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## ***Eimeria* Species and Haemosporidia of Domestic Chickens and Guinea Fowls Sold at Selected Poultry Markets in Lagos, Nigeria**

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**Introduction:** Parasitic diseases are a major setback to sustainable poultry production. This study determined the occurrence of *Eimeria* species and haemosporidia among domestic chickens and helmeted guinea fowls in live-bird markets in Lagos State, Nigeria.

**Methods:** Blood samples and intestinal contents at three distinct segments of the gut were collected from 60 domestic chickens and guinea fowls each. Wet smears of intestinal contents were microscopically examined for oocysts typical of *Eimeria* species while thin films of blood were Giemsa-stained for the demonstration of protozoa.

**Results:** Results revealed that 19(31.7%) and 21(35%) chickens and guinea fowls were positive for *Eimeria* spp. infection respectively. There was no significant difference ( $P>0.05$ ) in *Eimeria* spp. infections between the chicken breeds nor between sexes of both birds. Oocysts of *Eimeria* were mostly recovered from the caeca and small intestines of the guinea fowls and chickens respectively. Domestic chickens were infected with three different haemoprotozoa: *Plasmodium* spp. (23.3%), *Leucocytozoon* spp. (6.7%) and *Haemoproteus* spp. (3.3%); while *Plasmodium* spp. (15%) and *Haemoproteus* spp. (3.3%) were the only blood protozoa infecting guinea fowls. The infection rates of haemosporidia between the breeds of chickens and the sexes of both birds did not differ significantly ( $P>0.05$ ).

**Conclusion:** *Eimeria* parasites and haemosporidia are prevalent among chickens and guinea fowls sold in Lagos State. To prevent severe economic losses in the future, appropriate control measures should be designed and implemented.

**Keywords:** *Eimeria*, haemosporidia, chicken, guinea fowl, Lagos State

## 1.0 INTRODUCTION

Poultry are birds such as chickens, turkeys, ducks, guinea fowls, pigeons, peacocks, quails and ostriches domesticated for their nutritious meat and eggs [1]. Poultry farming makes substantial contribution to household and nationwide food security throughout the developing world [2]. In Africa, poultry meat is estimated to represent about 25% of all meat types, and in some areas accounts for 100% of the animal protein available [3]. In addition to their nutritional benefits, poultry serve as a colossal means of generating income and providing revenue [1]. The Nigerian poultry industry contributes about 15% to the country's Gross Domestic Profit (GDP) [4].

Diseases are however a major factor limiting poultry production globally. Various viral, bacterial and parasitic diseases are responsible for significant economic losses associated with high morbidity and mortality, and increased management costs [1,5]. Parasitic diseases rank high among these diseases which threaten the poultry industry [6]. Coccidiosis, an intestinal disease caused by the apicomplexan parasite, *Eimeria* costs the global poultry sector over US\$3 billion every year [7]. Presently, *Eimeria* parasites are recognized as one of the most important pathogens of intensively managed poultry. They negatively impact the overall gut health of their hosts; causing malabsorption, appetite loss, dehydration, reduced feed conversion efficiency, severe weight loss and death [8]. Also important among poultry are blood protozoa of the genera Plasmodium, *Leucocytozoon* and *Haemoproteus*. Although these haemoparasites are uncommon causes of severe morbidity and mortality, they have been implicated in occasional disease outbreaks that reduce bird fitness, feed consumption and conversion efficiencies [9].

Certain host, parasite, environmental and management factors determine the occurrence of these parasites and enhance their survival and spread among poultry. Indigenous poultry breeds are generally more resistant to local parasite strains when compared to their hybrid/exotic counterparts and may act as good reservoirs of infection [10]. The short, direct life-cycle and faeco-oral transmission route of *Eimeria* are reasons for its ubiquity in intensive poultry production where birds are usually densely stocked in confined units [8]. Haemoparasitic infections on the other hand are more common in free-ranging systems where birds are frequently exposed to bites of insect vectors [8].

Generally, live-bird markets (LBMs) in Nigeria – where variety of poultry species and products are sold to consumers for their consumption, for subsistence rearing and/or for rituals – are limited in infrastructure that help

control the spread of *Eimeria* and haemosporidian parasites. Sanitary conditions at sales and slaughtering points are extremely poor. Proper waste disposal facilities, tap water or borehole systems, and easy-to-clean cages, floors, walls and drains are scarce [11]. Structures that ensure separation between birds and public and the quarantine of sick birds are also absent, putting poultry farms and free ranging birds in the environment at risk of infection [8].

There is dearth of information available on the prevalence of parasitic infections among poultry in Lagos, Nigeria. Such data is required to justify the need for control, to avert possible financial losses and ensure food security. This present study therefore aimed at determining the prevalence and intensity of *Eimeria* spp. and haemosporidian infections of domestic chickens and helmeted guinea fowls sold at selected LBMs in Lagos State.

## 2.0 METHODOLOGY

### 2.1 Study Area

Lagos State is located in the mangrove region of the southwestern geopolitical zone of Nigeria, covering a land area of 3,577km<sup>2</sup>, and about 41 meters above sea level. She has an average temperature of 31 degrees celcius and a relative humidity of 72%. Lagos State is recognized as the commercial hub of Nigeria, with the highest Gross Domestic Profit (GDP) in Africa. This present study was carried out in LBMs at Oyingbo and Onipanu markets located within Lagos Island and Shomolu Local Government Areas (LGAs) of Lagos State respectively. Both LBMs are daily markets where urban and semi-urban consumers buy poultry and poultry products mainly obtained from distant or close commercial producers.

### 2.2 Study Design

This study lasted three months (January to March, 2017), with a total of 120 birds, comprising of 60 domestic chickens and 60 guinea fowls sampled at random at the LBMs. Only birds presented for slaughter and dressing were included in the study. The sexes (male or female) of the selected birds were recorded upon collection. Only the sampled chickens were categorized as exotic (i.e. specialized strain types such as layers, broilers or breeders) or local (i.e. indigenous chicken ecotypes) breed types.

### 2.3 Sample Collection

Fresh blood samples were collected from severed veins in the neck region of the selected birds into EDTA-coated bottles. Mucosal scrapings and contents of the small intestine, large intestine and caeca of each sampled bird

were collected separately into sterile sample bottles. The samples were transported immediately to the laboratory for parasitological examination.

### 2.4 Parasitological Examination

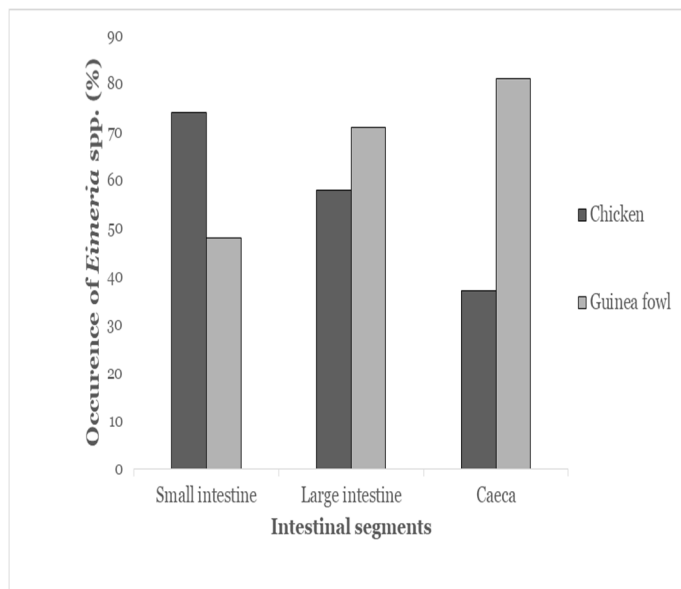
Thin smears of blood were prepared and Giemsa-stained for microscopic examination of haemosporidia under ×100 power objectives as described by [12].

The luminal contents and mucosal scrapings of the intestinal tract samples collected were concentrated by floatation method, using saturated NaCl(aq) solution and examined under the microscope at ×10 and ×40 power objectives for the presence of *Eimeria* oocysts [12]. The intensity of *Eimeria* infection in positive samples were categorized as unapparent (1-10 oocysts per field), low grade (11-20 oocysts per field) and severe (>20 oocysts per field) [13].

### 3.0 RESULTS

*Eimeria* spp. infection was encountered among 19(32%) domestic chickens and 21(35%) guinea fowls in this study (Table I). The infection rates between both sexes of chicken [male (38.5%), female (26.5%)] and guinea fowl [male (33.3%), female (36.4%)] were similar (P>0.05). There was also no significant difference in *Eimeria* infection between the exotic (28.2%) and local (38.1%) breeds of chicken (P>0.05).

The prevalence rates of the haemosporidian infections occurring among the birds sampled in this study are presented in Table 1. Fourteen (23%), 4(7%) and 2(3%) chickens were infected with *Plasmodium*, *Leucocytozoon* and *Haemoproteus* species respectively. Guinea fowls were only positive for blood protozoa of the genera *Plasmodium* (15%) and *Haemoproteus* (3.3%). The rate



**Figure 1:** *Eimeria* spp. infections across selected segments of the gastro-intestinal tract of slaughtered chickens and guinea fowls

of *Plasmodium* spp. infection was significantly higher among local chickens (38.1%) when compared to the exotic breeds (15.4%) (P<0.05). Also, more male (26%) than female (6%) guinea fowls were infected with *Plasmodium* spp. (P<0.05).

Table 2 presents the level of *Eimeria* spp. infection severity examined among infected poultry. Majority of birds had severe infections while 4(21.0%) chickens and 2 (9.5%) guinea fowls suffered from unapparent infections.

Oocysts of *Eimeria* spp. were mostly recovered from the small intestines of infected domestic chicken (74%) and least in their caeca (37%) (Figure 1). Infection with the protozoa was encountered least in the small intestines (48%) of infected guinea fowls and highest in their caeca (81%).

Table I: Prevalence of *Eimeria* spp. and haemosporidian infections among sampled poultry

Poultry	Variables	No. examined	<i>Eimeria</i> spp. n (%)	Haemosporidia		
				<i>Plasmodium</i> spp. n (%)	<i>Leucocytozoon</i> spp. n (%)	<i>Haemoproteus</i> spp. n (%)
Chicken	–	60	19 (31.7)	14 (23.3)	4 (6.7)	2 (3.3)
	Breed					
	Exotic	39	11 (28.2) <sup>a</sup>	6 (15.4) <sup>a</sup>	2 (5.1) <sup>a</sup>	2 (5.1) <sup>a</sup>
	Local	21	8 (38.1) <sup>a</sup>	8 (38.1) <sup>b</sup>	2 (9.5) <sup>a</sup>	0 <sup>a</sup>
	Sex					
Male	26	10 (38.5) <sup>a</sup>	7 (26.9) <sup>a</sup>	1 (3.8) <sup>a</sup>	2 (7.7) <sup>a</sup>	
Female	34	9 (26.5) <sup>a</sup>	7 (20.6) <sup>a</sup>	3 (8.8) <sup>a</sup>	0 <sup>a</sup>	
Guinea fowl	–	60	21 (35.0)	9 (15.0)	0	2 (3.3)
	Sex					
	Male	27	9 (33.3) <sup>a</sup>	7 (25.9) <sup>a</sup>	0 <sup>a</sup>	1 (3.7) <sup>a</sup>
Female	33	12 (36.4) <sup>a</sup>	2 (6.1) <sup>b</sup>	0 <sup>a</sup>	1 (3.0) <sup>a</sup>	

‘–’ indicates ‘not applicable’

Values within a column marked by different letters are significantly different (P<0.05)

**Table 2:** Severity of *Eimeria* spp. infections among slaughtered poultry

Poultry	No. infected	Unapparent infections n (%)	Low-grade infections n (%)	Severe infections n (%)
Chicken	19	4 (21.0)	1 (5.3)	14 (73.7)
Guinea fowl	21	2 (9.5)	3 (14.3)	16 (76.2)

#### 4.0 Discussion

Protozoal diseases are common among domesticated birds, and some cause moderate to severe economic losses in both commercial and backyard production systems [8].

*Eimeria* spp. infection occurred at a prevalence rate of 32% among domestic chickens in this study. This finding is similar to those reported in Ebonyi (33.6%) [14], Kaduna (33.3%) [13] and Enugu (35.5%) [15] states of Nigeria. Surveys conducted in Ogun State [16; 17], Ondo State [18], Abuja (FCT) [19; 20], and in Borno State [21] however revealed lower prevalence of 6.8%, 4%, 7.7%, 14.6%, 25% and 12.6% respectively. Higher prevalence than what was recorded in this study were also reported among chickens in other parts of Nigeria [22; 23; 24]. These variations can be attributed to the different seasons in which these studies were conducted, the breed of chickens sampled, the farming systems and chicken management practices adopted in the respective study areas. The differences in prevalence rates may also reflect the quality of control in the various study areas.

The prevalence of *Eimeria* infection among local chickens (38.1%) in this study was higher than that determined for exotic species. Although this finding was not statistically significant, it is similar to the results of Agbolade *et al.* [16] and Babatunde *et al.* [20], but different from those of Jatau *et al.* [13] and Lawal *et al.* [21] who reported higher prevalence of infection among exotic chicken breeds. Indigenous chicken strains are mostly managed extensively where the birds are allowed to scavenge for food in their environment. This free-ranging habit increases their risk of exposure to infective oocysts littered in the surroundings. Although, the local breeds of some domestic animals are resistant to endemic infectious diseases than the exotic strains [25], authors in another study carried out in Nigeria found no clear-cut difference in the susceptibility statuses of a Nigerian indigenous chicken line and broiler chickens experimentally infected with caecal isolates of *Eimeria* [26].

Majority of the domestic chickens positive for *Eimeria* oocysts in this study were severely infected. This finding is

not in agreement with an earlier study where unapparent infections was observed to be most frequent among infected birds sampled at a live-bird market in Zaria, Kaduna [13]. Differences in the stocking densities of birds at both markets, the immunity of the sampled birds to *Eimeria* infection, the species or strains of *Eimeria* involved, and the effectiveness of the control tool(s) employed against coccidiosis at both study sites are plausible reasons for this discrepancy.

*Eimeria* are largely organ- and tissue- specific, and the degree of damage caused by a species is said to be dependent on its predilection site within its host's intestinal tract. Species which infect the lower regions of the gastro-intestinal tract are expected to be more virulent when compared to those infecting tissues in the upper regions [27]. In this study, oocysts were recovered mostly from the small intestines of infected chickens, followed by their large intestine and least from the caeca. It is therefore possible that the most prevalent species infecting the birds in this study are moderately pathogenic. Nonetheless, all seven species of *Eimeria* identified to affect chickens worldwide inflict economically significant damage on susceptible birds, regardless of their pathogenic status [28].

Little to no information exists on *Eimeria* spp. infection among guinea fowls, most studies have focused on the domestic chicken. The high percentage occurrence of *Eimeria* infections in the caeca of guinea fowls in this study may however signify the presence of highly pathogenic species.

Three haemoprotozoan genera were encountered among chickens in this study: *Plasmodium* spp. (23.3%), *Leucocytozoon* spp. (6.7%) and *Haemoproteus* spp. (3.3%). Previous studies in Nigeria have only reported the incidence of *Plasmodium* spp. and/or *Haemoproteus* spp. infections among domestic chickens [29; 30]. The availability of suitable ecology and ethology for insect vectors of *Leucocytozoon* spp. in the areas where the sampled birds were raised is a plausible reason for their occurrence in this study.

*Plasmodium* spp. (23.3%) were the most prevalent blood protozoa infecting domestic chickens in this study. The infection rate of these blood parasites in a survey carried out in Kano State (21.1%) [31] was similar to that reported in this study. However, studies by and in Borno (9.6%) [32] and Sokoto (6%) [33] states respectively revealed considerably lower infection rates, but higher prevalence rate in Imo (80%) [30]. These differences can be attributed to varying climatic conditions in the areas where these investigations were carried out.



Furthermore, avian malaria infections were remarkably higher among local chickens compared to exotic breeds. This finding agrees with the outcome of several other surveys carried out in Nigeria where exotic chickens were mostly found negative for avian malaria infection [30 – 33]. Although it was discovered otherwise in a study in Ogun State where the difference in infection rate between the breeds were not significant [25]. This finding may validate claim that indigenous breeds of domestic animals are less susceptible to local strains of parasites.

## 5.0 Conclusion

This study revealed that *Eimeria* parasites are prevalent among domestic chickens and helmeted guinea fowls sold at selected live-bird markets in Lagos State. Blood parasites belonging to three different apicomplexan genera—*Plasmodium*, *Haemoproteus*, and *Leucocytozoon* – were also encountered. The presence of these parasites, especially *Eimeria* spp. indicate potential financial losses and pose a threat to food security in Lagos State. Strict measures should be put in place immediately to control the spread of these infections among poultry in the State. Furthermore, research should be carried out in the future to ascertain the specific parasite species infecting these birds in the study area. Such data will inform rational and cost-effective control decisions.

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## Authors' Contribution

**ETI** Conceived and designed the study, wrote the paper; **OOA** Collect data, contributed to analysis, wrote the paper; **SCE** Collected the data, performed analysis; **OOA** Conceived and designed the study, wrote the paper; **MBA** wrote paper. All authors approved the final version of the manuscript

## Declaration of Conflict of Interest

The Authors declare that there is no conflict of interest.

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