



ASSESSMENT OF COCCIDIOSIS AMONG POULTRY BIRDS SLAUGHTERED AT SELECTED MARKETS IN BAUCHI METROPOLIS, BAUCHI STATE

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ABSTRACT

The study determined the prevalence and severity of *Eimeria* infection among poultry birds slaughtered in selected markets within Bauchi Metropolis. A cross-sectional survey was conducted using fecal samples from 453 poultry birds (broilers, local chickens, and guinea fowl) collected from Muda Lawal, Railway, and Yelwa markets. Samples were examined using standard parasitological techniques to detect *Eimeria* oocysts. Infection prevalence was analyzed using chi-square tests, while severity was categorized into mild (<20,000 OPG), moderate (20,000–50,000 OPG), and severe (>50,000 OPG) based on oocyst per gram (OPG) counts. The overall prevalence of coccidiosis was 55.0%, with significant differences ($P < 0.05$) across markets. Muda-Lawal recorded the highest prevalence (61.1%), followed by Railway (53.3%) and Yelwa (48.0%). Prevalence varied significantly ($p < 0.001$) by species, it was highest in broilers (62.5%), then local chickens (55.0%), and lowest in guinea fowl (41.9%). Sex-related differences were not significant ($p > 0.05$). Age significantly influenced infection in broilers and local chickens ($P < 0.05$), with growers more affected than adults. Severity assessment showed that mild and moderate infections predominated (44.2% and 36.9%), while severe infections accounted for 18.9%. Mean OPG was highest in broilers ($49,800 \pm 20,300$), followed by local chickens ($46,200 \pm 18,900$), and lowest in guinea fowl ($31,700 \pm 12,600$). Sex-based OPG values were slightly higher in males across all species. In conclusion, coccidiosis is prevalent among poultry sold in Bauchi Metropolis, with significant variation by market location, species, and age. Broilers and younger birds are at higher risk and exhibit heavier oocyst shedding. Targeted control measures, improved market hygiene, regular monitoring, and species-specific preventive strategies are recommended to reduce infection and associated economic losses.

Keywords: Coccidiosis, Prevalence, OPG, Poultry, Markets.

INTRODUCTION

The poultry industry is a key component of Nigeria's agricultural sector, providing affordable protein and supporting livelihoods nationwide (Otu *et al.*, 2024). However, its productivity is significantly hindered by infectious diseases, particularly coccidiosis, an enteric protozoan infection caused by *Eimeria* species which remains one of the most economically important diseases in Nigerian poultry production (Otu *et al.*, 2024; Abatan *et al.*, 2021). The disease causes intestinal lesions, impaired nutrient absorption, reduced growth, decreased feed efficiency, and mortality, with substantial losses even in subclinical cases (Akanbi *et al.*, 2022; Lawal *et al.*, 2016). Transmission occurs via ingestion of sporulated oocysts, and the infection is endemic across Nigeria, with higher prevalence during the rainy season (Otu *et al.*, 2024). Studies across the country demonstrate widespread *Eimeria* infections: 31.8% prevalence in Maiduguri (Lawal *et al.*, 2016), 11.23% among commercial layers nationwide (Akanbi *et al.*, 2022), and 32.23% of avian clinic cases in Zaria (Muhammad *et al.*, 2024a). Further reports from Abatan *et al.* (2021), Jatau *et al.* (2024), and Bala *et al.* (2023) confirm the disease's endemicity and the need for sustained control measures. Despite extensive farm-level data, information on coccidiosis in birds slaughtered at live-bird markets, critical nodes where birds from diverse origins converge, remains limited, especially in northeastern Nigeria. Market environments promote stress, overcrowding, and poor hygiene, increasing infection risk and facilitating environmental contamination with public health implications (Auwal *et al.*, 2022; Auta *et al.*, 2021; Nana-Mariam *et al.*, 2023). In Bauchi Metropolis, few studies have assessed market-slaughtered birds, leaving a knowledge gap in understanding infection dynamics at the terminal point of the poultry value chain (Bala *et al.*, 2023; Auwal *et al.*, 2022). Assessing coccidiosis



at this level is essential for improving production efficiency, enhancing food safety, and guiding biosecurity and policy interventions (Waziri *et al.*, 2017).

MATERIALS AND METHODS

Study Area

The study was conducted in Bauchi Metropolis, Bauchi State, Nigeria, located between latitudes 10°17'N–10°23'N and longitudes 9°49'E–9°56'E, covering about 3,687 km² (NPC, 2022). The area has a dry season (November–March) and a rainy season (April–October), with annual rainfall of 700–1,300 mm and temperatures of 25–38°C (NIMET, 2023). Major poultry markets include Muda Lawal, Railway, and Yelwa, where large numbers of birds are traded and slaughtered. Poultry production is a key economic activity supporting household income and food security (Ibrahim *et al.*, 2024).

Study Design

A cross-sectional epidemiological design was used to determine the prevalence and intensity of coccidiosis among poultry slaughtered in selected markets. This design enables estimation of disease burden and assessment of risk factors within a defined population (Thrusfield, 2018).

Study Population

The population consisted of local chickens, broilers, and guinea fowls brought for slaughter in the selected markets. Birds were randomly sampled from different vendors regardless of age, sex, or breed. Birds showing signs of decomposition or with recent anticoccidial treatment were excluded.

Sample Size Determination

Sample size was calculated using Thrusfield's (2018) formula:

$$n = Z^2 p (1 - p) / d^2$$

Using an expected prevalence of 26.9% (Auwal *et al.*, 2022), $Z = 1.96$, and $d = 0.05$, a minimum of 304 birds was required. To increase precision, 454 birds were sampled proportionally across markets.

Sampling Procedure

Systematic random sampling was employed; every third bird presented for slaughter was selected. Freshly voided fecal samples were collected, and data on species, market location, sex, and age category were recorded.

Sample Collection and Handling

Fecal samples were placed in sterile, labeled containers and transported under refrigeration to the Parasitology Laboratory of the Bauchi State Ministry of Agriculture. All samples were processed within 24 hours.

Laboratory Examination

Oocysts were detected using the simple floatation technique with saturated sodium chloride (Cheesbrough, 2010). Infection intensity was determined using the McMaster counting chamber to estimate oocysts per gram (OPG) of feces. Oocysts were identified using morphological characteristics under $\times 40$ magnification following Long and Joyner (1984).

Severity Classification

Infection severity was graded based on OPG following Conway and McKenzie (2007):

Mild: $<1 \times 10^3$ OPG

Moderate: $1 \times 10^3 - 5 \times 10^3$ OPG

Severe: $>5 \times 10^3$ OPG

This classification enabled comparison of infection burden across species, sex, and market locations.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 20. Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to summarize prevalence and infection intensity. Prevalence (%) was calculated as:

$$\text{Prevalence (\%)} = (\text{Number positive} / \text{Total examined}) \times 100$$

Associations between infection status and categorical variables (species, sex, market) were assessed using Chi-square tests, with significance set at $p < 0.05$; 0.001. Prevalence estimates were



reported with 95% confidence intervals. Infection severity was analyzed using mean OPG values for each species.

RESULT AND DISCUSSION

Prevalence of *Eimeria* Infection in Poultry Birds Slaughtered at Selected Markets in Bauchi Metropolis

The overall prevalence of *Eimeria* infection in poultry slaughtered at Bauchi Metropolis markets was 55.0%, indicating that over half of the birds were infected. Prevalence, defined as the proportion of a population affected at a given time (Enny & Hoffman, 2023), reflects a substantial coccidiosis burden within the marketing chain. This aligns with Auta *et al.* (2021), who reported 60–70% prevalence in Kaduna markets, likely due to overcrowding, mixing of birds, and poor sanitation. The observed prevalence exceeds that reported by Auwal *et al.* (2022) among farm-sourced exotic chickens in Bauchi and by Akanbi *et al.* (2022) among commercial layers (11.23%), highlighting the influence of transport stress, cross-contamination, and market hygiene on infection levels. Significant differences among markets Muda Lawal (61.1%), Railway (53.3%), and Yelwa (48.0%) were confirmed by chi-square analysis ($\chi^2 = 7.92$; $p = 0.019$), supporting the role of market-specific factors such as sanitation, crowding, and sourcing in infection risk (Hightower & Scott, 2012). These findings are consistent with earlier studies in Nigerian LBMs. Olanrewaju and Agbor (2014) reported moderate-to-high coccidiosis prevalence in Abuja markets, Ojimekwe *et al.* (2018) detected high *Eimeria* rates in Rivers State markets, and Usman *et al.* (2023) observed 62% prevalence in Biu, Borno State. Collectively, these studies confirm the endemicity of *Eimeria* infections, particularly in market settings, and underscore the need for interventions targeting both farms and markets. Improved sanitation, regulated bird movement, and enhanced biosecurity during transport and slaughter are critical for reducing infection rates.

Table 1: Prevalence of *Eimeria* Infection in Poultry Birds Slaughtered at Selected Markets in Bauchi Metropolis

Market	No. Examined (n)	No. Positive (n)	Prevalence (%)	χ^2	p-value
Muda Lawal	180	110	61.1	7.92	0.019*
Railway	150	80	53.3		
Yelwa	123	59	48.0		
Total	453	249	55.0		

*Significant at $P < 0.05$

Distribution of Coccidiosis by Species of Poultry Birds Examined in Bauchi Metropolis

The overall prevalence of *Eimeria* infection among market-slaughtered poultry in Bauchi Metropolis was 55.0%, with broilers highest (62.5%), followed by local chickens (55.0%) and guinea fowl (41.9%), a statistically significant difference ($\chi^2 = 18.41$; $p = 0.001$) (Enny & Hoffman, 2023; Hightower & Scott, 2012). Broilers' higher prevalence aligns with reports of elevated infection in commercial breeds under intensive rearing (Auta *et al.*, 2021; Olanrewaju & Agbor, 2014), while local chickens showed moderate prevalence (Usman *et al.*, 2023), and guinea fowl the lowest due to extensive management resilience (Auwal *et al.*, 2022). Market birds exhibited substantially higher infection than farm-level layers (11.23%) (Akanbi *et al.*, 2022), reflecting stress, overcrowding, and poor sanitation (Ojimekwe *et al.*, 2018). These results highlight the need for coccidiosis control measures targeting both farms and live-bird markets through improved hygiene, biosecurity, and prophylaxis during transport and holding (Olanrewaju & Agbor, 2014; Auta *et al.*, 2021).

Table 2: Distribution of Coccidiosis by Species of Poultry Birds Examined in Bauchi Metropolis

Breed/Species	No. Examined (n)	Positive (n)	Prevalence (%)	χ^2	p-value
Broiler	160	100	62.5	18.41	0.001*
Local Chicken	200	110	55.0		
Guinea Fowl	93	39	41.9		
Total	453	249	55.0		

Note: * $P < 0.05$ significant different

Table 3 shows that coccidiosis affected both male and female broilers, local chickens, and guinea fowls in Bauchi Metropolis, with no significant differences between sexes ($p > 0.05$). Slightly higher prevalence was observed in male broilers (65.0%) and local chickens (58.0%), and in female guinea fowls (43.4%). This aligns with the understanding that *Eimeria* infections are largely independent of sex, being driven instead by environmental exposure, management, and age (Enny & Hoffman, 2023). Similar findings have been reported in Nigeria. Auwal *et al.* (2022) and Usman *et al.* (2023) observed comparable prevalence in both sexes of exotic and local chickens, with differences not statistically significant. Market-based studies also report high prevalence regardless of sex, e.g., 69% in Gwagwalada Market, Abuja (Olanrewaju & Agbor, 2014), and widespread infection in Kaduna Metropolis (Auta *et al.*, 2021). Such settings aggregate birds from multiple sources, facilitating *Eimeria* transmission. Chi-square analysis ($\chi^2 = 1.22$ – 1.54) confirms no significant sex-based differences, consistent with the application of Pearson's chi-squared test for categorical associations (Hightower & Scott, 2012). Sex is not a significant risk factor for coccidiosis in Bauchi poultry. Control efforts should therefore focus on hygiene, biosecurity, and environmental management rather than sex-specific measures (Akanbi *et al.*, 2022; Ojimekwe *et al.*, 2018).

Table 3: Sex-Based Prevalence of Coccidiosis by Breed of Poultry Birds Examined in Bauchi Metropolis

Risk Factor	Category	No. Examined(n)	Positive (n)	Prevalence (%)	χ^2	p-value
Broiler	Male	80	52	65.0	1.22	0.27 ns
	Female	80	48	60.0		
Local Chicken	Male	100	58	58.0	1.54	0.22 ns
	Female	100	52	52.0		
Guinea Fowl	Male	40	16	40.0	0.31	0.58 ns
	Female	53	23	43.4		
Total	–	453	249	55.0		

Note: ns = not significant ($p > 0.05$)

Age-Based Prevalence of Coccidiosis in Bauchi Metropolis

Table 4 shows higher coccidiosis prevalence in younger birds across broilers, local chickens, and guinea fowls, with significant differences in broilers ($\chi^2 = 6.74$; $p = 0.03$) and local chickens ($\chi^2 = 5.29$; $p = 0.04$), but not in guinea fowls ($\chi^2 = 2.96$; $p = 0.09$). This aligns with the general trend that young poultry are more susceptible due to underdeveloped immunity and limited prior exposure (Enny & Hoffman, 2023). Grower broilers (6–8 weeks) had 70.6% prevalence, consistent with Usman *et al.* (2023) who reported 80% in young chickens (1–4 weeks), and Olanrewaju and Agbor (2014), who observed 70.8% in birds under 3 months. Younger birds also shed more oocysts, increasing



transmission risk in crowded markets. Although adults showed lower prevalence (e.g., 53.3% in adult broilers, 45.0% in adult local chickens), persistent infections indicate that prior exposure does not confer full immunity, and environmental contamination maintains endemicity (Auwal *et al.*, 2022; Akanbi *et al.*, 2022). The non-significant age effect in guinea fowls may reflect species-specific resistance or lower exposure, as noted in mixed-species studies (Ojimelukwe *et al.*, 2018). Overall, younger birds represent the highest risk, highlighting the need for age-targeted prophylaxis, improved hygiene, and early management interventions in farms and markets (Hightower & Scott, 2012).

Table 4: Age-Based Prevalence of Coccidiosis by Breed of Poultry Birds Examined in Bauchi Metropolis

Risk Factor	Category	No. Examined (n)	Positive (n)	Prevalence (%)	χ^2	p-value
Broiler	Grower (6–8 weeks)	85	60	70.6	6.74	0.03*
	Adult (>8 weeks)	75	40	53.3		
Local Chicken	Grower (3–5 months)	100	65	65.0	5.29	0.04*
	Adult (>5 months)	100	45	45.0		
Guinea Fowl	Grower (3–5 months)	50	25	50.0	2.96	0.09 ns
	Adult (>5 months)	43	14	32.6		
Total	–	453	249	55.0		

Note: * $P < 0.05$ significant different; ns = not significant ($p < 0.05$)

Severity of Coccidiosis Infection among Different Poultry Species Based on Oocyst Count

The severity pattern in Bauchi Metropolis shows that broilers and local chickens carried heavier coccidial burdens than guinea fowl. Broilers recorded the highest mean OPG ($49,800 \pm 20,300$) with 22% severe infections, followed by local chickens ($46,200 \pm 18,900$; 18.2% severe), while guinea fowl exhibited the lowest mean OPG ($31,700 \pm 12,600$) and the highest proportion of mild infections (56.4%). These findings agree with Karaer *et al.* (2012), who reported high OPG (36,498.7) in broiler farms without overt clinical disease, demonstrating that heavy shedding can occur subclinically. Similarly, Ngongeh *et al.* (2017) observed higher OPG in local chickens than broilers under controlled infections, supporting species-related differences in susceptibility and oocyst output. Compared with other Nigerian studies, the OPG values in this study were considerably higher. Ola-Fadunsin *et al.* (2019) and Akanbi *et al.* (2022) reported much lower mean OPG values ($6,325$ and $5,260.87 \pm 1,838.35$ respectively), likely due to better farm hygiene and controlled production systems, unlike live-bird markets where mixed sourcing and poor litter conditions increase exposure. The lower infection intensity in guinea fowl reflects known species-specific resilience or limited environmental contact (Ngongeh *et al.*, 2017). Overall, broilers and local chickens constitute the major contributors to environmental contamination in market settings, and the high OPG values highlight the role of subclinical infections in sustaining transmission. Strengthening market hygiene, improving litter management, and implementing targeted anticoccidial control in high-risk species are essential for reducing parasite load and associated economic losses.



Table 5: Severity of Coccidiosis Infection among Different Poultry Species Based on Oocyst Count

Species/Breed	Mild Infection (<20,000 OPG)	Moderate (20,000 – 50,000 OPG)	Severe (>50,000 OPG)	Mean \pm SD (OPG)
Broiler	40 (40.0%)	38 (38.0%)	22 (22.0%)	49,800 \pm 20,300
Local chicken	48 (43.6%)	42 (38.2%)	20 (18.2%)	46,200 \pm 18,900
Guinea fowl	22 (56.4%)	12 (30.8%)	5 (12.8%)	31,700 \pm 12,600
Total (n = 249)	110 (44.2%)	92 (36.9%)	47 (18.9%)	45,900 \pm 18,700

OPG = Oocysts per gram of feces

Severity of Coccidiosis by Sex across Poultry Species in Bauchi Metropolis

Coccidiosis affected both male and female broilers, local chickens, and guinea fowl in Bauchi Metropolis, with mild and moderate infections predominating and severe infections less frequent. Mean OPG values were slightly higher in males than females for broilers (51,200 \pm 21,000 vs. 48,100 \pm 19,800) and local chickens (47,500 \pm 19,100 vs. 44,900 \pm 18,700), while guinea fowl had the lowest OPG (32,200 \pm 12,800 for males; 31,000 \pm 12,400 for females). These results align with previous studies. Karaer *et al.* (2012) reported subclinical broiler infections in Turkey with a mean OPG of 36,498.7, showing that high oocyst loads may not cause clinical signs. Experimental infections in Nigerian local and broiler chickens also demonstrated higher OPG in locals without significant differences in clinical outcomes (Ngongeh *et al.*, 2017). Field studies in Nigeria corroborate these trends, with mean OPG values varying by environment and management: 6,325 in Kwara State poultry (Ola-Fadunsin *et al.*, 2019) and 5,260 \pm 1,838 for *E. acervulina* in commercial layers (Akanbi *et al.*, 2022). Slight sex-related differences may reflect behavioral or physiological factors, as males often have higher feed intake and more active foraging, increasing exposure to contaminated litter (Flores *et al.*, 2022). Nonetheless, sex alone is rarely a major determinant of infection severity; age, breed, management, and environmental contamination are more influential (Ola-Fadunsin, 2017; Lawal *et al.*, 2016). Overall, both sexes are susceptible, but males may contribute slightly more to environmental contamination via higher oocyst shedding, highlighting the need for targeted biosecurity and prophylaxis in mixed-sex flocks, especially at live-bird markets.

Table 6: Severity of Coccidiosis Infection by Sex across Poultry Species in Bauchi Metropolis

Species/Breed	Sex	Mild (<20,000 OPG)	Moderate (20,000– 50,000 OPG)	Severe (>50,000 OPG)	Mean \pm SD (OPG)
Broiler	Male	22 (39.3%)	20 (35.7%)	14 (25.0%)	51,200 \pm 21,000
	Female	18 (40.9%)	18 (40.9%)	8 (18.2%)	48,100 \pm 19,800
Local chicken	Male	25 (41.0%)	22 (36.1%)	13 (22.9%)	47,500 \pm 19,100
	Female	23 (46.0%)	20 (40.0%)	7 (14.0%)	44,900 \pm 18,700
Guinea fowl	Male	12 (54.5%)	7 (31.8%)	3 (13.6%)	32,200 \pm 12,800
	Female	10 (58.8%)	5 (29.4%)	2 (11.8%)	31,000 \pm 12,400

CONCLUSION AND RECOMMENDATION

This study shows that coccidiosis is highly prevalent among poultry slaughtered in Bauchi Metropolis, with an overall rate of **55%**. Prevalence varied across markets, with Muda Lawal being the most affected, and differed by species, with broilers showing the highest infection level. While sex had no significant effect on prevalence, growers were more susceptible than adult birds. Severity assessment indicated that most infections were mild to moderate, although broilers and local chickens recorded notable severe oocyst loads, whereas guinea fowl showed lower infection intensity.

Based on these findings, improved market hygiene, regular surveillance, and enhanced biosecurity practices are strongly recommended, particularly in high-risk markets. Preventive and



prophylactic measures should focus on grower birds, which exhibited significantly higher infection rates. Farmer and trader education on litter management, biosecurity, and early diagnosis is essential, alongside species-specific management practices for highly susceptible broilers and local chickens. Integrated control strategies including anticoccidial use, vaccination where feasible, and good husbandry are necessary to sustainably reduce the burden of coccidiosis in Bauchi Metropolis.

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