimicrobial Resistance and Antimicrobial Residues in the Zambian Poultry sector (CAAZAP) aims to optimize antimicrobial prescribing and use practices among the veterinary personnel and farmers to reduce antimicrobial use and residues in broilers by 30% in selected districts of Zambia. This will be achieved through interventions, including to develop and implement poultry treatment guidelines, which will be complemented by targeted education and training with supporting incentives across the poultry production chain.

The concept of Standard Treatment Guidelines (STGs) for commonly occurring poultry diseases treatable at the point of contact with the vet is gaining acceptance in improving the quality and uniformity of veterinary care worldwide. Its popularization and acceptance will help veterinary practitioners to plan and prescribe medicines appropriately and rationally to treat the diseases with minimum expenses and minimum use of medicines.



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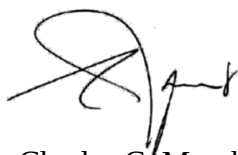
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The production of this document is a culmination of a broad consultation of the various stakeholders in the animal health sector drawn from the Government, the private sector and academia, among others. These include, but are not limited to, the following:

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INTRODUCTION

The poultry sector in Zambia plays a critical role in national food security, livelihoods and income generation. Poultry products, particularly broiler meat and table eggs, serve as affordable sources of high-quality animal protein for a significant portion of the population. However, the growth and productivity of this sector continue to be threatened by the burden of infectious and non-infectious diseases, which result in high morbidity and mortality, reduced production efficiency and economic losses for farmers.

Despite the increased use of veterinary antimicrobials in poultry production to manage these health challenges, the sector has witnessed a rising threat of antimicrobial resistance (AMR) linked to non-prudent use of drugs. The absence of standardized treatment protocols for poultry diseases in Zambia has further contributed to inconsistent therapeutic practices, potential misuse of antimicrobials and increased risk of antimicrobial residues in poultry products.

In response to these challenges, the Ministry of Fisheries and Livestock, through the Department of Veterinary Services and with support from local and international stakeholders, has developed these *Poultry Treatment Guidelines*. The guidelines aim to provide veterinarians and veterinary paraprofessionals with standardized, evidence-based recommendations for the effective and responsible treatment of common poultry diseases in Zambia. Emphasis is placed on accurate disease diagnosis, rational use of antimicrobials, adherence to withholding periods (WHP) and alignment with the One Health approach to AMR mitigation.

These guidelines serve as an important reference tool to promote animal health and welfare, enhance production efficiency and safeguard public health by ensuring the responsible use of veterinary medicines in poultry production systems. They are intended for use in both commercial and village poultry settings and will be updated periodically in line with emerging scientific evidence, field experiences and regulatory changes.

General Treatment Guidelines

Effort must be made to establish an accurate diagnosis prior to administration of any treatment. Professional stewardship should be practiced in managing residuals of therapeutics, keeping in mind the complex link between food animals and the human consumers as well as their indirect link to the biological ecosystem - plant and soil flora and fauna included. All treatment must be given by correct routes and dosage.

OBJECTIVES

The objectives include:

- To provide standardized, evidence-based treatment protocols for the most common diseases and conditions affecting poultry.
- To encourage the prudent use of veterinary drugs to reduce the risk of antimicrobial resistance and drug residues in poultry and poultry products.
- To enhance the health, productivity and welfare of poultry through timely and appropriate treatment interventions.
- To offer clear guidance and decision-making tools to veterinary practitioners involved in the treatment of poultry.

METHODOLOGY

The development of the Standard Treatment Guideline followed a systematic, evidence-based, and consultative approach designed to ensure scientific credibility, practicality, and alignment with both national and international standards. The process involved:

Situational Analysis: A comprehensive situational analysis was conducted to assess the current status of antimicrobial use (AMU) and antimicrobial resistance (AMR) in the poultry production sector. This involved the review of existing national reports, scientific literature and field-level insights.

Stakeholder Engagement: The methodology emphasized broad consultations with stakeholders, including veterinary professionals, poultry farmers, agro-vet outlets, academia and regulatory agencies. Feedback from these groups was instrumental in shaping the structure and focus areas of the guideline.

Treatment Guideline Alignment: The treatment guideline was aligned with international and regional frameworks such as the Global Action Plan on AMR by the WHO, WOAHA guidelines and the Zambian National Action Plan on AMR. This ensured coherence and integration into broader health and development objectives. The WHO AWaRe classification (Access, Watch, and Reserve) was integrated to categorize antimicrobials based on their public health importance. Drugs in the *Access* category, such as tetracyclines and penicillins, were prioritized as first-line treatments, while those in the *Watch* group (e.g., fluoroquinolones, third-generation cephalosporins) were restricted for **second-line use** and specific indications. *Reserve* antimicrobials were excluded from empirical recommendations to preserve their efficacy.

Drafting of Guidelines: Based on the synthesized evidence from desk reviews, reports and field experiences, the consultant and team drafted the treatment guidelines. The guidelines include disease name, causative agent, key clinical signs, recommended treatment (including drug names, dosages, routes and duration), supportive care and preventive measures. Emphasis was placed on promoting responsible antimicrobial use. The first draft of the treatment guideline was inputted into an Artificial Intelligence (AI) platform for the purposes of language editing and improving clarity of expression, without altering the scientific content.

Validation Workshop: A final validation workshop was convened to review, critique and appraise the draft treatment guidelines. The workshop brought together a broad range of stakeholders to ensure the guidelines were technically sound, implementable and aligned with national priorities. Stakeholders included: Ministry of Livestock and Fisheries, Department of Veterinary Services; Ministry of Health, AMR focal point, Zambia Medicines Regulatory Authority, Veterinary Council, University veterinary schools, national and provincial veterinary officers, private veterinary practitioners and para-veterinary staff, pharmaceutical wholesalers/distributors and importers; diagnostic laboratory managers and One Health development partners (e.g., FAO, WHO, Fleming Fund and civil-society/public-health representatives).

The treatment guideline was appraised using the AGREE II instrument to assess its methodological rigor and overall quality. Each participant independently reviewed the guideline using the six AGREE II domains (1) Scope and Purpose, (2) Stakeholder Involvement, (3) Rigor of Development, (4) Clarity of Presentation, (5) Applicability, and (6) Editorial Independence. Scores were then compiled, averaged, and discussed in plenary to reach consensus on areas requiring improvement.

Finalization and Endorsement: Following review and validation, the treatment guideline was finalized and submitted for official endorsement by the Department of Veterinary Services and relevant veterinary statutory bodies.

Monitoring and Future Revisions: To ensure the treatment guidelines remain current and evidence-based, a structured monitoring and review mechanism has been established. The guidelines will undergo a comprehensive review every two years, coordinated by the Department of Veterinary Services (DVS) in collaboration with the Antimicrobial Resistance Coordinating Committee.

1.0 MANAGING DISEASE OUTBREAKS ON POULTRY FARMS

In 2023, Zambia's poultry population showcased remarkable diversity and scale, reflecting the country's growing poultry industry. Village chickens emerged as the dominant group, with a staggering 26,162,649 individuals (Zambia Statistics Agency, 2024). Trailing behind, broiler chickens numbered 5,325,381, while layer exotic chickens made up 2,065,451 of the total. Ducks, turkeys, guinea fowls, pigeons, quails and rabbits also contributed to the varied poultry landscape, each with its own unique population size (Zambia Statistics Agency, 2024). These figures provide a clear snapshot of Zambia's vibrant poultry sector, offering valuable insights into the trends and dynamics that shape the industry.

In 2023, Zambia's poultry industry showed significant regional variations in the distribution of broiler and layer chickens. Lusaka emerged as the leading province for both broiler and layer chicken farming, with 2,680,661 broilers (50.3% of the national total) and 512,106 layer chickens (24.1%). The Copperbelt followed closely with 1,226,639 broilers (23%) and 452,294 layer chickens (21.3%) (Zambia Statistics Agency, 2024). Other provinces such as Central, Northern, Southern and Western also contributed notably to the national totals, with Central raising 327,434 broilers and 126,068 layers, Northern raising 268,916 broilers and 35,269 layers, Southern raising 156,460 broilers and 157,253 layers and Western raising 36,482 broilers and 57,702 layers. Smaller contributions came from Eastern, Muchinga and North Western, with Eastern raising 39,417 broilers and 37,224 layers, Muchinga contributing 4,852 broilers and 4,852 layers and North Western raising 242,653 broilers and 157,253 layers. In total, Zambia raised 5,325,381 broiler chickens and 2,127,690 layer chickens across 4,380,577 households and 944,804 establishments, reflecting the diverse and growing poultry sector (Zambia Statistics Agency, 2024). To maintain this growth and protect against the risks associated with poultry farming, particularly disease outbreaks, it is crucial to implement effective biosecurity measures from the outset, ensuring flock health and productivity.

Commercial poultry medicine is a specialized field within veterinary science that prioritizes preventive care to ensure flock health and productivity. Disease outbreaks on poultry farms are typically due to lapses in biosecurity measures, which, while often unexpected, should not be entirely surprising. It is important that any establishment factor biosecurity at the beginning to ensure adequate conceptual and structural biosecurity. Effective biosecurity extends beyond simple quarantine practices, encompassing a comprehensive approach that includes external, internal and resilience components. These strategies cover a range of preventive practices, including vaccination, preventive medication, optimized nutrition, genetic selection for disease resistance, good husbandry and meticulous management.

Another important cause of disease outbreak on the farms is as a result of various stress factors. These could be natural or as a result on human actions. Careful investigation to anticipate these saves on both the direct and indirect effects of stress.

The tools used for diagnosing diseases in poultry are varied and adapted to the commercial farm setting. Though these tools are applied to a single animal species, they address a wide range of conditions. Veterinarians rely heavily on ethology (the study of animal behavior) as a diagnostic tool, though it often goes unrecognized as a formal skill. Other essential tools include gross pathology,

histopathology, epidemiology, microbiology, molecular biology and serology, with immunology, pharmacology, therapeutic practices and public health considerations forming the broader foundation of a commercial poultry veterinarian's role.

1.1 Considerations for Disease Treatment

- **Operating within the Food Industry Context:** In the poultry sector, veterinarians must always consider the food production context, as treatment decisions directly impact food safety and quality. This means prioritizing not only the health of the flock but also the safety of animal products as human food sources. Every treatment decision incorporates food safety principles and the range of treatment options is often limited by regulatory constraints to ensure consumer safety.
- **Antimicrobial Treatment Constraints:** In commercial broiler production, the short lifespan of chickens limits treatment options, particularly for antimicrobials with long withholding periods (WHPs). Veterinarians must consider the flock's slaughter date before administering treatments and clearly communicate antimicrobial use and its consequences to both farmers and processors. In egg-laying flocks, WHPs are critical for any medication and a WHP longer than zero days can preclude egg sales during treatment. In backyard flocks, which may produce eggs for personal or limited commercial use, additional considerations arise, such as ensuring treatment safety and appropriate WHPs due to potential trade of eggs and birds.
- **Flock Treatment vs. Individual Treatment:** Treatments in commercial operations typically target the flock rather than individual birds, as treating single birds is usually not feasible or cost-effective. In high-value or niche farms, exceptions may be made, such as providing hospital pens for valuable breeds or rare genetic stock. In contrast, backyard flock owners often view their birds as pets and individual treatment may be a more frequent occurrence due to the personal connection owners have with their birds.
- **Rational Grounds for Antimicrobial Use:** Justifications for antimicrobial treatments should include critical needs such as animal welfare, managing disease risk in susceptible flocks, zoonotic potential and addressing economic loss. Antimicrobial treatment should be avoided when ineffective, such as for viral or nutritional conditions, or when better alternatives exist, such as early processing or allowing a mild disease to self-resolve. Care must also be taken with medications that might interact negatively with bacterial vaccines or serve as non-specific preventive measures without a clear disease context.

1.2 Prudent Use of Antimicrobials

Prudent antimicrobial use is essential in poultry medicine. When treating a flock, mass administration through water or feed will reach both sick and healthy birds and sick birds' reduced feed or water intake often limits their drug exposure. As such, mass antimicrobial therapy functions more as a preventive measure for uninfected birds rather than targeted treatment. In Zambia, options are further restricted by the limited number of registered medications and strict food safety regulations, placing greater emphasis on preventive strategies over therapeutic use. Alternatives to antimicrobials—though varying in efficacy—include probiotics, prebiotics, medium-chain fatty acids, essential oils and acidifiers.

There is also increasing scrutiny from consumers and industry stakeholders who demand transparency in antimicrobial use and prefer sustainable practices that minimize reliance on these drugs. Veterinary interventions are under more stringent oversight, necessitating strong antimicrobial stewardship and well-documented justifications for using such treatments.

1.3 Key Practical Considerations in Poultry Treatment

- **Diagnosis:** A diagnosis, even if only tentative, is essential before beginning any medication. Identifying the cause of illness allows for a more targeted and effective treatment approach.
- **Drug Susceptibility and Resistance:** Understanding susceptibility patterns of infectious agents and testing for resistance is critical. Resistance testing, where available, should precede antimicrobial use. However, reliance solely on past responses may be misleading, as prior improvements may not always be due to antimicrobial treatment.
- **Bactericidal vs. Bacteriostatic Selection:** Bactericidal drugs eliminate bacteria, while bacteriostatic drugs inhibit bacterial growth. Both can be effective in poultry, as immune system function is ultimately essential for recovery regardless of the antimicrobial's mechanism of action.
- **Site of Infection and Dosage:** Selecting drugs that effectively reach the infection site is crucial. Dosage considerations should factor in variable water and feed intake, which can depend on flock health, ambient temperature and management practices. Starting treatment at the maximum recommended dosage can ensure efficacy.
- **Timing and Duration of Medication:** For acute diseases, medication should start as soon as possible and continue until mortality and symptoms subside, typically within 3-5 days. Chronic conditions may need longer medication durations to prevent spread to other flocks.
- **Administration Methods:** Oral medication via drinking water is generally preferred for its ease of administration and adaptability. However, care must be taken to avoid dilution with fresh water and medications should be prepared daily to maintain efficacy. Concurrent administration of different antimicrobials is generally discouraged due to potential interactions.

1.4 Antimicrobial Pharmacology and Stewardship in Poultry

Effective poultry treatment with antimicrobials requires a deep understanding of the pharmacokinetics (PK) and pharmacodynamics (PD) of these drugs across various poultry species. Most antimicrobial agents used in Zambia for poultry are older classes, with few newly developed options. This limited formulary underscores the importance of appropriate drug selection, dosage and administration to avoid resistance and maximize treatment efficacy.

- **Administration via Water and Feed:** In Zambia, most antimicrobials are administered orally, primarily mixed in water or feed. This method has practical advantages but also challenges related to dose consistency. Knowledge of factors affecting water and feed consumption, such as age, environmental conditions and feeding schedules, is vital to achieve effective therapeutic levels.
- **Variability in Pharmacokinetics:** Avian physiology, metabolism and environmental factors introduce variability in drug absorption, distribution and elimination. Differences in drug

metabolism among species, interaction with dietary elements and water sanitation practices can all impact the effectiveness of antimicrobial treatments. Variability considerations should guide dosage regimens and prompt re-evaluation when expected responses are not observed.

1.5 General Approach to Disease Investigation

- **Production and Farm Records:** A review of production records, including vaccination history, visitor logs and biosecurity practices, provides a valuable context for understanding flock health. Observing farm layout and nearby risks, such as neighbouring farms or water bodies attracting wild birds, can help identify potential disease sources.
- **Flock and Shed Examination:** Examining the overall farm environment, from litter quality to rodent control, helps evaluate farm hygiene standards. Inside sheds, indicators like air quality, temperature, lighting and water availability all influence disease risk. Bird behaviour, such as distribution, feeding and drinking habits, also provides insight into flock health.
- **Clinical and Post-mortem Examinations:** Individual examination identifies clinical signs, while necropsies of affected birds reveal pathological clues. Typically, 5-10 birds are selected for necropsy to provide a representative sample for diagnosis.
- **Personal Safety and Biosecurity:** Personal protective measures are essential during disease investigation to prevent zoonotic transmission and iatrogenic spread of disease.
- **Treatment Options and Prevention Advice:** If a diagnosis points to a bacterial infection, antimicrobial therapy may begin and should comply with WHP requirements. Preventive measures, emphasizing biosecurity, vaccination, nutrition and hygiene, are ultimately the most sustainable approach to minimizing future outbreaks.

2.0 COMPREHENSIVE PROTOCOL FOR AVIAN POST-MORTEM EXAMINATION

2.1 Purpose of Post-Mortem Examination

The avian post-mortem examination, or necropsy, is a systematic procedure used to inspect and analyze a carcass to identify lesions and pinpoint the cause of death. This examination is vital in poultry pathology for confirming diagnoses, evaluating treatment efficacy and managing disease outbreaks. Findings from the necropsy often offer valuable information about underlying infectious agents, environmental stressors, or husbandry practices impacting flock health and productivity.

2.2 Submission of Carcass or Specimens

- **Timeliness:** Carcasses should ideally be submitted for examination as soon as possible, preferably within 8–12 hours post-mortem, to prevent degradation and ensure accuracy in findings. In warmer climates, carcasses should be kept cool to slow decomposition.
- **Preparation:** Prior to necropsy, the carcass should be thoroughly soaked in cold water mixed with a mild detergent to moisten feathers, which reduces contamination and enhances visibility. Once prepped, place the bird in a sealed plastic bag and refrigerate it (avoiding freezing) until the time of necropsy.

2.3 Materials and Equipment Needed for Examination

Pathologists conducting a necropsy must use designated sterile instruments and protective equipment to maintain hygiene and prevent cross-contamination. Required materials include:

- **Standard Instruments:** Scalpels, scissors, forceps, poultry shears, weighing scales, petri dish and dissection boards for detailed examination.
- **Protective Gear:** Gloves, masks, goggles, aprons and boots to ensure personal safety and maintain specimen integrity.
- **Reagents:** 10% neutral buffered formalin for tissue fixation, saline solution for cleaning organs and alcohol or other disinfectants to sterilize feathers and prevent contamination.

2.4 Standardized Post-Mortem Protocol (Anatomical Approach)

A consistent approach ensures a thorough and reliable examination. The primary steps of a typical necropsy include:

- Collecting Case History
 - Obtain a complete clinical history, including any symptoms observed, treatment administered, vaccination records and information on the bird's environment and flock. This context is critical for interpreting post-mortem findings.
- External Examination and Preparation of the Carcass
 - Conduct an initial external examination to assess body condition, muscle tone, feather quality and check for signs of external parasites, injuries, or lesions. Record any abnormalities.
 - Secure the bird in dorsal recumbency (lying on its back) to stabilize it during the examination, ensuring safe and effective access to all anatomical structures.
- Opening Body Cavities
 - Make a central incision in the abdomen, cutting laterally along the rib cage and remove the breast muscle to expose the thoracic and abdominal cavities. Observe and document any fluids or exudates in these cavities that may indicate infection or inflammation.
- Systematic Organ Examination
 - **Gastrointestinal Tract:** Carefully detach the oesophagus, crop, proventriculus, gizzard and intestines. Each organ should be inspected for lesions, foreign material, or signs of parasitism.
 - **Liver and Spleen:** Remove the liver and spleen and assess for size, shape, colour changes and any signs of necrosis or other lesions.
 - **Kidneys:** Since kidneys are often obscured by other organs, special attention is required to examine them thoroughly for abnormalities or infection.
 - **Heart and Lungs:** Inspect the heart's structure, colour and surrounding tissues, as well as the lungs and air sacs, noting any cloudy membranes, fluid accumulation, or signs of respiratory disease.

- **Nervous System:** Examine the brachial and sciatic nerves for swelling or discoloration, which may indicate viral infections such as Marek's disease.
- **Musculoskeletal system:** Examine the strength of bones that would examine deficiencies in calcium and magnesium. Haemorrhages on muscles can indicate important viral infections like Newcastle and Infectious bursal diseases.

2.5 Detailed Examination of the Alimentary Tract

To prevent contamination of other tissues, the gastrointestinal tract should be examined last. This involves inspecting the mucosal lining for ulcers, signs of inflammation and the presence of parasites. Each segment, including the proventriculus, gizzard, intestines and cloaca, is examined for physical abnormalities, structural integrity and possible sources of infection or obstruction.

2.6 Documentation and Laboratory Analysis

All findings should be meticulously recorded on a structured necropsy report. When abnormalities are detected, tissue samples should be collected and preserved in 10% formalin for histopathological analysis. Additional samples may be submitted for bacteriological, virological and toxicological testing as needed to achieve a comprehensive diagnosis.

2.7 Concluding the Necropsy and Follow-Up

The post-mortem examination should conclude with a summary of preliminary findings and possible diagnoses. This data is essential for implementing effective flock management practices. Necropsy results help inform targeted preventive strategies, such as biosecurity measures, vaccination protocols and husbandry adjustments. In cases of suspected infectious diseases, necropsy findings guide containment and treatment efforts to prevent spread within the flock or to neighboring farms.

2.8 Poultry Post-Mortem Examination Form

This form is intended for recording findings from a systematic post-mortem examination of poultry. Complete each section to ensure a comprehensive assessment of the specimen.

1. General Information

Farm/Owner: _____
Flock ID/Batch Number: _____
Species/Breed: _____
Age: _____
Date of Examination: _____
Veterinarian/Inspector: _____
Weight of Carcass (g): _____

2. Case History

Clinical Signs Observed Prior to Death: _____
Any Recent Treatment or Vaccination: _____
Housing & Management Notes: _____

3. External Examination

Body Condition: ☐ Good ☐ Fair ☐ Poor
Skin and Feathers: ☐ Normal ☐ Abnormal
Describe any abnormalities (lesions, parasites, feather condition): _____
Eyes: ☐ Clear ☐ Discharge ☐ Swollen
Nostrils/Beak: ☐ Clear ☐ Nasal Discharge ☐ Swollen
Vent: ☐ Clean ☐ Soiled
Observations of External Parasites: ☐ None ☐ Present (describe) _____

4. Body Cavities

Presence of Abnormal Fluids in Body Cavity: ☐ None ☐ Present (describe) _____
Description of Fat Deposits: ☐ Normal ☐ Reduced ☐ Absent ☐ Excessive

5. Organ Examination

Respiratory System

Lungs: ☐ Normal ☐ Congested ☐ Lesions
Notes: _____
Air Sacs: ☐ Clear ☐ Cloudy ☐ Thickened ☐ Lesions
Notes: _____

Cardiovascular System

Heart: ☐ Normal ☐ Enlarged ☐ Lesions ☐ Fluid Around Heart
Notes: _____

Digestive System

Esophagus and Crop: ☐ Normal ☐ Impacted ☐ Lesions ☐ Foreign Material

Proventriculus: ☐ Normal ☐ Ulcerated ☐ Lesions ☐ Enlarged

Gizzard: ☐ Normal ☐ Erosions ☐ Foreign Objects ☐ Lesions

Intestines: ☐ Normal ☐ Inflamed ☐ Haemorrhagic ☐ Lesions ☐ Parasites

Notes: _____

Hepatic System

Liver: ☐ Normal ☐ Enlarged ☐ Discoloured ☐ Lesions ☐ Fatty

Notes: _____

Renal System

Kidneys: ☐ Normal ☐ Enlarged ☐ Pale ☐ Lesions

Notes: _____

Reproductive System (if applicable)

Ovaries/Testes: ☐ Normal ☐ Enlarged ☐ Discoloured ☐ Lesions

Notes: _____

Musculoskeletal System

Bones: ☐ Normal ☐ Deformed ☐ Lesions

Joints: ☐ Normal ☐ Swollen ☐ Lesions

Muscle Condition: ☐ Normal ☐ Haemorrhagic ☐ Pale ☐ Discoloured

Nervous System

Brain: ☐ Normal ☐ Swollen ☐ Lesions

Spinal Cord: ☐ Normal ☐ Abnormalities observed

6. Other Observations/Findings

7. Preliminary Diagnosis

Diagnosis (if any): _____

Differential Diagnoses: _____

8. Samples Collected for Further Testing

☐ Liver ☐ Lungs ☐ Spleen ☐ Heart ☐ Kidneys ☐ Intestines ☐ Brain

☐ Other (specify): _____

Lab Tests Requested: ☐ Bacteriology ☐ Virology ☐ Histopathology ☐ Parasitology ☐

Toxicology ☐ Other _____

9. Summary and Recommendations

Summary of Findings: _____

Recommended Actions: _____

Biosecurity Recommendations: _____

Signature of Veterinarian/Inspector: _____ **Date:** _____

3.0 ANTIMICROBIAL STEWARDSHIP AND THE WHO AWaRe FRAMEWORK

The use of antimicrobials in poultry production is critical for managing bacterial diseases; however, inappropriate or excessive use contributes significantly to the global challenge of antimicrobial resistance (AMR). To support rational use of antimicrobials in both human and animal health, the World Health Organization (WHO) developed the AWaRe classification (Access, Watch and Reserve), which provides a framework for guiding antimicrobial stewardship.

3.1 Access Group

Antimicrobials in the Access group are considered first- or second-choice agents for common infections. In poultry practice in Zambia, examples include chlortetracycline and oxytetracycline. These drugs should be regarded as the preferred first-line choices, provided they are effective for the condition being treated and must always be used in strict accordance with recommended dosages and treatment durations.

3.2 Watch Group

The Watch group includes antimicrobials that have a higher potential for resistance development. Their use should be carefully monitored and restricted to situations where Access group antimicrobials are ineffective or contraindicated. Examples relevant to poultry practice include enrofloxacin. In Zambia, veterinarians are encouraged to use these antimicrobials only when absolutely necessary, ideally based on culture and sensitivity testing and to ensure that veterinary justification for their use is clearly documented.

3.3 Reserve Group

The Reserve group consists of last-resort antimicrobials that are critically important for treating multidrug-resistant infections in humans. These antimicrobials should not be used in routine poultry practice in Zambia. They should only be considered under exceptional circumstances and with regulatory approval from the Ministry of Fisheries and Livestock. Avoiding their use in poultry is essential to protect their effectiveness for critical human health needs.

3.4 Practical Application in Zambia

In applying the AWaRe framework, veterinarians in Zambia are expected to prioritize antimicrobials in the Access group, restrict the use of those in the Watch group and avoid the use of Reserve antimicrobials in poultry production. Responsible veterinary practice also requires documenting prescriptions, dosages and treatment outcomes in line with national protocols. In addition, veterinarians should provide farmer education on the risks of antimicrobial overuse, the importance of completing prescribed treatments and the role of good husbandry, vaccination and biosecurity in reducing reliance on antimicrobials.

This guideline clearly indicates first-line, second-line, and third-line treatment options to guide practitioners in selecting the most appropriate therapy. First-line treatments represent the preferred initial options for managing a condition; second-line treatments are alternatives used when first-line options are ineffective, contraindicated, or unavailable; and third-line treatments are reserved for specific circumstances requiring more advanced or restricted use.

4.0 NON-INFECTIOUS DISEASES OF POULTRY

4.1 Ammonia Toxicity

Ammonia is an invisible, irritating gas with a distinctive smell and its concentration in poultry houses is influenced by factors such as the frequency of feces removal, ventilation quality, chicken density and activity, bedding type, litter temperature and pH. When ammonia levels reach toxic concentrations (>25ppm), the gas dissolves in the moisture on mucous membranes and eyes, forming ammonium hydroxide, which irritates and damages the eyes and mucociliary structures of the respiratory tract. This mucosal damage increases susceptibility to secondary infections like colibacillosis.

Clinical Symptoms and Lesions

- At 50–75 ppm: Decreased feed intake, reduced body weight and lowered egg production.
- At 75–100 ppm: Respiratory signs appear.
- Above 100 ppm: Corneal ulceration, blindness, sensitivity to light (photophobia), swollen eyelids and stunted growth.
- Lesions: Damage to the cornea (keratoconjunctivitis), increased mucus production and haemorrhages in the respiratory tract.

Diagnosis

- Diagnosis is based on history, clinical signs and eye examination.

Treatment and Prevention

- Reduce ammonia levels through effective ventilation.
- Ensure proper ventilation, maintain clean and dry bedding, avoid overcrowding and consider adding natural zeolites to litter.

4.2 Ascites Syndrome

Ascites, or pulmonary hypertension syndrome, is a metabolic disease in broiler chickens characterized by the accumulation of non-inflammatory transudate in one or more of the peritoneal cavities or potential spaces. This condition develops due to hypoxemia, which leads to increased cardiac activity and can subsequently cause pulmonary hypertension. Hypoxemia also stimulates an increase in red blood cells, resulting in higher blood viscosity, which further elevates pulmonary pressure.

Clinical Symptoms and Lesions

- Cyanosis, redness of abdominal skin and congestion of peripheral vessels.
- Affected chicks are typically smaller than their penmates, with ruffled feathers, reduced weight, pale and shrunken combs, reluctance to move, distended abdomen, laboured breathing and sudden death.
- Affected broilers often die lying on their back.
- Postmortem lesions may include yellowish clear fluid with or without fibrin clots, hydropericardium, right-sided cardiac enlargement, left ventricular dilatation, a mottled or shrunken liver, oedematous and congested lungs and in some cases, no specific pathological lesions.

Diagnosis

Diagnosis is based on lesions observed during postmortem examination.

Treatment and Prevention

- There is no specific treatment.
- Preventive measures include controlling early growth to reduce oxygen demand, implementing feed restriction, using mesh feed, providing a diet with lower energy content, applying light restriction or intermittent lighting programs, ensuring adequate ventilation, relocating to lower altitude areas, monitoring sodium levels in feed and water to avoid salt intoxication and genetic selection.

4.3 Cannibalism

Cannibalism in chickens and turkeys is a behavioral issue commonly seen as vent-picking or pecking at unfeathered areas such as the head, comb, wattles, or toes. Although no single cause is pinpointed, factors like overcrowding, excessive light and nutritional imbalances are closely linked to its occurrence. Additional contributing factors include overly fat pullets (where mucosa protrudes from the vent during and after egg-laying), insufficient feeder space, deficiencies in minerals and vitamins, skin injuries and not removing dead birds regularly.

Treatment and Prevention

- There is no specific treatment
- To control cannibalism, trim the tip of the beak at one day old and repeat the process between 6 and 12 weeks of age. Cautery is often necessary to achieve haemostasis.

4.4 Carbon Monoxide Toxicity

Carbon monoxide (CO) is a colorless, odorless gas produced by improperly functioning brooders or furnaces. It disrupts oxygen transport from the lungs to tissues due to its greater binding affinity for hemoglobin than oxygen. CO poses a serious risk to both chickens and humans, leading to illness and even mortality.

Clinical Symptoms

Symptoms include lethargy, labored breathing, lack of coordination, stunting, convulsions and death. Exposure to sublethal levels of CO is linked to an increased prevalence of ascites. Postmortem findings may reveal bright red-colored blood, bright pink-colored lungs and cyanosis of the beak and face.

Diagnosis

Diagnosis is based on history, clinical signs, postmortem findings, CO level measurement in the air and carboxyhemoglobin analysis in blood.

Treatment and Prevention

- Remove the source of CO production and ensure adequate ventilation.
- Use only properly functioning brooders and furnaces.
- Maintain adequate ventilation at all times.

4.5 Calcium and Phosphorus Deficiency

Adequate calcium and phosphorus nutrition relies on not only the total amounts in the diet but also the chemical forms available and the diet's vitamin D content. The ideal calcium-to-phosphorus (Ca) ratio for growing chicks and pigs ranges between 1:1 and 2:1, while laying hens require a higher calcium intake.

Clinical Symptoms

Deficiency symptoms include bone abnormalities, subnormal growth, reduced egg production, decreased appetite, lower feed efficiency and the development of pica or depraved appetite.

Treatment and Prevention

For starting chicks (0–8 weeks), supplement with 0.9% calcium and 0.7% phosphorus. For growing chicks (up to 18 weeks), provide 0.6% calcium and 0.4% phosphorus.

4.6 Manganese Deficiency

Manganese is an essential co-activator for enzymes involved in lipid and carbohydrate metabolism. Manganese deficiency is relatively common in poultry due to poor absorption from feed. In young, growing chicks, manganese deficiency can cause perosis, thin-shelled eggs and poor hatchability and may also lead to chondrodystrophy. (See also Calcium and Phosphorus imbalances, Vitamin D deficiency.)

Clinical Symptoms

Perosis, a malformation of the hock joint, is common in young chicks, with bending and lateral rotation of the tibia and tarsometatarsus near the joint. Shortened and thickened long bones in the legs

and wings may also be observed. In adult chickens, eggshells become thinner and more prone to breakage, with reduced egg production, smaller egg size and lower hatchability rates.

Diagnosis

Diagnosis is based on clinical symptoms, physical examination and nutritional analysis of feed.

Treatment and Prevention

- Provide a diet with 20 mg/kg of manganese for laying hens and 60 mg/kg for broilers.
- Ensure the diet includes all essential nutrients, particularly manganese, choline, niacin, biotin and folic acid.

NOTE: Avoid excessive levels of calcium and phosphorus, as they can decrease manganese absorption from feed.

4.7 Riboflavin Deficiency

If poultry feed ingredients are not carefully selected or if a specific supplement is missing, a riboflavin (vitamin B2) deficiency may occur.

Clinical Symptoms

In young chicks, as early as one week old, symptoms include curling of the toes, difficulty walking and occasionally diarrhea. Other signs are decreased egg production, increased embryonic mortality and an enlarged liver with higher fat content. Hatchability rates drop within two weeks.

Treatment and Prevention

Administering vitamin B preparations can lead to rapid recovery, with a dose of 100 mcg typically sufficient for riboflavin-deficient chicks, followed by the inclusion of adequate riboflavin in the diet. It is essential to ensure adequate vitamin B levels in starter and grower diets as well as in the diets of parent breeders.

4.8 Vitamin D Deficiency

Vitamin D is essential for the proper absorption and metabolism of calcium and phosphorus. Deficiency can lead to rickets in young chickens and osteoporosis and poor eggshell quality in laying hens. Rickets and osteoporosis are commonly seen in poultry due to a lack of vitamin D. Birds raised in strict confinement require higher dietary vitamin D levels than those with access to sunlight. Additionally, mycotoxins in feed or litter may interfere with vitamin D absorption, along with the absorption of fat and other fat-soluble vitamins.

Clinical Symptoms

- **Young chickens:** Frequent resting in a squatting position, reluctance to walk and a stiff gait. Other signs include stunted growth, enlarged hock joints, beading at the ends of the ribs, softened beaks and ruffled feathers.

- **Laying chickens:** Thinning eggshells, with severe cases showing a prompt reduction in egg production and hatchability. The breastbone becomes less rigid and rib ends may exhibit beading.
- **Lesions:** In young birds, soft bones and enlarged parathyroid glands; in adults, bones tend to become osteoporotic rather than soft.

Treatment and Prevention

- Add dry, stabilized forms of vitamin D3 to commercial diets, providing three times the recommended level for approximately three weeks.
- Use diets containing adequate levels of calcium, phosphorus and vitamin D.
- Increase exposure to sunlight when possible.
- In cases of severe mycotoxicosis, administer a water-miscible form of vitamin D in the drinking water to provide about three times the normal dietary amount.

CAUTION: Excessive vitamin D intake can be toxic.

4.9 Vitamin E Deficiency

Vitamin E functions as an antioxidant, protecting cell membranes from oxidative damage. Deficiency in vitamin E leads to oxidative damage, manifesting as encephalomalacia, muscular dystrophy, or exudative diathesis.

Clinical Symptoms

- **Growing chicks**
 - *Encephalomalacia:* Symptoms include ataxia, paresis, loss of balance, falling on the back, head twisting and repeated muscle contractions in the legs. Postmortem findings include a softened, swollen cerebellum with oedema, haemorrhages and necrosis.
 - *Muscular dystrophy:* No apparent signs typically, though locomotor issues may occur. Postmortem lesions present as light-coloured streaks in the breast muscle.
 - *Exudative diathesis:* Subcutaneous oedema appears in the breast, abdomen and mandibular area with cyanotic legs. Postmortem findings include subcutaneous oedema in these areas.
- **Mature chickens**
 - Reduced hatchability, increased embryonic mortality, cloudy eye spots leading to blindness, haemorrhages, reduced growth and vascular system issues in the abdomen.

Diagnosis

Diagnosis is based on the recognition of clinical symptoms, particularly encephalomalacia and muscular dystrophy, along with feed analysis to assess selenium and vitamin E levels.

Treatment and Prevention

- **Encephalomalacia:** Prevention through adding synthetic antioxidants to feed; treatment often has limited success.
- **Exudative diathesis:** Adding selenium to feed prevents this condition.
- **Muscular dystrophy:** Adding cysteine (a sulphur-containing amino acid) to the feed can prevent muscular dystrophy.
- **Vitamin E Supplementation:** Recommended levels are 30 to 150 mg/kg in feed. A single oral dose of 300 IU of vitamin E per bird often cures exudative diathesis or muscular dystrophy, although birds with encephalomalacia may not respond well to treatment.

5.0 VIRAL DISEASES OF POULTRY

In Zambia, several viral diseases significantly impact poultry health and productivity. Newcastle Disease (ND), a major concern, affects commercial and village chickens, causing high mortality rates despite available vaccines. First reported in 1952, ND remains prevalent in the country. Infectious Bursal Disease (IBD) primarily affects young chickens, leading to immunosuppression and increased susceptibility to other diseases, with very virulent strains identified in Zambia, posing further challenges to poultry health. Fowl Pox, caused by the Avipoxvirus, also affects poultry, manifesting as wart-like growths on the skin and mucous membranes, resulting in decreased productivity and, in severe cases, mortality. Marek's Disease, a highly contagious viral neoplastic disease, is characterized by T cell lymphoma and infiltration of nerves and organs by lymphocytes and it remains a significant concern for poultry farmers in Zambia. Addressing these viral diseases requires comprehensive strategies, including vaccination programs, biosecurity measures and ongoing surveillance to mitigate their impact on Zambia's poultry industry.

5.1 Avian Encephalomyelitis (AE)

Avian Encephalomyelitis (AE), also known as “epidemic tremor,” is an infectious viral disease caused by the avian encephalomyelitis virus (AEV). The incubation period varies: after vertical infection, it ranges from 1–7 days, while after horizontal infection, the minimum is 11 days. In young chickens, morbidity ranges from 40–60%, with an average mortality rate of 25%, which can rise to 50%. In laying hens, AE typically causes a sudden drop in egg production, which later returns to normal.

Clinical Symptoms

- **Young chicks:** Symptoms include nervous signs, a dull eye expression, ataxia, sitting on hocks, falling on the side, head and neck tremors and paralysis.
- **Laying hens:** Sudden, temporary drop in egg production.

Diagnosis

Diagnosis is based on clinical symptoms and histopathologic lesions in the brain, spleen and heart muscle. Confirmation involves isolating and identifying the virus from the brain. Differential

diagnosis includes Newcastle disease, nutritional deficiencies (such as Vitamin E or A deficiency, riboflavin deficiency, or rickets) and Marek's disease (which usually affects older birds).

Treatment and Prevention

Treatment

There is no treatment available for AE.

Prevention

Vaccinate breeder flocks during the growing period to prevent vertical transmission. Vaccination should be administered at least four weeks before the start of lay, as the vaccine virus can be transmitted vertically, leading to infection in progeny.

5.2 Avian Influenza

Avian Influenza in chickens is caused by an orthomyxovirus, specifically type A influenza viruses.

Clinical Symptoms and Lesions

Symptoms vary from a slight reduction in egg production or fertility to severe infections involving the central nervous system (CNS), though respiratory signs are most common. Severely affected birds may also show greenish diarrhea, cyanosis and swelling of the head, comb and wattles. Shanks and feet may display discoloration due to ecchymoses and there may be blood-tinged discharges from the mouth and nose.

Diagnosis

The virus is identified through isolation in a chicken embryo.

Treatment and Prevention

Treatment

There is no specific treatment for avian influenza. Broad-spectrum antibiotics may help control secondary bacterial infections and increasing the house temperature can reduce mortality.

Prevention

Vaccination with an autogenous virus or one of the same hemagglutinin type is recommended. Note that the virus can change its antigenic characteristics and may infect humans.

5.3 Egg Drop Syndrome (EDS)

Egg Drop Syndrome (EDS) is a significant cause of egg production losses, especially severe in broiler breeders and brown egg-laying chickens. The disease is caused by the Egg Drop Syndrome Virus (EDSV), which is transmitted vertically through eggs or via the fecal-oral route. The virus typically remains latent until chickens approach peak egg production.

Clinical Symptoms

Symptoms include loss of eggshell pigmentation, production of thin-shelled, soft-shelled and shell-less eggs, reduced egg production (up to 40%), rough or chalky eggshells and mild depression. Postmortem findings include inactive ovaries, atrophy of the oviducts, edema, white exudates in the uterus and eggs in various stages within the abdominal cavity.

Diagnosis

Diagnosis is based on history and clinical symptoms. For confirmation, laboratory testing is required. In non-vaccinated flocks, seroconversion can be detected using haemagglutination-inhibition tests (using fowl red blood cells), ELISA, or serum neutralization tests. Virus DNA can also be identified by PCR. EDS should be differentiated from Newcastle Disease, Avian Influenza and Infectious Bronchitis.

Treatment and Prevention

Treatment

No effective treatment exists for EDS. Molting may be induced in laying hens to help restore egg production. To prevent disease spread, only chicks from uninfected flocks should be sourced and biosecurity measures should be implemented to prevent horizontal transmission.

Prevention

Inactivated vaccines can be administered to birds at 14–18 weeks of age to prevent clinical disease, although virus shedding may still occur, albeit at reduced levels.

5.4 Fowl Pox

Fowl pox is a slow-spreading viral infection affecting chickens and other poultry, marked by proliferative skin lesions. Transmission occurs through direct contact between infected and susceptible birds or via mosquitoes. In Zambia, fowl pox is prevalent in both commercial and backyard poultry operations.

Clinical Symptoms

Fowl pox presents in two forms:

- **Dry form (cutaneous):** Characterized by wart-like nodules on unfeathered areas such as the comb, wattles, around the beak, feet, vent and other skin areas.
- **Wet form (diphtheritic):** Exhibits yellowish lesions on the mucous membranes of the mouth, pharynx, larynx and trachea, leading to respiratory distress. Lesions on the eyelids can cause closure of one or both eyes and a reduction in egg production in laying hens.

Diagnosis

Diagnosis is based on characteristic cutaneous lesions. Haematoxylin-eosin staining reveals eosinophilic cytoplasmic inclusion bodies, while virus isolation provides confirmation.

Treatment and Prevention

- There is no specific treatment for fowl pox.
- Vaccinate the flock with an attenuated fowl pox vaccine, ideally before expected exposure. If the disease is already present and less than 20% of the birds show lesions, vaccination may still help control its spread.
 - Regular cleaning and disinfection, multi-age site avoidance, control of cannibalism and dust and mosquito control are essential.

Note: Passive immunity may interfere with vaccine virus multiplication.

5.5 Infectious Bronchitis (IBV)

Infectious Bronchitis (IBV) is an acute, highly contagious viral disease caused by coronaviruses, affecting the respiratory, urogenital and intestinal tracts of hybrid layers, meat-type and fancy chickens across all age groups. It is a significant cause of economic losses worldwide. The virus spreads via mucous secretions from the upper respiratory tract and fecal droppings, with airborne transmission being the most common in densely populated chicken areas.

Clinical Symptoms and Lesions

- **Young chicks:** Respiratory signs such as coughing, gasping, sneezing, nasal discharge, eye exudate, huddling near heat sources, reduced weight gain and lower feed efficiency.
- **Nephrogenic form:** Symptoms include depression, wet droppings, increased water intake and reduced egg production.
- **Laying hens:** May exhibit respiratory signs, up to a 70% drop in egg production, misshapen eggs, smaller egg sizes and unpigmented eggshells.
- **Postmortem lesions:** Tracheitis, airsacculitis and sinusitis are common, with lesions possibly becoming caseous. Nephropathogenic strains cause interstitial nephritis, leading to pale, enlarged kidneys. Infected young hens may show fluid yolk material in their reproductive tracts.

Diagnosis

Diagnosis is based on detecting the viral genome, antigens, or antibodies against IBV. Respiratory tract and urogenital tract lesions are often present but can be nonspecific. Respiratory lesions in field cases may be complicated by secondary bacterial infections. Differential diagnoses include Avian Metapneumovirus, mild forms of Newcastle Disease, Low Pathogenic Avian Influenza and Infectious Laryngotracheitis.

Treatment and Prevention

- No specific treatment exists. Supportive care, reducing overcrowding, enforcing strict biosecurity and preventing stress (e.g., cold stress) can lower mortality rates. Antibiotics may help reduce mortality from secondary bacterial infections. For nephropathogenic strains, a low-protein diet and electrolytes in drinking water are beneficial.
- Vaccination is widely used, targeting specific serotypes. The first dose is often administered in the hatchery, with broader protection achieved by combining different vaccine strains. Live vaccines for different respiratory pathogens can interfere with each other if applied within short intervals, so simultaneous application may be preferable.

5.6 Infectious Bursal Disease (IBD)

Infectious Bursal Disease (IBD), also known as Gumboro disease, is an acute, contagious viral disease affecting young chickens (3–6 weeks old). The virus targets the bursa of Fabricius, where it replicates and destroys B lymphocytes, leading to diarrhea, trembling, incoordination, bursal atrophy and varying degrees of immune suppression. Highly resistant, the virus can persist for months in contaminated houses and weeks in water, feed and droppings. Transmission occurs via feces and fomites, with morbidity generally high, while mortality varies based on the strain's pathogenicity and bird immunity.

Clinical Symptoms and Lesions

- **Symptoms:** Vent picking, whitish or watery diarrhoea, soiled vent feathers, anorexia, depression, ruffled feathers, trembling and pronounced protrusion.
- **Necropsy findings:** Swollen, oedematous, necrotic, haemorrhagic and atrophied bursa. Haemorrhages may appear in thigh and pectoral muscles and kidneys may be swollen.

Diagnosis

Presumptive diagnosis relies on characteristic symptoms like rapid onset, high morbidity, spiking mortality and quick recovery. Definitive diagnosis requires virus isolation from the cloacal bursa and spleen, followed by identification.

Treatment and Prevention

Treatment

- No specific treatment exists, but antibiotics can prevent secondary bacterial infections. Options include:
 - **Access:** Chlortetracycline: 3–4 kg per ton of feed, or 20–60 mg/kg for 5–7 days.
 - OR
 - **Access:** Doxycycline: 200 mg, 250–600 g per 1000 liters of drinking water for 3–5 days (equivalent to 20 mg/kg body weight).

Prevention

- **Biosecurity:** Depopulate and rigorously disinfect contaminated farms, apply strict hygiene measures, control movement of personnel and materials and use all-in/all-out protocols.
- **Vaccination:** Live vaccines derived from chick embryos or cell cultures, of varying virulence, are administered in drinking water. These are primarily for pullets and broilers to provide early protection, supplemented by maternal antibodies.
- **Maternal antibodies:** High maternal antibodies may interfere with live vaccination effectiveness. Monitoring antibody levels in breeder flocks can optimize vaccination timing to prevent immunity gaps.
- **Breeder vaccination program:** Live vaccines are used for priming during the growing period. Inactivated vaccines (classical or variant strains) boost and extend immunity, given after priming and before egg production, often with an oil-adjuvant, inactivated vaccine.
- **New methods:** In-ovo or day-one live IBD vaccination combined with anti-IBDV antibody is also available, helping achieve early protection.

5.7 Infectious Laryngotracheitis (ILT)

Infectious Laryngotracheitis (ILT) is a highly contagious, acute respiratory disease caused by a herpesvirus, primarily affecting chickens and pheasants. It is characterized by severe breathing difficulties, coughing, rattling sounds, head extension and respiratory noises (rales).

Clinical Symptoms and Lesions

- **Acute form:** Blood, mucus and yellow caseous deposits or casts within the trachea are typical findings.
- **Subacute form:** Small bleeding spots in the trachea and larynx, along with symptoms like conjunctivitis, tearing, tracheitis and mild respiratory noises. Blood-stained tracheal discharge may mark the beak and mouth, accompanied by a drop in egg production. Mortality in adult birds can reach up to 50%.

Diagnosis

Diagnosis is based on characteristic symptoms and can be confirmed by identifying intranuclear inclusion bodies in the tracheal lining early in the infection or by isolating and identifying the virus through laboratory tests or animal inoculation.

Treatment and Prevention

No specific treatment is available for ILT.

- Source new chicks from ILT-free flocks.
- Avoid mixing infected or vaccinated birds with unexposed birds.
- Follow strict biosecurity measures.
- Reduce dust levels in housing to lessen symptom severity.

- In endemic areas, vaccination with modified, low-virulence virus strains, administered via eye drops, can help control the disease.

5.8 Marek's Disease (MD)

Marek's Disease (MD) is a viral, tumor-inducing and immunosuppressive condition in chickens caused by *Gallid herpesvirus 2* (GaHV-2), a herpesvirus in the *Mardivirus* genus. The disease is characterized by lymphoid cell infiltration into nerve trunks and various organs. It primarily affects chickens from 8–9 weeks of age, with notable cases peaking at 16–20 weeks and 24–30 weeks. The virus spreads through inhalation of infected feather follicle dust or excretions.

Clinical Symptoms and Lesions

Symptoms typically emerge around 3 weeks and peak between 2 and 7 months. Affected birds show multifocal lymphoid proliferation across various tissues and tumors may form in the liver, spleen, gonads, kidneys, heart, proventriculus, skeletal muscles and skin. Peripheral nerve infiltration leads to visible enlargement, loss of normal striations and paralysis, resulting in signs such as wing paralysis, blindness, ataxia and emaciation.

Diagnosis

Since the presence of the herpesvirus doesn't always indicate disease, diagnosis should focus on clinical signs, case history, gross lesions and histopathology rather than on virus presence alone. MD must be differentiated from peripheral neuropathy of unknown origin and lymphoid leucosis.

Treatment and Prevention

- No specific treatment is available; severely affected birds should be regularly culled and sick chickens euthanized.
- Enforce rigorous biosecurity.
- Utilize genetically resistant chicks.
- Avoid factors causing immunosuppression.
- Apply an appropriate vaccine and maintain biosecurity to prevent outbreaks.
- Commonly used vaccines include:
 - Rispens or CVI988 (serotype 1 MDV),
 - SB1 (serotype 2), and
 - HVT (serotype 3 MDV).

These are often combined to provide comprehensive protection.

5.9 Newcastle Disease (ND)

Newcastle Disease (ND), also known as pseudo-plague, is a highly infectious viral disease in poultry caused by a Paramyxovirus. It exhibits a wide range of morbidity, mortality, symptoms and lesions, leading to significant economic impact. First reported in Ethiopia in 1974 among exotic chickens, ND is now widespread globally.

Clinical Symptoms and Lesions

The virus (PMV-1) is categorized into five pathotypes:

- **Velogenic viscerotropic strains:** Lead to high mortality (up to 100%) and severe intestinal damage.
- **Velogenic neurotropic strains:** Result in high mortality (up to 100%) and serious respiratory and nervous system symptoms.
- **Mesogenic strains:** Cause respiratory and nervous symptoms, with lower mortality in adults but high mortality in young birds (up to 50%).
- **Lentogenic strains:** Show respiratory symptoms only, without mortality in young or adult birds.
- **Lentogenic asymptomatic strains:** Produce no visible symptoms.

Symptoms vary by strain

- **Neurotropic:** Drooping wings, leg dragging, twisting of the head and neck, circling, depression, inappetence and paralysis.
- **Viscerotropic:** Respiratory signs, including gasping, coughing and sneezing in severe cases and watery-green diarrhoea with swelling of head and neck tissues. ND progresses quickly, with young chickens being particularly susceptible. Laying flocks may experience a temporary or permanent drop in egg production.

Diagnosis

A tentative diagnosis is based on clinical symptoms, lesions and epidemic patterns, but virus isolation and identification are needed for confirmation. A rise in hemagglutination-inhibition antibodies in paired serum samples is confirmatory. Differential diagnosis includes acute fowl cholera, avian influenza, infectious laryngotracheitis and fowl pox.

Treatment and Prevention

There is no specific treatment for ND, though antibiotics may address bacterial complications.

- Control insect and rodent populations, ensure good litter quality and follow strict sanitation and disinfection protocols.
- **Vaccination:** Effective protection involves at least one live vaccine if there are no maternal antibodies, followed by an inactivated or vector vaccine. Live vaccines can be applied via eye drops or beak dipping. Inactivated vaccines follow priming with a live virus; vector vaccines are also an option.
 - Vaccination aims to reduce infection rates and environmental virus shedding.
 - Controlling mycoplasma and other bacteria is important, as these can exacerbate vaccine reactions.

6.0 BACTERIAL DISEASES OF POULTRY

In Zambia, several bacterial diseases significantly impact poultry health and productivity. Colibacillosis, caused by *Escherichia coli*, is prevalent in broiler chickens and leads to conditions such as septicemia, pericarditis and airsacculitis. Infectious Coryza, caused by *Avibacterium paragallinarum*, results in inflammation below the eye, nasal discharge and sneezing, reducing egg production in laying hens. Airsacculitis, often caused by *E. coli* and *Mycoplasma gallisepticum*, can lead to respiratory distress, decreased growth rates and increased mortality. Additionally, Salmonellosis, caused by *Salmonella* species, is a growing concern, particularly with the emergence of antimicrobial-resistant strains, such as extended-spectrum beta-lactamase (ESBL)-producing *Salmonella* strains, posing challenges for treatment and public health. Effective management of these bacterial diseases in Zambia requires strategies such as prudent antimicrobial use, strict biosecurity measures, health monitoring and adherence to treatment guidelines to minimize their impact on the poultry sector.

6.1 Avian Campylobacteriosis

Avian Campylobacteriosis, caused by *Campylobacter jejuni* or *Campylobacter coli*, originates primarily from environmental contamination and is a food-borne infection that can affect humans through consumption of contaminated poultry products.

Clinical Symptoms and Lesions

Symptoms in birds range widely, from asymptomatic cases to severe diarrhea or even death in rare cases. The variation in symptoms depends on the bacterial strain, the infective dose and the age of the bird at the time of infection. Observed lesions may include intestinal distension, watery intestinal contents, and, in infections with cytotoxic strains, hemorrhages.

Diagnosis

Diagnosis is achieved through bacterial culture.

Treatment and Prevention

- Treatment for *Campylobacter* infection in poultry is uncommon.
- Prevention relies on strict biosecurity practices, including thorough cleaning and disinfecting of housing between flocks, rodent and wild bird control and insect management.

NOTE: Campylobacteriosis is zoonotic and can be transmitted to humans via ingestion of undercooked or raw contaminated poultry meat. Antimicrobial susceptibility of the bacteria is important for informing treatment options.

6.2 Colibacillosis

Colibacillosis is a bacterial infection in poultry caused by *Escherichia coli* (*E. coli*). While it can lead to both localized and systemic infections, systemic cases generally arise when environmental or infectious conditions are unfavorable. Outbreaks are more common in chickens raised under poor

sanitary conditions, with infection spreading through ingestion or transovarian routes. Although all age groups are susceptible, young birds are typically more severely affected.

Clinical Symptoms and Lesions

Symptoms of colibacillosis include acute fatal septicemia or subacute forms such as pericarditis, sinusitis, omphalitis, airsacculitis and sudden death. Young birds surviving septicemia may develop subacute fibrinopurulent airsacculitis, pericarditis, perihepatitis and lymphoid depletion in the bursa and thymus. Postmortem findings often show peritonitis, pericarditis and perihepatitis.

Diagnosis

Diagnosis relies on identifying predisposing factors, observing characteristic signs of visceral serositis and epicarditis and isolating a pure *E. coli* culture from the heart blood, liver, or spleen.

Treatment and Prevention

Treatment Options

- **First line treatment**

Access:

- **Sulfamethazine-trimethoprim:** 1 ml per 5 liters of drinking water daily for 5 days.
OR
- **Tetracycline:** 13.3 g per 120 liters of drinking water (60 mg/kg in feed daily for 3–5 days). Individual birds may be treated with 1 ml of a 5% SC solution.
OR
- **Chlorotetracycline:** 100–125 mg/kg body weight, or 100 g per 75–100 liters of drinking water for 4–5 days.
OR
- **Amoxicillin trihydrate:** 200 g per 600 ml of drinking water (for 2000 birds; 20 mg/kg, once daily for 3–5 days).
OR
- **Doxycycline:** 200 mg, 250–600 g per 1000 liters of drinking water for 3–5 days (20 mg/kg per day).

Prevention

- Ensure strict management practices to minimize contamination, such as sourcing from disease-free breeder flocks, maintaining clean water and quality feed, ensuring good ventilation, avoiding wet litter, controlling vermin and implementing biosecurity.
- **Vaccination:** Autogenous vaccines and inactivated vaccines specific to certain serogroups (e.g., O2 and O78) along with live or recombinant vaccines are effective against specific strains.

NOTE: It is advisable to perform sensitivity testing to select the most effective antibiotic. However, treatment outcomes may vary and the focus should be on preventive measures. Early treatment is recommended for better outcomes.

6.3 Chlamydiosis

Chlamydiosis is a disease in wild and domestic birds that can be subclinical, acute, subacute, or chronic, affecting the respiratory, systemic, or digestive systems. It is caused by the intracellular bacterium *Chlamydia psittaci*, which is shed in secretions or droppings and primarily spreads through inhalation.

Clinical Symptoms and Lesions

Common symptoms include nasal and eye discharge, conjunctivitis, sinusitis, green to yellow-green droppings, lethargy, ruffled feathers, weakness, decreased appetite and weight loss. Acute cases often show airsacculitis, pericarditis, perihepatitis, peritonitis with serofibrinous exudates and hepatosplenomegaly. Chronic cases may present with an enlarged spleen, a discolored liver, or both.

Diagnosis

Diagnosis is based on impression smears from affected tissues, stained using Giemsa, Gimenez, or Macchiavello's methods to reveal intracellular organisms.

Treatment and Prevention

Treatment options

- **First line treatment**

Access:

- **Doxycycline:** 20 mg/kg in drinking water daily for 3–5 days.
OR
- **Chlortetracycline:** 20–30 mg/kg or 400–750 g per ton of feed for at least 2 weeks.

NOTE: Extended treatment of 2–6 weeks is often necessary. Recovered birds may remain carriers, with respiratory discharges and faeces being infectious. Airborne dust and particles can also carry the bacterium.

Zoonotic Risk: *Chlamydia psittaci* can transmit to humans, potentially causing eye lesions and other symptoms.

6.4 Fowl Cholera

Fowl cholera, also known as Avian Pasteurellosis or avian hemorrhagic septicemia, is a contagious bacterial disease in poultry caused by *Pasteurella multocida*. It typically presents with rapid onset, high morbidity and mortality, often involving septicemia. Transmission occurs through contact with secretions from carrier birds, infected droppings, ingestion of contaminated carcasses and through

contaminated water, feed, equipment, or clothing. The bacterium is primarily excreted from the mouth, nose and conjunctiva of infected birds, contaminating their environment.

Clinical Symptoms and Lesions

- **Acute form:** Symptoms include sudden death, fever, depression, loss of appetite, mucoid discharge from the mouth, ruffled feathers, diarrhoea, bluish discoloration of the head and increased respiratory rate.
- **Chronic form:** Signs may include swelling of the joints, footpads, wattles, or tendon sheaths near the hock joint, along with conjunctivitis, respiratory sounds (rales) and torticollis (neck twisting). Postmortem findings often show localized infections in the oviduct or peritoneal cavity.

Diagnosis

Diagnosis is based on history, clinical signs and lesions, with confirmation by isolating *P. multocida* through bacterial culture. Differential diagnosis includes HPAI, NCD, colibacillosis, fowl typhoid and fowl pox.

Treatment and Prevention

Treatment options:

- **First line treatment**

Access:

- **Sulfonamides:** Such as Sulphadimethoxazole, Sulphaquinoxalene and Sulphamethazine at 0.5–1% in feed or 0.1% in drinking water.
OR
- **Chlortetracycline:** 20–60 mg/kg in feed daily for 5–7 days or until symptoms are resolved.
OR
- **Doxycycline:** 200 mg, 250–600 g per 1000 liters of drinking water for 3–5 days (20 mg per kg body weight daily).
OR
- **Oxytetracycline:** 200 mg, 80 mg per kg body weight daily for 3–5 days, or 40 g per 100–150 liters of drinking water for 3–5 days.
OR
- **Amoxicillin:** 150 mg, 16 mg/kg body weight or 100 g per 100 liters of drinking water for 3–5 days.

Prevention

- Vaccinate pullets in areas with high disease prevalence, using serotype-specific vaccines.
- Implement strict sanitation, rodent and predator control and proper disposal of dead birds to prevent disease spread.

NOTE: Early intervention with adequate dosages is essential and sensitivity testing may assist in selecting the most effective antibiotic.

6.5 Fowl Typhoid

Fowl typhoid is a septicemic disease, either acute or chronic, caused by *Salmonella gallinarum*, a salmonella strain adapted to poultry. It is transmitted through eggs, affecting especially growing or mature birds, or through ingestion. Morbidity and mortality rates vary greatly depending on factors like age, nutrition, flock management, concurrent diseases and the dose and route of exposure. In chicks, mortality can range from 10% to as high as 93%.

Clinical Symptoms and Lesions

- **Young chicks:** Symptoms include severe depression, laboured breathing, reduced appetite, slimy droppings, white urates on the cloaca and high mortality (up to 93%). Vertical transmission may also lead to decreased hatchability.
- **Mature birds:** Signs in older birds include irregularly shaped cystic or nodular ova, reduced feed intake, decreased egg production and hatchability, lethargy, acute septicaemia and potential death.
- **Lesions** may include an enlarged liver, spleen and kidneys; white nodules on the liver, spleen, cardiac muscle, pancreas, lungs and caecal wall; salpingitis, peritonitis, caecal cores (cheesy material in the cecum) and swollen joints containing yellow, thick fluid.

Diagnosis

Confirmed through isolation and identification of *S. gallinarum*. Fowl typhoid should be differentiated from other infections, including *P. multocida*, *E. coli*, Newcastle Disease and Highly Pathogenic Avian Influenza.

Treatment and Prevention

Treatment options

Treatment is not recommended in Zambia. Cull the affected flock.

Prevention

- Source poults from fowl typhoid-free stock and place them in clean housing.
- Practice strict culling of infected breeder flocks, maintain rigorous biosecurity, ensure thorough sanitation of poultry facilities and vaccinate with the rough *S. gallinarum* (9R) strain at 6–7 weeks of age.

NOTE: Antibiotics may be ineffective as recovered birds can become carriers. Eradication remains the most effective control method.

6.6 Fowl Paratyphoid

Fowl Paratyphoid infections are caused by various non-host-adapted *Salmonella* serotypes, primarily *Salmonella typhimurium*, followed by *S. enteritidis* and *S. arizonae*.

Clinical Symptoms and Lesion

- Infections are often subclinical, with increased mortality rates due to stressors like transport, delayed feeding, chilling, or overheating. Common signs include depression, poor growth, weakness, diarrhoea and dehydration, though symptoms are generally nonspecific.
- Post-mortem lesions include an enlarged liver with necrosis, enlarged spleen, unabsorbed yolk sac and necrotic lesions in the intestinal mucosa, along with caeca filled with cheese-like exudate.

Diagnosis

Diagnosis relies on isolating and identifying the causative agent. Differentiation from diseases such as Pullorum disease, Newcastle Disease and staphylococcosis is necessary.

Treatment and Prevention

Treatment is not recommended in Zambia. Cull the affected flock.

Public Health Significance

Paratyphoid *Salmonella* species are often zoonotic. Measures such as logistic slaughtering and heat treatment can reduce human exposure to *Salmonella* from poultry products. Sourcing chicks and eggs from salmonella-free breeding stocks is strongly advised.

6.7 Infectious Coryza (IC)

Infectious Coryza (IC) is an acute respiratory infection in chickens caused by *Avibacterium paragallinarum* (*A. paragallinarum*). Birds with chronic infections or carriers act as reservoirs for the bacteria. It spreads through direct contact, airborne droplets and contaminated water sources. The incubation period is typically 1–3 days, with the infection lasting 2–3 weeks, exhibiting high morbidity but low mortality.

Clinical Symptoms and Lesions

Symptoms include nasal discharge (serous to mucoid, occasionally purulent), sneezing, facial swelling, conjunctivitis, head and wattle abscesses, difficulty breathing, sinusitis, tracheitis, airsacculitis, hepatitis, endocarditis, salpingitis, oophoritis, peritonitis and synovitis. In layers, egg production may decrease significantly (10–40%) and chronic cases may have a foul odor.

Diagnosis

Diagnosis relies on the disease history, clinical signs and bacterial identification. IC must be differentiated from other respiratory diseases like chronic fowl cholera, Newcastle Disease, Infectious Bronchitis, Avian Influenza, mycoplasmosis and infectious laryngotracheitis.

Treatment and Prevention

Treatment options

- **First line treatment**

Access:

- **Sulfamethazine-trimethoprim:** 1000 mg/l in drinking water or 2000 g per ton of feed for 3 days.
OR
- **Doxycycline hyclate:** 200 mg, 250–600 g per 1000 liters of drinking water for 3–5 days (20 mg per kg body weight).
OR
- **Oxytetracycline (20%):** 200 g per 100 liters of drinking water for 3–5 days.
OR
- **Amoxicillin:** 16 mg/kg body weight or 100 g per 100 liters of drinking water for 3–5 days.

Prevention:

- After cleaning and disinfecting, keep poultry houses empty for 2–3 weeks before introducing new stock.
- Avoid farms with birds of different ages to minimize disease spread.
- In endemic regions, vaccination of pullets with serotypes A, B and C can help control the disease.

NOTE: Antibiotic treatment reduces disease severity but does not completely eliminate the bacteria. Sulfonamides should be avoided in layers.

6.8 Gangrenous Dermatitis (GD)

Gangrenous Dermatitis (GD) is a sporadic skin infection in poultry characterized by necrosis of the skin and subcutaneous tissue, commonly affecting broilers aged 4–6 weeks and pullets aged 6–20 weeks. It is caused by *Staphylococcus aureus* and sometimes *Clostridium septicum*. The disease is often triggered by immune suppression related to infectious bursal disease, poor environmental conditions (like high litter moisture), inadequate removal of dead birds and skin injuries from overcrowding or aggressive feeding times.

Clinical Symptoms and Lesions

The disease has a sudden onset, presenting with depression, lethargy and a rapid increase in mortality within 8–24 hours. Other signs include gangrenous necrosis on the skin over the wings, abdomen, thighs and breast. Necropsy findings often reveal cellulitis of subcutaneous tissue, hemorrhagic edema beneath the skin, subcutaneous emphysema and an underlying musculature that appears “cooked.”

Diagnosis

Tentative diagnosis is based on a history of rapid onset and high mortality with low morbidity, along with characteristic skin lesions. A definitive diagnosis is made by isolating and identifying *C. septicum* or *S. aureus* (or both).

Treatment and Prevention

Treatment options

- **First line treatment**

Access:

- **Amoxicillin:** 16 mg/kg body weight or 100 g per 100 liters of drinking water for 3–5 days.
OR
- **Doxycycline:** 200 mg, 250–600 g per 1000 liters of drinking water for 3–5 days (20 mg per kg body weight).
OR
- **Tetracyclines and erythromycin:** As per guidelines for *Mycoplasma synoviae* infection.

- **Second line treatment**

Watch:

- **Tilmicosin:** 300 ml per 1000 liters of drinking water for 3–5 days (20 mg/kg body weight).

Prevention:

- Maintain optimal litter conditions, avoid overcrowding, practice strict sanitation and disinfection, minimize skin injuries, control cannibalism and remove dead birds regularly.
- Vaccinate breeder flocks against Infectious Bursal Disease.
- Early intervention with oxytetracycline at 0.02% in feed can significantly reduce mortality in field outbreaks of clostridial infections.

6.9 Mycoplasma Synoviae Infection (Infectious Synovitis)

Infectious Synovitis is an acute or chronic respiratory and joint infection in chickens and turkeys, caused by *Mycoplasma synoviae*. It primarily affects young broiler chickens but can also occur in

adults. The infection is most commonly transmitted transovarially, but it can also spread through aerosols, direct bird-to-bird contact and ingestion of contaminated feed or water.

Clinical Symptoms and Lesions

Affected birds may rest on the ground with swollen heads, hocks, or footpads. At necropsy, joints are found to contain sticky, viscous, gray to yellow exudates. Parenchymatous organs like the liver and spleen may become swollen and additional symptoms may include airsacculitis and diarrhea.

Diagnosis

Diagnosis is based on clinical signs and lesions, with agglutination reactions and ELISA commonly used. Confirmation of *M. synoviae* can be made by isolating and identifying the organism in embryonated eggs or by hemagglutination-inhibition testing.

Differential diagnoses include diseases caused by *Avibacterium paragallinarum*, *M. gallisepticum*, Newcastle Disease, Low Pathogenic Avian Influenza, Avian metapneumovirus, Infectious Laryngotracheitis, Infectious Bronchitis, *E. coli*, *S. aureus*, *Enterococcus faecalis* and Reovirus.

Treatment and Prevention

Treatment options:

- **First line treatment**

Access:

- **Chlortetracycline:** 20–60 mg/kg or 300–400 mg per ton of feed for 5 days.

- **Second line treatment**

Watch:

- **Tylosin:** 100 g per 200 liters of drinking water for the first 3 days of life, repeated every 5 weeks for 1–7 days depending on infection severity.
OR
- **Erythromycin:** 500 mg per gallon of water for 7 days.
OR
- **Tilmicosin:** 15–20 mg/kg body weight in chickens and 10–27 mg/kg in turkeys for 3 days, typically achieved with 75 mg per liter of drinking water.

Prevention:

- Use sero-negative breeding stock to reduce egg transmission.
- Apply antimicrobials to infected flocks to alleviate symptoms and reduce shedding and vertical transmission. However, effects may be short-term.
- Culling infected reproduction stock is not economically viable in high-prevalence situations, where antibiotic treatment and vaccination programs may reduce disease impact.
- Effective biosecurity practices are crucial to reduce horizontal transmission.

NOTE: Injectable treatments are most effective for reducing disease severity.

6.10 Necrotic Enteritis

Necrotic Enteritis is an acute intestinal infection in poultry, characterized by sudden onset, high mortality and extensive necrosis of the small intestine's mucosal lining. It is primarily caused by *Clostridium perfringens* Type A and, less commonly, Type C. The disease is most common in broiler chickens aged 2–5 weeks but can also affect pullets and laying hens, especially in facilities with built-up litter. Key predisposing factors include pathogenic *C. perfringens*, coccidiosis, nutritional shifts and stress.

Clinical Symptoms and Lesions

Birds may exhibit severe depression, loss of appetite, ruffled feathers, dark diarrhea, and, in laying hens, decreased egg production and a sudden spike in mortality. Necropsy findings often show dehydrated, darkened breast muscle, a swollen and congested liver, ballooned intestines filled with foul-smelling brown fluid and necrotic mucosa covered with a pseudomembrane. Subclinical cases may result in poor performance and reduced weight gain.

Diagnosis

Diagnosis is based on post-mortem examination and is confirmed by isolating and identifying the bacterium. Indicative results can be obtained from stained smear preparations and further confirmation is achieved through anaerobic culture.

Differential Diagnosis

Coccidiosis and Ulcerative Enteritis.

Treatment and Prevention

Treatment options:

- **First line treatment**

Access:

- **Amoxicillin:** 16 mg/kg body weight or 100 g per 100 liters of drinking water for 3–5 days.
OR
- **Doxycycline:** 200 mg, 250–600 g per 1000 liters of drinking water for 3–5 days (20 mg/kg body weight).

Prevention:

- Use coccidiostats or anticoccidial vaccines.
- Optimize feed composition to avoid sudden changes and reduce fishmeal, wheat, barley and rye in the diet.
- Minimize stress factors, enforce strict hygiene and practice regular disinfection.

- Use probiotics to help lower the incidence and severity of necrotic enteritis.

NOTE: Due to the rapid progression of Necrotic Enteritis, effective control relies on managing predisposing factors, as timely antibiotic treatment can be challenging.

6.11 Pullorum Disease

Pullorum Disease (PD), or Bacillary White Diarrhea, is a bacterial infection caused by *Salmonella pullorum*, primarily affecting young chickens with high mortality rates and substantial economic impact. Transmission occurs vertically through eggs or horizontally in hatcheries, leading to high mortality, particularly in the first few days to 2–3 weeks of life. Mortality often peaks during the second week in vertically infected flocks.

Clinical Symptoms and Lesions

- **In young birds:** Symptoms include reduced hatchability (in cases of vertical transmission), severe depression, weakness, decreased appetite, slimy droppings, blindness, laboured breathing and white, chalky urates around the vent. Birds that recover remain carriers.
- **Lesions in young birds:** Common findings are unabsorbed yolk sacs, focal necrosis in the liver and spleen, cheesy material in the ceca and plaques in the lower intestinal lining.
- **In adult carriers:** Lesions may include pericarditis, peritonitis, or deformed ovarian follicles with coagulated cystic ova, sometimes accompanied by salpingitis and peritonitis. In some cases, no visible lesions are present.

Diagnosis

Diagnosis is based on flock history, symptoms, mortality rates and lesions, but confirmation requires isolating and identifying *S. pullorum*. Screening tests such as tube-agglutination or serum-plate testing are useful.

Differential Diagnoses

Conditions similar to PD include colibacillosis, pasteurellosis, erysipelas, paratyphoid infections, Highly Pathogenic Avian Influenza (HPAI) and Newcastle Disease.

Treatment and Prevention

Treatment options

Treatment is not recommended in Zambia. Cull the affected flock.

Prevention

- Source breeding stock from PD-free flocks.
- Obtain chicks from Pullorum-free farms.
- Remove carrier birds and implement a strong biosecurity program.

6.12 Salmonellosis

In chickens and turkeys, salmonellosis is caused by host-specific *Salmonella* serotypes like *Salmonella pullorum* and *S. gallinarum*, leading to Pullorum Disease and Fowl Typhoid, respectively. Non-host-specific serotypes, including *S. typhimurium* and *S. arizonae*, result in paratyphoid infections and have significant zoonotic potential.

Treatment and Prevention

Treatment is not recommended in Zambia. Cull the affected flock.

6.13 Avian Spirochetosis

Avian Spirochetosis is an acute, febrile septicaemia in poultry, transmitted by *Argas persicus* ticks, affecting various bird species.

Clinical Symptoms and Lesions

Signs include lethargy, depression, drowsiness, shivering and increased thirst, with young birds often more affected. Early stages show greenish-yellow diarrhoea high in urates.

Diagnosis

Identification involves dark-field microscopy to detect *Borrelia* in blood and Giemsa-stained smears, with frequent anaemia.

Treatment and Prevention

Treatment

- **First line treatment**

Access:

- **Chlortetracycline:** 20–30 mg/kg in feed for 5–7 days.
OR
- **Amoxicillin:** 100 g per 10 liters in water for 3–5 days.

Prevention

Control tick populations to limit spread.

6.14 Staphylococcosis

Staphylococcosis is an infection in poultry caused by *Staphylococcus aureus*, commonly resulting in synovitis and septicemia. *S. aureus* is typically part of the normal skin flora but can cause infection when there is an injury, either accidental or from procedures like debeaking or detoeing.

Clinical Symptoms and Lesions

Signs of infection include omphalitis, synovitis and lameness, often due to osteomyelitis in the proximal tibiotarsus, femur, proximal tarsometatarsus, distal femur and tibiotarsus. Additional symptoms may include gangrenous dermatitis, bumblefoot and septicemia.

Diagnosis

Confirmed through isolation of *Staphylococcus aureus*.

Treatment and Prevention

Treatment options:

- **First line treatment**

Access:

- **Sulphadimethoxine:** 1892 mg per gallon of water or 0.05% solution for 6 days.
OR
- **Amoxicillin:** 16 mg/kg body weight or 100 g per 100 liters of drinking water for 3–5 days.
OR
- **Doxycycline:** 200 mg, 250–600 g per 1000 liters of drinking water for 3–5 days (20 mg per kg body weight).
OR
- **Oxytetracycline:** 500 mg, 80 mg per kg body weight daily for 3–5 days, or 40 g per 100–150 liters of drinking water for 3–5 days.

- **Second line treatment**

Watch:

- **Tilmicosin:** 300 ml per 1000 liters of drinking water for 3–5 days (20 mg/kg body weight).

Prevention:

- Prevent immunosuppressive diseases.
- Avoid sharp objects in poultry housing and during transportation.
- Ensure proper sanitation in hatcheries.
- Use competitive exclusion with *Lactobacillus acidophilus* to protect chickens with minimal natural gut flora.

NOTE: Due to common antibiotic resistance in *S. aureus*, sensitivity testing is recommended. Take food safety precautions, as enterotoxin-producing strains of *S. aureus* in poultry can cause food poisoning.

6.15 Streptococcosis

Streptococcosis is a systemic or localized infection in poultry caused by streptococci, which act as opportunistic pathogens. *Streptococcus zooepidemicus* and *S. faecalis* are among the most pathogenic in birds, though other streptococcal species can also cause serious illness. The infection spreads through oral or aerosol transmission.

Clinical Symptoms and Lesions

- **Acute form:** Birds may exhibit signs such as depression, lethargy, pale combs and wattles and a decrease or stop in egg production. Necropsy findings may include an enlarged spleen, liver and kidneys.
- **Chronic form:** Symptoms include lameness, swollen hock and wing joints, conjunctivitis, depression and weight loss. Common lesions include fibrinous arthritis, synovitis, salpingitis, pericarditis, perihepatitis, necrotic myocarditis and valvular (vegetative) endocarditis.

Diagnosis

Confirmed through isolation and identification of the bacteria.

Treatment and Prevention

Treatment options:

- **First line treatment**

Access:

- **Sulphadimethoxine:** 1892 mg per gallon of water or 0.05% solution for 6 days.
OR
- **Amoxicillin:** 16 mg/kg body weight or 100 g per 100 liters of drinking water for 3–5 days.
OR
- **Doxycycline:** 200 mg, 250–600 g per 1000 liters of drinking water for 3–5 days (20 mg per kg body weight).
OR
- **Oxytetracycline:** 500 mg, 80 mg per kg body weight daily for 3–5 days, or 40 g per 100–150 liters of drinking water for 3–5 days.

- **Second line treatment**

Watch:

- **Tilmicosin:** 300 ml per 1000 liters of drinking water for 3–5 days (20 mg/kg body weight).

Prevention:

- Minimize stress and prevent conditions or diseases that may suppress immunity.
- Implement effective cleaning and disinfection practices.

- Ensure proper housing and management of the flock.
- Sanitize eggs to prevent contamination of eggshells.

NOTE: Sensitivity testing is recommended before antibiotic treatment, as antibiotic resistance is common with streptococcal infections.

6.16 Tuberculosis

Tuberculosis in poultry is a chronic, slow-spreading bacterial infection caused by *Mycobacterium avium* serovars 1 and 2, characterized by gradual weight loss. It primarily affects birds over one year of age, with infected birds spreading the organism through their feces. Cadavers and offal can transmit the infection to other birds or predators.

Clinical Symptoms and Lesions

Symptoms typically appear in later stages of infection, including depression, progressive weight loss, breast muscle wasting, diarrhea, reduced egg production in laying hens and sometimes lameness. In young chicks, yellow to grey granulomatous nodules of various sizes are often found in the liver, spleen, bone marrow and intestines.

Treatment and Prevention

Treatment

There is no effective treatment.

Prevention:

- There is no vaccine available.
- Infected flocks should be culled and poultry housing should be deeply cleaned and disinfected.
- Dispose of contaminated equipment and remove several centimeters of soil from poultry houses to limit reinfection.
- Enforce strict biosecurity measures, including control of rodents and wild birds.

NOTE: *Mycobacterium avium* can be zoonotic and may pose a risk of infection to humans.

6.17 Ulcerative Enteritis

Ulcerative Enteritis is an acute bacterial infection in young chickens, poultry and game birds, characterized by sudden onset and rapid mortality increase. It is caused by *Clostridium colinum* and often occurs after coccidiosis, aplastic anemia, infectious bursal disease, or under stressful conditions. Transmission occurs through contaminated droppings, with infection spreading via feed or drinking water.

Clinical Symptoms and Lesions

Infected birds appear listless, with closed eyes, dull and ruffled feathers and a hunched posture. Lesions include hemorrhagic enteritis in the duodenum, followed by necrosis and ulcerations. The liver may display light yellow coloring or large, irregular yellow areas along the edges.

Diagnosis

Diagnosis is based on postmortem lesions and the isolation of large Gram-positive, sporulated bacteria.

Treatment and Prevention

Treatment options

- **First time treatment**

Access:

- **Penicillin:** 13.5 – 20 mg per kg body weight daily for 5 days
OR
- **Streptomycin sulphate** at 0.006% in feed or 0.26g/litre of water for 5 days

Prevention

- Remove contaminated droppings and disinfect the poultry house.
- Minimize stress factors.

NOTE: Early treatment is recommended for better outcomes.

7.0 FUNGAL DISEASES OF POULTRY

In Zambia, fungal diseases such as Aspergillosis, Favus and Mycotoxicosis pose significant challenges to poultry health. Aspergillosis, caused by *Aspergillus fumigatus*, affects the respiratory system of young birds and is often linked to poor environmental conditions, including wet litter and moldy feed. Fungus, caused by *Achorion gallinae* or *Trichophyton gallinae*, leads to scaly lesions on the birds and can spread rapidly in unsanitary environments. Mycotoxicosis, resulting from mold-contaminated feed, suppresses immunity and lowers productivity. Effective management includes strict biosecurity measures, proper ventilation, hygiene and optimal feed storage.

7.1 Aspergillosis

Aspergillosis is a fungal infection in birds caused by *Aspergillus fumigatus*, commonly found in litter and feed. Infection primarily occurs through inhaling fungal spores.

Clinical Symptoms

- Acute Aspergillosis occurs in young birds and leads to outbreaks with high morbidity and mortality. Symptoms include respiratory distress and decreased feed intake.

- Chronic Aspergillosis affects mature birds, causing reduced feed intake and economic losses. Symptoms often include difficulty breathing, gasping, increased respiratory rate, cyanosis and typically no rales. Mortality rates can vary from 5% to 50% within the first three weeks of life. Other signs include diarrhoea, anorexia, lethargy, progressive weight loss and increased thirst, with occasional nervous symptoms. Lesions appear as cream-colored plaques in the lungs and may also be found in the larynx, air sacs, liver, intestines, brain, or around the eye.

Diagnosis

Diagnosis is based on clinical signs and visible lesions, with confirmation through fungal culture or microscopic examination.

Treatment and Prevention

Treatment

- Typically, treatment is ineffective once birds are infected.

Prevention

- Adhere to strict sanitation in hatcheries and fumigate contaminated areas with formaldehyde or thiabendazole (120–360 g/m³).
- Avoid using mouldy litter or contaminated feed; spray contaminated feed with nystatin.

NOTE: Aspergillosis can be zoonotic and spreads via inhalation or ingestion. Protective equipment, such as gas masks and protective clothing, should be used, especially since formaldehyde is restricted in some countries and minimizing human exposure is essential.

7.2 Mycotoxicoses

Mycotoxicoses are diseases caused by toxic fungal byproducts that develop in grains and feeds. Hundreds of mycotoxins exist, many of which interact with other toxins, pathogens, or nutritional deficiencies, amplifying their effects. Many mycotoxins remain chemically stable and toxic over time. Key types include:

7.2.1 Aflatoxicosis

Aflatoxins, produced by *Aspergillus flavus*, *A. parasiticus* and related fungi, are highly toxic and carcinogenic. In poultry, aflatoxicosis primarily impacts the liver but can also affect immune, digestive and blood-forming systems. It reduces weight gain, feed efficiency, egg production, fertility and hatchability. Ducklings, turkeys and pheasants are most susceptible, while chickens, quail and guinea fowl are more resistant.

Symptoms range from general poor condition to high morbidity and mortality. The liver may show redness from necrosis or turn yellow due to fat buildup. Chronic exposure may cause the liver to appear yellow-gray and shrunken.

7.2.2 Ergotism

Claviceps fungi infect grains, particularly rye, producing alkaloids that cause neurological issues, gangrene in extremities and hormonal effects on the pituitary gland. In poultry, this results in vesicles on the comb, wattles and face, which rupture and may cause permanent disfigurement. In laying hens, reduced feed intake and egg production are common.

7.2.3 Fusariotoxiosis

Fusarium species produce toxins that harm poultry. Symptoms include feed refusal, mouth and skin irritation, digestive issues and suppressed immune and bone marrow function. Lesions include mouth necrosis, red gastrointestinal mucosa, mottled liver and spleen atrophy. In hens, egg production decreases and birds may show cyanosis and bone deformities.

7.2.4 Ochratoxiosis

Produced by *Penicillium viridicatum* and *Aspergillus ochraceous*, ochratoxins are highly toxic to the kidneys, liver, immune system and bone marrow. Symptoms include inactivity, hypothermia, diarrhea, weight loss and death. Sublethal doses impair weight gain, feed conversion and reproductive outcomes.

7.2.5 Citrinin Mycotoxicosis

Citrinin, produced by *Penicillium* and *Aspergillus* species, is found in corn, rice and other grains. It causes increased urination, leading to watery droppings and reduced weight gain, with kidney lesions visible upon necropsy.

7.2.6 Oosporein Mycotoxicosis

Oosporein, from *Chaetomium* species, can cause gout and high mortality in poultry. Symptoms include gout due to kidney impairment, elevated uric acid, increased water intake and watery droppings.

7.2.7 Cyclopiazonic Acid

Produced by *Aspergillus flavus*, cyclopiazonic acid affects feed conversion, weight gain and mortality. Lesions appear in the proventriculus, gizzard, liver and spleen, with a dilated proventriculus and thickened mucosa from hyperplasia and ulceration.

7.2.8 Sterigmatocystin

A precursor to aflatoxin, sterigmatocystin is less common but similarly hepatotoxic and carcinogenic.

Diagnosis of Mycotoxicoses

Suspected mycotoxicosis cases require a thorough diagnostic evaluation, including necropsy, histopathology and toxin analysis in feed samples.

Treatment and Prevention

Treatment

No specific treatment exists for mycotoxicoses.

Prevention

- Replace contaminated feed with clean feed. For aflatoxicosis, adding vitamins, crude protein and dietary energy may reduce toxicity. Vitamins E and C may counteract T2 toxins and ochratoxins.
- Treat concurrent diseases to reduce combined effects.
- Provide activated charcoal in feed for individual birds.
- Regularly inspect and manage feed storage, keeping it short-term and protected from moisture.
- Clean feed mills frequently to remove leftover feed.
- Ensure good ventilation in poultry housing to reduce humidity.
- Use mycotoxin binders in feed.
- Add antifungal agents, like propionic acid (0.5–1.5 g/kg), to inhibit fungal growth.

8.0 PARASITIC DISEASES OF POULTRY

Parasitic diseases such as Coccidiosis, Ascariasis and *Raillietina echinobothrida* affect poultry health. Coccidiosis, caused by *Eimeria*, damages the intestinal lining, leading to diarrhea and weight loss. Ascariasis, caused by *Ascaridia galli*, results in weight loss and reduced egg production, particularly in young chickens. *Raillietina echinobothrida*, a tapeworm, causes stunted growth and emaciation. Effective management involves strict biosecurity, sanitation, regular deworming and optimal environmental conditions to reduce parasitic infections.

8.1 Coccidiosis

Avian coccidiosis is a protozoal infection caused by *Eimeria* species, commonly affecting young growing birds, characterized by diarrhea and enteritis. Each *Eimeria* species affects different parts of the intestine and cross-protection does not occur among species. Coccidial oocysts are present in litter and transmitted through ingestion of feed, water, or soil. Infection severity depends on the *Eimeria* species, number of oocysts ingested and the bird's age and immune status.

Clinical Symptoms and Lesions

Symptoms include decreased growth rate, severe diarrhea, reduced feed and water intake, weight loss, decreased egg production and increased mortality. Lesions in the intestine vary with the *Eimeria* species:

- *E. acervulina* targets the upper small intestine
- *E. bruneti* affects the lower intestine

- *E. maxima* and *E. necatrix* affect the middle intestine
- *E. tenella* localizes in the cecum

Diagnosis

Diagnosis is based on clinical symptoms and the detection of oocysts in feces or intestinal scrapings.

Treatment and Prevention

Treatment options

- **Monensin:** 20 mg/kg, as a feed premix.
OR
- **Sulfachlorpyrazine sodium monohydrate:** 300 mg/kg (0.03%) or 100 g per 100 liters in drinking water for 3 days.
OR
- **Amprolium HCl:** 125 mg/kg (0.0125%) in feed or 38.4 mg/ml in drinking water for 1–2 weeks.
OR
- **Trimethoprim-Sulphaquinoxaline sodium (1:5):** 30 mg/kg in drinking water for 5 days or until two days after symptoms resolve.
OR
- **Amprolium HCl + Sulphaquinoxaline base + Vitamin K3:** 100 g per 150 liters of drinking water for 5–7 days.
OR
- **Sulphadimidine Sodium:** 100 mg/kg body weight, administered for 3 consecutive days, followed by 2 days off and another 3-day treatment.
OR
- **Diclazuril:** 0.3 mg/kg body weight daily for 3 days.
OR
- **Toltrazuril:** 7 mg/kg body weight or 100 ml per 100 liters of drinking water for 48 hours, or 300 ml per 100 liters of water for 8 hours each day over 2 days.
OR
- **Clopidol:** 125 mg/kg (0.0125%) in feed for continuous feeding.

Supportive Therapy

Coccidiosis often causes diarrhoea leading to dehydration and electrolyte imbalances supportive therapy include providing fluids and electrolyte.

Prevention

Preventive options

- **Amprolium HCl (25%) + Ethopabate (1.6%):** 500 g per ton of feed from day-old to 16–18 weeks.
OR
- **Lasalocid sodium:** 75–125 mg/kg in feed continuously from day-old to adulthood.
OR
- **Clopidol:** 125 mg/kg (0.0125%) in feed for continuous feeding. It should not be used in laying birds and if used in broilers, the withdrawal period should be 5-7 days

CAUTION: All anticoccidial drugs shall be dispensed as prescription only medicine (POM-V).

NOTE: The primary intervention for coccidiosis is immunity buildup through natural infection or vaccination, with early treatment recommended if symptoms arise. Additional prevention includes vaccination and strict hygiene. Rotate anticoccidial drugs periodically to prevent resistance, as drug efficacy varies. Avoid skin and eye contact with Clopidol and rinse immediately if contact occurs.

8.2 Histomoniasis (Blackhead Disease)

Histomoniasis, or Blackhead Disease, is a protozoal infection in chickens and occasionally other galliform birds, caused by *Histomonas meleagridis*. The disease is typically transmitted via the eggs of the cecal nematode *Heterakis gallinarum*, though direct transmission through contaminated feces also occurs. The eggs of *Heterakis gallinarum* are highly resistant to environmental conditions and can remain infective for 2–3 years.

Clinical Symptoms and Lesions

Symptoms include listlessness, drooping wings, sulfur-colored droppings and cyanosis of the head. The disease is more severe in young birds, which may die within days, while older birds may experience progressive emaciation before death. The condition should be differentiated from infections caused by *Eimeria tenella*, *Salmonella*, *Tetratrichomonas gallinarum* and other pathogens that produce similar lesions.

Diagnosis

Diagnosis is based on distinctive ulcerations in the ceca and necrotic lesions in the liver. For more accurate diagnosis, molecular methods such as PCR are recommended.

Treatment and Prevention

Treatment

- **Dimetridazole:** 0.06–0.08% in feed for 7 days. For prophylaxis, use at 0.015–0.02% in feed for 5 days.

Prevention:

- Implement strict biosecurity to prevent birds from accessing cecal worm eggs.
- Control *H. gallinarum* infection with deworming measures.
- House turkeys and chickens separately and avoid using infected soil for at least a year.
- No effective vaccines are available.

NOTE: Flocks showing clinical signs should be treated immediately, with bedding replaced at the onset of treatment. Treatment should continue after symptoms have subsided. Antihistomonal drugs are banned from the market, so alternative management practices are essential.

8.3 Gastrointestinal Parasitism

Poultry can be infected by nematode and cestode parasites, including economically significant species like *Heterakis gallinarum*, *Syngamus trachea*, ascarids, capillarids and cestodes such as *Raillietina* and *Davainea proglottina*. *Syngamus trachea*, specifically, infects the trachea and lungs of various domestic and wild birds.

Clinical Symptoms

Symptoms include reduced appetite, slower growth, diarrhea, anemia, gasping and coughing (especially in *Syngamus* infections), poor condition and anorexia.

Diagnosis

Diagnosis is based on clinical symptoms, post-mortem examination and identifying the parasite or its eggs.

Differential Diagnosis

Conditions like necrotic enteritis, streptococcosis, enterococcosis, avian tuberculosis, rotavirus infection, coccidiosis, histomoniasis, or mycotoxicosis may show similar symptoms.

Treatment and Prevention

Treatment options

- **Piperazine:** 582–970 mg/kg body weight in drinking water, or 195–390 g per 100 liters of drinking water; deworm chickens at 4–6 weeks of age.
OR
- **Phenothiazine:** 0.5 g per bird as individual treatment or in feed, administered monthly to control ascarids. Alternatively, phenothiazine (0.5 g/head) combined with piperazine (0.5–0.51% with 0.11% in drinking water) as a 1-day treatment can eliminate heterakids and ascarids.
OR

- **Coumaphos:** 0.004% in feed for 10–14 days for replacement birds, or 0.003% in feed for 14 days for layers, effective against capillaries.

OR

- **Ivermectin:** 10 mg, 0.25–0.32 mg per kg body weight. Do not use in breeding or egg-producing birds for human consumption.

Prevention:

- Implement strict sanitation and disinfect bedding, feeders and drinkers.
- Control secondary hosts such as beetles, roaches, grasshoppers and earthworms.
- Maintain a regular deworming schedule and avoid multi-age farming practices.

9.0 ECTOPARASITES OF POULTRY

9.1 Fowl Ticks

The *Argas persicus* tick, most active in poultry houses during warm, dry conditions, hides in cracks and crevices during the day. These ticks cause anemia in birds and can transmit diseases like spirochetosis and aegyptianellosis.

Clinical Symptoms

Birds may show symptoms of anemia, weight loss, depression, toxemia, paralysis and reduced egg production. Red spots appear where ticks have fed and birds often seem restless, especially at night due to the nocturnal activity of the ticks.

Treatment and Prevention

- **Coumaphos (20% EC):** Apply a 250 ppm spray to walls, ceilings and cracks.
- **Permethrin (10% EC):** Use a 0.1% solution for surfaces; apply a 0.05% solution directly to birds to control mites only.
- **Carbaryl (Sevin) 80% WP:** Spray a 0.5% solution on birds, at a rate of 1 gallon per 75 adult hens. Repeat every 4 weeks if necessary.

Applying acaricides with a high-pressure sprayer is recommended after thoroughly cleaning the poultry house.

9.2 Lice

Lice infestations, common in poultry kept under poor hygiene and during colder seasons, reduce egg production and cause skin irritation, which can lead to secondary infections.

Diagnosis

Infestation can be identified by observing lice or their eggs on the skin or feathers.

Treatment and Prevention

- Apply acaricides as for tick control.
- Inspect birds regularly for lice or egg clusters around the vent and feather bases.
- Avoid contact with other infested birds and thoroughly clean premises and replace litter, focusing on nests and transport cages.

9.3 Chicken Mite (Red Mite)

Dermanyssus gallinae infests chickens, turkeys and other birds, hiding during the day and feeding at night. They cause economic losses due to reduced production and the need for treatment.

Clinical Symptoms and Lesions

Infested birds may display nervousness, pecking, stress, anemia, bloodstains on eggs, and, in severe cases, death.

Treatment and Prevention

Treatment

- **Dichlorovos (23 EC):** Dilute 5 oz/gallon, applying 1 gallon/100 birds or 1–2 gallons per 1000 sq. ft.
- **Tetrachlorvinfos (50 WP):** Apply similarly to Dichlorovos.

Prevention

Due to their ability to hide and survive without feeding, mites are difficult to control. Biosecurity measures, thorough cleaning and disinfection with effective acaricides and biological controls during downtime are essential. Mites may also cause dermatitis in humans.

9.4 Common Chigger

Trombicula alfreddugesi (also known as harvest mites) infest birds, humans and other mammals.

Clinical Symptoms and Lesions

Parasitized birds become lethargic, may stop eating and can die from starvation. Larvae often appear on the ventral side of the bird.

Treatment and Prevention

- Use miticide sprays as used for chicken mites.
- On range, keep grass short and dust with sulfur or Malathion to control chiggers.

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