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Prevention and Control Methods for Coccidiosisin Chickens, A Review

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Abstract: Poultry production has a major role in the economy of developing countries, including an important role in poverty alleviation by means of income generation and household food security. The poultry farming has been adversely affected by a variety of constraints. Of these constraints, Coccidiosis in poultry is still considered as one of the main diseases affecting performance of poultry reared under intensive production systems. Chicken coccidia species are *E. acervulina, E. maxima, E. tenella, E. necatrix, E. mitis, E. brunetti and E. praecox*. The life cycles of *Eimeria* species are complex, consisting of two developmental stages in the host: an exogenous stage (Sporogony) and an endogenous stage (Schizogonyand gametogony).The disease is transmitted through horizontal course and characterized by enteritis. Prevention and control methods of coccidiosis include biosecurity measures, chemoprophylaxis, immunoprophylaxis (Natural immunity and vaccine)and other alternative options (Antioxidants, fats, essential oil, herbal extracts and medicinal plants and immune response modulators). In Ethiopia, Poultry coccidiosis, caused by for example *E. acervulina, E. necatrix, E. maxima* and *E. tenella*, is endemic in all parts of the our country and affects mainly young growing birds. Avian coccidiosis represents a serious disease that results in annual global economic losses of approximately $2.4 billion, including production losses and disease prevention and treatment costs. Hence strong prevention and controlling scheme is important to ensure the sustainability and profitability of the poultry sector.

Key words: Coccidiosis · Coccidiostat · Eimeria · Poultry · Vaccine

INTRODUCTION

Poultry production has a major role in the economy of developing countries, including an important role in poverty alleviation by means of income generation and household food security [1]. Poultry is a source of self-reliance for women since, poultry and egg sales are decided by women [2]. More than half of Ethiopian households both in rural and urban areas keep chickens, although there is considerable variation in the distribution of chicken keeping, with most households in highland areas keep chickens and far fewer doing so in lowland pastoral areas [3]. The total chicken population in Ethiopia is estimated at 49.3 million [4] with 99% of the population consisting of indigenous breeds reared under village production systems and the remaining 1% being exotic breeds reared under intensive management [5].

Production is characterized by free range backyard or village systems [6] and chicken production is considered an integral part of many families livelihoods [7]. Studies across Africa and in Ethiopia in particular, show women often directly control the income generated from the sale of chickens and chicken products and that this is sometimes their only source of independent income. Hence, chicken production is important in developing countries where options for income generation for women are limited [3].

The poultry farming has been adversely affected by a variety of constraints. Of these constraints, poultry diseases continue to play the major central role in hampering its development, value and profitability, particularly to small-scale poultry farming [8]. Avian coccidiosis is one of the most economically important diseases of poultry in worldwide. The disease is caused

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by the prozoan parasite Eimeria species, Chicken are susceptible to seven species of coccidia. The commonest species are E. tenella, which causes caecalcoccidiosis and E. Acervulina as well as E. maxima which cause chronic intestinal coccidiosis. The symptoms of coccidiosis include reduced feed conversion efficiency, weakness, diarrhea, weight loss and anemia followed by death [9].

In commercial poultry flocks, it is responsible for 6 10% mortality and an estimated global economic loss of $2.4 billion United States Dollar (USD) annually due to reduction in egg production, growth rate, feed intake and feed conversion efficiency [10]. In Ethiopia, available evidences witness that poultry mortalities due to diseases are estimated to be 20- 50% where avian coccidiosis is one of the major diseases causing significant poultry losses. It is the most important cause of mortalities in all farms and contributes to 8.4% loss in profit in large-scale farms and 15.86% loss in profit in small-scale farms as reported by various investigators [11]. These all facts indicates that the importance of prevention and control program to reduce the impact of the disease.

Therefore the objective of this seminar papers is:

- To highlight on the control and prevention methods of coccidiosis in chicken.
- To give general information on chicken coccidiosis

Overview of Coccidiosis

Life Cycle of Coccidiosis: There are seven different *Eimeria* that infect chickens, but only three cause most of the trouble in the coccidiosis*: E. tenella*, *E. maxima* and *E. acervulina*. Turkeys, ducks, geese and other types of poultry are all infected by different types of coccidia. Chicken coccidian species: *E. acervulina*, *E. maxima*, *E. tenella*, *E. necatrix*, *E. mitis*, *E. brunette* and *E. praecox* [12].

The life cycles of *Eimeria spp*. are complex, consisting of two developmental stages in the host: an exogenous stage (Sporogony) and an endogenous stage (Schizogonyand gametogony). Some species vary in the number of asexual generations and in the time required for each developmental stage [13]. During the exogenous phase, the unsporulated (Noninfective) oocyst is excreted from the chicken and undergoes sporulation in the presence of moisture, warmth and oxygen, thus becoming a sporulated (Infective) oocyst. Sporulatedoocysts of *Eimeria*contain four sporocysts, each containing two sporozoites and divides into tropozoites. The endogenous phase occurs in the intestine of the host and involves several rounds of asexual reproduction (Schizogony) followed by sexual differentiation (Gametogony), fertilization and the shedding of an unsporulatedoocysts [14].

At least two generations of asexual development (Sometimes as many as four) give rise to a sexual phase, where small, motile microgametes seek out macrogametes to form the zygote which matures into an oocyst that is released from the intestinal mucosa and is ultimately shed in the feces [15].

Source of Infection and Transmission: Normally, most birds pass small numbers of oocysts in their droppings without apparent ill effects. The disease is transmitted through horizontal course. Infection is via the fecal oral route by eating sporulatedoocystes. Bird's young chickens pick up the infection from contaminated premises (Soil, houses, utensils, feeds drinking and water etc.). Wet areas around water fountains are a source of infection. Oocysts remain viable in litter for many months. In this way, they can contaminate a farm from year to year [16].. Humans can transmit coccidiosis, too, through shoes and equipment [17].

Clinical Findings: Clinical signs are highly variable in flocks. Outward signs of coccidiosis in chickens include droopiness and listlessness, loss of appetite, loss of yellow color in shanks, pale combs and wattles, ruffled, unthrifty feathers, huddling or acting chilled, blood or mucus in the feces, diarrhea, dehydration and even death. Moreover, decreased feeding and watering, poor weight gain and feed conversion efficiency are also common findings. Survivors of severe infections recover in 10-14 days, but may require even more time to recover to normal production [18].

Gross lesion arethin, fragile, often translucent intestinal walls**,** ballooning of the gut**,** hyperemia of the mesenteric blood vessels and blood vessels on the serosal side of the intestine**,** flaccid gut edges after incision, lack of tonus**,** watery or foamy contents**,** poorly digested feed particles at the end of the gastrointestinal tract**,** multicoloured oily appearance of the gut contents in contact with the mucosa Caeca enlarged with clotted blood, middle portion of the small intestine is distended to twice its normal size, intestinal lumen filled with blood, Lining of the small intestine covered with tiny hemorrhages, intestinal mucosa swollen and thickened [19].

Diagnosis and Treatment: *Diagnosis* for the extent of clinical disease of flock appearance, morbidity, daily mortality, feed intake, growth rate and rate of lay are important for diagnosis. Birds with clinical cases of coccidiosis frequently display a typical 'sick bird' attitude with depression, prostration, huddling under the heat source as if chilled, soiled vents and watery or bloody droppings [12].

Gross lesions caused by *E. acervulina* are confined to the upper small intestine (Duodenum) and may extend to the midgut (Jejunum). The lesions have a unique appearance, consisting of white patches or transverse white lines inside the gut. *E. maxima* comprise multiple petechial (Pinpoint size) haemorrhage is seen from the outside of the midgut area. In addition, segmental ballooning or enlargement of the midgut with presence of orange tainted mucous. However, unless the lesions are typical they are harder to identify than those caused by *E. acervulina* and *E. tenella*. And lesions of *E. tenella* are confined to the caeca and consist of the presence of haemorrhages on the outside or inside of the wall of the caeca, free blood or a chocolate coloured fluid content inside the caeca with a thickening of its wall or the presence of a large core of cellular debris and blood. *E. tenella* can kill birds so dead birds in a flock with increased mortality should always be examined for the presence of lesions compatible with *E. tenella*infection or caecalcoccidiosis [20].

Coccidial infections are confirmed by demonstration of oocysts in feces or intestinal scrapings. Examination of wet smears diluted with isotonic saline under coverslip with appropriate lighting will normally be sufficient to detect to schizonts, gamonts and oocyst. The causal species will usually be identified by examination. But diagnosis may be complicated by a number factors, multiple species infections are common, heavy infection may occur secondary to other primary disease conditions (e.g. salmonellosis, infectious bursitis or clostridial disease), heavy infections lead to `overflow` of parasite and lesions to coalesce and ironically be obvious (e.g. *E. acervulina*) and birds in the field are beings continuously infected, so that parasites at all stages in the life cycle may be found [21].

Treatment: The effective use of anticoccidial feed additives over the past 50 years has played a major role in the growth of the poultry industry and has allowed the increased availability of high quality, affordable poultry products to the consumer. These anticoccidials can be classified as chemicals which have specific modes of action against parasite metabolism, such as amprolium, clopidoldecoquinate, halofuginoneand polyether ionophores [22].

Sulfa drugs (Like sulfamethazine administered at 0.1 percent for two days) are also effective, but shouldn't be used in layers. Administration of water dispersible vitamin A and K supplements may also enhance recovery. It is important to remember that no anticoccidial is effective against all the different strains of coccidian and that overtime, coccidian can become drug resistant [17].

Amprolium is an anticoccidial drug. No withdrawal time to guard against residue in the meat. It is given in the drinking water and interferes with metabolism of the vitamin thiamin (Vitamin B1) in coccidia. Amprolium treats both intestinal and cecalcoccidia. Quinolones are 'Coccidiostats' that arrest the coccidia in an early stage of development. An example is decoquinate. The drugs are used for prevention [23].

Economic Importance of Coccidiosis: The poultry industry is one of the most important food suppliers in the world. Chicken meat represents an important source of animal proteins and fats, as well as a source of a whole range of organic and inorganic substances [24].

The chicken meat market represents a very dynamically developing area, with a significant increase in production with time. European and American countries dominated the chicken market fifty years ago with 79% of total production. However, by 2012, Asian and American countries contributed approximately 77% of total world production.(add a reference) In the period between 2000 and 2012, world chicken meat production increased by 58.48%.(add a reference) Asian production increased by 68.83%, production by Australia and New Zealand increased by 68.49%, African production increased by 67.73%, European production increased by 65.82% and production by the Americas increased by 47.67%. (add a reference) Currently, world production is dominated by the USA, China, Brazil, Mexico, Russia and India [25].

This growing demand of meat is related to the increasing number of inhabitants in the world and their increasing purchasing power, in addition to the fact that chicken meat is cheaper than other types of meat [26]. Although the supply of meat in the world has increased, factors that limit the progress of this industry still exist, such as the handling, housing and rearing of birds in addition to disease control (Nutritional, metabolic and parasitic diseases). In an industry that raises

approximately 40 billion chickens annually, avian coccidiosis represents a serious disease that results in annual global economic losses of approximately $2.4 billion USD including production losses and disease prevention and treatment costs [13].

This disease is a major cause of mortality, poor performance and lost productivity in domestic livestock, mostly because modern production involves the rearing of large numbers of birds in small confinement areas at high densities, thus assisting in parasite dispersal. For example, in a modern broiler house, 200–500 birds are housed under one roof at a stocking density of one bird per m2 [27].

The ability of coccidiosis causing parasites to survive environmental challenges as well as the emergence of drug resistance represents a serious threat to the secure production of poultry-derived food products [13].

Prevention and Control of Coccidiosis

Biosecurity Measures: Owners of animals have a key responsibility in preventing or eradicating disease in poultry. Measures can include careful restocking, practicing good biosecurity and being ready to implement measures aimed at controlling specific diseases should be present. Biosecurity meaning safe life is often simply a case of good cleanliness, eg washing hands after handling poultry, or disinfecting boots when visiting markets or other farms. Practising good biosecurity is particularly important offering peace of mind, healthy stock and viable businesses. Good biosecurity helps prevent the spread of coccidiosis and plays a vital role in keeping new disease away from animals. It also helps improve farm efficiency and protects neighbouring farms and the countryside [28].

The recommended biosecurity measures should be followed and minimize the farming hazards are as follows are; Locational Biosecurity:-The farm should be located at elevated and well ventilated site. It should be away from water logging areas nearby villages. The broiler and layer farms should not be established in close vicinity. The farms having more than 50,000 layer capacity should have separate brooding and growing facility. The construction of sheds should be in east west orientation. The minimum distance of 150 ft. between brooding / growing and laying sector and 50 ft. between same sector should be maintained. Multi storied poultry sheds are not desirable. Every individual farm should be provided with fencing, wheal dip at main gate and foot dip a every shed door steps. The maximum width of shed in deep litter should not exceed 30 ft. The shed should be 2 ft. above ground level with pucca floor. In case of cage system the maximum width of shed should be 22.5 ft. for layer house and the rows and tiers should not be more than three. The height of platform should not be less than 6 ft. from the ground. The provision of closed disposal pit or incerinator should be there which should be at least 500 ft. away from the operational area. The litter material disposal area should be away from the operational area [29].

Disinfectants are not effective against coccidia, so sanitation focuses on good hygiene and removing infected droppings. Put waterers and feeders at a height level with the backs of the birds, so they cannot defecate or scratch litter into them, keep birds from roosting on the feeders with anti-roosting wire, suspend waterers or put them on wire-covered platforms to help keep them clean, clean the waterers and feeders frequently, keep older birds away from chicks, since old birds are carriers, add fresh litter or rake litter frequently to cover parasites [20].

Remove any wet or crusted litter. Moisture in the litter is affected by the following: Heat source (A propane radiant brooder heats a larger area and dries out litter more than a heat lamp), ventilation (Housing should prevent drafts but not be airtight.), humidity (Along with ammonia and other gases, needs to escape), water leaks (Water leaks must be prevented.), condensation (Condensation may occur in buildings with uninsulated roofs and walls and will contribute to litter moisture),feed (Rations with excessive protein or excessive salt can result in wet litter). Plamondon recommends starting with at least six inches of shavings and adding a thin layer of fresh litter on top, which will prevent chickens from eating old litter at first. He turns it daily with a spading fork to keep it from getting packed down and crusted over. If the litter seems too wet, he adds more dry litter. He only removes litter when it is too deep to manage or when too wet [23].

Chemoprophylaxis: Coccidiostats have, in fact, contributed substantially to the remarkable success of modern poultry production. Included among the coccidiostats used in poultry are the ionophoric antibiotics and various chemotherapeutics substances. Coccidiostats are incorporated in the feed to commercially raised broiler chickens and during the growth period to many replacement pullets. Ideally, the drugs should show no adverse effects on growth, feed

intake, feed conversion or health, leave no residues in meat and should not be dangerous for man and environment [30].

Coccidiostats are generally considered to be free from side effects and toxicity as long as they are used in their target species at the correct dose. However, the ionophoric antibiotics and some of the chemotherapeutic coccidiostats have a narrow range of safety and there are many reports in the literature of accidental intoxications of target and non-target species with various anticoccidial drugs [31].

The ionophores (Monensin, salinomycin, lasalocid, narasin, maduramicinand semduramicin) form complexes with various ions, principally sodium, potassium and calciumand transport these into and through biologic membranes. The ionophores affect both extra and intracellular stages of the parasite, especially during the early, asexual stages of parasite development. Drug tolerance was slow to emerge in chicken coccidia, probably because of the biochemically nonspecific way these fermentation products act on the parasite. Recent surveys suggest that drug tolerance is now widespread, but these products remain the most important class of anticoccidials. Some ionophores may depress feed consumption when the dosage is above recommended levels. Primarily, this is the result of reduced feed consumption, but the reduced growth may be offset by improved feed conversion [12].

Immunoprophylaxis

Natural Immunity: A small-scale, low density production system can allow a low level of exposure to coccidia,which permits the chick to develop immunity without triggering the disease. However, birds may not pick up enough parasites to cause immunity, or they may be overwhelmed by too many. In addition, immunity is only species specific. Exposure to one type of coccidia will not protect a chicken from the other six types that can infect it. Early detection is a management method to avoid the use of preventative medication. If you can catch the disease when it initially infects only a few birds, you may have time to treat the birds with a rescue drug or make a management change, such as moving the birds to fresh pasture. Early detection requires close observation and experience. Watch feed intake in particular it goes down in the early stages of coccidiosis. The choice of production system is an important management decision. High-density, large-scale production almost always requires the use of anticoccidial medication. In contrast, in low-density, small-scale production, the birds tend to stay ahead of the parasites and may not require medication. Many small-scale producers do not use anticoccidial medication; however, as the size of the flocks grows, more problems are encountered and more management is required for natural immunity [23].

Vaccines to Prevent Coccidiosis: The importance of vaccination as the best-suited control strategy has been investigated for several decades now. Some species of *Eimeria*, such as *E. maxima,* are highly immunogenicand a primary infection can result in the development of solid immunity; however, in general, repeated infections and a large number of oocysts are required to generate a good immune response against *Eimeria*. Vaccination against coccidiosis relies on this natural development of protective immunity. Conventional vaccines incorporate live or attenuated parasites as a mixture of multiple species, or sometimes even multiple

Eimeria strains. Even though there is tremendous antigenic variation between *Eimeria*spp., the early developmental stages within the host are considered most important for the promotion of a protective immune response [32].

Livacox® Q there is a tetravalent vaccine against coccidiosis in breeding chickens. This is a suspension of attenuated oocytes *E. tenella, E. acervulina, E. maxima* and *E. necatrix* in a 1% water solution of chloramine B. Each dose contain 300 to 500 oocytes of *E. tenella, E. acervulina* and *E. maxima* and 100 oocytes of *E. necatrix*. Both vaccines are applied once between the 1st and 10th day of the chicken's life (Recommendation is between the 5th and 7th day) in drinking water. The successful application of thisvaccine implies the prohibition of applying anticoccidials in feed and/or water already from the first day of the chickens' lives. Also, it is not recommended to apply anticoccidials agents and/or sulphonamides for at least 2 days prior and 14 days after vaccination [33].

Attenuated vaccines, i.e. vaccines of the second generation, contain live oocysts of attenuated lines of Eimerian species. These vaccines are much safer due to the biologically attenuated pathogenicity of the vaccinal parasitesand controlled infectious challenge thus posing no risk of clinical coccidiosisoutbreak. Thesevaccines belong to the group of attenuated vaccines [34].

In the case of live anticoccidial vaccines, poultry are generally immunized with more than one *Eimeria* species simultaneously. An accurate assessment of protection

may be achieved by challenging individual groups of vaccinated birds with all species of *Eimeria* that are part of the vaccine. In practice, this may be laborious and time-consuming. Nevertheless, a challenge model gives an accurate estimate of vaccine efficacy. Traditionally, reduced lesion scores and oocyst shedding from challenged, vaccinated birds compared with unvaccinated control birds challenged similarly have been used as measures of protection against coccidiosis. In addition, the severity of lesion scores has been correlated with the functional efficacy of vaccines [35].

The development of recombinant, vectored vaccines has been pursued for more than 2 decades in an attempt to improve the efficacy of vaccination against coccidiosis. The biggest advantage of recombinant vaccines is that they do not carry the live parasites or any of the developmental stages. In general, the vectors used to deliver the vaccine are safe and in many cases, an immune response is elicited against the vector as a protective measure. In addition, in most cases, the vector organism will be attenuated during vaccine development, making it safe for the host [36].

Other Alternative Options

Antioxidants: In the poultry industry, the use of antioxidants from natural sources can help in restoring the balance of oxidants/antioxidants, leading to an improvement of birds infected with coccidiosis. Fruits and other plant materials provide a good source of an antioxidant due to their high content of phenolic compounds [37].

Most of the antioxidants available are found as dietary supplements. One of this antioxidant is vitamin E, known to delay lipid peroxidation in muscles and improve meat quality. Various fruit and herb plants such as plum, cranberries, pomegranate, bearberry, grape seed extract, pine bark extract, rosemary, oregano, green tea and other spices function as antioxidants in meat and poultry products [37].

Curcumin, present in Curcuma longa, could reduce the severity of an infection of the upper and middle part of the small intestine caused by *E. acervulina* and *E. maxima* [38] used the antioxidants properties of several plant extracts and compared those to the drug toltrazuril.The extract's mechanism of action is thought to involve oxidative stress [39].

Herbal Extracts and Medicinal Plants: The emergence of drug resistant strains of Eimeria and the regulations on using anticoccidial drugs results in searching for the substitute preventive methods. People also seek out for the animal products without any chemical drugs for betterment of livestock production with the help of botanical elements as the sustainable alternatives [40]. A number of botanicals, herbal complexes and commercial herbal anticoccidials with promising anticoccidial effects have been reported in the literature. Some of these are summarized in the following paragraph

Neem (Azadirachtaindica) is a traditional medicinal plant [41] which contains limonoids, protolimonoids, tetranortriterpenoids, pentanortriterpenoids, hexanortriterpenoids and nonterpenoid, some of which are thought to have an influence on eimeria life cycle switching [42] compared the anticoccidial efficacy of salinomycin sodium and neem fruit in boilers. It was concluded that the addition of 0.3% ground neem fruit in the boiler diet showed efficiency in repression of coccidiosis as compared to salinomycin sodium. Similarly, Allen *et al*. [43] investigated the influence of *Artemesiaannua* on poultry infected with *E. acervulina*, *E. tenella* or *E. maxima*. Four experiments were conducted to investigate the anti-coccidial activities of Artemisia annua leaves when added to broiler chicken diets. Gadzirayi *et al*. [44] reported that the anticoccidial effects of *A. excelsa*were comparable with sulphachlopyrazine sodium monohydrate in terms of improved live weight gains and reducing oocyst output in broiler chickens. Other species of aloe plant such as Aloe vera have also been reported as having anticoccidial activities.

Ola-Fadunsin and Ademola used Moringaoleifera acetone extract and assessed its anticoccidial activity. They used this extract to treat broiler chickens naturally infected with several Eimeria species Some plants used against Eimeria also possess activities against other protozoan parasites such as plasmodia and trypanosomes, which makes the plant or its extracts a feasible phytomedicine [45].

Oocysticidal activity of the commercial oils carvacrol, carvone, isopulegol, thymol and eugenol was also evaluated. The lysis was monitored in suspensions of oocysts from *E. tenella* (45%), *E. maxima* (32%), *E. acervulina*(10%), *E. necatrix*(6%) *and E. mitis*(7%) through the release of internal substances at 273□nm. Although the mechanism of action of essential oils is still unknown, these two reports are an example of the use of natural substances as agents for the destruction of the most resistant structure of the parasite, the oocyst. Nevertheless, the economic factor for obtaining these products could be an impediment for their extensive use in farms [46].

Immune Response Modulators: Enhanced immune responses were observed in one-day old chickens fed with a lyophilized powder extracted from plums. These chickens show an increased body weight gain, a reduced fecal oocyst shedding rate and an increase in the mRNAs for IFN-γ and IL-15. Furthermore, chickens fed with plum exhibited a greater spleen cell proliferation [47].

Probiotics are defined as live microbial feed supplements designed to benefit the host by improving the intestinal microbial ecology. The commercial probiotic MitoMax, containing Pediococcusacidilactici and Saccharomyces boulardii, was evaluated as an alternative control method to prophylactic drugs against coccidiosis [48]. Arabinoxylans derived from wheat (Triticumaestivum) have also been shown to have immunostimulatory and protective effects against coccidiosis in broiler chickens [49].

Current Status of Coccidiosis in Poultry in Ethiopia: Poultry coccidiosis is endemic in Ethiopia, causing great economic losses particularly in young birds, in all production systems [50]. 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 [51]. The species of coccidia identified in Ethiopia are *E. tenella,E. necatrix*, *E. maxima* and *E. acervulina*, *E. mivati*and*E. brunette* [52]. Studies conducted in Arsi zone (Tiyo district) revealed prevalence rates of 22.58% and 12.25% for clinical coccidiosis in rhode Island red (RIR) and local strain chickens respectively [53]. Additional investigation done in central Ethiopia revealed that *E. acervulina* was the most prevalent coccidial species [54]. Whereas study conducted in Kombolcha disclosed that *E. burneti* was the most prevalent coccidian species.

Prevalence rate of 50.8% and 11% in deep litter intensive system and backyard extensive production system, respectively from Bisoftu and its surrounding. Moreover study on the occurrence of coccidiosis and distribution of Eimeria species in dead chickens of 1-60 days of age, at Kombolcha Poultry Multiplication and Research Centre, Ethiopia indicated that out of 965 dead birds, 370 (38.34%)were found to have clinical coccidiosis. The Eimeria species identified in those studies were *E. brunetti*, *E.tenella, E. acervulina*and *E. necatrix* with prevalence of 45.3%,40.8%, 9.7% and 4.1%, respectively [52]. An overall prevalence of 19.5% was also found in Nekemte town, East Wollega, Ethiopia [55]. Similarly, the study conducted Gonder town indicated that out of 384 chickens 165 (43%) of the chickens were found positive [56]. An overall prevalnce of 17.5% has been also reported from Tigray [57].

The possible risk factors associated with the outbreak of coccidiosis in Ethiopia were reported as absence of proper disposal of litters, wetting of litters from leaking pipes, absence of all-in all-out system, the presence of stressors (Such as change in diets and concurrent infections) and extensive use of coccidiostats [58]. Moreover, Gari *et al*. [53] have reported that the potential risk factors for the occurrence of coccidiosis in free-ranging local chickens were non-selective picking behavior during feeding, age group, high moisture conditions whereas in Rhode Island Red breeds that were kept under intensive deep litter system, the potential risk factors observed from farm assessment through questionnaire were age groups, production systems, flock size, moisture level in the poultry house and level of biosecurity [50].

CONCLUSION

Coccidia are common protozoan parasites. They are present in all most all chicken and turkey flocks. Heavy infection of coccidia cause serious disease and will kill many chickens. Chickens of all ages can come down with coccidiosis, anticoccidial drugs commonly used in the industry have decreased efficacy because of an increase in the occurrence of drug-resistant parasite strains. Infections with coccidia are often associated with severe economic losses. Thus, live vaccination may offer a realistic long-term solution to the coccidiosis problem. This vaccination will immunize poultry against the disease. The probiotic (Enterococcus faecium) is a common component of intestinal microbial of normal human and animals. The advantages of these bacteria are higher resistance against extreme internal and external conditions. It is non-pathogenic, non-haemolytic and non-proteolitic and has an excellent propagation potential. The prevention and control of coccidiosis will be focusing on high standards of bird health, nutrition and management of the production environment. The disease is widely distributed in Ethiopia and causing huge problem in the poultry industry.

Based on the above conclusion the following Recommendations are forwarded;

- More attention should be given to improved sanitation and hygiene at the farm level.

- Controlling moisture with the appropriate installation and management of watering systems is mandatory.
- Extensive training should be given for poultry farmer on poultry husbandry methods
- Research must be conducted on coccidiosis for promoting effective treatments as well as control and prevention.

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