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# Prevalence of Coccidiosisand Identification of Eimeria Species in Addis Ababa Poultry Farms

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**Abstract:** Poultry sector plays a vital role in income and employment generation as well as source of protein. This vibrant sector is seriously affected by coccidiosis, a protozoan parasite disease caused by the genus *Eimeria*. A cross sectional study on coccidiosis in chicken population aged less than 6 months and greater than 6 months in Addis Ababa poultry farms was conducted from November 2014 to April 2015. The study involved fecal examination and identification of *Eimeria(E.)* spp. Out of 278 samples taken, 57 (20.5%) of them were found to harbor different *Eimeria* spp. The prevalent *Eimeria* spp are *Eimeria acervulina* (9.4%), *Eimeria mitis*(3.6%), *Eimeria maxima*(0.4%), *Eimeria mivati*(3.2%), *Eimeria tenella* (0.4%), *Eimeria necatrix*(3.2%) and mixed for *E. mitis* and *E. maxim*a (0.4%). The result reveal that all age groups were susceptible to *Eimeria* but younger chickens were more susceptible to infection than older chickens and the difference was significant ($p<0.05$). In conclusion, coccidiosis remained a major problem in the farm by changing its mode of occurrence from time to time as to the variations of the management system. Further strategies needs to be implemented to reduce the loss due to coccidiosis.

**Key words:** Addis Ababa · Coccidiosis · Eimeria Spp · Poultry · Prevalence

## INTRODUCTION

Poultry sector, is an imperative source of animal protein (meat and egg), has recorded a considerable development in employment generation. This organized and vibrant sector is adversely affected by the protozoan parasites of the genus *Eimeria*. It is caused by a protozoan parasite of the phylum Apicomplexa, family Eimeriidae and different species of the genus *Eimeria*. In domesticated chickens, at least seven species of *Eimeria* have been recognized as the causative agents of coccidiosis in chickens of which *Eimeria tenella* (*E. tenella*), *Eimeria necatrix* (*E. necatrix*), *Eimeria maxima* (*E. maxima*) and *Eimeria brunette* (*E. brunette*) being highly pathogenic species [1]. *Eimeria acervulina* (*E. acervulina*) and *Eimeriamitis* (E. mitis) are less pathogenic whilst *Eimeria praecox* (*E. praecox*) is regarded as the least pathogenic [2].

Coccidiosis has been shown to be common to intensively managed commercial poultry farms especially where management or hygienic standards are compromised [3]. The disease occurs only after ingestion of sporulatedoocysts in susceptible hosts. Both clinically infected and recovered birds shed oocysts in their droppings, which contaminate feed, dust, water, litter and soil. The infection occurs through ingestion of feed or water contaminated with sporulatedoocysts. Oocysts may be transmitted by mechanical carriers (e.g., equipment, clothing, insects, farm workers and other animals) [4]. Oocystsresides and multiplies in intestinal mucosa causing coccidiosis; which is characterized by dysentery, enteritis, emaciation, drooping wings, poor growth, low production [5] with high rate of mortality and morbidity [6]. Due to higher stocking densities and intensive husbandry practices, its incidence is being increased in poultry farms [7].

Poultry coccidiosis, caused by several distinct species of *Eimeria*, are remains the most economically significant parasitic infection of the poultry industry, worldwide [8]. The disease is endemic in most of the tropical and subtropical regions where ecological and management conditions favor an all-year round development and propagation of the causal agent [9].

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Poultry production in Ethiopia has affected by many diseases, among which important ones are Newcastle disease, Coccidiosis, Salmonellosis and Chronic Respiratory Disease. Coccidiosis in chickens is also considered to be one of the major problems of poultry industry [10]. Moreover, with the increasing interest in poultry production evidenced by the proliferation of poultry farms, it is pertinent to continually evaluate the prevalence, frequencies of the different *Eimeria species* and management issues associated with common poultry diseases such as coccidiosis in any given farm [11].

In Ethiopia despite the immense research works done by several outstanding researchers in the area of poultry coccidiosis in different parts of the country, the disease is still continued being a major economic problem demanding much research and investigation [12] in addition to that several reports had indicated that coccidiosis is widely prevalent in poultry population of various regions of Ethiopia, but the species involved was not known in Addis Ababa farms. Thus, this study was conducted to address the following objectives:

**Objectives:**

- To estimate the prevalence of coccidiosis in Addis Ababa poultry farms.
- To identify the prevalent *Eimeria species* in Addis Ababa poultry farms.

## MATERIALS AND METHODS

**Study Area and Study Population:** The study was conducted from Nov. 2014 to April 2015 in Addis Ababa poultry farm. Addis Ababa has a subtropical highland climate. The area is characterized by bimodal rainfall with an average annual rainfall of 1100mm. The average annual daily minimum and maximum temperature ranges from 10.7°C - 23.6 °C, respectively and relative humidity varying from70% to 80% during rainy season and from 40% to 50% during the dry season [13]. Study populations are all age and sex group of chicken reared in Addis Ababa poultry farms in Yeka, Kolfe, Arada, Bole and Gulale sub cities.

**Study Design:** The study design would be cross sectional and purposive sampling technique was implemented to select the animal in the farm to be sampled. Initially from 10 sub cities of Addis Ababa administration, five sub cities namely Yeka, Kolfe, Arada, Bole and Gulale sub cities were selected randomly. In the five cities farms were selected again randomly. From the selected farms chickens were selected purposively. One sample per 100 birds was taken from each farm. Each farm was visited once and the fecal samples were brought to the laboratory for parasitological examination. Information regarding the age and breed of chickens, history of dysentery and general information of farms such as farmer's name, address and farm location were collected through questionnaires.

**Sample Size Determination:** The number of animals to be sampled in the study was calculated using Thrusfield formula [14]:

$$N = \frac{1.96^2 p(1-p)}{D^2}$$

where N is number of animals to be sampled, P is the expected prevalence of the disease (P=23.1%) and D is precision level (0.05). Previous study by Alemayehu *et al*. [15] reported a prevalence of 23.1% in Addis Ababa. The sample size for fecal examination would be 273 and extra sample was added that lead totally 278.

**Sample Collection and Examination:** Freshly deposited fecal samples or cloacal samples from chicken of different ages, breed and sex were collected. The samples were collected in plastic bottles containing 2.5% potassium dichromate and brought to protozology laboratory where they were examined for the presence of oocysts. When the samples were not immediately examined they were stored at refrigeration temperature (about 4°C) until examination. The presence of oocyst in the fecal samples was examined by the direct fecal smear or floatation method using saturated solution of sugar. The *Eimeria species* was identified based on morphology of oocysts (shape and size) [16]. The morphology and size of Oocysts would be microscopically determined using calibrated ocular microscope at 40x magnification as described by Long and Reid [17].

**Data Management and Analysis:** The collected data was entered into Microsoft excel spread sheet to create a data base. The data was then analyzed by using SPSS software. Chi square test was used to test the association of coccidiosis with different risk factors. P-Value less than 0.05 was considered significant. Descriptive statistics percentages were also used to analyze the data. Finally, the data was presented as tables in accordance to the different category of age, sex, manifestation of clinical sign, different species of Eimeria and labeled alphabetical farm name.

## RESULTS

From 278 fecal samples examined, 20.5 % (n=57) were positive for coccidiosis. Aprevalence of 9.4% (n=26), 0.4% (n=1), 0.4% (n=1), 3.6% (n=10), 3.2% (n=9), 3.2% (n=9), 0.4% (n=1) were found for *E. acervulina*, *E. tenella E. maxima*, *E. mitis*, *E. mivati*, *E. necatrix*, Mixed infection for *E. maxima* and *E. mitis* respectively. Table 1 shows the prevalence of Coccidia species, from the different faecal sample examined. *E.acervulina* was found to be the dominant species.

Age category prevalence was calculated to be 27.68 % (n=31) and 15.66 % (n=26) for those less than six-month and for those six and greater-than-six-month age category ones respectively making statistical significant difference ($X^2$=5.924, df=1 and p<0.05). Prevalence of the disease based on the sex was also found to be 35.48 % (n=11) from 31 sampled males and 18.6 % (n=46) from 247 sampled females showing statistically significant difference ($X^2$=4.804, df=1 and p<0.05). Based on clinical manifestation of birds sampled from those birds with clinical sign (total=51), 19.6 %

Table 1: Frequency of distribution of Eimeria species as single and mixed infections (n = 57) in Addis Ababa poultry farm in 2014/2015

| No Emeria spp. | Frequency | Percent |
|---|---|---|
| *E.acervulina* | 26 | 9.4 |
| *E.tenela* | 1 | 0.4 |
| *E. maxima* | 1 | 0.4 |
| *E.mitis* | 10 | 3.6 |
| *E.mivati* | 9 | 3.2 |
| *E .necatrix* | 9 | 3.2 |
| Mixed for *E. maxima* and *E. mitis* | 1 | .4 |
| Total | 57 | 20.5 |

Table 2: Prevalence of coccidiosis based on clinical manifestation

| | | Clinical sign | | |
|---|---|---|---|---|
| Manifestation | | Without clinical sign | With clinical sign | Total |
| Examination result | Negative for Emeria | 180 | 41 | 221 |
| | Positive for Emeria | 47 | 10 | 57 |
| Total | 227 | 51 | 278 | |

($X^2$=031, df=1 and P-value)

Table 3: Prevalence of coccidiosis among the poultry farms of Addis Ababa in 2014/2015

| | | Farm code | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | Total |
| Result | Negative for Emeria | 4 | 5 | 20 | 5 | 7 | 6 | 4 | 3 | 2 | 4 | 10 | 15 | 9 | 10 | 52 | 32 | 33 | 221 |
| | positive for Emeria | 4 | 5 | 10 | 1 | 3 | 2 | 2 | 2 | 3 | 1 | 3 | 0 | 6 | 0 | 2 | 11 | 2 | 57 |
| Total | | 8 | 10 | 30 | 6 | 10 | 8 | 6 | 5 | 5 | 5 | 13 | 15 | 15 | 10 | 54 | 43 | 35 | 278 |
| | | 50 | 50 | 33. | 16. | 30 | 25 | 33. | 40 | 60 | 20 | 23 | 000 0 | 40 | 0 | 3.70 | 25. | 5.7 | |

($X^2$=44.628, df=16 and P-value<0.05)

Table 4: Distribution of different *Eimeria species* on the poultry farm of Addis Ababa

| | | Farm code | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | Total |
| Type of *Emeria* spp. | No Emeriaspp | 4 | 5 | 20 | 5 | 7 | 6 | 4 | 3 | 2 | 4 | 10 | 15 | 9 | 10 | 52 | 32 | 33 | 221 |
| | *E. acervulina* | 1 | 2 | 1 | 0 | 0 | 0 | 1 | 2 | 2 | 1 | 2 | 0 | 5 | 0 | 1 | 7 | 1 | 26 |
| | *E. tenela* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| | *E. maxima* | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | *E. mitis* | 1 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 3 | 0 | 10 |
| | *E. mivati* | 2 | 2 | 2 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| | *E. necatrix* | 0 | 0 | 3 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 9 |
| | Mixed for *E. maxima* and *E. mitis* | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Total | | 8 | 10 | 30 | 6 | 10 | 8 | 6 | 5 | 5 | 5 | 13 | 15 | 15 | 10 | 54 | 43 | 35 | 278 |

($X^2$=165.841, Df=112 and P-Value<0.05)

(n=10) was positive and from those birds without clinical sign (total=227), 20.7 % (n=47) was positive for the disease (Table 2) which is statistically not significant differences (P-value>0.05). Clinical sign observed was diarrhea, weight loss, depression and loss of appetite. Prevalence of coccidiosis vary among the farms sampled and the difference is statistically significant ($p<0.05$). Distribution of different *Eimeria species* on each farms were detected like farm C were with many species of Eimeria while other farms are without or with two or single *Eimeria species* infection such as farm B and A as indicated in Table 4.

## DISCUSSION

An overall prevalence of 20.5% coccidiosis was found in this study. The present result is nearly similar to the report of Alemayehu *et al*. [15] who reported 23.1% incidence rate in Addis Ababa poultry farm. In the present study, percentage prevalence of infection in Addis Ababa poultry farms may be lowered due to measurement like treatment and/or management conducted at farm level.

However, in the previous work, *Eimeria species* were not identified except prevalence and from this study *E. acervulina* was found to be highest frequently occurred and *E.tenella* was the less frequent one. Previous studies conducted in Ethiopia by Ashenafi, *et al*. [10] and M. Safari, [18], revealed that *E. acervulina* was the most prevalent species. On the other hand Lobago*et al*. [19] reported that *E. brunette* was the most prevalent species. The probable reasons for this discrepancy could be the difference in virulence of the *Eimeria species* at different management system and/or due to the possibility of drug resistance. The practice of feeding premixed coccidiostats to poultry in large poultry-raising and production establishments has reduced the significance of *E. tenella* and *E. necatrix*and emphasized the importance of other species. Moreover, many coccidiostatic drugs have been directed against *E. tenella*, with the result that other species are increasingly incriminated as a cause of poultry coccidiosis [20]. Mixed infections with two *Eimeriaspp; E. mitis*a and *E. maxima* were observed in one farm.

Statistically, significant difference (P-value<0.05) was observed in the prevalence of coccidiosis between the sexes. This may be due to that the number of females kept at the farm is greater than the number of males that females are required for laying eggs in many of poultry farms. It might also be attributed to egg production stress where females are egg producer and more energy would be utilized for egg production and decrease resistances to diseases.

The results of this study reveal that all ages of poultry are susceptible to coccidiosis but younger birds are more susceptible to infection than older birds. Age is one of the most principal factors in coccidiosis [6].

Prevalence of coccidiosis distribution among the farm was statistically significant differences. Observation showed that the husbandry methods and the environment which they are been kept in the farm was variably from farm to farm. Management of poultry farm plays a momentous function in the spread of coccidiosis because coccidialoocysts are omnipresent and are easily spread in the poultry farm environment. Further, owing to their high reproduction potential, it is very complex to keep chickens coccidia free, especially under current intensive rearing conditions [21]. Oocystssporulate readily in poultry house litter. However, they can be damaged by bacteria, other organisms and ammonia that are also present and their viability can begin to reduce after three weeks [22]. Prevalence varied by management and did not vary by flock size [4] while bad management, such as wet litter that encourages oocyst sporulation, contaminated drinkers and feeders, bad ventilation and high stocking density, can worsen the clinical signs. Therefore, coccidiosis can be controlled by good management practices including good ventilation, cleaning and decontamination of drinkers and feeders, dry and clean litter; and proper stocking density in the farm [23].

Statistically insignificant difference (P-value>0.05) was observed in the occurrences of coccidiosis based on manifestation of clinical sign. The study revealed that more prevalent in subclinical cases. This was in agreement with Anne [24]; however, in low-density production or with the use of preventative medication, coccidiosis generally remains a subclinical disease that only affects performance without the alarming losses of the farm. Statistically significant differences were observed based on the distribution of different *Eimeria* species. This is the detection of six Eimeria species known to infect the chicken, with multiple species identified on the majority of positive farms, indicates a complex species population structure. Several previous reports have revealed differences of the prevalence and composition of *Eimeria* populations in different places and different regions of the world [25] in China and in Australia [26].

## CONCLUSSIONS

Coccidiosis is highly prevalent in Addis Ababa poultry farm and it is a major challenge to poultry production. The coccidia species identified were *E. acervulina*, *E. mitis, E. necatrix*, *E. mivati* and *E. tenella* while *E. acervulina* and *E. mitis* were predominant species. Efforts towards the control of the disease through good management practices and the proper use of anticoccidial drugs should be considered. More attention should be given to improved sanitation and hygiene at the farm level. Including, all parameters which can improve litter quality such as; appropriate installation and management of watering systems providing adequate feeding space, maintaining recommended stocking density and supplying adequate ventilation.

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