بسم الله الرحمن الرحيم

Sudan University of Science and Technology

College of Graduate Studies

An Epidemiologic Study on cattle Fasciolosis in Omdurman locality, Khartoum State, Sudan

دراسة وبائية عن مرض الديدان الكبدية في الابقار محلية أم درمان - ولاية الخرطوم- السودان

A Thesis Submitted to the College of Graduate Studies in partial fulfillment of the Requirements for the Degree of Master of Science in Preventive Medicine (M.P.V.M)

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الأية

بسم الله الرحمن الرحمن الرحيم

قال تعالي:

)قَالُواْ سُبْحَانَكَ لاَ عِلْمَ لَنَا إِلاَّ مَا عَلَّمْتَنَا إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ (.

صدق الله العظيم

سورة البقرة(32)

Dedication

Dedicate this dissertation to

My *mother*

My *father*

My *academic advisor, for all of his untiring guidance and support during the course of* ***my*** *master.*

Acknowledgement

First and foremost, praise to Allah for giving me the strength to finish this work.

I would like to express my deep gratitude to my master supervisor, professor Galal Eldin Elazhari Mohammed Elhassan for his advice, direction and continuous interest and constructive criticism in reviewing the dissertation.

My thank *extend to Elsabaloga slaughterhouse staff for assistance during the sample collection.*

My *appreciation is extended to instrumental person at all times starting sample collection until the final stage.*

Finally, I would like to thanks my father to his support and encouragement.

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Abstract

An abattoir survey was conducted on 144 cattle slaughtered at El-Sabaloga abattoir, North Omdurman, Omdurman State, Sudan, during the period from December 2014 to February 2015. The objective was to estimate prevalence of Bovine Fasciolasis and to investigate risk factor associated with disease. Routine meat inspection procedure was employed to detect the presence of *Fasciola* in liver. Faecal materials were collected in to polythene bags directly from the rectum of each of the cattle being sampled after they had been slaughtered.The examined cattle originated from three areas: Eldeain, Neyala, Soge Elmoalhe. The prevalence of *Fasciola* infection according to the areas was: Eldeain 0%, Neyala 3.3%, Soge Elmoalhe 4.49%. The prevalence distribution of Fasciolasis according to the age of animal was: young animal (>2year) 5.2%, medium animal (2-5year) 4%, and l0% in old anima (>5years) .The prevalence distribution of Fasciolasis according to treatment were: 1.69%in animal treated 9.3%in animal that owner said not treatment. The prevalence of Fasciolasis according to the drinking from ground were: 0%in animals were not drinking from ground, 4.09% of animals were drinking from ground

.The prevalence of Fasciolasis in breed of animal were 3.6% indigenous, 0%in cross breed, 0%in Habashi (Karowr) breed.

The result of the univariate analysis by using the chi-square for the following potential risk factors were: age (p-value0.32not significant) source of animal (p-value0.29 not significant), treatment (pvalue0.03 significant), drinking from ground (p-value 0.33 not significant),breed of animal(p-value 0.62 not significant). The treatment of animal were found to be significantly associatially with Fasciolasis.

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

On conclusion the study showed that the all prevalence of Fasciola infection in cattle slaughtered in Elsabaloga slaughter house was caused by *Fasciola gigantica.*

ملخص البحث

اجري البحث علي 144رأس من البقر مذبوحا في مسلخ السبلوقة (محلية امدرمان) في ولاية الخرطوم ,السودان .خلال الفترة من ديسمبر 2014م الي فبراير 2015م ،كان الهدف هو تقدير معدل انتشار مرض الديدان الكبدية في البقر والتحقق من عوامل الخطر المرتبطة بهذا المرض .أجرى التفتيش الروتيني للحوم للكشف عن الديدان الكبدية في الكبد وأخذ عينات من البراز من المستقيم مباشرة بعد فتح الاحشاء الداخلية وذلك من الحيوانات التي سبق اختيارها كعينات قبل الذبح.

كان مصدر البقر المختار من ثلاث مناطق وهي الضعين , نيالا، وسوق المويلح بمحلية امدرمان . كان معدل انتشار المرض في الابقار وفقا للمناطق التي اتت منها الحيوانات: 0% في الابقار القادمة من منطقة الضعين ،3.3% في الابقار القادمة من نيالا و 4.49% للقادمة من سوق المويلح .وقد كان معدل انتشار المرض في الابقار وفقا لسنها 2.5 في الابقار الصغيرة)اقل من سنتين(،4% في الابقار المتوسطة العمر)من سنتين الي خمس سنوات(، 0 %في الابقار كبيرة العمر)اكبر من خمس سنوات (. اما انتشار المرض في الابقار اعتماد علي معالجتها فكان: 9.3 %في الابقار التي لم تتلقي العلاج ،1.6%في الابقار التي تلقت العلاج .وكان معدل انتشار الديدان الكبدية في الابقار اعتمادا علي شربها المياه من الارض) الحفاير والترع (كالاتي:0%في الحيوانات التي تسقي من مصادر اخري ،4.9في الحيوانات التي تعتمد في

شربها علي الحفاير والترع .كان معدا انتشار المرض اعتمادا علي سلالة الحيوانات مالاتي: 3.6%في الحيوانات المحلية،0% في سلاله الحيوانات المستورده 0 % في سلاله الحيوانات الحبشية.

عندما تم تحليل عوامل المخاطر بواسطة التحليل الاحادي وباستخدام مربع كاي كانت نتيجة التحليل :لعمر الحيوان(p=0.32القيمة) ولمصدر الحيوان(p=0.29القيمة) وللمعالجة (p=0.03القيمة) وللشراب من الارض (p=0.33القيمة) ولسلالة الحيوان(p=0.62القيمة). باستخدام مربع كاي لتحليل قيمة عوامل الخطر وجد ان العلاج (p=0.03القيمة) كانت له علاقة معنوية بانتشار المرض وعندما تم التحليل المتعدد لمعرفة درجة الارتباط بينة وبين العوامل الاخري وجد انة لاتوجد علاقة معنوية بين انتشار المرض والعوامل الاخرى.

اوضحت الدراسة ان كل معدلات الاصابة بالديدان الكبدية في الابقار المزبوحة في مسلخ السبلوقه تسببها .*Fasciola gigantica*

INTRODUCTION

1.1 Background

Fascioliasis is one of the most prevalent helminthdisease throughout the world (Okewole2000). It has the widest geographic spread of any emerging vector-borne zoonotic disease occurring in more than 51 countries worldwide (Mas-Coma*et al*., 2009). Fasciolosis isalso known as Fascioliasis, Distomatosis and liver Rot .The disease is an important disease of cattle caused by trematodes i.e *Fasciola hepatica* and *Fasciola gigantica* (common liver flukes) . This condition of internal parasitism is one of the major problems thatlowers the livestock productivity throughout the world (Vercruysse and Claerebont, 2001).

The parasite is transmitted by ingestion of metacercaria of *Fasciola species* on plants from contaminated fresh water(WHO, 1999). The organism causes ‘liver rot’ among sheep and cattle which are the definitive hosts; humans are incidental hosts(Usip*et al*., 2012).At present, Fascioliasisis a vector-borne disease presenting the widest known latitudinal, longitudinal and altitudinal distribution. *Fasciola hepatica* has succeeded in expanding from its European original geographical area to colonize five continents, despite theoretical restrictions related to its biology and in turn dependent upon environmental and human activities (Mas-Coma2005).The fluke species are hermaphroditic, have similar life cycles, and cause similar clinical manifestations in animals.Climatic diversities are particularly important to the development of the snails that act as intermediate hosts for Fasciolias is in areas with differing environmental characteristics. Techniques have identified two Fasciolias, including *F. hepatica* and *F. gigantica*. It is established that areas with only one *Fasciola spp*. are distinct from local and zonal areas where both Fasciolids co-exist (Amor *et al*; 2011).

1.2 Justification:

Fascioliasis is a zoonosis, i.e. a disease of animals that can be transmitted to humans. Susceptible animal reservoir hosts for *Fasciolaspecies* include:

- The main domestic animals: cattle, sheep, pigs,buffaloes and donkeys.
- Other domestic animals: horses, goats, and camels.
- Sylvatic animals (hares, rabbits and rodents).

Sheep and cattle are the most important definitive hosts of *Fasciola hepatica*; goats, buffalo, horses, camels, hogs, deer, and rabbits can also be infected (Kaplan, 2001).

Fascioliasis is a major constraint in development of livestock industry causing huge economic losses. It causes reduction in productivity of animal in terms of lowered growth rate, meat and milk production, fertility, feed efficiency and draught power (Asrat, 2004).Condemnation of infected livers and cost of control measures are other sources of economic loss. It has been estimated that economic losses due to Fascioliasis reached up to US$ 2 billion per year worldwide (Mas-Coma., 2009).

Animal resources in the Sudan are considered as one of the largest in the Arab and African countries. Cattle played a significant role in the economic cycle in rural and urban areas. Intensive and semi-intensive production system of Sudan distributed either within aggregation sites in different locations or in small herds located in different sites around towns. The high needs for animal proteins especially milk and milk products in recent years in Khartoum State oriented the producers to import highly milk producing foreign breeds to face the human consumption(Mohamed *et al.*, 2011).Fasciolosis was considered as a secondary disease until the mid-90s. Recent research has furnished numerous hitherto-unknown aspects and new information which have given rise to complete new general picture of this disease, explaining why human Fascioliosis has recently been included within the list of important human parasitic diseases by World Health Organization (Mas-Coma, 2004).

1.3 Objectives:

Therefore, this study was aimed to:

1. Estimate the prevalenceof Fasciolosis in cattle in Omdurman locality– Khartoum state -Sudan.
2. Investigate the risk factors that associated with Fasciolasis infections.

Chapter One

Literature Review

2.1 Classification

According to Saira (2011) *Fasciola SPP*classified as following:

Kingdom: ***Animalia***

Phylum: ***Platyhelminthes***

Class: ***Trematoda***

Order: ***Digenea***

Family: ***Fasciolidae***

Genus: ***Fasciola***

Species: ***Fasciola hepatica***

Species: ***Fasciola gigantica***

2.2Etiology:

Fasciolasis is caused by *Fasciola gigantica and Fasciola hepatica* . Adult flukes of both species (*Fasciola hepatica* and *Fasciola gigantica*) are live in the bile ducts and immature live in the parenchyma of the liver (Vercruysse *et al*., 2001).

2.3Morphology of Fasciola:

Fasciola gigantica measures 4 to 10 cm in length (Figure 1), and the distribution of the species is limited to the tropics and has been recorded in Africa, the Middle East, Eastern Europe and south and eastern Asia (Torgerson *et al*,. 1999). *Fasciola hepatica* measures 2cm to 3 cm in length by 1.3cm in width (Figure 2), and has a cosmopolitan distribution. *Fasciola hepatica* is one of the largest fluke in the world. Theadult worm has a very characteristic leaf shape with the anterior end being broader than the posterior end and anterior cone and a ventral sucker at the base of the cone which allow it to attach to the lining of the biliary ducts. Each worm possesses ovaries and testes which are highly branched and allow for individual flukes to produce eggs independently(Usip *et al* 2012).

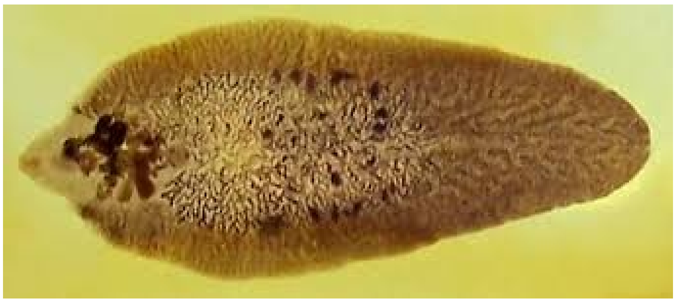

Figure 1: Morphology of mature adult worm of *F. gigantica*

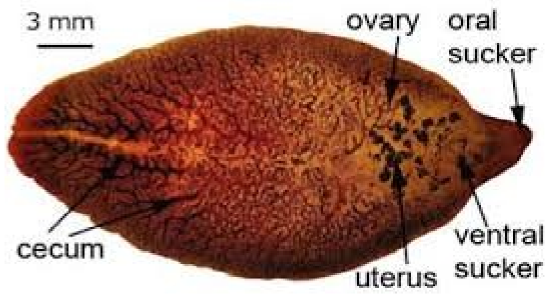

Figure 2: Morphology of mature adult worm of *F. hepatica*

Source: http://www.parasitesinhumans.org/fasciola- hepatica-liver-fluke.

2.4 Morphology of Fasciola Egge:

The *Fasciola* egg is yellow-brown in color, large and oval in shape. It has an indistinct operculum (lid). It contains an unsegmented ovum surrounded by many yolk cells (Monica, 1987).The shape of the eggs (Figure 3) of the two flukes is also very similar with the measurements of *F.hepatica* and *F.gigantica* being approximately 150μm x 90μm and 200μm x 100μm, respectively (Saira , 2011).

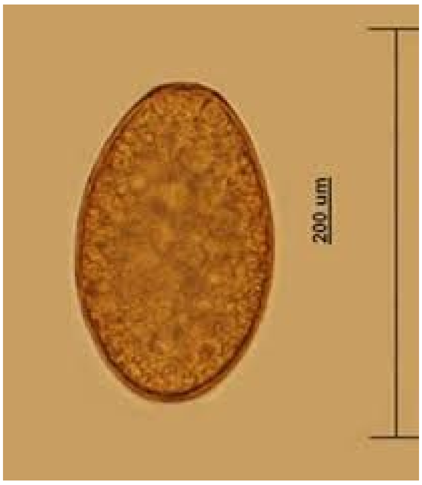

Figure 3: Morphology of *Fasciola* Egge

Source:<u>**http://upload.wikimedia.org/wikipedia/commons**</u>

Life cycle:

The life cycle of Fascioliasisbegins with release of unembryonated eggs into the biliary ducts which are then passed in the stool of herbivores (definitive hosts) or humans (incidental hosts). Eggs become embryonated in water and release miracidia which invade a snail (intermediate host),in the snail theparasites undergo several developmental stages (sporocysts, rediae, and cercariae. The cercariae are released from the snail and encyst as metacercariae on aquatic vegetation or other surfaces. Immature eggs are discharged in the biliary ducts and in the stool. Mammals acquire the infection by eating vegetation containing metacercariae. Humans can become infected by ingesting metacercariae-containing freshwater plants, especially watercress. After ingestion, the metacercariae excyst in the duodenum and migrate through the intestinal wall, the peritoneal cavity, and the liver parenchyma into the biliary ducts, where they develop into adults (figure 4). In humans, maturation from metacercariae into adult flukes takes approximately 3 to 4 months. The adult flukes (*Fasciola hepatica*: up to 30 mm by 13 mm; *Fasciola gigantica*: up to 75 mm) reside in the large biliary ducts of the mammalian host. *Fasciola hepatica* infects various animal species, mostly herbivores(Usip *et al*.,2012).

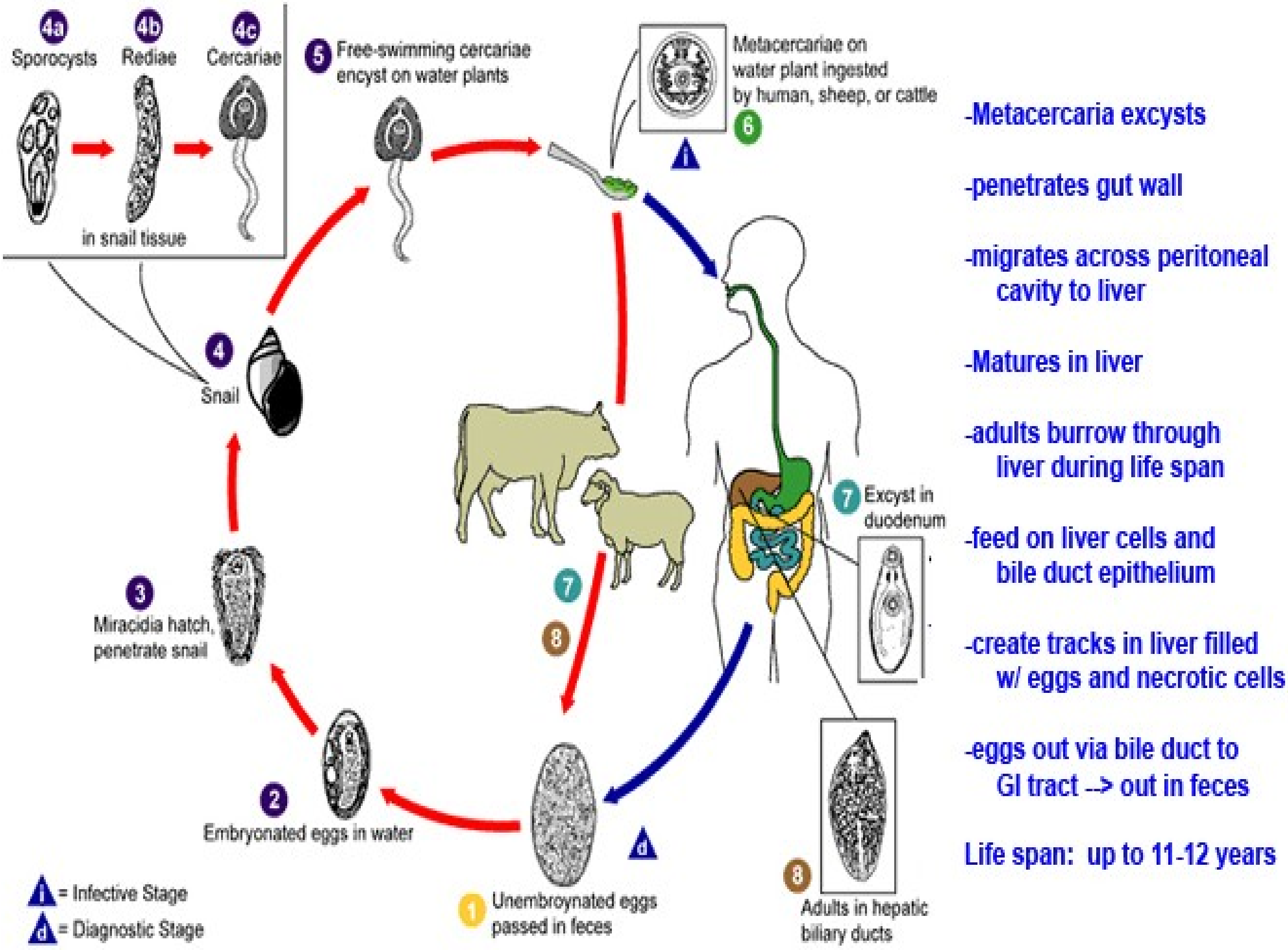

Figure4: Lifecycle of *Fasciola*

Source:http://www.dpd.cdc.gov/dpd

2.6Pathogenesisand clinical sings: Inadult cattle, the infection usually takes a chronic course, with no obvious clinical signs. Significant production losses occur in the herds having a prevalence of *F. hepatica* infection of 25 % or above (Vercruysse *et al*., 2001).Calves are susceptible to disease but in excess of 1000 metacercariae are usually required to cause clinical Fascioliasis. In this case the disease is similar to sheep and is characterized by weight loss, anemia, hypoalbuminemia and death (Boray, 1969). The course usually is determined by the number of metacrcariae ingested over a short period (The Merck Veterinary Manual, 2005). Acute Fasciolosis is common in sheep and goats while the chronic form is found mostly in cattle. Symptoms of Fasciolosisinclude anemia, emaciation and reproductive dysfunction in animals with the chronic form. While in acute Fasciolosis, the animals usually show signs of anorexia, dullness, diarrhea, muscular atrophy, subcutaneous edema and impaired immune systems. Hepatic Fasciolosis is often characterized by a swollen liver (Ozung, 2011). The signs and symptoms of Fasciolosisdepend upon the intensity of infection, which signifies the number of metacercariae ingested by the animal. In sheep and cattle, clinical presentation is divided into 4 types. Acute type I Fasciolosis occurs when the animal ingests more than 5000 metacercariae, which may lead to its sudden death, without showing any previous clinical signs. The common signs are ascites, weakness and extensive abdominal hemorrhage. In acute type II Fasciolosis infection occurs as a result of the ingestion of 1000-5000 metacercariae. In this case the animal dies by showing signs of pallor, loss of condition and ascites. Sub acute Fasciolosis occurs due to the ingestion of 800-1000 metacercariae. The animal becomes weak, anemic and weight loss may result in death of the animal. Chronic Fasciolosis occurs when 200-800 metacercariae are Ingested. This is prolonged and does not have clear key symptoms except for gradual weight loss (Saira, 2011). Acute Fasciolosisoccurs as disease outbreak following a massive, but relatively short-term, intake of metacercariae. It typically occurs when stocks are forced to graze in heavily contaminated wet areas as a result of overstocking and /or drought. Death usually results from blood loss due to hemorrhage and tissue destruction caused by the migratory juvenile flukes in the liver resulting in traumatic hepatitis. This is more commonly seen in sheep than in other hosts (Michael, 2004). Importance of cattle Fascioliasis consists in economic losses caused by condemnation of livers at slaughter and production losses especially due to reduced weight gain. While the worms are in the process of maturing and making their way to a person's bile ducts, he or she will generally experience vomiting and other severe gastrointestinal symptoms. Once the worms reach their full size, which can take three or four months, many of these symptoms will lessen (Usip *et al*; 2014).

2.7Lesions:

Microscopically, the liver showed areas of coagulation necrosis, extensive hemorrhages in streaks or foci, and disruption of the parenchyma with neutrophil and eosinophil infiltration .There was also fibrosis and bile duct proliferation in some areas. Several vessels were occluded by thrombi. Immature *F. hepatica* flukes were observed in the parenchyma surrounded by fibrosis and degenerated hepatocytes, neutrophils, eosinophils and hemorrhages in several areas. Peritonitis with fibrino-hemorrhagic deposits was observed on the serous surfaces. Multifocal fibrosis, hemorrhages, and neutrophil infiltration were observed in the renal cortex, and hyaline casts were present in the renal tubules (Maria *et al*.,2013).

2.8 Human Fasciolosis:

Food-borne trematodiases, including Fascioloisis, are neglected in the international public health arena in comparison with other helminthic diseases.These diseaseshad been considered a secondary zoonotic disease until the mid-1990s.Human Fascioliasis is at present emerging or re-emerging in many countries, includingincreases of prevalence and intensity and geographical expansion. Research inrecent years has justified the inclusion of Fascioliasis in the list of important human parasitic diseases. Among the different epidemiological situations, human hypo- to hyperendemic areas, including epidemics, are noteworthy. A global analysis of the distribution of human cases shows that the expected correlation between animal and human Fascioliasis only appears at a basic level. Areas presenting very high human prevalences and intensities, especially in children and females, have been recently described. In hypo- to hyperendemic areas of Central and SouthAmerica, Europe, Africa and Asia, human Fascioliasis presents a range of epidemiological characteristics related to a wide diversity of environments. Thus far well-known epidemiological patterns of Fascioliasis may not always explain the transmission characteristics in any given area and control measures should consider the results of ecoepidemiological studies undertaken in the zones concerned (Mas-Coma 2005). Human infection with Fasciolosis was very sporadic until the last three decades when clinical cases and outbreaks were reported. It is a major public health problem in several areas of world, including the highlands of Bolivia, Ecuador and Peru; Nile Delta in Egypt; and central in Vietnam. The infection was limited in the past to specific and typical geographical areas, but it is now has a world wide spread. Withhuman cases being increasingly reported from Europe, Americas and Oceania (where only *F.hepatica* is transmitted), and from Africa and Asia (where the two species overlap).As a consequence, human Fasciolosis should be considered as a zoonosis of major global and regional importance. Human infection causes serious hepatic pathological consequences due to the severe damage which occurs in the liver cells mainly during the early migrating stages of the flukes (Soliman, 2008).The infection is most often characterized by fever, pain, eosinophilia and abdominal inflammation (WHO, 1999).The World Health Organization reported that the infection is considered a neglected disease and that where animal cases are reported as human cases are usually found (WHO, 2012).

2.9 Diagnosis:

In animals is based predominantly on faeces examinations and immunological methods. However, clinical signs, biochemical and haematological profile, season, climate conditions, epidemiology situation, and examinations of snails must be considered(Torgerson and Claxton, 1999).

Confirmatory diagnosis however, is based on demonstration of *Fasciola spp* eggs through standard examination of feces in the laboratory, post mortem examination of infected animals. Even though it is impossible to detect Fasciola in live animals, liver examination at slaughter or necropsy was found to be the most direct, reliable, and cost effective technique for diagnosis of Fasciolosis. There is other laboratory tests (enzymatic and/or serological procedures) used to qualify the infection mainly for research purposes (Dechasa et al., 2012).The current diagnostic tests for Fasciolosis in cattle are qualitative only, yet the level of infection is considered an important factor in determining production losses. (Dargie, 1987; Vercruysse,. 2001).

The immuno enzymatic techniques as indirect ELISA have been found very suitable for the diagnosis of Fasciolosis due to their high sensitivity and the possibility of many sera samples (Arriaga et al., 1989). During migratory phase of infection, *F. hepatica* antigens are available to the immune system, and it is possible to detect them by serologic probes as sandwich-enzymelinked immunosorbent assay SEA (Langley and Hillyer, 1989). When the parasite is established in the bile ducts less antigen is there available to the immune system, and its detection must be directed to fecal or bile samples. It has been demonstrated that most of pathological damage takes place when flukes are migrating through peritoneal cavity and liver parenchyma before their establishment in the bile ducts. It is very important to use early diagnostic techniques to reduce the great losses in cattle. An indirect-enzyme immune-linked immunosorbent assay IEA allows an early diagnosis ofFasciolosis.

F. hepatica antibodies can first be detected by indirect-ELISA between 3 and 6 weeks after infection during the liver migratory phase of immature worms (Marin, 1992). Long persistence of high levels of immunoglobulin, even though animals have been successfully treated, makes interpretation more difficult in detected antigenemia as early as 2 weeks after infection in cows (Langley and Hillyer, 1989). It is concluded that it is very important and useful to combine two enzymatic assays, indirect and direct ELISA, to achieve a more reliable knowledge of the real infection status of the host.

Molecular identification based on PCR gene specific primers and cloning of internal transcribed spacer and their sequence comparison was also used. The phylogenetic diversity in Fasciola was also studied by using six 38 microsatellite markers. The ITS markers were popularly used in molecular systematics world over in different organisms for determining species origin and classification, whereas microsatellites investigates genetic diversity present in an organism. The presence of diversity in the genome of an organism ensures its successful survival and makes it adaptable to the prevailing environment. The considerable variability present proposes interbreeding which is favorable for diversity (Saria, 2011).

2.10 Treatment and control:

The treatment is essential for controlling spread of Fascioliasis as infected animalspass eggs through feces. These methods involve reduction in the number of intermediate snail hosts by chemical or biological means, strategic application of anthelmintics, reduction in the of snails by drainage, fencing and other management practices and reduction in the risk of infection by planned grazing management(Michael , 2004).

In developed countries it is supported by analyzing on costs and benefits, but in developing countries there are more priorities for utilization of limited reserves of cash and treatment of animal. Grazing on mutual lands is inefficient till a high proportion of livestock owners treat. Treating with an anthelmentic 4 times a year is effective against young parasites, but there are few marked places where it will be feasible. The most frequently used drug in *F. hepatica* infected dairy herds is Albendazole (Mezo et al., 2008), a broad spectrum anthelmintic that is also active against nematodes in gastro intestinal tract which can have a negative effect on milk production (Charlier et al., 2007).

Oxyclozanide is the only effective drug against mature flukes over 14 weeks old (Boray, 1986; Richards et al., 1990) and greater improvement in milk yield would be expected with drugs such as Triclabendazole, which is effective against all stages of parasite. Triclabendazole (TCBZ) is the current drug of choice used for the treatment of *F. hepatica* infections, because of its high activity against both Juvenile and adult flukes (Boray et al., 1983; Fairweather, 2005). Indiscriminate use of anthelmentics has caused resistance (Boray, 1990), so thedisease has not been eradicated.Combinations of some older drugs have a high efficacy against the mature and immature flukes (Boray, 1994). One potential strategy to deal with resistance is by manipulating the pharmacokinetics of the drug, thereby enhancing its bioavailability active lifespan, with the goal of increasing its efficacy. The metabolism of benzimidazble-type drugs, as TCBZ, can be affected by co-treatment with inhibitors that target the flarin monooxygenase (FMO) and Cytochrome P450 (CyP450) enzyme pathways. This may lead to an enhancement of the bioavailability of the active metabolisms (Lanusse and Prichard, 1991). In turn, the enhanced bioavailability has been shown to improve the efficacy of the drug (Benchaoui and Mckellar, 1996). Rediae of *F. hepatica* (Boray, 1964) and *F. gigantica* (Wilson and Dennison, 1980) can reduce or sterilize the fecundity of lymnaeid snails by damaging the gonads. *F. hepatica* in *L.truncatula* (Kendall, 1950) and *F.gigantica* in *L.natalensis* (Madsen and Monrad, 1981), impair the growth of snails in the early stage of infection. But in the later stage growth rate may be stimulated by *F. hepatica* (Wilson and Dennison, 1980). When there are heavy infections with *F. hepatica* it kills the snails (Boray, 1964). Although anthelmintic treatment is effective against Fasciolosis, this is an expensive and non-sustainable measure, and drug resistant strains have been reported.The alternative to anthelmintics is the development of a vaccine. In developed countries vaccines would have to be as cost effective as Fasciolicides. Vaccines in developing countries would have to be affordable, but would have the advantage that their efficacy would be independent of the levels of infection in other animals in the community. Lymnaeid Snails with thin shells and no operculum are vulnerable to predators such as, crustaceans, amphibians, birds, rodents and reptiles.(Rana and Roohi*et al*2014).

Approaches to the control of Fasciolosis in ruminants are compared for developed countries, and for developing countries with particular reference to regions growing irrigated rice.In all environments problem definition and investigation are based on one or more of observation, abattoir surveys, faecal egg counts, tracer animals and snail studies. In developed countries each husbandman grazes a large number of animals, controls access to pasture and water, and markets high value products. Strategic and tactical treatments control Fasciolosis in these circumstances and will continue to do so while anthelmintics remain effective. In many developing countries subsistence families possess small numbers of animals, feed and water sources are shared by many families, and the products are mainly draft power, fertiliser and meat for local consumption. Consequently the agricultural cycle, and the life cycles of the parasite and intermediate host, are closely interrelated and there is some scope for controlling infection by modifying husbandry practices. Anthelmintics are not affordable. Recent observations of a major Fasciola resistance gene with substantial dominance, in Indonesian Thin Tail sheep infected with *Fasciolagigantica*, suggest that parasite control by breed substitution, or cross-breeding and selection, is feasible. Such control would be inexpensive to implement, and sustainable (Roberts andSuhardono 1996).

Behavior changes have the potential to be the most effective and cost efficient approaches to disease control and thus, education is an essential aspect of any public health effort. The primary message of *Fasciola hepatica* campaign is to keep domestic animal herds separate from the growing sites of aquatic plants. This limits the risk of contaminating the vegetation and thus decreases both human infection and the animal reservoir (Chitsulo,et al, 2001). . Infection can potentially be avoided by cooking these plants fully before eating them. In some areas, eating these plants raw is relatively customary, and Fascioliasis in humans is more common in those areas (Usip et al., 2012).

2.11Geographic distribution and prevalence of Fasciolosis in selected regions of the world:

Fascioliasis has the widest geographic spread of any emerging vector-borne zoonotic disease occurring in more than 51 countries worldwide (Mas-Coma*;* 2009), while 91 million are at risk worldwide (Keiser and Utzinger, 2009).The cercariae of liverflukes were observed from a pond first time by OttoMuller in 1773 (Andrews, 1999). These are *Fasciola* gigantica*(F. gigantica*) is found in the tropics and sub tropics and *Fasciola hepatica (F.hepatica*) in the temperate zones.Losos (1995) reported that *F. gigantica* predominates in Africa and it is usually transmitted by a snail of the genus *Lymnae* which get to the definitive or final host following the ingestion of the metacercariae during grazing on vegetation.According to Wikipedia Free Encyclopedia (2010), countries where Fascioliasis of ruminants was repeatedly reported are:

- Europe: UK, Ireland, France, Portugal, Spain, Switzerland, Italy, Netherlands,Turkey, Germany, Poland.
- Asia: Russia, Thailand, Iraq, Iran, China, Vietnam, India, Nepal, Japan, Korea,Philippines.
- Africa: Kenya, Zimbabwe, Nigeria, Egypt, Gambia, Morocco.
- Australia and the Oceania: Australia, New Zealand.
- Americas: United States, Mexico, Cuba, Peru, Chile, Uruguay, Argentina, Jamaica, Brazil.

The prevalence of *Fasciola* infection depends on several factors related to the biology ofthe vectors, biology of the parasite and the management of flocks and herds. A lot of prevalence studies have been carried out to investigate the level of spread of *Fasciola* species infections. In Africa, Megard (1975) gave the prevalence rates in

Kenya (33%), Sudan (37%), Cameroun (45%), Ethiopia (30-90%), Uganda (10%), Central African Republic (62%) and Rwanda (50%).

Perfuse study conducted in Nigeria reports that the prevalence of Fascioliasis in cattle slaughtered in the Sokoto metropolitan abattoir recorded in this research work can be attributed to the climatic conditions of this location which does not favour the survival of the intermediate hosts, the snail. This intermediate host prefers swampy areas with slowly moving water and small streams which also allow sufficient moisture for the survival of the infective metacercariae. In contrast, the study area, Sokoto, occupies low flat and naturally dry land (semiarid area). This probably explains the low percentage of infection with Fascioliasis among cattle slaughtered in the abattoir (Kabir*et al* 2014).

There are many ecological factors affecting snail populations including temperature, light, hydrogen ion concentration (pH), vegetation, depth of water, current of the water, chemical composition of the soil, and snail population competition(Malek 1980, Brown 1994). It has been reported that the Lymnaeid intermediate hosts of *F. gigantica* are distinguishable from those of F. *hepatica*, both similar morphologically and as to habitat requirement (Malek 1980). The species of *Fasciola* can become adapted to new intermediate hosts under certain conditions at least based on laboratory trials. It has been reported that the most important intermediate hosts of *F. gigantica are L. auricularia;* however*, L. rufescens and L.acuminata* are the host snails in the Indian Subcontinent*; L. rubiginosa* and *L.natalensis* are the hosts in Malaysia and in Africa respectively; and the synonymous *L.cailliaudi* is the intermediate host in east Africa (Malek1980, Souslby 1982). The most important and widespread (Europe, Asia, Africa and North America) intermediate host of *F. hepatica* is *L. truncatula* (Souslby 1982). There is some evidence, at least based on laboratory trails, that the species of *Fasciola* can become adapted to new hosts, either amphibious or aquatic, under certain conditions.

The snail population is low in the summer months due to high temperatures, and increases gradually to reach its maximum in spring when the temperature is mild and vegetation flourishes. Overall, rates of snail infection vary between 10% and 40%. The highest infection rate was found to be in summer and this may be a factor responsible for lowering snail density in this season. *L. cailliaudi* has been found responsible for transmission of both *F. hepatica* and *F. gigantica* (Farag 1998). Tropical Fasciolosis caused by infection with *F. gigantica* is regarded as one of the most important single helminth infections of ruminants in Asia and Africa (Murell, 1994). Together with major nematode infections, Fasciolosis is a significant constraint on the productivity of domestic ruminants throughout Asia, South-East Asia and Africa and is thus a significant impediment to global food production (Murell, 1994). Ogunrinade and Ogunrinade (1980) reported a total liver condemnation rate of 7% among cattle population of 10 million from slaughter rate of 4% in Nigeria. In 1986, 46.3% of livers were condemned due to *F. gigantica* in Zimbabwe (Chambers, 1987).

A study was carrid in Nigeria examined the seasonal prevalence of Fasciolosis between the sexes in Nigerian cattle .The possible role and effect of sex on prevalence of the disease .One thousand cattle were examined for infection using thefecal and bile examination for *Fasciola* eggs and agar gel precipitation test .Prevalence was higher (52.3%) during the rainy seasons .The annual prevalence was higher in females (63.7%) than in male (36.3%) (Adedokun *et al*., 2008).

In a study aimed to determining the prevalence of Fascioliasisand the economic loss of condemned liver due *to Fasciola* infection in cattle slaughtered at three abattoirs in Eket Urban, Akwa Ibom State of Nigeria. A total of 279 cattle consisting of 185 males and 94 females were examined. The result of the investigation showed of out of 279 cattle consisting of 185 males and 94 females examined, 38 (13.62%) of the cattle were infected with Fascioliasis. The prevalence recorded for female cattle was 17.02% compared to that of the males which was 11.89%. The species of the adult flukes recovered from the liver was *Fasciola gigantica*. about 342kg condemnable weight of livers from 38 cattle ,was lost due to *Fasciola* disease, Fascioliasis is of serious economic importance to the livestock industry, especially in Nigeria where most livestock farmers are still ignorant of the disease (Usip*et al*;2012).

Ogunrinade and Adegoke, (1982) in their research,discovered that out of 1.2 million cattle slaughtered in Northern Nigeria, 30,000 or 2.5% were positive of Fascioliasis, with the highest prevalence record at abattoirs situated in Northern Guinea Savannah being 5.55% while the lowest incidence found in Jos plateau was 0.88%.

A cross-sectional study, to investigate the prevalenceand economic loss of Fascioliasis in Iran reports thatOverall 3.28% of the livers were found to be infected. For total number of sheep,goats and cattle slaughtered annually in region study, it was estimated that 7 505 livers wereinfected and total annual economic losses of fascioliasis of studied animals was 41 784 USD(based on market prices in study period). Of this, 23 360 USD, 30 240 USD and 15 400 USDwere associated with the Fascioliasis of sheep, goats and cattle, respectively (Hassan et *al*., 2013).

2.11 Geographic distribution and prevalence of Fasciolosis in Sudan:

Bovine Fasciolosis in the Sudan is endemic in the four provinces: White Nile, Upper Nile, Bahr El Ghazal and Equatoria. Some foci of Fasciolosis also exist in Southern Kordofan and Southern Darfur province. Fasciolosis undoubtedly accounts for serious economical losses in the Sudan as a result of mortality, reduced productivity, expenses of treatment and particularly condemnation of infected livers (Haroun; 1975).

A retrospective study aimed to investigate the different pathological conditions reported in livers of slaughtered cattle and sheep leading to their total condemnation at abattoir Al kadaroo Abattoir in North Khartoum-Sudan,(Suhair 2013)reported that total number of slaughtered cattle and sheep at Al kadaroo Abattoir and the total number of different grossly detected liver affections throughout the study period, compared to the total number of sheep slaughtered, the total number of affected and condemned livers was 1564(0.84%) this value was lower than that reported for cattle, 5793(9.29%). This result could be related to the high prevalence of *Fasciola* infestation in cattle, 5272 (91%) amongst the other liver lesions.

Chapter Two

MATERIALS AND METHODS

3.1 Study area:

The study was carried out in Omdorman - Khartoum State which is situated in Northern Sudan between latitude 16°N and 14°N. It is regarded as one of the areas of intensive and semi intensive production system in Sudan. The climate is an arid type which is characterized by a wide range of daily and seasonal temperature. A temperature of 45°C may occur during the summer with hot dry weather and low humidity. During winter the weather is cool and dry with a mean daily temperature of 24°C. The maximum rainfall is from mid July to mid September, in this season there is an increase in relative humidity with a maximum of 68% in August (Mohamed *et al.*, 2011).Man had worked in the State in agriculture and animal husbandry since ancient time, and specialized in the breeding of cattle, camel, goat and sheep for milk and meat production.

The State is composed of seven localities namely Khartoum, Khartoum North, East Nile, Omdurman, Ombeda, Karare and Jabelawlia (Agriculture Census Report., 2009).

3.2 Abattoir:

Slaughterhouse Elsabaloga:

This abattoir is located in the West of Omdurman, Khartoum State. It consists of administrative building, veterinary services department, maintenance department and the health of the environment. Cattle are slaughtered in hole, goats and sheep on the anther hole. The capacity of the slaughterhouse is 200 head of cattle and 600 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.

3.3 Study population:

The population of animals in Khartoum state is 240003 for cattle .There are distributed in Khartoum State as 138067 in East Nile, 28016 in Baharri ,13578 in Ombeda, 13901 in Karari ,20455 in Omdurman,20360 in Jabal Awlia and 562 in Khartoum (Agriculture Census Report.,2009).

3.4 Study Design and data collection:

Across-sectional study design was employed to generate the desired data. The cross-sectional study of active abattoir survey wasmade according to the standard procedures recommended for ante mortem inspection by Gracey and post mortem inspection by FAO (1994), and investigated the risk factors which associated with the disease by going to the abattoir to collect samples and data by filling out the questionnaire. The abattoir in Omdoeman (Elsabaloga)wasused inthis studyit has an average slaughter of 100 to150 cattle per day. Twovisits per week weremade toElsabaloga abattoir.

On the other hand a questionnaire was designed for animal and farms owners the information included: animals, source, knowledge about the disease (yes/no), treatment (yes/no), drinking from ground (yes/no) during the sampling. During the ante-mortem inspection the age, sex, breed, source, and body condition of each individual animal were assessed and recorded. Age determination was done by teeth dentition (Ammar., 2013), which was divided to three categories: <2, 2-5 and >5; the cattle breed into three categories: indigenous, cross and foreign; source of animals .all animal sex was male for this rezones I deleted it from risk factor .

3.5 Sample Size Determination and Sampling Procedures:

The total number of cattle required for the study was collected based on the formula given by Martin et al (1987).

$n=4PQ/ L^2$

n=number of animals to be sampled.

P=expected prevalence of bovine Fasciolosis in Khartoum state. 10% estimated by appropriate epidemiological methods byAmmar (2013).

Q=1-P in this study Q=.9

L=allowable error =5%

Confidence intervalof 95%.

The sample size =4*.1*.9/.05*.05= 144 cattle.

The sampling procedure was carried out using simple random sampling in such a way that sampling units were select at randomly (Thrusfield., 2005).

3.6Parasitological Examinations:

3.6.1Laboratory examinations:

3.6.1.1 Faecal examinations:

3.6.1.1.1Sedimentation method:

This test was used for detecting those eggs which didn’t float well in available flotation solutions. Those are the operculate eggs such as fluke infestation, Fasciola, Paramphistomes and Schistosoma. Two to three grams of faeces wereput in a mortar and emulsified with 42 ml tap water. They were grounded with pestle and mixed well. The suspension was then poured through a tea sieve into a beaker to remove the large particles. The sieved suspension was then poured in a centrifuge tubes and centrifuged at 1500 rpm for two min (this was the first wash). The dirty supernatant was poured off and re-suspended in water and centrifuged at 1500 rpm for two min. This was repeated four times till the supernatant fluid was clear. A bit of the deposit was taken and smeared on slide and covered by slide cover**.**

3.6.2Ante-mortemexaminations:

Regular visits were made by the investigator to conduct ante-mortem examination of slaughter animals. The cattle were selected by systematic random method, from each sex cattle present, first animal was selected and enumerate marks on its body tagged before slaughter. A total of 144 cattle was examined in the Elsabaloga abattoir during the survey period which extended from December to November 2015.

3.6.3Procedure for post mortem examinations of the liver:

Post mortem inspection was carried out according to the method described by Thornton’s and Gracey (1981). Meat inspection at Elsabloga abattoircarried out by officials of Ministry of Livestock and nomadic resettlement. The team comprised of a veterinarian with official meat inspectors. Liver examination was carried concurrently during meat inspection of bovine carcasses and organs.

3.5.3 Management and Analysis:

Data collected from the active abattoir survey about the risk factors and the results was entered into Excel spread sheet, cases were categorized as either positive or negativeand analyzed using Statistical Package of Social Science (SPSS) version 16 wereused.

Frequency table of the distribution according to the potential risk factors were constructed.

Cross tabulation of Fasciolosis infection per according to potential risk factors was made.

Univariate analysis: chi-square test was used to describe the variables, number of tested animals and degree of freedoms, chi-square p-value.

Multivariate analysis: by logistic regression modelswere described the risk factors, number of positive cases, odds ratio, confidence intervals and p-value. Multivariate analysis by logistic regression models was performed for risk factors significant at level (≤0.25)inunivariate modle.The significant level in themultivariate analysis was (≤0.05).

Chapter Three

Results

4.1 Prevalence:

Of the total 144 cattle inspected, 5(3.5%) animals were positive, and 139 (96.5%) animals were negative for bovine Fasciolosis (**Table 1.1**).

Table1.1: Prevalence of Fasciolosis in 144 cattle examined in ElsabalogaSlaughter house, Sudan.

Disease	Frequency	Relative frequency (%)	Cumulative frequency (%)
Negative	139	96.5	96.5
Positive	5	3.5	100.0
Total	144	100.0	

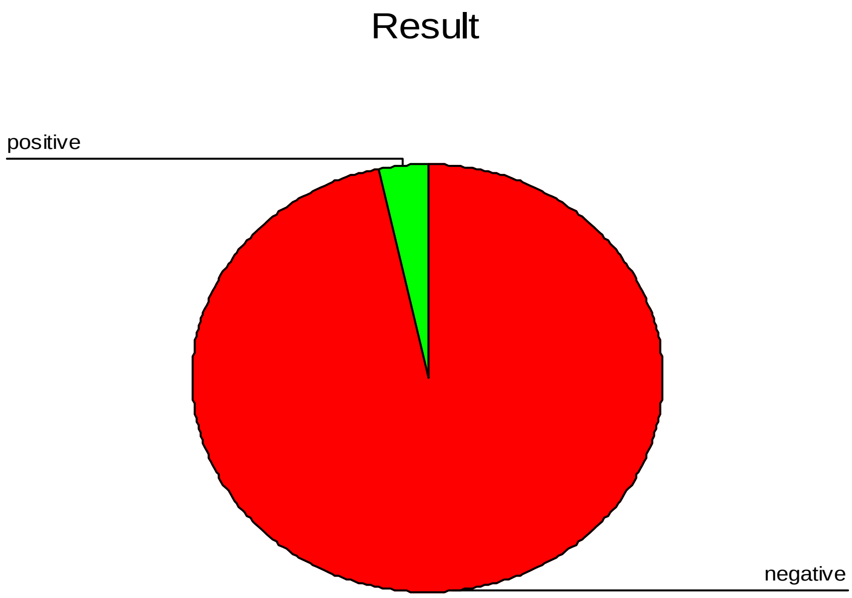

Figure (6): Frequency of the present and absent of Fasiolasis in 144 cattle

4.2 sex of animal:

One hundred and fortyfour ofmalescattle were examined in this study. The presences of Fasciolssis in cattle were investigated. (Table 1.3)shows the sex distribution of cattle.

The infection rate was 3.5%. No measures of association were computed between sex and diseased because sex was a constant and all animal were males.

4.3 Age of animal:

Total144 of the cattle of various ages were examined in this study. The presences of Fasciola in cattle were investigated. (Table1.3)shows the age distribution of cattle, 19 0f cattle wereyoung(animal age less than two years)and 100 cattle were medium age (animal age from two to five years) and25 of cattle were old (animal age more than five years). Infection was higher in animal which were young(animal age less than tow years)(5.2%) but in mediumanimal(animal age from two to five years) the infection rate was 4%and in old animal (animal age more than five years) infection rate was 0%.

The chi-square test showed no significant association between infection and age of animal (p-value .32)(Table4).

4.4 Source of animal:

Totalof the144 cattle inspected,(Table 1.3) showsthe number of infected animal with Fasciolasis from various source .the highest rate of infection was in animal fromElmewalh(4.49%). Animal from Neyala had infection rate 3.3% and the less rate of infection was in Animal from ELdeain (0%). Animal from Elmewallh had infected rate (4.5%).

The chi-square test showed no significant association between infection and source of animal (p-value .29) (Table4).

4.5 The effect of treatment on present of disease:

Totalof the144 cattle inspected, table (1.3) shows the 112 of cattle were treated and 32 0f cattle were not treated. The highest rate of infection was in animal which were not treated (9.3%) and treated animal hadlow infection rate (1.6%).

The chi-square test showed there wassignificant association between infection and treatment (p-value .03) (Table4).

4.6 The effect of knowledge about disease on presences of disease:

Therelationship of knowledge about disease andpresences of Fasciolasis in 144 cattle were investigated. Table (1.3) showsthat the knowledge about disease in allcattle ownershad no any knowledge about disease.

The chi-square test showed no significant association between infection and Knowledge about disease (p-value .03) (Table4).

4.7 The effect of drinking from ground on presences of disease:

The Drinking from groundand presences of Fasciolasis in 144 cattle were investigated. Table (1.3) showd that 144 (100%) of cattle were examined in this study were found tobe drinking from ground and had infection rate (3.5%).

The chi-square test showed no significant association between cattle Fasciolasis and Drinking from ground (p-value .33) (Table4).

4.8 Breed of animal:

The results showed distribution of Fasciolasis infection in Elsabaloga slaughter house by breed .Total number of indigenous breed examined was 137 animals, among this 137 animals 5 were found infected with highest rate of infection (3.6%).Total number of cross was 3, among these no animal was infected ,with rate of infection 0%. Total number of Habashi(karor) was 4 among these no animal was infected with rate of infection 0%.

The result of study showed that there is no significant association between Fasciolasis infection and breed of animal (p-value .33) (Table4).

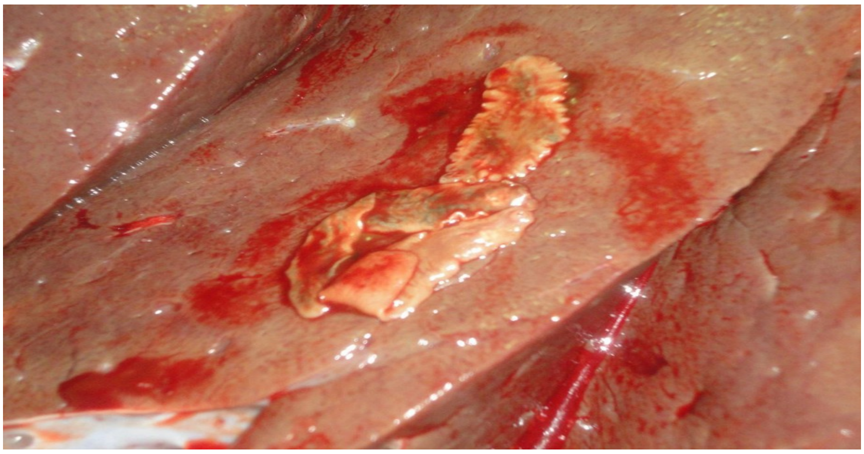

Figure 5: *Fasciola gigantica* in the liver

Table1.2:

Frequency table of distribution of 144 cattle examined for bovine Fasciolasis in Elsabaloga slaughter house-Omdurman- Khartoum -Sudan. According to potential risk factors investigated:

Risk factors	**Frequency**	**Relative frequency (%)**	**Cumulative frequency (%)**
SEX			
Male	144	100.0	100.0
Female	0	0	0
AGE			
Young(<2)	19	13.2	13.2
Medium(2-5)	100	69.4	82.6
Old(>5)	25	17.4	100.0
Total	144	100.0	
SOURCE			
Eldeain	25	17.4	17.4
Neyala	30	20.8	38.2
Elmoalhe	89	61.8	100.0
Total	144	100.0	
TRETMENT			22.2
No	32	22.2	100.0
Yes	112	77.8	
Total	144	100.0	
knowledge			

About disease Yes No Total	 0 144 144	 0 100.0 100.0	 0 100.0

Table1.2 Continued

Risk factors	**Frequency**	**Relative frequency (%)**	**Cumulative frequency (%)**
Drinking from ground No Yes Total	 22 122 144	 15.3 84.7 100.0	 15.3 100.0
Body condetion Good Boor Total	 144 0 144	 100.0 0. 100.0	 100.0 0
Breed Indigenous Cross Habashi Total	 137 3 4 144	 95.1 2.1 2.8 100	 95.1 97.2 100.0

Table 1.3:

Cross tabulation of Fasciolosis infection in 144 cattleexamined for bovine Fasciolasis at Elsabaloga slaughter house -Omdurman- Khartoum Stat-SudanAccording to potential risk factors investigated:

Risk factors	Number tested	Number positive	Percentage (%)
sex Male Female	 144 0	 5 0	 3.5 0
Age Young(<2) Medium(2-5) Old(>5)	 19 100 25	 1 4 0	 5.2 4 0
Source Eldeain Neyala Elmewalh	 25 30 89	 0 1 4	 0 3.3 4.49
Treatment No Yes	 32 112	 3 2	 9.3 1.6
knowledge about disease No Yes	 144 0	 5 0	 3.5 0

Table1.3 Continued

Risk factors	Number tested	Number positive	Percentage (%)
Drinking from			

ground No Yes	 22 122	 0 5	 0 4.09
body condition good poor	 144 0	 5 0	 3.5 0
Breed Indigenous Cross Habashil	 137 3 4	 5 0 0	 3.6 0 0

Table 1.4:

Univariate analysis for potential risk factors of bovine Fasciolosis in 144 cattle examined at Elsabaloga slaughter house-Omdurman- Khartoum State -Sudan using the Chi-square test (df =degree of freedom, χ^2 = Chi-square).

Risk factors	Number tested	Number positive (%)	df	χ^2	P-value
Age Young(<2) Medium(2-5) Old(>5)	 19 100 25	 1(5.2) 4(4) 0(0)	*2*	*.56*	*.32*
Source Eldeain Neyala Elmewalh	 25 30 89	 0(0) 1(3.3) 4(4.5)	*2*	*.55*	*.29*
Treatment No Yes	 32 112	 3(9.3) 2(1.8)	*1*	*.03*	*.03**
Drinking from ground No Yes	 22 122	 0(0) 5(4.1)	*1*	*.33*	*33*
Breed Indigenous Cross Habashi	 137 3 4	 5(3.6) 0(0) 0(0)	*2*	*.87*	*.62*

*****is mean significant value

Table1.5:

Multivariate analysis for potential risk factors of bovine fasciolosis in 144 cattle examined atElsabaloga slaughter house-Omdurman- Khartoum State -Sudanusing logistic regression. Ref: Reference, Exp (B): Exponan (B), 95%CI: 95%Confidence Interval:

Risk Factors	df	Sig.	Exp(B)	95.0%C.I.forEXP(B)

				Lower	Upper
TRETMENT	1	.063	5.690	.908	35.660

Chapter Four

Discussion

The results obtained in this study are an indication that bovine Fasciolasis infection occurs in the cattle slaughtered in West Omdurman (Elsabaloga abattoir), Khartoum State, Sudan. With the prevalence rateof 3.5% which was moderately low. In this slaughter house were all of animals were male and in good body condition, because the animals' owners were meat industry companies they pay animals and placed them in pens for few weeks before slaughtered them. Few animals came through traditional owners. Cattle owners had no knowledge about the disease, they medicate there animals as general treatment with no knowing the actual type of the disease.

In ours study the prevalence of Fasciolosis in cattle slaughtered in Elsabaloga abattoir, Khartoum State, Sudan was 3.5%, which is lower than study conducted in West Omdurman abattoir, Khartoum State (Ammar., 2013) Of the total 400 cattle inspected, 40 (10%) animals were positive, and 360 (90%) animals were negative for bovine Fasciolosis, also lower than Prevalence of Fascioliasis in cattle slaughtered in Sokoto Metropolitan Abattoir, Sokoto, Nigeria metropolitan abattoir which was 27.68%. However, it is much lower than those reported from different countries, which was 28.63% in Ethiopia (Rahmeto et al., 2010), 21% also in Ethiopia (Yemisrach and Mekonnen ., 2012), 75 % in Nigeria (Oyeduntan et al., 2008), 50% also in Nigeria (Ozung, et al., 2011),52.1% in Nigeria (Olusegun et al., 2011), 29% in Ethiopia (Mult et al., 2012), 16% in Tanzania (Mellau et al., 2010). 357 (8%) at Mekelle municipality abattoir were found to harbor mixed infection of Fasciolosis and hydatidosis(Gebertsadik et al., 2012)., 21% in Brazil(Alves et al., 2011), 32% in Ethiopia(Mihreteab et al., 2010), 20% in Ethiopia (Kassaye et al., 2012), 51% in Egypt (Kuchai et al., 2011), 23% in Ethiopia (Asressa et al., 2012) and 65% in Turkey(Yildirim et al .,2007).

Differences in prevalence among geographical locations could be attributed mainly to the variation in the climatic and ecological conditions such as altitude, rainfall and temperature. *Fasciola* prevalence has been reported to vary over the years mainly due to variation in amount and pattern of rainfall (Mungube et al., 2006).

In univariate analysis the prevalence of bovine Fasciolasis is significantly associated (p-value =0.25) with one factor which was the treatment. Age of animals was one factor investigated in this study. Our results showed that the rate of bovine Fasciolosis was 5.2% in young age (<2 years) and 4% in medium age (2-5 year) and

0% in old age (5<) .The results showed that there is no significant association between bovine Fasciolosis and age of animals examined (P-value = 0.32). These results are not consistent with other studies regarding young animal's with low rate of infection than old animals. In turkey, the rate of infection in age groups was: 87.2% in the age group ≥6 years, 79.5% in age of 3-5 years and 51.6% in age ≤2 years (Yildirim et al., 2007). In Ethiopia, the prevalence was higher in adult when compared to young (Yemisrach and Mekonnen 2012).

This finding is not surprising due to the fact that bovine Fasciolasis is a chronic disease, the higher age reflects a much longer period of exposure to infection .The prevalence of bovine Fasciolasis by source of animal had been investigated in this study. The rate of infection in cattle coming from Eldeain was 0%, Neyala was 3.3% and Elmewallh was 4.5%.

There is no significant association between bovine Fasciolasis and source of the animals (P-value = 0.2.9).These results are not consistent with other studies regarding the different prevalence according to the source. In Sudan the rate of infection in Khartoum state was 0%, in Blue Nile state was 27.3%, in White Nile state was 38%, in Darfour state was 0%, in Kordfan state was 0% and in Algdarif state was 50% (Ammaret al., 2013). In Zimbabwe, higher prevalence was found in the watering areas compared to the flat areas (Pfukenyi et al., 2006). In Egypt, the prevalence was higher in comparatively low land areas as compared to high altitudes (Kuchai et al., 2011). The reason behind this maybe due to be of geographic reasons, outdoor rearing in open grazing areas, increase irrigated land masses from the currently constructed dams and ponds and the tendency of famers to feed their animals in these marshy and damp areas because of feed scarcity.

The results of this study showed that Indigenous breed cattle have higher rate of infection than Habashi and cross breed, the rate of infection in Indigenous cattle was 3.6%, in Habashi cattle was 0% and in cross cattle was 0%. But There was no significant association between bovine Fasciolosis and breed of cattle (P-value =

0.62). This is in disagreement with other studies carried out in Sudan showed significant association between bovine Fasciolosis and breed of cattleforeign breed cattle came from Ethiopia, which rate of infection in foreign cattle was 50%, in indigenous cattle was 7.5% and in cross cattle was 0.0% (Ammar., 2013), in Japan where the prevalence was higher in Japanese native cattle than Friesian or Jersey cattle (Kato et al., 2005), and in Spain where the prevalence was higher in cross breed cattle than that in autochthonous Rubia Gallega Friesian or Brown Swiss cow (Sanchez et al.,2002) .

In the present study multivariate analysis showed that there was no significant associated with the prevalence of bovine Fasciolosis and treatment in logistic regression (ExpB= 5.8, 95% CI = .908 – 35.660).

5.2 Conclusion:

The prevalence of Fasciolosis in cattle revealed that infection was more common in animal un treated than in animal treated, in an indigenes breed than in cross and abashi breed, in medium age than old and young age, in animal drinking from ground than animal not drinking from ground with no statistically significant difference between rate of infection in animal drinking from ground animal not drinking from ground, age, and also between breeds.

5.3 Recommendations:

A control program should be performed based upon:

especially newly purchased ones with effective drugs such as albendazole and praziquantel ,public enlightenment about the disease and the role of snails in the life cycle of the parasite as well as associated health risks in animals and humans; artificial pasture land (rangeland system) that seems to be a good panacea in control of the disease in cattle; development of well-defined interval for deworming of cattle,; proper meat inspection (with appropriate compensation for condemned animals or their parts) that should be revisited and properly enforced; abattoir record keeping that should be reviewed to provide information on livestock diseases.

Application of good drainage and build of dams at appropriate sites in marshy and low laying areas may reduce the snail problem. Keeping the animals off from marshy areas inhabited by intermediate host or by fencing of these dangerous zones.

Finally, the farmers should be educated and informed about the importance of the disease control programs and regular deworming of animals.

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Table 1:

SEX

Appendix 1

Frequency Tables of 144 cattle examined for bovine Fasciolasis at Elsabaloga slaughter house -Omdurman- Khartoum Stat-Sudan According to potential risk factors investigated

Table 1:

SEX

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	144	100.0	100.0	100.0

Table 2:

AGE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	young	19	13.2	13.2	13.2
	medium	100	69.4	69.4	82.6
	old	25	17.4	17.4	100.0
	Total	144	100.0	100.0	

Table 3:

SOURCE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	eldeain	25	17.4	17.4	17.4
	neyala	30	20.8	20.8	38.2
	elmoalh	89	61.8	61.8	100.0
	Total	144	100.0	100.0	

Table 4:

TRETMENT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	32	22.2	22.2	22.2
	yes	112	77.8	77.8	100.0
	Total	144	100.0	100.0	

Table 5:

Knowledge about disease

	Frequenc	Percent	Valid	Cumulative

	y		Percent	Percent
Valid no	144	100.0	100.0	100.0

Table 6

Drinking from ground

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	22	15.3	15.3	15.3
	yes	122	84.7	84.7	100.0
	Total	144	100.0	100.0	

Table 7:

DISEASE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	negative	139	96.5	96.5	96.5
	positive	5	3.5	3.5	100.0
	Total	144	100.0	100.0	

Table 8:

body condition

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	good	144	100.0	100.0	100.0

Table 9:

Breed

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	indigenous	137	95.1	95.1	95.1
	cross	3	2.1	2.1	97.2
	habashi	4	2.8	2.8	100.0
	Total	144	100.0	100.0	

Appendix 2

Crosstab Table of 144 cattle examined for bovine Fasciolasis at Elsabaloga slaughter house -Omdurman- Khartoum Stat-Sudan According to potential risk factors investigated.

Table 1:

DISEASE * AGE

Crosstab

		AGE			Total
		young	medium	old	
DISEASE	negative	18	96	25	139
	positive	1	4	0	5
Total		19	100	25	144

Table2

DISEASE * SOURCE

Crosstab

		SOURCE			Total
		eldeain	neyala	elmoalhe	
DISEA	negative	25	29	85	139

SE	positive	0	1	4	5
Total		25	30	89	144

Table3

DISEASE * TRETMENT

Crosstab

		TRETMENT		Total
		no	yes	
DISEASE	negative	29	110	139
	positive	3	2	5
Total		32	112	144

Table4

DISEASE * Drinking from ground

Crosstab

		Drinking from ground		Total
		no	yes	
DISEASE	negative	22	117	139
	positive	0	5	5
Total		22	122	144

Table5

DISEASE * body condition

		body condetion	Total
		good	
DISEASE	negative	139	139
	positive	5	5
Total		144	144

Table6

DISEASE * local breed

Crosstab

Count

	local breed	Total

		indigenous	cross	habashi	
DISEASE	negative	132	3	4	139
	positive	5	0	0	5
Total		137	3	4	144

APPENDEX 3

Chi-square table of 144 cattle examined for bovine Fasciolasis at Elsabaloga slaughter house -Omdurman- Khartoum Stat-Sudan According to potential risk factors investigated**.**

Table1

DISEASE * AGE

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.164(a)	2	.559
Likelihood Ratio	2.004	2	.367
Linear-by-Linear Association	.989	1	.320
N of Valid Cases	144		

Table2

DISEASE * SOURCE

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.178(a)	2	.555
Likelihood Ratio	2.023	2	.364
Linear-by-Linear Association	1.095	1	.295
N of Valid Cases	144		

Table3

DISEASE * TRETMENT

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.277(b)	1	.039		
Continuity Correction(a)	2.312	1	.128		
Likelihood Ratio	3.450	1	.063		
Fisher's Exact Test				.073	.073
Linear-by-Linear Association	4.247	1	.039		
N of Valid Cases	144				

Table4

DISEASE * Drinking from ground

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.934(b)	1	.334		
Continuity Correction(a)	.111	1	.738		
Likelihood Ratio	1.690	1	.194		
Fisher's Exact Test				1.000	.431
Linear-by-Linear Association	.928	1	.335		
N of Valid Cases	144				

Table5

DISEASE * local breed

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-	.265(a)	2	.876

Square			
Likelihood Ratio	.507	2	.776
Linear-by-Linear Association	.238	1	.626
N of Valid Cases	144		

Appendix 4

Questionnaire:

To investigate the risk factors associated with Fasciolosis:

(1) The age:<2 years { } 2-5 years { }>5 years { }

(2) The sex: male { } female { }

(3) The breed: Kennan { } Cross { } indigenous { }

(4) The body condition: Good { }Poor { }

(6) The source:Khartoum{ }Niala{ }Eldean{ }

(7) Knowledge about the disease:Yes { }No { }

(8) The treatment: Yes { } No { }

(9) The drinking from groundYes { }   No { }