TRANSACTIONS ON SCIENCE AND TECHNOLOGY

A Post-Mortem Evaluation of Coccidiosis and Helminthiasis of Poultry Birds Slaughtered at Lafia Ultra Modern Market, Lafia, Nasarawa State, Nigeria

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ABSTRACT Poultry diseases remain one of the major threats to boosting poultry production in Nigeria. To this end, a post-mortem evaluation of coccidiosis and helminthiasis of poultry birds (*Gallus gallus domesticus*) slaughtered at Lafia Ultra-Modern Market, Lafia, Nasarawa State was carried from May to August 2017. A total of 100 fresh faecal samples from slaughtered chickens was collected into properly labeled sterile bottles and conveyed immediately to the Zoology Laboratory in Federal University of Lafia for the recovery of helminths and detection of coccidia oocysts. Faeces were grossly examined for blood, colour, mucus and presence of adult worms and proglottids. Adult worms and proglottids seen were removed with forceps and preserved in sample bottles containing 10% formalin for further identification. Concentration technique enlisted was the Simple Salt (NaCl) Floatation. Of the 100 fresh faecal samples examined only 24% were infected with helminths while none had coccidia infection. Cestodes had a high prevalence 11% than nematodes 9% but showed no significant difference ($P > 0.05$). A 4% co-infection was recorded. Of the five helminth species recorded, *Raillietina* species was the most prevalent parasite 34% while the least was *Choanotaenia infundibulum* 2%. The males were more infected 30% than the females 18%, however, there was no significant difference ($P = 0.2207$) in helminth prevalence between sex. Local breed was more infected 30% while no exotic breed was infected 0%. Thus, there was a very high significant difference ($P < 0.001$) in prevalence of helminth parasites between breeds. This study recorded a complete absence of trematodes and *Eimeria* species while cestodes and nematodes were implicated as the major cause of helminth infection in domestic chicken. Good management practices should be adhered to by poultry farmers based on domestic chickens' potential in supplementing the protein deficit of Nigerian diets.

KEYWORDS: Gastrointestinal helminths, Trematodes, *Eimeria* species, *Gallus gallus domesticus*
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INTRODUCTION

Poultry refers to domesticated birds kept for meat or egg production (Muazu *et al*., 2008; Ugwu, 2009; Getu, 2014) and generally plays a vital role in the national economy as a revenue provider, and provides employment (Gefu, 2002; Nnadi & George, 2010; Al-Jamaien *et al*., 2013; Opara *et al*., 2014; Letebrhan *et al*., 2015). In 1998, poultry meat represented 28% of the world total meat consumption compared to 26.5% for beef (Nnadi & George, 2010; Quiroz-Castañeda & Dantán-González, 2015). It is also estimated that poultry provides 12kg of protein needs per inhabitants each year, whereas cattle provides 5.3 kg (Nnadi & George, 2010; Roy, 2013; Nghonjuyi *et al*., 2014). Moreover, when compared to a number of other livestock species, fewer social and religious taboos are related to the production, marketing and consumption of poultry products. For these reasons, poultry products

have become one of the most important protein sources for man throughout the world (Radfar *et al*., 2012; Beyene *et al*., 2014).

Poultry production in Africa and parts of Asia is still distinctively divided into commercialized and village enterprises subsector each with its peculiarities. The former comprises of strains specifically developed on the basis of primary products into parent stocks, layers and broilers each with its specialized equipment and management practice. The latter however, consists of indigenous domestic fowls (*Gallus domesticus*) variously referred to as local chicken, backyard poultry, village chickens and/or free-range chickens (Njue *et al*., 2001; Al-Jamaien *et al*., 2013; Kaboudi *et al*., 2016). For most African countries, backyard poultry accounts for more than 60% of the total national flocks (TNF) (Biu *et al*., 2012; Garbi *et al*., 2015). In Nigeria, the poultry population is estimated to be 160 million; comprising of 72.4 million chickens, 11.8 million ducks, 4.7 million guinea fowls, 15.2 million pigeons, and 0.2 million turkeys which is estimated at US $250. Backyard poultry constitute about 60%, and thus the most important form of poultry production (Onyeagocha *et al*., 2010; Akintunde *et al*., 2015; Barde *et al*., 2015; Omokaro, 2015) but faced with disease threat (Lasseinde, 2002; Etuk *et al*., 2004; Akintunde & Adeoti, 2014).

A lot of losses in poultry have been linked to disease causing agents such as viruses, bacteria and parasites. It has been estimated that more than 750 million chickens, guinea fowls and ducklings in Africa die each year as a result of various infections such as coccidiosis and helminthiasis (Sonaiya, 1990). Coccidia and helminths are among the common poultry parasites (Afia *et al*., 2019) with predilection to the gastrointestinal tract. They exert their effects on the host by different ways such as blood sucking, tissue destruction during larval migration, feeding, mechanical or chemical irritation of contact surfaces, liberation of toxic metabolites, and obstruction of excretory ducts, air passages, or blood vessels (Nielsen, 1976; Kassai, 1999). Avian coccidiosis is an enteric parasitic disease causing production losses, high morbidity (due to acute, bloody enteritis) and mortality rates (Shirley *et al*., 2005). A parasitic infestation brings about unthriftiness, poor growth and feed conversion, decreased egg production, and in severe cases, death.

Poultry coccidiosis is an economically important disease in chicken caused by the intracellular protozoa parasite of phylum Apicomplexa, order Eucoccidiorida, family Eimeridae, genus *Eimeria* (Jeurissen *et al*., 1996; Taylor *et al*., 2007). *Eimeria* is a single celled obligate intracellular protozoan parasite in the epithelial cell of the intestine (Kennedy, 2001; Patrick & Mgbere, 2010; Lai *et al*., 2011). About 1800 *Eimeria* species affect the intestinal mucosa of different animals and birds (Nematollahi *et al*., 2008; Muazu *et al*., 2008; Kaboudi *et al*., 2016). Chickens are highly susceptible to about eleven different species of the genus *Eimeria*. The most common species are *Eimeria tenella*, which causes caecal coccidiosis, while *E. acervulina* and *E. maxima* cause chronic intestinal coccidiosis (Kaboudi *et al*., 2016). In Nigeria, the disease is caused by *Eimeria tenella, E. necatrix, E. bruneti, E. acervulina, E. mitis* and *E. praecox* (Owai & Gloria, 2010; Jatau *et al*., 2012). Coccidiosis remains one of the most expensive and common diseases in poultry production (Dalloul & Lillehoj, 2006) which has caused a huge loss of at least $1.5 billion every year to the world's commercial chicken producers (Arabkhazaeli *et al*., 2011; 2013; 2014). It is a major parasitic disease of poultry, with a substantial economic impact to the poultry industries in Nigeria (Etuk *et al*., 2004; Musa *et al*., 2010; Usman *et al*., 2011). Poultry coccidiosis generates economic losses due to morbidity, mortality, reduced body weight, plus the expenses related to preventive or therapeutic control and/or vaccinations (Williams, 1999; Dalloul & Lillehoj, 2006; Puttalakshmamma, 2008). It is probably the most common disease in modern poultry production, where confinement rearing is practiced (Lorenzoni, 2010; Amare *et al*., 2012).

Helminths are also parasites found mostly within the gastrointestinal tract of both domesticated and wild birds that are known to impede physiology and growth of these birds. They cause avian helminthiasis (Afia *et al.,* 2019). Poultry helminths are commonly divided into three main groups; nematodes (roundworms), trematodes (flatworms) and cestodes (tapeworms) (Jordan and Pattison, 1996). Nematodes constitute the most important group of helminth parasites of poultry both in number of species and the extent of damage they cause; the main genera include *Capillaria, Heterakis* and *Ascaridia* (Jordan & Pattison, 1996). *Ascaridia galli* has been incriminated as the most common and most important parasite of poultry (Hodasi, 1969; Pam *et al*., 2006; Luka & Ndams, 2007). The cestodes of significant importance are of the two genera *Railleitina* and *Hymenolepsis* (Oniye *et al*., 2001; Luka & Ndams, 2007). Trematode infections are not very common in domestic chickens as *Prosthogonimus ntowi* has been the only species reported from the forest belt of Ghana (Hodasi, 1969).

Helminthiasis causes interference with the host metabolism, resulting in poor feed utilization and reduced growth rate, as well as size and age at maturity, and these have been described as common characteristics of village chickens (Permin & Hansen, 1998; Afia *et al.,* 2019). Helminthiasis also leads to malabsorption, diarrhoea, anaemia and other states of poor health, particularly in young birds (Ehrenberg & Ault, 2005; Hotez *et al*., 2007).

Information regarding the incidence of gastrointestinal parasites is essential in understanding the epidemiology of the diseases, and also serves as a guide in the design of appropriate control measures. Still, there is deficit of information regarding the incidence of these gastrointestinal parasites in slaughtered poultry birds in Lafia, Nasarawa State capital. Hence, a post-mortem on gastrointestinal parasites of poultry birds slaughtered in Lafia ultra modern market was investigated.

MATERIALS AND METHODS

Study Area

Lafia ultra modern market is located in Lafia, Nasarawa state. Lafia is a town in central Nigeria (Latitude 8°24'N, 9°1'E and Longitude 8°13'E, 9°8'N). It has a total landmass of about 2797.53 km2 Lafia L.G.A shares boundary with Plateau State in the north east, Obi and Doma Local Government Areas (LGAs) in the South, Nasarawa Eggon in the West and Wamba LGA in the North (Agidi *et al.,* 2017). It is the capital city and the largest town in Nasarawa State, having a population of 330,712 inhabitants. The main economic activities of the State are agriculture; growing of cash crops 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.

Lafia LGA has a tropical sub-humid climate, with two distinct seasons which are wet season and dry season. The wet season lasts for seven months which is between April and October, while the dry season is between November and March. Rainfall is moderately high in Lafia, ranging from 1200 mm to 1600 mm. Average maximum and minimum daily temperatures are 35°C and 21°C in rainy season and 37°C and 16°C in dry season respectively (Agidi *et al.,* 2017).

Sample Collection

A total of 100 fresh faecal samples from slaughtered chickens in Lafia ultra modern market were collected and examined for gastrointestinal helminths and coccidia oocysts during the month of May to August 2017. The faecal samples were put in properly labeled sterile bottles and conveyed

immediately to the Zoology Laboratory in Federal University of Lafia, for the recovery of helminths and detection of coccidia oocysts.

Preparation and Examination of Samples

Faeces were examined for blood, colour, mucus and presence of adult worms and proglottids. Adult worms and proglottids seen were removed with forceps and preserved in sample bottles containing 10% formalin for further identification (Soulsby, 1982) and examined for morphology under the light microscope at 10x magnification. Identification of helminths was performed according to the helminthological key (Soulsby, 1982).

Direct Microscopic Examination

Direct microscopic examination was done by placing a very small quantity of faecal dropping on a glass slide using a tooth pick and emulsifying with a drop of normal saline and Lugol's iodine on different slides. Mounted slides were sealed with a glass cover slip and viewed on a light microscope (Suwansaksri *et al*., 2002).

Concentration Technique

Concentration technique adopted was the Simple Salt (NaCl) Floatation as described by Gillespie (2006) and Parameshwarappa *et al*. (2012). About 2 g of the faecal sample was placed in a test tube and 30 ml of the salt solution was added to make an emulsion by mixing the solution with the faeces and strained through a metal tea strainer into a second test tube. The salt solution was added until a meniscus was formed in the test tube. A glass coverslip was placed over the meniscus and allowed to remain for 15-20 min. after which the coverslip was removed and placed on a slide then examined under the microscope.

Statistical Analysis

The prevalence (P) in percentage was calculated using the formula:

$$P = \frac{n}{N} x\ 100$$

where n is the number of positive samples analyzed at that point in time, and *N* is the total number of chickens sampled at that point in time.

Data obtained were analyzed using R Console software (Version 3.2.2). Proportions of helminth parasites in faecal samples of slaughtered *Gallus gallus domesticus* were compared using Pearson's Chi-square test. Also, Pearson's Chi-square test was used to compare prevalence rate across helminth species found, prevalence rate of the infection in relation to sexes as well as breed of poultry. Level of significance was set at $P < 0.05$.

RESULTS AND DISCUSSION

Prevalence of Gastrointestinal Parasites of Gallus gallus domesticus Slaughtered in Lafia Ultra Modern Market

The prevalence of gastrointestinal parasites infection in this study is shown in Table 1. Out of a total of 100 domestic chickens studied, 24 (24.0%) were infected with helminths while none had protozoa nor trematode infection. Cestodes had the highest prevalence of 11 (11.0%), followed by the nematodes with prevalence of 9 (9.0%), and a mixed infection of both nematodes and cestodes 4 (4.0%) was the least. Prevalence rate between the helminths showed no significant difference (χ^2 = 3.25, df = 2, P = 0.1969). The outcome of this study is in agreement with the works by Yoriyo *et al.*

(2008) and Afia *et al.* (2019) in which cestodes and nematodes were implicated as the major cause of helminth infection in domestic chickens. The observed high prevalence of both parasites could be due to the high availability of infective stages, and the ability of their infective stages to survive outside the host for a long time before they are picked up again. Furthermore, the birds may have fed on insects, mites and worms which may be carriers of the infective stages of the parasites. The domestic chickens feed on a wide range of contaminated diets within their habitats which predisposes them to parasitic infections (Smyth, 1976; Frantovo, 2000).

Table 1. Prevalence of gastrointestinal parasites of *Gallus gallus domesticus* slaughtered in Lafia ultra modern market (N = 100)

Parasite group	No. infected	Prevalence (%)
Protozoa	0	0
Nematodes	9	9
Cestodes	11	11
Trematodes	0	0
Mixed infections	4	4
Total	**24**	**24**

The complete absence of trematodes in both local and exotic *Gallus gallus domesticus* slaughtered in Lafia ultra modern market agrees with several studies by Fabiyi (1972) in Bauchi, Gadzama and Strivastava (1986) in Borno, Oyeka (1989) in Anambra, Fatihu *et al.* (1991) and Luka & Ndams (2007) in Kaduna, Yoriyo *et al.* (2008) in Bauchi, and Afia *et al.* (2019) in Akwa-Ibom States of Nigeria. Also, the absence of trematodes may be due to non-accessibility of the birds to infected snails (Puttalakshmamma *et al.*, 2008).

The non-occurence of coccidia infection in this study could be due to the administration of anti-coccidia medication to the birds by the poultry owners in view of the fact that it is one of the most common and rampant poultry disease (Musa *et al.*, 2010), and may also be attributed to the complex life cycle of *Eimeria* species which are in three distinctive phases, including merogony (schizogony), gametogony and sporogony (during which the oocyst must undergo a final process called sporulation before they are again infective. Sporulation requires warmth (25°–30°C), moisture, and oxygen (Yun *et al.*, 2000). Coccidiosis is most prevalent among young chicks of 1-5 weeks of age, with oocysts appearing in feacal samples of the chicks as early as 7 days of age, while the clinical disease manifestation occurs by the 4th week (Obasi *et al.*, 2001). In this study, feacal samples examined were those of older birds, hence the apparent absence of coccidia oocysts. Earlier reports by Reyna *et al.* (1983) corroborates the absence of coccidia infection in this study as they reported that older birds were resistant to coccidia infection due to previous exposure and recovery. On the contrary, a study by Kaboudi *et al.* (2016) on the prevalence of coccidiosis in free-range chickens in Sidi Thabet, Tunisia recorded 31.8% overall coccidiosis infection which spread across *E. tenella* (61.5%), *E. maxima* (12%), and *E. acervulina* (1.5%). Kaboudi *et al.* (2016) observed mixed *Eimeria* species infection with overall prevalence of 26.5%. Also, the findings in this study contrasts several earlier reports from other parts of Nigeria including Jos-Plateau (Fabiyi, 1972; Pam *et al.*, 2006), Anambra State in South-East of Nigeria (Oyeka, 1989), and in Zaria, where *Eimeria* species was found as the commonest and most important parasite infection of poultry (Fatihu *et al.*, 1991; Jordan & Pattison, 1996; Oniye *et al.*, 2001; Luka & Ndams, 2007).

Out of the 100 feacal samples examined, 4% had co-infection of cestode and nematode parasites which may probably due to the birds having common food preference which might have been contaminated by the two parasites. According to Kennedy (1975), this occurs at a particular time which enhances the establishment of mixed or single infection. This finding is in agreement with Afia *et al.* (2019) who recorded a mixed infection of about 38% in chickens of Ibesikpo Local Government Area, Akwa Ibom State, Nigeria.

Helminth Parasite Species of Infected Gallus gallus domesticus Slaughtered in Lafia Ultra Modern Market

Twenty four (24.0%) domestic chickens were infected by five species of gastrointestinal helminth parasites which comprised three cestodes and two nematodes, including mixed infections. The most prevalent cestode parasites recovered in the chickens was *Raillietina* species 8 (33.3%, Figure 1(a)) followed by *Hymenolepis cantaniana* 2 (8.3%) and *Choanotaenia infundibulum* 1 (4.2%). The nematode parasites identified included *Ascaridia galli* 7 (29.2%, Figure 1(b)) which was the most prevalent nematode parasite recovered and *Strongyloides avium* 2 (8.3%). There was also a mixed infection of *Strongyloides avium* and *Ascaridia galli* 1 (4.2 %), *Strongyloides avium* and *Raillietina* species 1 (4.2%), and *Ascaridia galli* and *Raillietina* species 2 (8.3%) as shown in Figure 2. Therefore, there was a significant difference ($\chi^2 = 77.69$, df = 7, $P < 0.0001$) in prevalence rate between species of helminth parasites. The very high prevalence of cestodes recorded in this study is similar to earlier reports by Dede & Richards (1998), Oniye *et al.* (2001), Audu *et al.* (2004), Atsineka & Banke (2006) and Afia *et al.* (2019). *Raillietina* species (33.3%) was the most prevalent cestode encountered in this study probably due to their cosmopolitan nature. Cheng (1973) showed that they are considered cosmopolitan and contribute to nutrient depletion in birds. Also, Afia *et al.* (2019) reported that the occurrence of *Raillietina* species was the highest (19%) in chickens.

(a) (b)

Figure 1. Figure showing (a) *Raillietina* species; and (b) *Ascaridia galli*

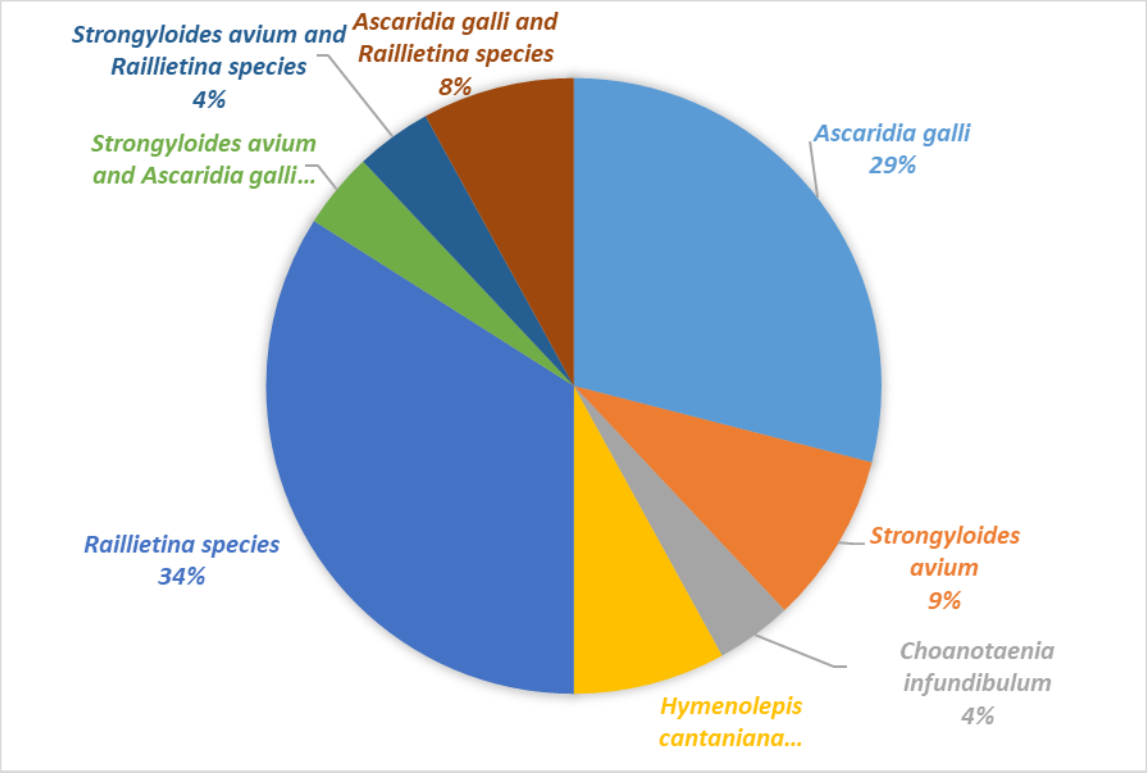

Figure 2. Helminth parasite species of infected *Gallus gallus domesticus* slaughtered in Lafia ultra modern market

The high prevalence of *Ascaridia galli* over other nematodes may possibly be due to the ability of its eggs to withstand harsh climatic conditions due to thick albuminous shells (Ashour, 1994), direct life cycle and capability for early infection by the second larval stages (Soulsby, 1982). The study by Afaia *et al.* (2019) recorded *Ascaridia galli* as the most prevalent of the nematodes identified in chickens. This is contrary to the findings of Mukaratirwa *et al.* (2001) indicating *Allodapa brumptias* as the most abundant in a survey of parasitic nematode infections of chickens in rural Zimbabwe.

Sex-specific Prevalence of Helminth Parasites of Gallus gallus domesticus Slaughtered in Lafia Ultra Modern Market

The sex-specific prevalence of the helminth parasites showed that 15 males were infected with four species of helminth parasites which were *Ascaridia galli* 5 (10.0%), *Choanotaenia infundibulum* 1 (2.0%), *Hymenolepis cantaniana* 2 (4.0%), *Raillietina* species 5 (10.0%) and a mixed infection of *Ascaridia galli* and *Raillietina* species 2 (4.0%). While 9 females were infected with three species of helminth parasites which were *Ascaridia galli* 2 (4.0%), *Strongyloides avium* 2 (4.0%), *Raillietina* species 3 (6.0%), mixed infections of *Strongyloides avium* and *Ascaridia galli* 1 (2.0%) and *Strongyloides avium* and *Raillietina* species 1 (2.0%) (Table 2). Although the males were more infected than the females, there was no significant difference ($\chi^2 = 1.5$, df = 1, P = 0.2207) in prevalence rate between the sexes. The lack of variation in prevalence of helminths in relation to male and female chickens sampled suggests that both sexes are susceptible to helminthic infection. This agrees with previous studies by Magwisha *et al.* (2002) and Uhuo *et al.* (2013) who observed that helminthic infection prevalence in chickens had no sex preference. However, in this study helminths infected more males than females probably due to the fact that males are free rangers that move about to distant locations in search of breeding mates thereby end up feeding on food items everywhere visited.

Table 2. Sex-specific prevalence of helminth parasites of *Gallus gallus domesticus* slaughtered in Lafia ultra modern market

Parasite species	Males (N=50)		Females (N=50)	
	No. infected	Prevalence (%)	No. infected	Prevalence (%)
Ascaridia galli	5	10.0	2	4.0
Strongyloides avium	0	0.0	2	4.0
Choanotaenia infundibulum	1	2.0	0	0.0
Hymenolepis cantaniana	2	4.0	0	0.0
Raillietina species	5	10.0	3	6.0
Strongyloides avium and *Ascaridia galli*	0	0.0	1	2.0
Strongyloides avium and *Raillietina* species	0	0.0	1	2.0
Ascaridia galli and *Raillietina* species	2	4.0	0	0.0
Total	**15**	**30.0**	**9**	**18.0**

Breed-specific Prevalence of Helminth Parasites of Gallus gallus domesticus Slaughtered in Lafia Ultra Modern Market

Out of 80 local breeds of chickens examined, 24 were infected by *Ascaridia galli* 7 (8.8%), *Strongyloides avium* 2 (2.5%), *Choanotaenia infundibulum* 1 (1.3%), *Hymenolepis cantaniana* 2 (2.5%), *Raillietina* species 8 (10.0%), and mixed infections of *Strongyloides avium* and *Ascaridia galli* 1 (1.3%), *Strongyloides avium* and *Raillietina* species 1 (1.3%), and *Ascaridia galli* and *Raillietina* species 2 (2.5%). While none of the 20 exotic breed examined were infected by any gastrointestinal parasites (Table 3). Hence, there was a significant difference ($\chi^2 = 24$, df = 1, $P < 0.0001$) in prevalence rate of helminth parasites between breeds. The high prevalence of infection in local breed is not unusual because of their free-range mode of management practice which allows them free access to virtually all types of environments, thus predisposing them to various forms of infections. This agrees with Ruff *et al.* (1991) and Abebe *et al.* (1997) who stated that free-ranging chickens are more prone to disease acquisition. Also, Afia *et al.* (2019) recorded significant variation in the prevalence rate of helminthic infection between broiler and local chickens.

Table 3. Breed-specific prevalence of helminth parasites of *Gallus gallus domesticus* slaughtered in Lafia ultra modern market

Parasite species	Local breed (N=80)		Exotic breed (N=20)	
	No. infected	Prevalence (%)	No. infected	Prevalence (%)
Ascaridia galli	7	8.8	0	0.0
Strongyloides avium	2	2.5	0	0.0
Choanotaenia infundibulum	1	1.3	0	0.0
Hymenolepis cantaniana	2	2.5	0	0.0
Raillietina species	8	10.0	0	0.0
Strongyloides avium and *Ascaridia galli*	1	1.3	0	0.0
Strongyloides avium and *Raillietina* species	1	1.3	0	0.0
Ascaridia galli and *Raillietina* species	2	2.5	0	0.0
Total	**24**	**30.0**	**0**	**0.0**

CONCLUSION

The two breeds of *Gallus gallus domesticus* were free from trematode and coccidia infections. Only the local breeds of poultry birds had helminth infections. This study indicated that cestodes and

nematodes are highly significant helminth problems of local free-range chickens in the study area. Therefore, good management practices focusing on sanitation, proper housing, good nutrition and deworming aimed at improving local chicken farming and production in Lafia should be instituted, as chickens have the potential of supplementing the protein deficiency of Nigerian diets in future. Measures should be taken to control these helminth parasites by educating the farmers on the impact of the disease and conditions that increase the prevalence of the disease in a locality.

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