Study of Coccidiosis in Quial in Khartoum State-Sudan

دراسة هرض الكوكسيذيا في طائر السواى بولاية الخرطوم – السودان

By

Suzan Omer Mohammed Alameen

B.V. Sc College of veterinary Science
University Of Bahri (2013)

A thesis submitted to the College of Graduate Studies in partial Fulfillment of the Requirement for the Degree of Master in Preventive Veterinary Medicine (MPVM)

Supervisor:
Dr: Iman Mohammed EL Nasri Hamza

October, 2017
(وَأَنْزَلْنَا عَلَيْهِمْ الْمَنْ أَوْ السَّلْوُى كُلُوا مِنْ مَّطْيَاتٍ مَا رَزَقَنَاكُمْ وَمَا طَلَّبُونَا وَلَكِنَّ كَانُوا أَنفَسَهُمْ يَطَلَّبُونَ)

سورة الأعراف / 160

صدق الله العظيم
DEDICATION

To my father

To my darling mother, sisters and my brother

To my husband who always support me

With respect and love
Acknowledgments

First of all thanks to Allah who gave me the strength and ability to complete this work. I deeply indebted to my supervisor Dr Iman ELnasri for her keen interest, advice, help and encouragement.

I would like to thank the researchers and all the technical staff members of the department of Avian Pathology and Diagnosis. Special thanks are Extended to the Staff of the faculty of Veterinary medicine Sudan university of science and technology and director of the Central Veterinary Research laboratories (CVRLC) for their help and support.

Finally, I wish to express my thanks to all my colleagues.
### Table of content

<table>
<thead>
<tr>
<th>No</th>
<th>Subjects</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>الأعْنَاب</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td>Dedication</td>
<td>Ii</td>
</tr>
<tr>
<td></td>
<td>Acknowledgement</td>
<td>Iii</td>
</tr>
<tr>
<td></td>
<td>Contents</td>
<td>Iv</td>
</tr>
<tr>
<td></td>
<td>List of tables</td>
<td>Vii</td>
</tr>
<tr>
<td></td>
<td>List of figures</td>
<td>Viii</td>
</tr>
<tr>
<td></td>
<td>Abstract</td>
<td>Ix</td>
</tr>
<tr>
<td></td>
<td>Arabic Abstract</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Introduction</td>
<td>1</td>
</tr>
</tbody>
</table>

#### CHAPTER ONE : Literature Review

1.1 The quail  
1.1.1 Quail diseases  
1.2 Coccidiosis  
1.2.1 Life cycle  
1.2.2 Eimeria species  
1.2.2.1 Eimeria Tsunodia  
1.2.2.2 Eimeria uzura  
1.2.2.3 Eimeria bateri  
1.2.3 Transmission  
1.2.4 Clinical signs  
1.2.5 Necropsy technique  
1.2.6 Diagnosis  
1.2.6.1 Differential Diagnosis  
1.2.7 Treatment  
1.2.8 prevention  

IV
### CHAPTER Two :Materials and Methods

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Study area</td>
<td>13</td>
</tr>
<tr>
<td>2.2</td>
<td>Samples</td>
<td>13</td>
</tr>
<tr>
<td>2.3</td>
<td>Clinical examination of live birds</td>
<td>13</td>
</tr>
<tr>
<td>2.4</td>
<td>Postmortem Techniques</td>
<td>13</td>
</tr>
<tr>
<td>2.4.1</td>
<td>Equipment for postmortem</td>
<td>13</td>
</tr>
<tr>
<td>2.4.2</td>
<td>Postmortem Technique</td>
<td>13</td>
</tr>
<tr>
<td>2.4.3</td>
<td>Microscopic examination</td>
<td>14</td>
</tr>
<tr>
<td>2.4.3.1</td>
<td>Preparation of Wet smear</td>
<td>14</td>
</tr>
<tr>
<td>2.4.3.2</td>
<td>Examination of wet smear</td>
<td>14</td>
</tr>
</tbody>
</table>

### CHAPTER THREE:RESULT

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Samples positive to Emirea species</td>
<td>16</td>
</tr>
<tr>
<td>3.2</td>
<td>Clinical signs</td>
<td>17</td>
</tr>
<tr>
<td>3.3</td>
<td>Postmortem lesion</td>
<td>17</td>
</tr>
<tr>
<td>3.4</td>
<td>Detection of coccidian oocyst</td>
<td>21</td>
</tr>
<tr>
<td>3.4.1</td>
<td>Distribution of Eimeria species</td>
<td>21</td>
</tr>
<tr>
<td>3.4.1.1</td>
<td><em>Eimeria. tsunodai</em></td>
<td>21</td>
</tr>
<tr>
<td>3.4.1.2</td>
<td><em>Eimeria.uruza</em></td>
<td>21</td>
</tr>
<tr>
<td>3.4.1.3</td>
<td><em>Eimeria. bateri</em></td>
<td>21</td>
</tr>
<tr>
<td>3.5</td>
<td>Types of infection</td>
<td>24</td>
</tr>
</tbody>
</table>

**Chapter Four : Discussion**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Discussion</td>
<td>29</td>
</tr>
<tr>
<td>Conclusion</td>
<td>31</td>
</tr>
<tr>
<td>Recommendation</td>
<td>32</td>
</tr>
<tr>
<td>Reference</td>
<td>33</td>
</tr>
</tbody>
</table>
### LIST OF TABLES

<table>
<thead>
<tr>
<th>NO</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Distribution of samples according to location, sex and age</td>
<td>15</td>
</tr>
<tr>
<td>3.1</td>
<td>Number of birds showing clinical sign</td>
<td>16</td>
</tr>
<tr>
<td>3.2</td>
<td>Distribution of postmortem lesions in examined birds</td>
<td>19</td>
</tr>
<tr>
<td>3.3</td>
<td>Number of positive and negative samples</td>
<td>20</td>
</tr>
<tr>
<td>3.4</td>
<td>Distribution of Eimeria species according to site of infection</td>
<td>23</td>
</tr>
<tr>
<td>3.5</td>
<td>Type of Eimeria infection in different sample</td>
<td>26</td>
</tr>
</tbody>
</table>
## List of Figures

<table>
<thead>
<tr>
<th>Fig No</th>
<th>Title of figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>life cycle of coccidai</td>
<td>5</td>
</tr>
<tr>
<td>1.2</td>
<td>E.Tsunoda</td>
<td>6</td>
</tr>
<tr>
<td>1.3</td>
<td>E.uzur</td>
<td>7</td>
</tr>
<tr>
<td>1.4</td>
<td>Eimeria bateri</td>
<td>7</td>
</tr>
<tr>
<td>3.1</td>
<td>Distended ceca and congested duodenum</td>
<td>18</td>
</tr>
<tr>
<td>3.2</td>
<td>E. tsunodai oocyst found in cecum</td>
<td>22</td>
</tr>
<tr>
<td>3.3</td>
<td>E.bateri found in large intestine</td>
<td>25</td>
</tr>
<tr>
<td>3.4</td>
<td>E. uzura oocyst found in duodenum</td>
<td>27</td>
</tr>
<tr>
<td>3.5</td>
<td>E.bateri found in large intestine</td>
<td>28</td>
</tr>
</tbody>
</table>
Abstract

This investigation was made to determine the coccidial infection in Quails reared on different farms in Khartoum state. In this study, 100 samples of Quails were processed by clinical, post-mortem and microscopic examination during the period from February to May 2017. Samples were collected from three farms in Khartoum state. Results revealed that 20 samples of Quails were positive. High infection was found in females and young birds. The higher infection rate and intensity was recorded in the small intestine. Microscopic examination showed the presence of three types of Eimeria (E. tsunodai, E. uzura, E. bateri). Clinical examination showed ruffled feathers, diarrhea, macroscopic lesion of infected birds revealed hemorrhage in intestinal mucosa, gases in cecal tonsils, enlargement, and congestion of the duodenum.
الملخص

تم إجراء هذه الدراسة لمعرفة اصابات طيور السمان بمرض الكوكسيديا المأخوذة من مختلف مزارع ولاية الخرطوم. تم اخذ 100 عينة من طيور السمان الحيّة في الفترة من فبراير إلى مايو 2017 من ثلاث مزارع بولاية الخرطوم. تم فحص العينات بواسطة الفحص الخارجي والتشريحة كما تم تحديد وجود 20 عينة إيجابية.

كانت أعلى نسبة اصابات قد سجلت في الاناث والطيور الصغيرة. كما اظهرت النتائج وجود ثلاثة انواع من الاميريا (E.tsunodai, E.uzura , E.bateri) كما اظهرت الطيور المصابة اعراض نفث في الريش، اسهالات ونزيف الغشاء المخاطي للامعاء وغازات في لوزتي الاعور بالإضافة الى تضخم واحتقان في الاثنين عشر.
**Introduction**

The Quail was belong to the family phasianidae that inhabits woodland and forest areas around the world. More than 15 different species were identified, each species being found in different parts of the world and all have slightly different appearances depending on how they have adapted to their environment. Quails range in size depending on the species from the Japanese quail which is around 10cm, tall to the larger mountain quail that can grow up to 25 cm tall. Quails do not tend to migrate and therefore spend their life's within the same area. In some parts of the world, Quails are kept as poultry birds for the small amount of meat that they contain and for the quail's brightly coloured eggs.

Quails are characterized by fast body weight gains and short rearing period until egg production (6-7 weeks) (sokol et al., 2014). They are able to mate normally at 2 month old. Quails tend to breed in more open areas such as farmland and lay their eggs in nests. The number of eggs vary between one and 12 eggs depending on the species of Quails, The baby quail hatch out of their eggs in less than a month. Although quails are omnivorous birds, they tend to have a primarily vegetarian diet eating seeds, wheat, barley, flowers and fruits but they will also eat insects such as worms and grasshoppers.

Humans domesticated Quail for its meat and egg production. The most common domesticated breed is the *Coturnix* quail (also known as the Japanese quail), due to their large size. This breed contains more meat and produces more eggs than the others. Button quails (also known as King Quail, Chinese-Painted Quail and Blue-Breasted quail) are rarely kept for food production because they are smaller and produce fewer eggs. Although they are kept in large aviaries to clean the leftover seeds that fall to the floor. Other type of Quails such as California, Gambel, Bobwhite, Scaled quails, etc. are less common and are rarely kept as pets. Coccidiosis is one of the
major intestinal parasitic disease that has the greatest economic losses. Several Eimeria species were described from different species of quails in different countries such as E coturnicis, E uzura, E Tsunodia, E Tahamensin, E Taldykuganica and E bateri (Roa, 1992, Teixeria et al., 2004, Amoudi, 1987, Tsutumi, 1972, Abdel Rahman et al., 2010). Infection is rare in birds younger than 1 month. The rate of infection up to 80% was detected in birds 7-9 weeks old while decrease to 21-4% in birds older than 10 weeks (Abdel_Rahman et al., 2010).

In Sudan chicken coccidiosis was intensively studied five species of Eimeria were identified in broiler and layer chickens (Mohammed et al., 1990, Ali et al., 1991 and Khaier et al., 2015). No available Information about Quail Coccidiosis in the country.

**Objective of this study is:**

- To investigate the coccidial infection in domesticated quails in Khartoum state.
- To determine the species of Eimeria that infectd the domesticated quails in Khartoum state.
- To increase the Knowledge of the quail coccidiosis.
Chapter one
Literature Review

1.1 Quail

The Quail is belong to Kingdom / Animalia Phylum/ Chordata Class/ Aves Order/ Galliformes Family/ Phasianidae Genus/ Coturnix . the family phasianidae that inhabits woodland and forest areas around the world. More than 15 different species were identified, each species being found in different parts of the world and all have slightly different appearances depending on how they have adapted to their environment. Quails range in size depending on the species from the Japanese quail which is around 10cm tall to the larger mountain quail that can grow up to 25 cm tall. Quails do not tend to migrate and therefore spend their lives within the same area. In some parts of the world, Quails are kept as poultry birds both for the small amount of meat that they contain and for the quail's brightly coloured eggs ,its characterized by fast body weight gains and short rearing period until egg production (6-7weeks ) (sokol et al ., 2014 ) . At 2month old they are then able to mate normally, Quails tend to breed in more open areas such as farmland and lay their eggs in nests. The number of eggs vary between one and 12 eggs depending on the species of Quails , the baby quail hatch out of their eggs in less than a month. Although quails are omnivorous birds, they tend to have a primarily vegetarian diet eating seeds, wheat, barley, flowers and fruits but they will also eat insects such as worms and grasshoppers. Humans domesticated Quail for its meat and egg production . The most common domesticated breed is the Coturnix quail (also known as the Japanese quail), Due to their large size. This breed contains more meat and produces more eggs than the others. Button quails (also known as King Quail, Chinese-Painted Quail and Blue-Breasted quail) are rarely kept for food production because they are smaller and produce fewer eggs. Although
They are kept in large aviaries to clean the leftover seeds that fall to the floor. Other type of Quails such as California, Gambel, Bobwhite, Scaled quails, etc. are less common and are rarely kept as pets. 

https://a-z-animals.com/animals/quail/.

1.1 Quail disease

Free living quail serve as hosts to a large number of protozoan, helminth, and arthropod parasite, none of which are considered to be significant causes of disease in wild quail. It is beyond the scope of this article to cover these organisms (Bennett, 1982).

1.2 Coccidiosis

It is one of the major parasitic disease, several Eimeria spp were described from different species of quails in different countries such as E.coturnicis, E.uzura and E.bateri in India (Rao and sharma, 1992). E.uzura and E.Tsunodia in Japan (Teixeria et al, 2004) E.Taha mensin from Arabian quail in Sudia Arabia (Amoudi, 1987). From Japanese quail all over the world including E.uzuria, E.bateri and E.Taldy kuganica in small intestine and E.Tsunodia in the caecum (Tsutsumi, 1972, Bashtar et al, 2010). Infection is rare in birds younger than 1 month. Infection rate up to 80% was detected in birds 7-9 weeks old while decrease to 21-4% in birds older than 10 weeks (Abdel_Rahman et al, 2010).

1.2.1 Life cycle

The life cycle of coccidai is similar in all species and contain two stages sexual and Asexual. Stage of life cycle in diagram No (1)
1.2.2 *Eimeria* species:

Descriptions of *Eimeria* date from the beginning of the last century, and ever since means for an appropriate characterization and identification of the species have been discussed. Several parameters can be used emphasized and encouraged precision in the description of species, and established basic characteristics for an appropriate description of the oocysts. However, Some *Eimeria* species with similar morphology were initially excluded because of the differences in the size of the oocysts. The measurements, in the beginning of the investigation, the measurements allowed distinguishing from closely related species. Initially, *E. coturnicis*, *E. tahamensis* (Amoudi, 1987) and *E. fluminensis* (Teixeira & Lopes, 2004).
1.2.2.1 *A. Eimeria tsunodai*

Sporulated oocysts were ovoid. Oocyst wall was smooth, double layered, with brownish inner layer and colorless outer layer. Despite usually only one polar granule was present. Micropyle (Minute opening believed to exist in the investing membrane of certain oocyte) and residual body of the oocyst were absent. The sporocysts varied from ovoid to ellipsoid. They had a finer end where a small and fainted Stieda body projected. The residual body (a cytoplasmic vacuole (lysosome) containing accumulated particulate products of metabolism, for example, lipofuscin) of the sporocyst was present and dispersed among the sporozoites, which were in pairs with globules visible at the enlarged extremity. Teixeira and lopes.,2004) (Harith et al.,2014).

![](image)

Figure (1.2): E.Tsunoda

1.2.2.2 *Eimeria uzura*

Sporulated oocysts were ovoid. Oocyst wall was smooth, double layered, with brownish inner layer and colorless outer layer. Two to five polar granules were observed in the oocysts, sometimes with a massive aspect, but not refractive). The micropyle and residual body of the oocysts were absent. The sporocysts were ovoid with a finer end, where a piriform Stieda body projected. The residual body of the sporocysts was present and had concentric granules between the sporozoites, which had refractive globules at the enlarged extremity. Teixeira and lopes.,2004), (Harith et al.,2014).
1.2.2.3 *Eimeria bateri*

Sporulated oocysts were subspherical, ovoid or ellipsoid. Oocyst wall was smooth, double layered, with brownish inner layer and colorless outer layer. A single and refractive polar granule was present, but micropyle and the residual body of the oocyst were absent. Sporocysts were ovoid and measured with a prominent knob-like Stieda body. The residual body of the sporocyst was dispersed among the sporozoites, which had refractive globules at the enlarged extremity (Teixeira and Lopes, 2004).

1.2.3 Transmission

Coccidiosis is transmitted by direct or indirect contact with droppings of infected birds. When a quail ingests oocyst, the organisms invade the lining of the intestine and produce tissue damage as they undergo reproduction. Within a week after infection, the coccidia shed immature descendants that are referred to as oocysts. The oocysts shed in the droppings are not capable
of infecting another bird unless they pass through a maturation process (sporulation) in the litter. This sporulation occurs within a one to three day period if the litter is warm and damp but can take much longer if the conditions are cool and dry. After sporulation the coccidia are infective if consumed by a new host bird.

The number of infective coccidia consumed by the host is a primary factor as to the severity of the resulting infection. An infection may be mild enough to go unnoticed while a large infective dose of coccidia may produce severe lesions that can cause death. Coccidia survive for long periods outside the bird’s body. They are easily transmitted from one house to another on contaminated boots, clothing, free-flying birds, equipment, feed sacks, insects and rodents.

http://www.howtoraisequail.com/coccidiosis-can-infect-quail.html

1.2.4 Clinical sign
Most cases of coccidiosis in growing quail are characterized by low mortality, slow growth, and poor feed utilization (higher feed conversions). Young quail are more severely affected than older ones. Egg production is decreased when adult quail contract coccidiosis, but weight is unaffected. (Tsutsumi Y., 1972).

1.2.5 Necropsy finding:
Thickening in the intestinal mucosa, hemorrhage in the cecum and softening feaces this reported by (Mohammad.,2012). Congested intestine and filled by brownish color reported by (Anbarasi.,2014).

1.2.6 Diagnosis
Clinical examination, Microscopic examination for intestinal scraping, or fecal samples collected from infected birds, flotation technique and sporulation (Teixeira et al., 2004) flotation and direct smear (Mohammad et al., 2012) direct smear (Harith et al., 2014). Flotation (p_anharasi et al., 2015).
1.2.6.1 Differential diagnosis

Ulcerative enteritis (clostridium colinum).

1.2.7 Treatment

Different drugs were used for treatment and prevention of coccidiosis. This medicine was applied in water by oral route such as Amprolium and Toltrazuril (Baycox).


1.2.8 Prevention

Prevent of coccidiosis by sanitation alone is not adequate. It is best prevented by addition of a drug (coccidiostat) to the feed that controls the growth of coccidia in the digestive tract. Many coccidiostats are available commercially. Coccidiostats should not be indiscriminately used and recommendations must be followed precisely.

A coccidiosis vaccines is now available for chicken. The product is useful only in certain types of poultry operations and must be used as recommended.

http://www.howtoraisequail.com/coccidiosis-can-infect-quail.html

1.3 Other quail disease

Quail are generally quite hardy little birds and don’t get sick often if kept properly. Belong to the bacterial disease. There are two forms of quail disease. The first form is highly chronic and a mortality rate of 100% is observed among the infected birds. The major symptom is diarrhea, with white colored feces. The second form of quail disease prevails for a longer period of time. Loss of appetite is the major symptom. Birds affected with this disease will die within 6 to 10 months due to gradual weight loss.

1.3.1. Bacterial diseases of quail:
Occur as (A) septicemia (fowl cholera,( Hinshaw WR.,1943) Panigrahy B.,1982) salmonellosis, 4 erysipelas, (Panigrahy B.,1977) staphylococcosis, (Shane ..,1985) streptococcosis, pseudotuberculosis, Proteus infection,( Sah RL, 1983) Pasteurella anatipestifer infection Vallee A.,1973);(B) enteritis (quail disease, Panigrahy B.,1977); (C) omphalitis (salmonelloses- pullorum, fowl typhoid, and paratyphoid); (D) sinusitis
Environment and management are also important contributors to primary bacterial diseases. Introduction of the diseases into a flock often occurs following lapses in recognized good management procedures.( Zander ..,1984).

1.3.1.1 Ulcerative Enteritis
Also known as quail disease although the disease occurs in other avian species, is a widespread, common, and significant disease of quail, especially bobwhite. It is caused by Clostridium colinum or, less commonly, by C. perfringens.( Itoh H.,1985) Clinical course of the disease in a flock and signs in acutely affected individual birds are similar to those described for the septicemic diseases . Chronically affected birds show weight loss and have an unthrifty appearance. Mortality may approach 100 per cent in young quail .

1.3.1.2 Infectious coryza
This is a bacterial infection that is mainly spread to Quail from Chickens. Its caused by Haemophilus paragallinarum Quail with infectious coryza also experience conjunctivitis and keratitis. Air sacculi tis occurs in quail infected with M. gallisepticum( Reece ., 1981)

1.3.1.3 Nonspecific omphalitis
Is a major cause of early quail mortality,( Arora 1979, Serafin 1982 , Shane 1985) .Gram-negative bacteria such as Proteus,Pseudomonas, and Escherichia coli are typically recovered when affected chicks are cultured. Gram-positive bacteria, especially Streptococcus and Staphylococcus, can
also be found in some cases but are less common. Reduced hatchability and weak chicks are often associated with omphalitis.

1.3.1.4 Staphylococcus and *E. coli*

Are most frequently isolated from quail with cellulitis and abscesses. These infections follow injuries. Reduce picking, accidents, and injuries and providing a clean, sanitary environment will aid in the reduction and prevention of these lesions. (Shane.,1985)

1.3.2 Viral disease

1.3.2.1 Quail Bronchitis

This is a disease of Bobwhites only. Japanese Quail are resistant as are most other species of Quail. Symptoms include rattles while breathing and coughing. There can also be conjunctivitis, (inflammation of the eye). This is mainly transmitted through wild birds. So keep the wild birds out of your aviaries. There is no treatment for this disease.


1.3.2.2 Pox in quail

Is a serious disease that may result in very high mortality . (Shane 1985) Losses as high as 90 per cent have occurred in bobwhite flocks in the south east United States. The disease is seasonal, being most prevalent during the warmer periods of the year when ornithophilic biting arthropods are most numerous ( Shane 1985).

1.4 Mycotic Diseases

Quail are susceptible to the common mycotic diseases that affect poultry, including crop mycosis, *Aspergillosis*, and *Dactylariosis*. Young birds under 4 weeks of age are most commonly affected with diseases in this group. Mortality is more common in outbreaks of *Aspergillosis* and Dactylariosis; Unthriftness and poor growth with occasional mortality occur in flocks with crop mycosis.(Olson ,1969) .
1.4.1 Aspergillosis

Can involve the brain, lungs, trachea, air sacs, or eyes. The disease follows exposure and inhalation of high numbers of infective spores. Often this occurs in the incubator or Hatcher from fungal growth in contaminated eggs or on residual debris in the warm, moist environment, or during early brooding when chicks are placed on previously wet litter containing high numbers of spores. Incubating dirty or cracked eggs containing *aspergillus* growth is a prime source for hatchery contamination. Problems such as stress during brood concurrent infections increase the like life hood of aspergillosis. (Olson, 1969).
CHAPTER TWO
Materials and Methods

2.1. Study area
Three farms located in Western area Gobra, Northen area ALhalfaia and South area Kalakla in Khartoum state were investigated. Samples were collected according to The farmer willing, during the period from February to May 2017.

2.2. Number and Type of samples:
One hundred live quails with different age and species were collected including 71 males and 29 females table (1). Samples were processed in department of Avain pathology and diagnosis Central Veterinary Research Laboratory

2.3 Clinical examination of live birds
Birds were examined clinically for general body condition, external parasite, skin dehydration, nasal and lachrymal discharge, ruffled feather, wings paralysis and diarrhea. any symptoms were further recorded.

2.4 Post mortem examination
2.4.1. Equipment for Postmortem
All equipments such as Scissors; knifes forceps, gloves, containers. used in postmortem examination were washed with soap and water then Sterilized by hot air oven in 160 °C for 1 1/2 hour.

2.4.2. Postmortem Technique
After euthanasia for the birds, carcasses were damped in a disinfectant Solution to limit the dispersion of infected dust and feathers .Birds were laid on its back with feed towards the operator . Skin over the abdomen was removed, Breast and thigh muscles were carefully examined. Abdominal muscles, ribs and coracoids bone were cut and removed from the chest to expose the internal organs and the chest cavity. Liver, lung, heart and air sac were also examined. Respiratory system, trachea and bronchi, lungs and air
sacs were also examined for any changes. Finally gastrointestinal tract were separated and removed by cutting between the oesophagus and the proventriculus down to the cloaca. Proventriculus and gizzard are cut open to detect the presence of feed and any submucosal haemorrhage. Necropsy was concluded with the examination of the mucosal surfaces of the oesophagus, crop, and intestine with special focus to lymphatic tissue such as peyers patches and cecal tonsils (haemorrhage, thickening or any other abnormalities were recorded). Spleen, kidney, brain and ovary and/or testes were also examined.

2.4.3 Microscopic examination

2.4.3.1 Preparation of Wet smear
Intestines were open with sterile scissors and forceps scraping from inside layer of the intestine were placed in a clean glass slide. wet smear were prepared by adding drop of sterile distilled water then covered with cover slip.

2.4.3.2 Examination of wet smear
The wet smear were examined under the microscope (lens 40). To identify the oocyst of Emiria species.
Table (2.1) Distribution of samples according to location, sex and age

<table>
<thead>
<tr>
<th>Location</th>
<th>Adult</th>
<th></th>
<th>Young</th>
<th></th>
<th>Total number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
<td></td>
</tr>
<tr>
<td>Gobra</td>
<td>13</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>Kalakla</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Al halfaia</td>
<td>40</td>
<td>11</td>
<td>11</td>
<td>12</td>
<td>74</td>
</tr>
<tr>
<td>Total number</td>
<td>54</td>
<td>13</td>
<td>16</td>
<td>17</td>
<td>100</td>
</tr>
</tbody>
</table>
CHAPTER THREE

Result

3.1 Samples positive to Emirea species

In the current study and according to morphology of the oocyst and pathological characteristics of infection twenty samples were found positive for Eimeria spp including 8 females, 12 males. Female had a highly infection rate as 28% of the female examined were found positive while only 17% of male were positive table (3.1).

Table (3.1) Distribution of positive samples

<table>
<thead>
<tr>
<th>Sex</th>
<th>Positive(%)</th>
<th>Negative(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male (n=71)</td>
<td>12 (17%)</td>
<td>59 (83%)</td>
</tr>
<tr>
<td>Female (n=29)</td>
<td>8 (28%)</td>
<td>21 (72%)</td>
</tr>
<tr>
<td>T N (n=100)</td>
<td>20 (20%)</td>
<td>80 (80%)</td>
</tr>
</tbody>
</table>
3.2 Clinical signs
Total of 14 Quails showed clinical signs, including ruffled feather and dullness were the predominant signs observed, in addition nervous sign, drop in wings, diarrhea, dehydration and emaciation were also seen (3.2).

3.3 Postmortem lesions
During Postmortem examination 62 birds showed lesions, The most obvious lesions seen in most of birds examined were distended ceca with gases and congested duodenum Fig (3.1) which is detected in 26 and 11 birds respectively (3.3).
Fig (3.1): Distended ceca and congested duodenum
Table (3.2) Number of birds showing Clinical signs

<table>
<thead>
<tr>
<th>Clinical signs</th>
<th>No of quails sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nervous sign</td>
<td>3</td>
</tr>
<tr>
<td>Drop in wings</td>
<td>2</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>1</td>
</tr>
<tr>
<td>Dehydration</td>
<td>1</td>
</tr>
<tr>
<td>Emaciation</td>
<td>0</td>
</tr>
<tr>
<td>Ruffled feather</td>
<td>4</td>
</tr>
<tr>
<td>Dullness</td>
<td>3</td>
</tr>
</tbody>
</table>
Table (3.3): Distribution of postmortem lesions in examined birds.

<table>
<thead>
<tr>
<th>post mortem lesion</th>
<th>No of birds</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congested duodenum</td>
<td>11</td>
<td>18%</td>
</tr>
<tr>
<td>Fragile liver</td>
<td>9</td>
<td>15%</td>
</tr>
<tr>
<td>Intestinal gases</td>
<td>9</td>
<td>15%</td>
</tr>
<tr>
<td>Haemorrhagic enteritis</td>
<td>7</td>
<td>11%</td>
</tr>
<tr>
<td>distended Cecal with gases</td>
<td>26</td>
<td>41%</td>
</tr>
<tr>
<td>Total number</td>
<td>62</td>
<td>100%</td>
</tr>
</tbody>
</table>
3.4 Detection of coccidian oocyst

Three different Eimeria species were detected namely *E. tsunodai*, *E. bateri*, *E. uzura* in both male and female samples.

3.4.1 Distribution of Eimeria species

3.4.1.1 *E. tsunodai*

It was detected in 7 samples which found only in ceca. *E. tsunodai* has an ovoid sporulated oocyst, with a smooth double layer, no polar granule. Fig(1).

3.4.1.2 *E. uzura*

was found in the duodenum of 6 samples. It has an ovoid, double layer wall the inner one is brownish and the outer was colorless, two to five polar granule were present Fig(2).

3.4.1.3 *E. bateri*

It was seen in 8 samples. It has an ovoid or ellipsoid shape, single and refractive polar granule were present. It was found in duodenum and large intestine Fig (3.2).

Regarding the site of Infection in the digestive system of the birds examined, small intestine showed higher rate table (3.4).
Fig (3.2): *E. tsunodai* oocyst found in cecum
Table (3.4) Distribution of *Eimeria* species according to site of infection

<table>
<thead>
<tr>
<th>species</th>
<th>positive sample</th>
<th>Site of infection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Duodenum</td>
</tr>
<tr>
<td><em>E. tsunodai</em></td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td><em>E. uruza</em></td>
<td>6</td>
<td>+</td>
</tr>
<tr>
<td><em>E. bateri</em></td>
<td>8</td>
<td>+</td>
</tr>
</tbody>
</table>
3.5 Types of infection

Results showed that three types of infection were detected in the positive birds. Three samples were infected with single type of *Eimeria* species while 16 birds were infected with two type of *Eimeria* species while only one sample showed the presence of the 3 species recovered during this study table (3.5).
(3.3) *E. bateri* found in large intestine
Table (3.5) Type of Eimeria infection in different samples

<table>
<thead>
<tr>
<th>Type of infection</th>
<th>No of +ve birds</th>
<th>Rate of infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>3</td>
<td>15%</td>
</tr>
<tr>
<td>Double</td>
<td>16</td>
<td>80%</td>
</tr>
<tr>
<td>Mixed</td>
<td>1</td>
<td>5%</td>
</tr>
</tbody>
</table>
Fig (3.4) *E. uzura* oocyst found in duodenum
Fig (3.5) *E. bateri* found in large intestine
Quails considered a branch of the modern poultry industry in Sudan. Several Eimeria spp are highly pathogenic to their host causing great economic losses in quail breeding and limiting development of this industry (Mohmmed, 2012). For diagnosis of quail coccidiosis, detection of oocyst is used as the most easily accessible stage in many coccidians species (Mehlhorn, 2008). The current study described the presence of coccidiosis in quail by morphological characteristic of the eimeria oocyst and pathological lesions of infection. Quails were examined clinically and by intestinal scraping collected from mucosal surface of small and large intestine, results revealed that 20 samples were infected with Eimeria spp. During this study infection rate was 20% which is lower than result reported previously (78%) by Harith et al (2014), However nearly similar infection rate (29%) was recorded by Bashtar et al (2010).

In the current study only three cases were found infected with single Eimeria species namely E. tsunodai this was online with (Mehlhorn 2008) Infection with single eimeria species is rare. However double and mixed type of infection were observed in 17 birds this result is agreed with (Mohammed, 2012).

Results showed that females had highly infection rate compare to male this is disagree with Hairth et al (2014) who reported that male was more susceptible to the disease. on the other hand young birds was found more susceptible than older ones; this result is agreed with Anbarasi et al (2014).this may be due to development of immunity in grown up quails. Quails are found to be affected by subclinical form of coccidiosis this was confirmed by (Texieira and lopes, 2004). Necropsy finding show congested
intestine and filled with brownish contents this finding reported by (Abarasi.,2014)

Three eimeria species were found in this study with different rate this agreed with Mohmmed et al (2012), Teixeira.,( 2004), Bashtar.,(2010). other species which is not detected during this study was E.fluminensis reported by Harith et al (2014) E.bateri had high infection rate while E.uruza is low which similar to Harith et al (2010) . On the other hand presence of E. bateri disagree with Mohammad.,(2014) .

Coccdiosis in quails remains to a significant problem because coccidian are resistance to popular antiprotozoal drugs agent and the chronic form of disease had economic impact (Anbarasi et al 2014).

The difference in the percentage of infection in many studies may be related to different factors such as, environmental conditions, type of anticoccidial drugs may have contributed to this difference (Nematollahi A,2008) .
Conclusion

This study indicated the presence of coccidiosis in quail farms in Khartoum state. Three species were found. Crowdedness and poor management in farms lead to subclinical infection in adults which spread the infection to young through contaminated food. The diagnosis of coccidiosis in early stage help in control of disease. Proper diagnosis, vaccination, antiprotozoal drugs and good management and knowledge of the diseases may decrease the infection.
**Recommendation**

1. Good management and sanitation (cleaning, disinfecting, avoid the humidity and crowdedness).

2. Farmer must be aware about quail diseases specially coccidiosis to decrease economic losses and control of the diseases.

3. Proper application of Biosecurity measures and avoid rearing of chicken and quail in the same vicinity.
REFERENCES

- Amoudi MA Eimeria Taha mensis nsp. (Apicomplexa Eimeriidea) from
  34: 455-456.

- Ali SF, Abdalla HS , Osman AY , Salim Al. Survey of Eimeria species
  in poultry in Khartoum province . The Sudan journal of Veterinary
  Research (1991);10:44-45.

  Ministry of Agriculture, Fisheries and Food (MAFF).. Her Majesty

- Awaad MHH, Hafez HM, El-Dimerdash MZ, et al!: Some
  epidemiological aspects of Salmonella gallinarum infection in
  Japanese quail (Coturnix coturnixjaponica). Zentrablatt Fur Vetmed
  B(1981); 28:704-712.

- Arora KL Blood sampling and intravenous injections in Japanese quail

- Bashtar, A.R.;Abdel-Ghaffar, F.; Al-Rasheid, K.A.; Mehlhorn, H. and
  Al Nasr, I.. Light microscopic study on Eimeria species infecting
  107(2):409-416.

- Bennett GF, Whiteway M, Woodworth-Lynas CB: A Host-Parasite

  (Coturnix coturnix Japonica)--A flock survey and experimental
  transmission of selected avian pathogens. Avian Dis (1965) 9:212-219,

- Chew-Lin M: Adult coturnix quail bronchitis. Avian Dis (1980) 24:520-
  526.
- https://a-z-animals.com/animals/quail/
- Itoh H: Ulcerative enteritis in Japanese quails (Coturnix coturnix japonica) with Clostridium perfringens type A. J Jpn Vet Med Assoc (1985) 38:301-305,
- Olson LD:


