بسم الله الرحمن الرحيم

Sudan University of Science and Technology

College of Graduate studies

Prevalence and Risk Factors of Chicken Coccidiosis in Atbara Locality, Sudan

نسبة الاصابة وعوامل الخطر لمرض الكوكسيديا في الدواجن في محلية عطبرة، السودان

A thesis Submitted for Partial Fulfillment of the Requirements of the Degree of Master in Preventive Veterinary Medicine

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بسم الله الرحمن الرحيم

قال تعالى:

﴿يَا أَيُّهَا الَّذِينَ آمَنُوا إِذَا قِيلَ لَكُمْ تَفَسَّحُوا فِي الْمَجَالِسِ فَافْسَحُوا يَفْسَحِ اللَّهُ لَكُمْ وَإِذَا قِيلَ انشُزُوا فَانشُزُوا يَرْفَعِ اللَّهُ الَّذِينَ آمَنُوا مِنْكُمْ وَالَّذِينَ أُوتُوا الْعِلْمَ دَرَجَاتٍ وَاللَّهُ بِمَا تَعْمَلُونَ خَبِيرٌ﴾

صدق الله العظيم

سورة المجادلة الآية (11)

Dedication

This Thesis is dedicated to

My father Mohmed,

My mother Fiza,

My children Abd Elrhman & Yasmeen

My brother Ahmed & Abobker and My sister Rania

Acknowledgments

Firstly, I thank The Almighty ALLAH for giving me strength and health during the study period. Then, I would like to express my warm thanks to Dr. Iman Mohammed El Nasri, my supervisor who supported and helped me to get results of a high quality. She was always beside me whenever I faced a trouble or had a question about my research or writing.

I also express my thanks to all technical assistance of Atbara veterinary research Laboratory without them the research would not have been successfully conducted.

Last but not least, I must express my very deep gratitude to my parents and my family members for providing me with unfailing support and continuous encouragement through the years of my study. Without their moral support and encouragement, this accomplishment would not have been possible.

I would also like to thank my children for taking the time that I have been preoccupied with.

Abstract

A cross-sectional study was conducted to investigate the incidence of poultry coccidiosis in Atbara locality and to determine some of the possible risk factors associated with the disease during the period December 2018 to September 2019. A total of 501(**(496) fecal samples , (5) live birds)** sample were examined. Live bird samples were examined clinically and pathologically. Fecal samples were examined by floatation technique.

Seasonality, age, weight, strain, breed, management, system, source of feed and water, and type of production were the Risk factors considered during the study.

Results showed that coccidiosis was prevalent among poultry flocks in Atbara locality (74) positive samples were detected with a prevalence of (14.9%). The following correlation with coccidiosis in poultry in a single-variable analysis under a significant level of significance greater than or equal to 0.25 the moral value of each of the following risk factors is (season = 0.01) (age = 0.7) (weight = 0.9) (Strain = 0.32) (type of production = 0.4) (management = 0.13) (Drinking water source = 0.8) (Food source = 0.003) (Breeding system = 0.13) .

using Multiple Variables analysis to determine the probability of a correlation between coccidiosis in poultry and potential risk factors, result showed that there is a significant correlation with two risk factors season and food source.

ملخص البحث

أجريت دراسة مقطعية لتحديد معدل انتشار مرض الكوكسيديا في الدواجن ودراسة بعض عوامل الخطر المحتملة المرتبطة بها من ديسمبر 2018 الي سبتمبر 2019 في محلية عطبرة في ولاية نهر النيل تم جمع العينات عشوائيا بعدد 501 ((496)عينات براز،(5) دواجن حية) عينة من الدواجن. تم فحص عينات الدجاج سريريا ومرضيا كما تم فحص جميع عينات البراز بطريقة الطفو كانت النتيجة إيجابية بعدد (74)عينة وسلبية بعدد (422) عينة.

عوامل الخطر التي تمت دراستها هي الموسم، العمر، الوزن، السلالة، نوع التربية، الإدارة، مصدر مياه الشرب، مصدر الطعام، نوع الانتاج.

اظهرت النتائج ان عدوي الكوكسيديا كانت منتشرة بين الدواجن في محلية عطبرة (74عينة ايجابية) بنسبة انتشار 14.9.وأظهرت عوامل الخطر التالية الارتباط مع مرض الكوكسيديا في الدواجن في تحليل وحيد المتغير تحت مستوي كبير من المعنوية أكبر من او تساوي 0.25 القيمة المعنوية لكل من عوامل الخطر التالية (الموسم=0.01) (العمر=0.7) (الوزن=0.9) (السلالة=0.32) (نوع الانتاج=0.4) (الادارة=0.13) (مصدر مياه الشرب=0.8) (مصدر الغذاء=0.003) (نظام التربية=0.13).

باستخدام التحليل متعدد المتغيرات لتحديد احتمال وجود ارتباط بين مرض الكوكسيديا في الدواجن وعوامل الخطر المحتملة وأظهرت النتيجة أن هناك ارتباط كبير مع بعض عوامل الخطر (الموسم ومصدر الغذاء).

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Introduction

Coccidiosis is recognized as the parasitic disease that has the greatest economic impact on poultry production. Lillehoj and Okamura (2003) reported that intestinal parasitism is a major stress factor that can lead to malnutrition and lowered performance. Coccidiosis is caused by protozoa, in poultry most species belong to the genus *Eimeria*. *Eimeria* have a direct life cycle with only one host and are host specific to the sites of development in the intestine, and to cell types; epithelial cells of the intestinal villi or cells of the crypts (Conway and Mckenzie,2007).

The infectious process is rapid (4–7 days) and is characterized by parasite replication in host intestinal cells with extensive damage to the intestinal mucosa(Richard and Gerhold, 2011).

Coccidia are distributed worldwide in poultry, game birds reared in captivity, and wild birds (Richard and Gerhold, 2011).The disease is endemic in most of the tropical and subtropical regions where ecological and management conditions favour an all-year round development and propagation of the causal agent (Obasi *et al*., 2006). Coccidiosis are ubiquitous, they are everywhere chickens are reared (traditional, industrial, label or organic/bio farms) their survival is assured by a highly resistant form of transmission - the oocysts - which may survive for several months in the environment (Constable, 2016).

Nine species of *Eimeria* have been described in chickens; which were differ in their pathogenicity, seven are currently recognized *Eimeria acervulina, Eimeria praecox, Eimeria maxima, Eimeria mitis, Eimeria necatrix, Eimeria tenella* and *Eimeria brunette.* The occurrence of clinical coccidiosis is directly related to the number of oocysts ingested by poultry at one time, the pathogenicity of the *Eimeria* species, the age of the infected chicken and the management system. High inscidence of coccidiosis is usually observed in poultry managed under intensive management system like

deep litter due to increased likelihood of high oocysts accumulation in the litters. Furthermore, higher stocking densities have been linked with increased incidence of coccidiosis due to a higher rate of infection and transmission of the coccidian oocysts in dense flocks from one poultry house to another. (Al-Quraishy *et al*., 2009).

The presence of nonspecific clinical symptoms usually prevent the correct diagnosis of the disease. Clinical disease can be prevented by continuous adding of the anticoccidials drugs in the feed. However, persistence of the sub clinical disease is always a possibility (Kahn, 2005).. According to Braunis, (1980) and Razmi and Kalideri (2000) sub clinical forms of the disease depend on the size of the *flock*. Infection of young chicken cannot be avoided in intensive production systems, whatever prophylactic measures have been taken (Lunden et al.,2000 ; Dakpogan and Salifou,2013) Coccidiosis is a global disease of high economic impact regarding prophilaxis, medication, mortality, morbidity, and poor feed conversion (Williams ,(1998); Kinung'hi *et al*.(2004) and Dallouil and Lillehoj, (2006))

In the Sudan, many cases were reported in different regions of the country in both broiler and layers chicken (Mohammed *et al* .,1990; Ali *et al* .,1991 and Khaier*et al*.,2015). No available Information about chicken coccidiosis in River Nile State.

Objectives:

The objectives of the present study is:

General objective:

To determine the presence of coccidiosis among only one chicken farms in Atbara locality, River Nile State.

Specific objectives:

- To determine risks factors associated with the disease in Atbara locality.
- To determine the presence of the parasite in different husbandry system of Atbara poultry farms.

Chapter One

Literature Review

1.1 Avian Coccidiosis

Coccidiosis has agreatest economic impact on poultry production,as the annualy cost for prophylaxis and therapy exceed tow billion Euro (Dallouil and Lillehoj, 2006).

Coccidiosis is recognized as the parasitic disease that has the greatest economic impact on poultry production .It is distributed worldwide in poultry, game birds reared in captivity, and wild birds causing significant losses in poultry industry (Kinunghi *et al*., 2004; Lobago *et al*., 2005; Richard and Gerhold, 2011**)**. Coccidiosis is characterized by enteritis, and is known to be the most important cause of mortalities in all poultry farms and continued to be a problem as reported by various investigators (Fessesse- Work., 1990; Kalifa., 1997; Hagos., 2000 and Kinunghi *et al*., 2004) .

1.1.1 Etiology

Poultry coccidiosis is caused by a protozoan parasite known as *Eimeria* of the phylum Apicomplexa, family Eimeriidae. A numbers of *Eimeria* species have been recovered from poultry which are affecting a particular part of the intestinal tract (McDougald, 1998) (Table 1.1). Taxonomic classification of the *coccidia* is still controversial and is becoming more reliant on the development of molecular techniques and studies.

Table 1.1 Species of *Eimeria* with their predilection site in the host

Species	Site of lesions
E. tenella	Caecum
E. acervulina	Duodenal loop
E .neatrix	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)

1.1.2 Life cycle of *Coccidia*

Eimeria have a direct life cycle with only one host (Fayer, 1980; Hnida and Duszynski,1999; (Kvičerova and Hypša, 2013; Hashimoto et al.,2014 and Vrba and Pakandl, 2015). The life cycle of a typical *Eimeria* species comprises a parasitic and non-parasitic phase. Stages of *coccidia* in chickens appear both within the host as well as outside. The developmental stages in the chicken give rise to a microscopic egg known an oocyst . The oocyst is passed out in the droppings .Under proper conditions of temperature and moisture, the oocyst develops within 1-2 days to form a sporulated oocyst (Fanatico,2006).

The sporulated oocyst is the infective form which is capable of causing infection when picked by susceptible chicken. At this stage, the oocyst contains eight bodies called sporozoites. Each sporozoite is capable of entering a cell in the chicken intestine after its release inside the intestinal lumen .

Inside enterocytes , sporozoites were divided many times producing either a few or many offspring (merozoites).The numbers of merozoites produced depend on the species of *coccidia* involved. Each merozoite, in turn, may enter another intestinal cell. This cycle may be repeated several times. Because of this cyclic multiplication, large numbers of intestinal cells are destroyed. Eventually, the cycle stops and sex cells (male and female) are produced. The male fertilizes the female to produce an oocyst, which ruptures from the intestinal cell and passes in the droppings. Thousands of oocysts may be passed in the droppings of an infected chicken; therefore, poultry raised in crowded or unsanitary conditions are at great risk of becoming infected. (*Hofstad,* 1984; Fanatico, 2006 and Conway and Mckenzie, 2007).

1.1.2.1 Structure of a coccidian oocyst

The characteristic Structure of a coccidian oocyst is the Stieda body, it is a plug which is found at one end of the sporulated oocyst (Figure 1.1).This Stieda plug is only found in the avian *Isospora* species and is used as a way of differentiating between mammalian and avian *Isospora* spp (Levine, 1982). *Isospora* species were formally classified in the genus *Atoxoplasma* but are now

considered to belong to *Isospora*. In 2005 (Barta *et al*., 2005) placed all coccidian oocysts from mammals that contained 2 sporocysts (each with 4 sporozoites in each sporocyst), and *without* Stieda bodies, into the genus *Cystoisospora*. Similar oocysts from birds *with* Stieda bodies in their sporocysts were placed in the genus *Isospora*.

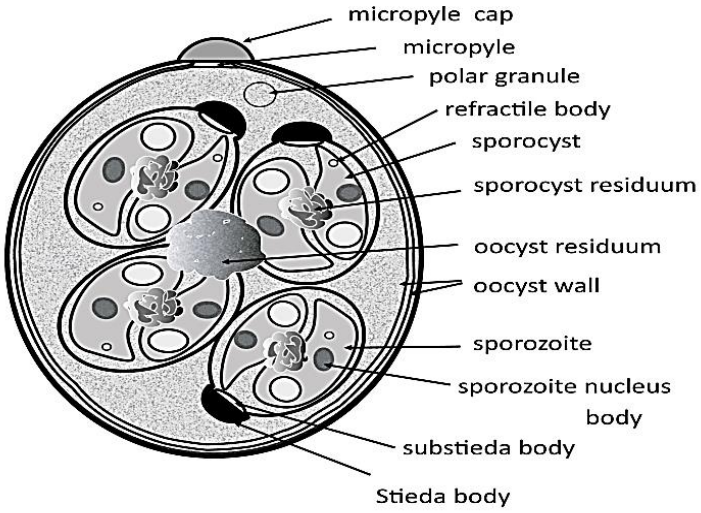

Figure 1.1 General oocyst morphology (Levine, 1982)

Oocyst size, shape and color are helpful in identification of *Eimeria* species, the majority of *Eimeria* oocysts have ovoid shape. *Eimeria maxima* (30.5 x20.7μm) is the largest while *Eimeria mivati* (15.6 x13.4μm) and *Eimeria mitis* (15.6 x 14.2μm) are the smallest as compared to other species of *Eimeria*. *E. tennela, E. maxima, E. acervulina, E. hagani* and *E. burnetti*are ovoid while *E. necatrix*is oblong (Reid, 1978).

The thick wall of the oocyst enables it to survive for up to 12 months in moist conditions and a temperature between 30°C and 40°C (Constable, 2016). Oocysts become dried out or damaged by being exposed to direct sunlight (Long, 1982).

1.1.2.2 Sporulated oocysts

Sporulated oocysts of *Eimeria* species contain four sporocysts, each containing two sporozoites, whilst those of sporulated *Isospora* spp. contain two sporocysts each containing four sporozoites. Intestinal forms of *Caryospor* spp. are characterised by a single sporocyst containing 8 elliptical (oval) sporozoites (Samour, 2016) Table (1.2).

Table 1.2 Morphological difference of sporulated oocysts (Samour, 2016)

Sporulated oocysts	Number of sporocysts	Number of Sporozoites
Isospora	2	4
Eimeria	4	2
Caryospora	1	8

The sporulation process may take a few hours or days depending on the conditions at the time and the specific species of *coccidia*. An interesting fact about some *coccidia* is that they generally shed more oocysts in the late afternoon and evening than in the morning. This favors transmission of the parasite amongst birds at roosting time (Dolnik, 2011).

The parasites shedding schedule appears to be calibrated by the light-dark cycle (diurnal periodicity) experienced by the bird throughout the day. The reason the coccidian parasite does this is probably an adaptive trait which aims to minimize the exposure of the oocysts to the sun and in so doing decreases their possibility of drying out (Martinaud *et al*., 2009).

1.1.3 Epidemiology

Sudden outbreak of coccidiosis occurs following the ingestion of high doses of the sporulated oocysts over a short period of time by non-immune young (3-8 week old) birds (Musa *et al*., 2010). Birds of any age are susceptible to coccidiosis but most birds get infected in the early few weeks of life (Chookyonix *et al.,* 2009).Coccidiosis has been reported about 3 days following ingestion of large numbers of sporulated oocysts (Urquhart *et al*.,1996) and under field condition, the incubation period for intestinal Coccidiosis was reported to be 5 days while that of caecal coccidiosis was 5-6 days (Chookyonix *et al.,* 2009 and Musa *et al.,* 2010).

Clinically infected and recovered adult birds continues shedding oocysts in their faeces thereby contaminating feed, water and soil (Trees, 1999 and Musa *et al*., 2010). Additionally, oocysts have been practically shown to survive outside the host for up to 2 years and resist low temperatures, dry conditions and many forms of disinfectants (David, 2000).

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 warmth of 25^{o}-30^{o}C, favour oocysts sporulation (David., 2000). It was also observed that oocyst sporulation is delayed or not even occur at 10^{o} C in dry conditions, while at

45-50^{o} C oocysts could sporulate within a day and under optimal conditions of temperature (21- 30^{o}C), adequate moisture and oxygen, oocysts could sporulate and become infective within 1-2 days. Higher temperature 56 ^{o} C destroyed oocyst within one hour (Trees, 1999; Etuk *et al*., 2004; Musa *et al.*, 2010).

In general , coccidiosis is the result of a breakdown in the balance between:

The parasites:(their number, their pathogenicity and their ability to promote immunity in the host),the host:(its susceptibility, including its protection by anticoccidials, and its ability to regenerate from the damage caused by the parasite) and finally the environment : (intensive rearing particularly predisposes conditions for coccidiosis).

The highest incidence of coccidiosis is during spring and fall, especially when weather is cold and humid (rain). The incidence is significantly smaller during hot and dry weather conditions (*M*aungyai *et al*, 1990; Calnek, 1997; Razmi and Kalideri, 2000).

1.1.4 Pathogenicity of *Eimeria species*

Pathogenicity of coccidiosis is influenced by host genetics, nutritional factors, concurrent diseases, age of the host, and species of the coccidium. There are seven valid species of chicken *coccidia*, *E. acervulina*, *E. brunetti*, *E. maxima*, *E. mitis*, *E. necatrix*, *E. praecox*, and *E. Tenella* (Shirley,1986), each species developing in a particular location within the chick digestive tract. It is common to find at least six species (e.g., *E. acervulina*, *E. maxima*, *E. tenella*, *E. brunetti*, *E.mitis*, and *E. praecox*) in litter samples from a single flock during its first 6 weeks (Williams, 1995).

Five of the species, *E. acervulina*, *E. brunetti*, *E. maxima*, *E. necatrix*, and *E. tenella*, are well known and identifiable with relative ease, because they produce characteristic gross lesions. Their pathogenicities range from moderate to severe.

On the other hand, lower mortality and mild lesions were observed in infection caused by *E. praecox* and *E. mitis* , and therefore considered to be benign. However, experimental infections result in enteritis, diarrhea, and reduced feed efficiencies (Williams,1998), indicating that these two species certainly can cause commercial losses and hence need to be controlled.

The five most pathogenic species listed above can be differentiated in the host on the basis of clinical signs, characteristic lesions at particular sites of infection in the chicken intestine, and consideration of the prepatent period, size of oocysts, and morphology of intracellular stages. However, the less pathogenic species such as *E. mitis* and *E. praecox* might be overlooked.

Eimeria necatrix and *Eimeria tenella* are the most pathogenic in chickens, because schizogony occurs in the lamina propria and crypts of Lieberkühn of the small intestine and ceca, respectively, and causes extensive hemorrhage. *Ekofoidi* and *E legionensis* are the most pathogenic in chukars, and *E lettyae* is most pathogenic in bobwhite quail. Several *Eimeria* species are pathogenic in pheasants, particularly *E phasiani* and *E colchici*. Most species develop in epithelial cells lining the villi (kahn, 2005).

The pathogenicity of *coccidia* depends largely on the successful replication of developing parasites inside the host. The pathogenic process starts during shizogonic phase of the parasite development. The pathogenic process during the first generation of shizonts is negligible. However, the most pathological stadium is during the second generation of shizonts. Their development, deep in the cells, results in inflammation, mucus desquamation, capillary rupture and hemorrhage. This stadium of the disease is accompanied with severe clinical symptoms. In this stadium, possible outcome could be death of the bird (kahn, 2005) .

Death is a consequence of haemorrhagae (bird can lose 60 to 80 percent of the blood volume), toxemia or as a consequence of gangrene or rupture of the intestinal wall (kahn, 2005). This parasite lives and multiplies in the intestinal tract and causes tissue damage. This damage can interfere with the food

digestion and nutrient absorption, as well as causing dehydration and blood loss. The tissue damage can also expose the bird to bacterial infections, like *Clostridium* and *Salmonella*. Diseases that suppress the bird's immune system may act with coccidiosis to produce a more severe problem. For example, Marek's Disease may interfere with the development of coccidiosis immunity and Infectious Bursal Disease may exacerbate a *coccidia* infection (Julie, 1999).

1.1.5 *Eimeria* species in chicken

1.1.5.1 *Eimeria tenellea*

It is one of the most highly pathogenic *coccidia* in chickens which causes the caecal or bloody type of coccidiosis. This parasite develops in the cells of the ceca, which are the two blind sacs near the end of the intestine. Acute infection occurs most commonly in young chicks. Infections with *Eimeria tenellea* is characterized by bloody diarrhea , high morbidity and mortality(Mcdougald and Sfitz-coy, 2008).

1.1.5.2 *E. necatrix*

It is a major pathogen of poultry which causes bloody intestinal coccidiosis, develops in the small intestine (early stages)and later in the cecum (sexual stages). Like *E. tenella*, it develops within deeper tissues of the small intestine . (Morris *etal* 2007.,and Lacob and Duma 2009).{ It causes high mortality in susceptible birds}. Coccidiosis caused by *E.necatrix* mainly occurs in chichens older than 8 weeks when raised on alitter floor (Mcdougald *etal* 1990., Mattiello *etal* 2000). Balloon like intestine, thickened Mucosa, and the intestine lumen filled with fluid, blood and debris are the most characheristic gross .Lesions of coccidiosis caused by *E.necatrix* Lesion in dead bird are observable as black and white plaques (salt and pepper appearance) (Chapman H.D, 2014)

1.1.5.3 *E. bruentti*

Highly pathogenic, site of development is caeca and rectum , gross lesions is inflammation of the intestinal wall with pinpointed hemorrhages sloughing of epithelia (chapman H.D, 2014)

1.1.5.4 *E. acervulina and E. maxima*

They are of medium pathogenicity which cause chronic intestinal coccidiosis with low mortality and high morbidity Both species develop in epithelial cells, primarily in the upper part of the small intestine. They cause subclinical coccidiosis associated with marked weight loss. (AGRI-FACTS., 2001)

1.1.5.5 *E mitis and E praecox*

E.mitis, is develops in ileum , less pathogenic, cause limited enteritis causing fluid loss . Mala bsorption of nutrients (chapman H.D , 2014)

1.1.5.6 E.praecox

E.praecox develops is duodenum , and jejunum,and is less pathogenic which cause watery intestinal contents mucus and mucoid casts.(Mcdugald and .Fitz-coy.2008).

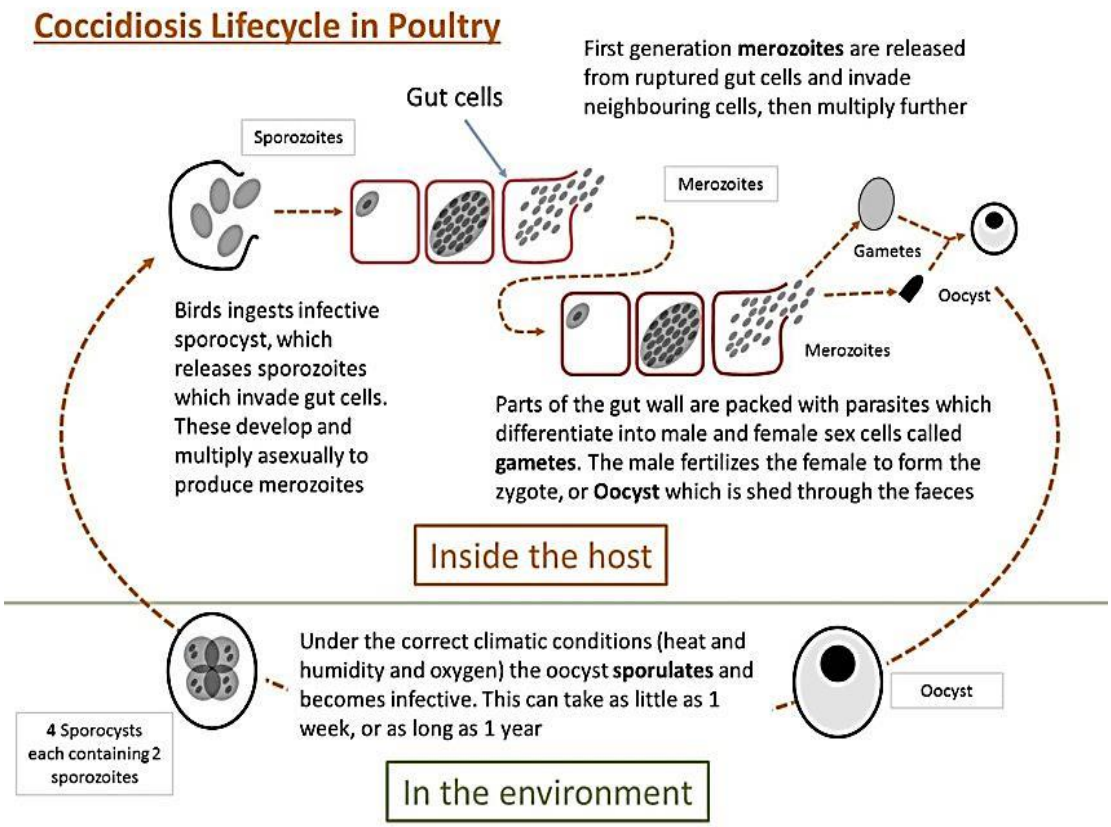

Figure 1.2 Life cycle: The different stages of *Eimeria* in and outside intestinal cells

(Adapted from www.farmhealth on line.com)

1.2 Coccidiosis

1.2.1 Pathogenesis

The infectious forms of the Disease are oocysts in the form of spores (sporulated oocysts). Birds get infected orally through ingestion of contaminated feed and/or water. After ingestion, the action of mechanical and chemical factors in the gut (bile and trypsin) leads to the release of sporocyst and then the sporozoite in the duodenal lumen .sometimes the sporocyst passing down the whole length of the digestive tract before releases the sporozoite. Then sporozoites invade epithelial cells of the intestine. Transfer of the sporozoits up to the locus of the primary lesion is with the help of intraepithelial lymphocytes (Daszak,1999).

1.2.2 Clinical signs

Infection with pathogenic *Eimeria*, leads to Clinical signs of sudden increase in daily mortalities and diarrhea while infection with less pathogenic species results in poor growth and impaired feed conversion.

Many infections are subclinical so the bird appears healthy even though it is infected with *coccidia*. In those bird that are symptomatic, clinical signs are due to the destruction of the cells in the intestine that occurs during the asexual stage of the coccidian lifecycle. Clinical signs in captive birds include general depression, inactivity, anaemia, loss of appetite with subsequent weight loss, ruffled feathers, distended abdomen, dehydration, diarrhea and death (Constable, 2016).The diarrhea may or may not be tinged with blood and Sudden death with no prior clinical signs may also occur (Ball *et al*., 1998).

1.2.3 Transmission of the disease

Coccidia are almost universally present in poultry-raising operations, but clinical disease occurs only after ingestion of relatively large numbers of sporulated oocysts by susceptible birds. Both clinically infected and recovered birds shed oocysts in their droppings, which contaminate feed, dust, water, litter, and soil. Oocysts may be transmitted by mechanical carriers such as equipment, clothing, insects, farm workers, and other animals.

1.2.4 Immunity

Protective immunity usually develops in response to moderate and continuing infections and in the absence of infection immunity may wane. True age-immunity does not occur, but older birds are usually more resistant than young birds because of earlier exposure to infection(Richard and Gerhold, 1955). Immunity is species specific , Each species is host specific and able to produce specific immunity in the bird, but there is no cross immunity between species (Beach and Corl ,1925;Edger,1958).

1.2.5 Diagnosis of coccidiosis

1.2.5.1 Examination of gross lesions

Postmortem examination is essential to confirm diagnosis. Lesions may be noticeable from the serosal surface but the mucosal surface should be examined carefully .The procedures for killing birds and techniques for postmortem examination are based on the technique discussed by (Zander, 1978).

The entire length of the external serosal surface of the digestive tract from the gizzard to the lower rectum needs to be examined under strong light. In examining the serosal surface a search should be made for whitish plaques or petechiae. Whitish streaks or rounded colonies of oocysts in the duodenal area often indicate *E. acervulina* or *E. mivati*. In the mid gut area on both sides of the *yolk sac diverticulum*, whitish plaques may be produced by colonies of *E.necatrix* schizonts. (Conway and McKenzie, 1991).

The characteristics of the observed lesions such as its location on the intestinal tract, its appearance and severity, the nature of intestinal contents and other associated gross change can be useful in establishing a diagnosis (Conway and Mckenzie, 2007). While cutting through the intestinal wall, thickened areas indicating parasitic invasion of the mucosa or submucosa. Presence of mucus, blood, casts, or cores and presence of cheesy coagulation necrosis should be noted. Presence of blood in the caeca suggests a diagnosis of *E. tenella*.,but bleeding may originate from the more anterior zones of the intestine and moving

to the cecum may led to a misdiagnosis the case of *E. necatrix* as *E. tenella* infection.

Other characteristics that is useful in species identification includes : zone of intestine parasitized, nature of macroscopic lesions, minimum sporulation time, minimum prepatent period, schizonts size and area in which it develops, location of the parasite within the epithelial cells and cross-immunity trails (Reid, 1978).

The lesion produced by *E. tenella* is found mostly in the caeca. Lesion scoring is a technique developed to provide a numerical ranking of gross lesions caused by coccidian. The entire gastrointestinal tract is removed unbroken from the bird. The gizzard and the rectum are left attached for orientation to locate the lesion observed in various parts of the intestine. The lesions are scored 1upto 4 based on the key identification characteristics discussed by (Conway and McKenzie, 1991), because it damages the gut and allows bacteria to enter and cause secondary infections (Fanatico, 2006). It is important to demonstrate the parasite in association with lesions by examination of mucosal scrapings.

1.2.5.3 Differential Diagnosis

As differential diagnosis Histomoniasis, Hemorrhagic Syndrome and ulcerative and necrotic enteritis may also produce somewhat similar gross lesions (Reid, 1978).salmonellosis(Hafez,1997).

1.2.5.3 Examination of fecal Material

Oocysts in faeces of infected birds can be detected using floatation methods with saturated salt or sugar solution while this method is not reliable for diagnosis of coccidiosis. It can be a useful indicator of subclinical infection. Concentration floatation technique is used for the collection of *Eimeria* oocysts from intestinal content of chickens**.** *Eimeria* oocysts isolation depends on the measurements of oocysts by using a calibrated ocular micrometer at 400x magnification ,determination of location and characteristics of intestinal lesion, oocyst morphology and sporulation time of *Eimeria* species (Conway and Mckenzie ,1997).

Diagnosis by fecal examination may lead to quite erroneous results (Soulsby, 1982). Thus, with *E. acervulina*, which has a high biotic potential, comparatively larger numbers of 14 oocysts are shed than, for example, with *E. necatrix*. Furthermore, the accurate identification of the oocysts of various poultry *coccidia* is not easy (Soulsby, 1982). In some instances, the major pathology is produced before oocysts are shed in the feces (e.g. *E. tenella*) ,and, conversely, the presence of large number of oocysts may not necessarily indicates a serious pathogenic condition.

1.2.5.4 Molecular Techniques

The PCR methods should prove very useful for epidemiological surveys of avian coccidiosis. (Shirley , 1975) was the first one used a molecular biological approach to differentiate species on the basis of isoenzyme patterns of oocysts by starch block electrophoresis. (Ellis and Bumstead ,1990) were among the first people who to demonstrate that rRNA and rDNA probes could be used to identify individual species through characteristic restriction fragment patterns. *(Procunier et al*.,1993) used a randomly amplified polymorphic DNA assay to differentiate *E. acervulina* and *E. tenella* and detect within strain differences. Recombinant DNA techniques have been used to discriminate different strains of *E. tenella* (Shirley., 1994) and develop markers for precocious and drug-resistant strains (Shirley and Harvey., 1996), PCR amplification of internal transcribed spacer region 1 from genomic DNA has been used to detect and differentiate six *Eimeria* species (Schnitzler *etal*., 1997). Eight species (including *E. hagani*) are claimed to be differentiated using a two-step PCR procedure (Tsuji *etal*., 1997), and six Australian species have been characterized using a PCR-linked restriction fragment length polymorphism approach (Woods *etal*., 2000).

1.2.7 Treatment

Administration of amprolium solution, 0.024% of the active ingredient in drinking water for 3 - 5 days. Sulfonamides (sulfamethazines , 0.1% for 2 days, 0.05% for 4 days or commercial combinations of sulfa drugs) in drinking water.

Administration of water dispersable vitamin A and K supplements may enhance recovery.(Poultry Diseases,2005).The emergence of drug resistance strains of *coccidia* presents a major problem. Continuous use of anticoccidial drugs leads to increased incidence of drug resistant strain development which results in reduced activity of the drug against the agent (Roy, 2007).

1.2.7 Prevention and Control

Practical methods of management cannot prevent infection .poultry that are maintained at all times on wire floors to separate bird from droppings have fewer infections ;Clinical coccidiosis is seen only rarely under such circumstances .Other methods of control are vaccination or prevention with anticoccidial drug (Shirleyy and Chapman (2005).

1.2.7.1 Management procedures

Management procedures which limit saturation of litter include appropriate installation and management of watering systems. Nipple drinkers reduce spillage of water onto litter compared to bell and trough drinkers. Setting of Acceptable ventilation rate. It should Maintaining recommended stocking density, The commitiment to make enough feeding space .Also, adding anticccidials to diets prevents clinical infection. Addition Chemical and ionophoric anticoccidials for broilers in shuttle programs. And Synthetic coccidiostats for breeders and floor-reared commercial egg production flocks which allow the development of premunity(Shirley and Chapman (2005).

1.2.7.2 Vaccination

A species-specific immunity develops after natural infection the degree of which largely depends on the extent of infection and the number of reinfection, protective immunity is primarily a T- cell response. Commercial vaccines consist of low doses of live, sproulated oocysts of the various coccidal species administered at low doses, Modern anticoccidial vaccines should be given to day –old chicks, either at the hatchery or on the farm .Because the vaccine severs only to introduce infection, chickens are reinfected by progeny of the vaccine strain on the farm. Most commercial vaccines contain live oocysts of

coccidia that are not attenuated. The self- limiting nature of coccidiosis is used as a form of attenuation for some vaccines, rather than biologic attenuation. Some vaccines sold in Europe and south America include attenuated lines of *coccidia*. Layers and breeders maintained on floor litter must have protective immunity.

Historically, these birds were given asuboptimal dosage of an anticoccidial drug during early growth, with the expectation that immunity would continue to develop from repeated exposure to wild types of *coccidia*. This method has never been completely successful because of the difficulty in controlling all of the factors affecting the reproduction of *coccidia* under practical conditions, while anticoccidial drugs have been preferred for protection of these birds, vaccination programs are gaining popularity .Better administration techniques and choice of *coccidia* strains in the product are improving the feasibility of vaccination in broilers. (THE Merck veterinary manual, 2005) (Shirley et al., 2007).

Chapter Two

Materials and Methods

2.1 Study Area and study population:

Study Area

The current study was conducted in Atbara locality.

Atbara city located at latitude 7-141 north and longitude 59, 33 east, and it is 350 meters above sea level. The city is also located at the confluence of the Nile River with its Atbara tributary. It represents an excellent geographical location on which the city was built, to the east of the Nile and to the north of Atbara. It is 13 km north of the city of El-Damer, and the city is about 310 km north of Khartoum, the capital, 611 km north of Khartoum, the capital, 611 km south of Wadi Halfa and 474 km west of Port Sudan. Therefore, the city is characterized by its proximity to ports and administrative capitals.

This study began by collecting sample in December 2018 to September 2019.In that time poultry farms were in East, West, North Atabra. Exactly in Alamn Elgzai N:17,72078 /E:34,02471 and Asyala N:17,71092/E:33,97162. Seasons in which get samples is summer (dry), Winter (cold) and Autumn (rain and humidity).

study population

Samples getting from layers and broilors. Population number were estimated as (66400) chicken in Report of the planning department in Atbara locality, 2018.

Table 2.1 Study information

Study area	Atbara
Study period	December 218 to September 2019
Direction	East – West – North
Region	Alamn Elgzai- ALsyala
Location	N:17,72078/E:34,02471 N:17,71092/ E:33,97162
Season	Summer – Winter – Autumn
Breeding type	Layers- Broilers

Table 2.2 Study sample

Sample	Information
Bread	Lohman – Rose
Management	Good – Poor
Source of water	Public water line – well
Source of feed	Processed inside the farm – commercial
System	Open – semi closed
Age	< 1 year – = 1 years - > 1 years
Weight	< 1500 kg – = 1500 kg – > 1500 kg

2.2 Number and Type of Samples

Samples were randomly selected from 25 poultry farms distributed in Atbara locality. Samples include fecal materials (n =496) and live birds (n=5). The number of poultry in 2018 were estimated as 66400 bird (Report of the planning department in Atbara locality 2018).

The formula applied to calculate sample size was the formula for simple random sampling method since it is used as study method and the study has considered 95% confidence level and 5% absolute precision (Thrus field, 2005).

n = * (pexp * q)

d2

n= the required sample size

Pexp= Expected prevalence

q = (1- Pexp)

d = Desired absolute precision (5%)

Where Z (a multiplier for 95% confidence interval based on the normal distribution).

The equation was compensated and the result was 384, and to provide a higher representation of the characteristics of the community, which leads to a truer deepening of the results of scientific research, I increased the sample size by 496 .

2.3 Clinical Examination of Live Birds

Before conducting a Clinical examination, the bird's appearance and behavior should be observed from a distance and within the flock. A healthy bird should be bright, alert, and interacting with the flock, with good appetite and free of abnormal behavior.

The clinical examination found were anorexia ,reduced weight gain and feed conversion in infected chicks, depressed, have ruffled feathers, wings droop, diarrhea, tend to huddle, decreases consumption of food and water, emacition, dehydration, reduced egg production, cecal coccidiosis produce bloody dropping and anemia .

2.4 Postmortem Examination

Post mortem examinations were conducted on suspected chickens. using sterile scalpel, scissors, forceps, secateurs and dry swabs Then samples were taken in sterile bags and transported to lab.

The examination was performed on a daily basis and the finding (major gross lesions associated with coccidiosis) of each age group were reported.

2.4.1 Postmortem technique

Post mortem examinations on selected coprologically positive chickens. After killing chicken, carcasses were moist with a disinfectant solution to limit the dispersion of infected dust and feathers .In the postmortem used different sterile equipments for examination, with scissors, cut through one lateral commissure of the mouth and examine the oral cavity, continue at the cut commissure and make alongitudinal incision through the skin of the neck to the thoracic inlet reflect the skin laterally, birds placed on its back with the feet towards to me, make alongitudinal incision in the esophagus and crop .Note the content and oder, make alongitudinal incision in the larynx and trachea and examine, with bone shears ,remove the upper beak with atransverse cut near the eyes .examine the nasal cavity and infraorbital sinuses connect the lateral skin incisions with atransverse skin incision across the middle of the abdomen .Reflect the skin of the breast anteriorly ,and of the abdomen ,posteriorly,

examined breast muscles (paleness, haemorrhages, congestion or decreased muscle mass, incision abdominal muscles ribs and coracoids bone and removed from the chest to expose the internal organs and the chest cavity, examined the liver, lung, heart, air sac, mucosa of the larynx, trachea and syrinx, separate the gastrointestinal tract by incision between the oesophagus and proventriculus and near the cloacae, proventriculus and gizzard were remove and examine the presence of feed and submuosal haemorrhage , examined spleen which located at the junction of the proventriculus and gizzard (size, consistency and colour.

Inspect Kidney the elongated and lobulated organs embedded in the Pelvis, observation of the ovary and ovi duct or testes which are located on the top of the kidneys is fundamental finally focus to mucosal surface of intestine ,lymphatic tissue such as peyers patches and caecal tonsils (enlargement and haemorrhagic).

examine the brain. disarticulate the head and skin it .Remove the calvarium with strong scissors.

2.4.2.1 Examination of the intestine

Examination of the serosal surface of unopened intestines for lesions was done after being freed from mesentery. After opening of intestine with scissors, extending from the duodenum to the rectum, including caecum, all intestinal walls were examined for gross pathological changes. The intestinal portions were divided into five sections, the duodenum, jejunum, mid intestine (above and below the yolk sac diverticulum), the lower part (distal ileum and rectum) and caecum. The lesions were considered positive when there was a minor to major abnormalities like (enlargement, petechia, reddening, thickening, ballooning, hemorrhage (bleeding), caecal core, whitish spot), and were considered negative when there were no gross abnormalities.

After the autopsy of the 5 chickens,the result was all positive ,and I saw the some sign like present spots of blood in intestine and present mucus and blood in intestine.

2.4.3 Sampling method

2.4.3.1 Fecal collection

(496) Faecal samples were collected directly from freshly voided droppings of birds witha clean plastic wrap and a spatula and were brought to the Atbara vetrenary laboratory for immediate examination of poultry coccidiosis.

About 3g of faeces were weighted by calibrated teaspoon and put into container mixed with asaturated solution of sodium chloride (Nacl) and strained through asieve (15-50ml volume) to remove coarse fecal material.The mixture was put in centrifuge tube(15-50 ml volume) until to become dome shaped ,then the cover slip was placed on top of the tube for 10 minutes on the bench .The egg were floated to the surface and touched with acover slip, and then the cover slip was placed on aclean slide and examined under compound microscope at 10x10 magnification (soulsby,1982)O=ach bird were collected in separate spatula was blended by mortar and pistol and then floatation technique using sodium chloride solution were applied to harvest oocyst .

2.4.3.2 Mucosal scraping

Small scraps were taken from different segments of intestine and put on the slide and diluted with saline then covered with cover slip and examined under microscope first with (10x magnification and proceeded to 40x magnification) appropriate light and recorded oocyst shape and size of oocyst by using micrometer

2.4.4 Examination of fecal samples

2.4.4.1 Microscopic examination

The faeces of each bird were collected in separate spatula was blended by mortar and pistol and identification of coccidia and helminth eggs oocysts was done using a standard microscope under ×10 objective magnification.Then the average length and width was measured using ocular micrometer from at least 3-5 oocysts to determine the size and shape. Positive samples were further examined for species identification.

2.4.4.2 Preparation of wet smear

Wet smears were prepared according to (Alumaili, O.A.R ,2013)
After putting asmall amount of feces on aglass slide,a drop of liquid was added to the feces and thoroughly mixed and the mixture covered with acover slip .The slide was examined under microscope using the 10X objective, and then go over it with the 40X objective.

2.4.4.3 Examination of wet smear

Direct Smear: Direct fecal smears are most useful for the diagnosis of protozoal parasites which have motile trophozoite stages that are passed in the feces. Cysts and oocysts of *coccidia* and Giardia sp. can be seen on direct smears; however, these non-motile stages are more likely to be recovered when concentrated using a flotation technique. In order to be diagnostic, direct smears must be performed using fresh feces. Fresh feces means body temperature (usually less than five or ten minutes old!). As the specimen cools, trophozoites lose their motility and their diagnostic features become less recognizable. In preparing the smear, use saline. Water will rupture some trophozoites, rendering them unrecognizable. Small scraps were taken from different segments of intestine and put on the slide and diluted with saline then covered with cover slip and examined under microscope first with (10x magnification and proceeded to 40x magnification) appropriate light and recorded oocyst shape and size of oocyst by using micrometer

2.4.5 Identification of species of *Eimeria*

Species of *Eimeria* were identified by combination of microscopic features of oocyst morphology (shape, size, sporulation time and color of the oocysts), the predilection site of *Eimeria* in the gut, the nature of gross lesions induced and histopathological .

2.5. Equipment

2.5.1 Microscope

Samples were examined by obtical microscopy with two magnification lenses 10X (To do slide scan) and 40X (To examine the sample).Under

microscope keep the iris diaphragm more closed and the light source dim to see more detail.

2.5.2 Ocular micrometer at 400x magnification

The measure the size of oocysts

2.5.3 Morter and pestle

To make dilute paste from feacal sample and chloride sodium(Nacl)

2.5.4 Slide and cover slip

2.5.5 Tube and holder

2.5.6 Sieve

2.6 Reagent and solution

2.6.1 In this study used concentrated saline solution Sodium chloride (Nacl)(250g salt/200ml water.

Figure 2.1 Microscopic examination

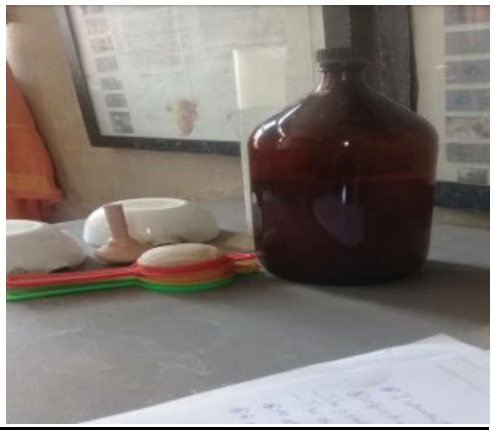

Figure 2.2 Floatation technique

2.7 Questionnaire

Questionnaire for data collection to investigate the risk factors which could be associated with poultry coccidiosis in Atbara locality.

The questionnaire contains: season – breeding type – management – system – age – weight – type of production – source of water – source of feed – result.

Chapter Three

Result

3.1 Prevalence of chicken Coccidiosis

According to presence or absence of coccidiosis in floatation test.

Result showed A total of 74 (14.9) samples were positive for poultry coccidiosis (table3.1).

While (422samples) were negative (85.1%) (in table3.1).

3.2 Analysis of Risk Factor for chicken Coccidiosis

3.2.1 Season

The presence of infection was investigated during the three seasons, Winter, Autumn and Summer.

Higher prevalence of the disease was detected in winter followed by autumn and summer (table3.3).

The Chi squire test showed that there was significant association between *coccidia* infection (Table 3.4) and season of the year. (P-value= 0.01),($\mathbf{X^2}$=13.6)(table3.4)

3.2.2 Breed

The presence of infection was investigated during the two breeds Rose and Lohman. Higher prevalence of the disease was detected in Lohman followed by Rose (table 3.3).

The Chi squire test showed that there was no significant association between *coccidia* infection (Table 3.4) and breed of chicken. (P-value.0.32),($\mathbf{X^2}$= 0.33)(table3.4)

3.2.3 Management

The presence of infection was investigated in the two type of management poor and good according to what I saw in the poultry farms in Atbara, from which random samples were taken. Higher prevalence of the disease was detected in poor followed by good (table3.3).

The Chi squire test showed that there was no significant association between *coccidia* infection (Table 3.4) and management (P-value.0.13%),($\mathbf{X^{2=1.6}}$.)(table3.4)

3.2.4 Source of water

The presence of infection was investigated in the two source of water public water line and well.

Higher prevalence of the disease was detected in water public line followed by well. (table3.3).

The Chi squire test showed that there was no significant association between *coccidia* infection (Table 3.4) and Source of water (P-value.0.8)(. $\mathbf{X^2}$=3.0)(table3.4)

3.2.5 Source of feed

The presence of infection was investigated in the two sources of feed processed inside the farm and commercial. Higher prevalence of the disease was detected in processed inside the farm followed by commercial. (table 3.3)

The Chi squire test showed that there was significant association between *coccidia* infection (Table 3.4) and Source of feed (P-value. 0.003)($\mathbf{X^2}$=6.4)(table 3.4)

3.2.6 Type of production

The presence of infection was investigated in the two Type of production layer and broiler. Higher prevalence of the disease was detected in layer followed by broiler (table 3.4).

The Chi squire test showed that there was no significant association between *coccidia* infection (Table 3.4) and Type of production (P-value.0.4)($\mathbf{X^2}$=0.2)(table3.4).

3.2.7 System

The presence of infection was investigated in the two system open and semiclose. Higher prevalence of the disease was detected in open followed by semiclose (table3.4).

The Chi squire test showed that there was no significant association between *coccidia* infection (Table3.4) and season of animal (P-value.0.13) (X^2=1.53) (table3.4).

3.2.8 Age

The presence of infection was investigated in the three ages < one year, = one year and > one year. Higher prevalence of the disease was detected during < one year followed by = one years and > one year (table 3.4)

The Chi squire test showed that there was no significant association between *coccidia* infection (Table 3.4) and age of chicken (P-value.0.7) ($X^{2=0.7}$) (table3.4).

3.2.9 Weight

The presence of infection was investigated in the three weights in live birds =1500kg, <1500kg and >1500kg.

Total of samples tested for = 1500kg was (279) chicks, (40) chicks were affected, rate of infection (14.3) (table 3.3).

Total of samples tested for < 1500kg was (134) chicks, (20) chicks were affected, rate of infection (15.0) (table 3.3).

Total of samples tested for > 1500kg was (83) chicks, (14) chicks were affected, rate of infection (16.8) (table 3.3).

Higher prevalence of the disease was detected in =1500kg followed by < 1500kg and >1500kg (table 3.4).

The Chi squire test showed that there was no significant association between *coccidia* infection (Table3.4) and weight of chicken (P-value.0.8) ($X^{2=0.32}$) (table3.4).

Table 3.1 Frequency of coccidiosis in poultry in Atbara locality

Result	Frequency	Percent	Valid percent	Cumulative Percent
Positive	74	14.9	14.9	14.9
Negative	422	85.1	85.1	100.0
Total	496	100.0	100.0	

Table 3.2 Frequency for potential risk factor of coccidiosis in poultry in Atbara locality

Risk factors	Frequency	Valid percent	Cumulative percent
Season:			
winter	418	84.3	84.3
Autumn	40	8.1	92.3
Summer	38	7.7	100.0
Total	496	100.0	
Breed Lohman	323	65.1	65.1
Rose	173	34.9	100.0
Total	496	100.0	
Management:			
poor	377	76.1	76.0
good	119	24.0	100.0
total	496	100.0	
source of water:			
public water line	443	89.3	89.3
well	53	10.7	100.0
total	496	100.0	
Source of feed:			
Processed inside the farm	462	93.1	93.1
Comerical	34	6.9	100.0
Total	496	100.0	
type of production:			
layer	320	64.5	64.0
broiler	176	35.5	100.0
total	496	100.0	
System:			
Open	303	61.1	61.1
Semi close	193	38.9	100.0
Total	496	100.0	
Age:			
<One year	235	47.4	47.4
=one year	192	38.7	86.1
>one year	69	13.9	100.0
Total	496	100.0	
Weight:			
=1500kg	279	56.2	56.2
<1500kg	134	27.0	83.3
>1500kg	83	16.7	100.0
Total	496	100.0	

Table 3.3 Cross tabulation of *coccidia* infection in poultry at Atbara city

Risk factor	Poultry tested	Poultry affected	Rate of infection%
Season:			
Winter	418	73	17.4
Autumn	40	0	0
Summer	38	1	2.6
Breed:			
Lohman	323	46	14.2
Rose	173	28	16.2
Management:			
Poor	377	52	13.7
Good	119	22	18.4
Source of water:			
Public water line	443	62	13.99
Well	53	12	22.64
Source of feed:			
Process inside farm	462	74	16.017
Commercial	34	0	0
Type of production:			
Layer	320	46	14.4
Broiler	176	28	16.0
System:			
Open	303	50	16.5
Semiclose	193	24	12.4
Age:			
<one year	235	36	15.3
=oneyear	192	30	15.6
>one year	69	8	11.6
Weight:			
=1500kg	279	40	14.3
<1500kg	134	20	15.0
>1500kg	83	14	16.8

Table 3.4 Summary of univariate analysis for potential risk factor of *coccidia* infection in 496 chicks examined at Atbara city using chi square test

Risk factor	No. examined	No. positive(%)	Df	X^2	p-value
Season:					
Winter	418	73(17.4)	1	13.6	0.01
Autumn	40	0(0)			
Summer	38	1(2.6)			
Breed:					
Lohman	323	46(14.2)	1	0.33	0.32
Rose	173	28(16.2)			
Management:					
Poor	377	52(13.7)	1	1.6	0.13
Good	119	22(18.4)			
Source of water:					
Public water line	443	62 (14.0)	1	3.0	0.8
Well	53	12(22.6)			
Source of feed:					
Process inside farm	462	74 (16.01)	1	6.4	0.003
Commercial	34	0(0)			
Type of production:					
Layer	320	46(14.4)	1	0.2	0.4
Broiler	176	28(16.0)			
System:					
Open	303	50(16.5)	1	1.53	0.13
Semiclose	193	24(12.4)			
Age:					
<one year	235	36(15.3)	1	0.7	0.7
=one year	192	30(15.6)			
>one year	69	8(11.6)			
Weight:					
=1500kg	279	40(14.3)	1	0.32	0.8
<1500kg	134	20(15.0)			
>1500kg	83	14(16.8)			

*Df: degree of freedom =1.

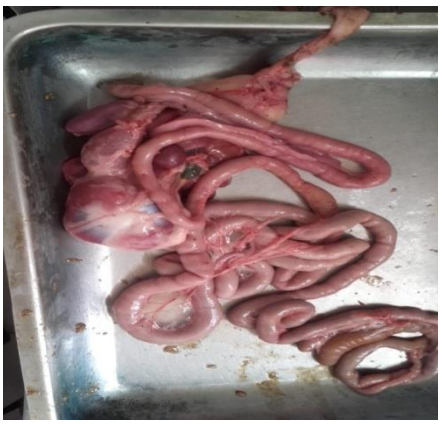

Figure 3.1 Positive sample for Coccidiosis (layer)

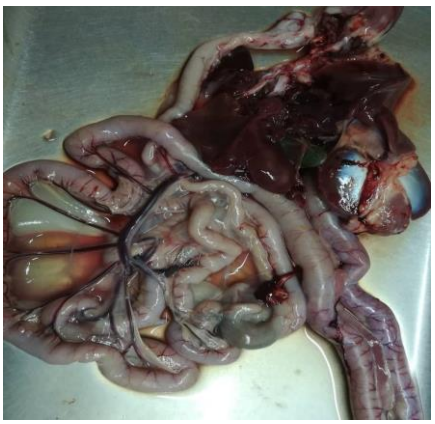

Figure 3.2 Positive sample for coccidiosis (broilor)

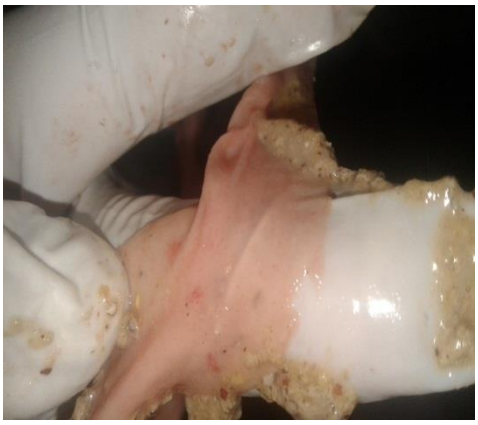

Figure 3.3 Present spots of blood in intestine in positive sample

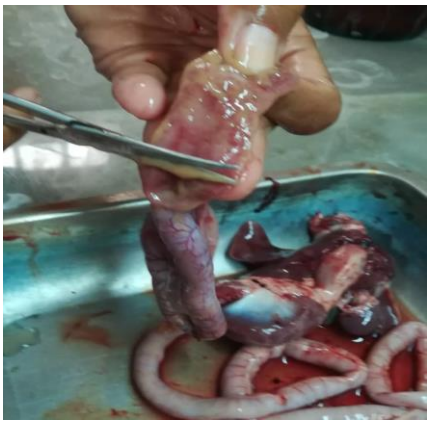

Figure 3.4 Present mucus and blood intestine in positive sample

Figure 3.5 Internal parasite (scaris spp)

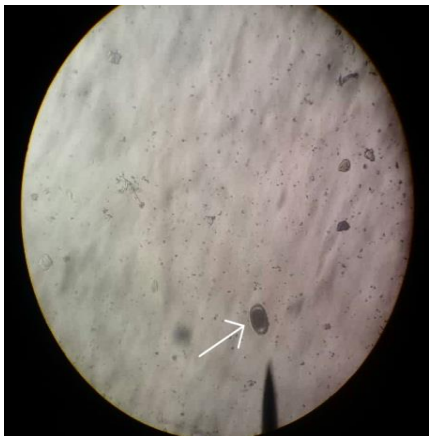

Figure 3.6 Capillaria obsignata

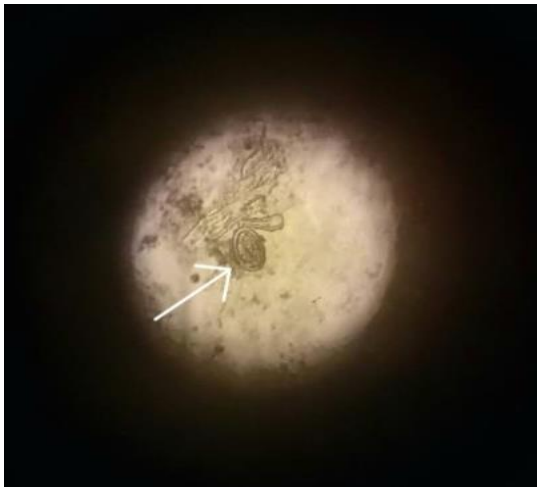

Figure 3.7 Ascaris spp Figure coccidiosis in layer

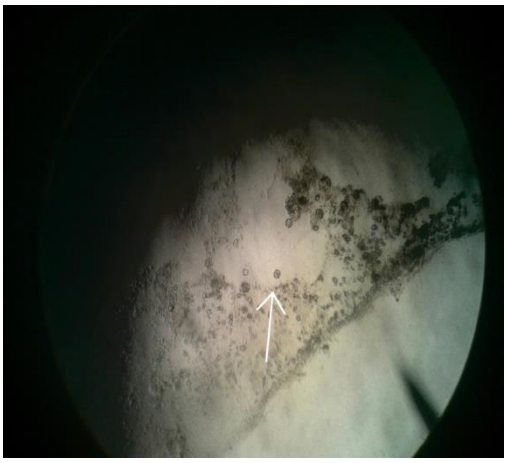

Figure 3.8 Positive result of coccidiosis in layer

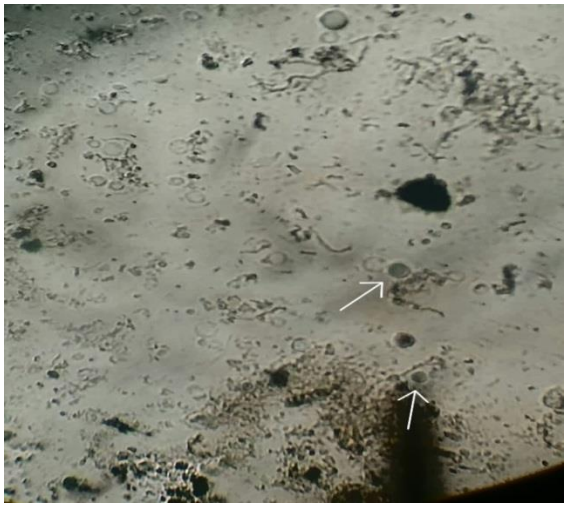

Figure 3.9 Emeria tenella in layer 1

Figure 3.10 Emeria necatrix in layer

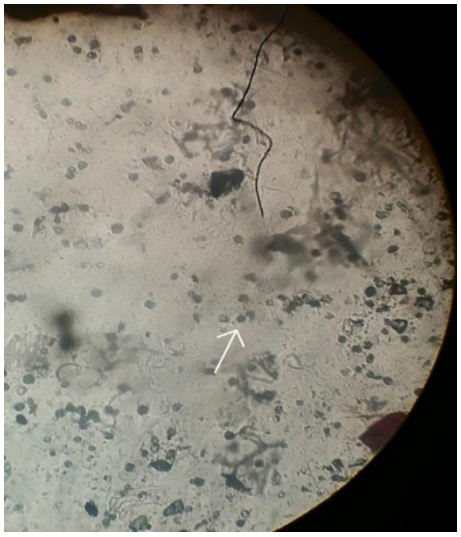

Figure 3.11 Emeria necatrix in broiler

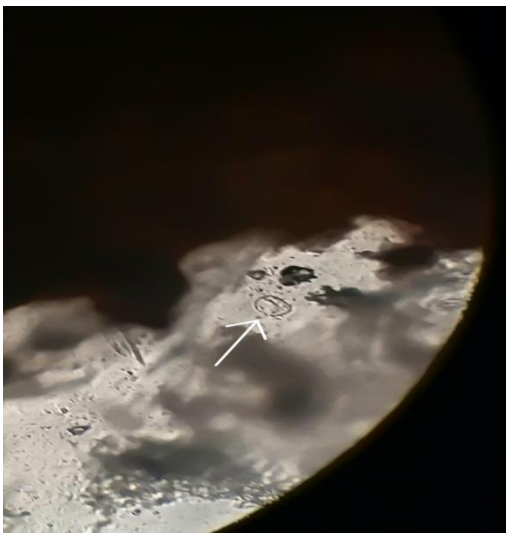

Figure 3.12.Emeria suvulina in broiler

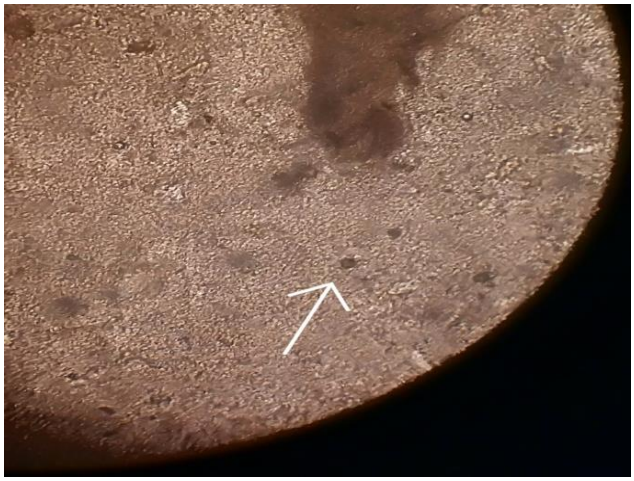

Figure 3.13 Emeria tenalla in broiler

Chapter Four

Discussion

4.1 Discussion

The prevalence of poultry coccidiosis recorded during these study is higher than the result reported in Khartoum, North city and Omdurman city which is 5.5% (Awad, A. A . and Ghada, H. A. 2017). This variation in prevalence of the disease may be due to epidemiology of coccidian infection and differences in management systems of the farms.

In the present study the prevalence of poultry coccidiosis was14.9% in Atbara locality, which is lower than previous studies carried out in Western Ethiopia 20.57% (*Diriba Oljira* et al., 2012) and Nigeria 31.8% (jallailudeen Rabana Lawal etal 2016).

Higher prevalence were also reported 56.25% by (Sachin Pant etal 2018) in and around tarai region of uttarakh.

Lower prevalence of poultry coccidiosis was reported 9.59% in Pakistan, (Asim Shamim etal.,2015).

The prevalence of poultry coccidiosis according to system was estimated in this study ,the rate of infection in open was higher compare to semiclose .There was no significant association between the system and the disease .The highest rate of infection was found in open system ,This may be due to the fact that open system is more influenced by environmental factors than to semiclose .In many cases, they are affected by diseases that lead to the death of large numbers.

The prevalence of poultry coccidiosis related to type of production was studied in layer and broiler and there was no statistically significant association.

The highest rate of infection was found in broiler this may be due to their rearing under deep litter system of management.

,In Benue State (G. Agishi1,etal2016) study in Makurdi we found lower prevalence of type of production than this study, there was no statistically significant association

The results of the study of that the prevalence of poultry coccidiosis in different seasons winter , Autumn and summer showed that was significant association .The highest rate of infection was found in winter .This is due to the fact that at this time of the year environment are conducive for transmission and sporulation of oocysts, resulting in higher cases.

In(Asim Shamim, etal 2015) study in Azad Kashmir, Pakistan , we found prevalence of disease according to the seasons, as shown lower in winter and higher in autamn and summer.

The prevalence of coccidiosis related to management system of poultry which was poor and good. There was no statistically significant association. Good management have higher rate of infection .Due to the absence of negative environmental factors that increase the immunity of poultry.

In another study by *Hadas Gebretensae*,etal2014 in Gondar Town, North West Ethiopia was found higher prevalence in poor and good mangement. There was statistically significant association.

The Prevalence of poultry coccidiosis related to age was<one year ,=one year and >one year, There was no statistically significant association .The higher rate of infection was found in (=one year) may be poultry of this age had low immunity they cannot resists environmental conditions.

In most studies, age is divided into two parts adult and young. The prevalence of young 33.60%, adult 23.30%, there was statistically significant association in Around Bishoftu, Oromia Region, Ethiopia *(Dinka Ayana*,etal2017). This variation between Age groups may also be due to difference in management system, no maternal derived immunity or former immunity is not well developed in young chickens.

The Prevalence of coccidiosis related to breed of poultry was studied in Lohman and Rose .However, there was no statistically significant association(p-0.32).The highest rate of infection was found in Rose. This may be due to the housing and management of the study area which was conducive for sporulation, transmission and survival of oocyst, therefore the occurrence of Coccidiosis was insignificantly affecting both breeds

The results of the study showed that the prevalence of poultry coccidiosis in source of water was public water, well water. There was no statistically significant association ..

The Prevalence of poultry coccidiosis related to source of feed was feed processed inside the farm and commercial feed, there was statistically significant association .

The Prevalence of poultry coccidiosis related to weight was =1500kg, <1500kg and >1500kg,there was no statistically significant association .

4.2 Conclusion

I conducted a poultry coccidiosis study by taking feces and live poultry samples during the period between December 2018 and September 2019 from the Food Security and Al-Sayala area in the winter, summer and autumn. Stool samples were examined by flotation test and the live poultry samples were dissected, after which the results of the flotation test were statistically analyzed and we have taken into account Some of the risk factors are season, age, breed, management, source of water , source of food, production, diet, age and weight.

The output of this study indicates, that the overall prevalence of poultry coccidiosis was14.9%.

4.3 Recommendation

- Careful permanent to clean drinking water and feed submitted to poultry.
- Change the litter constantly and if it is possible that it is stirred in patrol with addition of lime district her to kill bacteria disease and if wet parts of litter must change them immediately by dry litter.
- Maintain good ventilation in poultry sheds.
- Taking into account the non-raising of different types and ages of poultry on the same farm.
- Observe the rules of hygiene and good cleaning of the wards before inhabiting the chicks with them, while the strangers do not enter the dormitory.
- Acommon practice in controlling infection with these parasites is exposure to natural infections or vaccination with one of the available vaccines. Exposing a chicken to a small number of eggs causes the species to become immune due to repeated infections. This exposure must be limited.
- Add anticoccidiosis to poultry feed like:
  - Monensin.
  - Maduramycin.
  - Salinomycin.
  - Amprolium.
  - 1kg or 2kg /1Ton.
- Reducing crowding in poultry sheds.
- To control this economically important parasitic disease of poultry, further studies need to be undertaken to come up with .sustainable and cost effective prevention and control methods.

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Appendixes

Appendix 1

Frequency table for the distribution of infection among 496 check examined at Atbara city according to potential risk factors.

A.Frequency distribution of Season:

Season

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Winter	418	84.3	84.3	84.3
	Autumn	40	8.1	8.1	92.3
	Summer	38	7.7	7.7	100.0
	Total	496	100.0	100.0	

B. Frequency distribution of Breed:

Breed

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Inma	323	65.1	65.1	65.1
	Omat	173	34.9	34.9	100.0
	Total	496	100.0	100.0	

C. Frequency distribution of Management:

management

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Poor	377	76.0	76.0	76.0
	Good	119	24.0	24.0	100.0
	Total	496	100.0	100.0	

D. Frequency distribution of Source of water:

source of water

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	public water iine	443	89.3	89.3	89.3
	Well	53	10.7	10.7	100.0
	Total	496	100.0	100.0	

E.Frequency distribution ofSource of feed:

Source of feed

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	ocessed inside the farm	462	93.1	93.1	93.1
	Commercial	34	6.9	6.9	100.0
	Total	496	100.0	100.0	

F.Frequency distribution ofType of production:

type of production

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Layer	320	64.5	64.5	64.5
	Broiler	176	35.5	35.5	100.0
	Total	496	100.0	100.0	

G. Frequency distribution ofSystem:

System

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Open	303	61.1	61.1	61.1
	semi close	193	38.9	38.9	100.0
	Total	496	100.0	100.0	

H. Frequency distribution ofAge:

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<one year	235	47.4	47.4	47.4
	=one year	192	38.7	38.7	86.1
	>oneyear	69	13.9	13.9	100.0
	Total	496	100.0	100.0	

I. Frequency distribution ofWeight:

Weight

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	=1500kg	279	56.2	56.2	56.2
	<1500kg	134	27.0	27.0	83.3
	>1500kg	83	16.7	16.7	100.0
	Total	496	100.0	100.0	

Appendix 2

Cross-tabulation for distribution of infection among 496 chick examinted at Atbara city according to potential risk factor

A. Poultry coccidiosis and Season cross-tabulation:

Crosstab

Count				
		resuit		
		+ve	_ve	Total
Season	winter	73	345	418
	autumn	0	40	40
	summer	1	37	38
Total		74	422	496

B. Poultry coccidiosis and Breed cross-tabulation:

Crosstab

Count				
		Resuit		
		+ve	_ve	Total
breeed	inma	46	277	323
	omat	28	145	173
Total		74	422	496

C. Poultry coccidiosis and Management cross-tabulation:

Crosstab

Count				
		resuit		
		+ve	_ve	Total
management	poor	52	325	377
	good	22	97	119
Total		74	422	496

D. Poultry coccidiosis and Sources of water cross-tabulation:

Crosstab

Count		resuit		
		+ve	_ve	Total
source of water	public water Line	62	381	443
	well	12	41	53
Total		74	422	496

E. Poultry coccidiosis and Sources of feed cross-tabulation:

Crosstab

Count		resuit		
		+ve	_ve	Total
Sourseof feed	processed inside the farm	74	388	462
	commercial	0	34	34
Total		74	422	496

F. Poultry coccidiosis and Type of production cross-tabulation:

Crosstab

Count		resuit		
		+ve	_ve	Total
type of production	layer	46	274	320
	broiler	28	148	176
Total		74	422	496

G. Poultry coccidiosis and system cross-tabulation:

Crosstab

Count		resuit		
		+ve	_ve	Total
system	open	50	253	303
	semi close	24	169	193
Total		74	422	496

H.Poultry coccidiosis and Age cross-tabulation:

Crosstab

Count		resuit		
		+ve	_ve	Total
age	<one year	36	199	235
	=one year	30	162	192
	>oneyear	8	61	69
Total		74	422	496

I.Poultry coccidiosis and Weight cross-tabulation:

Crosstab

Count		resuit		
		+ve	_ve	Total
weight	=1500kg	40	239	279
	<1500kg	20	114	134
	>1500kg	14	69	83
Total		74	422	496

Appendix 3

Univariate analysis for the associated of poultry coccidiosis in 496 chick with potential risk factors using Chi-square test.

A. Season:

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	13.667[a]	2	.001
Likelihood Ratio	21.479	2	.000
Linear-by-Linear Association	11.172	1	.001
N of Valid Cases	496		

B.Type of production:

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.211[a]	1	.646		
Continuity Correction[b]	.107	1	.744		
Likelihood Ratio	.209	1	.648		
Fisher's Exact Test				.693	.369
Linear-by-Linear Association	.210	1	.647		
N of Valid Cases[b]	496				

C. System:

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.536[a]	1	.215		
Continuity Correction[b]	1.232	1	.267		
Likelihood Ratio	1.566	1	.211		
Fisher's Exact Test				.246	.133
Linear-by-Linear Association	1.533	1	.216		
N of Valid Cases[b]	496				

D. Age:

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.706[a]	2	.703
Likelihood Ratio	.747	2	.688
Linear-by-Linear Association	.331	1	.565
N of Valid Cases	496		

E. Weight:

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.323[a]	2	.851
Likelihood Ratio	.315	2	.854
Linear-by-Linear Association	.290	1	.590
N of Valid Cases	496		

Appendix4

Questionnaire for data collection to investigate the risk factors which could be associated with poultry coccidiosis in Atbara locality.

*Poultry No ( )

1.Season

0-Winter ( ) 1-Autumn ( ) 2-Summer( )

2.Breeding type

0-Lohman ( ) 1-Rose ( )

3.Management

0-Poor ( ) 1-good( )

4.System

0-Open ( ) 1-Semiclose ( )

5.Age

0- < one year ( ) 1- =one year ( ) 2- >one year ( )

6.Weight

0=1500kg ( ) 1- <1500kg ( ) 2->1500kg ( )

7.Type of production

0-Layer ( ) 1-Broiler ( )

8.Source of water

0-Public water line ( ) 1-Well ( )

9. Source of feed

0-Processed inside the farm( ) 1-Comerical ( )

10.Result

0-postive + ( ) 1-Negative – ( )