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Declaration

I Moaaz Mohammed Elbashir hereby declare that the work entitled Prevalence of hydatid cyst in slaughtered livestock in Al Ain City Public Abattoir is my original work. I have not copied from any other work or from any other sources except where due reference or acknowledgement is made explicitly in the text, nor has any part been written for me by another person.

ABSTRACT

Hydatidosis is one of the most world widespread zoonoses causing morbidity and mortality in human and economic losses in livestock. The disease is caused by adult or larval (metacestode) stages of cestodes belonging to the genus Echinococcus and the family Taeniida. The metacestodes cause the formation of hydatid cysts in various organs of the intermediate host particularly liver, lung and kidney. The study was designed to determine the prevalence of Hydatid Cyst in slaughtered livestock in Al Ain City Public Abattoir (United Arab Emirates) and to compare the difference in its distribution in different species and its location in animal body. The research also aim to study the prevalence of hydatid cyst of slaughtered sheep and goats based on the origin of animals. A two month cross-sectional study was conducted from 1st January 2015 to 28th February 2015. All slaughtered animals during the two months were examined for the presence of hydatid cysts during post mortem inspection. A total of 29148 slaughtered animals comprising (14509 sheep, 11899 goats, 645 cattle and 2095 camels). During daily ante-mortem inspection the species of all the animals presented for slaughter were recorded as well as the country of origin of the sheep and goats. Detection of hydatid cysts was made during the post-mortem inspection. Different visceral organs including liver, lungs, kidneys, heart and spleen were systematically inspected and the anatomical distribution of the cysts in the carcass was recorded. Cysts were detected by the naked eye and palpation. The overall prevalence rate of hydatid cyst among the inspected livestock at Al Ain Public Abattoir was 0.57% of which sheep; goats, cattle and camels have the prevalence of 0.53%, 0.39%, 0% and 2.1% respectively. The liver was the most commonly infected organ. There were no cysts observed on the heart. For sheep and goats based on origin of animals the frequency of hydatid cyst was higher in imported breeds compared to the local breeds. The frequency of hydatid cyst was obviously higher in camels compared to other species. Effective meat inspection and proper disposal of condemned parts and slaughter waste, as well as strict control of stray dogs is strongly recommended to interrupt the life cycle of the parasite.
نسبة انتشار داء الأكياس المائية في المواشي المذبوحة بمسلخ الأهلية بمدينة العين دولة الإمارات العربية المتحدة - (2015)

خلاصة البحث

يعتبر مرض الأكياس المائية من أكثر الأمراض المشتركة انتشاراً بالعالم. مسبباتها خسائر اقتصادية على نطاق الثروة الحيوانية كما يحدث إصابة للإنسان قد ينتج عنها وفاة. بسبب المرض دودة شريطية أو الطور البرقيلي للدودة التي تتنمي في جسم المكروبات المشوكة وضمن عائلة الشريطيات. يتكون الطور البرقيلي (الأكياس المائية) في أعضاء العائل الوسيط كالكبد والرئتين والكليتين والقلب. مكتملت الدراسة لمزيد من نسبة انتشار الأكياس المائية في الماشية المذبوحة بمسلخ الأهلية بمدينة العين (دولة الإمارات العربية المتحدة). ومقارنة توزيع الإصابة بالمرض بين أنواع الماشية المختلفة ومقارنة توزيع الطيفي في أعضاء الذيبنج مسلخ الأهلية بمدينة العين. كما عتم الدراسة بتحديد نسبة انتشار مرض الأكياس المائية بالنسبة للخاف والراع.

استندتا على مصدرها. تم عمل دراسة مقطعية لكل المواشي المذبوحة بمسلخ الأهلية بمدينة العين في الفترة ما بين الأول من يناير 2015 إلى نهاية شهر فبراير 2015. كان عدد المواشي المذبوحة التي تم فحصها 8032 رأس من الماشية على النحو التالي: 19148 رأس من الخراف و9289 رأس من الماعز و645 رأس من الأبقار و925 رأس من الجمال. أثناء الكشف الحي تم تسجيل ورصد أنواع الحيوانات المذبوحة. وبالنسبة للماعز والأبقار تم أيضاً تسجيل ورصد مصدر الحيوانات. حددت الإصابة بالأكياس المائية من خلال كشف مثلث الذيبنج باستخدام الفحص العيوني مع الجس باليد للكشف عن أفات الأكياس المائية في الأعضاء المختلفة كالكبد والرئتين والكليتين والعضلات. كما تم تسجيل موضع الأكياس المائية التشريحي بالعظام الذيبنج المختلفة المصاحبة. وقد زادت الدراسة إن نسبة انتشار الإصابة بالأكياس المائية بين كل النبيج 57% و نسبة الإصابة بالقصص حسب نوع الحيوان كانت 0.53% و 0.03% و 0.01% و 0.02% للخاف والداعم والأبقار والخامخ على التوالي. أعلى نسبة انتشار الإصابة وجدت بالكبد. ولم ترصد أي إصابة بالقلب. بالنسبة للخاف والراع استندتا على مصدر الحيوان كانت نسبة انتشار الإصابة بين الحيوانات المستودرة أكبر مقارنة بالفصائل المحلية. ومن أهم توصيات الدراسة الاهتمام بالفحص البصري الفعال على الحيوانات المذبوحة والتخلص الأم لجوزاء الذبائح المعدودة ومخلفات الذبيح ومحاربة الذبيح خارج المسالخ والسيطرة على الكباب السائبة ومع وصولها إلى مخلفات الذبيح والحيوانات الناقفة لكسر حلقة دورة حياة الطفيلي ومنع انتشار المرض.
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**ABREVIATIONS**

**WHO**  
World Health Organization.

**OIE**  
Office International des Epizooties.(World Organization for Animals health)

**FAO**  
Food and Agriculture Organization.

**CE**  
Cystic Echinococcosis.

**AE**  
Alveolar Echinococcosis.

**PE**  
Polycystic Echinococoosis.

**CDC**  
Centers for Disease Control and Prevention.

**X-ray**  
Radiography.

**s.p, spp.**  
Species

**US**  
Ultrasound

**n or N**  
number

**CT**  
Computed Tomography

**MRI**  
Magnetic Resonance Imaging Scan
CHAPTER ONE
INTRODUCTION

1.1. General introduction

Echinococcosis often referred to as hydatid disease, hydatidosis, or echinococcal disease, is a parasitic zoonotic disease caused by adult or larval (metacestode) stages of cestodes belonging to the genus Echinococcus and the family Taeniidae. Echinococcus has four species, *Echinococcus granulosus*, *E. multilocularis*, *E. oligarthrus* and *E. vogeli* Echinococcus (Soulsby, 1982).

1.2. The adult tapeworm Echinococcus:

The adult tapeworm ranges in length from 2 mm to 7 mm and usually have no more than six segments, Like all tapeworms, Echinococcus has no gut and all metabolic interchange takes place across the syncytial outer covering, the tegument. The adult Echinococcus has a specialized attachment organ, the scolex, which has four muscular suckers and two rows of hooks, one large and one small, on the rostellum. The body of the tapeworm, called strobila, is segmented and consists of a number of reproductive units (proglottids), which may vary in number from two to six. The adult worm is hermaphrodite with reproductive ducts opening at a common, lateral, genital pore, there is a prominent cirrus sac, which may be horizontal or tilted anteriorly and the vitellarium is globular. The uterus dilates after fertilization, eventually occupying most of the terminal segment when the eggs are fully developed. The eggs are ovoid (30 µm-40 µm diameter), consisting of a hexacanth embryo oncosphere which is the first larval stage surrounded by several envelopes, the most noticeable one being the highly resistant keratinized embryophore, which gives the egg a dark striated appearance. The outer capsule quickly disappears once the eggs are liberated from the host. The eggs of Echinococcus are morphologically indistinguishable to those of other tapeworms of the genus Taenia. Metacestode. The metacestode which is the second larval stage basically consists of a bladder with an outer a cellular laminated layer and an inner nucleated germinal layer, which may give rise by asexual budding to brood capsules. Protoscoleces arise from the inner wall of the brood capsules. The
structure and development of the metacestode differs between the four species of Echinococcus (WHO/OIE, 2001)

1.3. The life cycle of *Echinococcus* spp:

The life cycle of *Echinococcus* spp require two mammalian hosts to complete of their life-cycles. The eggs or segments containing eggs (gravid proglottids) are passed in the faeces of the definitive host, mainly a carnivore. The eggs are highly resistant to environmental factors and can remain infective for many months or up to about 1 year in a moist environment at lower ranges of temperatures. The eggs may be subsequently ingested by the intermediate host, which are herbivorous such as sheep, cattle, and goats, camels, pigs, and horses. In the stomach of the intermediate host due to the action of enzymes the egg hatches and releases an oncosphere, then the oncosphere penetrates the intestinal wall and migrates through the circulatory system and transported to the liver, where some are retained. Others reach the lungs, and a few may be transported further to the kidneys, spleen, muscles, brain or other organs. Once the oncosphere has reached its final location, it develops into the metacestode stage. Time of development is variable and it may take several months before protoscoleces are produced (fertile metacestode). There may be several thousand protoscoleces within a single cyst. The definitive host becomes infected by ingesting the cyst-containing organs of the infected intermediate host. After ingestion, the protoscolices evaginate, attach to the intestinal mucosa, and develop into adult stages; each protoscoleces can develop into adult worm, but some are sterile. Humans are accidental intermediate hosts and are not able to transmit the disease and become infected by ingesting tapeworm eggs passed from an infected carnivore. This occurs most frequently when individuals handle or contact infected dogs or other infected carnivores or inadvertently ingests food or drink contaminated with fecal material. (WHO/OIE, 2001)

1.4. Echinococcosis in humans:

Echinococcosis in human an infection which is caused by a larval stage, the metacestode, of Echinococcus species and may result in asymptomatic infection to severe disease; it may even be fatal. The metacestodes of all four recognized Echinococcus species can infect humans and cause various forms which are cystic
echinococcosis (CE), caused by *Echinococcus granulosus*, alveolar echinococcosis (AE), caused by *E. multilocularis*, and polycystic echinococcosis (PE), due to *E. vogeli* or *E. oligarthrus* containing tapeworm eggs. When human infection with *E. granulosus* predilection site are mainly the liver and lungs, and to lesser extend to the bones, kidneys, spleen, muscles, eye and central nervous system. The incubation period lasts many years and the clinical signs depend on the location of the cyst and the pressure exerted on the surrounding tissues. Alveolar echinococcosis has long asymptomatic incubation period characterized by tumor-like lesion usually located in the liver. The larva are spread through the blood and lymphatic system to other organs (e.g. the spleen, lung and brain) and if not treated can be fatal, (CDC, 2013)

The diagnosis can be through imaging techniques; mainly ultrasound (US) computed tomography (CT), magnetic resonance imaging scan (MRI), and immunodiagnostic tests. Treatment usually expensive by surgery and extensive prolonged drug therapy. (Zhang et al., 2012)

The highest prevalence is found in rural areas where older animals are slaughtered. *Echinococcus granulosus* occurs practically worldwide, and more frequently in rural, grazing areas where dogs ingest organs from infected animals. *Echinococcus multilocularis* occurs in the northern hemisphere, including central Europe and the northern parts of Europe, Asia, and North America. *Echinococcus vogeli* and *Echinococcus oligarthrus* occur in Central and South America. (CDC, 2013)

In endemic regions, human incidence rates for cystic echinococcosis can reach greater than 50 per 100 000 person-years, and prevalence levels as high as 5%–10% may occur in parts of Argentina, Peru, East Africa, Central Asia and China. In livestock, the prevalence of cystic echinococcosis found in slaughterhouses in hyper endemic areas of South America varies from 20%–95% of slaughtered animals (WHO, 2015)

Echinococcosis infection constitutes a significant financial constraint derived from human health costs and livestock production losses. The global burden of CE and AE has been calculated to be of approximately 1 million and 600,000 DALYs respectively (Torgerson et al., 2010)
In addition the economic burden of CE on the global livestock industry has been estimated at over $2 billion per annum (Budke *et al.*, 2006) despite the substantial socioeconomic impact, CE and AE remain to be classified as neglected zoonoses (Craig *et al.*, 2007).

1.2. Problem identification and justification

Inspection records of slaughtered animals have been used as useful source for evaluation of epidemiological aspect of several zoonotic diseases. Hydatid cyst cause severe disease and death in human and also result in an economic loss for treatment cost and condemnation of edible carcasses.

1.3. Objectives

1.3.1. General Objective

To determine the prevalence of Hydatid Cyst in Slaughtered livestock in Al Ain city Public Abattoir, UAE.

1.3.2. Specific Objectives

1. To determine the difference in prevalence rates of Hydatid cyst in different species slaughtered in Al Ain City Public Abattoir, UAE.

2. To assess the distribution of hydatid cysts in different organs of infected slaughtered livestock in Al Ain City Public Abattoir, UAE.

3. To determine the Prevalence of hydatid cyst of slaughtered sheep and goats in Al Ain City Public Abattoir based on the origin of animals.
CHAPTER TWO

LITERATURE REVIEW

2.1. Glossary of Terms

The reference of all terms (WHO/OIE, 2001)

**Accidental host**: Host which does not play a role in epidemiology and is a ‘blind end’ for the parasite.

**Carrier**: Host that is infected without displaying clinical symptoms and signs, and that can be a source of infection to other individuals.

**Control**: Active implementation of a program to limit the prevalence of a specific disease.

**Endemic occurrence**: Constant occurrence of a disease in a population.

**Epidemic occurrence**: Occurrence of a disease to a level in excess of the expected (i.e., endemic) level.

**Host**: A person or other living organism that can be infected by an infectious agent under natural conditions.

**Infection**: Infection is not synonymous with an infectious disease, but in this text, the term is used frequently to denote both an infection and a disease.

**Life-cycle**: Biological cycle of a parasite.

**Domestic cycle**: Cycle involves only domestic animals.

**Morbidity**: Proportion of diseased individuals in a population.

**Mortality**: Number of deaths due to a disease that occur in a population in a particular geographic area within a defined period.

**Prevalence**:

**Point prevalence**: Number of cases of an infection or related attributes in a population at one given time without distinction of old and new cases.

**Period prevalence**: Number of cases of an infection or related attributes in a population during a specified period of time without distinction of old and new cases.

**Sample**: Selected part of a population.
**Screen**: Procedure for identification of an unrecognized infection or disease or defect using tests or other procedures that can be applied to a population or a selected subset

**Zoonoses**: An infectious disease that is transmissible under normal conditions from animals to humans.

### 2.2. Etiology

There are four species of the genus *Echinococcus* recognized and regarded as taxonomically valid: *E. granulosus* (cystic hydatidosis), *E. multilocularis* (multivesicular hydatidosis) *E. vogeli* (polycystic hydatidosis) and *E. oligarthrus* (Soulsby, 1982).

These four species are morphologically distinct in both the adult and the larval stages. In addition, several different strains of *E. granulosus* and *E. multilocularis* are recognized (FAO, 1982). The development of strains may be a result of the fact that tapeworms are hermaphrodites, which reproduce themselves through cross- or self-fertilization. A single mutant can therefore produce large genetically identical populations that differ from the original genus. These populations are referred to as strains (McManus and Smyth, 1986). Only *E. granulosus* is the most widely distributed species throughout the world (FAO, 1982)

#### 2.3. *Echinococcus granulosus*

*Echinococcus granulosus* is transmitted between the domestic dog and a number of domestic livestock. The dog/sheep cycle is most important. Sylvatic definitive and intermediate hosts also occur. The larval stage is a fluid-filled bladder or hydatid cyst that is unilocular, with communicating chambers. It is expansive in growth, and daughter cysts may be produced. Individual bladders may reach up to 30 cm in diameter and frequently found in liver and lungs, but may develop in other internal organs. The infection with this stage is referred to as cystic echinococcosis. (OIE, 2008).
2.4. *Echinococcus multilocularis*

*Echinococcus multilocularis* cycle occur between wild definitive hosts and small rodents. Unlike *E. granulosus*, the larval mass often contains a semisolid rather than a fluid matrix. It proliferates by exogenous budding, which results in infiltration of tissues. Infection with this stage is commonly referred to as alveolar echinococcosis. There are no distinct strains or genotypes of *E. multilocularis*, though regional variations at the continental scale have been described (WHO/OIE, 2001).

2.5. *Echinococcus oligarthrus*

The transmission cycle of *E. oligarthrus* is between wild felids as definitive hosts and large rodents as intermediate hosts. The metacestode is polycystic and fluid-filled can be separate or with multi chamber. The single cyst may reach a diameter of 5 cm. Predilection sites of the cysts are internal organs and muscles. To date, a few reports of human hydatidosis have been reported. The parasite appears not to infect dogs. (OIE, 2008).

2.6. *Echinococcus vogeli*

The definitive host for *Echinococcus vogeli* is the South American bush dog. The domestic dog is also susceptible and the intermediate hosts are large rodents (e.g. Cuniculuspaca). The metacestode is similar to that of *E. oligarthrus*. The two species can be distinguished by comparing the dimensions and proportions of the rostellar hooks on the protoscolex. (OIE, 2008).

2.7. life-cycles

Echinococcus spp. require two mammalian hosts for completion of their life-cycles. Gravid proglottid containing eggs or free eggs are passed in the faeces of a carnivore the definitive host,. Then the eggs are ingested by an intermediate host, in which the metacestode and protoscoleces develop. Then the intermediate host in eaten by a suitable carnivore and the life cycle is completed. (WHO/OIE, 2001)

The adult tapeworm lives the small intestine of the definitive host, from which segments containing eggs are passed with the faeces. When ingested by the intermediate host, the eggs are immediately infective, releasing larvae that penetrate into the lymphatic or vascular system, reaching the liver or lungs and possibly other organs. The hydatid cyst develops slowly over several months, forming an outer
laminated membrane and an inner membrane called the germinal layer. From the germinal membrane brood capsules develop, each containing one or several invaginated heads (protoscolices) that can develop into the adult tapeworm upon ingestion by the definitive host (Soulsby, 1982)

2.7.1. Eggs of the parasite

The eggs are highly resistant to environmental factors and can remain infective for many months or up to about 1 year in a moist environment at lower ranges of temperatures (about +4°C to +15°C). Eggs of Echinococcus are sensitive to desiccation. At a relative humidity of 25%, eggs of E. granulosus were killed within 4 days and at 0% within 1 day. Heating to 60°C-80°C killed eggs of E. granulosus in less than 5 min. On the other hand, Echinococcus eggs can survive freezing temperatures (WHO/OIE, 2001).

2.7.2. Intermediate host

Wide range of mammals can act as an intermediate hosts, the intermediate host is infected by the ingestion of the parasite eggs. An Oncosphere is released from the keratinized embryophore by the action of enzymes in the stomach and small intestine. The oncosphere activated by the bile secretions, then penetrates the wall of the small intestine aided by the hook movements, and possibly by secretions, of the oncosphere. The oncosphere gaining access to a venule or lacteal, is then passively transported to the liver, where some are retained. Others reach the lungs, and a few may be transported further to the kidneys, spleen, muscles, brain or other organs of the intermediate host including human in which metacestodes of Echinococcus species develop. From the epidemiological aspects, it might be useful to differentiate between ‘intermediate hosts, which play a role in the cycle, and the aberrant or accidental hosts (WHO/OIE, 2001).
2.7.3. Metacestode stage

Once the oncosphere has reached its final location, it develops into the metacestode stage. Time of development is variable and it may take several months before protoscoleces are produced (fertile metacestode). There may be several thousand protoscoleces within a single cyst of *E. granulosus* or an aggregation of vesicles of *E. multilocularis*. Each single protoscolex is capable of developing into a sexually mature adult worm. Not all metacestodes produce protoscoleces (sterile metacestode). When protoscoleces are ingested by a suitable definitive host, following the action of pepsin in the stomach, they evaginate in the upper duodenum in response to a change in pH, exposure to bile and to increased temperature. They then develop to the sexually mature adult tapeworm, approximately four to six weeks after infection, depending on the species and strain, and on the susceptibility of the host (WHO/OIE, 2001).

2.7.4. Definitive host

The predominant life cycle of *E. granulosus* takes place between domestic dogs as definitive hosts and livestock animals as intermediate hosts. Dogs that normally have contact with livestock were more likely to become infected with hydatidosis. Many factors influence the frequency of canine echinococcosis. The most important of these factors is the access of dogs to uncooked and infected meat. The determinants factors that might increase access to infected meat sources, is the easy access to the location where animals are slaughtered and access to livestock rearing area. The knowledge of the owners about echinococcosis and anthelmintic treatment is important factor. Some studies reported that dogs which were free to roam are susceptible to infection, compared to dogs kept indoor. Also a study in Uganda proved that stray dogs showed greater intensity of infection compared to domesticated dogs (Inangolet *et al.*, 2010).
2.8. Host range

A wide range of domestic animals such as sheep, goats, cattle, pigs, equines and camels can become an intermediate hosts for the larval stage (metacestode) of *E. granulosus*. The majority of risk factor evaluation in livestock species depend on data obtained in cross-sectional studies from abattoir surveys.

*E. granulosus* originally completed its life cycle among wild animals in a sylvatic cycle for example wolves and lions it has now adapted: into a "domestic" cycle, however, commonly involving dogs and sheep (FAO, 1982; Soulsby, 1982).

As *E. granulosus* has little host specificity with regard to intermediate hosts, hydatid cysts have been seen in a wide range of animals, including domestic ruminants, camels, giraffes, pigs, equines, elephants, hippopotamuses, marsupials and different types of deer, as well as humans (Raush, 1986; FAO, 1982).

2.9. Diagnosis of the disease

Echinococcosis is diagnosed in the definitive hosts by demonstration of the adult worm in the intestine at post mortem or by searching for the proglottids (tapeworm segments) in faeces, or by (arecoline purgation). In wild carnivores necropsy is commonly used for diagnosis, for example foxes in *E. multilocularis* endemic areas. Coproantigens is tests for specific antigens in faeces this test is highly genus specific for Echinococcus and more sensitive than arecoline purgation. (OIE, 2008).

2.10. Clinical signs of the disease

Tapeworms in the small intestine of the definitive host cause few ill effects. In the intermediate host, the cysts gradually grow in size and result in fibrosis in tissue, and result in disease manifestation. The symptoms of the disease in humans depend on the site where the cyst developed and the size and numbers of cysts. Infected livestock with *E. granulosus* may show reduced growth, decreased production of milk, decrease
wool production, and reduced the birth rate. The cysts grow slowly so that many infected animals are slaughtered before the cysts cause any clinical signs. (OIE, 2008)

2.11. Prevention and control of the disease

The best control measure for echinococcosis is to interrupt the life cycle of the parasite. This can be done by

- Preventing dogs from consuming infected meat with cysts by not allowing access of dogs to livestock carcasses or slaughter wastes from farms, households, abattoirs or butchers.
- Control of stray dog populations, registration programs of all owned dogs, and treating infected dogs with an anthelmintic to kill the adult tapeworm are very important control measures.
- Personal hygiene including proper hand washing after handling or play with dogs, and teaching children the importance of washing hands to prevent infection.
- Public awareness about the burden of the disease is also a crucial control measure. (WHO/OIE, 2001).

2.12. Geographical Distribution of Echinococcosis in the World

According to the international association of hydaidosis (IAH) E. granulosus is present worldwide only few countries are considered free from the disease. Areas of the world where there is a high incidence of E. granulosus is poor rural areas, where dogs are allowed access to infected animal carcasses. E. multilocularis occurs in the Northern hemisphere, including central Europe and the northern parts of Europe, Asia, and North America. E. multilocularis endemic France, Switzerland, Germany, Netherlands, Belgium, Luxembourg, Poland, the Czech Republic, the Slovak Republic, and Italy. While alveolar echinococcosis is not common, it is believed that in the coming years, it will be an emerging or re-emerging disease in certain countries as a result of E. multilocularis’ ability to spread. (IAH, 2013)
Distribution of hydatidosis world wide, WHO (2009)

2.13. Previous studies

There are significant differences in CE prevalence among host species. However, in previous studies different finding were reported studies as to which farm animal presented the highest rates. Studies from Libya and Ethiopia illustrate that sheep showed higher risk of infection compared to goats (Tashani et al., 2002). (Erbeto et al., 2010). A study in slaughtered animals in Al Baha region of Saudi Arabia reported camels as the domestic intermediate host most likely to be infected. (Ibrahim, 2010). Livestock origin has been a reason for significant differences in prevalence of cystic echinococcosis, in different locations this has been repeatedly reported in Tanzania and Kenya (Emest et al., 2009), (Njoroge, et al., 2002). The age of the host has an association with infection of hydatidosis. Several studies have recorded higher prevalence of hydatid cysts in older animals compared to young ones, studies in Tunisia and Greece recorded this result (Lahmar et al., 2007). (Christodoulopolous et al., 2008).
In a Survey of antibodies against various infectious disease agents in racing camels in Abu Dhabi, United Arab Emirates. The prevalence antibodies of Echinococcus polymorphous were observed in 2.6% of the tested camels (Afzal and Sakkir 1994)

A study was conducted over a period of one year in the major North Jeddah Abattoir to assess the current status of hydatidosis among slaughtered animals. The cysts count size and site of infection were conducted on randomly infected animals. A total of (91348) slaughtered animals; camels (541), cattle (615), goats (48370) and sheep (41822) were examined. The infection prevalence was 6.86%, 3.63%, 19.85% & 69.6% in camels, cattle, goats and sheep respectively. The liver was the predominant site of infection in all animals. The most commonly infected organs were liver and lungs which constituted 48.75% and 32.83% respectively, of the total infected organs. The intensity of cysts differed significantly among all host species. (Toulah et al., 2012)

A surveillance for cystic Echinococcosis was conducted in eight governmental slaughterhouses in Oman. Routine slaughtering of 282,020 animals was observed during 2010-2013 by duty veterinarians and suspected samples (n=1440) for cystic echinococcosis (CE) from camels (n=292), cattle (n=303), goats (n=682) and sheep (n=163) were collected. The infection rate of CE was calculated as 5.3, 0.6, 0.03 and 0.07 in camel, cattle, goats and sheep respectively (Al Kitani et al., 2015).
CHAPTER THREE

MATERIALS AND METHODS

3.1 Study area

The study was conducted in Al-Ain City which is located in the eastern region of Abu Dhabi Emirate just south of Dubai and east of Abu Dhabi. The Eastern region covers an area of approximately 13,100 km². Oman lies to the east, Dubai and Sharjah to the north, Abu Dhabi to the west and the Empty Quarter desert and Saudi Arabia to the south. In Al Ain, the mean annual rainfall is 96 mm and the average relative humidity is 60% with low humidity. Boer (1997) classified the UAE climate as hyper-arid and divided it into four climatic regions: the coastal zone along the Persian Gulf, the mountain areas northeast of UAE, the gravel plains around Al Ain area, and the central and southern sand desert. More rainfall and lower temperatures occur in the northeast than in the southern and western regions. Al Ain is an important services centre for a wide area extending into Oman. There are three major shopping centers, Al Ain Mall, Al Jimi Mall and Al Bawadi Mall (opened in 2009 in the Al Khrair area) as well as traditional souqs for fruit and vegetables and livestock. Industry is growing, but is still on a small scale.

AL Ain City, UAE (2015)
This study was conducted in Al Ain public slaughterhouse. The biggest slaughterhouse in Al Ain city. The abattoir is located in inside Al Ain central livestock market in Akharir Area. The facility is well equipped with suitable and appropriate technology and well qualified, trained and experienced veterinarians. The source of slaughtered animals is either from Al Ain central livestock market in which the abattoir is located or brought from different animal farms outside the livestock market. In the livestock market there are many breeds of animals which are imported through different UAE borders.

3.2. Study population

In this study a total of 29148 slaughtered animals were inspected (14509 sheep, 11899 goats, 645 cattle, 2095 camels). For sheep and goats the population was categorized according to the origin of animals: 5136 Indian sheep, 8817 local sheep, 416 Australian sheep, 140 Somali sheep, 6437 local goats, 5148 Indian goats and 314 Somali goats.

3.3. Study Design

A cross-sectional abattoir based study from 1st January 2015 to 28th February 2015 was conducted in Al Ain Public Abattoir to identify the prevalence of hydatid cyst in sheep, goats, cattle, and camels in slaughtered animals. The study was designed to investigate the following variables:

- Classification of slaughtered sheep and goats according to their origin.
- Determination of hydatid cyst during postmortem inspection in different species of slaughtered animals.
- Determination of the anatomical location of hydatid cysts in infected carcasses.

3.4. Data collection

Data was collected in daily ante-mortem inspection of animals presented for slaughter to determine animal species and the origin of animals for sheep and goats. During the post-mortem inspection, different visceral organs including liver, lungs, kidneys, heart...
and spleen were systematically inspected. Visual observation, palpation and systematic incision of each organ were made for the presence or absence of hydatid cysts according to procedures recommended by FAO/UNEP/WHO (1994). Daily numbers of the slaughtered animals and their organs with the cyst for each species were recorded in the daily report. In the case of sheep and goats the number of inspected animals and the number of positive cases was recorded according to the origin of animals.

3.5. Data analysis

Observed data was entered into Microsoft Excel spread sheets program and then transferred to SPSS version 16 for analysis. Descriptive statistics was compute. The prevalence of hydatid cyst was computed by dividing the number of positive cases by the total number of examined animals and expressed as percentage as follows:

\[
PR = \frac{\text{No of positive animals}}{\text{No of all inspected animals}} \times 100
\]

Pearson’s chi-square test was used to evaluate the association of sheep and goats origin and hydatidosis.
CHAPTER FOUR

RESULTS

The overall prevalence rate of hydatid cyst among the inspected livestock at Al Ain Public Abattoir was 0.57% of which sheep; goats, cattle and camels have the prevalence of 0.53%, 0.39%, 0% and 2.1% respectively (table 4.1).

**Table 4.1**

Prevalence of hydatid cyst in slaughtered sheep, goat, cattle and camel from 1st January 2015 to 28th February 2015 in Al Ain City Public Abattoir.

<table>
<thead>
<tr>
<th>Animal species</th>
<th>No. of animal examined</th>
<th>No. of positive cases</th>
<th>prevalence percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheep</td>
<td>14509</td>
<td>77</td>
<td>0.53%</td>
</tr>
<tr>
<td>Goats</td>
<td>11899</td>
<td>46</td>
<td>0.39%</td>
</tr>
<tr>
<td>Cattle</td>
<td>645</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Camel</td>
<td>2095</td>
<td>44</td>
<td>2.1%</td>
</tr>
<tr>
<td>Total</td>
<td>29148</td>
<td>167</td>
<td>0.57%</td>
</tr>
</tbody>
</table>
Distribution of hydatid cysts in different organs of infected slaughtered livestock was observed in liver (86.8%), lungs (4.8%), heart (0%), kidneys (1.2%), spleen (2.4%), and muscles (4.8%). (table 4.2)

Table 4.2

Distribution of hydatid cysts in different organs of infected slaughtered livestock in Al Ain City Public Abattoir from 1st January to 28th February 2015.

<table>
<thead>
<tr>
<th>Animal species</th>
<th>Liver</th>
<th>Lung</th>
<th>Heart</th>
<th>Kidney</th>
<th>Spleen</th>
<th>Muscles</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheep</td>
<td>61</td>
<td>6</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>6</td>
<td>77</td>
</tr>
<tr>
<td>Goat</td>
<td>40</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>46</td>
</tr>
<tr>
<td>Cattle</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Camel</td>
<td>44</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>44</td>
</tr>
<tr>
<td>Total</td>
<td>145</td>
<td>8</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>167</td>
</tr>
<tr>
<td>Percentage</td>
<td>86.8%</td>
<td>4.8%</td>
<td>0%</td>
<td>1.2%</td>
<td>2.4%</td>
<td>4.8%</td>
<td></td>
</tr>
</tbody>
</table>
For sheep and goats origin based result the prevalence was (1.3%) for Somali goats, (1.4%) for Somali sheep, (1.4%) for Indian sheep, (0.8%) for Indian goats, (0.1%) for local sheep, (0%) for local goats and (0%) for Australian sheep. (table 4.3). Based on the origin of slaughtered sheep and goats show significant difference in prevalence of hydatid cyst (P < 0.05). The prevalence of hydatidosis was significantly different in local and imported breeds (P < 0.05).

Table 4.3

Prevalence of hydatid cyst of slaughtered sheep and goats in Al Ain Public Abattoir form 1st January to 28th of February 2015, based on the origin of animals.

<table>
<thead>
<tr>
<th>Animal origin</th>
<th>No. of animal examined</th>
<th>NO. of positive cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indian sheep</td>
<td>5136</td>
<td>73</td>
<td>1.4%</td>
</tr>
<tr>
<td>Local sheep</td>
<td>8817</td>
<td>2</td>
<td>0.1%</td>
</tr>
<tr>
<td>Australian sheep</td>
<td>416</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Somali sheep</td>
<td>140</td>
<td>2</td>
<td>1.4%</td>
</tr>
<tr>
<td>Local goats</td>
<td>6437</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Indian goats</td>
<td>5148</td>
<td>42</td>
<td>0.8%</td>
</tr>
<tr>
<td>Somali Goats</td>
<td>314</td>
<td>4</td>
<td>1.3%</td>
</tr>
</tbody>
</table>
Figure 1: Hydatid cyst in camel live Al Ain Public Abattoir January 2015

Figure 2: Hydatid cyst in sheep muscle Al Ain Public Abattoir January 2015.
Figure 3: Hydatid cyst in sheep liver Al Ain Abattoir January 2015.
CHAPTER FIVE

DISSCUSSION

Hydatidosis is one of the most serious zoonotic diseases all over the world and endemic in many countries. Hence the disease has no specific pattern in live animals, one of the major methods of detection of the disease is through the detection of the intermediate host in slaughterhouses during post mortem inspection. Slaughterhouse play main role in the detection and control of the disease. Most of the studies conducted on the prevalence of hydatid cyst in the livestock the main source of data obtain from abattoir.

Hydatidosis was observed in liver (86.8%), lungs (4.8%), heart (0%), kidneys (1.2%), spleen (2.4%), and muscles (4.8%). In this study the liver was the predominant site of infection in all animals’. Previous study conducted in north Jeddah abattoir shows that the liver was the predominant of the infection in all slaughtered animals (Toulah et al., 2012). A view in literature support this fact (soulsby, 1982) state that the most commonly infected organs were liver and lungs of hepatic and pulmonary hydatidosis is justifiable as liver and lungs possess the first capillary field after the onchospheres pass the duodenum with blood compare to other.

The prevalence of hydatid cyst is higher in camels compare to other livestock (2.1%). Some camels are imported from kingdom of Saudi Arabia and Sultanate of Oman and sold in Al Ain central livestock market in which Al Ain Public Abattoir is located but difficult to determine their origins from the shape. A study in slaughtered animals in Al Baha region Saudi Arabia reported camels as the domestic intermediate host most likely to be infected with hydatid cyst (Ibrahim, 2010). The result of prevalence in slaughtered camels in Al Ain Public Abattoir is in the line with similar study on a survey of antibodies against Echinococcus polymorphous in racing camels in Abu Dhabi, United Arab Emirates. The antibodies against Echinococcus polymorphous were observed in 2.6% of the tested camels (Afzal and Sakkir, 1994).

In this study based on the origin of slaughtered sheep and goats show significant difference in prevalence of hydatid cyst (P < 0.00) compared to Previous study in Tanzania and Kenya show significant differences in prevalence of cystic
echinococcosis between study locations or different livestock origin (Ernest et al., 2009), (Njoroge et al., 2002)

According to the result of the study (table 4.1), Sheep has higher prevalence than goats this is in line with studies from Libya and Ethiopia illustrate that sheep registering higher risk of infection compared to goats (Tashani et al., 2002). (Erbeto et al., 2010).

Comparing the result of this study (table 4.1) to other study conducted in the region in Oman. A surveillance for cystic Echinococcosis was conducted in eight governmental slaughterhouses in Sultanate of Oman. The infection rate of cystic Echinococcosis was calculated as 5.3%, 0.6%, 0.7%, and 0.03% in camels, cattle, sheep and goats respectively (Abattoir based surveillance of cystic echinococcosis (CE) in the Sultanate of Oman during 2010-2013 (Al Kitani et al., 2015). The highest infection was recognized among camels in both studies.
CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1. CONCLUSION

- This study evaluates prevalence of hydatid cyst in slaughtered livestock in Al Ain city Public abattoir from the 1st of January to 28th of February that provide useful source for evaluation of epidemiological aspect of hydatidosis.
- Based on the results of the study some sheep, goats and camels slaughtered in Al Ain Public Abattoir are identified as intermediate hosts for hydatidosis and harboring the larval stage that poses a threat to cause infection and severe disease and death in human and also result in economic losses.
- Post-mortem inspection seem to be the first approach to estimate the prevalence of hydatid cyst in slaughtered animals but more advanced technical method could be more accurate.
- This study elucidate that hydatid cyst is highly prevalent in slaughtered camels compared to the other type of live stock.
- Cattles have the lowest prevalence compare to other type of livestock
- Prevalence of hydatid cyst among imported livestock raises questions about its role in contribution to the spread of the disease in the UAE.

6.2. RECOMMENDATIONS

Hydatidosis is a serious disease that results in an economic loss for treatment cost and condemnation of edible carcasses and could be fatal in human. Hence the following points were recommended to interrupt the life cycle of the parasite:

- Effective meat inspection and proper disposal of condemned meat at slaughterhouses and prohibiting and restricting illegal slaughter of livestock.
- Preventive measures should be taken to ban stray dogs from abattoirs and animal markets in order to prevent their access to livestock carcasses and slaughter waste.
- Development and implementation of stray dogs control strategies.
- Increase the awareness of the burden of the disease among abattoir workers, butcher, livestock breeders, school children and dog owners.
- Treating dogs with an anthelmintic (praziquantel) to kill the adult worm, dogs should be dosed at intervals with anthelmintic if necessary.
- Proper hand washing after handling dogs, and avoidance to consume any food or water contaminated with dog’s fecal matter.
- Further advanced studies to be conducted in camel hydatidosis due to the high prevalence of hydatid cyst among slaughtered camels.
- Some of these recommendations should be implemented by the competent authorities represented by Ministry of Environment and Water and local municipalities.
REFERENCES


Centers for Disease Control and Prevention (CDC), (2013) Echinococcosis 1600 Clifton Road Atlanta, GA 30329-4027, USA 800-CDC-INFO (800-232-4636) TTY: (888) 232-6348.


