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Prevalence and Associated Risk Factors of Poultry Coccidiosis in Intensive and Extensive Farming System in and Around Asella Town

Eden Abera[1], Abdissa Lemma Bedada[2*] and Lemma Yimer[1]

[1]*Welega University College of Veterinary Medicine, Ethiopia*
[2]*Asella Regional Veterinary Laboratory, PO box 212, Asella, Ethiopia*

**Corresponding author*

Abstract

Coccidiosis is major parasitic disease of poultry. It is an endemic disease in most of the tropical and subtropical regions of the world including Ethiopia. It commonly affects young chickens and chickens managed under Intensive system. A cross sectional study was undertaken in and around Asella Town from April 2021 to September 2021 with the objective of determining the prevalence of poultry coccidiosis and to identify the potential risk factors in Intensive and Extensive poultry farms. Flotation technique was employed on the feaces collected from randomly selected 307 chickens from both intensive and extensively management for presence of Coccidial oocysts. Accordingly out of total 156 (50.81%) of chickens were found to be positive for coccidian oocysts. The prevalence of coccidiosis was accounted 33.8%, 73.3%, 38.8%, 51.8%, In Chillalo, Wolkesa, Burka chillalo and Dosha respectively. Among examined chickens, higher infection (68.5%) rate was observed in chicken under the age category of 2 to 8 weeks (young) than in chickens greater than 8 weeks (31.0%). There was statistically significance difference (p =0.000) between the two age groups, As well as between treated chickens and non-treated chickens. Higher infection rate was detected in chickens under intensive management system (58.3%) as compared to chicken in extensive (43.6%). There was statistically significance difference (p =0.010) between the two management system. The prevalence was also statically Significance different (p=0.027) between exotic breed chickens (56.8%) and Local breed chickens (44.13%). Higher prevalence was observed in Female (55.6%) chickens than Male (41.2%).chickens which was statistically Significance different (p=0.017). The study indicated that poultry coccidiosis is still the most prevalent protozoa disease of poultry that need an intervention through improved management practices including good hygiene and Biosecurity practices should be given prime attention in the prevention and control of coccidiosis in the study area.

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Asella, Coccidiosis, Poultry, Prevalence, Risk factors.

Introduction

Poultry refers to domestic birds such as chickens, turkeys, ducks, guinea fowl, peasants, pigeons and more recently ostriches kept for meat or egg production. However, chicken, guinea fowls and turkeys are economic importance given the trade in poultry (Mohammed and Sunday, 2015).

Ethiopia has huge population of chickens estimated to be 56.53 million with indigenous, hybrid and exotic breeds of chickens representing 94.31%, 3.21% and 2.49%,

respectively (CSA, 2017). Moreover, compared to a number of other livestock species, fewer social and religious taboos are related to the production, marketing and consumption of the poultry products.

For these reasons, poultry products have become one of the most important protein sources for man throughout the world (Mohammed and Sunday, 2015). In Ethiopia, there are three types of chicken production systems. These are free-range production system, semi-intensive production system and intensive production system (ANRS BoARD, 2007).

Free ranging system is characterized by low level of input and output. It is especially favorable to smallholder farmers due to its low capital requirement, high cost, efficiency, flexible production system and low production risk. This production system contributes over 98% national egg and over 99% poultry.

There are also emerging small scale market oriented semi intensive system in urban and peril-urban areas holding small number of exotic breeds of chicken (50-1000) and are produced along commercial lines using relatively modern management methods. The commercial poultry production system contributes nearly 2% of the national poultry population in Ethiopia.

The system is characterized by indoor conditions with a medium to high bio-security level, holds imported exotic breeds that require intensive inputs such as feed, housing, health care and modern management system (Halima *et al.*, 2007). Poultry constitutes an important component of agricultural and household economy in the developing world and play important role to enable the landless poor farmers move out of poverty (Gueye, 2005).

Even if, Ethiopia owned huge chicken flock; there are different factors like diseases, predators, lack of proper health care, feed source and poor marketing information that hinder the productivity of the chickens in most area of the country.

Among the above obstacles, the poultry diseases are the main constraints incriminated for reduction of total numbers and compromised productivity (Ahmed, 2018). Among those diseases, coccidiosis is the parasitic protozoan disease caused by genus *Eimeria*. It is economically important and prevalent in chicken farm in Ethiopia (CSA, 2004).

Coccidiosis is a disease that is caused by protozoan parasites of the genus developing within the intestine *E. brunetti*, *E. maxima*, *E. mitis*, *E.praecox*, *E. necatrix*, *E. praecox* and *E. tenella*) are recognized, in the intestine of most domestic and wild animals and birds. Seven *Eimeria*, species of *Eimeria* as infecting chickens.

Although coccidiosis is a disease known for many years *E. tenella*, *E. maxima* and *E. acervulina* still considered as the most economical important parasitic condition affecting poultry production worldwide (Gussem, 2019).

Chickens suffering from coccidiosis quickly become less productive and, if they survive, poor performance continues the rest of their lives. Laying hens suffering intensive from coccidiosis will experience a reduction in rate of egg production (Negash *et al., 2015*).

The economic losses caused by chicken coccidiosis without including the sub clinical coccidiosis are estimated to be 2 billion USD throughout the world. Quantitative losses due to chicken coccidiosis in Ethiopia is not well documented, although it has been reported in Debrezeit by Alemayehu *et al.*, (2012), in Adiss Ababa by Oljira *et al.*, (2012), in Ambo by Gari *et al.*, (2008), and In and around Jimma town. (Chalchisa and Daresay, 2016).

In Ethiopia, the previous studies showed that coccidiosis contributes to 8.4% and 11.86% losses in profit in large and small-scale farms, respectively (Kinung'hi, 2004). Losses due to mortality following a severe outbreak may be devastating and incidence rates as high as 80% were sometimes observed in the country (Migbaru *et al.*, 2015).

Although several researches have been undertaken on poultry Coccidiosis in different parts of the country, the disease is still one of the major problems of the poultry industry. Coccidiosis is major parasitic disease of poultry with consequential economic losses because of mal absorption, bad feed conversion rate, reduced weight gain and increased mortality (Dinka *et al.*, 2015).

For the prevention and controlling of the disease, determining the prevalence and its potential risk factors is eminently important. Therefore, the objectives of this study include to determine prevalence of poultry coccidiosis in and around Asella town. And to assess the associated risk factors of poultry coccidiosis.

Literature Review

Poultry Coccidiosis

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).

Chicken coccidiosis is an enteric disease that impairs growth and suppresses the immune system resulting in high mortality which has been estimated to cost more than US$3billion annually in poultry industry (Blake and Tomley, 2014).

The disease is caused by a protozoan apicomplexan parasites of genus *Eimeria* which consist of over 1000 species (Blake, 2015). In chicken, seven species of *Eimeria* have been identified among which *E. tenella, E. maxima* and *E. acervulina* have been regarded as the most economically significant species (Thenmozhi *et al.*, 2014).

Coccidiosis in chickens is one of the major problems of poultry industry that is caused by protozoan parasites of genus *Eimeria*. It is considered as one of the most economically important diseases of domestic poultry that is responsible for significant economic losses to the worldwide poultry industry.

It is caused by one or several of seven *Eimeria* species infecting chickens. These species differ in their localization in the gut and in their ability to induce morbidity and mortality. This parasitic infection occurs in the epithelial cells of the intestine, despite the advances in nutrition, chemotherapy, management and genetics. Most *Eimeria* species affect birds between 3 and 18 weeks of age and can cause high mortality in young chickens (McDougald, 2003).

Among parasitic diseases that affect the poultry industry, coccidiosis is renowned as a dreadful disease that causes economic loss. It is caused by *Eimeria* species of the phylum apicomplexa. Over 1000 species of *Eimeria* have been reported to infect different host animals such as chicken, duck, turkey, cattle, rabbit, sheep and domestic dog and cat (Blake, 2015).

In chicken, seven species have been described which are *E. tenella, E. maxima, E. mitis, E. acervulina, E.brunetti, E. praecox, and E. necatrix*. The level of lesion caused by these species in different area of the gut is associated with their level of pathogenicity (Morris *et al.*, 2007).

Eimeria oocyst is the main cause of coccidiosis which get into chickens via ingestion of food, water and litter contaminated with oocyst (Shivaramaiah *et al.*, 2014). The oocyst which grows on the fecal shed by infected birds can also be transported to the chicken house through personnel that move from house to house (Belli *et al.*, 2006).

In Ethiopia, the study conducted by (Moges *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 sometimes observed in the country (Getachew *et al.*, 2008).

Etiology

Poultry coccidiosis is caused by the intracellular protozoan parasite of *Eimeria* species in the kingdom Protozoa, phylum Apicomplexa, class Coccidia, order Eucoccidiorida, family Eimeridae and genus *Eimeria* (Taylor *et al.*, 2007). Nine coccidian (*Eimeria*) species are identified as causative agents of poultry coccidiosis but only seven of them have been reported to be pathogenic (Kahn, 2008). *Eimeria necatrix and Eimeria tenella* are the most pathogenic *Emeria* species.

Emeria arcevulina, *Emeria maxima* and *Emeriami vati* are common and slightly to moderately pathogenic while *Emeria brunetti* is uncommon but pathogenic when it does occur. *Emeria miti, Emeria praecox and Emeria hagani* are relatively non-pathogenic species (Soulsby, 2002).

The morphology of coccidiaoocysts is similar for most *Eimeria* species. They are ellipsoidal or circular shaped with a thick cell wall and sporocysts. Majority of *Eimeria oocysts* have ovoid shape. (Clark and Blake, 2012). The most prevalent species of *Eimeria* that cause coccidiosis in cattle are *Eimeria bovis, E. zuernii, and E. auburnensis.*

The species of *Eimeria* that affects chickens are *E. acervulina; E. brunetti; E. maxima; E. mitis; E. necatrix; E. praecox; and E. tenella* among which the most economically important species in poultry are *E. tenella, E. acervulina, and E. maxima* (Taylor *et al.*, 2007).

Eimeria species are very host specific and sites of development is intestine (epithelial cells of the intestinal villi or cells of the crypts) (Varghese, 2004). The species of genus *emeria* which affect chickens and the site of development in intestine of affected chickens are illustrated in Table 1.

Epidemiology

The epidemiology of coccidiosis is a timely issue to be established for determining the potential risk factors and species causing the diseases, and subsequent design of preventive production system, agro-ecology and level of and control regimen, which is suiting the local management. Under farming conditions, it is impossible to produce a coccidia free environment (Jordan *et al.*, 2002).

Infected chickens shed oocyst for several days or weeks. Coccidial oocysts are normally introduced in to new facilities through contaminated equipment or vehicles coming from other poultry operations (Conway and Mckenzie, 2007).

Geographical distribution: Coccidiosis is a widespread disease in growing chickens around the world that can seriously restrict the development of poultry production (Conway and Mckenzie, 2007). The disease is endemic in most of the tropical and subtropical regions where ecological and management conditions are favorable for sporulation of oocyst and development the causative agent (Obasi *et al.*, 2006).

Poultry coccidiosis, caused by *E. acervulina, E. necatrix, E. maxima, E. tenella, E. mivati and E. brunetti,* is endemic in all parts of the Ethiopia and affects mainly young growing birds. In the past years coccidiosis used to be the most important cause of mortality in all farms.

Incidences of the disease were as high as 80% usually occurring in the form of outbreaks (Safari *et al.*, 2004). The disease contributed to be a problem with prevalence rate of 50.8% in deep litter intensive system and 11% in backyard poultry production systems, respectively (Kinunghi *et al.*, 2004). Coccidiosis is a disease common in intensively managed farms especially where management or hygiene standards are compromised (Musa *et al.*, 2010). Damp litter that has high moisture content and warm of 25-30°C, favour oocysts sporulation (David, 2000).

It was also observed that oocyst sporulation is delayed or not even occur at 10oC in dry conditions, while at 45-50°C oocysts could sporulate with in a day and under optimal conditions of temperature (21- 30oC), adequate moisture and oxygen, oocysts could sporulate and become infective within 1-2 days or could get destroyed at 560°C for one hour (Musa *et al.*, 2010).

It is impossible under farming conditions to produce a coccidia free environment (Jordan *et al.*, 2002). Birds get oocyst from food or water contaminated by faeces of infected animals. Infected chickens shed oocyst for several days or weeks.

Oocyst sporulated within two days under the proper condition and become infective. Chickens pick them up by pecking on the ground or in litter used for bedding in the house (Fanatico, 2006).

Coccidial oocysts are normally introduced in to new facilities through contaminated equipment or vehicles coming from other poultry operations (Conway and Mckenzie, 2007).

Eimeria species can cause infection in all ages but the age of the chickens is measured as a major factor in the prevalence of coccidiosis infection (Sharma *et al.*, 2015).

Life Cycle

Eimeria life cycle is complex and comprises of three stages, one occurs on litter under the conditions of humidity, temperature, and oxygen supply (sporogony), and two stages occurs in the cells of intestinal epithelium [merogony or schizogony (asexual reproduction) and gametogony (sexual reproduction)].

During the sporogony, which is considered a non infective stage, the oocyst is excreted in chicken feces and undergoes sporulation in the presence of humidity, warmth, and oxygen and thus becoming a sporulated oocyst, now infective.

Merogony or schizogony occurs in the intestine and comprises of several rounds of asexual multiple division (from two to four times), followed by gametogony that involves the formation of male and female gametes,

fertilization and formation of a zygote (oocyst) that will be excreted in feces (Lal *et al.,* 2009) Infection starts when the host ingest sporulated oocysts (Figure 1).

Pathogenesis

Infection is through ingestion of sporulated oocysts by oral route, with contaminated feed and/or water. After ingestion, infectious oocysts excyst, liberating the infective form called the sporozoit. Sporozoits infect epithelial cells of the intestine. Transfer of the sporozoits up to the locus of the primary lesion is with the help of intraepithelial lymphocyte. The parasites invade the lining of the intestine and cause tissue damage, lowered feed intake, poor absorption of nutrients from the feed, dehydration, and blood loss (Fabiyi, 2000).

Pathogenesis of the infection is influenced by species of the coccidium, concurrent diseases and nutritional factors. *E. necatrix* and *E. tenella* are the most pathogenic in chickens because schizogony occurs in the lamina propria and crypts of epithelium of the small intestine and ceca, respectively, and causes extensive hemorrhage. Most species develop in epithelial cells lining the villi (Kahn, 2008).

Clinical Signs

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. 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, Avian coccidiosis, caused by parasites of the genus *Eimeria*, produces anorexia and reduced weight gain and feed conversion in infected chicks (Safari, 2001).

Clinical signs of coccidiosis are due to destruction of the intestinal epithelium and, frequently, the underlying connective tissue of the mucosa. This may be accompanied by hemorrhage into the lumen of the intestine, catarrhal inflammation, and diarrhea. Signs may include discharge of blood or tissue, tenesmus, and dehydration (Geremew, 2018).

Poultry coccidiosis affects birds in both clinical and sub-clinical forms. The clinical form of the disease manifests through prominent signs of mortality, morbidity, diarrhea or bloody feces, dehydration, lowered feed intake, weight loss, paleness, huddling, ruffled feathers, and depression (Taylor *et al.*, 2007).

The occurrence of clinical coccidiosis is directly related to the number of sporulated oocysts ingested by a bird at one time, the pathogenicity of the *Eimeria* species, the age of the infected chicken and the management system. 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).

The sub-clinical coccidiosis manifests mainly by poor weight gain and reduced efficiency of feed conversion and gives rise to highest proportion of the total economic loss (Taylor *et al.*, 2007).

Treatment

Anticoccidial drugs available for use finely or various combination are amprolium, clopidol, diclazuril, ethopabate halofuginanone and ionophores (monensin, lasalocid, narasin, maduramicin, nicarbasin, robenidine), and sulphaquinoxaline. Amprolium is structurally similar to and is a competitive antagonist of thiamine (vitamin B) because rapidly dividing coccidian has relatively high requirements for thiamine; nitrobemzamibles exerts their greatest coccidiostatic activity against the asexual stages (Kahn, 2008).

While ionophores are anticoccidials commonly used in the large-scale industry and they alter the function of the cell membrane and rupture the parasite. Ionophores also have antibacterial action and help to prevent secondary gut diseases (Fanatico, 2006).

In the successful treatment of an outbreak of coccidiosis the aim is to treat birds already affected and at the same time allow sufficient merogonous development in the clinically unaffected birds to stimulate their residence (Taylor *et al.*, 2007).

Anticoccidials are commonly withdrawn from broilers within 3-7 days before slaughter to meet regulatory requirements and to reduce production cost; because of broilers have varying susceptibility infection at this point, the risk of coccidiosis outbreaks is increased with longer withdrawal period. The emergence of drug resistance strains of coccidia presents a major problem. Continuous use of anticoccidial drugs leads to increased incidence (Kahn, 2008).

Prevention and control

There are basically two means of prevention of coccidiosis: chemoprophylaxis and vaccination. Chemoprophylaxis using so-called anticoccidial products (ACP) or anticoccidials in the ration is by far the most popular: it is estimated that 95% of the broilers produced (Chapman, 2005)

Prevention of poultry coccidiosis can be achieved much easier than treatment. Coccidiosis can be prevented by good managemental practices (Ashenafi *et al.,* 2004). It can be controlled mainly by drugs and also an effective vaccine is now available for breeders or layer replacements. Drugs have been very important in controlling coccidiosis but the emergency of anticoccidial drug resistance has affected the use of fullness of the drugs.

The possibility that drugs may not always be relied up on to control coccidiosis has led to an interest in other means of control (Vegad, 2004). Apart from the use of drugs, control is now based on hygiene, vaccine and genetics. But genetics is a theoretical strategy not in practical use (Jordan *et al.,* 2002).

Although coccidiosis is controllable under most circumstances, the cost of control makes the disease one of the most expensive parasitic diseases encountered in the poultry industry. Good sanitary measures, avoiding water spillage, overcrowding, and the use of prophylactic anti-coccidia "Shuttle programme" are essential to control the menace of coccidiosis (Musa *et al.,* 2010).

Litter should always be kept dry and special attention given to litter near fonts or feeding troughs. Good ventilation also reduces the humidity in the house and helps to keep litter dry. Coccidial oocysts are extremely resistant to environmental conditions and disinfectant agents, so eradication of coccidiosis from chicken houses by litter removal, cleaning and disinfection is not feasible (Carvanates, 2008; Ajao *et al.,* 2010).

Recent advancement has shown that characterisation of the infective *Eimeria* species transcriptome may provide a better understanding of the biology of the parasite and aid in the development of a more effective control for coccidiosis (Amiruddin *et al.,* 2012).

A coccidian free environment is not likely achieved; chicks that become infected may develop acquired immunity or succumb to diseases if the balance is in favour of the parasite (Chookyinox *et al.,* 2009). Immunity to coccidiosis in chickens is *Eimeria* specific (David, 2000).

Birds that survive severe coccidiosis may never be productive which while survivors of one strain of *Eimeria* may become infected with another different strain there by requiring further treatment (Chookyonix *et al.,* 2009). Resistance to the diseases usually increases with age of birds (Chapman, 1997; Uza *et al.,* 2009).

Davis (1981) reported maternal immunity against coccidiosis occur at the height of serum antibody production, unfortunately serum antibodies have been found to be very essential for prevention against coccidiosis. Prophylactic administration of anti-coccidial drugs such as amprolium is a common practice in Nigeria (Abdu *et al.,* 2008).

Alternative Control Strategies

The search of alternatives to anticoccidial drugs and vaccines against avian coccidiosis has led to discover in fungal extracts, plant extracts, and probiotics a source of new compounds with anticoccidial activity. Many of them with the oocyst as target being that if the dispersion of oocysts is controlled then the possibilities of infection reduce.

The role of fats, essential oils and herbal and medicinal plants has been explored to control avian coccidiosis Other aqueous stem back extracts used for the treatment of coccidiosis include; *Khaya senegalensis*, and *Anona senegalensis*, *Aloe excels*, *Camellia sinensis*, *Curcuma longa*, *Echinacea purpure*, *Origanum vulgare*, *Saccharum officinarum*, *Triticum aestivum*, *Yucca schidigera* (Abbas *et al.,* 2012). Their photochemical analysis reveals that tannins, terpenes, anthraquinones, phlobitaminans, alkaloids, cardiac glycosides and steroids were present in various concentrations (Nwosu *et al.,* 2011).

Anticoccidial Treatment and Coccidiostats

The disease is controlled mainly by hygiene and use of chemical anti-coccidial agents (Chapman, 2000; Nwosu *et al.,* 2011; Elkhtam *et al.,* 2014). Coccidiosis though highly prevalent in Nigeria can be successfully managed using a combination of chemoprophylaxis and good hygienic practices (Chapman, 2000; Etuk *et al.,* 2004; Adewole, 2012). However, cost and indiscriminate use of anti-coccidial drugs including monensin, ionospheres

and nicarbazin have resulted in the emergence of resistant strains of *Eimeria*. These have cut short the usefulness of successive commercial drugs thereby prompting the exploration of new areas for appropriate medicinal relief (Patrick and Mgbere, 2010; Nwosu *et al.,* 2011).

Status of Poultry coccidiosis in Ethiopia

The prevalence rate of coccidiosis is higher during the rainy season, primarily because it is positively influenced by the warm and humid weather, which characterizes the rainy season period by providing favourable conditions for the growth and development of the infective oocysts (Etuk *et al.,* 2004; Alawa *et al.,* 2010).

Coccidiosis is also most prevalent among young chicks of 1-5 weeks of age as oocysts could appear in faecal samples of birds as early as 7 days of age with the clinical disease manifesting by the 4th week (Majero *et al.,* 2001; Obasi *et al.,* 2001). Obasi *et al.,* (2001) reported that exposure potential of chicken to coccidian parasites in warm humid tropical.

According to study conducted on Prevalence of poultry coccidiosis in and around Yabello, southern Ethiopia out of 384 fecal samples examined, 74 were found to be positive for *Eimeria* oocysts with the overall prevalence of 19.3 %.

The highest prevalence rate (22.1%) was observed in chicken reared in intensive management system and the lowest prevalence rate (16.7%) was observed in extensive management system. The prevalence rates of 18.4 and 21.9% were recorded in chicken grouped under the age category of 2-8 weeks (young) and greater than 8 weeks (adult), respectively. The prevalence rates of 18 and 21.6% were also recorded in good and poor body condition, respectively (Addis *et al.,* 2016).

According the study conducted on Study of The Prevalence Risk Factors Associated with Poultry Coccidiosis in Gondar Town, North Ethiopia Out of a total of 407 chickens examined for poultry coccidiosis, 218 were found positive. The overall prevalence of poultry coccidiosis in the study area was, therefore, 53.6% (Belayne *et al.,* 2016).

Studies conducted in Arsi zone (Tiyodstrict) revealed prevalence rates of 22.58% and 12.25% for clinical coccidiosis in rhode Island red (RIR) and local strain chickens respectively (Gari *et al.,* 2008). Additional investigation done in central Ethiopia revealed that *Eimeria acervulina* was the most prevalent coccidial species (Hagos, 2000; Safari, 2001; Lobago *et al.,* 2003), whereas study conducted in Kombolcha disclosed that *Eimeria burneti* was the most prevalent coccidian species. This variation may be because of the possibility of drug resistance or/and differences in virulence of *Eimeria* species under different management system sms.

Materials and Methods

Study Area

The study was conducted in Tiyo District, Arsi zone, from April 2021 to November 2021. Tiyo district is located in Oromia region, Arsi zone and the administrative center of the woredaAsella, which is the capital of Arsi zone, is located at about 175 km Southeast of Addis Ababa at 6°59’ to 8°49’ N latitudes and 38°41’ to 40°44’ E longitudes with an altitude of the area ranges from 2500 to 3000 m. a. s. l. Agricultural production system of the study area is of mixed crop and livestock production.

The area is characterized by mid subtropical temperature ranging from 8.4°C-22.6°C and with relative humidity ranging from 43 to 60% and has a bimodal rainfall occurring from March to April (short rainy season) and July to October (long rainy season), with annual average rainfall 2000 mm.

The area covers 23674.72 km square and topographically has highland escapement and lowland areas. The area is densely populated, with livestock population of 178,254 cattle, 157,571 sheep, 28,074 goats, 19,018 horses, 42,110 donkeys, 634mules and 181,046poultry (TWLDO, 2020).

Study Population

The study population was chickens randomly selected from Intensive poultry Farm, small holder farmers and bought directly from the farmers from Market. A total of 307 chickens from Bovas brown breed and Local chicken breed keep under traditional (Free ranging) and Intensive farming system.

During sampling age, (Young and Adult), sex (Male and Female) and breed (Exotic and Local), management type (Intensive and Extensive) and short interview of owners about the management, Housing Type and Post treatment history of their chickens was made. Age of chickens was

recorded by observing color of the shank and growth of the spur and most of the chickens bought were approximately in the range of growers or young (4-12 weeks of age) as an adult (greater than 12 weeks of age) (Solomon, 2014).

Sample Size Determination

By using simple random sampling methods and 95% confidence interval with required 5% precision, the sample size was determined by the formula (Thrusfield, 2018): To calculate the total sample size, the following confidence level (CL), 5% desired level of precision; and parameters was used. Thus, there was 72.4% expected prevalence of cocciodosis in poultry production in the study area.

$$n = \frac{1.96^2 * Pexp\ (1\text{-}Pexp)}{d^2}$$

When: n= required sample size; Pexp = expected prevalence (0.724) d= desired absolute precision (0.05). Hence, by using this formula, the sample size was calculated to be 307

Study Design and Sampling Methods

Across sectional study design was conducted from April 2021 to September 2021 to determine the prevalence of poultry coccidiosis with its potential risk factors in study area. Simple random sampling method was used to collect fecal samples by considering management, sex, breed and age of the chickens. A total of 307 chickens from different age, from both intensive and extensive production system in and around Asella town.

Study Methods

Simple random sampling method was used to collect fecal samples from 307. Pooled fecal samples was aseptically collected from bird's fresh droppings in poultry farms and squeezing out the feces into a sterile labeled polythene bags and was immediately transported to Asella Regional Veterinary Laboratory. Age, sex and breed of chickens, from which sample collected was recorded at the time of sampling.

Fecal Sample Collection and transportation

The fecal sample was collected per cloaca where possible and from the upper surface of the litter immediately after dropping of the faces and collected in a screw capped glass bottles (universal) bottles by using spatula which was cleaned after each collection an packed in ice box transported to Asella Regional Veterinary parasitology laboratory as much as it was in fresh state while collecting of fecal samples; date, management system, sex, age group, breeds and treatments given for sampled poultry was recorded.

Laboratory Examination

A 3 gram of chicken fecal droppings was taken and floatation fluid (50ml of saturated sodium chloride solution or saturated sugar solution) was added and after thoroughly mixed and processed, then prepared for examination under the microscope by putting the slides covered by cover slips containing the oocytes directly (Eshetu and Nigussu, 2017).

The fecal droppings was examined by compound microscope under the magnifications of 10x and 40xs.The Examination of fecal contents showed oval thick walled oocytes and large round in significant numbers was considered as coccidiosis oocytes (Chauhan and Roy, 2007).

Data analysis

The raw data was entered and managed using Microsoft Excel worksheet and summarized with descriptive statistics. The SPSS statistical software version 20 was used for Chi-square statistical analysis.

The statistically significant association between the risk factors and the infection was determined using p-value, $p<0.05$ as statistically significant and insignificant when the p-value is greater than 0.05.

Results and Discussion

The overall Prevalence of coccidiosis in the sample under examination in and around Asella town was summarized, out of the total 307 fecal sample of chickens examined, infections at different Age, Breed, Sex, and Management System. Out of total samples 156 were found positive for coccidial oocyst giving the overall prevalence rate of 50.81%.

The prevalence of coccidial infection accounted 34.8%, 73.3%, 38.8% and 51.5% Chillalo, Wolkesa, Burka Chillalo and Dosha. In this study generally factors, sex, breed, age, production System, management and

Treatment history were considered as risk factors for the occurrence of poultry coccidiosis in the study area.

Age wise prevalence of the coccidiosis was mentioned in Table 3:- This table suggested that out of the total 307 fecal sample of chickens examined 145 samples were from Adult chickens and the remaining 162 were from Younger age groups.

The prevalence rate is relatively higher in younger age of chickens (68.51%) than Adult age groups (31.03%). The Association between expected prevalence and new prevalence were significance significant P < 0.05 (P= 0.000) Table: 4.

Prevalence of coccidiosis between breeds

Within breed more positive result was evaluated for *Eimeria oocyst* up on microscopic examination in exotic breed (56.8%) than local breed (44.1%).The association was statically significant P < 0.5 (P = 0.027).

Within sex more positive result was evaluated for *Eimeria oocyst* up on microscopic examination in Female (55.6%) than Male (41.2%) respectively in Table 5 was evaluated. The association was statically significant P < 0.05 (P =0.017).

The result of prevalence of coccidiosis between management systems was explained in table 6. in Intensive farms out of 151 fecal sample of chickens examined 88 sample were positive for coccidial oocyst with prevalence rate of (58.3%),while in extensive farming system out of 156 fecal sample of examined 68 sample were positive and the prevalence rate of (43.6%) was evaluated. The association between expected prevalence were statically significant P < 0.05 (P = 0.010).

The current study indicated that the prevalence of coccidial infections in chickens was 50.81%, which is nearly similar to the previously reported prevalence of 53.6% in Gondar town (Belayne *et al.*, 2016). However, The present finding was higher than the finding of (Bereketmolla and Abdu Ali, 2014) who reported a prevalence of 38.5% in Kombolcha Ethiopia.

The variation observed among the studies might be attributed to the sample size, epidemiology of coccidial infection in the comparison study sites, season of the year, agro ecology and differences in management systems of the chicken.

The prevalence of coccidiosis in Chillalo, Wolkesa, Burka Chillalo and Doshakebele was accounted for 34.8%, 73.3%, 38.8% and 51.5% respectively. The association was statically significant (P< 0.05).

This finding is agreed with (Mulluken Gebeyeh and Liul Yizengaw, 2017) who reported study site were significantly associated with *Eimeria* infection (P < 0.05).

The prevalence of Coccidiosis was statically significantly higher in younger birds (68.51%) than Adults (31.03%) similar pattern of prevalence with Age was Reported by previously study by Hadas *et al.*, (2013) who Reported 68.1% in Young birds and 37.5%in Adults., But disagrees with the findings of Addis and Endale (2016) and Temesgen *et al.*, (2018) who reported higher prevalences in the Adults than in the Young. This could be associated with the immature immune system in young birds leaving them susceptible to infection even with the less pathogenic strains of *Eimeria* species.

The prevalence of coccidiosis was significantly Higher (P < 0.05) in Exotic breed 56.8% than Local breed 44.1%. This agreed with the findings of Gari *et al.*, (2008) and Driba *et al.*, (2012). The prevalence of poultry coccidiosis was higher in Female (55.6%) than Male (41.2%) poultry. This result agrees with high prevalence reports in female by different scholars (Adis and Endale, 2016; Akalu, 2017). The higher prevalence of coccidiosis among female might be attributed to stress during egg production.

The prevalence of poultry coccidiosis was significantly higher infection rate was detected in birds under Intensive management system (58.3%) as compared to birds in Extensive (Backyard) (43.6%). This finding is in line with (Tadessechalchisa and Feyissa Begna Deressa, 2016) and (Taylor *et al.*, 2007). However disagree with (Firmaye *et al.*, 2015) who stated that the prevalence rate of coccidiosis in Extensive managed chickens was greater than those chickens managed under Intensive management system.

In fact, Adhikari *et al.*, (2008) reported that coccidiosis was a disease of poor management. 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, contamination of feed and water by feaces and Nonuse of coccidio stats as preventive measure.

Table.1 Species of *Eimeria* with their predilection site in the host.

Species	Site of lesions
E. tenella	Caecum
E. acervulina	Duodenal loop
E. necatrix	Mid gut
E. maxima	Mid gut
E. hagani	Anterior gut
E. mivati	Duodenal loop to rectum and caecum
E. praecox	Anterior gut
E. mitis	Anterior gut
E. brunette	Lower intestine

Source: (Foreyt, 2001)

Table.2 Location and pathogenicity of *Eimeria* species

Species	Site of development	Pathogenesity	Desease
E.necatrix	Jejurium, ilium, caeca	+++++	Hemorhagic
E.brunetti	Caeca and rectum	++++	Hemorhagic
E.tenella	Caeca	++++	Hemorhagic
E.maxima	Jejunum, ileum	+++	Malapsorption
E.mitis	Ilium	++	Malapsorption
E.mitis	Duodenum, ilium	++	Malapsorption
E.acervulina	Doudnum, jejununm	+	Malapsorption

Source: (Reid *et al.*, 2014)

Table.3 The association between study site of chickens and occurrence of coccidiosis

Study site	No of Chickens examined	positive result	Prevalence (%)	X2	p-value
Chillalo	69	24	34.8%		
Wolkesa	90	66	73.3%		
Burka chillalo	80	31	38.8%	30.027	0.000
Dosha	68	35	51.5%		
Total	**307**	**156**	**50.8%**		

Table.4 The association between age of chickens and occurrence of coccidiosis.

Age	No of chickens Examined	Positive Result	Prevalence (%)	X^2	p-value
Young	162	111	68.51%	43.0143	0.000
Adult	145	45	31.03%		
Total	**307**	**156**	**50.81%**		

Table.5 The association between breed of chickens and occurrence in coccidial diseases

Breed	No of chickens Examined	Positive Result	Prevalence (%)	X^2	p-value
Local	145	64	44.13%	4.9006	0.027
Exotic	162	92	56.79%		
Total	**307**	**156**	**50.81%**		

Table.6 The association between sex of chickens and occurrence of coccidiosis

Sex	No of chickens Examined	Positive Result	Prevalence (%)	X^2	p-value
Female	205	114	55.60%	5.6770	0.017
Male	102	42	41.17%		
Total	**307**	**156**	**50.81%**		

Table.7 The association between Production systemof chickens and occurrence of coccidiosis.

Production system	No of chickens examined	Positive result	Prevalence (%)	X^2	p-value
Extensive	156	68	43.58%	6.6235	0.010
Intensive	151	88	58.27%		
Total	**307**	**156**			

Conclusion and Recommendation

Despite the reduction in the prevalence of coccidiosis in the present study, coccidiosis is a major burden to poultry producers and veterinary health professionals. Breed and age of chicken, and management systems are important risk factors that influence coccidiosis prevalence in Two Intensive poultry farm and Extensive poultry farm. Based on the above conclusion the following recommendations are forwarded:

Extensive management system

- Appropriate prevention and control of coccidiosis at the small holder farmers should be in place to alleviate the impact of the disease
- Low level management, housing and poor nutrition should be improved in the rural poultry production so that coccidiosis control efforts could be enhanced.
- Appropriate awareness creation, through farmers training about the general knowledge of coccidiosis occurrence, medication procedures and control methods should be undertaken for sustainable control of coccidiosis, focus should be made on women small holder poultry farmers in their efforts to improve income source and long Term economic potential.
- Biosecurity practice should be the primary concept in the prevention and control of coccidiosis. These are hygiene of poultry house personnel and permises, Disinfections and litter management keep coccidiosis out side. Disinfect shoes before entering the chicken house entering the chicken house, keep wild birds and other animals out and separate older birds from young ones.
- The feeding and watering troughs should be placed in a way that chicken can easily reach and adequate spaces are available for feeding and watering. Otherwise combination of feed and water with coccidian oocysts from chicken droping is inevitable and hence increases the risk of infection and disease.
- Avoiding damp areas in house should be the practical emphasise of poultry producers, leaking roofs of watering trough should be adjusted ;redistribute litters frequently to avoid concentration of the oocysts at place such as feeding and watering troughs, litter should be dry.
- Clean the house thoroughly before each new flock comes in clean out old litter, wash the walls, floor and disinfect the room using appropriate disinfectant that can kill coccidial oocysts.
- A reduction in feed in take is a sure sign" of something is wrong. Thus poultry supervisors and producers should monitor the drop in feed consumption.

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