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Prevalence of Haemoparasites Infections in Scavenging Indigenous Chickens in and Around Bishoftu

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Abstract: The purpose of this study was to determine the prevalence of haemoparasites infections in scavenging indigenous chickens and their association with different risk factors in and around Bishoftu. A cross sectional study was carried out from December 2015 to April 2016. Blood samples were taken from wing vein of total of 384 chickens thin blood smear was made on filed, the smear taken to Addis Ababa University College of veterinary medicine and agriculture for fixing with methanol and staining with Giemsa stain. Laboratory investigation was employed in order to identify haemoparasite of chickens. The present study revealed an overall prevalence of 43.4% (167/384). Four genera of haemoparasites of chickens were identified during study. Of the four genera plasmodium species was the most dominant ones (18.2 %) followed by Aegyptianella (10.4%), Leucocytozoon (9.6%) and Trypanosoma species (0.5%) which was the least identified haemoparasites. There was no significant difference ($p>0.05$) in prevalence of haemoparasites with regard to sex, age and origin of chickens except for Leucocytozoon which was significantly ($p<0.05$) prevalent in Dallota than Gote and Bishoftu. The difference in overall prevalence between sex and age group and origin of chickens was not statistically significant ($p>0.05$). This study revealed the presence of diverse genera of haemoparasite infection in scavenging indigenous chickens in the study area; hence integrated control strategies should be put in place to boost chicken productivity.

Key words: Bishoftu · Haemoparasites · Indigenous Scavenging Chickens · Prevalence

INTRODUCTION

In Ethiopia it is apparent that village chickens are more important than modern intensive poultry production, both with regards to total numbers and to meat and egg production, despite the poor productivity of village chickens. The backyard system of chicken rearing is characterized by minimum inputs from the owners. Chickens are usually kept in small numbers and feed on leftovers, require little attention and spend most of their time scavenging around the compound. They require no specific housing, breed naturally, receive no health care and are usually not vaccinated. In free-range chickens, parasitic infestations are often neglected despite their significant losses in terms of reduced growth rate, loss of production and mortality [1].

Most studies on poultry have focused on viral diseases such as New castle disease, infectious bursal disease, fowl pox, avian influenza, Marek's disease among and others. The extension messages that are developed on parasites are mainly for endoparasites while ecto- and haemoparasites have received less attention in most reports [2].

Pandey *et al.* [3] reports that in an extensive management system where chicken have access to outdoor areas and are not confined, such birds do have a great diversity of parasites.

Poultry kept in free range systems or on pastures are exposed to a number of vectors/final hosts transmitting protozoan diseases. The haemoparasites or blood parasites are mainly found in poultry in tropical areas and the following genera *Plasmodium* spp., *Leucocytozoon* spp., *Haemoproteus* spp., *Aegyptinella* spp., *Trypanosoma* spp. Over 10 species of these are of pathogenic and economic importance [4].

In the infected birds, the clinical disease is associated with fever, depression, anorexia, loss of body weight, dyspnea, hepatomegaly, splenomegaly, ocular

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haemorrhage, haemolytic anaemia, William [5]. Severe infections by haemosporidian can lead to death and involves different physiopathological phenomena such as anemia, thrombocytopenia and inflammation [6]. Avian haemosporidioses can be severe or even lethal for domestic birds and for birds in zoos [7]. At the population level, haemoparasites can affect their hot reducing fitness parameters such as body condition, reproductive success and survival [8].

Although work on fowl malaria has been done in Ethiopia as cited by Poulsen *et al.* [9] in Ghana, no published data has been found on prevalence of haemoparasites infections in Bishoftu as well as generally in Ethiopia. Therefore it is necessary to carry out a study on the prevalence of haemoparasites infections in scavenging indigenous chickens to develop strategies for successful control programs and thereby to improve the health and productivity of scavenging indigenous chickens.

MATERIALS AND METHODS

Study Area Description: The study was conducted in Bishoftu, from December 2015 to April 2016. Bishoftu is located at 90N to 400 E with an altitude of 1800 meters above sea level in central highland of Ethiopia at 47 Km south east of Addis Ababa. It has annual average rain fall of 1152 mm of which 84% falls down during the long rainy season that extends from June to September and short rainy season from March to May with an average rain fall of 800 mm. The mean annual maximum and minimum temperatures are 30.7°C to 8.5°C, respectively and the mean relative humidity is 61.3% [10]. Farmer in the vicinity of the town use mixed crop-livestock production system and representative ago-ecologies of the country. These agro climatic zones are inhabited with different plant and animal species [11].

Study Animals: The study was conducted on 384 scavenging indigenous chickens that originated from Bishoftu and around Bishoftu town (Gotte and Dallota). Chickens' blood samples were collected from individual randomly selected homesteads and systematic random sampling was used. The chickens were categorized into three age groups as Chicks (aged < 2 months), growers (2 to 8 months) and adult (aged > 8 months) [12].

Study Design: A cross-sectional study was conducted from December 2014 to April 2016 in Bishoftu to determine prevalence of haemoparasites infections of scavenging indigenous chickens in and around Bishoftu. Active data were generated from purposively selected chickens with regard to age, breed and sex. The samples were processed in Addis Ababa University College of veterinary medicine and agriculture Parasitology and pathology laboratory.

Sample Size Determination: The required samples size for this study were estimated by considering 50% haemoparasites infections prevalence since there is no prevalence study on haemoparasites of scavenging back yard indigenous chickens in the area before. Thus, the sample size calculated according to Thursfied, Thrusfield [13] using 95% confidence interval and 0.05 absolute precision.

Study Methodology

Data Collection and Examination

Hematological Examination

Sample Collection: A total of 384 blood samples were collected during the entire period of the study, directly from wing vein using lancet to puncture the skin overlying a vein. Blood was collected directly into a capillary tube. Thin blood smear were done on the field and the smears were taken to Addis Ababa University College of veterinary medicine and agriculture Parasitology laboratory.

Sample Processing and Examination: During sampling, data with regard to age and sex was recorded. The smears were fixed with absolute methanol for 5 minutes and then stain with 10 % Giemsa for 30 minutes, washed with tap water, blotted and examined under the microscope for presence of haemoparasites [14].

Data Management and Analysis: The data were checked, coded and entered in to Microsoft excel work sheet and analyzed using SPSS software version 20. Descriptive statistics like percentage was used to express prevalence while chi-square ($\chi 2$) test was used to compare the association of haemoparasites infections with different risk factors of age, sex and area. In all the cases, 95% confidence level and 0.05 absolute precision errors were considered. A p-value < 0.05 was considered statistically significant.

RESULTS

The research showed that out of the 384 chickens examined 167 were infected with overall prevalence of 43.4%. Leucocytozoon, Aegyptianella, Plasmodium and

Trypanosoma species were identified during this study. Some of them were infected with mixed infections, but majorities were infected with single infection. Out of 167 chickens 70(18.2%) were infected with plasmodium species which is the highest prevalent haemoparasite, followed by Aegyptianella 40(10.4%) and Leucocytozoon species 37(9.6%) which is nearly approached to Aegyptianella. Trypanosoma species was the least prevalent haemoparasites 2(0.5%). 13(3.4%) of them were infected with mixed infections (Aegyptianella and Plasmodium) which is followed by Leucocytozoon and Aegyptianella 7(1.8%) (Table 1).

Table 1: Type of haemoparasites with number of chickens infected and prevalence rate

Type of haemoparasites	Number of infected	Prevalence rate
Occurred chicken		
Leucocytozoon	37	9.6
Aegyptianella	40	10.4
Plasmodium	70	18.2
Trypanosoma	2	0.5
Leucocytozoon and Aegyptinella	7	1.8
Aegyptinella and Plasmodium	13	3.4
Total	167	43.4

Table 2: Prevalence of haemoparasites infections based on origins

	Origin				
	Gote	Dallota	Bishoftu		
Haemoparasites species	N=193	N=159	N=32	χ^2	P-value
Leucocytozoon	16(8.2%)	21(13.2%)	0(0.0%)	6.143	0.046*
Aegyptianella	19(9.8%)	21(13.2%)	0(0.0%)	5.116	0.077
Plasmodium	34(17.6%)	27(16.9%)	9(28.1%)	2.317	0.314
Trypanosoma	1(0.5%)	1(0.62%)	0(0.0%)	0.203	0.903
Leucocytozoon and Aegyptinella	4(2.07%)	3(1.8%)	0(0.0%)	0.665	0.717
Aegyptinella and Plasmodium	6(3.1%)	7(4.4%)	0(0.0%)	1.669	0.434
Overall prevalence	80(41.4%)	80(50.3%)	9(28.1%)	6.427	0.377

Table 3: Prevalence of haemoparasites infections based on age groups

	Age				
	Chick	Grower	Adult		
Haemoparasites	N=52	N=69	N=263	χ^2	P-value
Leucocytozoon	5(9.6%)	8(11.5 %)	24(9.1%)	0.38	0.826
Aegyptianella	5(9.6%)	8(11.5 %)	27(10.2%)	0.145	0.930
Plasmodium	10(19.2%)	7(10.1%)	53(20.1%)	3.713	0.156
Trypanosoma	0(0.0%)	0(0.0%)	2(0.7%)	0.925	0.630
Leucocytozoon and Aegyptinella	0(0.0%)	3(4.3%)	4(1.5%)	3.557	0.169
Aegyptinella and Plasmodium	2(3.8%)	2(2.8%)	9(13%)	0.085	0.958
Overall prevalence	22(42.3%)	28(40.5%)	119(45.2%)	2.450	0.874

Table 4: Prevalence of haemoparasites infections based on sex groups

	Sex			
	Male	Female		
Haemoparasites	N=122	N=262	χ^2	P-value
Leucocytozoon	10 (8.1%)	27(10.3%)	0.425	0.514
Aegyptianella	13(10.6%)	27(10.3%)	0.011	0.971
Plasmodium	27(22.1%)	43(16.4%)	1.826	0.114
Trypanosoma	0(0.0%)	2(0.7%)	0.936	0.465
Leucocytozoon and Aegyptinella	4(3.2%)	3(1.5%)	2.117	0.148
Aegyptinella and Plasmodium	2(1.6%)	11(4.2%)	1.667	1.62
Overall prevalence	55(45.1%)	113(43.1%)	6.060	1.09

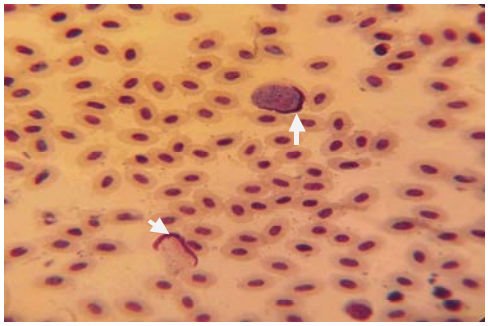

Fig. 1: Chicken blood smear showing an elongated host cell nucleusforming a long thin dark crescent band along one side of Leucocytozoon parasitized cell (arrow)

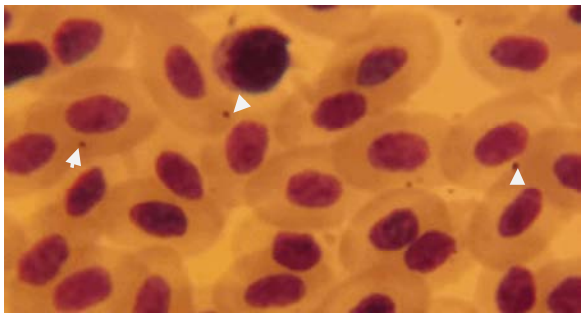

Fig. 2: Chicken blood smears showing the initial bodies of Aegyptianellain the RBCas small round intracellular inclusion body (arrow)

Among the three origins the overall prevalence of haemoparasites infections in Dallota was highest 50.3% followed by Gote 41.4% and the least infections was found in Bishoftu 28.1%. The difference in overall prevalence of haemoparasites infections between Dallota, Gote and Bishoftu was not statistically significant ($p>0.05$). There was statistical difference ($p<0.05$) in the prevalence of the Leucocytozoon infection and origins of chickens (Dallota) (Table 2).

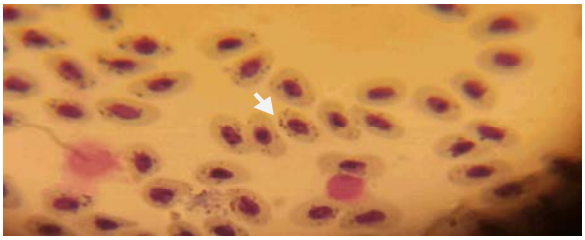

Fig. 3: Blood smear showing chicken RBC infected with plasmodium (arrow)

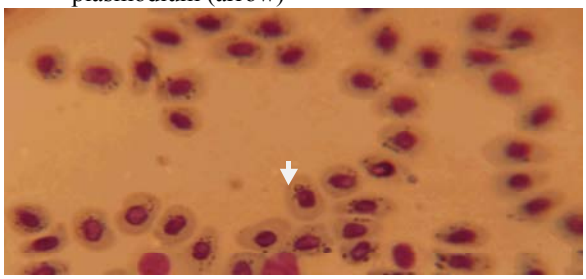

Fig. 4: Chicken blood smear showing RBC infected with a "signet-ring merozoites Plasmodium (arrow)

In this study the overall prevalence of haemoparasites infections was 42.3% in chick, 40.5% in grower and 45.2% in adult. There was highest prevalence of haemoparasites infections in adult followed by chick and grower. The difference in overall prevalence haemoparasites between chick, grower and adult was not statistically significant ($p>0.05$) and also there was no statistical difference ($p>0.05$) in the prevalence of various haemoparasites between age groups (Table 3).

The overall prevalence of haemoparasites in male and female sex groups was 45.1% and 43.1% respectively. This shows prevalence of haemoparasites infections between female and male chickens was nearly the same with slight difference. The difference in over all prevalence of haemoparasites between male and female was not statistically significant ($p>0.05$) as well as there was no statistical difference ($p>0.05$) in the prevalence of various species of haemoparasites and the two sex groups (Table 4).

DISCUSSION

During this study four haemoparasites namely Plasmodium, Leucocytozoon, Aegyptianella and Trypanosoma species were found to infect chickens in the study area. This means that suitable arthropod vectors (mosquitoes, simuliidae, culicoides, hippoboscid, Argas persicus …) were common throughout the sampling sites. There was also mixed infections among Aegyptianella, plasmodium and Leucocytozoon.

The findings of this study are consistent with the study by Permin *et al*. [15] in the Goromonzi district Zimbabwe, who reported the same haemoparasites, Plasmodium, Leucocytozoon, Aegyptianella and Trypanosoma during their study. In Kenya, Alex [14] had reported prevalence of plasmodium, Leucocytozoon and Haemoproteus. However, the result of this study lacked Haemoproteus infection. Other study in Ghana, Poulsen *et al.* [9] reported the occurrence of plasmodium and Aegyptianella, but their study lacked Leucocytozoon and Trypanosoma.

The overall prevalence of haemoparasites infections in chicken in this study was found to be 43.4%. This prevalence of blood parasites is comparable to the studies done by Poulsen *et al.* [9], who reported that the prevalence of avian blood parasites in Ghana to be 35% and Permin *et al.* [15] who reported prevalence of haemoparasites in free range chickens in Zimbabwe to be 32%. The lowest prevalence rate was reported 672/5040 (12%) in Nigeria by Opara *et al*. [16]. In contrast there were higher prevalence rate of haemoparasites infections reports 79.2% in Kenya by Alex [14], 72% in Malawi by Njunga [17] and 61.9% in Uganda by Valkiûnas *et al.* [18]. This huge difference might be attributed to difference in environmental conditions for the birds and parasites and management practices adopted by the farmers in these areas.

Out of 384 chickens examined 37(9.6%) were infected with Leucocytozoon. This prevalence is comparable to studies in Nigeria where, 5040 of 448 chickens (8.9%) harbored Leucocytozoon Opara *et al*. [16]. There was lower prevalence of Leucocytozoon infections 4.3% report in Zimbabwe by Permin *et al*. [15]. Alex, [14] in Kenya, Fallis *et al*. [19] in Tanzania and Sehgal *et al*. [20] in Uganda in their studies found prevalence of Leucocytozoon to be 52.1%, 50% and 31% respectively that were higher than this study finding. In other studies in Ghana reported by Poulsen *et al.* [9] and Malawi by Njunga [17] indicates zero prevalence of Leucocytozoon.

The second most prevalent haemoparasite Aegyptianella, found to infect 40(10.4%) of chickens in the study area. This prevalence is comparable to study reported by Poulsen *et al.* [9] who found the prevalence of Aegyptianella to be 9% in Ghana. Another study by Njunga [17] in Malawi and Permin *et al.* [15] in Zimbabwe reported the prevalence of Aegyptianella to be found 25% and 13.8% respectively that were higher than this study. Study did by Alex, [14] in Kenya, Fallis *et al.* [19] in Tanzania and Sehgal *et al.* [20] in Uganda lacked occurrence Aegyptianella species in their studies.

Other reports which were performed in different parts of the world, Aegyptianella is considered to be highly pathogenic to birds especially chickens with mortality risks in the range of 30-80% amongst young birds and the Aegyptianella is described as one of important haemoparasites in poultry production [21].

This study showed 70 (18.2%) of chickens harbored plasmodium and was the most prevalent haemoparasite encountered during this study. This prevalence is comparable with study reported by Njunga, [17] who found the prevalence of plasmodium gallinaceumto be 15% in Malawi. Another study reported by Permin *et al*. [15] in Zimbabwe showed prevalence of plasmodium gallinaceum to be 14.9%. There was lower prevalence rate report by Negesse, as cited by Poulsen *et al.* [9], the prevalence rate of fowl malaria in Ethiopia to be 2.5%.

In contrast to this study there was higher prevalence rate report of plasmodium gallinaceum in Kenya by Alex [14] which was 53.7%. In Ghana plasmodium juxtanucleare was reported and its prevalence rate was 27%.

Plasmodium gallinaceum is considered to be highly pathogenic to chickens with mortality rate in the range of 30-80% [22] cited progressive emaciation, anaemia, enlargement of spleen and liver.

2 (0.5%) of chickens were infected with Trypanosoma. This lower prevalence is contrast to results found in a study in Malawi by Njunga [17] and Zimbabwe by Permin *et al*. [15] that were 5% and 5.3% respectively. The least haemoparasite found during this study was Trypanosoma. This haemoparasite was found to infect chickens from Gote and Dallota.

There was no association between various species of haemoparasites and sex, age group and origin of chickens with the exception of Leucocytozoon which was significantly prevalent in Dallota than Bishoftu and Gote. There was no difference in overall prevalence of haemoparasites infection among age and sex group and origin of chickens.

There was highest prevalence rate in Dallota (50.3%) followed by Gote 41.4%. The least infection was seen in Bishoftu which was 28.1%. Among age group, there was highest prevalence in adult chickens (45.2%) followed by chick and grower. Their prevalence rate of infections was 42.3% and 40.5% respectively. Slightly higher prevalence rate of infection was detected in male chicken 45.1% than female 43.1%.

The reason for such prevalence variation between age, sex groups and origin of the chickens may be due to variation in management of chickens, exposure to invertebrate vector, immunity of chickens and agro ecological variation. However, there is need of further investigation on such variation on the prevalence of haemoparasites infection between age, sex groups and origin of the chickens and different area of Africa.

CONCLUSION

The chickens in scavenging production system in the study area were found to harbor diverse haemoparasites in nearly half of the chickens examined during this study. Among these parasites, Plasmodium was the most prevalent haemoparasites. There was highest prevalence in Dallota (50.3%) followed by Gote (41.4%) and lastly Bishoftu (28.1%). Regarding to age group there was highest prevalence in adult (45.2 %) followed by chick (42.3%) and the least infection was seen in grower (40.5%). Among sex group there was slightly higher haemoparasite infection in male (45.1%) than female (43.1%). Single haemoparasites infections were more common than mixed infections. Leucocytozoon and Aegyptianella (1.8%) and Aegyptinella and Plasmodium (3.4%) were among mixed infections. There was no association between haemoparasites infection and different risk factors; age, sex and origin of chicken except Leucocytozoon which found to be associated with origin of chicken. However, this study lacked the occurrence of Haemoproteus infection in all studies site. The difference in the prevalence may involve behavioral aspect or some physiological conditions intrinsic to the species that may make the host more or less susceptible to the parasites and variation in management practice by the owner of the chicken on the environment.

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