Prevalence of Coccidiosis in Local and Improved Breeds of Chickens in Lokoja, Kogi State

Emmanuel Chisom Nwoke[1,*], Elijah Adeola Omotosho[2], Obiokoye Adaeze Okagba[3], Blessing Eberechukwu Ogbonna[3]

[1]Department of Public Health Technology, College of Health Sciences and Technology Ezzangbo, Ezzangbo, Ebonyi State, Nigeria

[2]Department of Biological Sciences, Federal University Lokoja, Lokoja, Kogi State, Nigeria

[3]Department of Applied Biology, Ebonyi State University, Abakaliki, Ebonyi State, Nigeria

[*]Corresponding author: Emmanuel Chisom Nwoke1, emmanuelchisomnwoke@gmail.com

Abstract

This research project was carried out in order to determine the prevalence of coccidiosis in local and improved breeds of chickens in Lokoja, Kogi State and to identify the species of Eimeria causing coccidiosis in the area. The Wisconsin's faecal flotation technique was employed to analyze faecal samples obtained from 200 local and exotic breeds chicken within Lokoja metropolis. The samples were examined for the presence of Emeria oocysts and 94 (47.5%) of the samples examined were positive for Eimeria oocyts. The species of Eimeria causing the disease in the areas are: E. tenella, E. acervulina, E. necatrix and E. maxima. Females chickens had the highest prevalence rate 50 (100.0 %) compared to males 45 (90.0%). The highest rate of the infection occurred in young chickens 58 (116.0%) as compared to adults 58 (74.0%). The free-range management system had a higher prevalence rate 63 (63.0%) as compared to the semi-intensive management system 32 (32.0%).Chi-square test revealed no statistically significant differences in infections with sex, age and between the free range and semi intensive management systems. Therefore, farmers are encouraged to ensure adequate bio-security by avoiding wet litter which encourage oocysts sporulation, and reduce the stocking density of birds.

Keywords

Coccidosis, Eimeria Species, Chicken, Poultry

1. Introduction

Coccidiosis in Poultry: A Persistent Threat to Global Poultry Production and Animal Health

Coccidiosis is a globally recognized intestinal disease primarily affecting poultry and other vertebrates, leading to significant health challenges and economic losses within the livestock sector. This disease is caused by protozoan parasites belonging to the genus Eimeria, which are members of the phylum Apicomplexa. The condition poses a considerable threat to both intensive and extensive poultry farming operations, particularly in regions where biosecurity and management practices are suboptimal. The infection typically begins when birds ingest sporulated oocysts that contaminate their environment, including feed, water, litter, and soil. These oocysts are shed in the feces of infected or recovering birds, making fecal contamination a key driver of transmission. Infected birds may act as reservoirs for the parasites, continuously contaminating their surroundings, while other mechanical vectors, such as contaminated equipment, footwear, clothing, insects, rodents, and farm workers, further facilitate the spread of the disease [1].

Once ingested, the oocysts release sporozoites that invade the intestinal lining, initiating a destructive reproductive cycle that leads to epithelial cell damage, hemorrhage, and impaired nutrient absorption. The robustness of Eimeria oocysts in the environment-particularly under warm and moist conditions-enables them to survive for extended periods, contributing to the persistence of the infection on farms. Morphological similarities among Eimeria species complicate accurate diagnosis, often requiring microscopic examination of fecal matter or identification of lesions during necropsy. In many cases, diagnosis relies on a combination of clinical symptoms and post-mortem findings, although more advanced methods, such as polymerase chain reaction (PCR) and histopathology, are increasingly being used for precise identification, particularly in research or commercial settings [2].

Globally, coccidiosis has been documented in a range of climates and production systems. Studies have reported its occurrence in Iran [1], Egypt [3], Ethiopia [4], India [5], South Africa [6], and Nigeria [7,8] underscoring its widespread nature and the common challenges faced by poultry producers in managing it. In many developing countries, including Nigeria, the disease is especially prevalent due to the predominance of traditional and free-range poultry systems, where birds scavenge in open environments with high exposure to contaminated materials. However, a gradual shift toward semi-intensive and intensive systems is being observed, aiming to minimize such risks by improving housing and management practices.

Among chickens, nine distinct Eimeria species have been identified, each with varying degrees of pathogenicity and affinity for different parts of the intestinal tract. The most virulent species include E. tenella, E. necatrix, E. maxima, and E. brunetti, which are capable of causing severe hemorrhagic enteritis and high mortality rates. Other species such as E. acervulina, E. mitis, and E. mivati are considered moderately pathogenic, while E. praecox and E. hagani are usually associated with mild or subclinical infections. Pathogenesis depends largely on the parasite burden, the virulence of the species involved, and the immune status of the host. Infected birds often exhibit symptoms such as bloody droppings, diarrhea, lethargy, dehydration, weight loss, reduced feed conversion efficiency, and stunted growth. The disease primarily affects young birds between the ages of three and eighteen weeks, a period during which their immune systems are still developing and vulnerability to infection is high [9].

The economic burden of coccidiosis is multifaceted, including direct losses due to mortality and indirect effects such as poor growth rates, reduced productivity, increased feed costs, prolonged time to market, and elevated veterinary expenses. In commercial poultry operations, subclinical coccidiosis is particularly problematic because it often goes undiagnosed while still significantly impairing flock performance. Additionally, infected birds are more susceptible to secondary infections, particularly bacterial enteritis, which can further compound the economic impact.

Efforts to control coccidiosis have traditionally relied on the use of anticoccidial drugs incorporated into feed or water. These chemoprophylactic agents have been effective in reducing disease incidence and severity; however, their extensive and prolonged use has led to the emergence of drug-resistant Eimeria strains, reducing treatment efficacy. Furthermore, concerns over drug residues in meat and eggs have prompted stricter regulations and a shift toward alternative control measures. Vaccination using live attenuated or wild-type Eimeria strains is now increasingly employed, especially in large-scale operations, to stimulate protective immunity without relying on chemical control. These vaccines are usually species-specific, requiring careful formulation to include the Eimeria species most prevalent in a given region.

In addition to pharmaceutical and immunological approaches, non-chemical strategies are gaining attention. These include the use of probiotics, prebiotics, herbal extracts, essential oils, and other phytogenic feed additives that enhance gut health and modulate immune responses. These alternatives not only reduce the reliance on synthetic drugs but also improve overall bird resilience against parasitic infections. Moreover, the integration of good husbandry practices-such as proper sanitation, dry litter management, controlled stocking density, and adequate ventilation-is essential for effective control. Biosecurity measures that limit exposure to contaminated materials and prevent the introduction of infection from external sources are critical components of an integrated control strategy.

In regions where resources are limited, such as rural areas in Nigeria and other parts of sub-Saharan Africa, the implementation of such integrated strategies remains challenging. Financial constraints, limited access to veterinary care, lack of awareness, and poor infrastructure often hinder the adoption of effective disease control programs. Therefore, public awareness campaigns, farmer education, and government-supported interventions are necessary to improve disease management at the grassroots level.

2. Material and Method

2.1 Study Area

The study was conducted in Lokoja metropolis. Lokoja is located in Kogi State. It lies at the confluence of Niger and Benue rivers and it is the capital of Kogi State. The city’s population has grown to an estimated count of over 90,000 inhabitants. It is close to the federal capital of Nigeria, Abuja. Lokoja lies between latitude 7°45’N and 7°51’N and longitude 6°41’E and 6°45’E. It lies in the western bank of the River Niger at an altitude of 45-125 metres above sea level towards the Northwest which reaches an altitude of 400m above sea level. The highest temperature is obtained between March and April, while the lowest temperature is obtained between December and January. The first season of rainfall begins from March to July, with a break in the month of August, a period known as August break. Another season of rainfall commences from September and ends in October. The dry season begins from November and ends in March casting for about five(5) to six(6) months. The relative humidity is high during this raining season, this is about 80% during this period, whereas relative humidity is low during the dry season, as low as 5% during this season. The characteristics of the air within this period is dry and dusty. The harmattan comes at the period of the dry season. The atmosphere is usually cloudy during rainy season, as opposed to dusty dry season.

2.2 Sample Collection

Faecal samples were collected from the five different areas in Lokoja (Adankolo, Ganaja, Old market, newmarket, Felele). The samples were collected from chickens raised under semiintensive and free-range management, early in the morning as the chickensdefecated in sterile polythene or Santana bags. The areas of collection, sex, age, management system of the chickens were noted. A total of 200 faecal samples were collected from the (5) five different areas in Lokoja metropolis.

Fifty (50) males and Fifty (50) females of local breeds of chickens were examined.

0Fifty (50) samples were collected from young birds.

Fifty (50)samples were collected from adult birds.

One hundred (100) samples were collected from the semi-intensive management system.

One hundred (100) samples were collected from the free range management system.

2.3 Sample Analysis

2.3.1 Simple Flotation Method

In the laboratory, each sample were analyzed immediately using the test tube flotation method [10].

2.3.2 Faecal Sample Examination

To detect the presence of Eimeria oocysts, approximately 3 grams of faecal material were thoroughly mixed with 1 mL of a sugar-salt flotation solution in a rubber tube using a glass stirring rod. The homogenized mixture was filtered through filter paper set in a funnel and transferred into a test tube. The test tube was then filled with additional flotation solution until a convex meniscus was formed at the top, facilitating the upward movement of oocysts. A clean coverslip was gently placed on top of the test tube and allowed to stand undisturbed for 5-10 minutes to enable oocyst adherence. The coverslip was then carefully removed and placed on a microscope slide for examination under a light microscope at 40× magnification. This procedure follows the Wisconsin faecal flotation technique as described by Jargon and brain [11]. Morphological characteristics, including shape, size, wall thickness, and presence or absence of a micropyle, were documented for each sample using light microscopy.

2.4 Oocyst Sporulation Procedure

Faecal samples containing Eimeria oocysts were obtained from naturally infected chickens. The samples were homogenized in distilled water and filtered to remove large debris. The resulting filtrate was then suspended in a 2.5% aqueous solution of potassium dichromate ($K_2Cr_2O_7$), which served both to maintain moisture necessary for sporulation and to suppress bacterial and fungal contaminants competing for oxygen. The treated samples were placed in rubber tubes and incubated at ambient room temperature (approximately 25-28°C) for 24-48 hours to allow sporulation to occur. Microscopic examination was conducted at regular intervals to determine the presence of sporocysts within the oocysts. Morphological identification and measurements of the sporulated oocysts were carried out using a calibrated ocular micrometer under 40× magnification, following the protocol established by Conway *et al* [12].

2.5 Identification of Eimeria Species

Species identification was performed based on oocyst morphometrics post-sporulation. Diagnostic features, including oocyst shape, size, wall structure, and presence of micropyles or residual bodies, were used to differentiate Eimeria species. Comparative analysis of infection prevalence was conducted based on host variables such as sex, age, and management system. Chi-square (χ^2) statistical tests were employed to assess differences in infection rates across these categories.

2.6 Data Analysis

Data were analyzed using Chi-square statistical methods to determine the significance of observed differences in infection prevalence. Prevalence was calculated using the formula:

$(P\%)=(d/n)\times100$

where d represents the number of positive samples and n is the total number of chickens exaPrevalencemined. Species-specific prevalence was calculated as the proportion of chickens infected with a particular Eimeria species relative to the total number of infected individuals, expressed as a percentage.

Infection intensity was estimated based on the number of oocysts observed in 3 grams of faecal material and categorized as follows:

+: 1-10 oocysts (very light infection)

++: 11-20 oocysts (light infection)

+++: 21-30 oocysts (moderate to heavy infection)

These categories provided a semi-quantitative measure of infection burden across sampled individuals, facilitating comparisons of parasite load across experimental groups.

3. Results and Discussion

Table 1. Prevalence of coccidia infection in local and improved breeds of chickens in Lokoja, Kogi State in relation to the areas of sample collection, showing the Prevalence of Samples collected in each Area of which the samples where collected.

Area of collection of samples	No. of samples collected	No. of samples infected	Prevalence (%)
Old market	40	17	42.5
New market	40	22	55.0
Ganaja	40	11	27.5
Felele	40	18	45.0
Adankolo	40	27	67.5
Total	200	95	47.5

Table 2. Prevalence of coccidia infection in local and improved breeds of chicken in Lokoja, Kogi State according to sex, age and management systems (n=200).

Species of *Eimeria* identified	No. of samples infected (%)	No. infected by sex		No. infected by age		No. infected by management system		Intensity		
	(n=200)	Males (n=50)	Females (n=50)	Young (n=50)	Adults (n=50)	Semi-intensive (n=100)	Free range (n=100)	+	++	+++
	95 (47.5%)	45 (90.0%)	50 (100.0%)	58 (116.0%)	37 (74.0%)	32 (32.0%)	63 (63.0%)			
E. tenella	31 (15.5)	19 (38.0)	21 (42.0)	23 (46.0)	19 (38.0)	15 (15.0)	25 (25.0)	15	9	6
E. necatrix	27 (13.5)	12 (24.0)	14 (28.0)	19 (38.0)	12 (24.0)	8 (8.0)	20 (20.0)	18	8	0
E. maxima	20 (10)	8 (16.0)	10 (20.0)	9 (18.0)	4 (8.0)	5 (5.0)	10 (10.0)	11	6	4
E. acervulina	17 (8.5)	6 (12.0)	5 (10.0)	7 (14.0)	2 (4.0)	4 (4.0)	8 (8.0)	9	4	5
Total	95 (47.5)	45 (90.0)	50 (100.0)	58 (116.0)	37 (74.0)	32 (32.0)	63 (63.0)	53	27	15

Key: Number of coccidia oocysts per 3g of faeces

+ = 1-10 very light infection.

++ = 11-20 light infection.

+++ = 21-30 slightly heavy infection.

++++ = >30 heavy infection.

Table 3. Eimeria species identified from faecal samples of local and improved breeds of chicken in Lokoja, Kogi State size of occysts, characteristics and morphology of occysts.

Eimeria species	Size of occysts	Sporulation time, mean (range) in hours	Characteristics, morphology of an unsporulated occysts
E. tenella	22x19μm	18 hours	Double-contoured lines, Smooth, thin wall, no micropyle and ovoid.
E. necatrix	20x17 μm	18 hours	Double- contoured lines, thin wall, oblong, ovoid and no micropyle.
E. acervulina	18x14 μm	17 hours	Double-contoured lines, smooth wall, ovoid, visible micropyle.
E. maxima	31x24 μm	30 hours	Ovoid, no micropyle, thin wall and brownish.

Discussion

A prevalence rate of 47.5% for coccidiosis among chickens in the Lokoja metropolis indicates a significant and widespread burden of the disease affecting both indigenous (local) and exotic (imported) breeds of poultry within the region. This high percentage demonstrates that nearly half of the poultry population sampled in this study is affected by this parasitic infection, which highlights the urgent need for improved control measures, particularly in terms of biosecurity, hygiene, and disease prevention strategies.

The causative agents of coccidiosis in this particular area were identified as four distinct Eimeria species: Eimeria tenella, Eimeria acervulina, Eimeria necatrix, and Eimeria maxima. These species are known for their ability to invade and damage the intestinal lining of chickens, leading to a wide range of health problems that can ultimately result in economic losses for poultry farmers. The high infection rate observed may be closely linked to unsanitary poultry rearing environments, including poor waste disposal practices, accumulation of fecal matter, unclean water sources, and overcrowded housing conditions. These factors create ideal environments for the survival and transmission of Eimeria oocysts, the infective stage of the parasite, which are shed in the feces of infected birds and can survive for long periods in the environment.

The identification of these four Eimeria species in Lokoja is consistent with earlier studies conducted in different regions, suggesting that these species are not restricted to one location but are rather widely distributed across various geographical and climatic zones. For example, research conducted by Adang *et al* [13] , Dereja *et al* [14], Al- Natour *et al* [9] Getachew *et al* [15], and [16] all reported the presence of the same Eimeria species in both local and exotic chicken populations. This consistent pattern of occurrence across studies underscores the global significance of these particular parasites in poultry production systems and suggests that any effective control strategy must target these specific species.

Coccidiosis remains one of the most prevalent and economically important protozoan diseases affecting the poultry industry worldwide. It is a major constraint to poultry productivity, particularly in developing countries where resources for disease control are often limited. The disease primarily targets the intestinal tract of chickens, and different Eimeria species are known to infect specific segments of the intestines. For instance, E. tenella is often associated with severe lesions in the ceca, while E. acervulina typically infects the upper small intestine. Infection can lead to a range of clinical symptoms, including bloody or watery diarrhea, weight loss, reduced feed intake, poor growth performance, increased feed conversion ratios, and in severe cases, death. Moreover, the subclinical form of coccidiosis can be particularly dangerous as it may not show obvious symptoms but still compromise productivity and increase susceptibility to other diseases.

Several factors contribute to the variation in prevalence rates reported in different studies or locations. These factors may include the time of year when samples were collected, the number and age of birds sampled, breed types, regional climatic conditions, management systems, and the presence or absence of preventive treatment or vaccination programs. Research by Ashenafi *et al* [17] and Haug *et al* [18] confirmed that the prevalence of coccidiosis tends to fluctuate with changes in climate, particularly in relation to humidity and temperature, which influence oocyst development and survival. Likewise, Lobago *et al* [16] noted that epidemiological differences across regions are to be expected due to unique environmental and management conditions in each area. In tropical climates, for example, high humidity and warm temperatures can accelerate the sporulation (maturation) of oocysts, making them more infective and leading to rapid transmission within flocks. Poor housing conditions, such as overcrowding, inadequate ventilation, and infrequent removal of litter, further facilitate the accumulation and spread of oocysts, intensifying the risk of outbreaks.

In the current study, marked differences in prevalence were observed between different areas within the Lokoja metropolis. The Adankolo area recorded the highest prevalence rate of 67.5%, indicating a particularly severe problem in that locality. In contrast, the Ganaja area recorded the lowest prevalence at 27.5%. These disparities may be due to a combination of environmental, nutritional, and management-related factors. Birds in Adankolo may have had reduced access to quality nutrition, compromising their immunity and making them more susceptible to infections. Furthermore, higher levels of environmental contamination-such as accumulated feces and inadequate cleaning practices-could have facilitated the proliferation and persistence of oocysts in the area.

Sex-related differences were also noted in the infection rates, with male chickens showing higher levels of infection compared to females. This could be attributed to behavioral and physiological differences between the sexes. Males are generally more active and mobile, often foraging over a larger area, which increases their risk of encountering contaminated environments. Additionally, hormonal differences, particularly the influence of androgens, may affect immune function, making males more vulnerable to parasitic infections. In contrast, female chickens are often more carefully managed by poultry keepers, especially due to their economic value in egg production or breeding, which may lead to better health and lower exposure to disease-causing agents.

Age was another important determinant of infection, with younger birds exhibiting a higher prevalence rate than adult chickens. This trend is likely due to immunological immaturity in younger birds. Unlike older birds, which may have been previously exposed to Eimeria parasites and subsequently developed partial or acquired immunity, younger chickens have not had sufficient exposure or time to build up such defenses. Their indiscriminate feeding habits also put them at greater risk of ingesting oocysts from contaminated feed, water, or litter.

Furthermore, management system was found to play a significant role in disease prevalence. Birds raised under extensive (free-range) systems experienced higher infection rates than those managed in semi-intensive systems. In semi-intensive operations, poultry typically benefit from controlled feeding, routine health checks, deworming, vaccinations, and better housing conditions. In contrast, free-range birds frequently roam in the open environment, where they are more likely to encounter feces-contaminated soil, water, or vegetation. [19] supported this observation by noting the increased vulnerability of free-range birds to parasitic infections. However, it is interesting to note that Lawal *et al*. [20] reported higher coccidiosis rates in semi-intensive systems in a different context, suggesting that the risk of infection is also influenced by the specific implementation of management practices, and not just the system classification.

Finally, it is important to highlight that coccidiosis has a direct negative impact on the overall productivity of poultry, not just through mortality but also through nutritional deficiencies and poor feed utilization. As reported by Allen and Fetterer [21], coccidiosis can reduce the absorption of vital nutrients, including amino acids like arginine, which are essential for growth and immune function. This results in poor weight gain, low egg production, and economic losses, particularly for small-scale poultry farmers who may lack the resources for effective disease management.

4. Conclusion

Coccidiosis is common in local and exotic breeds of chickens in Lokoja, with chickens in some areas harboring more of the infection than others. Chicken raised under free-range management system has high rate of infection than those raised under semi intensive management system. Four species of Eimeria causing coccididosis in chickens in Lokoja, with E.tenella being the most prevalent. Poor management practice is the main risk factor favoring the onset ofcoccidiosis such as oocysts build-up, oocysts sporulation, and the humid environment.

Recommendation

The areas that have higher infection rates in Lokoja metropolis should have proper sanitation practices and maintain hygienic environmental conditions. This can help in reducing the survival of oocysts in these areas.

Coccidiosis is endemic in both commercial and backyard poultry farms in Nigeria due to poor management practices encouraging Eimeria oocysts build-up. Poultry farmers should practice strict biosecurity measures on their farms, create awareness on the prevalence of coccidiosis, engage in routine vaccination, and be educated on the importance of maintaining good hygienic standards and flock health management.

Local breed chickens within the metropolis require proper veterinary attention concerning coccidiosis to prevent uncontrolled outbreaks and economic loss.

Strict biosecurity measures such as changing clothes between farms or between poultry houses, avoiding water spillage in pens, keeping wild birds away from poultry houses, and using anticoccidial drugs are crucial control steps that must be implemented.

Farmers are strongly advised to consult registered veterinarians regularly for professional advice. Good management practices, maximum hygiene when handling poultry equipment (e.g., feeders and drinkers), and adherence to a vaccination schedule-preferably using attenuated or live vaccines-are essential for the prevention and control of coccidiosis in the study area.

Organizing regular training and capacity-building workshops for poultry farmers and attendants will enhance their knowledge on how to prevent, detect, and control coccidiosis effectively.

Proper litter management, including frequent removal and safe disposal of waste, along with the use of dry, absorbent bedding, helps limit moisture levels and reduces the survival of oocysts in poultry environments.

Conducting periodic environmental monitoring and fecal testing on poultry farms allows for early detection of Eimeria species and timely interventions before the disease spreads.

Adoption of the "all-in, all-out" system in flock management reduces the risk of cross-contamination between younger and older birds and lowers overall disease persistence on farms.

Clean and treated water must be provided consistently. Water containers and lines should be regularly cleaned and disinfected to prevent the spread of coccidiosis through contaminated drinking sources.

Balanced feeding practices should be encouraged, and the inclusion of probiotics or natural anticoccidial agents (such as garlic extract or oregano oil) can help strengthen poultry immunity and gut health.

Keeping detailed farm records-including health status, disease incidence, vaccination history, and treatment responses-supports informed decision-making and better disease control strategies.

Stakeholder involvement, particularly from local governments, veterinary services, and poultry associations, plays a vital role in providing technical support, disease surveillance, and access to affordable vaccines and medications.

New birds introduced into an existing flock should be quarantined and observed for signs of illness before being mixed with the main flock. Infected birds should be isolated immediately to reduce disease transmission.

Controlling rodents, insects, and other vectors is necessary, as they can mechanically carry and spread Eimeria oocysts across and between farms.

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