

**MAKERERE**



**UNIVERSITY**

**PREVALENCE OF COCCIDIOSIS AND KNOWLEDGE, PRACTICE AND  
EFFECTIVENESS OF ANTICOCIDIAL DRUG REGIMENS USED IN LAYER  
POULTRY FARMS IN KAKIRI SUB-COUNTY**

**BY**

**BALEMWA TONNY**

**ATHESIS SUBMITTED TO THE COLLEGE OF VETERINARY MEDICINE, ANIMAL  
RESOURCES AND BIOSECURITY FOR THE PARTIAL FULFILLMENT OF THE  
REQUIREMENT FOR THE AWARD OF BACHELOR OF VETERINARY MEDICINE  
FROM MAKERERE UNIVERSITY**

**2023- 2024**

## DECLARATION

I **BALEMWA TONNY** hereby declare the successful completion of my special project under the guidance of Dr. Katerega John. This project has never been submitted to any institution before. I affirm that this work is original and conducted with utmost diligence and dedication. I am grateful for the guidance and support provided by **Dr. Katerega John**. This declaration signifies the completion and authenticity of my special project work.

Signature...  ..... Date... 23<sup>rd</sup>/10/2023 .....

## APPROVAL

This concept note has been submitted for examination with the approval of my supervisor

**DR. KATEREGA JOHN. (BVM, MSc)**

Lecturer, Department of Pharmacy clinical and comparative medicine (PCM)

College of Veterinary Medicine, Animal Resources, and Biosecurity (COVAB)

Makerere University

Signature...  ..... Date: ... 23/10/2023 .....

## **DEDICATION**

I dedicate this research project report to my dear parents, Mr. and Mrs. Sebulege John, as well as to my brothers Kimbugwe Richard, Baleke Denis, Wampamba Francis, and Bigemule Fred. Additionally, I extend my dedication to my beloved sister, Nabweyambo Florence, who has continuously supported me throughout my academic journey.

## **ACKNOWLEDGEMENT**

I extend my sincere appreciation to my parents, Mr. and Mrs. Sebulege, for their unwavering love and support. Their belief in me and constant encouragement have been instrumental in my success.

I am truly thankful to the Serubogo family, Mr. and Mrs. Serubogo Michael, for their unending guidance and encouragement, and to Mr. Ziwa Francis for his generous financial support that eased my financial burdens. Their kindness has been a great blessing.

I owe a lot to my lecturer, Dr. Katerega, whose expertise and continuous support shaped my project. My friends, including Nanjosi Gloria, Maggie, Kabenge Jimmy, and my entire BVM 2018 cohort, have been a source of strength and shared joy throughout.

To all those who have played a role in my academic journey, known or unknown, your support and kind gestures have been a driving force. I thank each of you for your contributions.

To those I've mentioned and those I haven't, your unwavering support, prayers, and contributions have made this achievement possible. I am forever grateful.

## LIST OF ABBREVIATIONS, ACRONYMS AND SYMBOLS

|                       |  |
|-----------------------|--|
| <b>COVAB</b>          | College of veterinary medicine, animal resources and biosecurity |
| <b>BVM</b>            | Bachelor of veterinary medicine                                  |
| <b>Na<sup>+</sup></b> | Sodium ion   |
| <b>K<sup>+</sup></b>  | Potassium ion  |
| <b>H<sup>+</sup></b>  | Hydrogen ion   |
| <b>Ca<sup>+</sup></b> | Calcium ion  |
| <b>B1</b>             | Thiamine   |
| <b>NaCl</b>           | Sodium chloride  |
| <b>EPG</b>            | Eggs per gram  |
| <b>CL</b>             | Confidence interval  |
| <b>EEC</b>            | European economic community                                      |
| <b>DNC</b>            | Dinitrocarbailide  |
| <b>HDP</b>            | Dimethyl pyrimidine  |
| <b>ATP</b>            | Adenosine triphosphate   |
| <b>E.</b>             | Eimeria  |
| <b>PABA</b>           | Para-amino benzoic acid  |
| <b>DNA</b>            | Deoxyribonucleic acid  |
| <b>CDL</b>            | Central diagnostic laboratory                                    |

## TABLE OF CONTENTS

|   |      |
|---|------|
| DEDICATION .....  | i    |
| ACKNOWLEDGEMENT .....   | iii  |
| LIST OF FIGURES .....   | vii  |
| LIST OF TABLES .....  | viii |
| ABSTRACT.....   | ix   |
| CHAPTER ONE .....   | 1    |
| 1.0 INTRODUCTION .....  | 1    |
| 1.1 Problem statement.....  | 2    |
| 1.2 General objective .....   | 3    |
| 1.3 Specific objective.....   | 3    |
| 1.4 Research questions.....   | 3    |
| 1.5 Significance.....   | 3    |
| 1.6 Justification:.....   | 4    |
| CHAPTER TWO .....   | 5    |
| LITERATURE REVIEW .....   | 5    |
| 2.0 INTRODUCTION .....  | 5    |
| 2.1 Ionophores.....   | 8    |
| 2.2 Thiamine antagonist.....  | 10   |
| 2.3 Antifolates.....  | 12   |
| 2.4 Other anticoccidial drugs .....                                       | 14   |
| 2.5 Effectiveness of Anticoccidial Drugs: .....                           | 17   |
| 2.6 Farmers' Knowledge and Practices Regarding Anticoccidial Drugs: ..... | 19   |
| CHAPTER THREE .....   | 20   |
| 3.0 METHODOLOGY AND MATERIALS .....                                       | 20   |
| 3.1 Study design.....   | 20   |
| 3.2 Study area.....   | 20   |
| 3.3 Sample size .....   | 22   |
| 3.4 Data and sample collection .....                                      | 22   |
| 3.4.1 Data collection .....   | 22   |
| 3.4.2 Sample collection.....  | 22   |
| 3.5 Laboratory procedure.....   | 23   |
| 3.5.1 Flootation method .....   | 23   |
| 3.5.2 McMaster technique.....   | 23   |
| 3.6 Data and statistical analysis .....                                   | 24   |

|  |    |
|--|----|
| 3.6.1 Ethical consideration.....                 | 24 |
| CHAPTER FOUR.....                                | 25 |
| 4.0 RESULTS .....                                | 25 |
| 4.1 Households and farm characteristics.....     | 25 |
| 4.2 Prevalence of coccidiosis .....              | 26 |
| 4.3 Knowledge of farmers about coccidiosis ..... | 27 |
| 4.4 Practices of poultry farmers .....           | 28 |
| CHAPTER FIVE .....                               | 30 |
| DISCUSSION .....                                 | 30 |
| CHAPTER SIX.....                                 | 32 |
| CONCLUSION AND RECOMMENDATIONS.....              | 32 |
| 6.1 CONCLUSION.....                              | 32 |
| 6.2 RECOMMENDATIONS .....                        | 32 |
| REFERENCES. ....                                 | 33 |
| APPENDICES .....                                 | 36 |
| 1.0 Appendix Questionnaire .....                 | 36 |
| 2.0 pictorial evidence .....                     | 43 |
| 3.0 Program schedule.....                        | 46 |
| 4.0 showing proposed budget.....                 | 47 |
| 5.0 consent for my survey .....                  | 48 |

## **LIST OF FIGURES**

|   |           |
|---|-----------|
| <b>Figure 2 showing life cycle of Eimeria parasite.....</b>                         | <b>6</b>  |
| <b>Figure 3 Map showing location of subcounty in wakiso district in Uganda.....</b> | <b>21</b> |
| <b>Figure 4. prevalence of coccidiosis .....</b>                                    | <b>26</b> |

## **LIST OF TABLES**

|  |           |
|--|-----------|
| <b>Table 1 Characteristics of farms and respondents .....</b>          | <b>25</b> |
| <b>Table 2 Factors associated with prevalence of coccidiosis .....</b> | <b>26</b> |
| <b>Table 3 Knowledge about coccidiosis.....</b>                        | <b>28</b> |
| <b>Table 4 Practices in relation to coccidiosis .....</b>              | <b>28</b> |

## ABSTRACT

Coccidiosis, caused by protozoan parasites of the genus *Eimeria*, poses a significant threat to poultry worldwide, with seven known species infecting chickens. Despite being a long-known disease, it remains the most economically important parasitic condition in poultry production globally, causing severe symptoms like diarrhea, decreased growth, and high mortality rates. Birds contract the infection by ingesting oocytes from contaminated feeds, leading to the destruction of thousands of gastrointestinal cells. Preventing and controlling coccidiosis involve the use of anticoccidial drugs, combined with hygienic measures and improved farm management. However, coccidia's resistance to some drugs and challenges in assessing drug efficacy have emerged. As the broiler industry rapidly develops, the availability of effective anticoccidial drugs becomes crucial. Addressing drug effectiveness and interpreting the efficacy of anticoccidial programs are ongoing challenges in poultry management and disease control. This research aimed at determining the prevalence of coccidiosis, assessing the farmers' knowledge and practice regarding anticoccidial drugs, and establishing the effectiveness of these drugs in controlling the disease

A cross-sectional study was conducted in Kakiri Sub-County in 2023 aimed to address the significant impact of coccidiosis on poultry productivity. The research focused on 46 randomly selected poultry farms to determine the prevalence of coccidiosis using fecal flotation and McMaster techniques. Simultaneously, the study assessed farmers' knowledge and practices concerning the use of anticoccidial drugs, aiming to establish the effectiveness of these treatments on farmer's opinion in controlling the disease and the commonly used anticoccidial drug was identified. The questionnaire-based data collection involved well-structured interviews with farm owners and stakeholders, covering crucial factors such as chicken age, flock size, anticoccidial use, farmer's knowledge and practice on use of anticoccidials.

The prevalence of coccidiosis was found at 71.74% of the surveyed farms where 29 samples tested positive for the disease. Majority of the farmers reported use of toltrazuril (34.8%) in the management of the coccidiosis. Other drugs used include sulphadimidine (32.6%), amprolium (26.1%) and sodium salinomycin (6.5%). The farmers reported overall anticoccidial effectiveness of 78.3% from the used drugs indicating suboptimal efficacy of the drugs used in controlling

coccidiosis. Toltrazuril was reported as most effective by the farmers at 93.8% effectiveness rate. Amprolium and sulphadimidine indicated 83.3% and 66.7% effectiveness respectively while feed additive sodium salinomycin was least effective at only 33.3%. Although the farmers had knowledge about coccidiosis and anticoccidial, practices regarding the prevention and treatment of coccidiosis were found to be inadequate. Only 32.6% of the farmers practiced proper dosage, 10.9% practiced proper withdraw periods and 43.6% followed proper drug mixing procedures.

Due to a high coccidiosis prevalence, the study highlights the need for scheduled vaccination of birds at farm levels and awareness on biosecurity practices. This will have a significant impact on the health and productivity of poultry farms. The study highlights appropriate use of recommended anticoccidial drugs in poultry farms to archive maximum effectiveness of the drug regimens. Training programs and educational campaigns should be developed to equip farmers with the necessary knowledge and skills to effectively control coccidiosis. Additionally, further research is warranted to evaluate the effectiveness of anticoccidial drugs at laboratory level.

# CHAPTER ONE

## 1.0 INTRODUCTION

Coccidiosis is a disease that is caused by protozoan parasites of the genus *Eimeria*, it resides within the intestine of most animals and birds. There are seven species of *Eimeria* which including (*E. brunette*, *E. tenella*, *E. mitis*, *E. maxima*, *E. necatrix*, *E. acervulina*, and *E. praecox*) which are recognized as infecting chickens.

Although coccidiosis is a disease known for many years, it is still considered the most economically important parasitic condition affecting poultry production in the whole world (De Gussem, 2017). Many chickens have reportedly died of coccidiosis in different areas all over the country.

The birds have presented with decreased growth rates to a high percentage of visibly sick birds, severe diarrhea, and high mortality. Some also had decreased water and feed consumption, weight loss, the development of culls, and decreased egg production, which was eventually accompanied by deaths (The Independent News Reporter, 2019.).

Coccidian oocytes reside in fecal-contaminated environments. Birds acquire the infection when they accidentally swallow the oocytes from the contaminated feeds. Once in the intestine and the stomach the eggs develop and eventually infect the cells of the chicken's gastrointestinal tract. Once inside the bird's gastrointestinal cells, the coccidian transforms into a new sexual stage and reproduces, eventually lysing the gastrointestinal cell.

In this manner, the ingestion of a single oocyte can eventually be responsible for the infection and destruction of thousands of intestinal cells. As more and more of the intestinal cells are infected and subsequently destroyed, clinical signs including diarrhea and decreased growth become more and more apparent. As oocytes shed in the environment via feces, they eventually sporulate in the soil. They can remain viable for several months in the environment. Once ingested by another chicken the life cycle re-starts(Mayall, 2018).

In the past, it has been realized that eradication of coccidia is not realistic and hygienic measures alone are not able to prevent infections. However, if an outbreak of coccidiosis occurs, treatment via drinking water should start as soon as possible. The most commonly used drugs are sulphonamides, amprolium, and toltrazuril all in drinking water. Today the prevention and control of coccidiosis are based on chemotherapy using anticoccidial drugs, along with hygienic measures and improved farm management (Hafez, 2018).

Research has been done including; coccidiosis in chicken, Evaluation of a Pilot Flock Health and Productivity Monitoring program on the Performance of Smallholders, and many others. Due to the rapid development of the broiler industry, it has required the urgent availability of anticoccidial. This soon resulted to intensive activities by many pharmaceutical companies to manufacture a wide range of products that were effective in control of coccidiosis. However these products also prevented birds from gaining a natural immunity and they were not effective enough to kill all exposed coccidia due to the fact that the coccidia became resistant to some of these products(Hafez, 2018). Another problem tough to address with currently available gear, is the interpretation of the efficacy of an anticoccidial program(De Gussem, 2017). Therefore this research will aim at interpreting the effectiveness of anticoccidial program by highlighting the prevalence of coccidiosis, commonly used anticoccidial drug ad knowledge and practice on coccidiosis management among layer farms in kakiri subcounty.

## **1.1 Problem statement**

The poultry sector in Uganda has faced challenges in achieving its full potential of providing sufficient protein to support human life, mainly due to the prevalence of coccidiosis in birds across different regions. Coccidiosis leads to high morbidity, increased mortality, and reduced growth rates in birds, resulting in significant economic losses for farmers. In response to the disease, farmers resort to the use of various anticoccidial drugs to combat coccidiosis and protect their flocks. However, despite the continuous use of these drugs, cases of coccidiosis re-occurrence persist, indicating potential resistance to the drugs. This resistance is linked to farmers' limited knowledge of anticoccidial use and poor practices, which further exacerbate the economic losses incurred in purchasing drugs to treat the persistent coccidiosis in the flock.

To address this issue and improve coccidiosis management practices in Kakiri Sub County, this research aims to evaluate the treatment regimens for coccidiosis by examining farmers' knowledge of the disease and their usage of anticoccidial drugs. By gaining insights into farmers' practices and understanding, this study seeks to identify areas where educational interventions and support can be implemented to enhance the efficacy of anticoccidial treatment and reduce the economic impact of coccidiosis in poultry farming.

## **1.2 General objective**

To determine the prevalence of coccidiosis among poultry and assess the farmers knowledge, attitude and practices on effectiveness of drug treatment regimens in the management of coccidiosis in kakiri subcounty.

## **1.3 Specific objective**

- i. To determine the prevalence of coccidiosis among poultry in farms of kakiri subcounty
- ii. To determine the commonly used anticoccidial drug by poultry farmers in kakiri subcounty and their effectiveness based o farmer’s opinion.
- iii. To assess the knowledge and practices of farmers towards the use of anticoccidial drugs in poultry units of Kakiri subcounty.

## **1.4 Research questions**

1. What is the prevalence of coccidiosis among poultry in farms of kakiri subcounty?
2. What are the commonly used anticoccidials drug by poultry farmers in kakiri subcounty and their effectiveness?
3. What are the perceptions and practices towards the use of anticoccidial drugs by farmers in Kakiri subcounty?

## **1.5 Significance**

The research aims to contribute to the existing limited knowledge about the impact of coccidiosis on chicken production and performance. By shedding light on this aspect, the study seeks to aid in the development of extension strategies that can guide farmers, government authorities, and other

stakeholders in effectively managing coccidia infections in the poultry industry. The findings of this research will provide valuable insights into farmers' knowledge and perception of anticoccidial drug use in the specific study area. Understanding farmers' perspectives on the use of these drugs can help identify potential challenges and opportunities for improving coccidiosis management practices.

### **1.6 Justification:**

Coccidiosis is known to have significant negative effects on chicken production and performance, leading to economic losses for farmers. By addressing the knowledge gap in this area, the research aims to offer practical solutions and recommendations that can enhance the overall health and productivity of poultry. The study's focus on farmers' understanding and views regarding anticoccidial drug use is essential as it directly impacts disease management practices. Identifying gaps in knowledge or misconceptions can aid in the development of targeted educational interventions to improve poultry health and welfare. Moreover, considering farmers' perspectives will ensure that any recommended strategies align with their practices and are feasible in the context of the study area.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

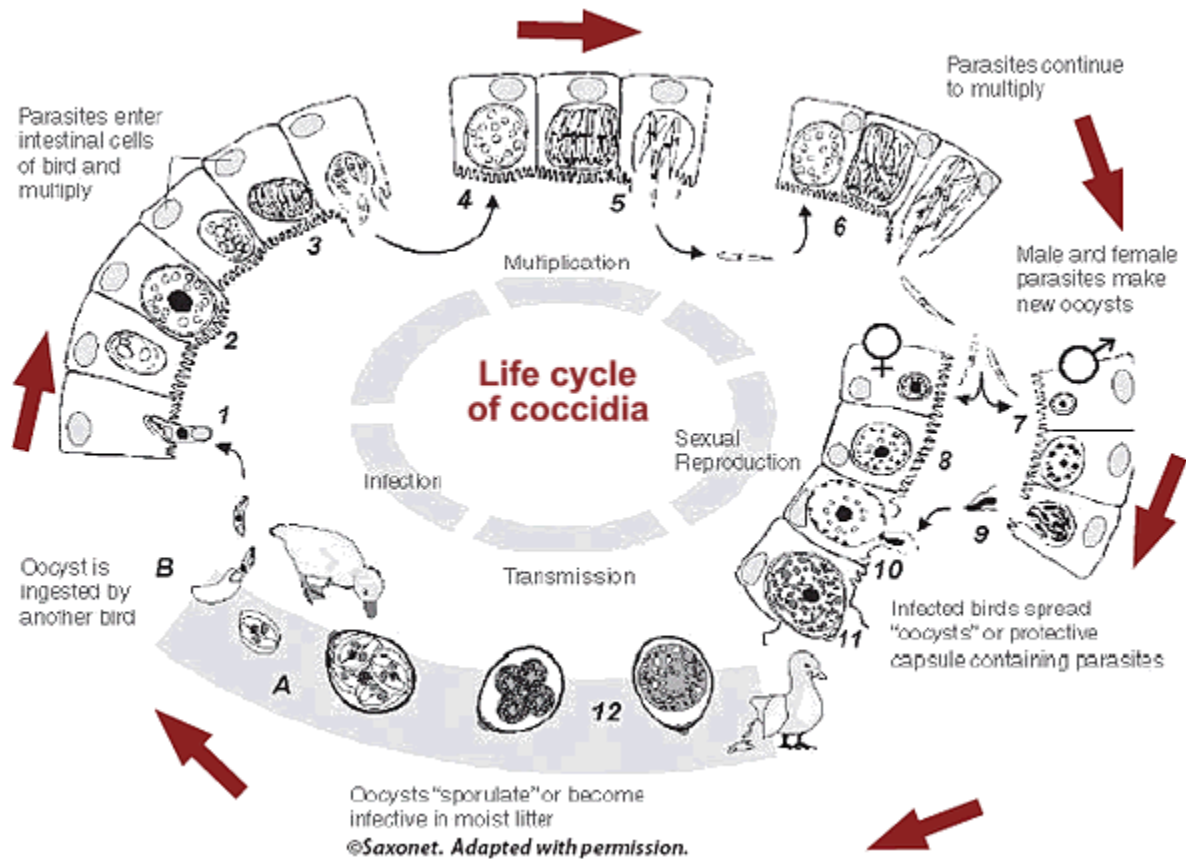
#### **2.0 INTRODUCTION**

Coccidiosis is a common and widespread disease of poultry caused by the protozoan parasites of the genus *Eimeria*. It is responsible for significant economic losses to the poultry industry worldwide. Anticoccidial drugs are widely used in the poultry industry to control and prevent coccidiosis. However, improper use of these drugs can lead to the development of drug-resistant strains of *Eimeria* and the contamination of poultry products with drug residues. This literature review aims to evaluate the effectiveness of anticoccidial drug regimens in poultry farms in Kakiri town council and the knowledge and practices of farmers regarding their use.

The demand for producing wholesome food is rising as a result of the growing human population. Governmental and public demand to guarantee that livestock farming adopts production strategies that minimize or completely eliminate environmental consequences has increased with rising production. When compared to other animal protein sources like pork and beef, chickens have the least negative environmental effects(Snyder, 2021)

Coccidiosis is a parasitic disease caused by *Eimeria* protozoa, which is a significant challenge to the poultry industry worldwide, leading to significant economic losses. Anticoccidial drugs are widely used for the prevention and control of coccidiosis in chickens. The aim of this literature review is to provide an overview of the different classes of anticoccidial drugs used in chickens, their mode of action, efficacy, and resistance (Peek HW, 2011).

The destruction of a host's enterocytes, which has a direct impact on chicken growth, mortality, and feed efficiency, causes coccidiosis to manifest as a diarrheal disease. According to estimates, *Eimeria* species cost the worldwide broiler industry US\$ 3 billion yearly in lost value as a result of production losses and the expenses related to preventive measures taken to lessen their effects. Nevertheless, the measurements used to calculate this value were from over 25 years ago. In 2016 worldwide coccidiosis burden was estimated to be £10.4 billion using updated parameters, which took into account rising chicken output and the market for antibiotic-free production, and the use of the coccidiosis vaccine. (Blake, 2022)



| < Anterior  | Inicio | Siguiete > |
|---|--------|------------|
| ATTRA - National Sustainable Agriculture Information Service is managed by the National Center for Appropriate Technology (NCAT) and is funded under a grant from the United States Department of Agriculture's Rural Business-Cooperative Service. Visit the NCAT Web site for more information on our sustainable agriculture projects. |        |            |
| Copyright © NCAT 1997-2007. All Rights Reserved.  |        |            |

**Figure 1 showing life cycle of Eimeria parasite**

Anticoccidial drugs are used to control and prevent coccidiosis in poultry. They are classified into two main groups: chemical and ionophore anticoccidials. Chemical anticoccidials include synthetic drugs such as sulphonamides, amprolium, and quinolones. Ionophore anticoccidials include naturally occurring compounds such as monensin, salinomycin, and narasin. These drugs are administered either as a feed additive or as a water medication.

Anticoccidial drugs used in chickens can be categorized into two groups, including ionophore and chemical drugs. Chemical drugs are synthetic compounds such as amprolium, triazines, and

sulphonamides. In contrast, ionophore drugs are natural compounds like monensin, salinomycin, and narasin. (Abbas RZ, 2019).

Anticoccidial drugs act by disrupting the lifecycle of Eimeria parasites responsible for causing coccidiosis in chickens. Chemical drugs work by inhibiting the parasite's growth and multiplication, while ionophore drugs alter the ion transport system, thereby disrupting the parasite's metabolic processes. (Peek, 2011)

The efficacy of anticoccidial drugs in chickens can be influenced by various factors, such as the species of Eimeria involved, the dose and duration of the treatment, and farm management practices. Chemical drugs have a broader spectrum of activity against all species of Eimeria. However, the efficacy of chemical drugs can be impacted by the development of drug resistance. On the other hand, ionophore drugs are less prone to drug resistance but can be affected by the presence of other ionophores in the feed or water by (Danforth HD, 1988), and (Witter RL, 1988)

The emergence of resistance to anticoccidial drugs by Eimeria parasites poses a significant challenge to the control of coccidiosis in chickens. Resistance to anticoccidial drugs can arise from the selection of resistant parasite strains due to the overuse or misuse of these drugs. To minimize the development of resistance, it is crucial to rotate anticoccidial drugs regularly, use them appropriately, and implement integrated control strategies such as vaccination and farm management practices

### **Anti-coccidial drugs**

Anticoccidial drugs are utilized to prevent and manage coccidian infections, with some drugs classified as coccidiocidal, destroying coccidial populations, and others as coccidiastatic, inhibiting coccidial replication and growth. Administering anticoccidial prophylactically, rather than therapeutically, is crucial for effective use. During the sexual cycle, which lasts around 5-6 days, some anticoccidial have heightened activity and may lead to anorexia and hemorrhage. Therefore, initiating treatment during this period can be more beneficial. Anticoccidial are generally incorporated into starter rations for broiler birds raised in floor pens.(Kant et al., 2013)

Most anticoccidial drugs exhibit their highest effectiveness against the first and second asexual cycles, while some agents can also inhibit the sexual stages of the parasite life cycle. Only a few drugs interfere with the metabolic pathways of the coccidia, leading to the blocking of specific stages of the parasite's development (Looker, 1986). The selection of an appropriate anticoccidial drug is based on its capacity to improve weight gain and feed conversion, as well as to suppress lesion development. The presence of drug residues in eggs and milk is also a concern related to the use of anticoccidials, so the establishment of specific withdrawal periods before slaughter is necessary. The emergence of drug-resistant strains of coccidia is a major problem, and strategies such as rotating different classes of drugs and implementing shuttle programs are employed to prevent the development of resistance. Various therapeutic regimens have been developed to enhance treatment efficiency and minimize the risk of resistance, such as the use of sub-therapeutic doses of anticoccidial drugs to promote immunity and the application of compound anticoccidial preparations (Kant et al., 2013)

The emergence of resistant strains of coccidia in the field occurs at varying speeds, as described by Kant (2013). According to Kant, the rate of emergence is classified as follows: Glycomide exhibits a very rapid emergence, quinolones show a rapid emergence, and clopidol has a less rapid emergence, while sulphonamides, nitrofurans, ribenidine demonstrate a moderate emergence. Amprolium displays a slow emergence, nicarbazine shows a very slow emergence, and monensin either emerges absent or very slowly. It is noteworthy that resistance is more likely to develop in birds reared under intensive conditions compared to farm animals. This overview provides a brief discussion on different approaches to treating coccidial infections, which target different stages of the coccidia life cycle.

## **2.1 Ionophores**

In the European Union, authorized ionophores, including monensin, salinomycin, lasalocid, narasin, maduramicin, and semduramicin, are named after the Greek term "ionophoros," which means "ion carrier." The majority of coccidiostats used in Europe are produced through the fermentation of *Streptomyces* spp. or *Actinomadura* spp. These ionophores have the ability to transport ions such as sodium (Na<sup>+</sup>), potassium (K<sup>+</sup>), and hydrogen (H<sup>+</sup>) across the hydrophobic membranes of the parasite wall by Martins et al., 2022.

The mechanism of action of ionophores involves aiding the movement of sodium ions across cell membranes, leading to an elevation in the intracellular concentration of sodium ions. This elevated sodium ion concentration hinders specific mitochondrial functions, including substrate oxidation and ATP hydrolysis. Furthermore, the exchange of intracellular sodium ions with extracellular calcium ions occurs, resulting in an increased intracellular concentration of calcium ions, which can lead to cytotoxicity. Additionally, certain drugs directly promote the transport of calcium ions within cells, thereby increasing the intracellular concentration of calcium ions. This elevated concentration of calcium ions specifically in cardiac and skeletal muscle cells contributes to the toxic effects of these drugs on the cells by Bello et al., 2023.

### **Monensin**

Monensin, a carboxylic polyether ionophore derived from *Streptomyces cinnamomensis*, is widely used in poultry feed to control coccidiosis (Rajendran et al., 2018). It acts as a monovalent ionophore, disrupting the transport of sodium and potassium ions (Roder, 2011). While effective, its narrow therapeutic window and potential toxicity require cautious dosing. Monensin has shown interactions with other drugs, but some combinations have demonstrated synergistic effects (Vereecken et al., 2020). Careful monitoring and dosing are crucial to ensure safe and effective use, promoting poultry health and productivity. Further research may improve understanding of optimal dosing and potential drug interactions by (Elkin, 2023). The study carried out by Ekinici et al., 2023 showed that Ionophores, like monensin, act by altering the ion gradient within protozoa, leading to disruptions in membrane potential. Monensin, for example, raises intracellular concentrations of  $\text{Na}^+$  and  $\text{Ca}^{+2}$  in protozoa, resulting in osmotic pressure changes and metabolic dysregulation. As a consequence, the protozoa swell and eventually burst. It is important to note that various ionophores target specific protozoa species, making them effective against different types of infections (Muller & Hemphill, 2011).

### **Lasalocid**

A study by Smith in, 2022 indicated that lasalocid a carboxylic polyether ionophore, is widely utilized as a feed additive to control coccidiosis in poultry. Its mode of action involves disrupting the membrane potential in protozoa by altering the ion gradient. Notably, lasalocid has been found

to increase intracellular Na<sup>+</sup> and Ca<sup>2+</sup> concentrations in protozoa, leading to osmotic pressure changes and metabolic dysregulation (Martins et al., 2022b). Consequently, the protozoa undergo swelling and eventual bursting. Due to its efficacy against different protozoa species, lasalocid has become an invaluable tool in combatting various coccidiosis infections (Martins et al., 2022a)

### **Maduramicin**

A study by Jenkins 2017 showed that is essential to use maduramicin with caution, as it has a narrow therapeutic window and can be toxic at higher doses. Maduramicin stands out as the most potent among the polyether ionophores. It is administered at a concentration of 5-6ppm in the feed, and its activity level aligns with that of other ionophores. The use of maduramicin has been associated with muscle necrosis and myoglobinuria in various animal species (Ekinici et al., 2023). Unlike others ionophores, Maduramicin primarily targets trophozoites and schizonts during the coccidian life cycle, inhibiting their development and replication as stated by McDonald 2020.

## **2.2 Thiamine antagonist**

### **Amprolium**

Amprolium is a thiamine analog used as an anticoccidial agent in poultry farming to control coccidiosis. It functions by competitively inhibiting the uptake of thiamine (Vitamin B1) by *Eimeria* species, thus disrupting their metabolism and development by Chapman, 2016. A study by Sharma et al., 2018 identified amprolium as primarily effective against the asexual stages of the coccidian life cycle, preventing their multiplication and reducing oocyst production. It is a widely used and cost-effective drug for coccidiosis control in poultry production sourced by Peek, 2020. Studies have shown that amprolium can effectively protect poultry birds against coccidial infections and improve their growth performance as it was studied by Williams et al., 2019. However in the study by McDougald, 2017, it is essential to administer the correct dosage, as under dosing may lead to treatment failure, while overdosing may cause thiamine deficiency in birds. Therefore, proper management and adherence to recommended dosage guidelines are crucial to ensure the safe and effective use of amprolium in poultry farms.

A study by (Emea, 2001) showed, for treatment purposes, amprolium is given either through drinking water at a concentration of 120 to 240 mg/l or mixed in the feed at a concentration of 125 mg/kg of feed for a period of 5 to 7 days. To prevent re-infection, it is administered in the drinking water at a concentration of 60 mg/l for 1 to 2 weeks. The maximum doses vary based on the age of the birds, ranging from 25 to 73 mg/kg of body weight per day in chickens and 14 to 60 mg/kg of body weight per day in turkeys. Amprolium is authorized as a feed additive according to Council Directive 70/524/EEC for poultry, with concentrations ranging from 62.5 to 125 mg/kg of complete feed. Additionally, it is used in combination with ethopabate (at a ratio of 25 parts amprolium to 1.6 parts ethopabate) for chickens, turkeys, and guinea fowl, with concentrations ranging from 66.5 to 133 mg/kg of complete feed. However, the authorization prohibits the use of the substance from laying age onwards and at least 3 days before slaughter (Council Directive 70/524/EEC).

There are no premarketing withdrawal requirements for amprolium. It is compatible with vitamins, antibiotics, minerals, and other commonly used ingredients in poultry feed. However, caution should be exercised when mixing it in concentrates containing high levels of choline, as it may undergo breakdown into picric acid.

In 2018 a study made by(Duszynski et al., 2018) showed that several compounds acting as thiamine antagonists have shown potential in combating coccidiosis. Amprolium, the first of its class, specifically targets the parasites' ability to take up thiamine. Its remarkable effectiveness against *Eimeria* prompted researchers to explore other amprolium analogues for their anticoccidial activity. Among these analogues, the ethyl derivative of amprolium demonstrated significant activity in inhibiting coccidiosis.

## **Clopidol**

Clopidol, also known as metichlorpindol or clopindol, belongs to a unique class called pyridinols and possesses valuable anticoccidial properties. It stands as the sole representative of this class. With its broad-spectrum activity, it acts predominantly as a coccidiostatic agent, affecting the sporozoites or trophozoites of the parasite. Notably, it exhibits its highest effectiveness against the sporozoite stage of *Eimeria*, the causative agent of coccidiosis.

Clopidol is a prominent member of the thiamine antagonist class of anticoccidial compounds, widely employed in the poultry industry to manage coccidiosis, a significant threat to poultry health and productivity. Coccidiosis, caused by protozoan parasites of the *Eimeria* species, can result in substantial economic losses for poultry producers. Clopidol serves as an effective tool in preventing and controlling coccidial infections in chickens.

The mode of action of clopidol revolves around its ability to inhibit the uptake of thiamine (Vitamin B1) by *Eimeria* parasites. Thiamine is a critical coenzyme in various metabolic reactions within the parasites, and its deprivation due to clopidol's action disrupts the normal growth and multiplication of *Eimeria* species. By targeting thiamine metabolism, clopidol hampers the parasites' ability to reproduce and cause harm to the host.

Recent research has underscored the efficacy of clopidol against various *Eimeria* species. Studies by De Macedo et al. (2020) highlighted the positive impact of clopidol on reducing oocyst output and lesion scores associated with coccidiosis in chickens. Moreover, findings from Gou et al. (2021) demonstrated that clopidol effectively controlled *E. necatrix* infections, showcasing its potential in managing this particular pathogen.

## **2.3 Antifolates**

### **Sulphonamides**

Sulphonamides, which have a long history of use as anticoccidial drugs, encompass a group of common medications including sulphadimidine, sulphaquinoxaline, sulphadimethoxine, sulphanitran, and sulphaguanidine. These sulphonamides exhibit a broad spectrum of activity against various species of *Eimeria* and possess coccidiostatic action. They are employed for both the prevention and treatment of coccidiosis, including during outbreaks

Sulphonamides, commonly referred to as sulfonamides, represent a class of antimicrobial agents frequently employed as anticoccidials in veterinary medicine stated by Chapman, 1997. These drugs are utilized to combat coccidiosis, a parasitic infection caused by protozoa of the genus *Eimeria*, which can severely impact poultry health and productivity. Sulphonamides work by

inhibiting the growth and replication of coccidia through disrupting their ability to synthesize folic acid, a crucial component for their survival.

A study by Peek et al., 2011 stated that in the realm of poultry production, sulphonamides are a vital tool to manage coccidiosis, a disease notorious for its economic implications. They are administered to poultry either through feed or water, targeting the gastrointestinal parasites responsible for the infection. Despite their efficacy, concerns about drug resistance development and potential residues in poultry products have prompted regulatory measures to ensure their responsible and controlled usage.

Sulfonamides have been widely employed for managing and treating coccidiosis in chickens. Nonetheless, reports have emerged about the ineffectiveness of Esb3 (sodium sulfachloropyrazine monohydrate; Ciba-Geigy) in addressing clinical cases of coccidiosis.(Siddiki et al., 2008). Also research study was carried out by Mehtabuddin et al., 2012 to assess the remaining concentration of sulfonamides in poultry eggs and meat. These drugs are commonly employed in poultry farming, and potential residues in meat and eggs could pose health risks to humans. The same similar research was done by Arnau et al., 2017 stated that Sulfonamides can be given to animals through feed in accordance with legal regulations for treating diseases, except in the case of laying hens used for food production. Moreover, during the process of producing animal feed, there's a possibility of cross-contamination from medicated feed, resulting in the presence of remnants of these medications in animal-derived products.

Sulphonamides are particularly effective against the intestinal forms of coccidia compared to the caecal forms. They impede the onset of the disease by targeting the second generation schizonts of *E. tenella* and *E. necatrix*. While they can also act on first generation schizonts and potentially affect sexual stages, higher doses are typically required to achieve these effects. Importantly, the use of sulphonamides does not impede the development of immunity.

## **2.4 Other anticoccidial drugs**

### **Nicarbazine**

Nicarbazin, a coccidiostat, falls under the carbanilide group and is primarily used as an anticoccidial agent for chickens up to 28 days old. It is a synthetic compound composed of equal parts of 4,4'-dinitrocarbanilide (DNC) and 2-hydroxy-4,6-dimethylpyrimidine (HDP), also known as DNC and N,N'-bis(4-nitrophenyl) urea, respectively. The mode of action appears to involve inhibiting succinate and energy-dependent transhydrogenases, leading to calcium accumulation in the presence of ATP (Nicarbazin, 2023) .

Nicarbazine displays coccidiocidal activity, primarily targeting the schizonts that emerge after the first generation. McLoughlin and Wehr, 2018 have reported a significant inhibitory effect on second-generation schizonts and a moderate action on the sexual stages of coccidia. It is available as a 22.5% premix, which is incorporated into the feed to achieve a final concentration of 0.0125%. The coccidiocidal effect of nicarbazine is attributed to its ability to penetrate the coccidia cells and disrupt the intracellular energy-supplying adenosine triphosphate (ATP). This disruption leads to an interruption of cellular energy supply and the inhibition of the sodium-potassium ion pump. Consequently, there is an influx of sodium ions and an influx of water, resulting in an intracellular ion imbalance or rupture of the coccidia cells and ultimately causing their death.

### **Ethopabate**

Ethopabate is a highly safe drug that falls under the category of monocyclic aromatics, specifically an arylamide compound with a single phenyl ring. It possesses anticoccidial properties, particularly effective against the intestinal forms of the parasite, but it does not exhibit activity against *E. tenella* or caecal worms. By competing with PABA for absorption by the coccidia, this drug interferes with the synthesis of folate, a crucial nutrient for the parasite's growth.

Ethopabate's mechanism of action centers on interfering with the metabolic pathways of the *Eimeria* parasites. Specifically, ethopabate inhibits the incorporation of p-aminobenzoic acid (PABA) into dihydrofolic acid, a vital step in the synthesis of nucleic acids essential for the

parasites' growth. By disrupting this metabolic process, ethopabate hinders the reproduction and development of *Eimeria* species, subsequently curtailing the severity of coccidiosis in poultry.

Recent studies have demonstrated the efficacy of ethopabate against various *Eimeria* species. Research by Wang et al. (2020) highlighted ethopabate's effectiveness against *E. tenella* in broilers, indicating its potential utility in managing this particular pathogen. Additionally, findings from Rahman et al. (2019) underscored the positive impact of ethopabate on reducing oocyst shedding and clinical signs of coccidiosis in chickens.

### **Buquinolate**

A research by Raines, 1968 showed that this compound exhibits a wide range of activity against all types of coccidia in chickens. It works by halting the development of sporozoites, but it does not kill these forms outright. If the drug is withdrawn too early, the inhibited stages may resume their development. It is administered in the feed at a concentration of 0.00825%. Additionally, buquinolate has the beneficial effect of improving feed conversion rates. It is characterized by low toxicity, and after the withdrawal of medicated feed, it is rapidly eliminated from the tissues

### **Decoquinolate**

Decoquinolate is a synthetic compound. It is widely utilized in the poultry industry to prevent and control coccidiosis, a parasitic disease caused by various species of the *Eimeria* protozoa (Long & Joyner, 1984). By disrupting the electron transport system in the mitochondria of *Eimeria*, decoquinolate interferes with the energy production process necessary for the parasites' survival and reproduction (Jenkins, 2015). This disruption significantly inhibits the growth and multiplication of *Eimeria* species, resulting in reduced coccidial infection severity and its associated impacts on poultry health and productivity.

Administration of decoquinolate occurs orally through poultry feed, ensuring that birds consume the required dosage for effective coccidiosis prevention (McDougald, 2003). Adherence to recommended dosing regimens and management practices is critical to maintaining the efficacy of decoquinolate and mitigating the development of resistance in *Eimeria* populations.

As with all antimicrobial agents, implementing rotation and combination strategies with other anticoccidials is essential to prevent the emergence of resistance (McDougald, 2003). Continual research and monitoring are paramount to evaluating the efficacy of decoquinate across various poultry production systems and understanding its effects on coccidial populations.

### **Robenidine**

A research by Chapman & Jeffers, 2006 Robenidine, is widely recognized for its role as an anticoccidial agent in poultry production. This synthetic compound is effective against *Eimeria* species, the protozoan parasites responsible for coccidiosis in chickens. Robenidine acts by disrupting the energy production process within the parasites' mitochondria, thereby inhibiting their growth and replication

In poultry farming, Garcia & Shirley, 2003 highlighted that robenidine is administered through feed, ensuring uniform distribution and consumption by the birds. Its activity against *Eimeria* makes it a valuable tool for preventing and controlling coccidiosis, a disease that can lead to significant economic losses due to decreased growth rates, increased mortality, and reduced feed efficiency.

As with other anticoccidial, prudent use practices are essential to prevent the emergence of resistance to robenidine. Implementing rotation or combination strategies with different classes of anticoccidial can help preserve the efficacy of this compound (Chapman & Jeffers, 2006). Regular monitoring of coccidial populations and the performance of treated flocks aids in assessing the ongoing effectiveness of robenidine in poultry health management.

### **Toltrazuril**

Toltrazuril is a triazinetrione derivative administered orally in the drinking water for the treatment of coccidiosis in chickens and turkeys. Toltrazuril induces modifications in the intricate composition of coccidian developmental phases, primarily characterized by an enlargement of the endoplasmic reticulum and Golgi apparatus, as well as irregularities in the peri-nuclear region, leading to disruptions in nuclear division. This compound also results in a decrease in the activity of enzymes involved in the parasites' respiratory chain. Despite these effects, the precise

biochemical mechanism underlying toltrazuril's hindrance of wall-forming structures in Eimerian macrogamonts remains unexplained (European Medicines Agency, 2019)

A study by Mahmoud Kandeel 2011 revealed that Toltrazuril's spectrum of efficacy covers all intracellular developmental stages excluding oocysts, as has been demonstrated for *Eimeria* species in poultry and have strong anticoccidial action against all types of coccidiosis in chicken, rabbit, pigeon, calves, and lambs

### **Halofuginone**

Halofuginone is a synthetic derivative of febrifugine, a natural compound extracted from the plant *Dichroa febrifuga*. It is an important anticoccidial agent used in poultry farming to combat coccidiosis caused by *Eimeria* species. Halofuginone is unique in its mechanism of action, targeting the formation of oocysts, the infective stage of coccidia. This compound interferes with the development of oocysts within the host, disrupting the synthesis of DNA and protein in these parasites (Chapman & Jeffers, 2006).

Administration of halofuginone to poultry can be through feed or drinking water, ensuring that the birds receive the required dosage for effective coccidiosis control. By specifically targeting the oocyst stage of the parasite's life cycle, halofuginone helps reduce the shedding of infectious oocysts into the environment, thereby decreasing the risk of disease transmission and re-infection (Shirley et al., 2007).

The use of halofuginone, like other anticoccidials, should be carefully managed to prevent the development of resistance. Strategies such as rotation and combination of different classes of anticoccidials can aid in maintaining the efficacy of halofuginone over time. Regular monitoring of coccidiosis prevalence and the performance of treated flocks is essential to ensure that halofuginone continues to contribute to effective coccidiosis management in poultry production.

### **2.5 Effectiveness of Anticoccidial Drugs:**

Numerous studies have been conducted to evaluate the effectiveness of anticoccidial drugs in chickens. One study found that the use of ionophores reduced the incidence of coccidiosis by up

to 98% and increased weight gain by up to 7% compared to untreated birds(Kariyasa & Dewi, 2011). Another study compared the efficacy of three different ionophores and found that all three were effective at reducing coccidiosis(Conway et al., 2022)

Several studies have evaluated the effectiveness of different anticoccidial drug regimens in poultry farms. A study conducted in Nigeria evaluated the efficacy of different anticoccidial drugs in broiler chickens. The study found that a combination of amprolium and sulfaquinoxaline was the most effective in controlling coccidiosis. Another study conducted by Khan et al. (2019) in Pakistan evaluated the efficacy of different anticoccidial drugs in layer chickens. The study found that a combination of monensin and salinomycin was the most effective in controlling coccidiosis.

Chemical compounds have also been shown to be effective in controlling coccidiosis in chickens. A study comparing the efficacy of amprolium and sulfadimethoxine found that both drugs were effective at reducing the incidence of coccidiosis, but amprolium was more effective (Bywater, 1982). Another study found that a combination of sulfadimethoxine and ormetoprim was more effective at controlling coccidiosis than either drug alone (Shirley, 1989)

Studies have shown that anticoccidial drugs are effective in controlling coccidiosis in chickens. A study by Chapman et al. (2010) showed that feeding ionophores to chickens reduced oocyst shedding by 97% compared to unmedicated chickens. Similarly, a study by Meimandipour et al. (2010) found that feeding a combination of ionophores and chemical agents reduced mortality due to coccidiosis by 60% compared to unmedicated chickens.

However, there are several factors that can affect the effectiveness of anticoccidial drugs. One of the most important factors is the dosage and timing of drug administration. A study by Mathis et al. (2015) showed that administering ionophores at a lower dose than recommended led to an increase in coccidial oocysts shedding and a decrease in weight gain in chickens. Similarly, a study by Williams et al. (2017) found that delaying the administration of anticoccidial drugs led to reduced efficacy in controlling coccidiosis in chickens.

Another factor that can affect the effectiveness of anticoccidial drugs is the strain of the coccidia parasite. A study by Dalloul et al. (2010) found that different strains of *Eimeria* showed different

levels of susceptibility to ionophores. Some strains showed resistance to certain ionophores, which can affect the efficacy of the drugs in controlling coccidiosis.

Furthermore, there is a concern that the efficacy of these drugs may decrease over time due to the development of drug-resistant strains of the coccidia parasite. A study by Jang et al. (2017) found that the efficacy of ionophores in controlling coccidiosis in chickens decreased over a 20-year period due to the development of drug-resistant strains of *Eimeria*.

## **2.6 Farmers' Knowledge and Practices Regarding Anticoccidial Drugs:**

Several studies have also evaluated farmers' knowledge and practices regarding the use of anticoccidial drugs. A study conducted by Ali et al. (2017) in Pakistan found that the majority of the farmers were aware of coccidiosis and its control measures. However, only a small proportion of farmers were aware of the proper use of anticoccidial drugs. Similarly, a study conducted by Ademola et al. (2020) in Nigeria found that most farmers were aware of coccidiosis and its control measures, but their knowledge and practices regarding the use of anticoccidial drugs were inadequate.

### **Conclusion:**

Anticoccidial drugs are an essential tool in the control and prevention of coccidiosis in poultry. The effectiveness of these drugs depends on their proper use, which requires farmers' knowledge and practices. Several studies have evaluated the effectiveness of different anticoccidial drug regimens and farmers' knowledge and practices regarding their use. The results of these studies indicate that a combination of different anticoccidial drugs is the most effective in controlling coccidiosis, and farmers' knowledge and practices regarding the use of these drugs need to be improved. Therefore, it is necessary to develop educational programs for farmers to increase their knowledge and practices regarding the proper use of anticoccidial drugs.

## CHAPTER THREE

### 3.0 METHODOLOGY AND MATERIALS

#### 3.1 Study design

In 2023, a cross-sectional study was conducted on exotic chicken layers selected at random from 46 farms situated in Kakiri subcounty. The main objective of the study was to assess the efficacy of various treatment regimens for coccidiosis. During the research period, a pooled fecal sample was collected from each farm, and a questionnaire was administered to gather relevant information.

The selection of farms was based on higher chicken populations, as documented by Kakiri sub county officials. The questionnaire sought to obtain data on several factors, including the age of the chickens, flock size, feed type, and type of anticoccidial used, knowledge and practices of the farmers, housing systems, and the geographical location of the farms. This information was obtained through brief interviews with the farm owners or stakeholders.

#### 3.2 Study area

Kakiri is situated approximately 29 kilometers (18 miles) to the northwest of Kampala, the capital of Uganda, accessible by road. It is positioned along the Kampala–Hoima Road, which connects Kampala to Hoima, a significant hub for oil-related activities in the country. The geographical coordinates for Kakiri are approximately 0°25'12.0"N latitude and 32°23'24.0"E longitude (Latitude: 0.4200; Longitude: 32.3900).

Due to its strategic location, Kakiri subcounty has become a hub for agricultural activities, including crop farming such as bananas, maize, cassava, beans, and rice, earning it the nickname "the upland rice grower." Moreover, there is substantial demand for animal protein, including milk, beef, fish, and chicken. Among various animal enterprises, poultry takes the lead, evidenced by the presence of numerous farms, both small-scale and large-scale, such as Wagaba Farm and Kyeyo Farm. These farms contribute to a significant chicken population in the area.

The study was conducted in Kakiri sub county wakiso district in Uganda. It has 10 parishes stretching from Buwanuka , Kakiri, Kamuli, Kikandwa, Lubbe, Luwunga, Magoggo, Nakyelongoosa, Nampunge and Ssentema.

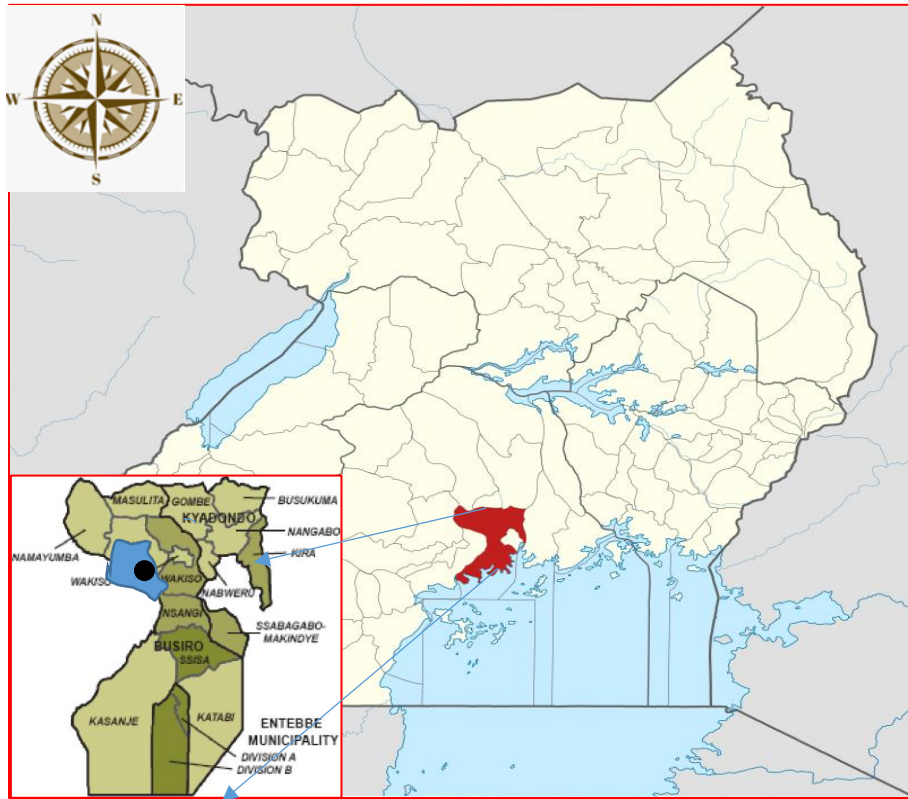


Figure 2 *Map showing location of subcounty in wakiso district in Uganda.*

**Key**



Kakiri subcounty



Kakiri town council



Wakiso district

### **3.3 Sample size**

Based on a review of the literature, there had been no previous recorded work on the prevalence of coccidiosis and the knowledge, practice, and effectiveness of anticoccidial drug regimens used in poultry layer farms of Kakiri subcounty

Therefore, the determination of the sample size was based on the estimated number of poultry farms in Kakiri subcounty, as provided by the local veterinarian, Mr. Damulira. The application of Slovin's Formula was involved in calculating the sample size:

$$n = N / (1 + Ne^2)$$

Where 'n' represents the sample size and 'N' is the estimated population. The margin of error, denoted as 'e' (level), was considered as 10%.

Accordingly, the estimated population was 85 farms, and the margin of error was 10%.

$$n = 85 / (1 + 85 * 0.01), n = 85 / 1.95 n = 45.9, \text{ or } 46 \text{ farms (rono, 2018).}$$

### **3.4 Data and sample collection**

#### **3.4.1 Data collection**

The study involved surveying farms and administering questionnaires (see appendix 1) to farmers and managers in the Kakiri subcounty to collect data on layer farming practice of the use of anticoccidials drugs, knowledge, practice and effectiveness of anticoccidial drug regimens used in poultry farms of kakiri subcounty. Data was gathered from 46 poultry farms, randomly selected from 9 parishes out of 11 parishes in kakiri. The questionnaire was designed to ask relevant questions and minimize bias while obtaining necessary information from farmers, managers, and other stakeholders on the selected farms. Sufficient time and clarifications were provided to respondents to ensure clear and accurate answers. For participants who had difficulty reading or writing, the questions were translated into the Luganda language.

#### **3.4.2 Sample collection**

Samples were collected from different areas within the poultry unit and then combined to create a pooled sample. These pooled samples were sent to the Central Diagnostic Laboratory (CDL) for analysis. On the farms, the pooled samples were gathered and placed in sterile stool containers, which were properly labeled with the farm identification number

### **3.5 Laboratory procedure**

After collecting the samples from the field, they were transported to the Central Diagnostic Laboratory (CDL) for evaluation. In the laboratory, the samples underwent two techniques: the flotation technique and the McMaster technique. The flotation technique involved using a solution with a higher specific gravity than the oocytes, allowing for the separation of oocytes from debris. On the other hand, the McMaster technique utilized a special microscopic slide that facilitated the easy counting of coccidia oocytes in the counting chamber. These techniques enabled the quantitative evaluation of coccidia oocytes in the samples.

#### **3.5.1 Flootation method**

The floatation technique for evaluating coccidiosis involves macerating approximately 4g of the sample and mixing it in a tube, followed by filtering the solution to separate debris from eggs using a goose or sieve. The sample is carefully poured into a test tube until the meniscus is formed, and then a coverslip is placed, creating a secure seal before centrifugation. Proper balancing of the tube is crucial, especially when examining multiple samples in a batch, as it prevents damage to the centrifuge. Balancing is achieved using the same type of tube and solution, avoiding water due to its lighter weight. Centrifugation is performed for 3-5 minutes at 1000-1500 revolutions per minute. Afterward, the coverslip is transferred to a microscope slide for examination. This technique accelerates the ascent of parasite eggs to the surface while keeping fecal debris at the bottom, reducing the time needed for examination significantly. It also increases the yield of parasite ova in the sample, increasing the sensitivity of the procedure(Hu et al., 2016).

#### **3.5.2 McMaster technique**

To evaluate coccidiosis using the McMaster technique, begin by taking a 4-gram fecal sample. Mix the feces thoroughly with 60 ml of saturated NaCl or another flotation solution in a clean glass beaker until the mixture is homogeneous. Filter the mixture through a sieve or cheesecloth with a 0.15mm opening and collect the filtrate in a new beaker.

Next, use a pipette to take a sample from the filtrate and transfer it to one of the chambers of the McMaster slide while vigorously mixing the filtrate. Repeat the mixing and sample procedure for the other chamber. Allow the slide to stand for 5 minutes.

Using a microscope, count the total number of coccidia eggs under both etched areas on the slide. Note that the eggs may be challenging to find, so it's best to first focus on the grid's etched lines, then adjust the focus slightly downward to see the eggs just below the top of the chamber.

To calculate the sample's total eggs per gram (EPG), multiply the total number of eggs counted in the two chambers by 100. The volume examined is 0.3 ml, as the etched area of each chamber is 0.15 ml (with the etched area measuring 1 cm X 1 cm, and the chamber being 0.15 cm deep). This calculation allows for the determination of the EPG for coccidia in the fecal sample, which is essential for assessing the severity of the infection and guiding treatment decisions. This is 1/200 of a 60 ml bottle. Because you began with 4g of feces and multiplied it by 100, the result is eggs per gram of feces(Saskatchewan, 2018)

### **3.6 Data and statistical analysis**

The data collected from questionnaires and laboratory results were entered into an Excel database and analyzed using STATA. The analysis aimed to assess the association between demographic factors, drug use practices, and treatment regimen effectiveness with the prevalence of coccidiosis in poultry farms. The status of coccidia infection served as the dependent variable, and a univariable analysis was conducted using the z-test with a significance level of 5% ( $p < 0.05$ ). The research aimed to identify significant connections between variables and coccidiosis prevalence, providing valuable insights for poultry farmers and veterinarians to better manage and control the disease. The statistical analysis ensures the reliability of the findings and supports informed decision-making.

#### **3.6.1 Ethical consideration**

The study ensured ethical considerations by obtaining written consent from the respondents after thoroughly explaining the study's objectives. An introductory letter from Makerere University's research coordinating office was provided to introduce the researcher to the respondents. Additionally, permission was sought from the local veterinary authority and local leaders, ensuring that the research was conducted with the necessary approvals and in accordance with the regulations and guidelines. These measures aimed to protect the rights and privacy of the participants while maintaining the integrity and validity of the research findings.

## CHAPTER FOUR

### 4.0 RESULTS

#### 4.1 Households and farm characteristics

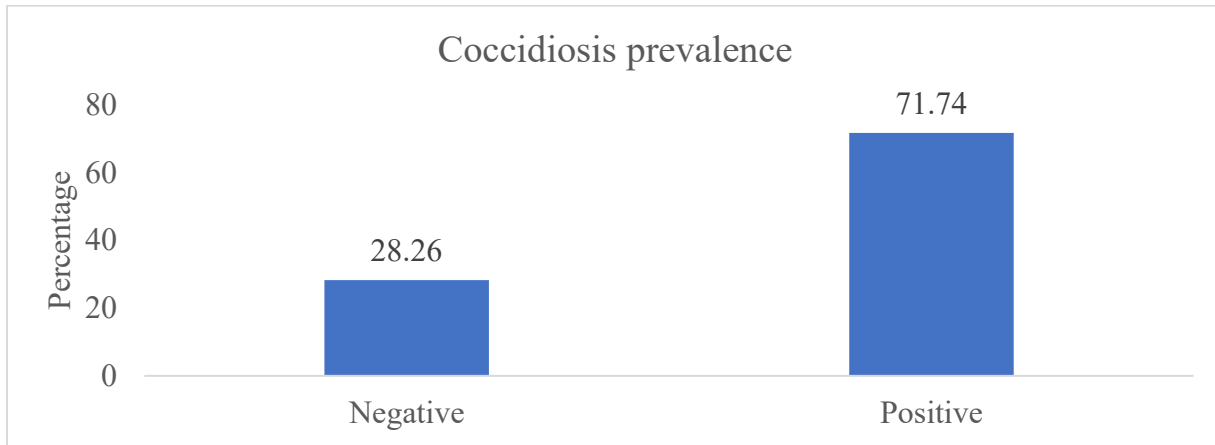
The commonest education level among the farmers is secondary school (56.52%). The next most common education level is tertiary school (43.48%). This suggests that most chicken farmers have a relatively high level of education. The majority of the farmers are male (73.91%). This is consistent with the fact that chicken farming is traditionally seen as a male-dominated industry. However, the proportion of female chicken farmers is increasing, as more and more women are entering the agricultural sector. There were 45.65% of the farmers less than 40 years of age, as well as large number of farmers who are over 40 years old, suggesting that chicken farming is a sustainable career option for people of all ages. The majority of the farmers had been in chicken farming for 3 to 4 years (26.09%) as well as more than 4 years (54.35%). This suggests that chicken farming is a profitable and sustainable industry for many people. The majority of the farmers had one batch of chickens (63.04%) whereas 36.96% had more than one batch. This might suggest that there was a range of scales of chicken farming, from small-scale backyard operations to large-scale commercial farms. More characteristics are found in table 1 below.

*Table 1 Characteristics of farms and respondents*

|  | <b>Characteristic</b> | <b>N(%) ;(95% CI)</b>      |
|--|-----------------------|----------------------------|
| <b>Education level</b>                           | Secondary             | 26 (56.52) ;(41.21, 70.75) |
|  | Tertiary              | 20 (43.48) ;(29.25, 58.79) |
| <b>Gender</b>                                    | Female                | 12 (26.09) ;(14.75, 41.41) |
|  | Male                  | 34 (73.91) ;(58.59, 85.25) |
| <b>Age of the respondent</b>                     | 18-40                 | 21 (45.65) ;(31.18, 60.84) |
|  | Above 40              | 25 (54.35) ;(39.16, 68.82) |
| <b>Number of years spent in chicken farming?</b> | 1 to 2                | 9 (19.57) ;(9.862, 34.38)  |
|  | 3 to 4                | 12 (26.09) ;(14.75, 41.41) |
|  | Above 4               | 25 (54.35) ;(39.16, 68.82) |
| <b>How many batches are at the farm?</b>         | more than one         | 17 (36.96) ;(23.60, 52.47) |
|  | one batch             | 29 (63.04) ;(47.53, 76.40) |

## 4.2 Prevalence of coccidiosis

Graph 1 below shows that 71.74% (33/47) of the chicken samples were positive for coccidiosis, while 28.26% (13/46) were negative. This means that over 70% of the chickens in the study were infected with coccidiosis.



**Figure 3. prevalence of coccidiosis**

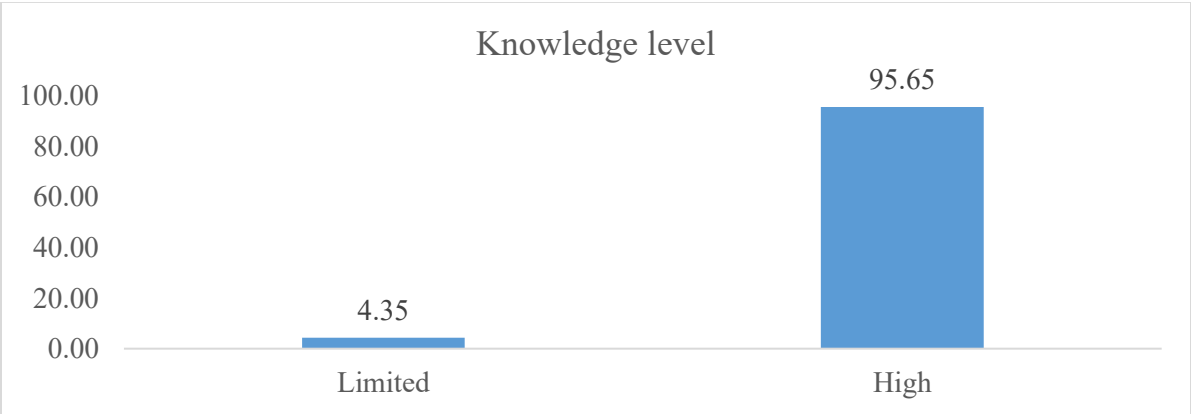
Chi-square test was used to determine if there was an association between the factors listed in the and coccidiosis (positive or negative) as presented in table 2. A p-value of less than 0.05 was considered to be statistically significant, meaning that there was a strong association between the two variables

**Table 2 Factors associated with prevalence of coccidiosis**

| Variable                                     | Characteristic | Coccidiosis Positive       | Chi-square p-value <sup>3</sup> |
|--|----------------|----------------------------|---------------------------------|
| Education level                              | Secondary      | 20 (76.92) ;(55.92,90.25)  | 0.37                            |
|  | Tertiary       | 13 (65.00) ;(40.95,83.69)  |                                 |
| Gender                                       | Female         | 8 (66.67) ;(35.44,88.73)   | 0.72                            |
|  | Male           | 25 (73.53) ;(55.35,86.49)  |                                 |
| Age of the respondent                        | 18-40          | 13 (61.90) ;(38.69,81.05)  | 0.17                            |
|  | Above 40       | 20 (80.00) ;(58.70,92.39)  |                                 |
| Number of years spent in chicken farming?    | 1 to 2         | 5 (55.56) ;(22.65,84.66)   | 0.27                            |
|  | 3 to 4         | 8 (66.67) ;(35.44,88.73)   |                                 |
|  | Above 4        | 20 (80.00) ;(58.70,92.39)  |                                 |
| How many batches are at the farm?            | more than one  | 10 (58.82) ;(33.45,80.57)  | 0.18                            |
|  | one batch      | 23 (79.31) ;(59.74,91.29)  |                                 |
| Have your birds ever been on any medication? | No             | 1 (100.00) ;(5.462,100.00) | 0.99                            |
|  | Yes            | 32 (71.11) ;(55.48,83.16)  |                                 |

|   |                   |                            |      |
|---|-------------------|----------------------------|------|
| Do you include anticoccidial in the feed? | No                | 9 (75.00) ;(42.84,93.31)   | 0.99 |
|   | Yes               | 24 (70.59) ;(52.33,84.29)  |      |
| What determines the choice of the drug?   | Non-vet           | 5 (71.43) ;(30.26,94.89)   | 0.99 |
|   | Veterinary advice | 28 (71.79) ;(54.90,84.45)  |      |
| What is the nature of the poultry house?  | Battery cage      | 3 (60.00) ;(17.04,92.74)   | 0.55 |
|   | Both              | 3 (100.00) ;(31.00,100.00) |      |
|   | Deep litter       | 26 (70.27) ;(52.83,83.56)  |      |

From graph 2 below, more (95.65%) of the farmers had deep understanding of Coccidiosis. These farmers are likely to be more successful in their businesses because they are able to make informed decisions about how to care for their chickens. They are also less likely to experience problems with their chickens, such as coccidiosis. However, there were 4.35% of the farmers with limited knowledge and these may end up making unformed decisions increasing health and economic costs.



### 4.3 Knowledge of farmers about coccidiosis

Most (95.65%) of the farmers included in the study had already experienced coccidiosis at their farm, and they believed that the disease could be treated and cured (95.65%). However, there were many uncertainties about how birds acquire coccidiosis, whereby some of the farmers believed that it can be spread through contaminated litter and others were completely unaware. In addition, there were some farmers who believed that coccidiosis can kill birds (95.65%) and lead to losses in production (97.83%) as presented in table 3 below.

**Table 3 Knowledge about coccidiosis**

| Variable   | Category                             | N(%) ;(95% CI)             |
|--|--------------------------------------|----------------------------|
| <b>Have you ever experienced coccidiosis at your farm?</b> | No                                   | 2 (4.35) ;(0.757, 16.04)   |
|  | Yes                                  | 44 (95.65) ;(83.96, 99.24) |
| <b>Do you think coccidiosis can be treated and cured?</b>  | No                                   | 2 (4.35) ;(0.757, 16.04)   |
|  | Yes                                  | 44 (95.65) ;(83.96, 99.24) |
| <b>How do you think birds acquire coccidiosis?</b>         | i don't know                         | 3 (6.52) ;(1.700, 18.93)   |
|  | Picking from the contaminated litter | 43 (93.48) ;(81.07, 98.30) |
| <b>Do you think coccidiosis can kill birds?</b>            | No                                   | 2 (4.35) ;(0.757, 16.04)   |
|  | Yes                                  | 44 (95.65) ;(83.96, 99.24) |
| <b>Do you think coccidiosis brings loss in production?</b> | No                                   | 1 (2.17) ;(0.114, 12.97)   |
|  | Yes                                  | 45 (97.83) ;(87.03, 99.89) |

#### 4.4 Practices of poultry farmers

Over 87% of the farmers had ever used medication on their birds. The majority of chicken farmers in Kakiri (60.87%) believed that anticoccidial drugs were actually very effective in treating coccidiosis although there were some variations in the effectiveness of the drugs, with some farmers reporting that they were not effective at all (6.25%). The most common source of anticoccidial drugs for chicken farmers was veterinary drug shops with a prescription (71.74%). However, some farmers also obtained the drugs from veterinary workers or from left over from previous courses of treatment. More practices were presented in table 4 below.

**Table 4 Practices in relation to coccidiosis**

|  |                             |
|--|-----------------------------|
| <b>Have your birds ever been on any medication?</b>                      |                             |
| No   | 1 (2.17) ;(0.114%, 12.97)   |
| Yes  | 45 (97.83) ;(87.03%, 99.89) |
| <b>What do you think about the effectiveness of anticoccidial drugs?</b> |                             |
| Not effective  | 3 (6.52) ;(1.700, 18.93)    |
| Slightly effective   | 15 (32.61) ;(19.97, 48.13)  |
| Very effective   | 28 (60.87) ;(45.39, 74.54)  |
| <b>Do you include anticoccidial in the feed?</b>                         |                             |
| No   | 12 (26.09) ;(14.75, 41.41)  |
| Yes  | 34 (73.91) ;(58.59, 85.25)  |
| <b>Where do you obtain the drugs for your birds?</b>                     |                             |
| Left over from previous course of treatment                              | 1 (2.17) ;(0.114, 12.97)    |
| Veterinary drug shop with a prescription                                 | 33 (71.74) ;(56.32, 83.54)  |

|  |                                   |
|--|-----------------------------------|
| Veterinary drug shop without a prescription  | 2 (4.35) ;(0.757, 16.04)          |
| Veterinary worker  | 10 (21.74) ;(11.45, 36.76)        |
| <b>What determines the choice of the drug?</b>   |                                   |
| Non-vet  | 7 (15.22) ;(6.837, 29.48)         |
| Veterinary advice  | 39 (84.78) ;(70.52, 93.16)        |
| <b>Do you observe withdraw period of the anticoccidial drug?</b>   |                                   |
| No   | 38 (82.61) ;(68.05, 91.68)        |
| Yes  | 8 (17.39) ;(8.322, 31.95)         |
| <b>How do you determine the dose to administer?</b>  |                                   |
| Base of the prescription of the drug seller  | 33 (71.74) ;(56.32, 83.54)        |
| Base on personal experience  | 1 (2.17) ;(0.114, 12.97)          |
| Follow manufacturer's instructions   | 12 (26.09) ;(14.75, 41.41)        |
| <b>How do you do the mixing of the drug?</b>   |                                   |
| Mix the drug with little water then add to the required volume   | 42 (91.30) ;(78.31, 97.18)        |
| Pour the drug in the drinking water for birds at once  | 4 (8.70) ;(2.823, 21.69)          |
| <b>Are there any challenges or misconceptions among poultry farmers that hinder the proper use of anticoccidial drugs?</b> |                                   |
| No   | 33 (71.74) ;(56.32, 83.54)        |
| Yes  | 13 (28.26) ;(16.46, 43.68)        |
| What is the location of the poultry house in relation to the sun?  |                                   |
| <b>North East to south West</b>  | <b>25 (54.35) ;(39.16, 68.82)</b> |
| South East to North West   | 5 (10.87) ;(4.072, 24.36)         |
| South to North   | 3 (6.52) ;(1.700, 18.93)          |
| <b>What is the nature of the poultry house?</b>  |                                   |
| Battery cage   | 5 (11.11) ;(4.164, 24.85)         |
| Both   | 3 (6.67) ;(1.738, 19.31)          |
| Deep litter  | 37 (82.22) ;(67.42, 91.49)        |

Overall, the results show that there is a need for more education and training for chicken farmers in Uganda about the use of anticoccidial drugs. This education should focus on the effectiveness of the drugs, the proper use of the drugs, and the potential risks associated with the use of the drugs.

## CHAPTER FIVE

### DISCUSSION

Coccidiosis is among the most common enteric parasitic diseases of poultry and a major constraint to successful poultry farming worldwide. Presence of this disease among poultry populations has resulted into low productivity due to low feed conversion rates (production losses), reduced welfare of birds and increased mortality resulting from the extensive damage of the gastrointestinal tracts. Efforts have been made to reduce the occurrence of coccidiosis including use of anticoccidial drugs which are often misused by farmers. This study was carried out to determine the prevalence of coccidiosis among poultry at farms, determine the most commonly used anticoccidial drugs and assess the knowledge, and practices of farmers towards the use anticoccidial drugs in Kakiri subcounty Wakiso District, Uganda.

This study revealed an overall coccidiosis prevalence of 71.7%. Studies from other researches have indicated rate between 19.3% to 38.34% by Wondimu *et al.*, (2019). The prevalence reported in this study is out of this range reported range in Ethiopia. Slightly lower rates of coccidiosis (66.9%) have been reported in Nigeria (Smith and Sherman, 2014; Johnson et al., 2015). The high prevalence reported in this study emphasizes the global challenge posed by this parasitic infection in the poultry sector. The differences in the reported prevalence may be due to different sample sizes, geographical locations, management practices and systems employed. It is important to note that poor farm management systems, location of farms near waste disposable areas, no biosecurity, and poor veterinary services have resulted into increased occurrences of the disease in areas where it is most prevalent. Lower prevalence reported in Ethiopia and Nigeria may be due to a better management and biosecurity system employed in such areas.

In this study, factors of age, gender, education level, number of birds, batches and experience, previous medication, choice of drugs and nature of the poultry house showed no significant association ( $P>0.05$ ) with coccidiosis status (negative or positive). Absence of significant association between coccidiosis and factors considered in this study is indicative of chance exposure of the birds to the parasite. However, significant association of coccidiosis with different factors has been indicated elsewhere. A study by Wondimu *et al.*, (2019) indicated significantly higher rates (51.1%) of the disease among younger birds compared to adult birds. This is

association is due to the fact that immunity is not well developed among the young poultry. In regards to the nature of the poultry house, a study by (Nelson et al., 2015) indicated significantly higher rates of coccidiosis among floor-based systems (50.4%) compared to caged based systems. This may be due to higher exposure of chickens to the sporulated *Eimeria* oocyst in the floor system. It is reported that environment such as overcrowding, leaking water troughs, and accumulation of feces are factors that contribute to the high prevalence of coccidiosis (A.Shubisa., 2016).

The study also assessed the use and farmers' reported effectiveness of different anticoccidial drugs by poultry farmers. Use of anticoccidial drugs was reported by all farmers in this study. Various drugs were reported by farmers in Kakiri subcounty including Toltrazuril, Sulphadimidine, and amprolium and sodium salinomycin. The drugs were either used as direct medication or indirectly via feeds. Toltrazuril indicated the highest effectiveness (93.8%) compared to other drugs while feed-administered sodium salinomycin indicated the lowest effectiveness (33.3%) in controlling coccidiosis among poultry. This finding is consistent with previous research (Garcia et al., 2016; Smith et al., 2019), which reported variations in the efficacy of different anticoccidial drugs. The variations in drug effectiveness are affiliated to emergence of drug-resistant strains of coccidian parasites, inappropriate and/or excessive use of drugs (Roberts et al., 2017; White et al., 2018).

The knowledge and practices of poultry farmers regarding coccidiosis and use of anticoccidials were also assessed in this study. It was observed that the majority of farmers (95.7%) were aware of coccidiosis and its impact on poultry health. This could be due to the ubiquitous distribution of *Eimeria* species in poultry establishments (Williams, 1996). It also confirms the widespread and endemic nature of coccidiosis in the study area. A similar study in Nigeria reported 95.9% knowledge about coccidiosis among poultry in Maiduguru district. From this study, it is shown that although the farmers know about the concept of anticoccidial drugs, many were not well-aware of the application and practices to ensure effectiveness and safety. The doses and withdrawal periods were among the most neglected aspects for specific drug. This ignorance in perception and in practice might result into drug resistance among the poultry, bring financial loss if the birds don't cure or might put threat to food safety if the birds are sold early. A study by Sharmin et al., (2021) showed significant levels of drug residues in chicken meat and eggs in Bangladesh which might have resulted from related ignorance indicated by findings of this study.

## **CHAPTER SIX**

### **CONCLUSION AND RECOMMENDATIONS**

#### **6.1 CONCLUSION**

This study indicated a high prevalence (71.7%) of coccidiosis in poultry farms in Kakiri subcounty. Factors including age, gender of the farmer, batches, number of birds and management system were not significantly associated with coccidiosis. Different anticoccidial drugs were reported by farmers with toltrazuril being the most common (34.8%) and effective (93.8%). Amprolium (83.3%) and Sulphadimidine (66.7%) were reported as the most effective anticoccidials by farmers while sodium salinomycin was reported least effective at 33.3% rate. About 95.3% had good knowledge about coccidiosis but administration practices such as doses, withdrawal periods and mixing procedures were not properly observed. This poses a significant threat to effectiveness of food-thrifty drugs and poultry productivity.

#### **6.2 RECOMMENDATIONS**

The high prevalence indicates a significant burden of the coccidiosis in the area, highlighting the need for effective control measures so as to minimize the occurrence and spread of coccidiosis; maximum hygienic measures should be practiced in handling utensils (like feeding and watering troughs) used in poultry houses in order to minimize moisture content in the littered houses.

- More research should be conducted on vaccinating of poultry against coccidiosis to find out if it is effective.
- Appropriate and responsible use of anticoccidial drugs to ensure their long-term efficacy and increase poultry productivity at the farms.
- To improve the knowledge and practices of poultry farmers regarding coccidiosis and its management, awareness and educational programs should be conducted to equip farmers with required knowledge about uses of anticoccidial drugs, biosecurity practices for prevention and control of coccidiosis at farm level.
- Further studies on anticoccidial resistant strains should be conducted so as to minimize drug resistance and also to find out if there is any strain which is resistant to anticoccidial drugs.

## REFERENCES.

- Arnau, S. G., Gallego, J., Berrueto, G. R., Leal, R., Oliag, P. T., Secretary, T., & Berrueto, G. R. (2017). *Report of the Scientific Committee of the Spanish Agency for Consumer Affairs , Food Safety and Nutrition ( AECOSAN ) in relation to the risk of the presence of sulphonamide residues in eggs resulting from cross-contamination in feed production.*
- Bello, A., Henri, J., Viel, A., Mochel, J. P., & Poźniak, B. (2023). Ionophore coccidiostats – disposition kinetics in laying hens and residues transfer to eggs. *Poultry Science*, 102(1). <https://doi.org/10.1016/j.psj.2022.102280>
- Conway, D. P., Dayton, A. D., & McKenzie, M. E. (2022). Comparative testing of anticoccidials in broiler chickens: The role of coccidial lesion scores. *Poultry Science*, 78(4), 529–535. <https://doi.org/10.1093/ps/78.4.529>
- De Gussem, M. (2017). Coccidiosis in poultry: review on diagnosis, control, prevention and interaction with overall gut health. *16th European Symposium on Poultry Nutrition*, 253–261.
- Duszynski, D. W., Kvičerová, J., & Seville, R. S. (2018). Treatment and Drug Therapies of Coccidiosis in Carnivora. *The Biology and Identification of the Coccidia (Apicomplexa) of Carnivores of the World*, 445–463. <https://doi.org/10.1016/b978-0-12-811349-3.00018-9>
- Ekinci, İ. B., Chłódowska, A., & Olejnik, M. (2023). Ionophore Toxicity in Animals: A Review of Clinical and Molecular Aspects. *International Journal of Molecular Sciences*, 24(2). <https://doi.org/10.3390/ijms24021696>
- Emea. (2001). Committee for Veterinary Medicinal Products: Amprolium. Summary Report. *European Agency for the Evaluation of Medicinal Products*, 767(January), 1–9. [www.emea.eu.int](http://www.emea.eu.int)
- European Medicines Agency. (2019). COMMITTEE FOR VETERINARY MEDICINAL PRODUCTS. TOTRALZURIL. Summary report (1). *EMEA/MRL/314/97-FINAL-Corr.*, 31(April 1998), 6–11.
- Hafez, H. M. (2018). Poultry coccidiosis: Prevention and control approaches. *Archiv Fur Geflugelkunde*, 72(1), 2–7.

- Hu, X. L., Liu, G., Wang, W. X., Zhou, R., Liu, S. Q., Li, L. H., & Hu, D. F. (2016). Methods of preservation and flotation for the detection of nematode eggs and coccidian oocysts in faeces of the forest musk deer. *Journal of Helminthology*, *90*(6), 680–684.  
<https://doi.org/10.1017/S0022149X15000942>
- Kant, V., Singh, P., Verma, P. K., Bais, I., Parmar, M. S., Gopal, A., & Gupta, V. (2013). Anticoccidial Drugs Used in the Poultry: An Overview. *Science International*, *1*(7), 261–265. <https://doi.org/10.17311/sciintl.2013.261.265>
- Kariyasa, K., & Dewi, Y. A. (2011). This document is discoverable and free to researchers across the globe due to the work of AgEcon Search . Help ensure our sustainability . *Journal of Gender, Agriculture and Food Security*, *1*(3), 1–22.
- Martins, R. R., Silva, L. J. G., Pereira, A. M. P. T., Esteves, A., Duarte, S. C., & Pena, A. (2022a). Coccidiostats and poultry: A comprehensive review and current legislation. *Foods*, *11*(18), 2738.
- Martins, R. R., Silva, L. J. G., Pereira, A. M. P. T., Esteves, A., Duarte, S. C., & Pena, A. (2022b). Coccidiostats and Poultry: A Comprehensive Review and Current Legislation. *Foods*, *11*(18), 1–20. <https://doi.org/10.3390/foods11182738>
- Mayall, G. (2018). Coccidiosis in Chickens. *The Veterinary Journal (1900)*, *87*(1), 45–46.  
[https://doi.org/10.1016/s0372-5545\(17\)40666-3](https://doi.org/10.1016/s0372-5545(17)40666-3)
- Mehtabuddin, Mian, A. A., Ahmad, T., Nadeem, S., Tanveer, Z. I., & Arshad, J. (2012). Sulfonamide residues determination in commercial poultry meat and eggs. *Journal of Animal and Plant Sciences*, *22*(2), 473–478.
- Muller, J., & Hemphill, A. (2011). Drug target identification in intracellular and extracellular protozoan parasites. *Current Topics in Medicinal Chemistry*, *11*(16), 2029–2038.
- Nelson, K. S., Bwala, D. A. A., & Nuhu, E. J. (2015). Nigerian veterinary journal. *Nigerian Veterinary Journal*, *36*(4), 1299–1317.
- Raines, T. V. (2021). Buquinolate—A Review. *Poultry Science*, *47*(5), 1425–1432.  
<https://doi.org/10.3382/ps.0471425>

- Rajendran, V., Ilamathi, H. S., Dutt, S., Lakshminarayana, T. S., & Ghosh, P. C. (2018). Chemotherapeutic potential of monensin as an anti-microbial agent. *Current Topics in Medicinal Chemistry*, 18(22), 1976–1986.
- Roder, J. D. (2011). Ionophore toxicity and tolerance. *Veterinary Clinics: Food Animal Practice*, 27(2), 305–314.
- rono, L. (2018). Microcredit and Its Relationship To the Growth of Small and Medium Enterprises in Konoin Subcounty, Kenya. *International Journal of Advanced Research*, 6(4), 961–968. <https://doi.org/10.21474/ijar01/6935>
- Saskatchewan, U. of. (2018). *Quantitative Faecal Flotation - McMaster Egg Counting Technique*. 22–24. <https://wcvm.usask.ca/learnaboutparasites/diagnostics/quantitative-faecal-flotation-mcmaster.php#:~:text=The McMaster technique uses a,of faeces can be calculated.>
- Siddiki, A. Z., Karim, M. J., & Chawdhury, E. H. (2017). Sulfonamide Resistance in Chicken Coccidiosis: A Clinico-Pathological Study. *Bangladesh Journal of Microbiology*, 25(1), 60–64. <https://doi.org/10.3329/bjm.v25i1.4860>
- Snyder, R. P. (2021). Coccidiosis in commercial broiler chickens: improving management of Eimeria species using live-vaccination or anticoccidial medication and developing and applying quantitative species-specific molecular assays. *PhD, January*, 1–157.
- The Independent News Reporter. (n.d.). Coccidiosis Disease Kills Hundreds of Poultry in Amuru :: Uganda Radionetwork. In “*Coccidiosis disease kills hundreds of poultry in Gulu.*” <https://ugandaradionetwork.net/story/coccidiosis-disease-kills-hundreds-of-poultry-in-amuru>
- Vereecken, M., Dehaeck, B., Berge, A. C., Marien, M., Geerinckx, M., & De Gussem, K. (2020). Synergistic effect of a combination of nicarbazin and monensin against coccidiosis in the chicken caused by Eimeria spp. *Avian Pathology*, 49(4), 389–393.
- Wondimu, A., Mesfin, E., & Bayu, Y. (2019). Prevalence of Poultry Coccidiosis and Associated Risk Factors in Intensive Farming System of Gondar Town, Ethiopia. *Veterinary Medicine International*, 2019. <https://doi.org/10.1155/2019/5748690>

## APPENDICES

### 1.0 Appendix Questionnaire

Title; Prevalence of coccidiosis and knowledge, practice and effectiveness of anticoccidial drug regimens used in layer farms in kakiri town council

#### Identification and location

Date and time of interview

Village

---

Parish

---

Subcounty

---

Name of the farm

---

Id number

---

GPS coordinates

#### Socio-demographic information

Education level

Primary

Secondary

Tertiary

Others

Gender

Male

Female

Age of the respondent

18 to 40

Above 40

**Animal management system**

Number of years spent in a business

1 to 2

3 to 4

Above 4

How many batches are at the farm?

One batch

Above one batch

What is the total number of birds at the farm?

---

At what age are your birds? (Age in weeks)

---

**Knowledge on Coccidiosis**

What do you understand by coccidiosis?

---

Have you ever experienced coccidiosis at your farm?

Yes

No

When did you last had coccidiosis?

A week ago

Two weeks ago

Three weeks ago

A month

What signs did the birds show?

Drop in feed consumption, open mouth breathing and greenish diarrhea (salmonellosis)

Ill-thrift, enlarged ad swollen navel, decreased appetite, diarrhea, pasting of feathers around vent (collibacillosis)

Reduced egg production, reduced feed consumption, oculo-nasal discharge with edema of face ad eyelids (infectious coryza)

Ruffled feathers, depression, blood in droppings, shivering, and mortality rate may increase (coccidiosis)

Do you think coccidiosis can be treated and cured?

Yes

No

How do you think birds acquire coccidiosis?

Picking from contaminated litter

I don't know

Do you think coccidiosis can kill birds?

Yes

No

Do you think coccidiosis brings loss in production?

Yes

No

### **Anticoccidial usage in birds**

Have your birds ever been on any medication?

Yes

No

Which condition were you treating basing on the color and consistence of feces and respiratory signs?

Coccidiosis (ekijorobero)

Newcastle (Nsotoka)

Gumboro (kipumpuli)

Fowl typhoid (Ekidukano kyenkoko)

I don't know

Which drug did you use to coccidiosis?

---

After use of the drug did the birds recover?

Yes

No

What do you think about the effectiveness of anticoccidial drugs?

Very effective

Slightly effective

Not effective

Do you include anticoccidial in the feed?

Yes

No

If yes, specify .....

Which drug or concentrate do you put in your feed?

---

Where do you obtain the drugs to for your birds?

Left over from previous course of treatment

Veterinary drug shop without a prescription

Veterinary drug shop with a prescription

Veterinary worker

What determines the choice of the drug?

Veterinary advice

Experience farmer

Do you observe withdraw period of the anticoccidial drug?

Yes

No

How do you determine the dose to administer?

- Follow manufacturer's instructions
- Base on prescription of the drug seller
- Base on personal experience

How do you do the mixing of the drug?

- Pour the drug in the drinking water for birds at once
- Mix the drug with litter water and then add to the required volume
- Add to the feed

Are there any challenges or misconceptions among poultry farmers that hinder the proper use of anticoccidial drugs?

- Yes
- No

If yes specify.....

**Observation**

What is the situation of the poultry house in relation to the sun?

- East to west
- South to north
- Northeast to southwest
- Southeast to North West

What is the nature of the poultry house?

- Deep litter
- Battery cage

Is there any signs of bird picking feed on the ground?

Yes

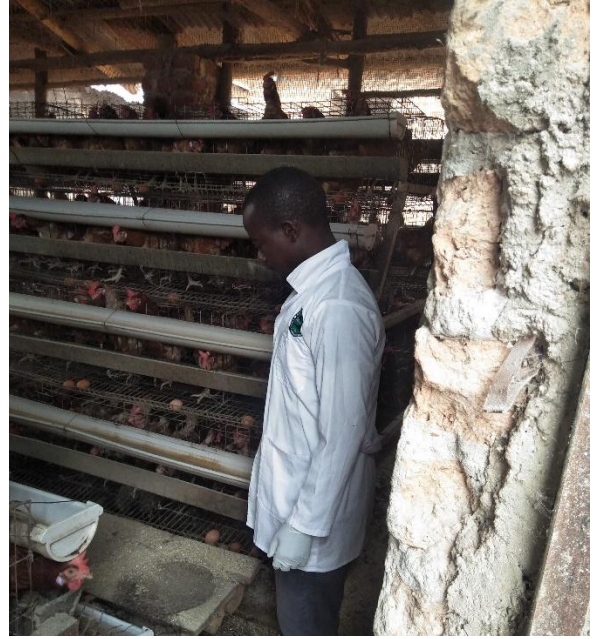
No

## 2.0 pictorial evidence

**Observing chicken dropping**



**Ready to collect chicken droppings**



**Collecting chicken samples**



**Interviewing the workers**



**Samples presented to CDL**



**Beakers arranged for Fecal analysis**



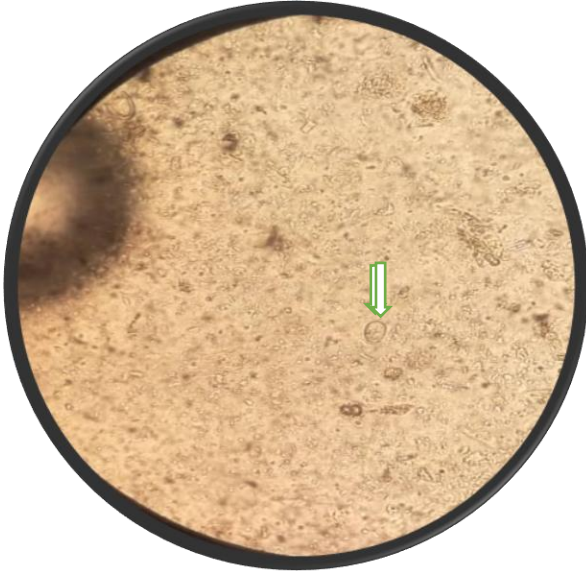
**Fecal analysis taking place**



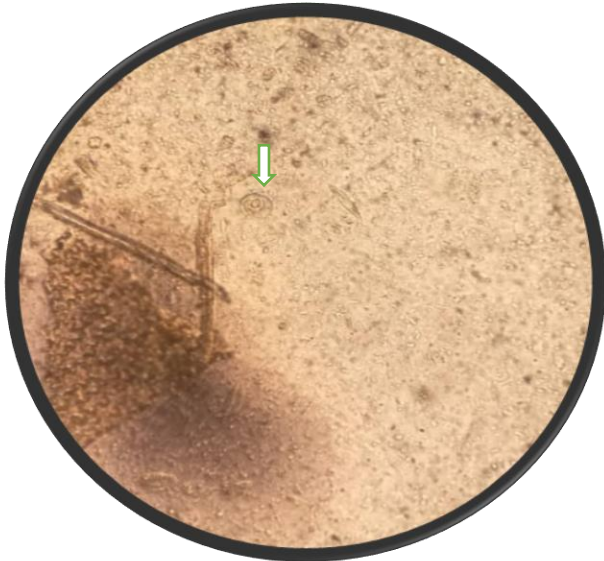
**Observing oocytes under a microscope**



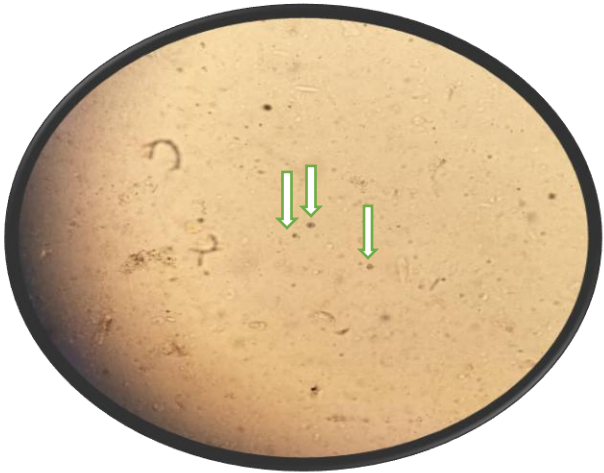
Unsporulated oocyte pointed with an arrow



Unsporulated oocyte pointed with an arrow



Three arrow pointing on different arrows



### 3.0 Program schedule

| Activity                           | Area                      | Time                        |
|------------------------------------|---------------------------|-----------------------------|
| Submission of the proposal         | COVAB                     | 28 <sup>TH</sup> /Dec/2022  |
| Presentation of the proposal       | COVAB                     | Jan/2023                    |
| Farm survey and visits             | Ssentema                  | 14 <sup>th</sup> /Jan/2023  |
|                                    | Kakiri and Nampunge       | 21 <sup>st</sup> /Jan/2023  |
|                                    | Kamuli                    | 28 <sup>th</sup> /Jan/2023  |
|                                    | Buwanuka and Magoggo      | 4 <sup>th</sup> /feb/2023   |
|                                    | Nakyerongosa and Kikandwa | 11 <sup>th</sup> /feb/ 2023 |
|                                    | Luwunga and Lubbe         | 12 <sup>th</sup> /feb/2023  |
| Data and sample collection         |                           | March to April/ 2023        |
| Laboratory tests and data analysis |                           | April to july / 2023        |
| Presentation of findings           |                           | August / 2023               |
| Submission of the manuscript       |                           | September / 2023            |

#### 4.0 showing proposed budget

| S/N | ITEM                               | QUANTITY                  | AMOUNT(Shs) | TOTAL(Shs) |
|-----|------------------------------------|---------------------------|-------------|------------|
| 1.  | Transport                          | 6 journeys                | 15000@      | 90,000     |
|     | questionnaire                      | 60 copies                 | 200@        | 12,000     |
| 2.  | Data/Airtime                       | 10GB                      | 8000@       | 80,000     |
| 3.  | Laboratory procedure               | 49 Flotation and McMaster | 10000@      | 490,000    |
| 4.  | Data analysis                      | -                         | -           | 250,000    |
| 5.  | Stipends                           |                           |             | 200,000    |
| 6.  | Research assistance and stationery | -                         | -           | 180,000    |
|     | Total                              |                           |             | 1,302,000  |

## 5.0 consent for my survey

**Title: A study on prevalence of coccidiosis and knowledge, practice and effectiveness of anticoccidial drug regimens used in layer poultry farms in kakiri sub-county**

**Date .../ ... /...**

**ID number .....**

**Introduction:** my name is **Balemwa Tonny** I am a student of makerere university pursuing a bachelor of veterinary medicine am in my final year. Am conducting a study on the mentioned topic.

This research study is conducted under Makerere University College of veterinary medicine, animal resources ad biosecurity and you are requested to take part in this study. I am requesting your consent to take part of this study. The study is interested in finding out the prevalence of coccidiosis, commonly used anticoccidial drugs and compering their effectiveness and the knowledge and practice of using anticoccidial drugs in layer farms.

**Purpose of the research:** this study will collect information on socio- demographic information, biosecurity at farm level, poultry husbandry practices, knowledge on coccidiosis and involve interviewer's observation. The result of the study will help in identifying which anticoccidial drug to use when and where and highlighting on the risk factors associated with coccidiosis.

**Study procedure:** If you kindly agree to participate in the study, you will be asked to fill and answer few simple questions on the above-mentioned topic and it will take not more than 30 minutes.

**Benefits:** there is no personal benefits from participating in the study. However, this study will generate information on the risk factors associated with coccidiosis.

**Risks:** there is no risk associate with your participation in the study.

**Confidentiality:** I will make sure that the information you provide will be kept confidential. Response will be completely anonymous; your name will not appear anywhere in the final write-up.

**Voluntary participation:** your participation in the study is voluntary and you are free to refuse participating or withdrawing from the study.

**Compensation:** there is no incentive to give you for participating in this study as a respondent.

**Contact person:** In case of an inquiry about the study contact **BALEMWA TONNY BVM 5** on **0772862753** or **0751287566**

**Consent to participate in the study.** I have read the above information describing the procedure, benefit and the risks of participating in the study.

I ..... Agree to participate as a volunteer in this study.

Signature ..... Date .....