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Original Research Article

Prevalence of Avian Coccidiosis and Identification of Eimeria spp in Local Broilers and Chickens in Lafia Modern Market, Nassarawa State, Nigeria

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Abstract: Coccidiosis is an important enteric parasitic protozoan disease of poultry. The disease is usually associated with high economic losses to poultry farmers worldwide. This study was conducted to determine the prevalence of coccidiosis, identify the species of circulating Eimeria species, determine the prevalence of Eimeria in respect to breed and gender and determine the deviation of infected birds from normal range of birds slaughtered in Lafia modern market, Nasarawa State, Nigeria. Out of the 204 examined chickens, 36.3% (74/204) of them harbored different Eimeria species. A total of 32.6% (44/74) male and 43.5 (30/74) female were infected. Statistically, no significant difference $p>0.05$ ($\chi2=1.559$, $p=0.2118$) was noted between the male and female. Among the local breed, 40.2% (49/74) was infected and for the broilers, 30.5% (25/74) was positive for coccidial infection. Again, there was no statistically significant difference $p>0.05$ ($\chi2=1.324$, $p=0.25$) between the local and broiler breeds. In the attempt made to identify the prevalent species of coccidian in the study area, five Eimerian species were identified, namely; Eimeria acervulina, Eimeria brunette, Eimeria mitis, Eimeria necatrix and Eimeria tenella with the prevalence of 14.22%, 5.88%, 1.47%, 6.86%, and 7.84% respectively. Results obtained from this study shows that coccidiosis is an important disease of chickens in the study area and further strategy needs to be implemented to reduce the infection rate of coccidiosis.

Keywords: Coccidiosis, Protozoan, Prevalence, Eimeria specie, Enteric.

1.0 INTRODUCTION

Poultry have been on the earth for over 150 million years (Atteh, 2013). It dates back to the existence of the original wild jungle fowl. In contemporary times, other avian species like ducks, geese, turkeys, pheasants, pigeons, peafowl, guinea fowl and domestic chickens. Poultry provides humans with food and fiber in the form of eggs, meat and feathers. Large commercial chicken industries provide the requirement for eggs and meat (Conan *et al*., 2012). Due to the high population growth in Africa (WHO, 2010) and growing income, the demand for eggs and poultry meat have significantly increased in recent years across the continent. According to estimates by the USAID (United States Agency for International Development), this trend is very likely to continue over the years. Therefore, the consumption of poultry and eggs will increase by 200% between 2010 and 2020 in some countries in sub-Saharan Africa (Gerber *et al.*, 2015).

One African country where this trend can clearly be seen is Nigeria. Nigeria is the largest country in Africa, with a total geographical area of 923,768 square kilometers (Asuming-Brempong *et al*., 2013). Its estimated population was 174.5 million people in 2013, and its population growth rate is 3% per annum (USDA, 2013). The Nigerian poultry industry in particular has been rapidly expanding in recent years and is therefore one of the most commercialized (capitalized) subsectors of Nigerian agriculture (Adewale and Ajibola, 2013).

In Lafia, Nassarawa State, as in most Urban and rural areas in Nigeria other developing nations,

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chickens are the most important class of the poultry species in terms of number and rate of investment in poultry production. The exotic breeds are usually managed intensively either in battery cages or deep litter system of management, while the village chickens are reared extensively; where they are allowed to scavenge food for survival (Olumayowa and Abiodun, 2011). The Nigerian poultry farming has faced many challenges from inception, adversities from natural hazards such as unfavorable weather condition, to human deficiencies like shortage of fund and poor health attention. Diseases such as avian flu have equally threatened the existence of poultry farms in Nigeria. One of the most frightening of such diseases threatening the existence of poultry birds in Nigeria is poultry coccidiosis (Jatau, *et al*. 2012).

Coccidiosis causes considerable economic loss in the poultry industry. Chickens are susceptible to at least 11 species of coccidia. The most common species are *Eimeria tenella*, which causes the cecal or bloody type of coccidiosis, *E. necatrix*, which causes bloody intestinal coccidiosis, and *E. acervulina* and *E. maxima*, which cause chronic intestinal coccidiosis. The disease occurs only after ingestion of sporulated oocysts in susceptible hosts. Coccidiosis occurs in the epithelial cells of the intestine, despite the advances in nutrition, chemotherapy, management, and genetics (Hamidinejat *et al.,* 2010). Bloody lesions, high morbidity and mortality are usually associated with *E. tenella* and *E. necatrix* which are the most pathogenic of all *Eimeria* species (Gari *et al.*, 2008, Györke *et al.*, 2013).

Coccidiosis in poultry is characterized by dysentery, enteritis, emaciation, drooping wings, and poor growth. Feed and water consumptions are usually reduced in infected birds. Weight loss, development of culls, decreased egg production, and increased morbidity and mortality often accompany outbreaks. Historically, poultry diseases remain one of the major threats to boosting poultry production in Nigeria (Akintunde *et al.*, 2015; Etuk *et al*., 2004). One of the common internal parasitic infections occurring in poultry is coccidiosis caused by *Eimeria* species that causes considerable damage and great economic losses to the poultry industry due to malnutrition, decreased feed conversion ratio, weight loss, lowered egg production and death in young birds (Puttalakshmamma *et al*., 2008).

Avian coccidiosis is an enteric parasitic disease causing production losses, high morbidity (due to acute, bloody enteritis) and mortality rates (Abbas *et al*., 2012). A parasitic infestation brings about lack of thriftiness, poor growth and feed conversion, decreased egg production, and, in severe cases, death. There is need for more knowledge and availability of information which is essential in understanding the epidemiology of the disease as well as developing appropriate control measures. The aim of this research is to determine the prevalence of coccidiosis and identification of *Eimeria* spp in slaughtered birds in Lafia market, Nassarawa State, Nigeria.

2.0 MATERIALS AND METHODS

2.1 Study Area

Lafia modern market is located within Lafia, Nasarawa state. Lafia is a town in central Nigeria (Latitude 8°35'N and Longitude 8°40'E) (Figure 3.1). It is the capital city and the largest town in Nasarawa State with a population of 330,712 inhabitants according to the 2006 census results. The State has 13 Local Government Areas namely; Awe, Nasarawa, Nasarawa Eggon, Obi, Toto, Wamba, Akwanga, Doma, Karu, Keana, Keffi, Kokona and Lafia. Local Government Areas bothering Lafia include, Nasarawa Eggon, Obi, Akwanga and Doma. Nasarawa State has a total land area of 27,137.8sqkm. It shares boundary in the North with Kaduna State, in the west with Federal Capital Territory Abuja, in the east with Plateau and Taraba States and in the south by Benue and Kogi State. The main economic activities of the State are agriculture; food such as yam, cassava and melon. Production of minerals such as salt is also another major economic activity in the state. Livestock keeping especially cattle is also practiced in the State, with large number of cattle herds' resident and grazing within and around Lafia and other Local Government Areas. Also, the Fulani's in the state engage in rearing local chickens and for commercial purposes as well as private individuals keeping large poultry.

The State has a climate typical of the tropical zone because of its location and is quite pleasant. It has a maximum and minimum temperature of 81.7°F and 16.7°F respectively. Rainfall varies from 131.73cm³ in some places to 145cm in others. The months of December, January and February are cold due to harmattan wind blowing across the State from the North-East. It is characterized by two distinct seasons: dry and rainy. The dry season spans from November to February, while the rainy season is from March to October (NPC, 2006).

2.1 Study Design

A cross sectional study design was conducted from January to March, 2018 to determine the prevalence of coccidiosis in local and broiler chickens, to identify the prevalent species of *Eimeria* in the study area, to determine the risk factors of coccidiosis (breed and gender) and to determine the effect of coccidiosis on the hematology.

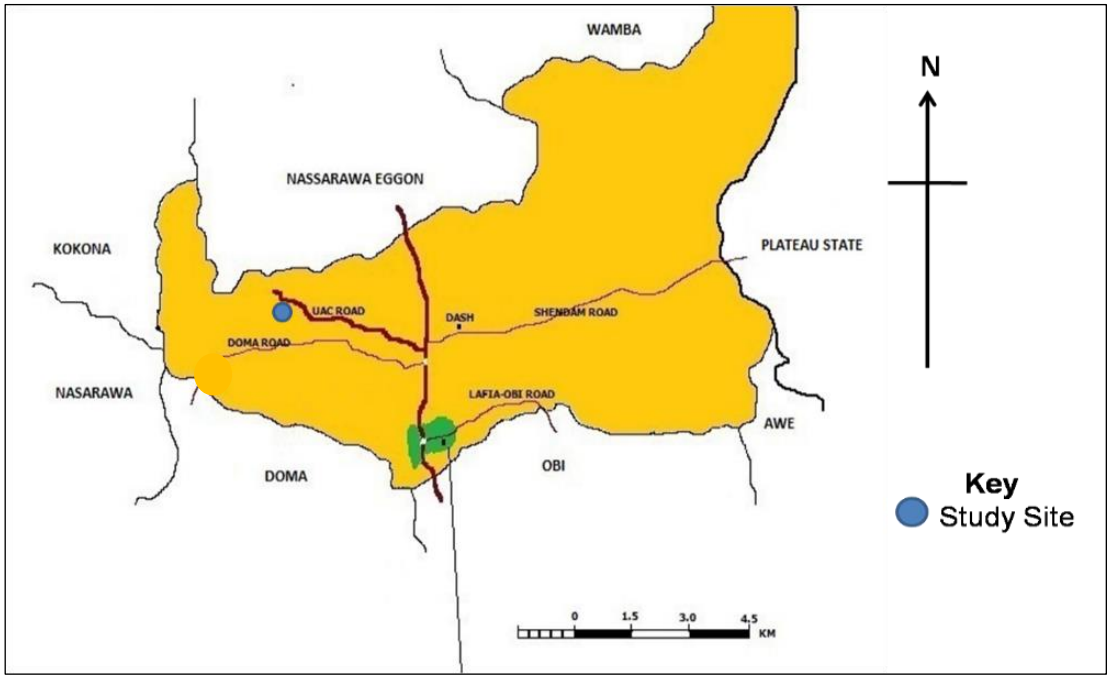

Figure 1: Map of Lafia showing Study Site [Source: Nasarawa Geographical Information Service (2018)]

2.2 Sample Collection

The studied birds were local breeds and broilers from the Lafia modern market. A total of 204 chickens of both sexes were used. The age of the chickens was determined by observing color of the shank and growth of the spur. All the chickens were approximately in the range of adult (greater than 12 weeks of age).

A total of 204 fresh faecal samples, and 204 gastrointestinal tracts (GIT) from the same slaughtered chickens were collected and examined for coccidian oocysts. Two millilitres (2ml) of blood were collected from each chicken for haematological analysis. The faecal samples were collected into properly labeled sterile bottles and GIT collected in clean labeled polythene nylon. The blood samples were collected in Ethylene Diamine Tetraacetic Acid (EDTA) bottle. The blood samples were taken to Dalhatu Araf Specialist Hospital (DASH) Laboratory for analysis while the fecal and GIT samples were conveyed immediately to the Zoology Laboratory at Federal University Lafia for the detection of coccidian oocysts.

2.3 Study methodology

2.3.1 Postmortem examination

The intestinal tract was opened with scissor, extending from the duodenum to the rectum including both cecal pouches. The gastrointestinal tract was grossly examined carefully as described by (Sell, 1996). The intestinal portions were divided into 4 sections, the upper part (duodenum and jejunum), the middle part (ileum), lower part (distal ileum and rectum) and cecal pouches. The intestinal walls of the different sites were examined for thickening, petechiae, coagulative necrosis, reddening, whitish spots, cecal cores, or bleeding. All observed gross pathological lesions were recorded**.**

2.3.2 Parasitological examination

The faeces and intestinal scraping, which was taken after postmortem of each bird were collected in separate petri-dish.

2.3.4 Direct microscopic examination

Direct microscopic examination was done by placing a very small quantity of faecal sample on a glass slide using a tooth pick and emulsifying with a drop of normal saline on glass slides. A cover slip was then placed on the smear before viewing on the microscope (Eduvie, 2002).

2.3.5 Concentration technique

The concentration and floatation methods were used to determine the presence and number of oocysts in the faecal samples according to Cheesbrough (2002). One gram of fresh faecal sample from the chicken was weighed with a weighing balance. The sample was then transferred into a beaker. A prepared saturated sodium chloride solution was poured into the sample in the beaker and mixed thoroughly, before sieving into another beaker using 90 mesh sieves. The filtrates were poured into test tubes and were placed in test tube racks. Each test tube was filled to the brim with the saturated solution of sodium with the help of Pasteur pipette.

Cover slips were used to cover the test tubes and were left to stand for about 20 minutes, allowing the ova/cysts of the parasites to float to the top of the test tube and attach itself on the cover slip. The cover slips were then gently lifted without brushing it against the test tube and placed on microscope slides sideways in one quick movement to avoid air bubbles on the glass-slides. The slides were viewed under a compound microscope using x10 and later with x40 objective lens. The *Eimeria* species were identified based on their morphologies using standard parasitological guide (Cheesbrough, 2002).

2.3.6 Identification of Species of *Eimeria*

Species of *Eimeria* were identified by combination of microscopic features of oocyst morphology (shape, size, sporulation time and color of the oocysts), the predilection site of *Eimeria* in the gut, the nature of gross lesions induced and histopathological finding as described by (Conway and McKenzie, 2008).

2.4 Data Analysis and Management

The data collected were coded and entered into Microsoft Excel and descriptive statistics was utilized to summarize the data using R-console Software program version 3.2.2. The point prevalence was calculated for all data by dividing positive samples by total number of examined samples and multiplied by hundred. Chi-square test was used to assess if there were statistically significant difference in poultry coccidiosis infection between gender and breed. For this analysis, P-value less than 0.05 was considered as significant whereas P-value greater than 0.05 was considered as not significant.

3.0 RESULTS

3.1 Prevalence of Coccidiosis

A total of 74(36.2%) birds were infected out of 204 chickens examined. Out of 122 local chickens screened, 49(40.2%) were positive of coccidiosis, while 25(30.5%) of the 82 broilers examined had infection (Table 1).

Table 1: Prevalence of Coccidiosis

Breed	Numbers Examined	Numbers Infected	Prevalence (%)
Local	122	49	40.2%
Broiler	82	25	30.5%
Total	**204**	**74**	**36.3%**

3.2 Prevalence Rate of Coccidiosis in Respect to Gender and Breeds

A total of 204 chickens were examined. Out of these, 122 were Local breed and 82 were Broilers with an infection rate of 49(40.2%) and 25(30.5%) respectively. There was a total of 135 Males and 69 Females from the two breeds. Out of these, 44(32.6%) Males were infected while 30(43.5%) Females were also infected (Table 2). The total number of chickens that tested positive to *Eimeria* was 74 (36.27%). There was no significant difference between the variables ($p>0.05$).

Table 2: Prevalence Rate of Coccidiosis in Respect to Gender and Breeds

Variables		№ of poultry examined	№ Positive (%)	χ^2 value	df	P value
Gender	Male	135	44 (32.6)			
	Female	69	30 (43.5)	1.559	1	0.2118
Breed	Local	122	49 (40.2)			
	Broiler	82	25 (30.5)	1.3236	1	0.25
Total		204	74 (36.3)			

P > 0.05: There was no significant difference observed in the prevalence of coccidiosis among the Different variables

3.5 Prevalence of *Coccidia* Species

Table 3 shows the prevalence of coccidian species in chickens from Lafia modern market. Out of the 204 samples examined, 74(36%) were found to be positive for coccidian oocyst of the *Eimeria* species. The following species were encountered: *E. acervulina*, *E. brunette*, *E. mitis*, *E. necatrix* and *E. tenella*. *E. acervulina* had the highest number of infections of 29(14.22%), followed by *E. tenella* 16(7.84%), while *E. mitis* 3(1.47%) had the least number of infections.

Table 3: Prevalence of *Coccidia* Species

***Eimeria* Species**	**No. Infected (n=204)**	**Prevalence (%)**
E. acervuline	29	14.22
E. brunette	12	5.88
E. mitis	3	1.47
E. necatrix	14	6.86
E. tenella	16	7.84
Total	**74**	**36.27**

Frequency Distribution of the Species as Single and Mixed Infection

E. tenella, E. necatrix, E. burnette, E. mitis and *E. acervulina* were the five *Eimeria* species identified in the study. All these species were identified as a sole infective agent (Table 4.) while some were mixed infective agents. Mixed infection cases recorded included; *E. tenella and E. acervulina, E. tenella and E. necatrix, E. acervulina and E. necatrix, E. brunette and E. acervulina.*

Among the single infection, *E. acervulina* occurred most frequently with prevalence of 31.08%, while *E. tenella*, *E. necatrix* and *E. brunetti* had 14.86% in each case. *E. mitis* had the least observed occurrence (4.05%). For the Mixed infection, *E. tenella* and *E. acervulina* occurred most frequently with prevalence of 8.11%, followed by *E. tenella* and *E. necatrix* (5.41%). The least prevalence was recorded for *E. acervulina* and *E. brunette* (2.70%). The result showed overall prevalence of 79.7% (59/74) and 20.3% (15/74) for single and mixed infection, respectively as shown in Table 5.

Table 5: Frequency Distribution of the Species as Single and Mixed Infection

Species of *Eimeria* as single infection	**№ Observed**	**Prevalence (%)**
E. acervuline	23	31.08%
E. necatrix	11	14.86%
E. brunette	11	14.86%
E. tenella	11	14.86%
E. mitis	3	4.05%
Mixed-Infections *E. tenella + E. acervulina*	6	8.11%
E. tenella + E. necatrix	4	5.41%
E. acervulina + E. necatrix	3	4.05%
E. acervulina + E. brunette	2	2.70%
Total	**74**	**100%**

Figure 2: A: Oocyst of *Eimeria necatrix* and B: *E. acervulina* (x400 magnification)

Figure 3: Oocyst of *E. brunette* (x400 magnification) and *Choanotaenia infundibulum*

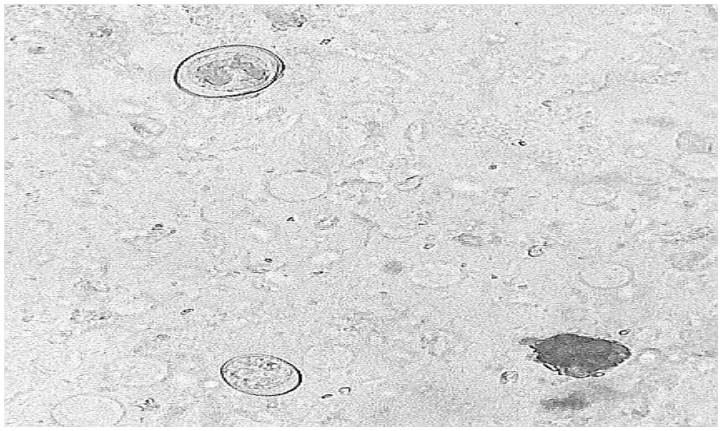

Figure4: Oocyst of *E. tenella* (x400 magnification)

Morphological features of the oocyte of *Eimeria* Spp at x400 magnification shows that it is sub-spherical with rough bilayered oocyst wall. Oocyst residuum, polar granule and the micropyle were absent**.**

4.0 DISCUSSIONS

Coccidiosis is considered the most prevalent intestinal parasitic disease in commercial chicken production system worldwide (Nematollahi *et al*., 2009). From this study, results show that chickens were infected with coccidiosis in the period of study which is January to March. This agrees with the finding of Lawal *et al.* (2016) who reported that in dry season, chickens could be infected with *Eimeria* species in Borno State, North East Nigeria. Similarly, it agrees with the findings of Awais *et al*. (2012) and Bachaya *et al*. (2015) who recorded peak coccidial infection in chickens in dry seasons in Pakistan. However, it disagrees with the findings of Ngele (2016) who reported that the high prevalence of infection among the chickens sampled was due to the period of the sampling which was during the rainy season. The high prevalence from this study may be attributed to the harsh dry cold harmattan weather which can be implicating in immunosuppression and predisposition of avian birds to wide range of diseases including coccidiosis. Poor management of poultry shed in the market could also be a factor.

The overall prevalence of coccidial infection from the 204 chickens sampled was 36.3%. This is in agreement with Muazu *et al.* (2008) who reported a prevalence of 36.65% in adult chickens from National Veterinary Research Institute, Vom, Jos-Nigeria. Ngele (2017) reported an overall prevalence of 33.6% in Afikpo Metropolis of Ebonyi State, Nigeria. Jatau *et al*. (2012) recorded a prevalence rate of 33.3% in Sokoto State, Nigeria. Olanrewaju *et al*., 2014 recorded a total prevalence 69% of coccidian infection in chickens from their work carried out in Gwagwalada main market, Abuja Nigeria. The prevalence of 31.8% was reported by Nikam *et al*. (2012) carried out in India.

In previous studies infection rate was reported to be 54.3% in Turkey,20.6% and 70.9 % in Ethiopia (Karaer *et al*., 2012; Oljri *et al*., 2012), in Pakistan, 71.9% was recorded, 78% in Jordan, 88.4% in Argentina and 92% in Romania. The variation in the reported prevalence might be attributed to different factors such as sampling periods, sample size,

geographical area and climatic conditions observed in the different study areas. It should be borne in mind however, that incidence of coccidiosis is high in highly humid geographical areas explaining the higher prevalence reported in different parts of Nigeria.

The high prevalence recorded in this study confirms the endemicity of coccidiosis caused by *Eimeria* species in Lafia Modern Market of Nasarawa State. However, the high rate of infection among the chickens sampled may be due to the husbandry method and the environment in which they are being kept in the market (i.e., the place of purchase) support the development of oocysts through developmental stages. Chickens feed and water is contaminated by oocysts because the environment is damp especially in the market place where nobody cares about cleaning the chicken cages. The number of *Eimeria* oocysts in the litter increases significantly at the time of placement of subsequent flocks.

There is higher incidence of coccidiosis in local chickens 40.2% compared to broiler chickens, 30.4%. This is in agreement with the work of Olanrewaju *et al*. (2014) who also recorded a higher rate of coccidiosis in local breed, 66% to broiler breeds with 60% from Gwagwalada Main market, Abuja-Nigeria. It also corroborates with the report by Benisheikh *et al*. (2013) who reported 38.8% rate of infection in local chickens and 22.8% in broiler chickens. Moreso, Ashenafi *et al*. (2004) in Ethiopia reported 25.8% incidence rate of avian coccidiosis in indigenous scavenging chickens. However, this does not agree with the reports of Jatau *et al*. (2012) with prevalence of 77.4% and 18.6% for broiler and local chickens respectively and Oljira *et al*. (2012) who reported high prevalence of coccidian infection in exotic broiler birds as compared to the local chickens with infection rate of 25.1% to 12.41% respectively. This variation in breed may be as a result of nutritional status of the breed as poorly feed birds may be more susceptible to coccidial infection although this finding shows no statistical significance in breed of the chickens.

Coccidian infection rate in this study was more in females than males with prevalence of 43.5% to 32.6% respectively. The association between the sex was statistically insignificant, p=0.21 indicating that both sexes have equal chance of acquiring and becoming infected with *Eimeria* oocysts during feeding or in an outbreak scenario. The finding agrees with the work of Lawal *et al*. (2014) who reported high frequency of coccidiosis in female chickens (7.4%), compared to the male counterpart (5.1%) in his Borno State, Nigeria. Oljira *et al*. (2012) also reported higher prevalence in female chickens (21.4%) than males (19.4%). However, Olanrewaju *et al*. (2014) disagrees with the findings above, recording higher prevalence of coccidiosis in males (20%) than in female chickens (19.3%) in Gwagwalada, Abuja-Nigeria.

Five important species of *Eimeria* were identified in this present study. They are; *E. acervulina, E. brunette, E. mitis, E. necatrix* and *E. tenella* with infection rate of 39%, 16.2%, 4.1%, 18.9%, and 21.6% respectively. The species of *Eimeria* identified from this study is in agreement with Ngele (2016) who reported five Eimerian species in his work carried out in Ebonyi State, Nigeria. Lawal *et al*. (2014) in Maiduguri also reported four species of *Eimeria* except for *E. brunetti*. Jatau *et al*. (2012) in his work carried out in Zaria, Nigeria reported about seven species, so is reports from Dinka and Yacob (2012) in Ethiopia, Muhammad *et al*. (2011) in Iran and Bachaya *et al*. (2015) in Pakistan all reported four Eimerian species except *E. brunetti* which suggests that those species of *Eimeria* are widely distributed in many countries.

The Eimerian species identified from this work are considered to be among the most important to poultry industry. Owai and Gloria (2010) and Jatau *et al*. (2012) reported that in Nigeria, coccidiosis is caused by *E. tenella, E. necatrix, E. acervulina, E. mitis, E. brunneti,* and *E. praecox*. The identification of *E. tenella and E. necatrix* in this study agrees with Maikai *et al*. (2007) who reported that they are the two most pathogenic species of *Eimeria.* Although *E. acervulina* has the highest prevalence of 39.2%, *E. tenella and E. necatrix* are the next two most prevalent with 21.6% and 18.9% infection rate respectively.

Single and mixed or co-infection of two *Eimeria* species were observed in the sample's chickens. This same observation of infection was made by Nematollahi *et al*. (2009); Razmi and Kalideri (2000); Sharma *et al*. (2013); Nikam *et al*. (2012); Jatau *et al*. (2012) from their different research works. Single infections were frequently encountered than mixed or co-infection with a total proportion of 79.7% to 20.3% respectively. The larger proportion of mixed infection consists of *E. acervulina* which may be due to the wide spread distribution of the specie in the area. Patrick and Mgbere (2010) observed and reported that infection with a single species of coccidian is rare in natural conditions, mixed infection being the rule but nevertheless in many outbreaks, the clinical entity can be ascribed principally to one species and occasionally, a combination of two or more.

The species of *Eimeria* obtained were more in the GIT and few in the dropping. This may be attributed to the fact that more species causes intestinal coccidiosis compared to only *E. tenella* that causes

cecal coccidiosis. There are other intestinal parasites encountered in this study. They are cestodes and nematodes with overall prevalence of 49%. This is in agreement with the finding of Yoriyo *et al*. (2008) where Cestodes and Nematodes were implicated as the major cause of helminth infection in domestic chickens with a total infection rate of 87.8%.

CONCLUSION

It can be concluded that avian coccidiosis is endemic in Lafia Modern Market of Nassarawa state due to the high prevalence of result obtained from this study. This is more prominent in Local breed than in broilers and higher in female chickens than male chickens however, no significant difference between breed as well as gender. From the specie of *Eimeria* obtained, *E. acervulina* occurred most frequently while *E. mitis* had the least frequency of occurrence. For the Mixed infection, *E. tenella* and *E. acervulina* occurred most frequently while *E. acervulina* and *E. brunette* occurred least frequently. Other disease-causing helminth organisms discovered in the tested samples include; *Ascaridia galli*, *Hymenolepis cantaniana* and *Strongyloides avium* amongst others.

REFERENCES

- Abbas, R.Z., Colwell, D.D., & Gilleard, J. (2012). Botanicals: An Alternative Approach for the Control of Avian Coccidiosis. *Worlds Poultry Science Journal*, 4, 439-443.
- Adamu, A.Y., Ahmed A.B., Abubakar M.B., & Lawal M.D. (2009). A Retrospective Study (2004-2008) of Poultry Diseases in Veterinary Teaching Hospital (VTH). Usman Danfodio University, Sokoto (UDUS) and Sokoto Veterinary Centre (SVC), Sokoto State, Nigeria. *International Journal of Animal and Veterinary Advances*, 1(1), 15-17.
- Adene, D.F., & Oluloyede O.B. (2004). Coccidiosis of Poultry,the Biology, Diagnosis, Treatment and Control. *Sterling-Horden Publishers (Nig.) Ltd, Ibadan*, pp 129-164.
- Adewale, M.T., & Ajibola, O.B. (2013). Does Capital Structure Enhance Firm Performance ? Evidence from Nigeria. *IUPJournal of Bank Management*, 12, 43–44.
- Adewole S.O. (2012). The Efficacy of Drugs in the Treatment of Coccidiosis in Chickens in Selected Poultries. *AR International*, 2, 20-24.
- Ajetomobi, J.O., & Adepoju, A.A. (2010). Avian Influenza Awareness and Profitability of Poultry Egg Production in Oyo State, Nigeria. *International Journal of Poultry Science*, 9, 183–187.
- Akintunde, O.K., Adeoti, A.I., Okoruwa, V.O., Omonona, B.T., & Abu, A.O. (2015). Effect of Disease Management on Profitability of Chicken Egg Production in Southwest Nigeria. *Asian Journal Poultry Science*, 9, 1–18.
- Al-Jamaien, H.H. (2013). Helminth Parasites in the Intestinal Tract of Indigenous Chickens in Jordanian Villages. *Pakistan Journal of Nutrition*, 12, 209–212.
- Al-Natour, M.Q., Suleiman, M.M., & Abo-Shehada, M.N. (2002). Flock-Level Prevalence of *Eimeria*Species Among Broiler Chicks in Northern Jordan. *Journal of Veterinary*. *Medicine*, 53, 305–310.
- Al-Quraishy, S., Abdel-Baki, A.S., & Dkhil, M.A. (2009). *Eimeriatenella*Infection Among Broiler Chicks *Gallusdomesticus* in Riyadh City, Saudi Arabia. *Journal of King, SaudiUniversity of Science*, 21, 191–193.
- Amos, T.T. (2006). Analysis of Backyard Poultry Production in Ondo State, Nigeria. *International Journal of Poultry Science*, 5, 247–250.
- Asuming-Brempong, S., Anarfi, J.K., Arthur, S., & Asante, S. (2013). Determinants of Commercialization of Smallholder Tomato and Pineapple Farms in Ghana. *American Journal of Agriculture*, 3, 606–630.
- Ashenafi, H., Tadesse, S., Medhin, G., & Tibbo, M. (2004). Study on Coccidiosis of Scavenging Indigenous Chickens in Central Ethiopia. *Tropical Animal Health and Production*, 36, 693-701.
- Atteh, J.O. (2003). Romancing The Chickens, 68th Inaugural Lecture, University of Ilorin. *Unilorin Press Publication*.
- Awais M.M., Akhtar, M., Iqbal, Z., Muhammed, F., & Anwar, M.I. (2012) Seasonal Prevalence of Coccidisis in Industrial Broiler Chickensin Falsalabad, Ounjab, Pakistan. *Tropical Animal Health and Production*, 44, 323-328.
- Bachaya, H.A., Abbas, R.Z., Raza, M.A., Iqbal,Z., Rehman, T.U., Baber, W., & Hussein , R. (2015). Existence of Coccidiosis and Associated Risk Factors in Broiler Chickens in Southern Punjab, Pakistan. *Pakistan Veterinary Journal*, 35(1), 597-600.
- Balami A.G., Ndahi J.J., Zaifada A.U., Mustafa M., & Jarafu D.J. (2014). A Retrospective Study of Poultry Diseases Diagnosed in Maiduguri, North East, Nigeria. Poultry Fish and Wildlife Science, 2(1),1-4.
- Barde, J.I., Garba, A., Gashua, M.M., Talba, M.A., Gugong, V.T., Sa'adatu, I., Owada, A.H., Konzing, L., Awulu, S.J., & Mohammed, M.N. (2011). Common Diseases of Poultry in Kaduna State. *Nigerian Veterinary Journal*, 33(3), 581–585.
- Benisheikh, A.A.G., Tom, I., Thamus, Z.Y., Sanda, K.A., & Biu A.A. (2013). Comparative Studies on the Prevalence of Coccidiosis in Indigenous(*Gallus gallus domesticus*) and Exotic Breed in Benisheikh Town, Borno State. *Journal of Medical*

and Applied Biosciences, 5(2), 33-37.

- Brown, M.A., Ball, S.J., & Snow, K.R.(2010). Coccidian parasites of British wild birds. *Journal of National History*. 44: 2669–2691.
- Butcher, G.D., Jacob, J.P., & Mather, F.B. (2009). *Common Poultry Diseases, Boards.*
- Byaruhanga, J., Tayebwa, D.S., Eneku, W., Afayoa, M., Mutebi, F., Ndyanabo, S., Kakooza, S., Okwee-Acai, J., Tweyongyere, R., Wampande, E.M., & Vudriko, P. (2017). Retrospective Study on Cattle and Poultry Diseases in Uganda. *International Journal of Veterinary. Science Medicine*, 7(1),10-16.
- Cattoli, G., Susta, L., Terregino, C., & Brown, C. (2011). Newcastle Disease: A Review of Field Recognition and Current Methods of Laboratory Detection. *Journal of Veterinary Diagnosis*, 23, 637–656.
- Chadd, S. (2007). Future Trends and Developments in Poultry Nutrition. *Procedure for International Conference Poultry in 21st Century*, 1–29.
- Chapman, H.D. (2014). Milestones in Avian Coccidiosis Research: A Review:*American History Review*. https://doi.org/10.1093/ahr/119.2.501.
- Chaves Hernández, A.J. (2014). Poultry and Avian Diseases. *Encyclopedia of Agriculture and Food Systems*, 10, 504–520.
- Cheesbrough, M. (2002). District Laboratory Practice in Tropical Countries Part I. *Published Cambridge University Press, United Kingdom.*
- Coles, E.H. (1986). *Veterinary Clinical Pathology*. *4th Edition.* Sounders Company, Philadelphia, P.A., USA. pp 486.
- Conan, A., Goutard, F.L., Sorn, S., & Vong, S. (2012). Biosecurity Measures for Backyard Poultry in Developing Countries: A systematic review. *BMC Veterinary Research*, 8 (8), 240-246.
- Conway, D.P., & McKenzie, M.E. (2008). Poultry Coccidiosis: Diagnostic and Testing Procedures: Third Edition, Poultry Coccidiosis: *Third Edition*. https://doi.org/10.1002/9780470344620
- Conway, D.P., McKenzie, M.E., & Dayton, A.D. (1990). Relationship of Coccidial Lesion Scores and Weight Gain in Infections of *Eimeria acervulina*, *E. Maxima and E.tenella* in Broilers. *Avian Pathology*, l(19), 489–496.
- Corkery, G., Ward, S., Kenny, C., & Hemmingway, P. (2013). Incorporating Smart Sensing Technologies into the Poultry Industry. *World's Journal of Poultry*, 3, 106–128.
- Cowper, B., Matthews, S., & Tomley, F. (2012). The Molecular Basis for the Distinct Host and Tissue Tropisms Of Coccidian Parasites. *Molecular Biochemistry Parasitology*, 9(5), 56-65
- Dalloul, R.A., & Lillehoj, H.S. (2006). Poultry Coccidiosis: Recent Advancements in Control Measures and Vaccine Development. *Expert Review Vaccines*, https://doi.org/10.1586/14760584.5.1.143
- Doyle, M.P., & Erickson, M.C. (2006). Reducing the Carriage of Foodborne Pathogens In Livestock and Poultry. *Journal of Poultry Science*, 10(5), 1090-1093.
- Dube, S., Zindi, P., Mbanga, J., & Dube, C. (2010). A Study of Scavenging Poultry Gastrointestinal and Ecto-Parasites In Rural Areas of Matebeleland Province, Zimbabwe. *International Journal of Poultry Science*, 9, 911–915.
- Eduvie L.O. (2002). Poultry Production in Nigeria. A Training Manual. National Animal Production Research Institute. *Federal Ministry of Agriculture and Water Resources, Ahmadu Bello University, Zaria, Nigeria.*
- Emokaro, C.O. (2015). Technical Efficiency and Production Elasticity of Broiler Producers in Edo State, Nigeria. *Applied Tropical Agriculture.*
- Etuk, E.B., Okoli, I.C., & Uko, M.U. (2004). Prevalence and Management Issues Associated with Poultry Coccidiosis in Abak Agricultural Zone of Akwa Ibom State, Nigeria. *International Journal of Poultry Science*, 3, 135–139.
- Ezekiel, C.N., Atehnkeng, J., Odebode, A.C., & Bandyopadhyay, R. (2014). Distribution of Aflatoxigenic Aspergillus Section Flavi in Commercial Poultry Feed in Nigeria. *International Journal on Food Microbiology*, 189, 18–25.
- Fukata, T., Komba, Y., Sasai, K., Baba, E., & Arakawa, A. (1997). Evaluation of Plasma Chemistry and Haematological Studies on Chickens Infected with *Eimeriatenella* and *Eimeriaacervulina*. *Veterinary Record*, 141, 44-46.
- Gari, G., Tilahun, G., & Dorchies, P. (2008). Study on poultry coccidiosis in Tiyo District, Arsi Zone, Ethiopia. *International Journal Poultry Science*, 7, 251–256.
- Gerber, P.J., Mottet, A., Opio, C.I., Falcucci, A., & Teillard, F. (2015). Environmental Impacts of Beef Production: Review of challenges and Perspectives for Durability. *Journal of Meat Science*, 109, 2–12.
- Gussem, M.D. (2006). Coccidiosis in Poultry : Review on Diagnosis, Control, Prevention and Interaction with Overall Gut Health. *16th European Symposium on Poultry Nutrition.*
- Györke, A., Pop, L., & Cozma, V. (2013). Prevalence and Distribution of *Eimeria*Species in Broiler Chicken Farms of Different Capacities. *Journal of Parasitology*, 20(9), 50-55.
- Hamidinejat, H., Shapouri Seifiabad, M., Mayahi, M., & Borujeni, M.P. (2010). Characterization of *Eimeria*Species in Commercial Broilers by PCR Based on ITS1 Regions of rDNA. *Iran Journal of Parasitology*, 5,48–54.
- Handipour, M.M., Olyaie,A., Naderi, M., Azad, F.,

& Nekouie, O. (2013). Prevalence of *Eimeria* Species in Scavenging Native Chickens of Shiraz, Iran. *African Journal of Poultry Farming,* 1(2), 34-36.

- Haug, A., Gjevre, A.G., Thebo, P., Mattsson, J.G., & Kaldhusdal, M. (2008). Coccidial Infections in Commercial Broilers: Epidemiological Aspects and Comparison of *Eimeria*Species Identification by Morphometric and Polymerase Chain Reaction Techniques. *Journal of Avian Pathology*, 37, 161–170.
- Ilyes, M., & Ahmed, B. (2013). Cestode Parasites of Free-Range Chickens (*Gallus gallusdomesticus*) in the North-Eastern of Algeria. *International Journal of Poultry Science*, 12(6), 681–684.
- Irizaary-Rovira, A.R. (2004). Avian and Reptilian Clinical Pathology(Avian Haematology and Biochemical Analysis). *Veterinary Clinical Pathology Secret*, 11(5), 282-313.
- Jatau, I.D., Sulaiman, N.H., Musa, I.W., Lawal, A.I., Okubanjo, O.O., Isah, I., & Magaji, Y. (2012). Prevalence of Coccidia Infection and Preponderance *Eimeria*Species in Free Range Indigenous and Intensively Managed Exotic Chickens During Hot-Wet Season, in Zaria, Nigeria. *Asian Journal of Poultry Science*, 6, 79–88.
- Kaboudi, K., Umar, S., & Munir, M.T. (2016). Prevalence of Coccidiosis in Free-Range Chicken in Sidi Thabet, Tunisia. Cairo *Journal of Sciene*, 11(55), 70-75.
- Kral, I., & Suchy, P. (2000). Haematological Studies in Adolescent Breeding Cocks. *Acta Veterinaria Brno*, 69, 189-194.
- Karaer, Z., Guven, E., Akcay, A., Kar, S., Nalbantoglu, S., & Cakmak, A. (2012). Prevalence of Subclinical Coccidiosis in Broiler Farms in Turkey. *Tropical Animal. Health Production*, 44, 589–594.
- Kim, D.K., Lillehoj, H.S., Lee, S.H., Lillehoj, E.P., & Bravo, D. (2013). Improved Resistance to *Eimeria acervulina*Infection in Chickens Due to Dietary Supplementation with Garlic Metabolites. *Britain Journal of Nutrition*, 109, 76–88.
- Lawal, J.R., Jajere, S.M., Ibrahim, U.I., Geidam, Y.A., Gulani, I.A., Musa, G., & Ibekwe, B.U. (2016). Prevalence of Coccidiosis Among Village and Exotic Breed of Chickens in Maiduguri, Nigeria. *Veterinary World Journal*, 9, 653–659.
- Lee, K.W., Lillehoj, H.S., Jang, S.I., Li, G.X., Bautista, D.A., Phillips, K., Ritter, D., Lillehoj, E.P., & Siragusa, G.R. (2011). Effects Of Coccidiosis Control Programs on Antibody Levels Against Selected Pathogens and Serum Nitric Oxide Levels in Broiler Chickens. *Journal of Applied Poultry Research*, 20, 143–152.
- Lillehoj, H.S., & Trout, J.M. (1993). Coccidia: A Review of Recent Advances on Immunity and Vaccine Development. *Journal of Avian Pathology*, 10(2), 841-848.
- Luka,S.A., & I.S.N.(2007). Gastrointestinal Parasites of Domestic Chicken *Gallus-gallusdomesticus L*innaeus 1758 in Samaru, Zaria Nigeria. *Science World Journal*, 2, 34–36.
- Maikai, V. A., Makeri, H. K., Adeiza, A. A., & Maikai, B. V. O. (2007). Preliminary Studies of AnticoccidialEffect of Mahogany (*Khayasenegalensis*) and African Locust Bean Tree (*Parkiabiglobosa*) Aqueous Bark Extracts on Chicken Infected with Coccidia. *Savannah Journal of Agriculture*, 2, 43-45
- Majero O.M.(1981). Coccidiosis Oocysts from Broiler Chickens in Nigeria. *Rev. Elev. Med. Vet. Pays Trop.*, 34, 23-25.
- Mansoori, B., & Modirsanei, M. (2012). Effects of Dietary Tannic Acid and Vaccination on the Course of Coccidiosis in Experimentally Challenged Broiler Chicken. *Veterinary Parasitology Journal*, 187, 119–122.
- Marques, E.A.G., Williams, D.J., Assis, I.R., & Leão, M.F. (2017). Effects of Weathering on Characteristics of Rocks in a Subtropical Climate: Weathering Morphology, in Situ, Laboratory and Mineralogical Characterization. *Environmental Earth Science*, 76, 65-69.
- Maxwell, O.N., Roseline, O.E., Daniel, O.O., & Cornelius, J.O. (2016). Haemoparasitism of Local and Exotic Chickens Reared in the Tropical Rainforest Zone of Owerri Nigeria. *Alexandria Journal of Veterinary Science*, 10(2), 54-55.
- Meskerem, A., Chaiwat, B., Nirat, G., & Montakan V. (2013). Haematological, Biochemical and Histopathological Changes Caused by Coccidiosis in Chickens. *Journal of National Science,* 47, 238-246.
- Molla, W., Haile, H., Almaw, G., & Temesgen, W. (2012). Gastrointestinal Helminths of Local Backyard Chickens in North Gondar Administrative Zone, Ethiopia. *Toulouse Journal of Medical Veterinary*, 163, 362–367.
- Muazu, A., Masdooq, A.A., Ngbede, J., Salihu, A.E., Haruna, G., Habu, A.K., Sati, M.N., & Jamilu, H. (2008). Prevalence and Identification of Species of *Eimeria*Causing Coccidiosis in Poultry within Vom, Plateau state, Nigeria. *Intetnational Journal of Poultry Science*, 7, 917–918.
- Muhammad Mehdi, H., Ahad, O., Mohammed, N., Fariborz, A., & Omid, N. (2011). Prevalence of *Eimeria* Species in Scavenging Native Chickens of Shiraz, Iran. *African Journal of Microbiology Research,* 5(20), 3296-3299.
- Mungube, E.O., Bauni, S.M., Tenhagen, B.A., Wamae, L.W., Nzioka, S.M., Muhammed, L., & Nginyi, J.M. (2008). Prevalence of Parasites Of

The Local Scavenging Chickens in a Selected Semi-Arid Zone of Eastern Kenya. *Tropical Animal Health Production*, 40, 101–109.

- Munteanu, N., & Demirbag, Z. (2009). Prevalence of *Eimeria*Species Among Broiler Chicks in Tabriz (Northwest of Iran). *Europian Journal of Parasitology*, 4, 53–58.
- Musa, B.M., Bussell, S., Borodo, M.M., Samaila, A.A., & Femi, O.L. (2015). Prevalence of Hepatitis B Virus Infection in Nigeria, (2013): A Systematic Review And Meta-Analysis. *Nigerian Journal of Clinical Practices*, 15(5), 30-35
- Nematollahi, A., Moghaddam, G.H., & Fashbaf Pourabad, R. (2009). Prevalence of *Eimeria* Species Among Broiler Chicks in Tabriz (Northwest of Iran). *Munis Entomology and Zoology*, 4,53-58.
- Ngele, K.K. (2017). Prevalence of *Eimeria* Species on Exotic Chickens Reared in Afikpo Metropolis, Ebonyi State, Nigeria. *Journal of Science And Technology*, 3(2), 67-81.
- Nikam, S.V., Kanse, V.S., Jadhav, B.N., & Jaid E.L. (2012). Comparative Study of Seasonal Incidence of Chickens Coccidiosis in Eight Districts of Marathwada Region, Maharashtra State, India. *Trends of Parasitology Research*, 1(1), 7-9.
- Nikolov, S.C. (2009). Effect of Stand Age on Bird Communities in Late-Successional Macedonian Pine Forests in Bulgaria. *Ecological Management*, 257, 580–587.
- Nnadi, P.A., & George, S.O. (2010). A Cross-Sectional Survey on Parasites of Chickens In Selected Villages in the Subhumid Zones of South-Eastern Nigeria. *Journal of Parasitology Research*, 1(4), 18-24.
- Novaes, J., Rangel, L.T.L.D., Ferro, M., Abe, R.Y., Manha, A.P.S., de Mello, J.C.M., Varuzza, L., Durham, A.M., Madeira, A.M.B.N., & Gruber, A. (2012). A Comparative Transcriptome Analysis Reveals Expression Profiles Conserved Across Three *Eimeria* spp. of Domestic Fowl and Associated with Multiple Developmental Stages. *International Journal of Parasitology*, 42, 39–48.
- N.P.C.(2006). PHC Priority Table. *population.gov.ng*, 1(1), 1.
- Obayelu, A.E. (2007). Socio-Economic Analysis of the Impacts of Avian Influenza Epidemic on Households Poultry Consumption and Poultry Industry in Nigeria: Empirical investigation of Kwara State. *Livestock Research of Rural Developmen*t, 19, 16-23
- Ogbe, A.O., Atawodi, S.E., Abdu, P.A., Oguntayo B.O., & Noel Dus. (2010). Oral Treatment of *Eimeria tenella*-Infected Broilers Using Aqeous Extract of Wild Mushroom(*Ganoderma Sp*.): Effect on Haematological Parameters and Histopathology Lesions. *African Journal of Biotechnology*, 9, 8923-8927.
- Ojo, S.O. (2003). Productivity and Technical Efficiency of Poultry Egg Production in Nigeria. *International Journal of Poultry Science, 2,* 459–464.
- Olanrewaju, C.A., & Agbor, R.Y. (2014). Prevalence of Coccidiosis Among poultry birds Slaughtered at Gwagwalada Main Market, Abuja, FCT, Nigeria. *The International Journal of Engineering and Science*, 3(1), 41-45.
- Oljra, D., Melaku, A., & Bogale, B.(2012). Prevalence and Risk Factors of Coccidiosis in Poultry Farms in and around Ambo Town, Western Ethiopia. American- Eurasian *Journal of Scientific Research*, 7(4), 146-149.
- Olumayowa, O., & Abiodun, O.O. (2011). Profit Efficiency And Waste Management in Poultry Farming: The Case of Egba Division, Ogun State, Nigeria. *International Journal of Poultry Science*, 10(2), 137–142.
- Owai, P. U., & Gloria, M. (2010). Effects of Components of *Meliaazadirachta*on Coccidia Infections in Broilers in Calabar, Nigeria. *International Journal of Poultry Science*, 9(10), 931-934.
- Patra, G., Ali, M.A., Chanu, K.V., Jonathan, L., Joy, L.K., Prava, M., Ravindran, R., Das, G., & Devi, L.I. (2010). PCR Based Diagnosis of *Eimeriatenella* Infection in Broiler Chicken. *International Journal of Poultry Science*, 9(3), 813–818.
- Patrick, O. U., & Mgbere, M. (2010). Effects of Components of *Meliaazadirachta*on Coccidia Infections in Broilers in Calabar, Nigeria. *International Journal of Poultry Sciences*, 9 (10), 431-434.
- Peek, H.W., & Landman, W.J.M. (2011). Coccidiosis in Poultry: Anticoccidial Products, Vaccines and other Prevention Strategies. *Veterinary Questionaire*, 31, 143–161.
- Permin, A., & Ranvig, H. (2001). Genetic Resistance to *Ascaridia galli* Infections in Chickens. *Veterinary Parasitology*, 102(9), 101–111.
- Pipy Fawole, O. (2006). Poultry Farmers' Utilization of Information in Lagelu Local Government Area, Oyo State of Nigeria. *International Journal of Poultry Science*, 5, 499–501.
- Pleidrup, J., Dalgaard, T.S., Norup, L.R., Permin, A., Schou, T.W., Skovgaard, K., Vadekær, D.F., Jungersen, G., Sørensen, P., & Juul-Madsen, H.R., 2014. *Ascaridiagalli*Infection Influences the Development of Both Humoral and Cell-Mediated Immunity After Newcastle Disease vaccination in chickens. *Journal of Vaccine*, 32, 383–392.

- Puttalakshmamma, G.C., Ananda, K.J., Prathiush, P.R., Mamatha, G.S., & Rao, S. (2008). Prevalence of Gastrointestinal Parasites of Poultry in and Around Banglore. *Veterinary World*, 1, 201–202
- Quiroz-Castañeda, R.E., & Dantán-González, E. (2015). Control of Avian Coccidiosis: Future and present Natural Alternatives. *Biomedical Research International*, 4(3), 6-10
- Radfar, M.H., Khedri, J., Adinehbeigi, K., Nabavi, R., & Rahmani, K. (2012). Prevalence of Parasites and Associated Risk Factors in Domestic Pigeons (*Columba livia domestica*) and Free-Range Backyard Chickens of Sistan Region, East of Iran. *Journal of. Parasite Diseases*, 36, 220–225.
- Razmi, G.R., & Kalideri, A.G. (2000). Prevalence of Subclinical Coccidiosis in in Broiler Chicken Farms in the Municipality of Mashhad, Khorasan, Iran. Prev. *Veterinary Journal of Medicine*, 44(3), 3-4.
- Reid, W.M. (1990). History of Avian Medicine in the United States. X Control of coccidiosis. *Avian Diseases*, 34:509–525.
- Reza Razmi, G., & Ali Kalideri, G. (2000). Prevalence of subclinical coccidiosis in broiler-chicken farms in the municipality of Mashhad, Khorasan, Iran. *Veterinary Journal of Medicine*, 44, 247–253.
- Riise, J.C., Permin, A., & Kryger, K.N. (2005). Strategies for Developing Family Poultry Production at Village Level – Experiences from West Africa and Asia. *World Poultry Science Journal*, 61,15–22.
- Sabourin, V., & Ayande, A. (2015). Commercial Opportunities and Market Demand for Nano-Technologies in Agri-Business Sector. *Journal of Technology Management Innovation*, 10, 40–51.
- Schulze, A. (2001). Comparative Anatomy of Excretory Organs in Vestimentiferan Tube Worms (*Pogonophora obturata*). *Journal of Morphology*, 250, 1–11.
- Sell, J.L. (1996). Physiological Limitations and Potential for Improvementin Gastrointestinal Tract Function of Poultry. *Journal of Applied Poultry Research*, 5:96–101.
- Shane, S.M., Stern, N.J., Saif, Y. M., Barnes, H. J., Glisson, J. R., Fadly, A. M., McDougald, L. R., & Swayne, D. E. (2003). Diseases of Poultry.*Journal of Veterinary World*, 4(8), 261-263.
- Sharma, S., Iqbal, A., Azmi. S., & Shah, H.A. (2013). Study of Poultry Coccidiosis in Organized and Backyard Farms of Jammu Region. *Veterinary World*, 6(8), 467-469.
- Shimizu, T., Yaegashi, H., Ito, T., & Kanematsu, S. (2015). Systemic RNA Interference is not Triggered by Locally-Induced RNA Interference in a Plant Pathogenic Fungus, *Rosellinia necatrix*. *Fungal Genetic Biology*, 76, 27–35.
- Shirley, M.W. (2000). The Genome of *Eimeria* spp., with Special Reference to *Eimeriatenella* - A Coccidium from the Chicken. *International Journal of Parasitology*, 99, 183-186.
- Slassie, L.G., Melesse, A., Banerjee, S., & Beyene, G. (2015). Characterization of Village Chicken Production System Under Traditional Management in Gantaafeshum district of Eastern Tigray, Ethiopia. *Livestock Research of Rural Development*, 27.
- Sreedevi, C., Jyothisree, C., Rama Devi, V., Annapurna, P., & Jeyabal, L. (2016). Seasonal Prevalence of Gastrointestinal Parasites in domestic fowl (*Gallus gallus domesticus*) in and Around Gannavaram, Andhra Pradesh. *Journal of Parasitology Diseases*, 40, 656–661.
- Stucki, U., Braun, R., & Roditi, I. (1993). *Eimeriatenella*: Characterization of a 5S ribosomal RNA Repeat Unit and its Use as a Species-Specific Probe. *ExperimentalParasitology*, 76, 68–75.
- Szymanski, M., Barciszewska, M.Z., Erdmann, V. A., & Barciszewski, J. (2002). 5S Ribosomal RNA Database. *Nucleic Acids Research*, 30, 176–178.
- Tsuji, N., Kawazu, S., Ohta, M., Kamio, T., Isobe, T., Shimura, K., & Fujisaki, K. (1997). Discrimination of Eight Chicken *Eimeria*Species Using the Two-Step Polymerase Chain Reaction. *Journal of Parasitology*, 83(2), 966–970.
- Uza, D.V., Olarunju S.A.S., & Orkpeh J.M.T. (2001). An Assessment of the Disease and Production Status of Indigenous Poultry in Benue and Nasarawa States of Nigeria. *Proceedings of the 26th Annual Confrence of Nigerian Society of Animal Production Zaria, Nigeria*, 26, 73-75.
- Wakenell, P.S.(2010). Haematology of Chickens and Turkeys. *Journal of Veterinary Haematology*, 6:957-967.
- Wang, Y., Li, P., Wu, Y., Sun, X., Yu, K., Yu, C., & Qin, A. (2014). The Risk Factors for Avian Influenza on Poultry Farms: A Meta-Analysis. *Prev. Veterinary Medicine*, 10(5), 6-8.
- Williams, R.B. (2005). Intercurrent Coccidiosis and Necrotic Enteritis of Chickens: Rational, Integrated Disease Management by Maintenance of Gut Integrity. *Avian Pathology*, 6(4), 30-37.
- World Health Organization (2010). Weekly Epidemiological Record, 30 April. No.18.85,157-164. Available at Accessed: Sept. 27, 2010.
- Wu, S.B., Stanley, D., Rodgers, N., Swick, R.A., & Moore, R.J. (2014). Two Necrotic Enteritis Predisposing Factors, Dietary Fishmeal and *Eimeria*Infection, Induce Large Changes in the Caecal Microbiota of Broiler Chickens. *VeterinaryMicrobiology*, 169(10),188–197.
- Yan, W., Liu, X., Shi, T., Hao, L., Tomley, F.M., & Suo, X. (2009). Stable Transfection of *Eimeriatenella*: Constitutive Expression of the

YFP-YFP Molecule Throughout The Life Cycle. *International Journal ofParasitology*, 39(3), 109–117.

- Yano, J.M., Yu, K., Donaldson, G.P., Shastri, G.G., Ann, P., Ma, L., Nagler, C.R., Ismagilov, R.F., Mazmanian, S.K., & Hsiao, E.Y. (2015). Indigenous Bacteria from the Gut Microbiota Regulate Host Serotonin Biosynthesis. *Journal of Cells*, 161, 264–276.
- Yoriyo, K. P., Adang, K. L., Fabiyi, J. P., & Adamu, S. U. (2008). HelminthParasites of Local Chickens in Bauchi State, Nigeria. *Science World Journal*, 3(2), 35-37.

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