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Full Length Research Paper

Poultry coccidiosis: Prevalence and associated risk factors in extensive and intensive farming systems in Jimma Town, Jimma, Ethiopia

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Despite the presence of large number of chicken in Ethiopia, contribution to national economy or benefit from this sector of activity is very limited due to diseases and management, out of which poultry coccidiosis is a leading problem. A cross sectional study was undertaken in Jimma town and College of Agriculture and Veterinary Medicine's (JUCAVM) poultry farm from November 2014 to April 2015 with the objective of determining the prevalence of poultry coccidiosis and associated risk factors. The fecal samples collected from live poultry and some after postmortem were subjected to flotation technique to increase sensitivity of the coprological examination of coccidian oocysts using light microscopy (10x). Postmortem examination was also performed to observe the pathological lesion and harvest coccidian oocysts. Out of the total 384 chicken examined, 152 (39.6%; 95% CI 34.7, 44.5) were positive for coccidian oocysts. Statistically significant difference (*P*=0.003) in the prevalence of coccidiosis was observed between young and adult as well as between exotic and local breeds of chickens. Higher infection proportion was detected in birds under intensive management system as compared to birds in back yard. The difference was statistically significant (*P*=0.000). The prevalence was also statistically significantly different (*P*=0.000) between exotic and local breed chickens. Higher prevalence was observed in chickens that were clinically diseased than subclinically harboring the oocysts which was statistically significant (*P*=0.03). However, no statistical significant association was observed between the prevalence and risk factors like sexes, feeding and watering sources. This study demonstrated that coccidiosis is an important problem of poultry for owners in Jimma town and JUCAVM poultry farm. Therefore, appropriate preventive strategies have to be designed to reduce the burden of this disease.

Key words: Coccidiosis, *Eimeria,* poultry, prevalence, risk factors, Jimma.

INTRODUCTION

The poultry industry plays an important role in the provision of animal protein (meat and egg) to human being, and is in general vital in the national economy by generating revenues (Nnadi and George, 2010).

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Approximately, 20 billion poultry exist worldwide among which about 75% are in developing countries Approximately, 20 billion (Gebremariam et al., 2011). Poultry is one of the most intensively reared of the domesticated animal species. Its importance in national economies of developing countries and its role in improving the nutritional status and income of farmers have been recognized (Nnadi and George, 2010).

The total poultry population in Ethiopia is estimated at 56.5 million, of which about 99% are bred under traditional backyard system of management, while 1% is exotic breeds maintained under intensive management system. There are 5-20 birds per households, with simple rearing system in backyard, with inadequate housing, feeding and health care (Tadelle and Ogle, 2001).

Despite the presence of large number of chicken in Ethiopia, contribution to national economy or benefit from this sector of activity is very limited due to nutritional and management factors, as well as diseases, notably: coccidiosis, newcastle disease, salmonellosis and chronic respiratory disease (Abel, 2008).

Coccidiosis is one of the serious poultry diseases that infect the lining of the intestines. It is a complex disease of poultry caused by different species of *Emiria* parasite. The damaged tissue caused by coccidia results in lower feed intake, interference with normal digestion and nutrient absorption, dehydration and blood loss (Pangasa et al., 2007). Chickens suffering from coccidiosis quickly become less productive and poor performers. Laying hens will experience a reduction in rate of egg production (Nematollahi et al., 2009). Coccidiosis affects the chickens in both clinical and sub-clinical forms (Sandhu et al., 2009). Factors contributing to outbreaks of clinical coccidiosis

include litter moisture exceeding 30%, immune suppression, suboptimal inclusion of anticoccidials in feed and environmental and managemental stress such as overstocking, poor feeding systems, and inadequate ventilation (Baba et al., 1982; Singla et al., 2007). Sub-clinical coccidiosis manifests mainly by poor weight gain and reduced efficiency of feed conversion contributing to big economic losses (Razmi and Kalideri, 2000).

The losses caused by coccidiosis without including the sub clinical coccidiosis are estimated to be 2 billion USD throughout the world. Quantitative losses due to coccidiosis in Ethiopia is not well documented, but it has been reported that it contributes to 8.4% loss in profit in large scale farms and 11.9% loss in profit in small scale farms (Gari et al., 2008). Losses due to mortality following a severe outbreak may be devastating and incidence rates as high as 80% were observed to occur in the form of an outbreak in Ethiopia (Kinung'hi et al., 2004). In all parts of the world where confinement rearing is practiced, coccidiosis represents a major disease problem demanding the attention of poultry producers, feed manufactures, and poultry disease experts (Nematollahi et al., 2009). To the authors' knowledge, the prevalence and associated risk factors of poultry coccidiosis in Jimma town backyard and intensive poultry farms has not been well addressed. Therefore, the objectives of this study were to determine the current prevalence and associated risk factors of poultry coccidiosis in Jimma town in Ethiopia.

MATERIALS AND METHODS

Study area

The study was conducted in Jimma town and Jimma University College of Agriculture and Veterinary Medicines's (JUCAVM) poultry farm, Oromia Regional State, Southwestern Ethiopia. Jimma is located at 352 km southwest of Addis Ababa, the Ethiopian capital city. Geographically, Jimma is located at 7°13' and 8°56' N latitude and 35°52' and 37°37'E longitude. The area has an altitude ranging between 1720 and 2110 m above sea level with an annual rain fall ranging between 1200 and 2000 mm. The annual mean temperature ranges from 12 to 28°C (NMA, 2013). In Kersa district, there are 70133 local and 1831 improved chickens to which Jimma town contributes a large share of poultry farms. The study wards of the town were *Bosaketo*, *Hirmata*, *Saxosamaro*, *Manderakochi* and *Mantina* and the JUCAVM poultry farm.

Study design and population

A cross-sectional study was undertaken from November 2014 to April 2015 on randomly selected exotic and local chickens, either from JUCAVM poultry farms or owned by local individuals reared in backyard. The study areas are selected based on convenience method because of their potential poultry bred. Chickens were selected by simple random sampling methods for inclusion into this study. The study included both sexes, different breeds and chickens under different managements.

Risk factors considered and questionnaires

The study was conducted on intensively and extensively reared chickens with consideration of age, breed, clinical status, sex, feed, water and management system of the chickens as risk factors. The information regarding the feed types, the source of drinking water, and hygiene status of the house where the chickens were bred was gathered directly from the owners and visual observation.

Sample size determination

The sample size was determined by assuming the required 5% precision and 50% expected prevalence when normal approximation is used for inference with 95% confidence interval as described in Thrusfield (2005) and these values had given the minimum required sample size equal to 384.

Study methodology

Coprological examination

Each of the birds' faecal samples was collected with a spatula from

Table 1. Final multivariable logistic regression model output of factors associated with fecal coccidian oocyst shedding of chickens from Jimma, Ethiopia.

Variables	Category	No. examined	No. positive	Prevalence (%)	95% CI	-2log LH p-value	OR	95% CI
Age	Young	112	66	58.9	49.8-68	0.003	0.26	0.08-0.84
	Adult (Ref.)	272	86	31.6	26.1-37.1			
Breed	Local(Ref.)	203	49	24.1	18.3-30	0.000	1.61	0.73-3.52
	Exotic	181	103	56.9	49.7-64.1			
Magt system	Backyard (Ref.)	191	44	23	17.1-29	0.000	2.63	1.19-5.80
	Intensive	193	108	56	49-63			
Feed	Industrial products	188	85	45.2	38.1-52.3	0.411	2.99	1.57-5.60
	Local grains (Ref.)	196	67	34.2	27.5-40.8			
Drinking Water	Tap water	160	45	28.1	21.2-35.1	0.128	0.59	0.35-1.01
	River water(Ref.)	224	107	47.8	41.2-54.3			
Clinical status	Clinical	181	82	45.3	38.1-52.6	0.03	1.57	1.04-2.38
	Subclinical(Ref.)	203	70	34.5	27.9-41			
Sex	Female	214	65	30.4	24.2-36.5	0.23	1.09	0.58-2.05
	Male(Ref.)	97	23	23.7	15.2-32.2			
Total		384	152	39.6	34.7-44.5			

No.: number of; OR: odds ratio; Ref: reference cell; Magt: management; LH: likelihood.

freshly voided faeces. The faecal samples were placed into sampling bottles, identified appropriately, and transported to College of Agriculture and Veterinary Medicine's parasitological Laboratory for processing. Before microscopic observation, floatation technique was used to concentrate the oocysts in order to increase the sensitivity of the examination. Sodium chloride solution was used as floating medium. The diagnosis of the oocysts in the faeces was made using 10x optical lens of the microscope.

Post mortem examinations of birds

Post mortem examination was conducted on dead birds to observe gross lesions associated with coccidiosis. It was carried out following the procedures described by Conway and McKenzie (2007). The gastro-intestinal tract was thoroughly examined for gross pathological changes as previously described (Lobago et al., 2005; Gari et al., 2008).Then, the mucosal scrapings were taken to demonstrate the protozoan developmental stage along with lesions by microscopic examination according to Lobago et al. (2005).

Data management and analysis

The raw data were entered, edited and cleaned in office Excel spread sheet. Computation of descriptive statistics was conducted using statistical package for social science (SPSS) version 20.0. The point prevalence was calculated as the percentage of infected chickens among the total number of samples examined. The strength and orientation of association between the prevalence of the disease and each risk factor was assessed by the Miltivariable logistic regression statistical model was used for association analysis The association between explanatory variables (factors evaluated) and the response variable (infection by coccidiosis) was considered statistically significant if the computed p-value was less than 0.05 (P<0.05).

RESULTS

Coprological result and risk factors

Out of 384 chickens examined for the presence of oocysts of *Emeria* spp., 152 (39.6%; 95% CI 34.8 and 44.5%) were found positive on coprological examination. Amongst the 25 chickens examined by post-mortem, 15 (60%) were positive to coccidiosis. The prevalence of coccidiosis was significantly higher (P-value=0.003) in chickens aged 3 to 18 weeks (young) as compared to their adult counterparts older than18 weeks, the odds of getting coccidiosis for the adults being 0.26 times less than the young (Table 1). The prevalence of coccidiosis was significantly higher (P=0.000) in exotic (56.9%) than local breeds (24.1%), exotic breeds having1.61 times more odds of harboring coccidiosis than the local (Table 1). The prevalence of the infection was a little bit higher in female (30.4%) than in male (23.7%) (Table 1). The prevalence was higher in clinical (45.3%) than subclinical (34.5%) diseased birds, clinical birds having 1.57 times more odds of harboring coccidiosis than the subclinical cases. This association was statistically significant (p = 0.03) (Table 1). Higher infection rate was detected in birds under intensive management system (56%) as compared to birds in backyard (23%) (p< 0.0001) (Table 1). The odds of oocyst harboring for the intensively

Table 2. Results of postmortem lesion examinations for poultry coccidiosis, Jimma town, Ethiopia

Site affected	Nature of gross lesion	Number of cases with lesion
Duodenum	White lesions and the mucosa sometimes show hemorrhagic appearance.	5
Jejunum	Petechiae, the jejunum thickened and ballooned with red pinpoint.	1
Ileum	Thin intestinal wall and hemorrhages	3
Caecum	Thickened and ballooned, its content mixed with blood	6

managed was 2.63 times than that of the backyards indicating positive association. In this study, the prevalence of coccidiosis was higher in chickens that were drinking river water (47.8%) than chickens that were drinking tap water (28.1%). The odds of getting coccidiosis for the chickens that were drinking tap water is 0.59 times less than the chickens that were drinking river water (Table 1).

Results of postmortem examination

Postmortem examination was carried out on 25 dead birds, out of which 15 (60%) were positive to coccidiosis by coprological examination, mucosal scraping examination and observation of pathological changes on mucosa of intestine and caecum. Observations from postmortem examinations are summarized in Table 2.

DISCUSSION

The cross-sectional study was primarily conducted to assess the prevalence of poultry coccidiosis and investigate potential risk factors related to the oocyst distribution. This is an important study because quantitative assessment of this disease will provide proxy of the economic burden of this important disease.

Coccidiosis is classified as an intestinal disease affecting small intestine and caecal portion of the large intestine. The present study showed that coccidiosis is an important health problem of chickens in the study area. In this study, the overall prevalence was 39.6%. This result was in line with some previous reports (Netsanet, 2003; Lobago et al., 2005; Mwale and Masika, 2011), and seemed to be higher than other reports (Oljira et al., 2012) (20.57%), (Garbi et al., 2015) (19.5%), (Gari et al., 2008) (22.58%) in poultry farms in Ethiopia and abroad. The wet climate and convenient temperatures of the current study area may be more favorable for the occurrence of coccidiosis. Observation showed that the poor poultry management and the environment such as overcrowding, leaking water troughs and accumulation of feaces support the development of oocysts. Most of these factors are the common problem in the current study area. The result obtained from this study also corresponds with the statement and findings of Slayer and Mallison (1995) who stated that overcrowding, accumulation of faeces and contamination of feed and water by faecal materials increases the number of *Eimeria* oocyst.

In this study, the prevalence of the disease was significantly higher in exotic breeds than local breeds. Higher prevalence in exotic breeds was also reported by Gari and colleagues (2008) who stated that the frequency of occurrence of coccidial infection in Rhode Island Red (RIR) breed was significantly higher than the local breed and this could be due to management system and breed factor (Williams, 2001).

Age difference plays a significant role in prevalence distribution of coccidia oocyst shedding. Indeed, a strong statistical association (P=0.003) was observed between the prevalence of coccidian oocyst shedding of age groups (Table 1). This agreed with the report of McDougald and Reid (1997) who also found that most *Eimeria* species affect birds between 3 and 18 weeks of age. Resistance to the disease usually increases with age of birds. This perhaps explains the decrease in prevalence with increasing age of birds (Uza et al., 2001).

Significantly higher infection rate was detected in birds under intensive management system (56%) as compared to birds in backyard (23%). The odds of oocyst harboring for the intensively management was 2.63 times higher than that of the backyards. The high prevalence in birds under intensive management system in the current study may be caused by improper cleaning and disinfection of the house (observation during data collection), overcrowding and contamination of feed and water by feaces (Slayer and Mallison, 1995).

Also, the prevalence of coccidiosis was higher in chickens that were drinking river water (47.8%) than the chickens that were drinking tap water (28.1%). Accumulation of faeces and contamination of feed and water as in the case of river water by faecal materials increases the number of *Eimeria* spp. oocysts (Slayer and Mallison, 1995).

Conclusion

In general, this study showed that poultry coccidiosis is an important chicken health problem for poultry owners in

Jimma which needs careful attention demanding interventions that will reduce the burden of coccidiosis. Age, management factors and breed difference are important risk factors that need to be worked on to minimize the impact of coccidiosis. Clinically diseased birds are more prone in harboring the oocyst. It is better if further research utilizing molecular techniques is conducted to identify the prevalent *Eimeria* species, as this will contribute to designing the appropriate preventive techniques.

Conflicts of interest

The authors did not declare any conflict of interest.

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