Prevalence of Avian Coccidiosis among Exotic Breed of Chickens within Bauchi Metropolis

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Abstract- A cross sectional study was conducted within Bauchi metropolis with the aim of determining the prevalence of poultry coccidiosis, associated risk factors and the different species of Eimeria among exotic breed of chickens. A total of 384 fecal samples which were randomly collected from live bird as fresh droppings or cutting open the intestine of slaughtered bird were examined consisting of 205 female and 179 male birds, 132 young and 252 adult birds, 231 broiler and 153 layer birds. The samples collected were subjected to simple floatation technique for qualitative studies. The different species of Eimeria were identified based on the shape and size of the oocyst. The overall prevalence rate was 26.9% (103/384). Higher prevalence rates of 30.3%, 34.8% and 33.2% was recorded in broiler, young, and female birds respectively. Ameerah farm recorded the highest prevalence rate from the various sampling sites (55.0%). A statistically significant difference (p<0.05) was observed among the breeds, age group and sampling sites. There was no significant difference (p>0.05) in the infection rate recorded in sex. Four species of Eimeria were identified (Eimeria tenella, E. necatrix, E. acervulina and E. maxima) with E. tenella having the highest infection rate (29.1%) in single infection and co-infection of E. tenella with E. acervulina had the highest prevalence (21.4%) in multiple infection. In conclusion, this survey demonstrated that coccidiosis is an important disease of poultry in Bauchi and as such, farmers are recommended to design appropriate strategies such practicing good bio security measures, proper sanitation, and administration of anticoccidial drugs prescribed by veterinarians. This will help in reducing the burden of this disease which will improve productivity of poultry as they serve as the major source of protein (meat and egg) in Bauchi and Nigeria at large.

Indexed Terms- Prevalence, Coccidiosis, Eimeria species, Bauchi, Risk factors

I. INTRODUCTION

Chickens are the most important class of the poultry species in Nigeria and other developing countries in terms of number and rate of investment. The poultry industry plays an important role in the provision of animal protein (meat and egg) to human being, and is in general vital in the national economy by generating revenues [30]. Losses in the poultry industry have been linked to poor management systems and diseases causing agents such as bacteria, viruses and parasites. Poultry coccidiosis, caused by the protozoan parasite of the genus Eimeria, remains one of the most important parasitic diseases in the poultry industry worldwide [28], [9]. The parasite colonize and infect the intestinal tract of different animals and birds [16] and the infection is been established through ingestion of feed or water contaminated with sporulated oocycts [5]. Infection with this parasite is characterized by dysentery, enteritis, diarrhea, which may bloody with certain *Eimeria species*, lower feed intake, interference with normal digestion and nutrient absorption, emaciation, dropping wings, and delayed sexual maturation [37], [7].

High incidence of coccidiosis is usually observed in poultry managed under intensive management system like deep litter due to increased likelihood of high oocysts accumulation in the litters [11], [30]. Furthermore, higher stocking densities have been linked with increased incidence of coccidiosis due to a higher rate of infection and transmission of the coccidian oocysts in dense flocks from one poultry house to another [21]. Indiscriminate use of anticoccidial drugs in feed and water has led to serious drug resistance problems [42].

Currently, there is paucity of information regarding the prevalence of coccidiosis in Bauchi, despite the fact that many people practice intensive system of rearing chickens. More so, the increasing demand of chicken as a source of protein (meat and egg) by the increasing human population saw an unprecedented growth and expansion of the poultry industry in Bauchi. Therefore, this study was conducted to determine the prevalence of coccidiosis among exotic chickens as well as identify the risk factors associated with its occurrence within Bauchi metropolis. This study will greatly help to develop control strategy against coccidiosis which will safeguard the industry from unnecessary lost.

II. MATERIALS AND METHODS

A. Study Area

Bauchi is a city in central Nigeria, with the number of residents exceeding 310,000 people, and the population of the city's metropolitan area is close to 1.5 million people. Centuries ago, the city was the capital of a large Sokoto Empire. Today it is an advanced transportation and commercial center, a tourist and recreation spot with some landmarks like the Yankari National Park, local monuments, etc. The latitude of Bauchi, Nigeria is **10.314159**, and the longitude is **9.846282**. Bauchi, Nigeria is located at Nigeria country in the cities place category with the gps coordinates of 10°18' 50.9724"N and longitude 9°50' 46.6152"E.

B. Sample Size Determination

The sample size was determined based on the formula recommended by [41].
$n = 1.962 \times Pexp (1- Pexp)/d2$
Where n = sample size required, Pexp = prevalence rate, d = desired absolute precision. Since the prevalence of coccidiosis in these breeds of chicken within Bauchi had not been studied earlier, 50% expected prevalence rate was assumed. A 95% confidence interval and 5% desired absolute precision was used [41]. These values had given the minimum required sample size equal to 384.

C. Sample Collection

Samples were collected between May 2019 amd September 2019. Fecal samples were collected from poultry dressing slap in Muda Lawal Market as well as from Pacific Farm in Fadaman Mada, Haib Farm opposite NAN agency, Zakari Poultry farm in Turum, College of Agriculture Poultry Farm, Ameerah Global Farm limited in Miri and ATBU Poultry farm. The fecal samples in the poultry farms were collected aseptically from the upper surface of the litter immediately after dropping of the feaces by the birds while in the dressing room, freshly eviscerated intestine of slaughtered chickens were cut open and the feces were squeezed out into a sterile labeled polythene bags and immediately transported to the Parasitology laboratory of Biological Sciences Department, Abubakar Tafawa Balewa University for further parasitological analysis. The age, breed and sex of the chickens from which the sample was collected were noted at the time of sampling.

D. Sample Examination

The samples were analysed microscopically. Before the microscopic observation, simple floatation technique was used to concentrate the oocysts in order to increase the sensitivity of the examination. The floatation solution was prepared by adding salt to a distilled water until the salt could no longer dissolve in the water (saturated salt solution). The diagnosis of the oocysts in the feaces was made using 10X optical lens of the microscope [39].

E. Eimeria species Identification

Identification of *Eimeria* spp, was based on the size and shape of the oocyst according to [20], key for coccidian species identification.

F. Statistical Analysis

Data were collected and analyzed initially in Microsoft office Excel version 2011 to obtain percentages and prevalence of coccidian oocysts. The prevalence (P) in percentage was calculated using the formula $P=d/n$, where d is the number of positive samples analyzed at that point in time and n is the total number of chickens sampled at that point in time [41]. The Software Program for Social Science (SPSS) statistical software version 22 was used for Chi-square statistical analysis. The statistically significant association between the risk factors and the infection was determined at $p<0.05$. For this analysis p value less than 0.05 was considered as significant whereas p value greater than 0.05 considered as non-significant.

III. RESULTS AND DISCUSSION

A. Results

Out of the 384 birds examined for coccidiosis, 103 (26.8%) were positive for coccidian oocysts. The prevalence of coccidiosis was significantly higher in broiler chickens 70 (30.3%) than layer chickens 33 (21.6%). Infection rates were 35 (19.6%) and 68 (33.2%) in female and male chickens respectively. Higher infection rate was observed in younger chickens 46 (34.8%) than adult chickens 57 (22.6%). A statistically significant difference (p<0.05) was observed among the breeds and age group. However, there was no significant difference (p>0.05) in the infection rate recorded between the two sexes (TABLE I).

Based on the sampling sites, higher prevalence of coccidiosis 22 (55.0%) was observed in Ameerah Farm while prevalence of 31 (36.1%), 9 (23.1%), 16 (35.6%), 13 (21.7%), 7 (17.5%) were observed from Haib Farm, Pacific Farm, Zakari Poultry Farm, Muda Lawal dressing slap, and A.T.B.U Poultry Farm, respectively. However, least prevalence was observed in samples collected from College of Agric Poultry Farm 5 (6.8%). The prevalence of coccidiosis in the different sampling sites was statistically significant (TABLE II).

Four Emeria species: *E. tenella, E. acervulina, E. necatrix* and *E. maxima* were identified as single and/or mixed infections, as a result of *E. tenella* co-infection with other species. Single infection occurrence recorded was 65 (61.9%) while mixed infections was 38 (36.2%) of the total infection. Eimeria tenella occurred most frequently with prevalence of 30 (29.1%) as single infection, whereas the prevalence of 17 (16.5%), 12 (11.7%), and 6 (5.8%) were observed in Eimeria necatrix, Eimeria acervulina and Eimeria maxima respectively, as single infection. Co-infection of Eimeria tenella with Eimeria acervulina was found to have higher prevalence 22 (21.4%) than co-infection with Eimeria necatrix 13 (12.6%) and Eimeria maxima 3 (2.9%) (TABLE III).

TABLE I
The Prevalence of Poultry Coccidiosis in Different Risk Factors

Risk factors	No. of Examined	No. of Positive	Percentage prevalence (%)
Breed			
Broiler	231	70	30.3
Layer	153	33	21.6
Age			
Young	132	46	34.8
Adult	252	56	22.6
Sex			
Female	205	68	33.2
Male	179	35	19.6
Total	384	103	26.8

In breed: $\chi2 = 0.613$, $p = 0.418$. In Age: $\chi2 = 8.413$, $p = 0.002$.
In Sex: $\chi2 = 0.353$, $p = 0.742$

TABLE II
Prevalence of Poultry Coccidiosis in Accordance with the Different Sampling Sites

Sampling sites	No. of Examine	No of Positive	Percentage prevalence (%)
Ameerah Farm	40	22	55.0
Pacific Farm	39	9	23.1
A.T.B.U Farm	40	27	17.5
Zakari Farm	45	16	35.6
College of Agric.	74	5	6.8
Haib Farm	86	31	36.1
Muda Lawal dressing slap	60	13	21.7
Total	384	103	26.8

In sampling sites: $\chi2 = 10.816$, $p = 0.000$

TABLE III
Distribution of Various Emeria species in the Two Breeds

Species o Eimeria	Broiler	Layer	Total	Percent ace prevale nce (%)
E. acervulina	9	3	12	11.7
E. tenella	18	12	30	29.1
E. maxima	5	1	6	5.8
E. necatrix	10	7	17	16.5
E. tenella + E. acervulina	14	8	22	21.4
E. tenella + E. maxima	3	0	3	2.9
E. tenella + E. necatrix	11	2	13	12.6

B. Discussion

Coccidiosis is one of the most prevalent intestinal parasitic diseases in poultry worldwide. This study was conducted to determine the prevalence of this disease and to investigate the risk factors associated with the disease. This study is very important as quantitative assessment of this disease will provide a baseline on prevalence of coccidiosis which will serve as resourceful information from which effective control strategies of Eimeria infection will be design, leading to significant improvement in the productivity of exotic breed of chickens. In this study, the overall prevalence of coccidiosis was 26.8% (n = 103). This result is higher than 11.4% prevalence rate as reported by [15] in Gombe state, 14.0% by [2] in Sokoto state, 18.9% by [33] in Kwara State. It is also higher than some findings in Ethiopia, 20.6%, 19.5%, and 22.6% by [35], [13] and [14] respectively. The prevalence was lower than 33.6% by [29] in Ebonyi state, 41.3% by [32] in Osun, 31.8% [19] in Maiduguri, 69.0% by [34] in Abuja, 77.0% by [31] in River state, 36.6% [26] in Vom, Plateau state, 33.3% by [17] in Zaria, Kaduna state, 40.1% by [3] in Makurdi, Benue state. However, this finding is in line with report by [12] in Awka Ibom. The disparity in prevalence of this disease reported worldwide maybe due variant factors such as climatic conditions, epidemiology of the parasites, geographical area, sampling size and period and the differences in management systems. The wet climate (the study was conducted during the rainy season) and poor poultry management such as overloaded stocking density, accumulation of feaces and leaking water from the watering canal in the litters might be factors responsible for the prevalence observed in the current study area. These observable factors corresponds with the statement and findings by [24], [38] and [40].

The prevalence of the disease was significantly higher (p<0.05) in broiler chickens with prevalence rate of (30.3%) than layers (14.1%). This relatively higher prevalence of coccidiosis in broiler chicken may be attributed to higher stocking density practice in broiler farms as they are reared for meat production as observed during samples collection. The higher prevalence in broilers is in agreement with the report [19] in Maiduguri, [30] in South eastern Nigeria and [17] in Zaria. It is also in accord with findings abroad [28] in Iran and [27]. Conversely, others reported higher prevalence among laying brids [33], [11] and [8].

This study also indicated that females tend to be more infected by the protozoan parastites (33.2%) than their male counterparts with prevalence rate of (19.6%). But there is no significant differences (p>0.05) This is in agreement with the findings of [4], [14], [19] and [35]. However, this was not in concordance with the findings of other researchers [13] and [32-34]. Devoid of statistically significant difference between the female and male chicken may be owing to homogenous chance of vulnerability for the parasite infection.

Age difference plays a vital role in the prevalence of the parasite as higher prevalence rate was observed in younger birds (52.3%) than adults birds (30.1%). This finding is in line with the studies by [18-19], [23], [32] and [36] having reported that all ages of birds are susceptible to coccidiosis, but younger birds are more susceptible to infection than older birds. Notwithstanding, it is analogous with findings by [6] and [11-12], their findings showed higher prevalence rates in adult birds than in other age brackets. The higher prevalence in younger birds observed might be because of the vulnerability of the younger birds to

the parasites since they have an immature immune system. The older bird might have develop resistance to the parasite with some been infected earlier. It is known that resistance to the disease usually increases with age of birds. This explains why there is reduction in prevalence of the protozoan parasite in Adult birds. Another reason for the higher prevalence in younger birds might be attributed to the type of cage in which they are reared (deep litter system).

In this study, four species of Eimeria were identified; *E. tenella, E. necatrix, E. maxima and E. acervulina*. These species were also analyzed by [1], [17] and [25]. *E. tenella* was the most prevalent species in single infection while co-infection of *E. tenella with E. acervulina* was most prevalent in multiple infection. The higher prevalence of *E. tenella* might be attributed to the fact that it generally affects younger birds [23] and it is rarely observed in the chickens below 2 weeks of age [10]. This explains why *E. tenella* is the most prevalent as younger birds in this study have been observed to harbor the parasite more.

CONCLUSION

The coccidian parasites as shown in this study remain an important chicken health problem for poultry owners in Bauchi. Poor management systems such as inadequate cleaning leading to accumulation of feaces in the litter, higher stocking density, leaking drinkers, as well as presence of ages group of birds in the same place were the main reasons for the occurrence of this important disease in Bauchi. These factors need careful intervention that will lead to the reduction of the burden of coccidiosis. Special attention should be given to the most susceptible age groups (younger birds) and breed (broilers) as these are the potential risk factors associated with poultry coccidiosis. Farmers are advised to carryout good biosecurity measures such as proper stocking density, keeping litter dry by repairing all leaking watering trough, appropriate use of anticoccidial drugs prescribed by registered veterinarians, daily cleaning of litters to avoid accumulation of feaces which help in oocysts development. These measures when practiced will be effective in reducing the losses induced by the disease.

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