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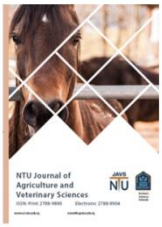

Knowledge, Attitude, and Practices of Poultry Farmers in Kwara State Concerning Chicken Coccidiosis and Its Control

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A B S T R A C T

This study is aimed at exploring the knowledge, attitude, and practice (KAPs) concerning chicken coccidiosis and to examine the usage of anticoccidials among poultry farmers in Kwara State, Nigeria. Information accessing the KAPs of chicken coccidiosis and its control was collected from one hundred and twenty-three poultry farmers using a semi-structured questionnaire. More number of farmers (121/123; 98.37%) had knowledge about chicken coccidiosis, with 16.26% of them documenting that it is caused by a protozoan. Higher number of the farmers believed chicken coccidiosis is economically important, preventable and treatable. More number of farmers (n = 106, 86.18%) had previously used anticoccidials in their farm compared to those that had not 17 (13.82%). The thiamine analogue alone of anticoccidial was the most used drug (n = 27, 25.47%; 95% CI = 18.14 – 34.52) used by farmers. The frequency of anticoccidial drug usage by farmers decreased as the number of drugs being used increased. Data from this study will assist the government and other relevant stakeholders in identifying areas where farmers in Kwara State need to improve their knowledge, attitude, and practice concerning chicken coccidiosis for more effective disease management and improved productivity.

Introduction

In the last twenty years, there has been a dramatic increase in the poultry production all over the world with more than 90 million tons of chicken meat and 1.1 trillion eggs produced yearly [1, 2]. The dramatic increase in poultry production is due to the relatively small capital required to start off, the ease of feed availability, the fast maturity of the birds and the universal acceptance in the consumption of poultry products [3, 4]. The fewer religious and social taboos associated with the production, marketing and consumption of poultry products in relation to other livestock species makes it a preferred protein source worldwide [5]. Poultry production contributes significantly to the socio-economic development of many developing countries of the world including Nigeria [6]. Poultry is an important component of the livestock subsector in Nigeria, and it has developed to the level of a commercial enterprise involving thousands of birds which provides employment, income, and animal protein for rural and urban dwellers as well as manure for crop production [7, 8].

Coccidiosis in poultry is caused by a protozoal parasite of the Phylum Apicomplexa belonging to the genus *Eimeria* [9]. *Eimeria* species invade the mucosa and damage the epithelial lining of the infected intestinal cells resulting in enteritis, malabsorption, and reduced feed conversion efficiency, significantly affecting poultry health, welfare, productivity, and reproductivity [10, 11]. Coccidiosis is usually controlled by a combination of chemoprophylaxis, vaccination, good hygienic practices and biosecurity [10, 12]. While these measures have shown to be effective in preventing clinical outbreaks, the highly resistant nature of oocysts, drug resistance, poor hygiene and biosecurity, and high cost of vaccines are contributing to the persistence of *Eimeria* parasites in poultry establishments in developing countries [13, 14].

The positive attitude of farmers and their compliance with disease control measures are a function of correct perception and accurate knowledge of the disease [15]. To achieve success in the control of diseases including coccidiosis, efforts must be made to assess and improve what is known and done about chicken coccidiosis among poultry farmers [10]. Previous studies have evaluated the Knowledge, Attitude, and Practices (KAPs) of chicken coccidiosis in commercial poultry farms in other parts of Nigeria [10, 16]. Other authors in different parts of Nigeria had assessed the adoption and usage of anticoccidial drugs and vaccines [12, 17, 18], with their findings revealing different levels of practices and identifying areas that should be improved for effective control of chicken coccidiosis. There is, however, a dearth of information concerning the KAPs of poultry farmers concerning chicken coccidiosis in Kwara State, Nigeria. This study, therefore, is aimed at exploring the KAPs concerning chicken coccidiosis and to examine the usage of anticoccidials among poultry farmers in Kwara State, Nigeria.

Materials and Methods

Study Area

This study was conducted in Kwara State, North central Nigeria. Kwara State is located between latitude 8°05N and 10°15N, longitude 2°73E and 6°13E. It is located in the middle belt within the Forest-Savanna region of Nigeria. The state has a total population of about 3 million persons and covers a total area of 36,825 km2, which is approximately 8% of the total land area of Nigeria. The state records an average annual rainfall of between 112.8 cm and 146.9 cm and a mean annual temperature ranging from 22.1°C to 33.3°C. It has a mean relative humidity of 49.6% [19, 20].

Study Design

This study involved getting information from a total of 123 poultry farmers in Kwara State. Willingness to participate in the survey and condition of confidentiality were among the criteria for the selection. The questionnaire was given to poultry farmers to assess their Knowledge, Attitude, and Practices (KAPs) about chicken coccidiosis and its control. The farmers were guided on how to fill out the questionnaire.

Questionnaire Administration

The study was conducted using a semi-structured questionnaire. The questionnaire was designed to collect data about the management practices of poultry farms, the knowledge, attitude, and practice of poultry farmers about chicken coccidiosis and its control.

Data Analyses

Data generated were compiled on a Microsoft Excel spreadsheet and then exported to the Statistical Package for Social Sciences (SPSS) (IBM SPSS Statistics 22) where the summary statistics of all categorical variables were performed. Statistic presented in percentages and 95% confidence intervals was performed.

Results

Management Practices among Poultry Farms

The management practices of poultry farmers in Kwara State showed that most of the farmers had a flock size of between 100 to 500 birds (21/123; 17.07%), while 7.32% of the

respondents had less than 100 birds in their farms (this category been the lowest). The other farmers had flock sizes and prevalences of 501 – 1000 (8.94%), 1001 – 2000 (13.01%), 2001 – 4000 (14.63%), 4001 – 8000 (15.45%), 8001 – 12000 (14.63%), and >12000 (8.94%). In the aspect of the management systems in which the poultry are housed, most farmers raised their poultry using the deep litter system only (54/123; 43.90%), while 30 (24.39%) and 39 (31.71%) of the farmers raised their poultry using cage system only and cage + deep litter systems respectively. Forty-eight out of the one hundred and twenty-three farmers kept only broilers representing 39.02% with a 95% confidence interval of 30.86 – 47.85. Thirty-three, sixteen, four, and three kept layers alone, broilers + layers, layers + turkeys, and broilers + turkeys with percentages of 26.83%, 13.01%, 3.25% and 2.44% respectively. A farmer each kept noilier alone, broilers + cockerels, and broilers + noilier. Sixteen of the farmers (13.01%) raised more than two poultry species at the same time and these poultry species included the other poultry species mentioned above along with local chickens, ducks, and guinea fowls. More farmers (82/123; 66.67%; 05% CI = 57.94 – 74.38) raised poultry alone with 41 (33.33%; 95% CI = 25.62 – 42.06) of the farmers raising other animals in their poultry farms. Of these 41 farmers, 29 (70.73%) raised ruminants (one or more of cattle, sheep, or goats) in their poultry farms. Four, three, and two of the farmers raised pigs, ruminants + fish, and dogs in their poultry farms representing 9.76%, 7.32% and 4.88% respectively. A farmer each reported that they also raised dogs + ruminants, pigs + ruminants + fish, and pigs + ruminants + rabbits + snakes in their poultry farms (Table 1).

Level of Knowledge about Coccidiosis

More number of farmers (121; 98.37%) had knowledge about coccidiosis in poultry compared to those that did not (2; 1.63%). On the causes of coccidiosis, only 16.26% (20/123) documented that it is caused by a protozoan. Seventeen of the farmers do not know the cause of coccidiosis representing 13.82% of the respondents. Forty-seven, twenty, nine, five, and three poultry farmers documented that coccidiosis is caused by poor management/dirty poultry pens, eggs, wet faeces, medications, and feed sources representing 38.21% 16.26%, 7.32%, 4.07%, 2.44%, and 0.81% of the respondents respectively. A farmer (0.81%; 95% CI = 0.14 – 4.46) each documented that coccidiosis is caused by light sources and overcrowding. Seventy-five farmers (60.98%; 95% CI = 52.15 – 69.14) reported that coccidiosis is transmitted by ingestion, while a farmer (0.81%; 95% CI = 0.14 – 4.46) each documented that the disease is transmitted through airborne and from the hatchery. Others reported that coccidiosis is transmitted by contact (26/123, 21.14%) and 16.26% (20/123) reported not knowing how the disease is transmitted. A vast number (92/123. 74.80%) of farmers documented bloody faeces as the sign associated with coccidiosis in poultry. Over half the number of the poultry farmers (n = 69, 56.10%) had not heard about anticoccidial resistance, with the rest (n = 54, 43.90%) reporting otherwise. On the prevention of anticoccidial resistance, 73 (59.35%; 95% CI = 50.51 – 67.62) had no knowledge, 33 (26.83%; 95% CI = 9.79 – 35.27) reported that it is by using different anticoccidials, while a farmer said it is by culling infected birds. Also, 4, 3, and 2 farmers reported that resistance can be managed by increasing anticoccidial dosage (3.25%), avoiding repeated treatments (2.44%), and conducting laboratory examinations; and vaccination (1.63%) (Table 2).

Attitude of Poultry Farmers Concerning Coccidiosis

The attitude of poultry farmers in Kwara State concerning coccidiosis is presented in Table 3. More of the poultry farmers (n = 106, 86.18%) think coccidiosis is an economically important disease, while 13.82% (n = 17) think it is not. One hundred and thirteen farmers (91.87%; 95% CI = 85.68 – 95.52) think coccidiosis is preventable, while 10 (8.13%; 95% CI = 4.48 – 14.32) think it is not. About 98.00% of the farmers think coccidiosis is treatable, while the others think it is not. Seventy farmers (56.91%) documented to have previously had an outbreak of coccidiosis, while others (53, 43.09%) reported otherwise. Of those that had had an outbreak, 51 (72.86%) reported the outbreaks to have occurred once in a while, 16 (22.86%) and 3 (4.29%) reported that the outbreak occurred often and once in 3 months respectively. A larger number of the farmers (n = 103, 83.74%; 95% CI = 76.22 – 89.22) think vaccines cannot be used for the control of coccidiosis, while 20 of the farmers (16.26%; 95% CI = 10.78 – 23.78) thought otherwise.

Practices among Poultry Farmers about Coccidiosis

More number of farmers (n = 106, 86.18%) had previously used anticoccidials in their farm compared to those that had not 17 (13.82%). Among the farmers that had used anticoccidials in their farms, 6, 36, and 64 used it for prevention, treatment, and both prevention and treatment purposes representing a percentage of 5.66%, 33.96%, and 60.38% respectively. Ninety-seven of the farmers (91.51%) administered anticoccidials through water, while 9 (8.49%) through feed and water. On the frequency of anticoccidial administration by farmers, 35, 23, 17, 14, 7, 6, and 2 farmers administered the drug once a while, 2 weeks – <1 months interval, regularly, <2 weeks interval, when there are clinical signs, 1 – 3 months interval, and >3 months interval and this represents 33.02%, 21.70%, 16.04%, 13.21%, 6.60%, 5.66%, and 1.89% respectively. A farmer (0.94%; 95% CI = 0.17 – 5.15) each administered anticoccidials

during the wet season and twice per production. Forty-nine of the farmers (46.23%) began the administration of anticoccidials to their birds when they were <3 weeks old, while 38 (35.85%), 12 (.32%), and 7 (6.60%) farmers began when their birds were 3 – <6 weeks, 6 – 9 weeks, and when clinical signs were seen respectively. More number of farmers (109, 88.62%) had never used vaccines for the control of coccidiosis in their farms compared to those that had (14, 11.38%). Among the farmers that had used vaccines for the control of coccidiosis, 3 (21.43%) used Immunocox® and LaSota vaccines separately, 2 (14.29%) used Evalon® and Livacox® vaccines separately, and 1 (7.14%) used Coccivac-D® + Evalon® vaccines, Lasota + Gumboro vaccines, anticoccidials, and Embazin-Forte® separately (Table 4).

Anticoccidial Usages for the Control of Coccidiosis

Based on the classes/groups and components of anticoccidial usages among poultry farmers in Kwara State, thiamine analogue alone was the most used (n = 27, 25.47%; 95% CI = 18.14 – 34.52) followed by aminopyrimidine + sulphonamides + vit K (n = 21, 19.81%; 95% CI = 13.34 – 28.39), sulphonamides alone (n = 19, 17.92%; 95% CI = 11.79 – 26.31), and guanidine alone (n = 11, 10.38%; 95% CI = 5.89 – 17.63). Sulphonamides + thiamine analogue and pyrimidine derivative + sulphonamides + vit K were the least used having (n = 1, 0.94%; 95% CI = 0.17 – 5.15) each. Guanidine + sulphonamides and guanidine + thiamine analogue usage had 2 frequencies and 1.89% each, sulphonamides + vit K had 3 frequencies and 2.83%, and aminopyrimidine + guanidine + sulphonamides + vit K with 4 frequency and 3.77%. Others were: aminopyrimidine + thiamine analogue + sulphonamides + vit K with 7 frequency and 6.60% and other components with 8 frequency and 7.55% (Table 5).

The classes and constituents of anticoccidial usage among poultry farmers in Kwara State are presented in Table 6. Among the guanidine alone class, diclazuril was the more used drug (n =8, 72.73%), while toltrazuril was less used (n =3, 27.27%). In the sulphonamides alone class sulphaquinoxaline was the more used drug (n =13, 68.42%), with Sulfadimidine Sodium + Sulfaquinoxaline (6, 31.58%) being the less used. In the aminopyrimidine + guanidine + sulphonamides + vit K class/group, sulphaquinoxaline + diaveridine + toltrazuril + vit K and sulfadimidine sodium + sulfaquinoxaline sodium + diaveridine + Diclazuril + vit K were used at the same frequency and percentage (n = 2, 50.00%). Among the others, tetracycline was the most used (n = 6, 75.00%) with bitter leaf and sulphaquinoxaline + diaveridine + metronidazole + tetracycline + vit K having the least usage with 1 frequency and 12.50% each. In the other classes/ groups, only one drug constituent was used.

The frequency of anticoccidial drug usage by farmers decreased as the number of drugs being used increased. Sixty-eight farmers used one anticoccidial drug (64.15%; 95% CI = 54.67 – 72.64), 32 farmers used two drugs (30.19%; 95% CI = 22.27 – 39.49), 4 farmers used three (3.77%; 95% CI = 1.48 – 9.30), and 2 farmers used four anticoccidial drugs (1.89%; 95% CI = 0.52 – 6.62) (Table 7).

Discussion

Poor farm management practices, poor biosecurity measures, and uninformed managerial decisions will continue to impair the success of chemoprophylaxis and vaccination against chicken coccidiosis [10, 21]. Thus, assessing the knowledge and attitude of farmers about coccidiosis and the control measures they adopt is essential to designing effective control strategies. In this current study, 123 commercial poultry farmers resident in Kwara State were questioned.

The higher number of farmers rearing their birds using the deep litter system could be attributed to the lower capital requirements for a deep litter system than a battery cage system of the same flock size, but deep litter system predisposes chickens to a higher risk of coccidiosis outbreak [22], which could have informed the report of a higher number of farmers to have experienced an outbreak of coccidiosis in their farms. The deep litter type of management offers optimal conditions of temperature and humidity for oocyst sporulation, thus encouraging infection. Also, rearing birds on deep litter favors the accumulation of oocysts, and birds are constantly in close contact with sporulated oocysts in the litter [23]. Coccidiosis transmission is also possible in battery cage systems, as houseflies are implicated as critical mechanical vectors [24].

The finding that broilers are the most kept chicken species by farmers in this study may be attributed to the quick production time of this chicken species as most farmers are into farming for a fast means of financial turnover. Also, broiler farming is believed to be a highly profitable choice for poultry farmers. Keeping poultry with other animal species is a practice among poultry farmers as Arowolo et al. [18] reported sizeable numbers of poultry farmers in southwestern Nigeria raised poultry with other livestock species in their farms.

The fact that a higher number of the farmers had knowledge about coccidiosis could be that they got the knowledge from themselves as poultry farmers in Kwara State gather together monthly for a meeting. This finding is anticipated since most farmers had previously experienced an outbreak of coccidiosis in their farms before. Moreover, *Eimeria* species the causative agents of

coccidiosis, are ubiquitous protozoan parasites of poultry that occur everywhere chickens are kept [25]. Also, Adeyemi et al. [16] and Adeyemi et al. [10] reported that more poultry farmers knew about coccidiosis.

Most of the farmers did not know the cause of coccidiosis in poultry, had not heard about anticoccidial resistance, and did not know and had not used vaccines for the prevention and control of coccidiosis in poultry. This is an indication that there is a need for training, seminars, conferences, and workshops on the diseases of poultry including coccidiosis. Most of the farmers were correct on the way coccidiosis is transmitted and the clinical signs associated with the disease. They reported that the protozoan disease is transmitted by the ingestion of contaminated feed and water and that blood in faeces is the major clinical sign associated with the infection. To prevent misdiagnosis, farmers are encouraged to employ the services of veterinarians to confirm the occurrence of coccidiosis by carrying out a proper parasitological laboratory diagnosis [10]. Chicken coccidiosis usually occurs through ingesting feed or water contaminated with sporulated oocysts of *Eimeria* species [26, 27].

Anticoccidial resistance can be prevented by the use of the shuttle and rotation drug programs [28]. In the shuttle drug program, one anticoccidial drug is incorporated into the starter feed for the first 2 to 3 weeks, then another type in the growers, then a third type in the finisher diet, and finally, a fourth type during withdrawal [29]. Rotation programs involve the alternation of the use of two or more drugs at intervals of several months, in successive flocks. The majority of the rotation programs involve the alternation of a synthetic drug employed in the starter and/or grower feed [28, 30]. Thirty-three of the farmers documented that using different anticoccidials can be used to prevent anticoccidial resistance; this may imply that the farmers were referring to the shuttle and rotation drug programs. Also, since a number of the farmers used more than one type of anticoccidial drug in their farm buttresses this assumption.

Most of the farmers in the study area think coccidiosis is an economically important disease. In the real situation of things, chicken coccidiosis is an economically important disease of poultry worldwide as the global cost of the protozoan to the poultry industry is estimated to be over US$2.4 billion per annum. These costs involve medication of the chickens, losses due to morbidity, poor growth, and mortality of the chickens surviving the disease [25].

Most of the farmers think coccidiosis can be prevented and treated. The reason they documented that they use anticoccidials in the prevention and treatment of the protozoan disease in poultry. This is similar to the report of Etuk et al. [31] and Adeyemi et al. [10] in their studies carried out in Akwa-Ibom and Lagos States, Nigeria where more farmers use anticoccidial drugs for the prevention and treatment of chicken coccidiosis. The frequency and onset of anticoccidial drug administration in poultry farms in Kwara State is an indication that chicken coccidiosis is a great challenge to the poultry sector in Kwara State. Chicken coccidiosis is recognized as the parasitic disease that has the greatest economic impact on poultry industries throughout the world [25, 27]. Most of the respondents reported that they administer anticoccidial drugs through drinking water, with very few documenting that they administer antcoccidials through in-feed administration. This aligns with reports of other studies [10, 12, 18]. Coccivac-D®, Evalon®, Immunocox®, and Livacox® were the vaccines used in the prevention and control of chicken coccidiosis in this study area. The variety of vaccines used in this area is more than the variety of vaccines reported to be used in other places in Nigeria where they documented the use of Immucox and Livacox in the prevention and control of chicken coccidiosis [10, 17].

Anticoccidials are broadly classified into ionophores and chemicals. The latter includes synthetic chemicals such as amprolium, sulphonamides, and diclazuril, while the former (e.g. lasalocid, narasin, monensin) are fermentation products of fungi [32]. From this study, only synthetic (chemicals) anticoccidials are used by farmers and none use ionophores. In previous studies in other places in Nigeria, no poultry farmer used ionophores in the treatment of chicken coccidiosis in their farms [10, 12, 31]. On the other hand, Arowolo et al. [18] were the only researchers who documented the use of ionophores anticoccidials in the treatment of chicken coccidiosis among poultry farms in Nigeria, and only a small proportion of the farmers used it. The non-usage of ionophores by poultry farmers in this study area could be connected to the relatively high cost of this class of anticoccidials [12, 32]. Resistance has been shown to develop faster to chemical drugs because they kill and destroy the *Eimeria* species [33], while ionophores, on the other hand, do not completely kill and destroy their targets. Instead, they permit leakage of small viable oocysts that circulate within a poultry shed to allow birds to acquire immunity [34]. This implies that the sole use of chemical drugs by farmers in this study area suggests that *Eimeria* species populations in the study area might be resistant to commonly used anticoccidials [10]. Among the chemical anticoccidials used, thiamine analogue and sulphonamides are the most used classes, while amprolium hydrochloride and sulphaquinoxaline are the most used drugs. The use of these drugs may be linked to the fact that they are readily affordable, effective against coccidiosis, and accessible.

Conclusion

This study showed that poultry farmers in Kwara State have some level of overall knowledge of chicken coccidiosis. Synthetic anticoccidials were majorly used to treat and prevent the disease. The use of vaccines in the prevention of chicken coccidiosis is not usually practiced by poultry farmers. There is need for educating and training poultry farmers about chicken coccidiosis. Data from this study will assist the government, veterinarians, poultry extension workers, and other relevant stakeholders in identifying areas where farmers in Kwara State need to improve their knowledge, attitude, and practice concerning chicken coccidiosis for more effective disease management and improved productivity.

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Conflict of interest

The authors declare that there is no conflict of interest of any kind regarding the publication of this article.

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Table 1. Management practices among poultry farms in Kwara State.

Variables	Frequency	Percentage (%)	95% CI
Flock size (birds)	**(N=123)**		
<100	9	7.32	3.90 – 13.32
100 – 500	21	17.07	11.45 – 24.69
501 – 1000	11	8.94	5.07 – 15.31
1001 – 2000	16	13.01	8.17 – 20.09
2001 – 4000	18	14.63	9.46 – 21.95
4001 – 8000	19	15.45	10.12 – 22.87
8001 – 12000	18	14.63	9.46 – 21.95
>12000	11	8.94	5.07 – 15.31
Management system	**(N=123)**		
Cage system only	30	24.39	17.65 – 32.68
Deep litter system only	54	43.90	35.45 – 52.72
Cage + deep litter systems	39	31.71	24.14 – 40.38
Types avian species kept	**(N=123)**		
Broilers alone	48	39.02	30.86 – 47.85
Layers alone	33	26.83	9.79 – 35.27
Noilier alone	1	0.81	0.14 – 4.46
Broilers + Cockerels	1	0.81	0.14 – 4.46
Broilers + Layers	16	13.01	8.17 – 20.09
Broilers + Noilier	1	0.81	0.14 – 4.46
Broilers + Turkeys	3	2.44	0.83 – 6.93
Layers + Turkeys	4	3.25	1.27 – 8.06
More two avian species	16	13.01	8.17 – 20.09
Are poultry kept alone in the farm	**(N=123)**		
Yes	82	66.67	57.94 – 74.38
No	41	33.33	25.62 – 42.06
Other animals also kept in farm	**(N=41)**		
Dogs	2	4.88	1.35 – 16.14
Pigs	4	9.76	3.17 – 24.06
Ruminants	29	70.73	55.52 – 82.39
Dogs + Ruminants	1	2.44	0.43 – 12.59
Ruminants + Fish	3	7.32	2.52 – 19.43
Pigs + Ruminants + Fish	1	2.44	0.43 – 12.59
Pigs + Ruminants + Rabbits + Snakes	1	2.44	0.43 – 12.59

CI = confidence interval; N =number of respondents per category

Table 2. Knowledge about coccidiosis among poultry farmers in Kwara State.

Variables	Frequency	Percentage (%)	95% CI
Knowledge about coccidiosis	**(N=123)**		
Yes	121	98.37	94.27 – 99.55
No	2	1.63	0.45 – 5.74
Causes of coccidiosis	**(N=123)**		
Do not know	17	13.82	8.81 – 21.02
A Protozoan	20	16.26	10.78 – 23.78
Feed sources	3	2.44	0.83 – 6.93
From eggs	20	16.26	10.78 – 23.78
Light source	1	0.81	0.14 – 4.46
Medications	5	4.07	1.74 – 9.16
Overcrowding	1	0.81	0.14 – 4.46
Poor manage/dirty poultry pens	47	38.21	30.11 – 47.03
Wet faeces	9	7.32	3.89 – 13.32
Transmission of coccidiosis	**(N=123)**		
Do not know	20	16.26	10.78 – 23.78
Airborne	1	0.81	0.14 – 4.46
By contact	26	21.14	14.85 – 29.17
By ingestion	75	60.98	52.15 – 69.14
From hatchery	1	0.81	0.14 – 4.46
Signs of coccidiosis	**(N=123)**		
Do not know	7	5.69	2.78 – 11.28
Anorexia + loss of weight	3	2.44	0.83 – 6.93
Blood in faeces	92	74.80	66.45 – 81.64
Blood in faeces + Depression	4	3.25	1.27 – 8.06
Blood in faeces + Other signs	4	3.25	1.27 – 8.06
Depression	3	2.44	0.83 – 6.93
Depression + Other signs	4	3.25	1.27 – 8.06
Pale comb + ruffled feather	3	2.44	0.83 – 6.93
Wet and green faeces	1	0.81	0.14 – 4.46
Blood faeces + Depression + Death	2	1.63	0.45 – 5.74
Heard about anticoccidial resistance	**(N=123)**		
Yes	54	43.90	35.45 – 52.72
No	69	56.10	47.28 – 64.55
How can drug resistance be prevented	**(N=123)**		
No idea	73	59.35	50.51 – 67.62
By avoiding repeated treatments	3	2.44	0.83 – 6.93
By conducting laboratory examinations	2	1.63	0.45 – 5.74
By increasing anticoccidial dosage	4	3.25	1.27 – 8.06
By observing good biosecurity	5	4.07	1.74 – 9.16
By using different anticoccidials	33	26.83	9.79 – 35.27
By vaccination	2	1.63	0.45 – 5.74
Culling infected birds	1	0.81	0.14 – 4.46

CI = confidence interval; N =number of respondents per category

Table 3. The attitude of poultry farmers in Kwara State concerning coccidiosis.

Variables	Frequency	Percentage (%)	95% CI
Do you think coccidiosis an economic important disease	**(N=123)**		
Yes	106	86.18	78.98 – 91.19
No	17	13.82	8.18 – 21.02
Do you think is coccidiosis preventable	**(N=123)**		
Yes	113	91.87	85.68 – 95.52
No	10	8.13	4.48 – 14.32
Is coccidiosis treatable			
Yes	120	97.56	93.07 – 99.17
No	3	2.44	0.83 – 6.93
Have you ever had an outbreak of coccidiosis in your farm	**(N=123)**		
Yes	70	56.91	47.68 – 65.71
No	53	43.09	34.68 – 51.92
How often was the out break	**(N=70)**		
Often	16	22.86	14.59 – 33.95
Once in 3 months	3	4.29	1.47 – 11.86
Once a while	51	72.86	61.46 – 81.88
Do you think vaccines can be used for the control of coccidiosis	**(N=123)**		
Yes	20	16.26	10.78 – 23.78
No	103	83.74	76.22 – 89.22

CI = confidence interval; N =number of respondents per category

Table 4. Practices among poultry farmers in Kwara State about coccidiosis.

Variables	Frequency	Percentage (%)	95% CI
Have you ever used anticoccidials	**(N=123)**		
Yes	106	86.18	78.98 – 91.19
No	17	13.82	8.81 – 21.02
Reason for the use of anticoccidials	**(N=106)**		
For prevention	6	5.66	2.62 – 11.80
For treatment	36	33.96	25.65 – 43.40
For prevention and treatment	64	60.38	50.86 – 69.17
Mode of anticoccidial administration	**(N=106)**		
Through water	97	91.51	84.65 – 95.47
Through feed and water	9	8.49	4.53 – 15.35
How often do you administer anticoccidials	**(N=106)**		
Once a while	35	33.02	24.80 – 42.43
<2 weeks interval	14	13.21	8.03 – 20.95
2 weeks – <1 months interval	23	21.70	14.92 – 30.46
1 – 3 months interval	6	5.66	2.62 – 11.80
>3 months interval	2	1.89	0.52 – 6.62
During wet season	1	0.94	0.17 – 5.15
Twice per production	1	0.94	0.17 – 5.15
When there are clinical signs	7	6.60	3.24 – 13.01
Regularly	17	16.04	10.26 – 21.19
At what age do you start anticoccidial administration to your flock	**(N=106)**		
<3 weeks	49	46.23	37.03 – 55.68
3 – <6 weeks	38	35.85	27.36 – 45.33
6 – 9 weeks	12	11.32	6.60 – 18.75
Where are clinical signs	7	6.60	3.24 – 13.01
Have you used vaccines to control against coccidiosis before	**(N=123)**		
Yes	14	11.38	6.90 – 18.20
No	109	88.62	81.80 – 93.10
What had you used as vaccines against coccidiosis	**(N=14)**		
Coccivac-D® + Evalon® vaccines	1	7.14	1.27 – 31.47
Evalon® vaccine	2	14.29	4.01 – 39.94
Immunocox® vaccine	3	21.43	7.57 – 47.59
Livacox® vaccine	2	14.29	4.01 – 39.94
LaSota vaccine	3	21.43	7.57 – 47.59
Lasota + Gumboro vaccines	1	7.14	1.27 – 31.47
Anticoccidials	1	7.14	1.27 – 31.47
Embazin-Forte®	1	7.14	1.27 – 31.47

CI = confidence interval; N =number of respondents per category

Table 5. Classes/groups and components of anticoccidial usages among poultry farmers in Kwara State (N=106).

Classes/groups of drugs used for treatment	Frequency	Percentage (%)	95% CI
Guanidine alone	11	10.38	5.89 – 17.63
Sulphonamides alone	19	17.92	11.79 – 26.31
Thiamine analogue alone	27	25.47	18.14 – 34.52
Guanidine + Sulphonamides	2	1.89	0.52 – 6.62
Sulphonamides + Thiamine analogue	1	0.94	0.17 – 5.15
Guanidine + Thiamine analogue	2	1.89	0.52 – 6.62
Aminopyrimidine + Thiamine analogue + Sulphonamides + Vit K	7	6.60	3.24 – 13.01
Aminopyrimidine + Sulphonamides + Vit K	21	19.81	13.34 – 28.39
Pyrimidine derivative + Sulphonamides + Vit K	1	0.94	0.17 – 5.15
Sulphonamides + Vit K	3	2.83	0.97 – 7.99
Aminopyrimidine + Guanidine + Sulphonamides + Vit K	4	3.77	1.46 – 9.30
Others	8	7.55	3.87 – 14.91

CI = confidence interval; N =number of respondents per category

Table 6. Classes/groups and constituents of anticoccidial usages among poultry farmers in Kwara State (N=106).

Classes/groups and constituents of drugs	Frequency	Percentage (%)	95% CI
Guanidine alone	**(N=11)**		
Diclazuril	8	72.73	43.44 – 90.25
Toltrazuril	3	27.27	9.75 – 56.56
Sulphonamides alone	**(N=19)**		
Sulphaquinoxaline	13	68.42	46.01 – 84.63
Sulfadimidine Sodium + Sulfaquinoxaline Sodium	6	31.58	15.37 – 53.55
Thiamine analogue alone	**(N=27)**		
Amprolium hydrochloride	27	100.00	87.55 – 100.00
Guanidine + Sulphonamides	**(N=2)**		
Sulphaquinoxaline + Toltrazuril + Diclazuril	2	100.00	34.24 – 100.00
Sulphonamides + Thiamine analogue	**(N=1)**		
Amprolium hydrochloride + Sulfadimidine sodium + Sulfaquinoxaline sodium	1	100.00	20.66 – 100.00
Guanidine + Thiamine analogue	**(N=2)**		
Amprolium hydrochloride + Diclazuril	2	100.00	34.24 – 100.00
Aminopyrimidine + Thiamine analogue + Sulphonamides + Vit K	**(N=7)**		
Amprolium hydrochloride + Sulphaquinoxaline + Diaveridine + Vit K	7	100.00	64.57 – 100.00
Aminopyrimidine + Sulphonamides + Vit K	**(N=21)**		
Sulphaquinoxaline + Diaveridine + Vit K	21	100.00	84.54 – 100.00
Pyrimidine derivative + Sulphonamides + Vit K	**(N=1)**		
Sulfamethoxazole + Trimethoprim + Vit K	1	100.00	20.66 – 100.00
Sulphonamides + Vit K	**(N=3)**		
Sulfachlopyrazine sodium + Vit K	3	100.00	43.85 – 100.00
Aminopyrimidine + Guanidine + Sulphonamides + Vit K	**(N=4)**		
Sulphaquinoxaline + Diaveridine + Toltrazuril + Vit K	2	50.00	15.00 – 85.00
Sulfadimidine Sodium + Sulfaquinoxaline Sodium + Diaveridine + Diclazuril + Vit K	2	50.00	15.00 – 85.00
Others	**(N=8)**		
Bitter leaf	1	12.50	2.24 – 47.09
Sulphaquinoxaline + Diaveridine + Metronidazole + Tetracycline + Vit K	1	12.50	2.24 – 47.09
Tetracycline	6	75.00	40.93 – 92.85

CI = confidence interval; N =number of respondents per category

Table 7. The number of different anticoccidial drugs used by poultry farmers in Kwara State (N=106).

Number of anticoccidial drugs	Frequency	Percentage (%)	95% CI
One	68	64.15	54.67 – 72.64
Two	32	30.19	22.27 – 39.49
Three	4	3.77	1.48 – 9.30
Four	2	1.89	0.52 – 6.62

CI = confidence interval; N =number of respondents per category