بسم الله الرحمن الرحيم

Sudan University of Science and Technology

College of Graduate Studies

Prevalence and Risk Factors of Ovine Hydatidosis in West Omdurman Locality

نسبة الإصابة وعوامل الخطر لمرض الأكياس العدارية بمحلية غرب أم درمان

A thesis Submitted to the College of Graduate Studies in Partial Fulfillment of the Requirements for the Degree of Master of Preventive Veterinary Medicine (MPVM)

By

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Dedication

- *To my lovely father*
- *To my kind unfailing support mother*
- *To my brother*
- *To my colleagues and friends*
- *To all who have helped me*

Acknowledgements

Firstly, praise to Almighty Allah for giving me the strength and stamina to finish this work.

With a great touch of pleasure and gratitude, I would like to express thanks to my supervisor, Dr.Siham El-iassulimanfor his advice, direction and continuous interest and constructive criticism in reviewing the dissertation.

My thanks extend toAl-sabalogaslaughterhouse staff for assistance during the period of sample collection.

My appreciation is extended to all who helped me in this study.

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الآية

بِسْمِ اللهِ الرَّحْمن الرَّحِيمِ

وَلَوْلَا فَضْلُ اللَّهِ عَلَيْكَ وَرَحْمَتُهُ لَهَمَّتْ طَائِفَةٌ مِنْهُمْ أَنْ يُضِلُّوكَ وَمَا يُضِلُّونَ إِلَّا أَنْفُسَهُمْ ۖ وَمَا يَضُرُّونَكَ مِنْ شَيْءٍ ۚ وَأَنْزَلَ اللَّهُ عَلَيْكَ الْكِتَابَ وَالْحِكْمَةَ **وَعَلَّمَكَ مَا لَمْ تَكُنْ تَعْلَمُ** ۚ وَكَانَ فَضْلُ اللهِ عَلَيْكَ عَظِيماً)

صدق الله العظيم

سورة النساء الآية (113)

Abstract

This study was conducted on 332 sheep slaughtered at Al-sabaloga abattoir, West Omdurman, Khartoum State, Sudan, during the period extended from December2014 to February 2015. The objectiveswere to estimate the prevalence of hydatid cysts in sheep and to investigate risk factors associated with the disease. Routine meat inspection procedure was employed to detect the presence of hydatid cysts in visceral organs (liver, lung, heart and muscle).The Examined sheep originated from three areas: North Kordofan, and White Nile. The overall prevalence was 2.8% . The prevalence of hydatid cysts infection according to age of sheep was 0.64% in animals equal or less than one years of age and 4.49% in animals of age more than one year. The prevalence of hydatid cysts infection according to grazing was 2.04% in close grazing and was 2.82% in open grazing systems .The distribution of the hydatid cysts according to the area (source) of sheep was 2.05% in North Kordofan, and 3.22% in White Nile. As for body condition the prevalence was 2.76% in good body condition and 0.0% in poor body condition. The prevalence of hydatidosis according to the breed of animals was 3.12% in Hamary ecotype and 2.14% in Kabashy breed. The distribution of the hydatid cysts according to the using of treatment was 0.43% in animals which were using drugs and was 7.69% in animals which were not using drugs . The prevalence of hydatid cysts infection according to the present of dogs was3.84% in area where dogs were present and was 1.70% in area where dogs were not present. The results of the univariate analysis by using the Chi-square for the following potential risk factors were : breed (P-value = 0.586), age of animal (p-value = 0.031), origin of animal (P-value = 0.514), body condition (p-value = 0.680), grazing (p-value =0.754), present of dog (p-value =0.230), and use of treatment (p-value

=0.000) . The use of treatment of animals was found to be significantly associated with hydatidosis (p-value =0.000).

Using multivariate analysis to determine possible significant association between hydatidosis and potential risk factors, the result showed that there was no significant association with any of the investigated risk factors.

ملخص البحث

أجرى البحث على 332رأس من الضأن مذبوحاً في مسلخ السبلوقة (محلية غرب امدرمان) في ولاية الخرطوم ، السودان. خلال الفترة التى إمتدت من ديسمبر 2014 إلي فبراير 2015 ، كان الهدف هو تقدير معدل إنتشار مرض الأكياس العدارية فيالضأن والتحقيق من عوامل الخطر المرتبطة بهذا المرض . تم اجراء التفتيش الروتينى للحوم للكشف عن وجود الأكياس العدارية في الأحشاء الداخلية.

كان مصدرالضأن المختار من منطقتين وهي منطقة ولاية النيل الأبيض وولاية جنوب كردفان . كان معدل إنتشار المرض فى كل الحيوانات2.7 %. كان معدل إنتشار عدوى الأكياس العدارية وفقاً لسن الماشية 64.% في الحيوانات التى عمرها يساوي سنةأواقل, 4.49 % في الحيوانات التى عمرها اكبرمنسنة . وكان معدل إنتشار الأكياس وفقاً للمناطق التى جاءت منها الحيوانات :3.22 % في النيل الابيض و2.05 % في جنوب كردفان . أما بالنسبة لحالة الجسم كان معدل إنتشار المرض هو2.76 % من حالة الجسم الجيد و0.0% في حالة الجسم الهزيل . وكان معدل إنتشار الأكياس العدارية وفقا لسلالة الضأن هو 3.12 % في الضأن الحمري و2.14% في الضأن الكباشي.اما بالنسبه لنظام الرعي كان معدل انتشار المرض في نظام الرعي المفتوح 2.82% والرعي المغلق 2.04% 0اما بالنسبه لاستخدام العلاج كان معدل انتشار المرض ف المناطق التي استخدم فيها العلاج 0.43% وكان 7.69% في المناطق التي لم يتم فيها استخدام العلاج0اما بالنسبه لوجود الكلاب كان معدل انتشار المرض 3.84% ف المناطق التي وجدت فيها كلاب وكان المعدل 1.70% في المناطق التي لم توجد فيها كلاب0

وعندما تم تحليل عوامل الخطر بواسطة التحليل الاحادي وبإستخدام مربع كاى كانت نتيجة التحليل : سلالة الحيوان (.586 = P القيمة) ولعمر الحيوان(.031 = P القيمة) ولمصدر الحيوان(.514 = P القيمة) ولحالة الجسم (.680 = P القيمة) ولنظام رعي الحيوان (.754 = P القيمة) ولتواجد الكلاب مع القطيع (.230 =p القيمه) واستخدام العلاج (0.000= pالقيمة).

بإستخدام مربع كاى لتحليل قيمة عوامل الخطر وجد أن : نظام استخدام العلاج (P =0.000 القيمة) كانت له علاقة معنوية بإنتشار المرض . وعندما تم تحليله بواسطة التحليل المتعدد لمعرفة درجة الإرتباط بينه وبين العوامل الاخري وجد أن عمر الحيوان له علاقه معنويه بالمرض (p = 0.100القيمه)0 وأظهرت الدراسة أن العضلات هي العضو الأكثر إصابة (6 أكياس) بينما الإصابة في الكبد كانت ثلاث اصابات , ولا يوجد كيس في القلب و الرئه. الفحص المجهري للأكياس وجد أن هنالك (4) أكياس عقيمة و4 اكياس خصبة.

Chapter One

Introduction

Hydatidosis is a chronic cyst-forming parasitic helminthic disease of human beings as well as domestic and wild ungulates. It is caused by infection with the larval (metacestode) stages of dog tapeworms belonging to the genus Echinococcus (family Taeniidae) and is also referred to as echinococcosis. Three broad morphological forms of echinococcosis are recognized clinically: Cystic echinococcosis caused by E granulosus, alveolar echinococcosis caused by E multilocularis, and polycystic echinococcosis caused by Echinococcus vogeli or Echinococcus oligarthrus . Human cystic echinococcosis is the most common presentation and probably accounts for more than 95% of the estimated 2–3 million global cases, with human alveolar echinococcosis causing around 0·3–0·5 million cases (all in the northern hemisphere); fewer than 150 cases of polycystic echinococcosis have been described, all in Central and South America. The global burden for human cystic echinococcosis was recently estimated to be more than that for onchocerciasis and almost the same as that for African trypanosomiasis. Until 2005, only four Echinococcus species were recognised, but a fifth species, Echinococcus shiquicus, has now been described in small mammals from the Tibetan Plateau, although its zoonotic potential is unknown (Craig et al., 2007).

Hyadatidosis is a cyclozoonotic infection of cosmopolitan distribution . It is one of the main forms of parasitic disease in farm animals caused by the larval stage of Echinococcus tape worms which utilizecanines as definitive host and various

herbivores or rodent asintermediate host . Species under genus Echinococcus are small tapeworms of carnivores with larval (metacestode) stages known as hydatids proliferating asexually in various mammals including humans.There arefive morphologically distinct species in this genus ; E.granulosus, E.multilocularis, E.oligarthus, E.vogeli and E. shiquicus (Thompson, 2002) .

OBJECTIVE:

The objectives of this study were:

1/To estimate the prevalence of Ovine hydatidosis in slaughterhouse in Khartoum State.

2/To investigate the risk factors associated with the Ovine hydatidosis.

Chapter Two

Literature review

1.1. Classification:

According to Solusby (1982) E. granulosus was classified as follows:

Kingdom: **Animalia**

Phylum: **Platyhelminths**

Class: **Eucestoda**

Order: **Taenidea**

Family: **Taenidae**

Genus: **Echinococcus**

Species: **E. granulosus**

Subspecies: **E. gr.granulosus**

E. gr.canadesis

The adult worm of E. granulosus consists of 3 to 4 segments and exhibits two hosts in its life cycle , a carnivore as a definitive host and one species of various domestic herbivorous animals as an intermediate host. Human can be infected with the larval stage if he ingests the eggs of the parasite with either his food or drink (Thompson , 1986) .

E.granulosus eggs are defecated by dung of final hosts and live for some months in humid soil . Mid-hosts (generally sheep, goat and cow) get infected by eating them. Then, membrane of eggs are torn in intestine and spread all around the body especially livers, lungs etc. by means of blood current and gradually grow up there. If these mid-hosts (sheep, goat and cow) or their infected organs

are eaten by dog races, mentioned cyst is torn 3in duodenum, its embryo fetus are stuck to the walls of narrow intestine and grow adult. Finally with the birth, life cycle of parasite continues. If the mid-host is humankind, life cycle of parasite does not continue because infected organs of human being are usually out of reach of dog races.

Hydatidosis (Cystic echinococcosis) caused by the larval stage (metacestode) of Echinococcus granulosus, the most important worldwide parasitic disease of livestock that has both economic and public health signi-ficance (Kebede et al., 2009). In Africa E. granulosus has been recognized from most countries including Ethiopia. C.echinococcosisis a zoonotic disease caused by the larval stages of the tape worm E.granulosus for which domestic intermediate hosts (IH) (cattles, sheeps, goats and camels) are major reservoirs for the disease occurrence in humans (Soulsby, 1982). Dogs are the obligate final host and become infected by ingesting infected offal's (lung, liver and spleen etc).

Sheep and other intermediate hosts contract hydatidosis by grazing on pastures contaminated with dog faeces containing eggs of the cestode. Man is an intermediate host and plays no role in the transmission of the parasite, unless he is eaten by a carnivore.

Cystic echinococcosis (CE), a cosmopolitan zoonoticinfection, is caused by the larval stages of the tapeworm Echinococcus granulosus (E.granulosus), which requirestwo mammalian hosts to complete its life cycle. Dogs andother carnivores are the definitive hosts while a widerange of ruminants (sheep, goats, cattle and camels) and humans act as the intermediate hosts (Zhang et al., 2003).The adult parasites are found in the small intestine of a carnivore and produces eggs in cestode segments (proglottids),

then, the eggs are released from the tract of the carnivore into the environment. After oral uptake of eggs by the intermediate host, a larval stage (oncosphere),penetrate the intestinal wall and reach visceral organs suchas liver, lung, heart, and kidney of animals and humans In these internal organs, the larva grow and develop hydatid cysts, which act as unilocular fluid-filled bladders (Zhang et al., 2003).

The prevalence of cystic echinococcosis is higherin rural communities of developing countries due to close proximity between dogs ,intermediate hosts species and man as well asdue to wide spread slaughtering of animals,absence of meat inspection procedures,improper dispoal of dead animals, failure totreat dogs with cestodicidal drugs and grazing of domestic herbivores in communal fields where stray dogs have free access (Ibrahim2010; Romig et al., 2011).

1.2.LIFE CYCLE:

Definitive hosts of E.granulosus are domestic dogs and some wild canids . Adult cestodes live attached deep inside mucosal crypts of definitive hosts small intestine of dogs . The parasite is 3 to 6 mm long. It has 22 large hooks and 18 small hooks on scolex and usually has three proglottids, of which only the last is gravid . The gravid proglottid contains several hundred eggs , detaches from strobila is expelled with feces , and distintegrates in the environment. Each egg contains an embryo (oncophere) with six hooks (hexacanth), which must be ingested by intermediate host to continue its development. Intermediate hosts are sheep, goats, bovine ,swine, equine, camelids, canids and man. The most common localization of these cysts in the intermediate hosts are

the liver (in about two-thirds of the cases) and the lungs(in about fourth of the cases).

The disease state caused by E.granulosus is sometime known as unilocular hydatid , because only single site is initially colonized, whereas E.multilocularis colonizes multiple sites and therefore leads to more serious clinical disease . In human these tapeworms cause condition known as hydatid disease.

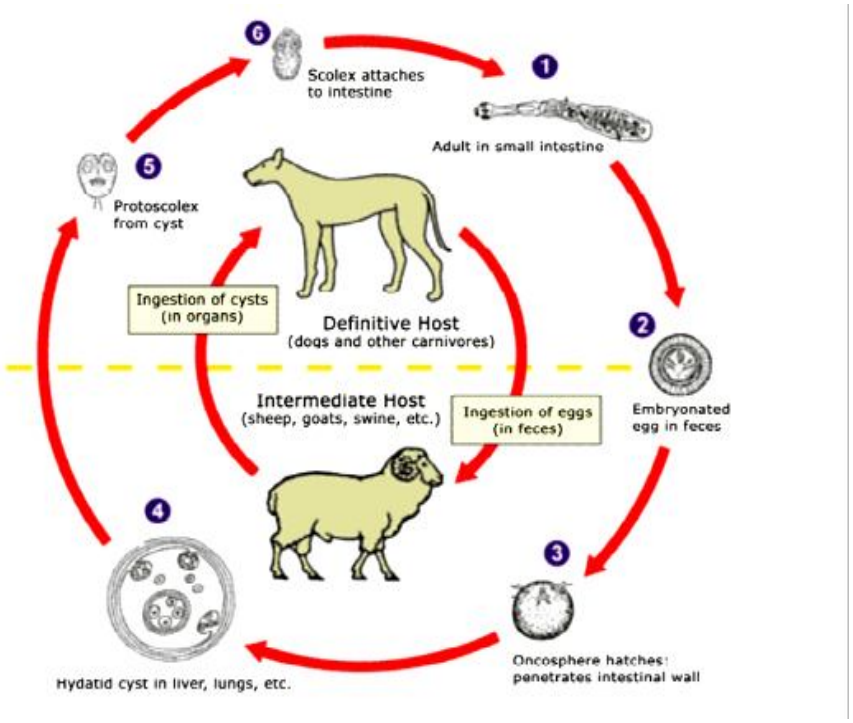


Figure (1):Life cycle of *Echinococcus species* (El-Ibrahim**,** 2009).

Echinococcus granulosus:

The definitive hosts for E. granulosus (canids, felids, and hyaenids) become infected when they ingest cysts (metacestodes) in the tissues of the intermediate hosts. Feeding the viscera of intermediate hosts to dogs perpetuates cycles in domesticated animals. The cysts develop into tapeworms, which mature in the host's small intestine. Gravid proglottids or eggs are shed in the feces, and are immediately infective. Echinococcus eggs have a sticky coat that will adhere to an animal's fur and other objects. Insects such as flies and beetles, or birds, can also act as mechanical vectors. In addition, the shed proglottids may perform rhythmic contractions that help to disperse the eggs widely on pastures.

Under ideal conditions, E.granulosus eggs remain viable for several weeks or months in pastures or gardens, and on fomites. They survive best under moist conditions and in moderate temperatures. Viable eggs have been found in water and damp sand for three weeks at 30°C, 225 days at 6°C and 32 days at 10-21°C. The eggs survive for only short periods of time if they are exposed to direct sunlight and dry conditions.

The intermediate hosts include a large number of domesticated and wild animals, particularly herbivores. Humans can also be infected. If an intermediate host ingests the eggs, the larvae are released, penetrate the intestinal wall, and are carried in blood or lymph to the target organs.

Etiology of Hydatidosis is caused by E.granulosus, E. multilocularis, E.oligarthusus and E.vogeli. Adult tapeworms are present in dogs , but the intermediate host harbor the larval stage which is known as hydatid cyst .

The morphology of hydatid cyst has three layers:

1. The outer pericyst is a dense and fibrous zone and composed of modified host cells. It is the protective layer.

2. The middle is the laminated membrane. It is acellular and allows the passage of nutrients.

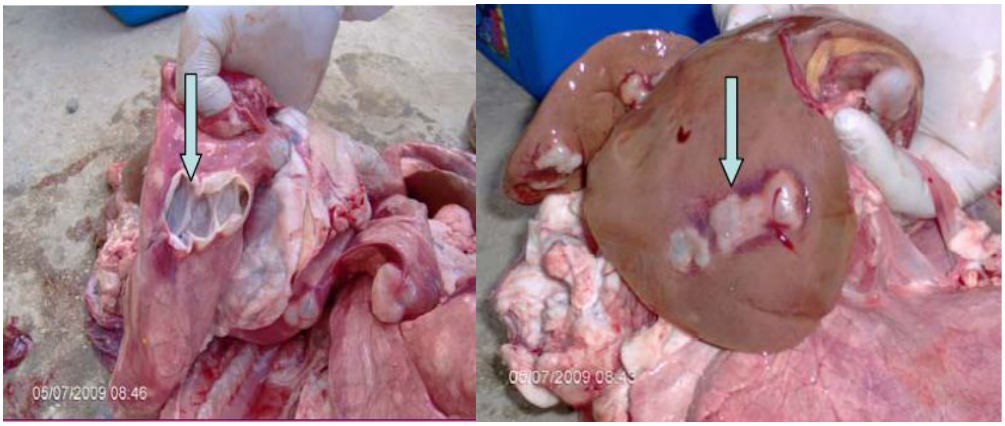
3. The inner layer is the germinative layer which gives rise to the hydatid fluid and small secondary cysts (brood capsules) which bud internally from this layer. Fragmentation of the germinative layer and brood capsules gives rise to daughter cysts. These may develop within the original cyst or separately.

The middle laminated membrane and the germinal layer form the true wall of the cyst, usually referred to as the endocyst, although the acellular laminated membrane is occasionally referred to as the ectocyst (Pedrosa et al,2000). Daughter vesicles (brood capsules) are small spheres that contain the protoscolices and are formed from rests of the germinal layer. 10-12 months after infection, protoscolices are produced in broad capsules.

Cysts containing protoscolices are fertile and can produce daughter cysts, whereas cysts without protoscolices are sterile. Before becoming daughter cysts, these daughter vesicles are attached by a pedicle to the germinal layer of the mother cyst. At gross examination, the vesicles resemble a bunch of grapes. Daughter cysts may grow through the wall of the mother cyst, particularly in bone disease (Pedrosa et al,2000).

The hydatid cyst, after 3 weeks, measures 250 µm in diameter and has central cavity. Around fifth months ,it measures approximately one- cm and it is apparent that its wall consist of two layers :an external cuticular, or laminar layer,formed by numerous thin lamina that resembles the cross-section of an onion

, and another, internal layer germinative or proligerous, which is delicate cellular syncytium . Larval form of E.granulosus typically consists of single cavity (unilocular). The interior of a hydatid cyst is filled with fluid. During the same period , brood capsule buds off from the germinative layer, and forming an invaginated protoscolices .



(A) **(B)**

Figure(2):
Hydatid cysts in lung (A) and liver (B) (El-Ibrahim, 2009)

Echinococcosis is caused by several species of Echinococcus, which is a tiny cestode parasite in the family Taeniidae. The two most important species are Echinococcus granulosus and Echinococcus multilocularis. E.granulosus causes a type of echinococcosis known as cystic echinococcosis, unilocular echinococcosis or cystic hydatid disease. Different strains of E. granulosus can be found in sheep, cattle, pigs, horses and reindeer.

All of the strains, except possibly the horse strain, infect humans. E. multilocularis causes a type of echinococcosis known as alveolar echinococcosis, alveolar hydatid disease, multilocular echinococcosis or multivesicular hydatidosis.

All Echinococcus spp. have an indirect life cycle, cycling between a definitive and an intermediate host. Intestinal infections occur in the definitive host, and tissue invasion is seen in the intermediate host. Carnivores are the definitive hosts for Echinococcus, and usually have no symptoms of infection. Disease may be seen in the intermediate hosts, including humans (OIE , 2005).

1.3.Pathogenesis in animals:

Cestoda*Echinococcus granulosus* of 5.7 mm length with a scolex bearing four suckers and with body containing 2-6 proglottids (terminal segments), this worm lives in dog intestine .

The proglottids (terminal segments) release eggs that are passed in feces, after infection by an intermediate host such as sheep, goats, swine, cattle, horse, and man, the eggs hatch in the small bowel and release an oncophere (hexacanth embryo) that penetrate the intestinal wall and migrates thought the circulatory system into various organs, especially the liver and lung, in these organs the oncosphere develops into cysts that gradually enlarges(Waleed*et al* .,2013).

1.4.Diagnosis:

1.4.1. Identification Clinical features:

The clinical features of cystic echinococcosis are highlyvariable. The spectrum of symptoms depends on the following; involved organs, size of cysts and their sites within the affected organ or

organs, interaction between the expanding cysts and adjacent organ structures,particularly bile ducts and the vascular system of the liver, complications caused by rupture of cysts, bacterial infection of cysts and spread of protoscolices and larval material into bile ducts or blood vessels, immunologic reactions such as asthma, anaphylaxis. The initial phase of primary infection is asymptomatic and may remain so for many years. Hydatid disease is seen in subjects of any age and sex, although it is more common in those aged 20–40 yrs (14, 15). The rate of growth of cysts is variable depending on the strain differences and the organ involved. Patients come to the clinician's attention for different reasons, such as when a large cyst has some mechanical effect on organ function or rupture of a cyst causes acute hypersensitivity reactions. CE can be seen in all age groups. In endemic areas, most hospital cases are recorded in the age groups between 21 and 40 years. Many infections are acquired in childhood but do not cause clinical manifestations until adulthood. The initial phase of primary infection is always asymptomatic. Latent periods may be very long such as 50 years.

1.4.2.Identification of the agent:

In the intermediate host, diagnosis depends on the detection of the larval cyst form, which can occur in almost anyorgan, but particularly in the liver and lungs. The diagnosis of echinococcosis in dogs or other carnivores requiresthe demonstration of the adult cestodes of Echinococcusspp. in their faeces or the small intestine or thedetectionof specific coproantigens or coproDNA. Investigators carrying out these procedures are exposed to the risk of infection and severe disease, which mustbe minimized by appropriate procedures.

Infective material can be decontaminated by freezing at –80°C (coretemperature) for 48 hours. Face masks,disposable gloves and an apron must be worn. Chemicaldisinfection is not reliable. Contaminated material must be destroyed by heat; hot water, at temperature of 85°C or above, is very effective. The decontamination of laboratories can be achieved at reduced humidity (40%) combined withincreased room temperature (30°C) for at least 48 hours.

1.4.2.1.Parasitological methods:

Fertility and viability tests:

Positive or suspected samples were taken to the laboratory for the cyst identification, fertility and viability tests were performed. Of the collected hydatid cysts, individual cysts where carefully incised and examined for protoscolices, which were similar to the appearance of white dots on the germinal epithelium; such cysts were characterized as fertile cysts; fertile cysts was subjected to viability test. A drop of the sediment containing the protoscolices was placed on the microscope glass slide and covered with a cover slip and observed for amoeboid like peristaltic movements with X40 objective. For clear vision, a drop of 0.1% aqueous eosin solution was added to equal volume of protoscolices in hydatid fluid on the microscopic slide with the principle that viable protoscolices should completely or partially exclude the dye while the dead ones took it up (Macpherson et al., 1985). Furthermore, infertile cysts were further classified as sterile or calcified (Soulsby, 1982).

Necropsy methods:

In cattle, diagnosis of cystic echinococcosis is mainly through post-mortem findings during meat inspection. The presence of hydatid cysts in internal organs is a veryimportant tool of diagnosis in that it actually confirms the disease.

The most reliable method for diagnosis of Echinococcusspp. in definitive hosts is bynecropsy, However, necropsy usually results in a biased sample, in that only unwanted dogs can be necropsied.

1.4.2.2. Immunodiagnostic techniques:

(ELISA diagnostic test):

In the 1980s an immunological method for detecting circulating antibodies against E.granulosusin serum was devised (Jenkins and Rickard, 1986). Specific circulatingantibodies against E.granulosuswere readily detectable in dogs raised worm-free andmonospecifically infected with E. granulosusin Australia, but in populations of ruraldogs in Kenya with natural infections of E. granulosusand other cestodes, detectionof antibodies was unreliable (Jenkins et al., 1990). The presence of antibodies inserum did not mean the dog was infected at the time of testing because the antibodiesagainst taenid cestodes remain detectable for weeks or months after worms have beenlost (Jenkins and Rickard, 1985).

In the early 1990s, an immunological method of detecting substances (Coproantigen) released in the faeces of tape-worm infected definitive hosts was devised independently in England and Switzerland (Allan and Craig, 1989; Deplazes et al.,1990). This method was adapted to detect Coproantigen of taenid cestodes includingE.granulosus(Deplazes et al., 1990; Deplazes et al., 1992).

1.4.2.3 .Coproantigen detection ELISA diagnostic test:

In dogs, the diagnosis of Echinococcusspecies using coproantigen-detection ELISAmethod has a number of advantages over the use of Arecoline purgation as adiagnostic test. Among the advantages is that the Coproantigen-detection ELISA has easier sample collection, is faster to do, and requires less personnel. These factors make it suitable for surveillance of large dog populations (Abbasi et al.,2003). Faecal samples for coproantigen testing can be collected in the field for some dogs hence eliminating the need of transporting the dogs to specific locations, unlike Arecoline purgation which requires taking dogs to specific purge sites and concentration of dogs in specific locations (Lopera et al., 2003). The other advantage of coproantigens test is that it enables early detection in the course of infection(Jenkins et al., 2000; Lopera et al., 2003). The important advantage of coproantigen test over the antibody detection is that those coproantigen-positive dogs are infected at the time of the testing, Coproantigen become undetectable a few days after removal of E. granulosus (Jenkins et al., 2000) and the test can be carried out at room temperature. The coproantigen test can be used to test E. granulosusin wild carnivores which are not easy to capture. The detection of coproantigen of E. multilocularishas beenperformed in wild fox populations in Japan (Sakai et al., 1998).

The diagnosis of Echinococcosisin dogs or other carnivores requires the demonstration of the adult cestodes and eggs of Echinococcusspp. Intheir faeces or the small intestine (Nonaka etal. , 2008) . While diagnosis in intermediate hosts occurs by necropsy finding . Whereas surveillance forE. granulosusin

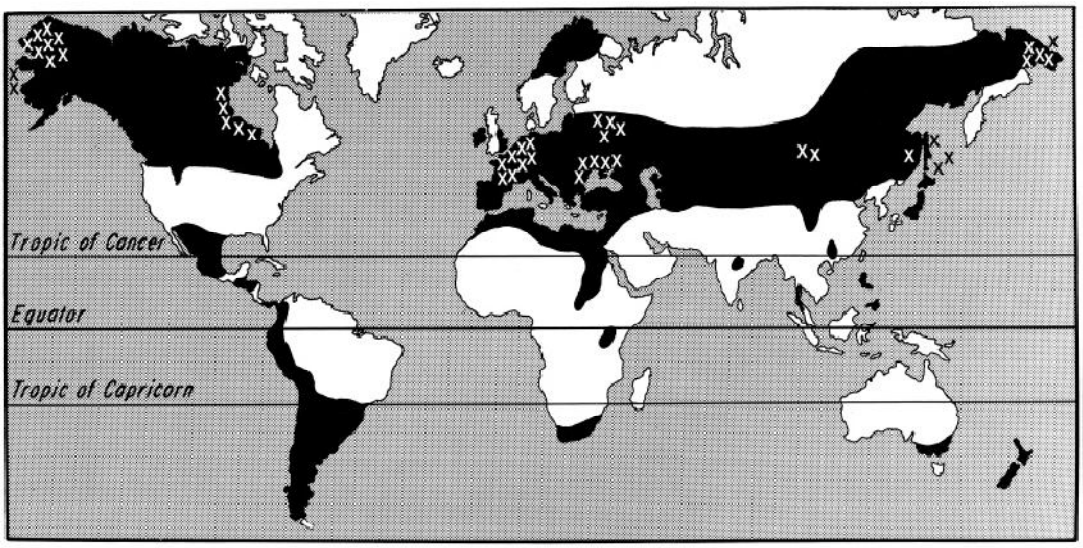
domestic animals may take place in licensed slaughter houses, that for Echinococcussp. in wildlife must be done by field surveys.

In livestock intermediate hosts, molecular methods are, however, important in identification of isolates or strains of E. granulosusfor epidemiological purposes (Mcmanus and Bryant , 1995) . Serologically or immunologically tests, useful in humans, are less sensitive and specific in livestockand at present cannot replace necropsy . Antibodies directed againstoncosphere, cyst fluid and protoscolex antigens can be detected in theserum of infected sheep, but this approach is presently of limited practicaluse as it does not distinguish between current and previous infections .

1.5.Geographic distribution and prevalence of echinococcosis inthe world:

Echinococcus granulosushas a world-wide geographic range and occurs in all continents including circumpolar, temperate, subtropical and tropical zones (Craig etal.,1996; Schantz et al.,1995). The highest prevalence of the parasite is found inparts of Eurasia, Africa, Australia and South America. Within the endemic zones, the prevalence of the parasite varies from sporadic to high, but only a few countries canbe regarded as being free of E.granulosus. The worldwide distribution of the disease is partly due to the easy adaptability of the parasite to several domestic and wild intermediate hosts (Bhatia, 1997). E.granulosusis present virtually worldwide since there are very few countries thatare considered to be completely free of E.granulosus.An important fact to keep inmind is that the areas of the world where there is a high incidence of infection by E.granulosusoften coincide with

rural, grazing areas where dogs are able to ingestorgans from infected animals.



Figure(3): Global distribution of E.granulosus(black) and E.multilocularis(x)
(Source:TMCRhttp://tmcr.usuhs.mil/tmcr/chapter3/geographic.h).

Prevalence of echinococcosis (CE) in Africa:

Studies conducted in North Africa have shown wide significant variation in infection to cattle and sheep depending on the location (Azlaf and Dakkak, 2006). The variation in infection is as a result of several factors which aid transmission of Echinococcus spp. The infection rates in cattle are especially high in Middle Atlas (8.72%) and in the Loukkos (37.61%) (Azlaf and Dakkak, 2006). A recent study in Ngorongoro District of Tanzania showed an overall prevalence of 47.9% and species prevalence of 48.7%, 34.7% and 63.8% in cattle, goats and sheep respectively (Kazwala, 2008).

Countries around the Mediterranean region, have exhibited high prevalence of CE in both humans and livestock. Egypt has recorded human cases between 1.34- 2.6 cases per 100,000 people through hospital surveys and 6.4% prevalence in cattle and buffalo through abattoir surveys.

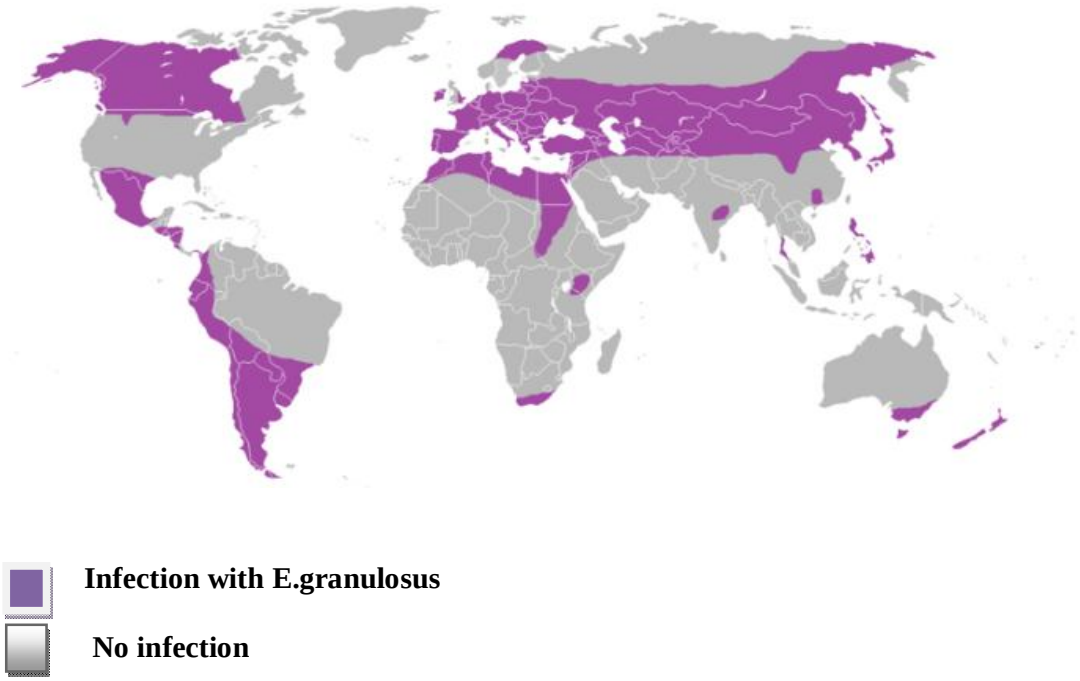


Figure 2.4 :
Global distribution of Echinococcus granulosus (Omer, 2013).

E.granulosus is the most widespread (Figure 2. 4) of the species with areas of high endeminicity in southwestern Asia, northern Africa ,Australia, Kenya and Uganda. The distribution of Emultilocularis is limited to the northern hemisphere. The most Important endemic areas are northern Tundra's of Europe, Asia, America and central Siberia, E.oligarthrus and E.vogeliare present only in South and Central America. Although the areas of infection coincide, since the definitive host of E. vogeliexists only from Panama to northern Argentina, cases of polycystic hydatidosis outside this area are probably imported or due to E.oligarthrus. (Acha and Szyfres, 2001).

1.6.Treatment Prevention and control of echinococcosis:

Chemotherapy is apparently more effective among young rather than older patients. Small cysts that have thin walls without infection or communication, as well as secondary cysts (even when multiple) are most susceptible to chemotherapy. Chemotherapy may, however, be less effective for thin-walled daughter cysts within a mother cyst. Some of the treated patients exhibit relapses, but these are usually sensitive to retreatment in a high proportion of cases (up to 90%). The rate of relapses after chemotherapy is relatively high (14%-25%) Chemotherapy is indicated for inoperable patients with primary liver echinococcosis and for patients with multiple cysts in two or more organs. Cysts localised in bones are less susceptible to chemotherapy. Since radial surgery is often impossible (e.g. cyst localization in spine or pelvis), long-termchemotherapy may be needed. Another important indication for chemotherapy is the prevention of secondary echinococcosis. The pre-surgical use of benzimidazoles (ABZ or MBZ) may reduce the risk of recurrence of CE and/or facilitate the operation by reduction of intracystic pressure, but this is not well documented.

Two benzimidazoles have been extensively evaluated using animal models and used on over 2,000 patients:

- Albendazole (ABZ) (Eskazole®, Zentel®; 400 mg tablets and 4% suspension, SmithKline Beecham, England)
- Mebendazole (MBZ) (Vermox®; 500 mg tablets, Janssen Pharmaceutica, Belgium).

These drugs show definite efficacy against CE, and are generally well tolerated.

In animals, prevention and control of echinococcosis is achieved by sanitary disposalof slaughterhouse waste to prevent access by dogs and also regular de-worming ofdogs. Ruminants acquire infection by grazing on contaminated pastures.

Contamination of pastures is as a result of using dogs for herding cattle. Therefore,limiting the use of dogs in herding cattle can help in the control of CE. Fencing off ofthe grazing area can also help in prevention of transmission of CE to cattle and other ruminants by preventing dogs from defecating on pastures where cattle graze.Control of hydatidosis in animals will result in reduced risk of human exposure.Children are particularly at risk of zoonotic infections because of their close and regular contact with dogs and these also require regular de-worming (Hegglin andDeplazes, 2008).

Diagnosis and treatment of CE is very difficult and the disease can be asymptomatic in many patients. Because of this, the disease is under reported and can take up to 5 to10 years for the cysts to cause problems. Treatment of CE in humans is through medical and surgical means and also puncture and aspiration, injection andreaspiration (PAIR). Medical treatment is cheaper and is done by administration of dewormersto the infected humans. Medical treatment is usually used when surgery isnot possible due to anatomical location which can cause difficulties in the removal of the cysts. Medical treatment is used even in surgical treatment as a pre-surgicalchemotherapy to reduce the possibility of rescinding of scoleces and thus reoccurrence of the cyst.

Chapter Three

Material and Methods

3.1.1 Study area:

Study area:

Khartoum State lies at the junction of the two rivers, the White and the Blue Niles in the North Eastern part of central Sudan. It lies between latitude 15-16 N and longitude 21-24 East with a length of 250 k and a total area of 20,736 km^2 the surface elevation ranges between 380 to 400 m a.s.l.

Most of Khartoum State falls within the semi-arid climatic zone while the Northern part of it falls within the arid climatic zone. The State is prevailed with a hot to very hot climate with rainy season during the summer and warm to cold dry winter. Rain fall ranges between 100-200 mm at the North Eastern parts to 200-300 mm at the Southern parts with 10-100 mm at the North Western parts.

Temperature in summer ranges between 25-40 C^O during the months of April to June and between 20-35 C^O during July-October Period. Temperature degrees continue to fall during the winter period between November-March to the level of 15-25 C^O.

Khartoum State divided into three clusters (cities), built at the convergence of the Blue and White Niles: Omdurman to thenorthwest across the White Nile, North Khartoum, and Khartoum i Omer,k1999).

this study was done in West Omdurman(Ombada) inSlaughter of Alsabaloga.

3.1.2 Al-Sabaloga Abattior:

This abattoir is located in the west of Omdurman, Khartoum State. It consists of administrative building, Veterinary Services Department, Maintenance Department, the health of the environment. Cattle is slaughtered in the basement, goats and sheep on the top floor. The capacity of slaughter house is 300 head of sheep per day. Electric bus is used to move the carcass. It provides services for carcass export and local consumption.The ante mortem and post mortem examination are conducted by veterinarians. Fluids are disposed off through the sewage system and the solid parts through burning in the incinerator.

3.2 Type of study:

The study design was a cross sectional study which provides snapshot information on occurance of a disease (Martin et al. , 1987). A Cross-sectional study was conducted at Alsabaloga abattoir on three randomly selected days .These days selected were Sunday,Tuesday and Thursday. The animals in these days selected by systematic random sampling method. From each five animals one animal was selected for examination.

3.3 Ante –mortem examination :

Regular visits were made by the investigator to conduct ante -mortem examination of slaughter animals. A total of 332sheep were examined in the Alsabaloga abattoir during the survey period which extended from December2014 to February 2015 During the antemortem inspection, the age, sex, breed, origin and body condition of each animals were determined . The age of animals was determined by Incisors of animals teeth. Body condition of each individual animal was assessed and

recorded depending on their body condition score, were ranked as poor or good. Animal origin was also recorded as State, from which the animal came .

3.4 Post -mortem examination :

During the post mortem examination, visual inspection , palpation and systemic incision of each visceral organs were performed particularly the liver , lungs, kidneys, heart and spleen . In parallel, the following data were recorded :serial number, date, infection, infected organ, number of cysts, and size of cyst. Infected organs were collected in polyethene pags and taken to Helate koko hospital laboratory to conduct cyst count, cyst sizecyst fertility and viability of protoscoleces.

3.5 Laboratory examination

3.5.1. Examination of cysts:

Infected organs were transported to the laboratory of Helate koko hospital for further analysis to determine the state of the cysts . The fertility of cysts were examined microscopically . Each cyst was cut-opened with scissor and the content of the cyst was poured into a clean petri dish. A drop of cyst fluid was put in a clean slide and then examined under the microscope (40×) for the presence of protoscolices .The viability of protoscolices was determined by flame cell motility. The cyst which contained no protoscolices as well as suppurative, calcified, or degenerated were considered as unfertile cyst . wherever the cysts were present, they were removed and incised . The shrunk, evacuated, pus formatted cysts were classified as degenerated cysts, while the solid and sands contained ones were considered as calcified cysts, while the fluid filled cyst and had no protoscolices by direct microscopic examination were considered as sterile cysts .

3.5.2. Size measurement :

Hydatid fluid was aspired from the cysts by syringe and the volume of cysts was estimated by measuring this fluid by using syringe.

3.6 Method of Sampling:

Systematic random sampling method was be chosen to collect Cyst from the ovine in Khartoum state. Samples was be distributed according to the proportion of ovine distribution in the localities of the state, and distribution of herds populations within the locality. Sample size was be determined according to the following formula:

$$\textbf{Sample size(n)} = 4*Q^{\wedge}* P^{\wedge}/L^2$$

$P^{\wedge}$ = the expected prevalence.

$Q^{\wedge}$= 1- P=0,96

L^2 = allowable error

N=4*10,7(1-10,7)/0,0025

The small sample size calculated (166) was multiplied by 2 to increase precission of the resulte (thursfield).

N=166*2=332

The previous prevalence selected equals 10.7 according to Alnour., et at (2010) in a study conducted in area Khartoum (Alkadro). Accordingly The sample size equals 332 animals after the inflation of the exact sample number by two to increase precision of the result (Thursfield, 2007).

3.7 Statistical analysis:

Frequency tables of the distribution according to the potential risk factors was constructed. Cross-tabulation of hydatidosis according to potential risk factors was made. Univariate analysis for risk factors associated with ovine Hydatidosis in Khartoum state, Sudan was be analyzed by the Chi-square test by using statistical packets for Social Sciences (SPSS).Multivariate analysis by Logistic Regression models was performed for risk factors significant at level ≤ 0.25 in the Univariate model. The significant level in the Multivariate analysis was be ≤ 0.05.

Chapter Four

Results

Descriptive statistical analysis frequency tables, cross tabulation and association tables between the disease and risk factors:

4.1 Results:

Of the total 332 sheep inspected, only 9 (2, 8%) animals were positive, and the rest were negative for hydatidosis (Table4.1).

Table4.1: Distribution of hydatidosis infection among 332 sheep examined in Al-sabaloga slaughter house:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-ve	323	97,2	97,2	97.2
	+ve	9	2,8	2,8	100.0
	Total	**332**	**100.0**	**100.0**	

4.2 Age of animals:

Three hundred thirty two sheep of various ages were examined in this study. The presence of cyst in various organs was investigated. The result showed that age distribution of animals, 154 of the sheep were less or equal to one years (young) and 178of sheep were more than one years (old), (Table4.2). Among young animals 1 animal was found infected. Rate of infection within young animals was(0.64%). However among adults 8 animals were found infected. Rate of infection within adults was(4.49 %) (Table 4.3).

The Chi- square test showed no significant association between hydatidosis and age of animals (p-value = 0.031),(Table4.4).

4.3 Source of animals:

Of the total 332 local sheep ecotype inspected, 186 animals were from White Nile,146 animal were from North Kordofan (Table4.2). Infected animals found in this study: 6 animals were from White Nile, 3 animals from North Kordofan. The rate of infection in White Nile was (3.22%) and North Kordofan(2.05%) (Table4.3).

The Chi-square test showed no significant association between the infection and source of animal (p-value = 0.514), (table4.4).

4.4 Breed:

The results of study showed distribution of hydatidosis in AL-sabaloga slaughterhouse according to ecotype. All the ecotypes were local ecotypes, 140 kabashy,192 hamary, only three animals were positive from kabashy and only six animals were positive from hamary(Table4.2). The rate of infection was(2.14%) in kabashy breed and(3.12%)in hamary breed (Table4.3).

The Chi- square test showed no significant association between the infection and breed (p-value = 0.586), (Table4.4).

4.5 Body condition:

The body condition of animals and the presence of infection were investigated 326 of sheep were found to be in good condition, while 6 of sheep were found to be in poor condition (Table4.2). Among good body condition 9 animals were found infected. The rate of infection within good animals was(2.76%). However no animal was found infected among poor animals. The rate of infection within poor animals was (0.0%**)** (Table4.3).

Chi- square test showed no significant association between the infection and body condition (p-value = 0.680), (Table4.4).

4.6 Grazing:

The number of animals in closed grazing were 49,and in open grazing were 283(Table 4.2).The number of infected animals in closed grazing was 1and was 8 in open grazing. The rate of infection was (2.04%) in closed grazing and(2.82%) in open grazing(Table 4.3).

Chi- square test showed no significant association between the infection and grazing system(p-value=0.754). (Table4.4) .

4.7 present of dogs:

The number of peoples who said no presence of dogs were 176 and peoples who said yes for the presence of dogs were 156(Table4.2).the number of infected animals in peoples who said no presence of dogs were (1.70%)and were (3.84%) in peoples who said yes for the presence of dogs (Table4.3).

Chi- square test showed no significant association between the infection and present of dogs(p-value=0.230). (Table4.4) .

4.8 Using of treatment:

The number of peoples who used treatment were 228 and those not using treatment were 104(Table 4.2).The number of infected animals in those using treatment group was(0.43%) and in groupnot using treatment was (7.69%)(Table 4.3).

Chi- square test showed significant association between the infection and using of treatment(p-value=0.000). (Table4.4) .

4.9 Location of cysts:

The location of cysts in different organs was investigated. The results showed that muscle was the most infected organ with hydatidosis in 7 cases and 2 case was found in the liver. No infection was found on lungs or others organs. (Table4.3).

Chi- square test showed significant association between the infection and location of cyst (p-value=0.00). (Table4.4).

4.10 Size of cysts (volume) :

Distribution of small than or equal to 3 ml , more than 3 ml and caseaous cysts in organs was listed in(Table4.2) . More than 3 ml size cysts was found in three case and small than or equal to 3 ml cysts was found in five cases , while the caseous cyst was found in one case, (Table4.3).

Chi- square test showed significant association between the infection and size of cyst(p-value=0.00) . (Table4.4) .

4.11 Fertility of cysts:

Macroscopic examination of the cysts revealed a total of 9 cysts.Four cysts were fertile and viable ,Four cysts were sterile (Table4.3), while the caseous cyst have was in one case.

Chi- square test showed significant association between the infection and fertility of cyst (p-value=0.00). (Table4.4) .

Table4.2: Summary of frequency and cross tables for potential risk factors of hydatidosis in 332 sheep examined at Alsabaloga slaughterhouse:

Risk Factors	Frequency	RelativeFrequency %	No. affected (%)
Origin			
White Nile	186	56	6(3.22)%
North Kordofan	146	44	3 (2.05)%
Age			
<1years	154	46.4	1(0.64)%
≥ 1years	178	53.6	8 (4.49)%
Body codition			
Good	326	98.2	9 (2.76)%
Poor	6	1.8	0(0)%
Breed			
Kabashy	140	42.2	3(2.14)%
Hamary	192	57.8	6 (3.12)%
Grazing			
Close	49	14.8	1 (2.04)%
Open	283	85.2	8 (2.82)%

Table4.2 Continued

Risk Factors	Frequency	RelativeFrequency %	No.affected(%)
Present of dog			
No	176	53	3 (1.70)%
Yes	156	47	6(3.84)%
Location			
No cyst	323	97.3	0(0)%
Liver	2	0.6	2(0.6)%
Muscle	7	2.1	7(2.1)%
Volume			
Nocyst	323	97.3	0(0)%
≤3 ml	6	1.8	6(1.8)%
>3 ml	3	0.9	3(0.9)%
Fertility			
No cyst	323	97.6	0(0)%
Fertile	4	1.2	4(1.2)%
Sterile	4	1.2	4(1.2)%
Caseous	1	0.3	1(0.3)%
Use of treatment	228	68.7	1(0.43)%
Yes	104	31.3	8(7.69)%
No			

Table4.3: Summary of univariate analysis for potential risk factors of hydatidosis in332 sheep examined at Alsabaloga slaughterhouse using the Chi- square test:

Risk factors	**No. inspected**	**No. affected (%)**	**d.f**	**Chi-square value**	**p- value**
Origin White Nile North Kordofan	 186 146	 6(3.22) 3 (2.05)	1	0.425	0.514
Age <1years ≥ 1years	 154 178	 1(0.64) 8 (4.49)	1	4.628	0.031
Body codition Good Poor	 326 6	 9 (2.76) 0(0)	1	0.170	0.680
Breed Kabashy Hamary	 140 192	 3(2.14) 6 (3.12)	1	0.296	0.586
Grazing Close Open	 49 283	 1 (2.04) 8 (2.82)	1	0.098	0.754

Table4.1.3 Continued

Risk factors	No. inspected	No. affected (%)	d.f	Chi-square value	p- value
Present of dog			1	1.438	0.230
No	176	3 (1.70)			
Yes	156	6(3.84)			
Use of treatment			1	14.249	0.000(*)
Yes	228	1(0.43)			
No	104	8(7.69)			

(*) mean significant

Table4.4: Summary of univariate analysis for potential risk factors of hydatidosis in 332 sheep examined at Alsabaloga slaughterhouse using the OR test:

Risk factors	No. inspected	No. affected (%)	d.f	OR	p-value	95% CI for	
						Lower	Upper
Origin White Nile North Kordofan	186 146	6(3.22) 3 (2.05)	1	.629 Ref	0.541	1.55	2.560
Age <1years ≥ 1years	154 178	1(0.64) 8 (4.49)	1	Ref 7.200	.031	.890	58.229
Body codition Good Poor	326 6	9 (2.76) 0(0)	1	0.000 Ref	0.680	–	–
Breed Kabashy Hamary	140 192	3(2.14) 6 (3.12)	1	Ref 1.473	.586	.362	5.994
Grazing Close Open	49 283	1 (2.04) 8 (2.82)	1	Ref 1.396	.754	.171	11.418

Table4.1.4 Continued

Risk factors	No. inspected	No. affected (%)	d.f	OR	p- value	95% CI for	
						Lower	Upper
Present of dog			1		.230		
No	176	3 (1.70)		Ref		–	–
Yes	156	6(3.84)		2.307		.597	9.383
Use of treatment			1		0.000**(*)**		
Yes	228	1(0.4)		Ref		–	–
No	104	8(7.69)		18.917		2.334	153.323

(*) mean significant

Table4.5: Multivariate analysis of hydatidosis and potential risk factors in 332 sheep examined at Alsabaloga slaughterhouse using logistic Regression:

Risk factors	No. inspected	No. affected (%)	d.f	Exp (P)	p-value	95% CI for	
						Lower	Upper
Origin White Nile North Kordofan	 186 146	 6(3.22) 3 (2.05)	1	 .322 Ref	0.580	0.006	17.8
Age <1years ≥ 1years	 154 178	 1(0.64) 8 (4.49)	1	 Ref 1.2	0.938	0.012	116.96
Body codition Good Poor	 326 6	 9 (2.76) 0(0)	1	 0 Ref	0.999	–	–
Breed Kabashy Hamary	 140 192	 3(2.14) 6 (3.12)	1	 Ref 0.531	0.513	0.08	3.537
Grazing Close Open	 49 283	 1 (2.04) 8 (2.82)	1	 Ref 0	0.995	0	–

Table 4.1.4 Continued

Risk factors	No. inspected	No. affected (%)	d.f	OR	p- value	95% CI for	
						Lower	Upper
Present of dog			1		0.965		
No	176	3 (1.70)		Ref		–	–
Yes	156	6(3.84)		1.098		0.016	74.6
Use of treatment			1		0.995		
Yes	228	1(0.4)		Ref		–	–
No	104	8(7.69)		1.129		0	–

Chapter Five

Discussion

In The present study the prevalence of disease was(2.8 %)in sheep slaughtered in Alsabaloga slaughterhouse, WestOmdurman ,Sudan . The result is similar to those of another study carried out in Sinnar area , Blue Nile State, Sudan from where the rate of infection in cattle was 2.7% (Ibrahim et al ., 2011). Another study showed also similar rate of ovine infection in Sudan which was 3% (Elmahdi et al., 2002).

The prevalence of hydatid cyst in this study (2.8%),is lower than the results in other studies which was (4.9%)in Ethiopia (Formsa and jobre., 2011%),(8.4%) in Libya (Alkhalidi.,1998),(11.1%)in iran (dalimi et al .,2002),(11.1%) in Iraq(Saida and Nouraddin .,2011) , (12.61%) in Saudia Arabia (Ibrahim ., 2010), (13.47%) in Ethiopia (Fikire et al.,2012) and (45.5%) in Iran (khanjari et al .,2012).

On the other hand the prevalence of hydatid cyst recorded during this study is higher than the result in other studies which was 1.6% in north kordofan (Khalid ,2014)0,14% in Khartoum State (Mohamadin and Abdelgadir,2011)

This might be due to the variation in environmental condition because; the eggs survive for only short periods of time if they are exposed to direct sunlight and dry conditions (OIE, 2005), and under ideal conditions, *E. granulosus* eggs remain viable for several months in pastures or gardens and on household fomites. The eggs survive best under moist conditions and in moderate temperatures. Viable eggs have been found in water and damp sand for 3 weeks at 30°C, 225 days at 6°C and 32 days at 10-21°C (OIE, 2005). In addition, the difference in hydatidosis prevalence rate between countries could be associated with different factors like control measures applied in place , the level of

community awareness created about the disease, education and economic status of the population, variation in the temperature, environmental conditions, the nature of the pasture and the way of raising these animal, levels of exposure and the maturity and viability of eggs (Njoroge *et al.,* 2002).Moreover, the environmental conditions in west Omdurman State are not suitable for the eggs to survive for long periods of time and this strengthens our study and support that, why our prevalence was lower than other studies. However, recent studies have shown prevalences lower than the present prevalence, 0.6% in Sinnar area , Blue Nile State, Sudan (Ibrahim *et al .,* 2011), 0.14% in Nigeria (Abdullahi *et al.,* 2011) and 0.33% in Egypt (Haridy *et al.*, 2000).

The prevalence of hydatid cyst infection according to source of investigated animals (origin) was estimated in this study. The rate of infection in White nile was 3.22% and in North kordofan was 2.05%. There was no significant association between the hydatidosis and origin of the animals (p-value = 0.514). This result is in agreement with the result of another study carried outin Ethiopia (Formsa and Jobre, 2011). The highest rate of infection was found in White Nile (3.22%) followed by North kordofan (2.05%). This could be attributed to the geographic location, outdoor rearing in open grazing areas, dense dog population (sheep dogs and wild carnivores) and absence of hygienic elimination of sheep offals which leads to environmental parasitic contamination.

With regards to rate of infection of hydatidosis in different age groups of sheep, no significant association (p-value = 0.031) was observed. Animals of more than one year of age were more affected (4.49%) compared with animals less or equal to one year (0.64%). The difference in infection rate could be attributed mainly to the fact that aged animals have longer exposure time to *E. granulosus*(Khanjari *et al.,* 2012). And also due to the fact that hydatid cyst infection is a chronic disease , the

older age reflects a much longer period of exposure to infection, the chances of detecting cysts at meat inspection are higher in aged animals due to the larger size of cysts. Also the older animal cysts have more time to enlarge. Beside that an *Echinococcus* egg, in general , requires at least 6- 12 months before the hydatid cyst stage grows sufficiently to produce protoscolices capable of infecting the carnivore host (Omer, 2013). This result is in agreement with the result of investigation carried out in Sinnar area , Blue Nile State, Sudan (Ibrahim *et al .,* 2011),and in Northern Iran (Daryani *et al.*, 2009).

The result of our study showed that the prevalence of hydatid cyst infection within different body condition of the animals was : 2.76 % in good body condition and 0.0% in poor body condition however, there was no significant association between hydatid cyst infection and body condition of animals (p-value = 0.680), this could be attributed to the fact, the hydatid cyst infection is mild disease which may not affect the general health of the affected animals , also lack of variability in relation to body condition might be due to the little tendency of including emaciated animals presented for slaughter . This result is agreement with the result of another study carried out in sudan **(**Abdalraswal, 2011). But this result disagrees with study conducted in Ethiopia (Melaku et al., 2012) and (Fikrie et al., 2012).

The prevalence of hydatid cyst infection related to breed of animals was assessed : 2.14% in kabashy breed and 3.12% in hamary breed . However, these was no signification association between breeds and hydatid cyst infection (P-value = 0.586), hamary breed had higher rate of infection .This may be attributed to the nature of pasture – grazing patterns of animals, also movement between these topographical location for pasture.

In this study the prevalence of hydatidosis and presence of dogs was as follows : 3.84% rate of infection in the presence of dogs and 1.70 % rate of infection in the absence of dogs, but there was no signification association between presence of dogs and hydatidosis (p-value =0.230) , higher rate of infection was detected in presence of dogs. Logically this is truth because of dogs play important role in complete the life cycle of worms because as a final host, also improper disposal of offals which may lead to continuous source of infection to stray dogs and subsequently a source of infection to domestic animals in the area.

In this study the prevalence of hydatidosis and grazing wasinvestigated : 2.04% rate of infection in close grazing and 2.82% rate of infection in open grazing ,but there was no signification association between grazing and hydatidosis (p-value =0.754), , higher rate of infection was detected in open grazing this due to the fact that sheep is higher at risk to contact with dogs which lead to increase rate of infection.

The occurence of hydatid cyst infection in relation to the using of treatment in animals was higher in animals that no using treatment ,rate of infection was7.69%and lower in animals with using treatment,rate of infection was 0.43%, there is was significant association between using of treatment and hydatidosis (p-value =0.00),thismean due to no using treatment are higher at risk to hydatidosis so infection is high.

The occurence of hydatid cyst infection in relation to the location of cyst in animals was higher in muscle.There was a significant association between hydatid cyst infection and location of cysts (p-value =0.00). These findings are consistent with the observations reported in Libya (Ibrahem and Craig, 1998) and Sudan (Mohamadin and Abdelgadir, 2011) .

Fertility of cyst is an important factor that can affect stability of *E .granulosus* cycle depending on geographical situation, kind of infected host and size of cyst. In our study there was significant association between hydatidosis and fertility of cyst (p-value=0.00). Most cysts in this study were fertile viable (4cases), sterile (4case)and one caseous(one case). This result agrees with a study conducted in Northern Iran (Daryani *et al.,* 2009) .

The variation in fertility, sterility and calcification may be related with strain difference (Mc Mans, 2006), (Arene, 1985). Genotype of infection strain affects the fertility rate of cysts in the intermediate hosts and there by the infectivity of strain for the subsequent (Mwambete et al., 2004)

The occurence of hydatid cyst infection in relation to volume of cyst fluids was gerater than 3 ml volume cysts found in three carcass and lesser than or equal to 3 ml cysts found in six carcass. There was a significant association between hydatid cyst infection and volume (p-value =0.00). This result is compatible with a study conducted in Sinnar area , Blue Nile State, Sudan (Ibrahim *et al* ., 2011), and Ethiopia (Kebede *et al.*, 2009).

Conclusions

The output of this study indicates, that the overall prevalence of hydatid cyst was: 2.8 %.

Unaffected animals were more spread to disease and the muscle were

The most predominant site.

The prevalence different from state to another.

The prevalence was manily in old animals,in good body condition and in open grazing.

By microscope examination of hydatid cyst, showed that 1.2% cyst were sterile and 0.9%cyst were fertile and 0.3%cyst were caseous.

study showed that the muscle was the most infected organ (6 cysts), and three cysts were found in the liver. No cyst was found in heart or lung . Microscopic examination of the 9 cysts (found in 9 affected animals) revealed that, four cysts were sterile, four cysts were fertile.

Significant association was observed between hydatidosis and the age of animals (p-value =0.031), breed of animals (p-value = 0.586) , location of cysts (p-value = 0.00) , body condition (p-value = 0.680)and using of treatment.

Recommendations

1. Scope of my thesis is to alert policy makers to design governmental control programs against hydatid cyst infection to minimize the prevalence in Sudan, and ensure effective protection not only for animal population but also for human at risk of contraction the infection.
2. Enforcement of legislation that will put end to backyard and roadside slaughtering practices.
3. Establishment of policy on dog keeping, handling including registration, treatment and elimination of stray dogs are essential.
4. Promoting the construction of abattoirs with their appropriate disposal pits particularly in rural areas conducting obligatory meat inspection services.
5. Enhancement of awareness of people about the economic and public health importance of the disease.

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Appendix

Appendice1

Origin

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	white nile	186	56.0	56.0	56.0
	north kordofan	146	44.0	44.0	100.0
	Total	332	100.0	100.0	

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than one	154	46.4	46.4	46.4
	equal and more than one	178	53.6	53.6	100.0
	Total	332	100.0	100.0	

body condition

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	good	326	98.2	98.2	98.2
	poor	6	1.8	1.8	100.0
	Total	332	100.0	100.0	

present of dog

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	176	53.0	53.0	53.0
	yes	156	47.0	47.0	100.0
	Total	332	100.0	100.0	

Breed

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	kabashy	140	42.2	42.2	42.2
	hamary	192	57.8	57.8	100.0
	Total	332	100.0	100.0	

Grazing

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	close	49	14.8	14.8	14.8
	open	283	85.2	85.2	100.0
	Total	332	100.0	100.0	

location of cyst

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no cyst	323	97.3	97.3	97.3
	liver	2	.6	.6	97.9
	muscle	7	2.1	2.1	100.0
	Total	332	100.0	100.0	

using of treatment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	228	68.7	68.7	68.7
	No	104	31.3	31.3	100.0
	Total	332	100.0	100.0	

Fertility

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no cyst	323	97.3	97.3	97.3
	fertile	4	1.2	1.2	98.5
	sterile	4	1.2	1.2	99.7
	caseous	1	.3	.3	100.0
	Total	332	100.0	100.0	

Volume

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no cyst	323	97.3	97.3	97.3
	equal and less than3	6	1.8	1.8	99.1
	more than 3	3	.9	.9	100.0
	Total	332	100.0	100.0	

Appendice2

Volume of cyst

Count		Volume			
		no cyst	equal and less than3	more than 3	Total
Result	-ve	323	1	0	324
	+ve	0	5	3	8
Total		323	6	3	332

Fertility

Count		Fertility				
		no cyst	fertile	Sterile	caseous	Total
Result	-ve	323	1	0	0	324
	+ve	0	3	4	1	8
Total		323	4	4	1	332

Using of treatment

Count		using of treatment		
		Yes	No	Total
Result	-ve	227	97	324
	+ve	1	7	8
Total		228	104	332

Location of cyst

Count		location of cyst			Total
		no cyst	Liver	muscle	
Result	-ve	323	0	1	324
	+ve	0	2	6	8
Total		323	2	7	332

Grazing

Count		Grazing		Total
		Close	Open	
Result	-ve	48	276	324
	+ve	1	7	8
Total		49	283	332

Breed

Count		Breed		Total
		Kabashy	Hamary	
Result	-ve	137	187	324
	+ve	3	5	8
Total		140	192	332

Present of dog

Count		present of dog		Total
		No	Yes	
Result	-ve	174	150	324
	+ve	2	6	8
Total		176	156	332

Body condition

Count		body condition		
		Good	Poor	Total
Result	-ve	318	6	324
	+ve	8	0	8
Total		326	6	332

Origin

Count		Origin		
		white nile	north kordofan	Total
Result	-ve	180	144	324
	+ve	6	2	8
Total		186	146	332

Age

Count		Age		
		less than one	equal and more than one	Total
result	-ve	153	171	324
	+ve	1	7	8
Total		154	178	332

Apendice 3

Age

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.785[a]	1	.052
Likelihood Ratio	4.326	1	.038
Linear-by-Linear Association	3.773	1	.052
N of Valid Cases[b]	332		

Origin

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.198[a]	1	.274
Likelihood Ratio	1.270	1	.260
Linear-by-Linear Association	1.195	1	.274
N of Valid Cases[b]	332		

Body condition

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.151[a]	1	.698
Likelihood Ratio	.295	1	.587
Linear-by-Linear Association	.150	1	.698
N of Valid Cases[b]	332		

Present of dog

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.582[a]	1	.108
Likelihood Ratio	2.667	1	.102
Linear-by-Linear Association	2.575	1	.109
N of Valid Cases[b]	332		

Breed

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.073[a]	1	.787
Likelihood Ratio	.074	1	.785
Linear-by-Linear Association	.073	1	.787
N of Valid Cases[b]	332		

Grazing

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.033[a]	1	.855
Likelihood Ratio	.035	1	.852
Linear-by-Linear Association	.033	1	.856
N of Valid Cases[b]	332		

Location of cyst

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.956E2[a]	2	.000
Likelihood Ratio	69.675	2	.000
Linear-by-Linear Association	280.849	1	.000
N of Valid Cases	332		

Using of treatment

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.025[a]	1	.001
Likelihood Ratio	11.266	1	.001
Linear-by-Linear Association	11.988	1	.001
N of Valid Cases[b]	332		

Fertility

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.001E2[a]	3	.000
Likelihood Ratio	70.918	3	.000
Linear-by-Linear Association	278.445	1	.000
N of Valid Cases	332		

Volume of cyst

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.966E2[a]	2	.000
Likelihood Ratio	70.010	2	.000
Linear-by-Linear Association	276.885	1	.000
N of Valid Cases	332		