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Study on prevalence of poultry coccidiosis in Nekemte town, East Wollega, Ethiopia

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A cross sectional study was conducted between November, 2013 and June, 2014 to determine the prevalence of chicken coccidiosis, identify *Eimeria* species and assess different risk factors in free ranging and intensively managed chickens. Test tube flotation technique was used for qualitative study of coccidian oocysts. Of 384 chickens examined, an overall prevalence of 19.5% (75) was found. The prevalence of coccidiosis was accounted 17.7% (95%CI = 13.2 - 23.0), 44.8% (95%CI = 33.2 - 56.8) and 4.7% (95%CI = 1.3 - 11.6) in Chelaleki, Burka-jato and Bake-jama, respectively. The prevalence was significantly different between breed (χ^2 = 5.1, p = 0.021), management (χ^2 = 15.9, p = 0.000) and age (χ^2 = 7.1, p = 0.008). However, no statistically significant difference (χ^2 = 0.03, p = 0.865) was found in the prevalence of coccidiosis between sex. Among different species of *Eimeria* isolated *Eimeria tenella* and *Eimeria acervulina* were identified to be the major cause of the disease and each accounted 29(38.7%) of the total isolate of infected birds followed by 13.33% *Eimeria necatrix* and 9.33% *Eimeria maxima*. In conclusion, the present study showed that coccidiosis was an important disease of poultry in the study area and therefore, poultries infected with this parasite should be treated, chicken house should be periodically cleaned and disinfected as well as effective biosecurity measures should be in place.

Key words: Coccidiosis, *Eimeria*, flotation, prevalence, oocyst.

INTRODUCTION

Poultry are kept in backyards or commercial production systems in most areas of the world and a recent survey made by Food and Agricultural Organization of the United Nations (FAO) put the whole poultry population in the world at approximately 22 billion, with about 75% in the developing countries (FAOSTAT, 2013). Over the years, there has been an increasing demand for poultry products both for nutritional supply and for poverty alleviation in the village communities. 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 people throughout the world. FAO has estimated the world poultry population accounted to be 14,718 million, of which 1,125 million distributed throughout the African, 1,520 million in South America, 6,752 million in Asia, 93 million in Oceania, 3,384 million in North America and 1,844 million in Europe (Anders and Jorgen, 1998). The total poultry population in Ethiopia was estimated to about 44.89 million. Poultry includes cocks, cockerels, pullets, laying hens, non-laying hens and chickens. Consequently, most of the poultry are chicken (40.11%), followed by laying hens (33%).

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Pullets, cocks and cockerels were estimated to about 4.12, 4.3 and 2.2 million, respectively. Others that were non-laying hens make up about 3.1% (1.39 million) of the total poultry population in the country. With regards to breed, 96.46, 0.57 and 2.97% of the total poultry were reported to be indigenous, hybrid and exotic, respectively (CSA, 2012).

Coccidiosis is an important parasitic disease in poultry industry all over the world (Nematollahi et al., 2009). In domestic chickens, at least nine species of *Eimeria* have been recognized to cause the disease (Gari et al., 2008; Bowman, 2009). The infection occurs through ingestion of feed or water contaminated with sporulated oocysts (Allen and Fetterer, 2002). It is a widely distributed disease among growing chickens around the world and can seriously restrict the development of poultry production. Due to higher stocking densities and intensive husbandry practices, the incidence of coccidiosis has been increasing in poultry population (Conway and Mckenzie, 2007).

Coccidiosis is endemic in most of the tropical and sub-tropical regions where ecological and management conditions favor an all year round development and propagation of the causal agent (Obasi et al., 2006). It remains one of the major disease problems of poultry in spite of advances made in prevention and control through chemotherapy, management and nutrition (Gari et al., 2008). Quantitative losses due to coccidiosis in Ethiopia were not well documented, but the study conducted by Kinung'hi et al. (2004) showed that coccidiosis contributes to 8.4 and 11.86% losses in profit in large and small-scale farms, respectively. Losses due to mortality following a severe outbreak may be devastating and incidence rates as high as 80% were observed in the country (Gari et al., 2008).

The aim of the study was to determine the prevalence of *Eimeria* species and associated risk factors in different poultry production systems in Nekemte town.

MATERIALS AND METHODS

Study area

The study was conducted in Nekemte town, East Wollega zone, Oromia regional state, Ethiopia, which lies at latitude of 90°5' N and longitude of 36° 33' E at an elevation of 2,088 m above sea level. Nekemte is located at a distance of 331 km west of the capital city Addis Ababa. The climatic condition alternates with long summer rainfall (June to September), short rain season (March to April) and winter dry seasons (December to February). The minimum and maximum annual rainfall and daily temperature ranges from 1450 to 2150 mm and 15 to 27°C, respectively. The total land coverage of the region is about 769,725 ha of which 336,220 ha is used for crop production, 184,412 ha for animal grazing, 256,901 ha covered with forest and 20,492 ha for other activities (EWARDO, 2007).

Study population

The study populations were Bovans brown and local chicken breed, kept under traditional (free ranging) and intensive farming system. Since the prevalence of chicken coccidiosis in Nekemte town has not been reported, sample size was determined based on the assumption that 50% expected prevalence rate, 95% confidence interval and 5% desired absolute precision (Thrusfield, 2005). Therefore, 384 local and Bovans brown was considered in the study.

Study design

A cross sectional study was conducted between November 2013 and June 2014 in three sub-cities of Nekemte, namely Chelaleki, Burqa-Jato and Bake-Jama to determine the prevalence of coccidiosis in local and Bovans brown breeds. Questionnaire survey was used to collect information from farmers and farm owners on the management systems used in poultry production; at the same time feacal samples were collected aseptically to conduct fecal examination in order to identify the species of *Eimeira*.

Sample collection

Freshly deposited 10 g feacal samples collected from chickens of different ages, breed, and sex kept under intensive and free-range system; samples were examined thoroughly. Samples were collected with a spatula, which was washed and cleaned after each collection in order to avoid contamination. Each feacal sample was placed in a pre-labeled bottle indicating the age, breed and sex of the chicken. The presence of feacal oocysts was determined using the concentration by flotation method. The principle allowed the eggs to float to the surface of the solution of higher specific gravity (S.G), which concentrates at the top and leaves debris lower down. The higher the S.G of the solution, the more the eggs of various types will float, and S.G of eggs various types will float. One gram of faecal sample was weighed using a top loader balance. Put into a beaker and mixed with saturated salt solution of NaCl(40%w/v), it was thoroughly mixed and strained using 90 mesh sieves into another beaker. The filtrate was poured into test-tube of respective faecal sample number and these were placed in test-tube stands. Each test tube was then filled to the brim with salt solution of NaCl. Cover-slip was placed on test tube surface and was left to stand for 15 min after which they are gently lifted (without brushing against the tubes). They were then placed on microscope slides sideways in one quick movement to avoid bubbles on the glass-slide and viewed under the microscope. Examinations of slides were carried out using x40 objective lens (Conway and McKenzie, 2007).

Data management and analysis

The raw data was entered and managed using Microsoft Excel worksheet and summarized with descriptive statistics. SPSS statistical software version 20 was used to determine the prevalence of the disease and the association between prevalence and risk factor was assessed by using Pearson's Chi-square and odd ratio. A statistically significant association between variables was considered to exist if the computed p-value is less than 0.05.

RESULTS

The overall prevalence of chicken coccidiosis in the study area was 19.5%. The prevalence of coccidiosis in Chelaleki, Burka-lato and Bake Jama district was accounted for 17.7, 44.8 and 4.7%, respectively (Table 1)

Table 1. Prevalence of chicken coccidiosis in the selected study area.

Sub-cities	No. examined	No. negative	No. positive	Prevalence (%)	95%CI
Chelaleki	232	191	41	17.7	13.2 - 23.0
Burka Jato	67	37	30	44.8	33.2 - 56.8
Bake Jama	85	81	4	4.7	1.3 - 11.6
Total	384	309	75	19.5	15.8 - 23.7

Table 2. Association between prevalence and risk factors.

Risk factors	No. examined	No. negative	No. positive	Prevalence (%)	χ^2 value	OR (95%CI)	p-value
Breed							
Local	147	127	205	13.6	5.3	0.52 (0.3 - 0.9)	0.021
Bovans	37	32		23.2			
Age							
2 - 8 weeks	263	202	61	23.2	7.1	2.3 (1.2 - 4.3)	0.008
>8 weeks	121	104	14	11.6			
Management							
Backyard	192	139	53	27.6	15.9	2.9 (1.7 - 5.1)	0.000
Intensive	192	170	22	11.5			
Sex							
Male	135	108	27	20.0	0.03	1.05 (0.6 - 1.8)	0.865
Female	249	291	48	19.3			

The overall prevalence of coccidiosis in Bovans brown and local breeds were 23.21 and 13.61%, respectively. There was statistically significant difference (χ^2 = 5.322; p = 0.021) in coccidial infection between Bovans brown and local breeds (Table 2).

Among examined chickens, higher infection (23.2%) rate was observed in chicken under the age category of 2 to 8 weeks (young) than in chickens greater than 8 weeks (11.6%). There was statistical significance difference (χ^2 = 7.12; p = 0.008) between the two age group. Higher infection rate was detected in back yard birds 27.6% as compared to birds under intensive management system 11.45%. There was statistical significance difference (χ^2 = 15.9, p = 0.000) between the two management system. The prevalence rate of 20 and 19.27% were also recorded in males and females, respectively. Male birds showed higher infection rate than females; however, there was no statistically significant difference (χ^2 = 0.03, p = 0.865) in between the two sexes (Table 2).

Based on morphological identification of oocytes, five species in poultry were of major interest. These included *Eimeira acervulina, E Eimeira tenella, E Eimeira maxima, E Eimeira necatrix, E Eimeira burneti* and *E Eimeira mitis*. However, detection was made for the first four species of oocysts. From 75 infected birds, *E. tenella* and *E. acervulina* accounted 29(38.7%) and 29(38.7%), respectively. Therefore, *E. tenella* and *E. acervulina* are considered as the predominant species responsible for infection of chickens residing in the study area. The remaining 10(13.33%) and 7(9.33%) were found to be infected by *E. necatrix* and *E. maxima,* respectively. Among 75 infected birds, 69(92%) were infected by single infection and 6(8%) of them were found with mixed infection (Table 3).

DISCUSSION

Coccidiosis is classified as an intestinal disease affecting the small intestine and caecal portion of the large intestine. The overall prevalence of chicken coccidiosis in the study area was 19.5%. The result agreed with the finding of Diriba et al. (2012) and Gari et al. (2008) who reported prevalence 20.57% in poultry farms in and around Ambo town, Western Ethiopia and 22.58% in litter system of exotic breed (Rhode Island Red) in Tiyo districts, Arsi zone, Ethiopia, respectively. The finding of this research was also close to the finding of Ashenafi et al. (2004). However, the present result was inconsistent with the findings of Netsanet (2003), who reported a

Table 3. Prevalence of morphologically identified Emeria species.

Species	No. examined	No. negative	No. positive	Prevalence	95%CI
Eimeria acervulina	75	46	29	38.7	28.2 - 50.02
Eimeria tenella	75	46	29	38.7	28.2 - 50.02
Eimeria maxima	75	65	10	13.3	7.0 - 23.2
Eimeria necatrix	75	68	7	9.3	4.2 - 17.6
Eimeria burneti	75	65	10	13.3	7.0 - 23.2
Eimeria mitis	75	68	7	9.3	4.2 - 17.6

prevalence of 38.5 and 41.43% in Kombolcha, Ethiopia. This variation in prevalence of the disease may be due to epidemiology of coccidian infection and differences in management systems of the farms.

The prevalence rate of disease was higher in Bovans brown (23.21%) than local breeds (13.61%). The finding was statistically significant difference (p = 0.021) between Bovans and local breeds. This agreed with the findings of Gari et al. (2008) and Diriba et al. (2012) who reported higher prevalence in exotic breeds. The findings also agreed with the findings of Jatau et al. (2012) who reported higher prevalence of the coccidian infection in exotic chickens as compared to that seen in the free ranging local chickens in Zaria (Nigeria). In the present study, higher rate of infection might be due to breed difference. It was also documented that some indigenous breed of chicken could produce immunity earlier than other breeds (Rehman, 1971). In addition, Calnek et al. (1991) have reported the existence of genetic variation in resistance to coccidiosis among breeds and strains.

The current study also revealed that all ages of poultry are susceptible to coccidiosis but younger birds (23.2%) are more susceptible to infection than older birds (11.6%). This also agreed with the report of Julie (1999) who stated that all ages of poultry are susceptible to infection. These upshots are in accordance with the conclusions of Omer et al. (2011) and Bachaya et al. (2012), who has also observed the same pattern of infection in the Farasan gazelles infected with the single species of *Eimeria* and susceptibility of younger chickens than older chickens in layers in Muzafargarh district, respectively. The result is in concurrence with the report of Muazu et al. (2008) which stated that the predominance of coccidial infection among adult chickens were 36.7% and among the younger chickens were 52.9%. The prevalence rate of the disease was significantly different (p = 0.008) between young and adult birds. This was because most coccidian infections occur at the age of 3 to 4 weeks but clinical diseases develop one or more weeks later. The disease appears to reach climax at 5 to 7 weeks of age and as age exceeded 7 weeks, most birds will develop immunity and increase resistance to the disease (Taylor et al., 2007; Bowman, 2009).

Upon the finding, the prevalence rate of coccidiosis in free ranging chickens (back yard) 27.6% was greater than those chickens managed under intensive management 11.45%. This finding is in line with Sharma et al. (2013) who stated high infection rate of backyard (un-organized) chickens with *Eimeria* species in Jammu region. However, the current finding was inconsistent with reports that coccidiosis was the most common problems to chickens kept under intensive management especially those on deep litter due to relative higher oocyst accumulation in deep litter (Methusela et al., 2002; Taylor et al., 2007). In fact, Adhikari et al. (2008) reported that coccidiosis was a disease of poor management. In the present study, statistically significant difference (p = 0.000) was found between backyard and intensive farms, and percentage prevalence of infection in backyard chickens may be high due to poor management practices, malnutrition, indiscriminate scavenging behavior of free ranging chickens and non-use of coccidiostats as preventive measures.

The present study also indicated that the prevalence of coccidiosis was relatively higher in male (20%) than female (19.27%) chickens; however, there was not statistically significant difference among sex (p = 0.865). This result is in consistent with the previous studies of Nematollahi et al. (2009) and Alemayehu et al. (2012). Absence of statistically significant difference between male and female might be due to equal chance of exposure for the parasite infection.

The biological characteristics of coccidia of chickens are well known and are variable which is used in the identification of different species of *Emeria* (McDougald, 2003). Some species are easily identified based on occyst size *(E. maxima*), whereas others produce unmistakable lesions (*E. tenella* and *E. necatrix*). In the current study, high prevalence of four important species of *Emeria* such as *E. tenella, E. acervulina, E. necatrix* and *E. maxima* were identified. This finding was in agreement with reports from Iran (Hadipour et al., 2013), Ethiopia (Ashenafi et al., 2004), Jordan (Al-Natour et al., 2002), France (Williams et al., 1996), and Argentina (McDougald et al., 1997) suggesting that those species of *Eimeria* were widespread in most countries. On the other hand, Hadipour et al. (2011) reported that at least four species of *Eimeria* (*E. tenella, E. acervulina, E. necatrix* and *E. maxima*) were found in the litter of flock, while the

E. tenella was the most rampant species (24%) followed by *E. acervulina* (18%), *E. necatrix* (12%) and *E. maxima* (10%). The high prevalence of the infection of studied chickens in the current study indicates the maintenance of oocysts in the farm and in the environment of free ranging birds.

The present study also indicated the presence of mixed *Eimeria* infection (8%). This was attributed to mixed infections that were observed in the fecal matter of both local and exotic chicken. Adhikari et al. (2008), who identified mixed *Eimeria* infection in chickens, reported similar finding. Furthermore, Getachew et al. (2008) reported 55.6% of oocysts being due to mixed infections.

Coccidiosis is the most important constraint for poultry production in both free ranging and intensive poultry management systems. Heavy infection of coccidia cause serious disease and cause higher mortality and morbidity rate in poultry production. The finding of the current study indicated that the existence of *E. tenella, E. acervulina, E. necatrics* and *E. maxima* were responsible for chicken coccidiosis in the study area. The occurrence of coccidiosis was associated with breed, age and the type of poultry management. Coccidiosisis is still the most important parasitic disease of poultry in the study area. This higher prevalence might be due to poor poultry production management systems. Therefore, good poultry management systems such as treating diseased poultry, maintaining cleanness of the environment and applying strict biosecurity measures play a significant role to minimize the infection among different poultry production systems.

Conflict of Interest

The author(s) have not declared any conflict of interest.

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