

Study on The Prevalence and Associated risk Factors of Poultry Coccidiosis in Pawe Poultry Farms, Metekel zone, Benishangul Gumuz Regional State, Northwest, Ethiopia

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ABSTRACT: A cross-sectional study was conducted to determine the prevalence of coccidiosis and its associated risk factors in pawe poultry farms from October 2019 to March, 2020. Flotation techniques were used for qualitative studies. The study involved questionnaire survey and fecal examination. In the present study, out of the 384 chicken examined, 74/384 (19.27%) were positive for coccidian parasites under intensive management system. The prevalence increased with the age categories of the chickens. (41.05%) infection were examined in day old chickens, while 11.95% were observed in 2-3wks of age categories, which was significant ($p < 0.05$). Similarly, *Eimeria* occurrence, was significantly associated. In this study, Sex, management, sanitary and treatment history were not risk factors for studied intensive poultry farms ($P > 0.05$). The findings suggested that coccidiosis was a common health problem in grower, layer and day old chickens. Various managerial problems that are associated with this prevalence of coccidiosis are identified and appropriate control strategies are recommended. In conclusion, the present study showed that coccidiosis is an important disease of poultry in the study area and further strategy needs to be implemented to reduce the loss due to coccidiosis.

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INTRODUCTION

Ethiopia has large population of chickens estimated to be 48.89 million with native chickens of non-descriptive breed, hybrid of chickens and exotic breed of chickens mainly kept in urban peri-urban and rural areas representing 96.6%, 0.55% and 2.8%, respectively (CSA, 2011). From the total population of chicken in Ethiopia, 99 % are raised under the traditional back yard management system, while 1 % is under intensive management system (Tadelle *et al.*, 2003).

Poultry is among the important species of livestock kept in Ethiopia. Three types of poultry production systems are identified in Ethiopia (Yami and Taddele, 1997). These are backyard poultry production system, small scale and large-scale intensive poultry production systems. The main objective of rearing chicken in all production systems is concerned with egg and meat production, for income generation and home consumption (Nasser, 1998).

In developing countries, animal production is being subjected to great pressure to satisfy the demand for animal protein required by the continued increase in human population, and also to have surplus for international trade (FAO, 1993; FAO, 1998). Among the animal production activities, poultry sector is the fastest growing. Thus, the production of poultry protein-products has greatly expanded in many of these countries in the recent past. Nevertheless, it has been adversely affected by a variety of constraints (FAO, 1998). Among the constraints, poultry diseases continue to play the major central role in hampering its development (FAO, 1998; Rushton *et al.*, 1999).

In Ethiopia, poultry production has been hindered by different prevalent diseases from which Newcastle disease, coccidiosis, salmonellosis and chronic respiratory disease are the important ones (Abebe *et al.*, 1997). Among the infectious diseases of poultry, coccidiosis is the major parasitic disease. Poultry coccidiosis is an economically important disease in chicken caused by the intracellular protozoa parasite of *Eimeria* species in the genus *Eimeria* family *Eimeridae* order *Eucoelidiorida* and phylum *Apicomplexa* (Taylor *et al.*, 2007). Infection by coccidia in sufficient number to produce clinical manifestations of disease is called coccidiosis (Charlton, 2006; Conway and Mckenzie, 2007).

Though nine species of *Eimeria* have been identified as causative agents of poultry coccidiosis, only seven of them have been reported to be pathogenic (Kahn, 2008). *Emeriatenella* (*E. tenella*) and *Eimeria necatrix* (*E. necatrix*) are the most pathogenic species. *Eimeria arcevolina* (*E. acervulina*), *Eimeria maxima* (*E. maxima*) and *Eimeria mivati* (*E. mivati*) are common and slightly too moderately pathogenic while *Eimeria brunetti* (*E. brunetti*) is uncommon but pathogenic when it does occur. *Eimeria mitis* (*E. mitis*), *Eimeria praecox* (*E. praecox*) and *Eimeria hagani* (*E. hagani*) are relatively non-pathogenic species (Soulsby, 1982; Lillehoj and Trout, 1993).

The disease is endemic in most of the tropical and subtropical regions where ecological and management conditions favour an all-year round development and propagation of the causal agent (Obasi *et al.*, 2006). In Ethiopia, poultry coccidiosis caused by (*E. acervulina*, *E. necatrix*, *E. maxima* and *E. tenella*), is endemic in all parts of the country and affects mainly young growing birds (Safari *et al.*, 2004). Coccidiosis remains one of the major disease problems of poultry in spite of advances made in prevention and control through chemotherapy, management and nutrition (Graat *et al.*, 1996). 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 (Reid, 1978).

The occurrence of clinical coccidiosis is directly related to the number of sporulated oocysts ingested by poultry at one time, the pathogenicity of the *Eimeria* species, the age of the infected chicken and the management system (Reid, 1990). The first and most frequent symptom is at the beginning yellow diarrhea. As the disease progresses, because of the blood in feces, feces are red or resemble the color of chocolate (Jordan, 1990). The feathers around the cloacae are covered with bloody deposits. Feces are stained with blood. Birds that survive first few days of the infection, can survive the next 10 to 15 days. During that time, birds are thirsty and rapidly lose weight (Calnek, 1997). Symptoms of the disease start to appear at the time when the second generation of shizonts starts rapidly to replicate, grow, mature and release the second generation of merozoites. Second generation of merozoites causes inflammation of the sub epithelial mucus, desquamation of the epithelia and capillary rupture in the caecum wall. As a consequence, bloody diarrhea occurs (Jordan, 1990). *Emeriatenella* causes moderate to severe cecal lesions, sometimes death. The birds become depressed, have ruffled feathers, the wings droop, have diarrhea and tend to huddle. Food and water consumption usually decreases and may become emaciated and dehydrated. Laying hens will experience a reduction in rate of egg production. Cecal coccidiosis may produce bloody droppings and anemia (Whitmarsh, 1997; Lillehoj and Trout, 1993).

In large population of chicken kept confined together, the risk of acquiring sufficient dose of oocysts is more likely to occur and the risk factor is very high for young chicken than old age groups, which develop immunity from pre-exposures (Becker, 1962). 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 (Alamargot, 1987). However, losses due to morbidity may be even more costly without the producers being aware that their flocks having any disease problem (Alamargot, 1987).

Poultry is the most important animal species in Ethiopia both for nutritional value they contribute and cash income generation than other animals since they are the main resources especially for poor families. Additionally, poultry raising system is now becoming more intensified than the past in which coccidiosis is the area of focus.

Regarding poultry coccidiosis in pawe poultry farm generally, information is scant both on local and cross breed chickens. Therefore, the objectives of this study were, to determine prevalence of poultry coccidiosis, identify the circulating *Eimeria* species, to identify the associated risk factors of coccidiosis.

1.1. General objectives

- Study on the prevalence and associated risk factors of poultry coccidiosis in Pawe poultry farms, Metekel zone, Benishangul Gumuz Regional State, Northwest, Ethiopia

1.2. Specific objectives

- To determine prevalence of poultry coccidiosis in pwe poultry farm
2. To identify the associated risk factors of coccidiosis.

MATERIALS AND METHODS

2.1. Study Area

The study was conducted from October to April 2020, in pawu poultry farm of Metekel zone, Benishangul Gumuz Regional State. It is located 557 km North-west of Addis Ababa, the capital city of Ethiopia. The district has 20 kebeles covering an area of 64,300 hectare with human population of 42,000. It is located at latitude of 11° and 15' 24.7''N and, longitude of 36° and 23'10''E. It has an altitude of 1064m above sea level. The minimum and maximum annual temperature is 15°C to 39°C respectively and its rainfall range is 900-1400 mm (NMSA, 2007). The livelihood of the pawu society largely depends on mixed livestock and crop production having livestock population of 70,336 Cattle, 6,790 Goat, 6,373 Sheep, 1,216 Equines, 119,611 Poultry and 3076 beehives (Pawu agricultural research center office, 2012E.c).

2.2. Study population

The study animals were cock and local breeds of chickens in pawu poultry farm and owned by Benishangul Gumuz regional state Agricultural bureau. Chickens were kept under intensive and semi intensive husbandry system. The study animals were grouped into sex (male and female), breeds (exotic and local) and the age was classified according to Ashenafi *et al.* (2004) as young (2-8 weeks) and adult (above 8 weeks of age). A total of >18000 cock breed were found in the farm. It is intensive management system. >280 mixed type of local (indigenous) breeds (for Biodiversity purpose) which are from semi-intensive management were involved for this study.

2.3. Sample size Determination

Since there is no earlier report from the study area, the sample size was calculated according to the formula given by Thrusfield (2005) using 50% expected prevalence with 95% confidence interval and 0.05 desired absolute precision. Therefore, total sample sizes of 384 chickens were used for this study.

2.4. Study Design and sampling methods

Cross-sectional study was conducted to determine the prevalence of coccidiosis in chicken with in pawu poultry farm. Random sampling method was used during sample collection. A total of 384 faecal samples were collected from broiler flocks farms. The faecal sample were collected from the upper surface of the litter immediately after dropping of faeces with spatula, then each faecal sample was placed in a pre-labelled universal bottle from each chicken and brought from Pawu poultry farm center to Regional Veterinary laboratory for parasitological analysis. During sample collection, information regarding management system, age, breed and sex were appropriately recorded.

2.5. Sample Collection And Laboratory Investigations

Freshly deposited faecal sample were collected from the upper surface of the litter immediately after dropping and examined thoroughly. The sample was collected with a spatula, which was washed and cleaned after each collection in order to avoid contamination. Each faecal sample was placed in a pre-labelled universal bottle indicating the age, breed and sex of the chicken. Oocysts in each faecal sample of chicken were detected by floatation technique using saturated sodium chloride solution (Conway and McKenzie, 2007). 3-5 grams of faecal sample was weighed using a top loader balance put into a beaker and mixed with saturated salt solution. 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 then filled to the brim with salt solution of sodium chloride. Cover-slip was placed on test tube surface and left to stand for 15 minutes after which they were gently lifted off without brushing against the tubes. This was then placed on microscopic slides sideways in one quick movement to avoid air bubbles on the glass-slide and viewed under the microscope. Examinations of the slides were carried out using 40X objective lens.

2.6. Data processing and analysis

While collecting fecal samples from study birds, all data were recorded with pre-designed format and enter into computer using Microsoft excel spread sheet. The individual bird details such as bird identification, sex, age, breeds, medication history, management system and the housing type of the farms were registered together.

The collected data is sorted manually and numbered before processing; however, data was checked again for completeness and internal consistence. Then the raw data were entered and managed in Microsoft Excel spread sheet. All statistical analyses were done using STATA 11 (Stata CorpTexa, USA). The prevalence was calculated for all data by dividing positive samples by total number of examined samples and multiplied by hundred. The association between the prevalence of the disease and hypothesized risk factors were assessed by Chi-square test. Univariate logistic regression was used to calculate the odds ratio for associated risk factors. A statically significant association between all variables was set at $P \text{ value} < 0.05$.

3. RESULTS

3.1. Prevalence of Coccidiosis

Flock based survey were used in pawe poultry farm, out of 384 examined chickens, 74(19.27%) were positive. 19.3% of Eimeria were identified by using floatation methods. The prevalence of coccidiosis by age group of 2-3wks, 10mth and day old chicks were recorded as 22/184(11.95) , 13/106(12.26) and 39/95(41.05) respectively and it has significant association among age categories ($p < 0.000$) (Table 1).

3.2 Coccidiais associated risk factors

In the present study, poultry examined were categorized in different age groups as 2-3 wks, 10mth, and day old chicks. The lowest poultry coccidiosis /eimeria/ prevalence (11.95%) was observed in 2-3wks of age and the highest (41.05 %) was seen in day old chicks. The difference in the prevalence was statistically significant ($p < 0.05$) (Table-1). The prevalence of coccidiosis varies in both sexes; the infection in male is slightly higher (21.76 %) than female (17.72 %) and the association was not statistically significant ($P > 0.05$) (Table 2). Similarly, poultry management system or sanitary measures were observed in the farm, so that infection in poor sanitary/ management system was 30.30% where as infection in good sanitary measures were 18.23% and it was statistically non- significant ($p > 0.05$). And also treatment history in the farms were assessed and 19.74% of the chickens in the farm was not get previous treatment were as 17.14% of the chicken get previous treatment in the farm and have no significant association ($p > 0.05$) as indicated in Table 2.

Table 1. Prevalence of Coccidiosis among age groups

Age groups	N	Prevalence(n)	Chi2	Df	p- value
2-3wks	184	22(11.95)	39.5	4	P<0.000
10mth	106	13(12.26)			
Doc	95	39(41.05)			
Total	384	74(19.27)			

N= number of birds observed, n=number of birds positive

Table 2. Prevalence of Coccidiosis by sex, managment and Rx

Risk factors	No. examined	No. positive	Prevalence (%)	Chi2	P -value
Sex category					
Male	147	32	21.76	0.95	0.32
Female	237	42	17.72		
Mgt/ sanitary/					
Good	351	64	18.23	2.82	0.09
Poor	33	10	30.30		
RX(treatment history)					
Yes	70	12	17.14	0.24	0.62

No	314	62	19.74		
Total	384	74	19.27		

3.3. Identified Genus of Eimeria In The Farm

During the farm survey, of the 384 cloacal fecal samples examined, 74/ 384(19.27%) were identified using floatation methods in the farm. So that, eimeria were the potential risk factors and it was statistically associated ($p < 0.000$).

4. DISCUSSION

Coccidiosis is known to be the most prevalent and most important disease of poultry production worldwide and its prevalence and economic significance has been reviewed by different workers in different production system. In present study, the overall prevalence was (19.27 %). The present result agreed with the finding in central Ethiopia (Ashenafi *et al.*, 2004), Addis Ababa (Alemayehu *et al.*, 2012) and in Kombolcha (Abadi *et al.*, 2012) with prevalence rate of 25.8%, 23.1% and 22.3%, respectively. Moreover, this result was in agreement with the finding in Ambo (Diriba *et al.*, 2012) and Arsi Tiyo (Gari *et al.*, 2008) who reported a prevalence of 20.57% and 22.58%, respectively. Similarly, the result of this research was very close to the finding of the previous reports 28 % by (Fessess-work, 1990) and 25% (Dereje N, 2002) around Debre-zeit town.

This relative prevalence of the infection in the sampled chickens might be due to management and the period of the study that may concede the same season. However, the present result in the prevalence of coccidiosis is much lower than the findings of Dinka and Yacob (71.1%), Gari (70.95%) and Alemargot (80%). This high reduction of prevalence of coccidiosis observed in the current study might be ascribed mainly to the application of preventive measures which basically sanitary measures and use of anti-coccidial drugs that were given at early stages of age. Other point may be due to breed difference, improvement of management system and bio security measures when compared to the setup in the previous study.

In addition, the present finding was smaller as compared to 38.3

84% (Netsant, 2003) at Kombolcha farm and 48.2% (Safari *et al.*, 2004) at Debre-ziet. This might be due to the difference in the study season (Lobago, *et al.*, 2005; McDoughed *et al.*, 1997), reported the prevalence of coccidiosis 28.9% during the rainy season and (McDoughed, *et al.*, 1997) also reported 12.2% during dry season. The other possible factors for fluctuating in prevalence can also be development of immunity against coccidiosis as there are anti-coccidial drug applications are commonly practiced in the farm.

In the present study, poultry examined were categorized in different age groups as 2-3 wks, 10mth, and day old chicks. The lowest poultry coccidiosis /eimeria/ prevalence (11.95%) was observed in 2-3wks of age and the highest (41.05 %) was seen in day old chicks. The difference in the prevalence was statistically significant ($p < 0.05$). This result is in line to the finding of (Chapmen *et al.*, 1992) and is not in agreement with Chapman and Johnson and Stayer, *et al.*, 1995 and Chapmen *et al.*, 1992). Similar finding was indicated by Solomon S.(2006) around Ambo, which was 20.78% in young chickens and 16.98% in adult. However, slight variation was observed between the age categories. This may be due to management system and breed factors.

In the current study, the occurrence of coccidiosis varies in both sexes; the infection in male is slightly higher (21.76 %) than female (17.72 %) and the association was not statistically significant between the sex groups ($P > 0.05$). This indicates there is no significant natural resistance variation in relation to the sex (Solomon, 2006; Pinard *et al.*, 1998).

Similarly, poultry management system or sanitary measures were observed in the farm, so that infection in poor sanitary/ management system was 30.30% where as infection in good sanitary measures were 18.23% and it was statistically non- significant ($p > 0.05$). The difference observed may be due to poor management system, malnutrition and non used anticoccidial drug in back yard chickens. The warmth and moisture environment favors greater transmission and contamination of oocysts. It was comparable to study done by Solomon (2006) in Ambo.

And also treatment history in the farms were assessed and 19.74% of the chickens in the farm was not get previous treatment were as 17.14% of the chicken get previous treatment in the farm and have no significant association ($p > 0.05$).

The probable reasons for this discrepancy could be the differences in virulence of the *Eimeria* species at different management system and /or due to the prophylaxis use of anti coccidial drugs in feed and water or may be due to breed differences. It is likely that resistance has developed to more recent anticoccidial drugs (Chapman, 2005) and very few drugs are equally efficacious against all *Eimeria* species (McDougald, 2003). The occurrence and incidence of coccidiosis is also, to a great extent affected by the type of chick reared and breed sensitivities to infection (Tyalor *et al.*, 2007). Many coccidiostats drugs have been directed against *Eimeria species*, with the result that other species are increasingly incriminated as a cause of poultry coccidiosis (Urquhart *et al.*, 1996).

5. CONCLUSION AND RECOMMENDATION

Poultry coccidiosis was the major problems in the study farms. 19.27 % of the *Eimeria* prevalence was recorded in the farms. Age of animals were potential risk factors during the survey; however, sex, sanitary/ management and previous treatment history were slightly risk factors. So based on the above conclusion , the following points are recommended for the farms;

- Bio - security measures such as sanitary measures/ should be applied in the farms;
- Bio security practices should be the primary concept in the prevention and control of coccidiosis
- Potential risk factors which are identified in the farms should be mitigated;
- Proper management system should be applied so as to increase productivity;
- Further study on the poultry disease which are risk to the farms, should be studied in order to identify the root cause that reduce production.

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