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Original Research Article

Prevalence, Intensity, Anticoccidial Efficacy, and Farmers' Knowledge of Chicken Coccidiosis in Kikuyu Sub-county, Kenya

Moses O. Orembe[1*], James Nganga Chege[2], Robert M. Waruiru[2], Davis Njuguna Karanja[2]

[1]KALRO-Kisii Research Centre, P. O. Box 523, Kisii 40200
[2] University of Nairobi, Department of Veterinary Pathology, Microbiology and Parasitology, Box 29053, Nairobi

***Corresponding author:** Moses O. Orembe
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Abstract: Chicken coccidiosis is a protozoan disease that significantly impacts poultry globally. The disease is caused by *Eimeria* species, which causes intestinal damage leading to reduced growth, diarrhea, and death in severe cases. Control strategy includes the use of anticoccidial drugs, vaccination, and good biosecurity. A cross-sectional study was conducted in Kikuyu Sub-County, Kiambu County, Kenya, from 28th October, 2021, to 8th November,2021, to assess the farmers' knowledge, attitude, and practices (KAP) on chicken coccidiosis and collect fecal samples for estimation of prevalence, intensity of infections, and speciation *Eimeria* species involved. Additionally, a trial was undertaken to test the efficacy of commercial anticoccidials drug in the market. A semi-structured questionnaire was used to assess farmers' KAP. Modified McMaster technique was used to analyze fecal samples for oocyst per gram (opg) of feces and positive fecal samples were cultured and sporulated oocyst examined microscopically to identify and characterize probable *Eimeria* species. One hundred- and twenty-five-day old chicks were acclimatized for 13 days then randomly assigned into five treatment groups; amprolium (GA3), toltrazuril (GT4), sulphachloropyrazine (GS5), negative (GN1) and positive (GP2) controls. After 24-hour of starvation, each chick in GA3, GT4, GS5 and GP2 was orally inoculated with 3.0×10^5 sporulated oocysts. Anticoccidial treatments based on the manufacturers' recommended dosage commenced when birds showed clinical signs typical of coccidiosis. Effects of treatment was monitored for 5 days through clinical observations and fecal oocyst counts. Experiment was terminated 10th day post infection (dpi). Data was analyzed through descriptive statistics, and one way ANOVA. A total of 48 farms; 10 in Sigona, 10 in Karai, 10 in Nachu, 10 in Kikuyu and 8 in Kinoo wards were used in the study. The KAP survey revealed that majority of farmers [41 (85.4%)] were smallholder with 5-1500 birds, while [7(14.6%)] were large holders with more than 1500 birds. Household heads were male [34 (70.8%)] and female [14 (29.2%)] who were more than 51 years 26 (54.2%) and had formal education [32 (66.7%)]. Three quarter [36 (75%)], of the farmers knew signs and symptoms of coccidiosis. To manage the disease, farmers either purchased drugs from the Agro-Veterinary stores [30 (62%)], prepared herbal medicines [7 (15.5%)], consulted veterinary service providers [6(13.5%)], or contacted Kenchic animal health practitioners [5 (9%)]. The overall prevalence of chicken coccidiosis was at [498 (87.5%)] with a mean intensity of 1,142 and a range of 0-25,000 opg. In Kinoo, the mean intensity (3106) was significantly higher ($p < 0.05$) than other wards. Using morphological features, *Eimeria* species identified were; *E. praecox* [135 (26.5%)], *E. mitis* [98 (19.6%)], *E. necatrix* [93 (18.6%)], *E. maxima* [89 (17.8%)], *E. brunetti* [68 (13.6%)] and *E. tenella* [18 (3.6%)]. Experimentally, coccidia infected chicks developed clinical disease by 5th dpi manifested as anorexia, reduced water intake, ruffled feathers, diarrhea and depression. Subsequent to which treatments were initiated. By the second day post treatment (dpt), oocyst output was reduced to 0 for toltrazuril, 200 for amprolium 500 for Sulphachloropyrazinas compared 0 and 1400 opg for noninfected and infected-untreated controls respectively. The three anticoccidial drug currently in use were efficacious. Based on high prevalence and intensity of coccidia infection in this study, it can be concluded that farmers' Knowledge, attitudes and practices are insufficient in prevention and control of chicken coccidiosis. Therefore, this study recommends that farmers be trained on farm hygiene, biosecurity and proper drug use. More research be done to confirm Eimeria species and their pathogenicity and search for alternative anticoccidial remedies to circumvent drug resistance.
Keywords: Coccidiosis, Eimeria, Prevalence, Anticoccidial drugs, Knowledge attitude practices, Kikuyu Sub-County.

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INTRODUCTION

Poultry production has a major impact on the socioeconomic growth of many third-world states (Mshelia *et al*., 2016). In Kenya, an estimated 43.8 million is the population of chicken in which5.1% of the total livestock (G.o.K, 2017). These chickens produce 35,000 tons of meat and 1.6 billion eggs (FAO, 2019).

Kiambu County has a population of 2,600,837 chickens, with Kikuyu Sub-County having the highest population of birds, i.e., 377,403 (KNBS, 2019).

Poultry health problems are caused by infectious and non-infectious agents, with major diseases being caused by viruses (Newcastle disease, Avian pox, Gumboro), bacteria (Fowl cholera, Salmonellosis, Infectious coryza), and parasites (Coccidiosis, Ascariosis, mange).

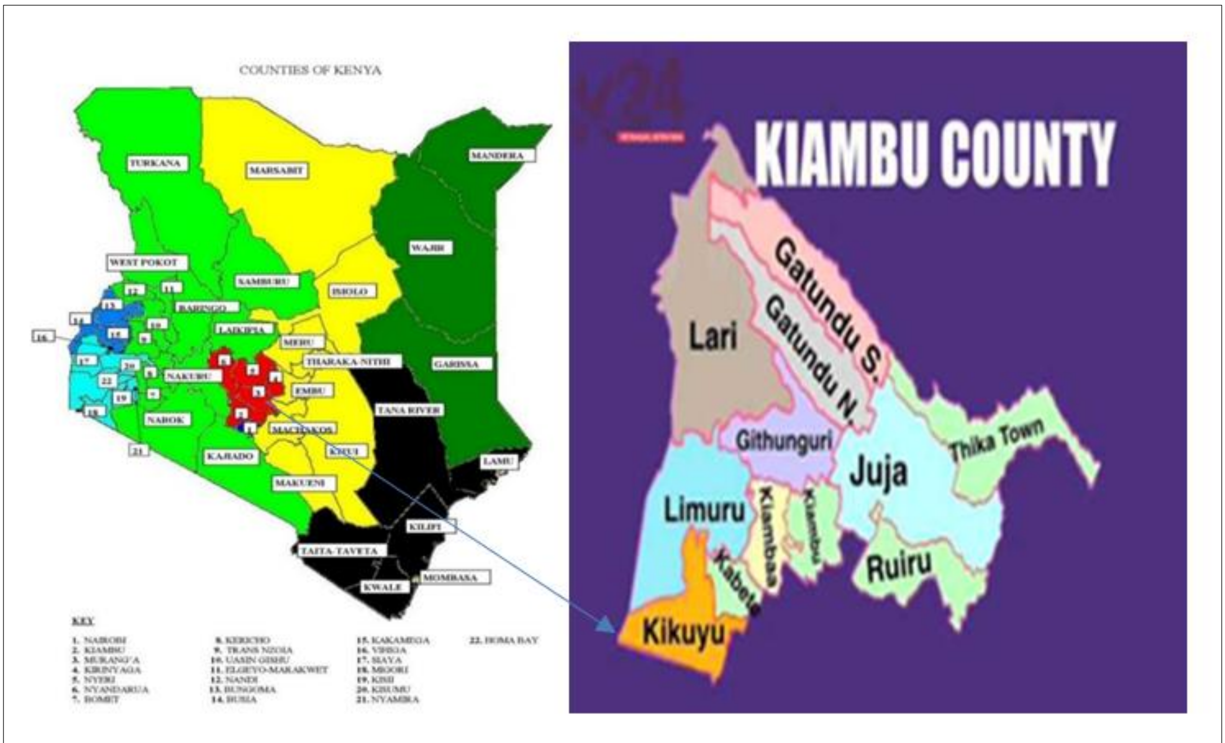
In Kenya, more research work has been done on bacterial and viral diseases relative to parasitic infections (Kemboi *et al.,* 2013; Mutinda *et al.,* 2013; Ngai *et al*., 2021).

Coccidiosis is a disease of hot and humid environments caused by different *Eimeria* species of the phylum Apicomplexa. Seven *Eimeria* species with various pathogenicity are known to cause coccidiosis in chickens (Verba *et al*., 2010). The disease is characterized by dysentery, bloody diarrhea, enteritis, poor growth, drooping wings, emaciation and decreased production (Gerhold, 2015). Additionally, high morbidity and mortality rates are reported, which are further aggravated by concurrent infections. Coccidiosis is considered a disease of poor management (Bachaya *et al* 2015), and Arabkhazaeli *et al*. (2013) reported that US$1.5 billion is the cost the world's commercial chicken farmers lose every year due to the disease. This study was designed to investigate the prevalence, intensity, efficacy of anticoccidial drugs, and farmers' knowledge of chicken coccidiosis in Central Kenya.

MATERIAL AND METHODS

Study Area

The study was done in Kikuyu sub-County in Kiambu County between 28.10.2021 to 12.11.2021.



Experiment Approval and Data Collection

Ethical approval number BAUEC/2022/340

Farm visit, semi-structured questionnaire, and observations were used to gather information on farmers' level of education on knowledge, attitude, and practices on chicken coccidiosis. A total of 48 farms were visited from the list of farmers provided by the Livestock office, Kikuyu Sub-County. The chicken fecal sample size was based on Thrusfield (2005) formula, in which 95% confidence interval, an expected prevalence 61.5%, and 5% desired absolute precision were used, and therefore 569 fecal collected from Sigona, Nachu, Karai, Kikuyu, and Kinoo wards of Kikuyu sub-county. Fecal samples collected were labelled and transported in an ice-packed cool box, chilled or kept at 4^0C until processing in the DVPMP laboratory, University of Nairobi.

Fecal Sample Processing in the Laboratory

Two grams (2 g) of chicken fecal sample was weighed and mixed with saturated sodium chloride (360grams of sodium chloride in 1000mls of hot water) in a mortar, the suspension was drawn by pipette into McMaster slide and examined by modified McMaster floatation technique (MAFF, 1986). The number of coccidia oocysts within the grid of the chamber was countered under a compound microscope at X10 magnification and total number of oocysts was multiplied by 100 to give the oocyst per gram (OPG).

Processing of Coccidia Inoculant

The inoculant of *Eimeria* oocysts was obtained from chicken droppings of naturally infected chickens in the Kikuyu sub-county, Kiambu. Positive fecal samples were centrifuged five times at 1500 rpm for ten minutes to remove sodium chloride. These oocysts free of sodium chloride are then placed into a petri-dish with potassium dichromate 2.5% in the incubator at 27^0C for seven days. In the incubator should be 60-80% humidity, on and off aeration, and continuously monitored by examining drops of (0.01ml) of the sub-sample under an oil immersion lens (Abed and Yakoob, 2013). The sporulated oocysts were then removed from the incubator and centrifuged five times at 1500 rpm for ten minutes to remove potassium dichromate. The various *Eimeria* species in the inoculum were then identified based on morphology, including size (after randomly measuring 10 oocysts in the order they were examined with a light microscope using the oil immersion lens (100X). The washed sporulated oocysts were counted per 1.0ml using the hemocytometry technique according to Soulbsy (2005). Pathogenicity of inoculum was tested in eight pretrial day-old chicks to determine the optimum number of oocysts required to establish experimental chicken coccidiosis, with a cutoff point of clinical expression of diarrhea and shedding of at least 300,000 oocysts per gram. This was established to be 300,000 oocysts per chick.

Experimental Chicks and Design

One hundred twenty-five (125) shavers male day-old chicks were procured from Muguku Hatcheries Farm-Kikuyu. They were weight on arrival, 14 and 24 days these were then randomly assigned into five treatment groups;

- GN1(uninfected and untreated),
- GP2 (infected and untreated),
- GA3(infected and treated with Amprolium),
- GT4 (infected and treated with Toltrazuril), and
- GS5 (infected and treated with sulphachloropyrazine).

On the 14th day, fecal samples were collected from all five treatments to confirm no coccidia infection, and thereafter, groups GP2, GA3, GT4, and GS5 were inoculated with 300,000 mixed *Eimeria* species isolated from naturally infected chickens.

On the 5^{th} day post-infection (dpi), observing clinical signs of Coccidiosis or Coccidia count of 300,000 mixed infections. Treatment groups: GA3 was treated with Amprolium Hydrochloride 20%, 5g/5litres of water for 5 days, GT4 was treated with 2.5% Oral Toltrazuril, 7mg/kg b.w.t/for two days and GS5 was treated with Sulphachloropyrazine 30%; 1.5 to 2g/litre on 1, 2, and 5day. Thereafter daily collection of fecal samples for laboratory analysis for oocyst coccidia count and recording clinical signs up to the 24^{th} day.

Experimental Anticoccidial Drugs

The three anticoccidial drugs were studied. Amprolium, Toltrazuril and Esb_3. Amprolium affects co-factor uptake and synthesis and is particularly effective against *E. acervulina, E. necatrix and E. tenella* (Kant *et al.,* 2013). Toltrazuril is a broad spectrum anticoccidial used in planned treatment programmes of poultry by inclusion in their drinking water (Chapman,1997). Esb_3 is a broad-spectrum sulphonamide with the longest history of use in the preventative and curative management of Coccidiosis in poultry (Kant *et al.,* 2013).

These drugs were administered according to the recommended dosage and usage as follows: Amprolium 20%, manufactured by Alfa Animal Healthcare Ltd, United Kingdom. Dissolve 6gm (2 ½ teaspoonful) in 100ml of drinking water. Treatment; 5gm/5litre of drinking water. Preventive 2,5 g/5 litres of drinking water 5-7 days. Sulphachloropyrazine (Esb_3) product of Elanco (Shanghai) Animal Health Co. Ltd, China, 1.5 to 2g/litre. Frequency of treatment a) 3 days of treatment, repeat if symptoms reappear, b) Treatment on 1^{st} ,3^{rd}, 5^{th} ,7^{th}, and 9^{th} day c) Treatment on 1^{st}, 2^{nd}, and 5^{th} 6^{th}, and 9^{th} day d) 1g/l on day; 0.5 g/l on 2^{nd} to 6^{th} day. 2.5% Oral Toltrazuril manufactured by Hebei Yuan Zheng Pharmaceutical Company Ltd, China. 7mg/kg b.w.t /day for 2 days, 24 hours continuously of for 8 hours or each day or 100ml/1000litre of drinking water. Withdrawal period 9 days.

Data Analysis

Data were entered into MS EXCEL processed and exported into SPSS version 20.0 for analysis, Yockey, (2016). Descriptive statistics were used to summarize the data. Chi-square, one-way ANOVA were used to analyse data. The resulting data was tested at significance level stated at $P \leq 0.05$.

RESULTS

4.1. Farmers' knowledge, attitudes and practices on chicken coccidiosis in Kikuyu Sub-County

Socio-Demographic Characteristics of Respondents

In this study, 48 poultry farms, Sigona (10), Karai (10), Nachu (10), Kinoo (8), and Kikuyu (10), were visited and household heads interviewed. The majority, 34 (70.8 %) of the farmers were males. The age range of the poultry farmers interviewed showed that this is an activity largely undertaken by an elderly population. The majority [26 (54.2%)] were more than 51 years of age, and the youngest [5 (10.4%)] were 31- 40 years, with none below the age of 30 years. Most farmers [18 (37.5%)] had attained secondary school level of education, a few 3 (6.3%) had primary level of education and a sizeable number (16) had no formal education (33.33%) as shown in Table 4.1 below. The highest number of respondents (40) were solely involved in farming (83.3%), while others combined poultry rearing with formal employment (12.5%) or other businesses (4.2%).

Table 4.1: The demographic characteristics of households, socio-economic activities, and farm features in Kikuyu Sub-County and respective administrative wards

Demographic characteristics of household head		Administrative ward, numbers, and percentage representation					Total
		Sigona	**Karai**	**Nachu**	**Kinoo**	**Kikuyu**	**Kikuyu Sub-County**
Age	**21-30 years**	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	31-40 years	0 (0%)	1 (2.1%)	2 (4.2%)	0 (0%)	2 (4.2%)	5 (10.4%)
	41-50 years	5 (10.4%)	2 (4.2%)	3 (6.3%)	3 (6.3%)	4 (8.3%)	17 (35.4%)
	Above 51years	5 (10.4%)	7 (14.6%)	5 (10.4%)	5 (10.42%)	4 (8.3%)	26 (54.2%)
Gender	**Males**	9 (18.8%)	5 (10.4%)	8 (16.7%)	4 (8.3%)	8 (16.7%)	34 (70.8%)
	Females	1 (2.08%)	5 (10.4%)	2 (4.2%)	4 (8.3%)	2 (4.2%)	14 (29.2%)
Level of education	**Non-formal**	1 (2.08%)	6 (12.5%)	4 (8.3%)	4 (8.3%)	1 (2.1%)	16 (33.3%)
	Primary level	1 (2.1%)	0 (0%)	0 (0%)	0 (0%)	2 (4.2%)	3 (6.3%)
	Secondary level	4 (8.3%)	2 (4.2%)	3 (6.3%)	3 (6.3%)	6 (12.5%)	18 (37.5%)
	Tertiary level	4 (8.3%)	2 (4.2%)	3 (6.3%)	1 (2.1%)	1 (2.1%)	11 (22.9%)
Occupation	**Farming**	8 (16.7%)	8 (16.7%)	8 (16.7%)	7 (14.6%)	9 (18.6%)	40 (83.3%)
	Business	1 (2.1%)	1 (2.1%)	0 (0%)	0 (0%)	0 (0%)	2 (4.2%)
	Salaried	1 (2.1%)	0 (0%)	2 (4.2%)	1 (2.1%)	1 (2.1%)	5 (10.4%)
	Clergy	0 (0%)	1 (2.1%)	0 (0%)	0 (0%)	0 (0%)	1 (2.1%)

4.1.2 The Farm Characteristics

All farmers interviewed were small scale land holders with a mean farm size of about ¼ of an acre (Table 4.2). The majority of the respondents 20 (41.67%) owned a quarter of an acre. The largest farm unit was $^3/_4$ of an acre, while the smallest was $^1/_8$ of an acre. With respect to number of chickens kept, most of the poultry farmers (32) had less than 500 birds, while the other had 501-1000 chickens 8 (16.67%), 1001-1500 birds 1 (2.08%) and more than 1501 birds 7 (14.58%). Cemented floors in chicken houses were the preference for majority 33 (68.75%) of farmers. Others used wooden 5 (10.4%) and earthen floor 10 (20.83%). Most of the farmers 44 (91.67%) use commercial feeds, and only 4 (8.33%) use home-made feeds. The farmers in addition to keeping chicken own other animals as seen in Table 4.2 below.

Table 4.2: The farm characteristics in Kikuyu Sub-County

Farm characteristics		Administrative wards, numbers and percentages					Kikuyu subcounty
		Sigona	**Karai**	**Nachu**	**Kinoo**	**Kikuyu**	
Farm size	$^1/_8$ acre	0 (0%)	0 (0%)	0 (0%)	3 (6.3%)	0 (0%)	3 (6.3%)
	$^1/_4$ acre	4 (8.3%)	5 (10.4%)	3 (6.3)	1 (2.1%)	7 (14.9%)	20 (41.7%)
	$^1/_2$ acre	2 (4.2%)	1 (2.1%)	5 (10.4%)	2 (4.2%)	3 (6.3%)	13 (27.1%)
	$^3/_4$ acre	4 (8.3%)	4 (8.3%)	2 (4.2%)	2 (4.2%)	0 (0%)	12 (25%)
Number of birds kept	5-500	3 (6.3%)	7 (14.6%)	7 (14.6%)	8 (16.7%)	7 (14.6%)	32 (66.7%)
	501-1000	3 (6.3%)	1 (2.1%)	2 (4.2%)	0 (0%)	2 (4.2%)	8 (16.7%)
	1001-1500	1 (2.1%)	0 (0%)	0 (0%)	0 (0%)	1 (2.1%)	2 (4.2%)
	≤1500	3 (6.3%)	2 (4.2%)	1 (2.1%)	0 (0%)	0 (0%)	6 (12.5%)
Chicken floor	Earthen	1 (2.1%)	4 (8.3%)	1 (2.1%)	4 (8.3%)	0 (0%)	10 (20.8%)
	Wooden	0 (0%)	0 (0%)	1 (2.1%)	4 (8.3%)	0 (0%)	5 (10.4%)
	Cement	9 (18.8%)	6 (12.5%)	8 (16.7%)	0 (0%)	10 (20.8)	33 (68.8%)
Feed source	Commercial	10 (20.8%)	9 (18.8%)	9 (18.8%)	6 (12.5%)	10 (20.8)	44 (91.7%)
	Homemade	0 (0%)	1 (2.1%)	1 (2.1%)	2 (4.2%)	0 (0%)	4 (8.3%)
Other animals	Cattle	0 (0%)	1 (2.1%)	0 (0%)	2 (4.2%)	1 (2.1%)	4 (8.3%)
	Sheep	2 (4.2%)	1 (2.1%)	0 (0%)	0 (0%)	3 (6.3%)	6 (12.5%)
	Goats	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (2.1%)	1 (2.1%)
	Cats	3 (6.3)	4 (8.3%)	6 (12.5%)	3 (6.3)	2 (4.2%)	18 (37.5%)
	Dogs	5 (10.4%)	4 (8.3%)	3 (6.25%)	2 (4.2%)	3 (6.3)	17 (35.4%)
	Others	0 (0%)	0 (0%)	1 (2.1%)	0 (0%)	0 (0%)	32 (66.7%)

4.1. 2: Knowledge and Practices of Farmers in Control of Chicken Coccidiosis

In total, farmers in Kikuyu, Sub-county identified 7 diseases as major challenges in chicken production, namely coccidiosis, Newcastle, fowl typhoid, pneumonia, coryza, gumboro, and worm infestation. The majority of the farmers had basic knowledge of chicken coccidiosis (72.8%) as they recognized the clinical signs of the disease (Table 4.3), such as death, diarrhea, bloody diarrhea, reduced water intake, and a high percentage of sickly birds as was observed in one of the farms (Figure 4.1). They also knew that chicken environmental 17 (35.41%), chicken status 11 (22.92%), were important factors in outbreaks of coccidiosis. Additionally, most of the respondents associated pathogens as the cause of chicken coccidiosis (Figure 4.2).

Table 4.3: The farmers' ability to recognize coccidiosis and its clinical signs in birds as per the respondents in Kikuyu Sub-County and the respective administrative wards

Symptoms	Administrative ward					Total
	Sigona	Karai	Nachu	Kinoo	Kikuyu	Kikuyu Sub County
Decreased water and feed intake?	7 (14.6%)	7 (14.6%)	7 (14.6%)	6 (12.5%)	7 (14.6%)	34 (70.8%)
Diarrhea	7 (14.6%)	7 (14.6%)	7 (14.6%)	6 (12.5%)	7 (14.6%)	34 (70.8%)
Bloody diarrhea	7 (14.6%)	7 (14.6%)	7 (14.6%)	6 (12.5%)	7 (14.6%)	34 (70.8%)
High number of birds die	7 (14.6%)	7 (14.6%)	7 (14.6%)	6 (12.5%)	7 (14.6%)	34 (70.8%)
Decreased feed and water consumption	7 (14.6%)	7 (14.6%)	7 (14.6%)	6 (12.5%)	7 (14.6%)	34 (70.8%)
Decreased growth rate	7 (14.6%)	7 (14.6%)	7 (14.6%)	6 (12.5%)	7 (14.6%)	34 (70.8%)
High percentage of sickly birds	7 (14.6%)	7 (14.6%)	7 (14.6%)	6 (12.5%)	7 (14.6%)	34 (70.8%)
Birds with depigmentation	7 (14.6%)	7 (14.6%)	7 (14.6%)	6 (12.5%)	7 (14.6%)	34 (70.8%)
Decreased egg production	7 (14.6%)	7 (14.6%)	7 (14.6%)	6 (12.5%)	7 (14.6%)	34 (70.8%)

Figure 4.1: Birds showing symptoms of coccidiosis as seen in a farm in Kikuyu subcounty

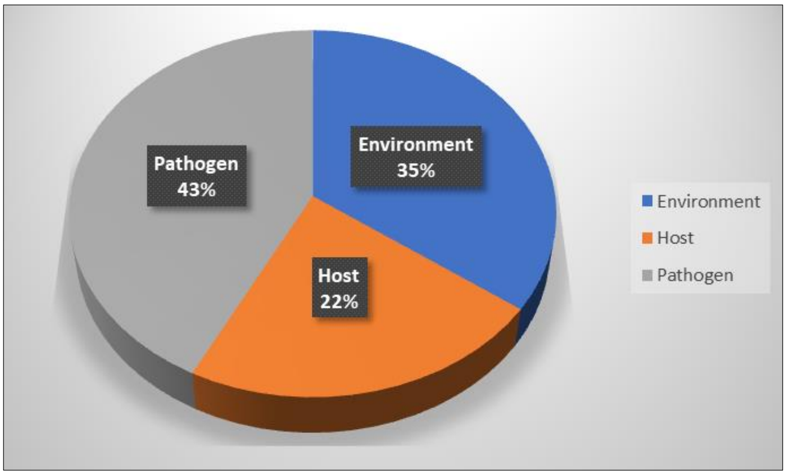


Figure 4.2: Factors associated with outbreaks of coccidiosis as stated by chicken farmers in Kikuyu subcounty

4.1.4: Practices towards the Control and Treatment of Chicken Coccidiosis

All the farmers interviewed used wood shavings as litter in their chicken houses. The majority of the farmers 29 (60.4%), changed the litter on monthly basis. The others changed it fortnightly 14 (29.2%) and once weekly 5 (10.4%) as seen in Table 4.4. Forty-three (90%) of the farmers used commercial feeds with coccidiostats while 5 (10%) used home-made feeds (Figure 4.3).

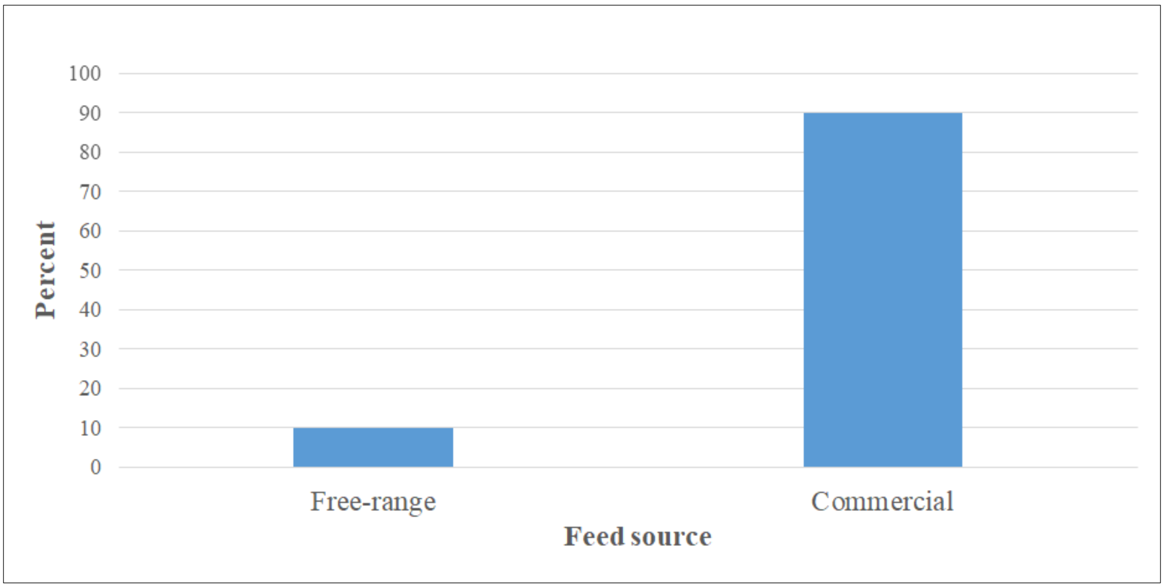


Figure 4.3: The source of chicken feed used by chicken farmers in Kikuyu Sub-County

From observations made during the farm visits, most of the farmers positioned the feeding troughs too low 19 (39.5%) or too high 18 (37.5%), and only 11 (22.91%) placed them at moderate / proper heights (Figure 4.4). All interviewed farmers used disinfectants in their poultry housed (Table 4.4) where majority used biosafe disinfectant 17 (35.4%) and a few used formaldehydes 6 (12.5%). The frequency of disinfectant application was monthly 31(64.6%), fortnight 13 (27.08%) and weekly 4 (8.33%). The number of chicken farmers who practiced Allin-Allout production system were 15 (31.8%).

Figure 4.4: Placements of feed and water troughs; the feed troughs are too low, birds resting on them and show evidence of soiling by faecal matter, while the water troughs are correctly placed

Table 4.4: Hygiene and biosafety measures in chicken houses in Kikuyu Sub-County

Hygiene and biosafety measures	Administrative wards					Total
	Sigona	Karai	Nachu	Kinoo	Kikuyu	Kikuyu Sub County

Litter change	Weekly	1 (2.1%)	2 (4.2%)	0 (0%)	1 (2.1%)	1 (2.1%)	5(10.4%)
	Fortnightly	3 (6.3%)	2 (4.2%)	2 (4.2%)	3 (6.3%)	4 (8.3%)	14(29.2%)
	Monthly	6(12.5%)	6(12.5%)	8(16.7%)	4 (8.3%)	5(10.4%)	29(60.4%)
Positioning of feeding/watering troughs	Too low	1 (2.1%)	4 (8.3%)	4 (8.3%)	5(10.4%)	5(10.4%)	19(39.5%)
	Too high	4 (8.3%)	5(10.4%)	5(10.4%)	1 (2.1%)	3 (6.3%)	18(37.5%)
	Proper	5(10.4%)	1 (2.1%)	1 (2.1%)	2 (4.2%)	2 (4.2%)	11(22.91%)
Disinfectants	Biosafe	5(10.4%)	3 (6.3%)	2 (4.2%)	3 (6.3%)	4 (8.3%)	17(35.4%)
	Kupacide	3 (6.3%)	4 (8.3%)	1 (2.1%)	2 (4.2%)	4 (8.3%)	14 (29.2%)
	Kerol	2 (4.2%)	0 (0%)	6(12.5%)	2 (4.2%)	1 (2.1%)	11(22.9%)
	Formaldehyde	0 (0%)	3 (6.3%)	1 (2.1%)	1 (2.1%)	1 (2.1%)	6 (12.5%)

4.1.4.2 Farmers' Practices in the Treatment of Chicken Coccidiosis in Kikuyu Sub-County

To manage clinical coccidiosis in chicken, 30 farmers (62.5%) purchased anticoccidial drugs from Agro-veterinary stores, 7 used herbal medicines (14.58%), 6 consulted animal health providers (12.5%), and 5 were Kenchnic contract farmers who consulted their sponsor. Incidentally, most of the farmers purchased anticoccidial drugs over-the-counter without valid prescriptions. The chicken farmers mostly used Amprolium 18 (37.5%) in the management of chicken coccidiosis (Table 4.5).

Table 4.5: Farmers' practices in treatment of chicken coccidiosis in Kikuyu Sub-County and the respective administrative wards

Practices for management of chicken coccidiosis		Administrative wards of Kikuyu Sub-County					Total
		Sigona	Karai	Nachu	Kinoo	Kikuyu	Kikuyu Sub County
Use herbal drugs		2 (4.2%)	1 (2.1%)	1 (2.1%)	1 (2.1%)	2 (4.2%)	7 (14.6%)
Purchase from agro-vets		5(10.4%)	6(12.5%)	6(12.5%)	5(10.4%)	8(16.7%)	30 (62.5%)
Contact veterinarian		1 (2.1%)	2 (4.2%)	1 (2.1%)	2 (4.2%)	0 (0%)	6 (12.5%)
Consult kenchic sponsor		2 (4.2%)	1 (2.1%)	2 (4.2%)	0 (0%)	0 (0%)	5 (10.4%)
Drug bought	Sulphachloropyrazine	2 (4.2%)	1 (2.1%)	2 (4.2%)	0 (0%)	4 (8.3%)	9 (18.8%)
	Trimethoprim	1 (2.1%)	1 (2.1%)	2 (4.2%)	0 (0%)	2 (4.2%)	6 (12.5%)
	Amprolium	4 (8.3%)	2 (4.2%)	5(10.4%)	4 (8.3%)	3 (6.3%)	18 (37.5%)
	sulphadimine	2 (4.2%)	2 (4.2%)	1 (2.1%)	3 (6.3%)	0 (0%)	8 (16.7%)
	Toltrazuril	1 (2.1%)	4 (8.3%)	0 (0%)	1 (2.1%)	1 (2.1%)	7 (14.6%)

4.2. The Prevalence, Intensity, and Speciation of *Eimeria* in Kikuyu Sub-County

4.2.1. The Prevalence and Intensity of *Eimeria* in Kikuyu Sub-County

Out of 569 fecal samples collected and examined, 498 (87.5%) were positive for coccidian oocysts (Table 4.6). The prevalence was highest in Kikuyu ward at 146 (83.5%) and lowest in Kinoo ward 81 (83.5%). The mean oocyst counts in Kikuyu -subcounty was 498 opg, with a range of 0 – 25000 opg. The intensity was highest in Kinoo ward 3108 opg and lowest in Nachu ward at 366 opg. The counts were significantly higher (ANOVA, $P > 0.05$) in Kinoo and Kikuyu wards relative to the other wards.

Table 4.6: The Prevalence and Intensity of *Eimeria* in Kikuyu Sub-County

Parameter	Administrative wards of Kikuyu Sub-County					
	Sigona (n=96)	Karai (n=116)	Nachu (n=100)	Kinoo (n=97)	Kikuyu (n=160)	Kikuyu Ssb County (n=569)
Prevalence	84 (87.5%)	102 (87.9%)	85 (85%)	81 (83.5%)	146 (91.3%)	498 (87.5%)
Intensity (opg) (Range)	453 (0 -1800)	687 (0 -18100)	366 (0 -1300)	3108 (0 -24000)	1076 (0 -7800)	1142 (0 -25000)

4.2.3 Morphological Identification of Coccidia Oocysts of Chicken in Kikuyu Sub-County

Based on 502 unsporulated Eimeria oocysts examined, the most common morphological shapes of oocysts seen were spherical, subspherical, and ovoid (Figure 4.3). The oocysts of *E. mitis* were subspherical, those of *E. brunetti* were ovoid, *E. tenella* broad and ovoid, *E. necatrix* oblong and ovoid, *E. praecox* spherical, and those of *E. maxima* were ovoid (Figure 4.3).

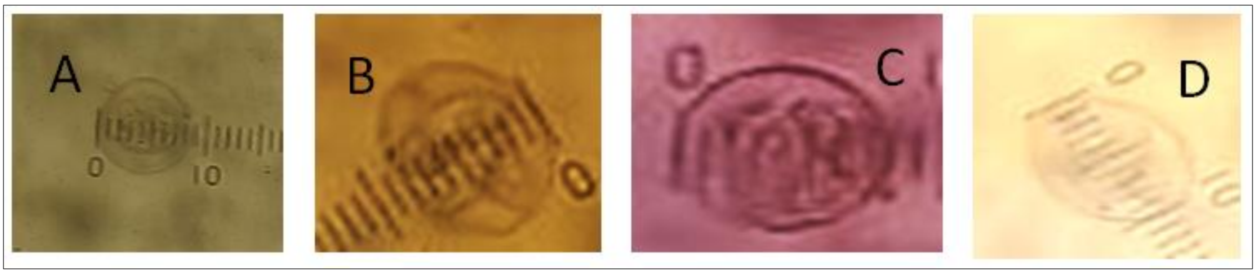


Figure 4.3: The various morphological forms of unsporulated coccidia oocyst (A-spherical; *E. preacox,* B and C – Subspherical: *E. mitis* D-Ovoid: *E.tenella* and *E. necatrix*)

The shape index of the 502 unsporulated Eimeria oocysts obtained by measuring the length/width ratio indicated that 6 *Eimeria* species infected chicken in Kikuyu Sub-County. The prevalence of the 6 *Eimeria* species in Kikuyu Sub-County are shown in Table 4.7 below. The most prevalent species was *E. Praecox* [133 (26.5%)], while *E. tenella* 18 (3.5%) was the least prevalent.

Table 4.7: Dimensions (µm) and shape indices of *Eimeria* species oocyst

S No.	Length	Width	Shape index	Suspected species	Prevalence (%)
1	20.7	18.4	1.125	*E. tenella*	18 (3.6%)
2	15.9	13.9	1.14	*E. mitis*	99 (19.6%)
3	23.6	19.6	1.20	*E. brunetti*	68 (13.6%)
4	29.1	18.7	1.58	*E. maxima*	89 (17.0%)
5	20.9	17.1	1.22	*E. praecox*	133 (26.5%)
6	20.4	17.0	1.21	*E. necatrix*	93 (18.6%)

On sporulation (Figure 4.5), the oocysts had four sporocysts each. The sporocysts were mostly elongated, ovoid forms with one end more pointed than other. At the pointed ends were the stieda bodies, and in some forms a micropyle was absent such as *E. mitis, E. brunetti, E. tenella, E. necatrix.* Each sporocyst contained two sporozoite, each having a granule pole.

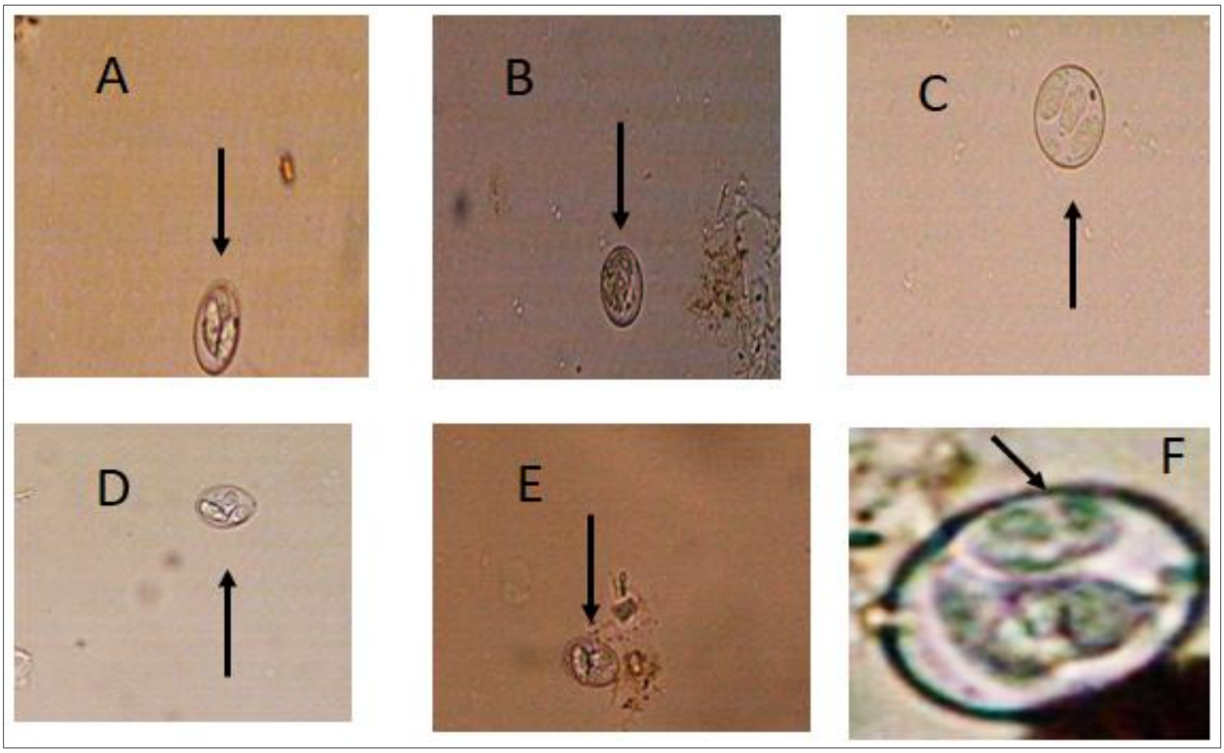


Figure 4.5: Sporulated oocysts of *Eimeria* species recovered in Kikuyu subcounty (A= *E. tenella*, B = *E. mitis,* C = *E. brunetti,* D = *E. Maxima*, E = *E. praecox,* and F = *E. necatrix*)

4.3 Assessment of the Efficacy of Anticoccidial Drugs

4.3.1 Growth Rate (Weight Changes)

The chicks' mean weights (in grams) on days 0, 14, and 24 of observation are shown in Table 4.8 and Figure 4.6. By day 14, there was no significant difference (ANOVA, P > 0.05) in weights, weight gain between the five groups. However, by day 24 of observation (10 days post-infection = 5 days post-anticoccidial treatment), the weight in group GN1 was significantly higher (ANOVA, P > 0.05) compared to the other four groups.

Table 4.8: Chicks' mean weight (MW), weight gain (WG), and daily weight gains on day 0, 14, and 24 of observation

Time	Mean weight (MW), weight gain (WG), and daily weight gain (DWG)														
	GN1			GP2			GA3			GT4			GS5		
	MW	WG	DWG	MW	WG	DWG	MW	WG	DWG	MW	WG	DWG	MW	WG	DWG
D0	34.68	-	-	33.76	-	-	34.96	-	-	34.28	-	-	35.64	-	-
D14	101.88	67.2	4.8	97.64	63.88	4.56	99.96	65	4.64	96.6	62.32	4.45	99.2	63.56	4.54
D24	181.87	147.38	11.45	167.33	133.76	10.33	171.38	136.48	10.61	166.71	132.24	10.46	165.9	130.29	10.22

Similarly, the daily weight gains by days were significantly higher (ANOVA, P > 0.05) in group GN1 compared to that of other groups and significantly lower in group GS5 compared to the rest.

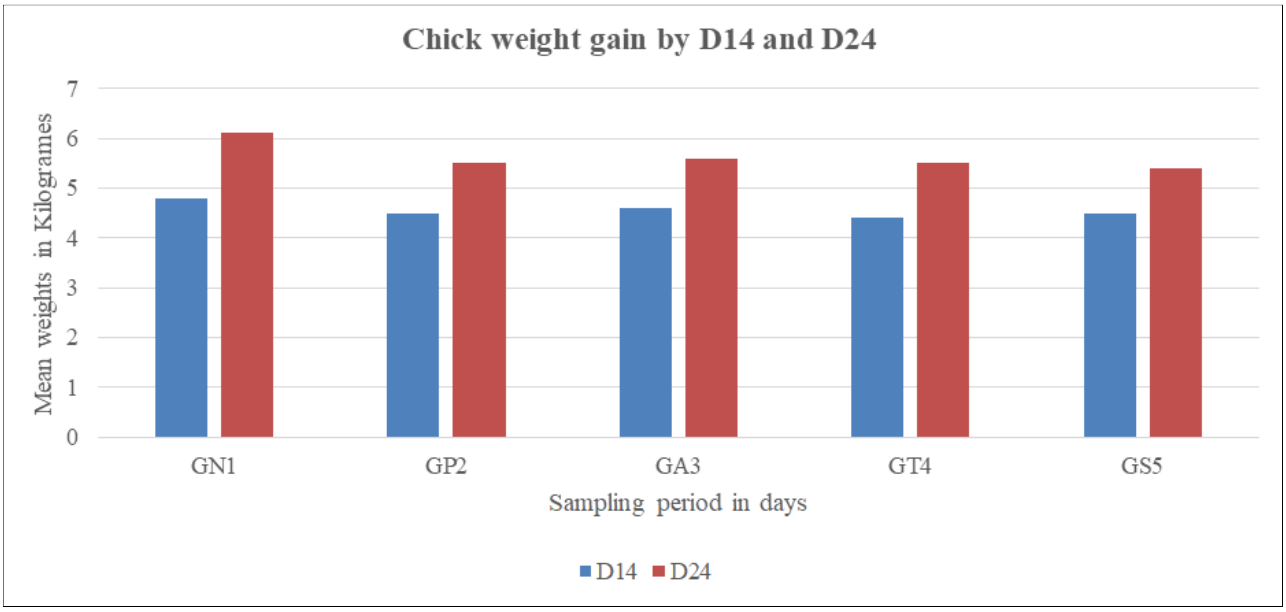


Figure 4.6: The chicks' weight gain on day 14th and day 24th of the experiment

4.3.1.2: Clinical Signs Post-Infection

The first signs of coccidiosis in infected chicks appeared on the 4th day post-infection. The chicks huddle together and had reduced activities in treatments GP2, GA3, GT4 and GS5. By the 5th day post-infection, the chicks showed general signs of coccidiosis, including ruffled feathers, being off-feed, huddling together, and having loose droppings. The number of chicks presenting such signs are shown in Figure 4.7 below. No such signs were observed in groups GN1.

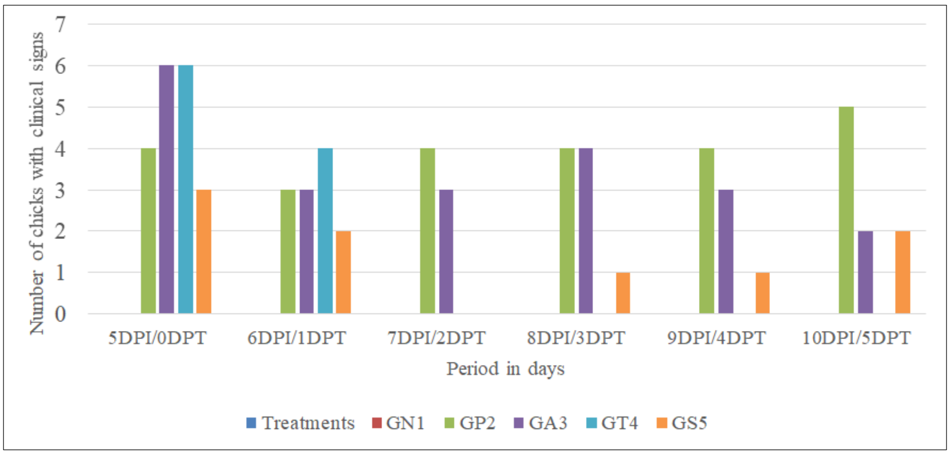


Figure 4.7: Number of experimental chicks presenting clinical signs during the post-infection and the post-treatment periods

4.3.1.3: Oocyst Coccidia Count Post-Infection and Post-Anticoccidial Treatment

The results of the coccidian oocyst counts are shown in Table 4… below. In all groups, no coccidia oocysts were detected on day 14 (day 0 post-infection) of observation, and none were detected in group GN1 (uninfected-untreated/negative control) throughout the study period.

In all the infected groups, oocysts were first detected on the 6^{th} day post-infection, which coincided with the first day of clinical manifestation of coccidiosis and the 1^{st} day of anticoccidial administration (Table 4.9). High levels of oocyst counts were detected in GP2 (infected and untreated) from 6Dpi to the end of the experiment (10DPI).

Table 4.9: Coccidia oocyst count post infection and anticoccidial drug administration

Treatment group	Mean coccidia oocyst counts post- infection (PI) and anticoccidial treatment (PT)						
	0 DPI	6DPI/1DPT	7DPI/2 DPT	8DPI/3DPT	9DPI/4DPT	10DPI/5DPT	Mean epg
GN1	0	0	0	0	0	0	0
GP2	0	1400	1200	1300	1200	1300	1280
GA3	0	1200	200	300	400	0	420
GT4	0	2700	0	0	100	200	600
GS5	0	1000	500	200	100	200	400

In all groups that received anticoccidial treatments, oocyst counts declined significantly (ANOVA, P > 0.05) from the 2^{nd} day of treatment to the end of the experiment (10DPI/5DPT) (Figure 4.7). There was no statistical difference (ANOVA, P > 0.05) in the pre-treatment coccidia oocyst counts between the groups, as none had been detected on the day of treatment (5DPI). The post-treatment oocyst counts were significantly higher in GP2 as compared to all other groups and significantly lower in GN1 as compared to all other groups. Among the treated groups, coccidia oocysts persisted and were observed in group GS5 on all five sampling dates.

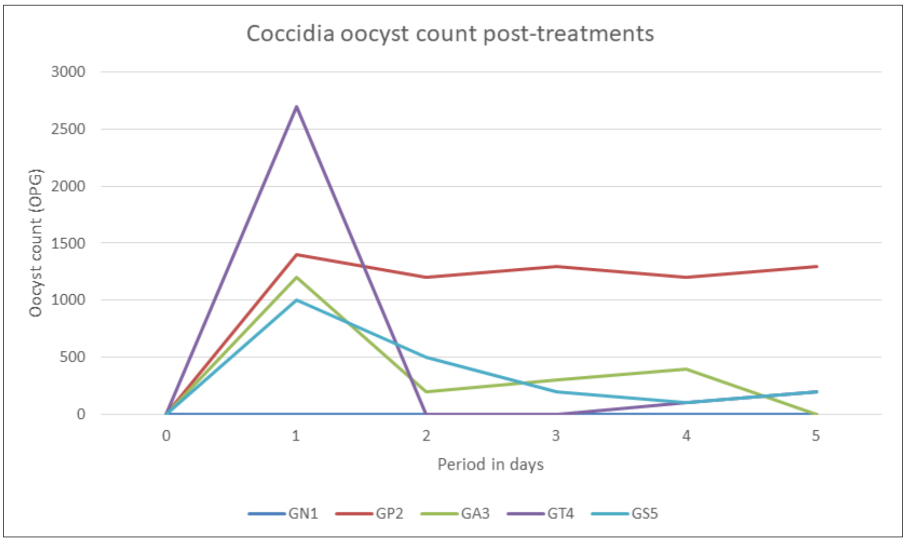


Figure 4.7: Coccidia oocyst counts post-treatments

DISCUSSION

This study was aimed at assessing farmers' knowledge, attitudes, and practices on chicken coccidiosis in Kikuyu Sub-County, Kiambu County, establishing the prevalence, intensity, and species of *Eimeria* that cause coccidiosis in the region, and evaluating the efficacy of three commonly used anticoccidial drugs on Eimeria isolates from the region.

In the present study, 70.8%. of the farmers were males, and this was similar to the findings of Lestari *et al*., (2017) in Indonesia, where male farmers represented 84%. However, the results of this study contradict those of Ndubi *et al*., (2025) in Central Highlands and Eastern Midland of Kenya, who indicated that females constitute the majority of poultry farmers. Women play important roles in both domestic and economic activities; they spend more time at home than men and can thus be more effective in intensive responsibilities of poultry management, and should thus be encouraged to be actively involved in poultry.

In the present study, the age range of poultry farmers interviewed showed that this is an activity largely undertaken by an elderly population who were over (50) years of age and constituted 61.2% of the respondents. This finding can be explained by the observation made by Adebo and Adesida (2017) that fewer people are presently going into poultry farming as several young people (males) nowadays venture into the commercial motorcycle business.

Findings from the current study indicate that 83.3% of the respondents were engaged in farming as their main source of income. The study farms, however, had a low acreage with a mean size of about ¼ of an acre, which could easily support chicken enterprises as it requires less space compared to other livestock. However, the low acreage can only support a few birds, as seen in this study, where 66.7% kept below 500 birds. This finding agrees with the study done by Nchinda *et al.,* (2011) in Haiti.

In the present study, 66.7% of the farmers had formal education. This is a reflection of the high level of literacy rates in Kiambu county, which stands at 88% (Kenya Demographic Health Survey (KDHS), (2022). This can increase their knowledge on chicken management as those with formal education are more likely to be informed of technologies and innovations in poultry diseases and parasites management (Adeyemi *et al*., 2019). This study thus supports these observations, as 70.8% of farmers had basic knowledge of chicken coccidiosis. They correctly associated it with signs and symptoms such as death, bloody diarrhea, reduced water intake, and a high percentage of sickly birds. They also associated disease outbreaks with environmental, host and pathogen risk factors. This is further supported by the fact that all farmers in the current study implemented hygiene and biosafety measures. Among these farmers 68.8% used cemented house floors that are easy to clean and disinfect, and they used wood shavings litter. However, 60.4% of the farmers changed at monthly intervals, which may be too long and allows the buildup of infective coccidia oocysts. In addition, 39.5% of the farmers placed the feeding troughs rather low, a fact that increases the risk of feed contamination with faecal matter, thus increasing the risks of coccidia infection Shubia *et al*., 2019; Hadas *et al*., (2019). When the farmers suspected such infections in their flocks, 62.5% of them purchased drugs from Agro-vets, without consulting animal health service providers. This may result in misuse, overuse, and underdosing that increase the risk of anticoccidial resistance (Nawarathne *et al*., 2021). For these reasons, there is a need to train the farmers on proper implementation of hygiene and biosafety measures and the use of anticoccidials.

The results from the present study indicate that coccidial infections in chickens in Kikuyu, subcounty, are high. The overall prevalence of 87.5% reported in this study is comparable to the prevalence reported of (71%) by Jatau *et al.,* (2012) in Nigeria. However, the prevalence recorded in the present study is higher than the 31.8% reported by Lawal *et al*., (2016), in Maiduguri, Nigeria, but lower than the 91% reported in Romania by Gyorke *et al*., 2013). This variation of prevalence may be due to the variation in the geographical location, breed of chicken, management systems, and anticoccidial drug usage. The higher prevalence recorded in this study may be because most of the farmers own small pieces of land, which might compromise levels of biosecurity measures. Most of the current study respondents had their level of water and feed troughs either too high or too low, making it possible for the contamination of water and feed with faeces, therefore facilitating faecal-oral coccidia infection. The low/high levels of watering troughs also result in spillage into the litter, allowing high moisture accumulation that encourages development of large numbers of coccidial in the environment.

From the faecal samples analyzed, the mean oocysts count 1,142 OPGs in chickens in Kikuyu, subcounty indicated moderate counts. The mean opg observed in this study is comparable to that reported by Labana *et al.,* (2024). However, the intensity recorded in the present study is higher than that reported by Sumo *et al* (2024), but lower than that reported by Ola-Fadusin *et al.,* (2018). The higher intensity recorded in this study may be due to the fact that majority of respondents change litter on monthly basis, the positioning of feed and water troughs and poor farm hygiene lead to favorable environment for the development of coccidia oocyst hence high intensity of the parasite. The mean opg observed here indicates subclinical infections. A high intensity of Eimeria infections in chicken cause among others reduced growth rate, low productivity, mortalities and economic losses to the farmers.

There are several factors that could explain the high prevalence and intensity of coccidiosis in the current study. Among these were wrong placements of feeding troughs that encouraged the birds to roost on them, leading to contamination with the birds' faecal droppings, poor placement of watering troughs that resulted in water spillage and high moisture accumulation, and the long intervals between litter changes that allowed accumulation of coccidia infective. This was in agreement with observations made by Dunlop and Selle, (2016), where poor hygienic conditions were associated with heavy coccidial infections in a poultry farm.

Out of the nine *Eimeria* species that are specific to chicken, *E. praecox*, *E. mitis*, *E. necatrix*, E. *maxima*, *E. brunetti,* and *E. tenella* were identified in this study. The most common species was *E. praecox* at a prevalence of (26.5%). This finding was in agreement with those of Tongkamsai *et al*., (2025), who also observed the dominance of this species at a prevalence of 40%. However, this differed from those by Jatau *et al*., (2012) who observed *E. maxima* (58.6 %) as the dominant species. The predilection sites of the observed species are: *E. tenella;* ceca, *E. praecox;* duodenum and proximal jejunum, *E. maxima;* jejunum and ileum, *E. brunetti*; ileum and rectum, *E. mitis*; ileum and *E. necatrix*; central jejunum and ceca, thus causing intestinal, cecal, and rectal coccidiosis. their consequences of their infection are: decreased weight gain, poor feed conversion, severe diarrhea, sometimes leading to mortalities (Zhou *et al*., 2024).

In the present study, the mean weights and the daily weight gains in the experimentally infected chicks and those of the non-infected control group were not significantly different (ANOVA, $P > 0.05$) during the pre-infection period. However, 10 days post-infection, the mean weights and the daily weight gains for chicks in the non-infected control group (GN1), were significantly higher (ANOVA, $P > 0.05$) than those in the four experimentally infected groups (GP2), (GA3), (GT4), and (GS5). In which Diclazuril induced a significant reduction in the mean oocyst shedding when compared with infected non-treated controls. Coccidial infections in chicken causes damage to the intestinal epithelium, thus interfering with the digestive and absorptive functions and consequent feed utilization (Amer *et al.,* 2010). This may thus explain the decreased weight gains in the infected groups of chicks as was observed in the current study.

In the present study, all infected chick groups first shed Eimeria/coccidia oocysts on the 6th DPI, which also coincided with the 1st day of clinical coccidiosis and of anticoccidial administration, but not in the uninfected control group (GN1). Significantly (ANOVA, $P > 0.05$) higher levels of oocyst counts were detected in infected and untreated (GP2) compared to those that received anticoccidial treatments. The high mean counts persisted at about the same level to the end of the experiment and the consequent damage during the developmental period further supports the significantly lower weight / daily weight gains observed in this group.

Generally, in chickens, the post-treatment oocysts count shows a reduction following anticoccidial administration work done by Elkomy *et al* (2015), unless in cases of resistance, as reported by Ojimelukwe *et al.,* (2018). In the current study, the significant decline in levels of Eimeria oocyst counts in all the treated groups from 2nd day of treatment to the termination of the experiment (10DPI/5DPT) was an indicator that the three anticoccidial tested were effective in reducing their discharge and the level of environmental contamination. These observations were similar to those reported by Amer *et al.,* (2010), different from those reported by Karmakar *et al.,* (2025), who reported an increase in mean oocyst count on 7th day post-infection, indicating resistance to the drugs used.

CONCLUSIONS

- Based on the high prevalence (87.5%) and intensity of coccidia infection in this study, it can be concluded that farmers' knowledge, attitude, and practices in Kikuyu sub-county were not sufficient to prevent and control chicken coccidiosis.
- Six *Eimeria* species identified were E. *maxima*, E. *brunetti*, E. *tenella*, E. *mitis*, E. *necatrix,* and E. *praecox,* with *E. praecox* being the most prevalent.
- Over sixty per cent (62.0%) of the respondents purchased anticoccidial drugs from Agro-vets without pharmacological knowledge, leading to misuse of anticoccidial drugs, thus a high risk of anticoccidial resistance.
- All three anticoccidials commonly used by farmers in Kikuyu Sub-County were effective in the treatment of coccidia infections in chicken, and Toltrazuril was the most effective.

Recommendations

- The study recommends that farmers be trained on farm hygiene, biosecurity, and proper drug use.
- More research to be done to confirm Eimeria species at the molecular level, and their pathogenicity
- Frequent anticoccidial efficacy tests should be conducted, and search for alternative anticoccidial remedies to circumvent drug resistance.

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REFERENCES

- Abed Alia Y Yakoob, H., 2013. Study the protective and therapeutic effects of crude garlic on mortality, oocyst output, and hepatic lesions in experimental infection with Eimeria stiedae in domestic rabbits. *Basrah Journal of Veterinary Research*, *12*(2), pp.314-331.
- Adebo, G.M. and Adesida, I., 2017. The Thrust and Tug Nexus for Okada 'Commercial motorcyclist' Business among Youths in Ekiti and Ondo States, Nigeria: Implications for Youth Development. *Asian Journal of Agricultural Extension, Economics and Sociology*, *15*(2), pp.1-10.
- Akintunde, O.K. and Adeoti, A.I., 2014. Assessment of factors affecting the level of poultry disease management in Southwest, Nigeria. *Trends in Agricultural economics*, *7*(2), pp.41-56.
- Arabkhazaeli, F., Modrisanei, M., Nabian, S., Mansoori, B. and Madani, A., 2013. Evaluating the resistance of Eimeria spp. field isolates to anticoccidial drugs using three different indices. *Iranian Journal of parasitology*, *8*(2), p.234.
- Bush, A.O., Lafferty, K.D., Lotz, J.M. and Shostak, A.W., 1997. Parasitology meets ecology on its own terms: Margolis et al. revisited. *The Journal of parasitology*, pp.575-583.
- Hadipour, M.M., Olyaie, A., Naderi, M., Azad, F. and Nekouie, O., 2011. Prevalence of Eimeria species in scavenging native chickens of Shiraz, Iran. *African Journal of Microbiology Research*, *5*(20), pp.3296-3299.
- Hammond, D.M. and Long, P.L., 1973. The coccidia. Eimeria, Isospora, Toxoplasma, and related genera. *The coccidia. Eimeria, Isospora, Toxoplasma, and related genera.*
- Jatau, I.D., Sulaiman, N.H., Musa, I.W., Lawal, A.I., Okubanjo, O.O., Isah, I. and Magaji, Y., 2012. Prevalence of coccidia infection and preponderance of Eimeria species in free-range indigenous and intensively managed exotic chickens during the hot-wet season, in Zaria, Nigeria. *Asian Journal of Poultry Science*, *6*(3), pp.79-88.
- Kemboi, D.C., Chegeh, H.W., Bebora, L.C., Maingi, N., Nyaga, P.N., Mbuthia, P.G., Njagi, L.W., and Githinji, J.M., (2013). Seasonal Newcastle disease antibody titer dynamics in village chickens of Mbeere District, Eastern Province, Kenya. *Livestock Research for Rural Development*, *25*(10), p.181.
- KNBS, V.I., 2019. Population by county and sub-county. *Kenya National Bureau of Statistics*.
- Margolis, L., Esch, G.W., Holmes, J.C., Kuris, A.M. and Schad, G., 1982. The use of ecological terms in parasitology (report of an ad hoc committee of the American Society of Parasitologists). *The Journal of parasitology*, *68*(1), pp.131-133.
- Ministry of Agriculture, Fisheries and Food, 1986. *The Analysis of Agricultural Materials–A Manual of the Analytical Methods used by the Agricultural Development and Advisory Service (ADAS)/Ministry of Agriculture, Fisheries and Food. 3e Reference book*, *427*.
- Mshelia, I.T., Atsanda, N.N., Bitrus, A.A., Adam, B.M., Fika, I.I., Balami, S.B., Jauro, S., and Malgwi, S.A., 2016. Retrospective study of selected endemic viral diseases of poultry diagnosed in Maiduguri, North-Eastern Nigeria. *Journal of Animal Health and Production*, *4*(2), pp.60-64.
- Mutinda, W.U., Nyaga, P.N., Njagi, L.W., Bebora, L.C., and Mbuthia, P.G. (2013). Gumboro disease outbreaks cause high mortality rates in Indigenous chickens in Kenya. *Bulletin of Animal Health Production Africa*, *61*, pp.571-578.
- Soulsby, E.J., 2005. Resistance to antimicrobials in humans and animals. *Bmj*, *331*(7527), pp.1219-1220.
- Yockey, R.D., 2016. *SPSS demystified: a simple guide and reference*. Routledge.