UNIVERSITY OF NAIROBI

COLLEGE OF AGRICULTURE AND VETERINARY SCIENCES,

FACULTY OF VETERINARY MEDICINE.

PROJECT REPORT

TITTLE : Prevalence of Fascioliasis and the economic loss of Condemned liver due to Fasciola infection in Cattle Slaughtered at local abattoirs in BungomaCounty

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FINAL PROJECT FINDINGS SUBMITTED TO DR. GATHURA IN PARTIAL FULFIMENT OF MY DEGREE COURSE IN VETERINARY MEDICINE.

Declaration

This project is my original work and has not been presented for award of degree in any other university.

MARK W. SIMIYU

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This project has been submitted with my approval as university supervisor for examination

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Abstract

This study was carried in August, 2014, November, 2014, December 2014 and January, 2015 (3months) in order to estimate prevalence and monatary loss of condemned liver due to fasciola infection. Prevalence of fascioliasis was calculated as the number found infected with *Fasciola*, expressed as the percentage of the total number of cattle slaughtered. A total of 1705 cattle consisting of 957males and 748 females from local livestock traders were inspected. The study involved actual postmortem examination of the inspection on the slaughtered cattle. The livers were examined for the adult flukes. The result of the investigation showed that 28 (1.6%) of the cattle were infected with fascioliasis. The prevalence rate recorded for female cattle was 2.1% compared to the male with prevalence rate of 1.3%. The species of the adult flukes recovered from the liver was *Fasciola gigantica*. In the three months study; about 92.4kg condemnable weight of livers from 28 cattle valued at ksh.46, 200.00 (Mean market price of 1kg of liver = Ksh. 500.00) was lost due to fasciola disease.

Local climatic factors, cattle trade, local management practices by local community, presence of snail intermediate hosts are probably the main factors influencing the incidence of disease in the present area of study. Control of snail intermediate host population will help reduce rate of infection with Fasciola species of livestock.

Key words: fascioliasis, liver, prevalence, slaughtered cattle,economic importance.

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CHAPTER ONE

1.0 INTRODUCTION

Meat derived from cattle, sheep and goats provides major sources of animal protein for the populace of Bungoma County and its environs, and Kenya in general. These ruminants incidentally serve as definitive host to the parasitic helminthes trematode of the family, Fasciolidae, commonly known as liver flukes. There are various species of these but the economically important ones are *Fasciola gigantic* in the tropics and *Fasciola hepatica* in the temperate region.

There have been a number of surveys performed by veterinary research groups concerning the prevalence of the disease and reviewed in many parts of the world (Megard,1975)

The aim of this study was to survey the prevalence of fascioliasis in slaughtered cattle in order to provide breeders with feedback which may prevent bovine fascioliasis. The results of post mortem meat inspection and the information extracted from the veterinary departments on Livestock in Mukuyuni sub County was analyzed statistically in a number of cattle slaughtered at the local Abattoirs ï Naitiri/Mbakalo market slaughter slab and Misikhu municipal slaughterhouse.

The climatic changes that have occurred in Bungoma County in the recent past such as prolonged season of rains may have had an effect on the prevalence and economic importance of fasciolosis on the rural population.

1.1 PROBLEM STATEMENT

Parasitic diseases are considered as a major health problem and cause a significant economic loss in countries where livestock productionis an important segment of the agricultural practice.There are only a few scanty reports on the prevalence and economic importance of fasciolosis in cattle in

Kenya, in spite of the well-known importance of the disease in livestock in the country. The existing accounts of fasciolosis in Kenya are based on local surveys in some areas of the country, often covering a few months or years (Bitakaramire 1968, 1973; Cheruiyot1983; Anon. 1986).

So the aim of the current research was to record the prevalence of fascioliasis in cattle in Mukuyuni sub-county of the larger Bungoma County and determine monetary loss in the livestock industry so that it can be given the attention it deserves and whether or not to institute control measures of this infectious disease in the region. Losses associated with the rejection of bovine liver affect farmers, butchers and consumers. However, to date, no empirical evidence exists of an evaluation of the monetary losses of the liver rejection in Bungoma

1.2 SPECIFIC OBJECTIVES

The objective of the present study was therefore to determine the prevalence and monetary importance of fasciolosis in slaughtered cattle from Mukuyuni Sub County of Bungoma as well as its relative occurrence. . The specific objectives of the study were:

- Determine prevalence of bovine fascioliasis in slaughtered animals.
- To investigate the intensity of the infection (worm burden) in the infected livers.
- To determine monetary losses of condemned liver due to fascioliasis.
- Effectiveness of meat inspection to local communities
- Determine control measures employed by livestock producers to prevent fascioliasis in cattle.
- Perception of local community and butcher men to meat inspection programme.

1 .3 JUSTIFICATION

There is lack of information by local communities on the importance of meat inspection before passage for human consumption and most people are unaware of zoonotic conditions. There is also lack of knowledge about the parasite at farmers level. Therefore, there a need not only to intensify and improve the control methods of fascioliasis in livestock production in the county in order to minimize this monetary loss but also to educate the public so that they are aware of its importance and effects, and also to create awareness to local communities on importance of meat inspection and public health concerns.

1.4 LIMITATIONS

There are a few factors that hindered achievements of good results which and include:

- Limited time for the study.
- Meat inspection record for analysis was not available at District Veterinary Officer.
- Owners did not want their livers incised for examination.
- Uncooperative correspondents ï arrogant butcher men and farmers during the oral interviews
- Incidences of Foot and Mouth disease hence closure of most abattoirs during December-January period.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 INTRODUCTION

Fascioliasis also known as fascioliosis, fasciolasis, distomatosis and liver rot, is an important helminthic disease caused by two trematodes *Fasciola hepatica* (the common liverfluke) and *Fasciola gigantic* (Mas-Coma, 2005). This disease belongs to the plant-borne trematode zoonoses. This parasitic liver condition has a worldwide distributions of both species (Soulsby 1986).The parasite is transmitted by ingestion of metacercaria of *Fasciola* species on plants from contaminated fresh water.

The illness occurs worldwide, particularly in regions with intensive sheep or cattle production. The definitive host range is very broad and includes many herbivorous mammals, wild and domestic ruminants-(cattle, sheep, goats, buffaloes) including humans). These flukes can also cause similar illnesses in animals that become infected by ingesting metacerceria in contaminated water. Economical effect of fascioliasis in sheep consists in sudden deaths of animals as well as in reduction of weight gain and wool production (Sinclair, 1962 &Roseby, 1970).

The two species of trematodes that cause fascioliasis (*Fasciola hepatica* and *F. gigantica*) are leaf-shaped worms, large enough to be visible to the naked eye (adult *F. hepatica* measure 20ï 30 mm x 13 mm pointed posterior ends). Adult *F. gigantica* measure 25ï 75 mm x 12 mm rounded posterior ends and more elongated)

The Adult Wormï Averaging 30mm in length and 13 mm in width, *Fasciola hepatica* is one of the largest flukes in the world. The adult worm has a very characteristic leaf shape with the anterior end being broader than the posterior end and an anterior cone-shaped projection. The fluke possesses a

powerful oral sucker at the end of the 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.

Fascioliasis cases have been steadily rising since the 1970s, primarily in rural areas, and has until recently been severely neglected by the medical community. Due to its increased spread and chronic nature, it is now a disease of global human concern (Mas-Coma *et al,*2009). Incidental human fascioliasis, acquired by eating watercress contaminated by sheep or cattle dung. Fasciolosis is now recognized as an emerging human disease. Fascioliasis was considered a secondary zoonotic disease until the mid-1990s, human fascioliasis is at present emerging or re-emerging in many countries, including increases of prevalence and intensity and geographical expansion (WHO,1995). Research in recent years has justified the inclusion of fascioliasis in the list of important human parasitic diseases. At present, fascioliasis is a vector-borne disease presenting the widest known world-wide 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. 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.

World Health Organization (WHO,1995) has estimated that 2.4 million people are infected with *Fasciola,* and a further 180 million are at risk of infection. It is a zoonosis, meaning an animal infection that may be transmitted to humans. No continent is free from fascioliasis, and it is likely that where animal cases are reported, human cases also exist; 91 million are at risk worldwide (Keiser and Utzinger, 2009). The infection is most often characterized by fever, pain, eosinophilia and abdominal inflammation (WHO, 1999).

Acute fascioliasis causes a substantial economic loss, which include death, loss of carcass weight, reduction in milk yield, condemnation of affected livers, decline in production (reproductive) performance, predisposition to other diseases and cost of treatment (Wamae and Ihiga 1991; Maingi and Mathenge ,1995). Recently, Preliminary data on economic loss due to fascioliasis in cattle indicates a reduction in production- Acute losses associated with fascioliasis has been recorded in East Africa (Maingi and Mathenge, 1995).

Indeed, most analyses of the global impact of fascioliasis focus on the economic impact caused by infections in domesticated herd animals. Depending on the disease prevalence in a herd, these losses can be significant. The direct economic impact of fascioliasis infection is increased condemnation of liver meat, but the far more damaging effects are decreased animal productivity, lower calf birth weight, and reduced growth in infected animals (Njeruh, 2004, Hillver, 2005 &Kaplan, 2001).Several researchers using slaughterhouse surveys have studied the infection rates of Fascioliasis in domestic animals.

2.2 LIFE CYCLE

The life-cycle of fascioliasis is complex.The life cycle includes freshwater snails (aquatic lymaidsnails) as an intermediate host of the parasite (Torgerson& Claxton, 1999). It involves a final host- herbivorous ruminant (where the adult worm lives), an intermediate host- freshwater snails of family *Lymnaea auricularia rubiginosa*, (where the larval stages of the worm develop) and a carrier (entailing suitable aquatic plants). The life cycle of fascioliasis (Fig 1) begins with release of unembryonated, immature egg in the biliary ducts and in the stool of herbivores (definitive hosts) or humans (incidental hosts). Eggs become embryonated in water; eggs release miracidia which invade a suitable snail intermediate host, including the genera *Lymanaea*,*Galba,Fossaria* and

Pseudo succinea. In the snail the parasites undergo several developmental stages (sporocysts, rediae, and cercariae. The cercariae are released from the snail and encyst as metacercariae on aquatic vegetation (Watercress and water-mint) or other surfaces. Mammals acquire the infection by eating vegetation containing metacercariae. Humans can become infected by ingesting metacercariae-containing fresh water plants, especially watercress.

After ingestion, the metacercariae excyst in the duodenum and migratethrough the intestinal wall, the peritoneal cavity, and theliver parenchyma into the biliary ducts, where they develop into adults. In humans, maturation from metacercariae into adult flukes takes approximately 3 to 4months. The adult flukes (*Fasciola hepatica*: up to 30mm by 13 mm; Fasciola gigantica: up to 75 mm) reside inthe large biliary ducts of the mammalian host. *Fasciola hepatica* infects various animal species, mostly herbivore

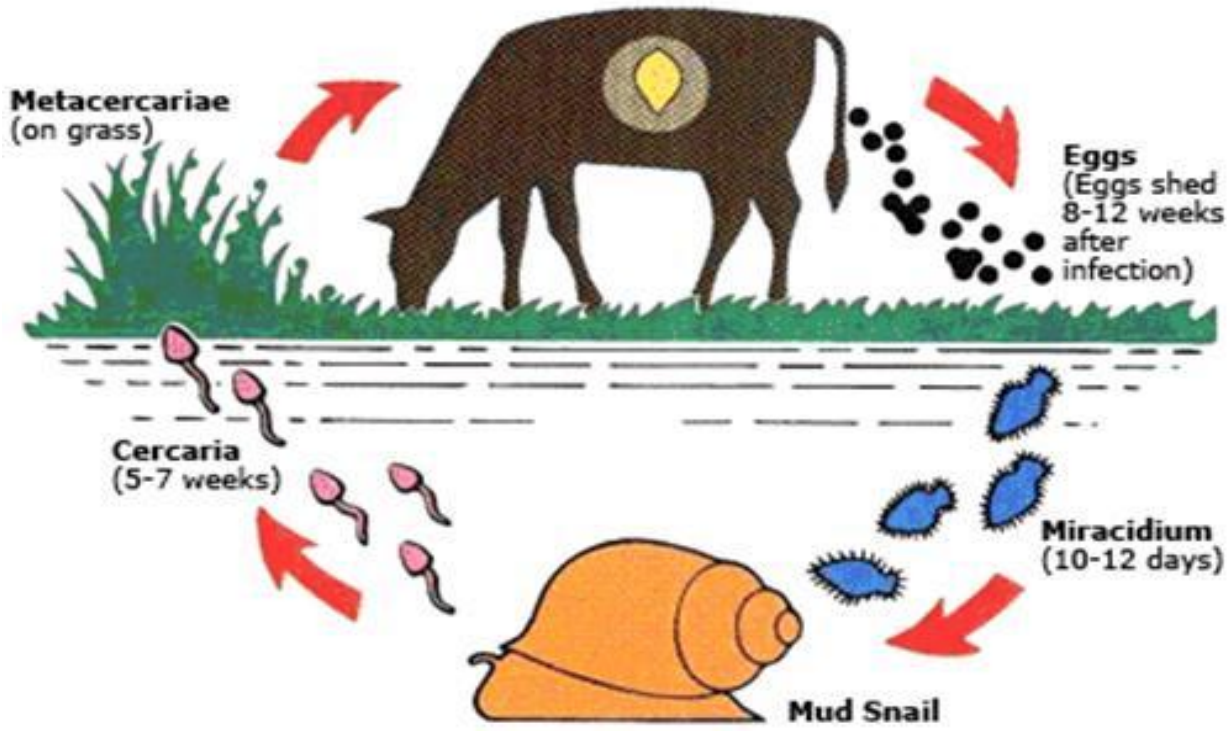

Figure 1

2.3 Source of infection for humans and transmission

Human *F. hepatica* infection is determined by the presence of the intermediate snail hosts, domestic herbivorous animals, climatic conditions and the dietary habits of man. Sheep, goats and cattle are considered the predominant animal reservoirs. While other animals can be infected, they are usually not very important for human disease transmission. Among wild animals, it has been demonstrated that the peri-domestic rat (*Rattus rattus*) may play an important role in the spread as well as in the transmission of the parasite in man (Wikipedia, free encyclopedia-***http://en.wikipedia.org/wiki/Fasciolosis*).**

Humans are infected by ingestion of aquatic plants that contain the infectious cercariae. Several species of aquatic vegetables are known as a vehicle of human infection. Because *F. hepatica* cercariae also encyst on water surface, humans can be infected by drinking of fresh untreated water containing cercariae. In addition, an experimental study suggested that humans consuming raw liver dishes from fresh livers infected with juvenile flukes could become infected.

People living in rural areas are typically more likely to become infected; however, cases may occur anywhere and can follow the trade routes of the carrier plants, which are part of the usual diet in many countries.

Pathogenicity: depends on number of metacercariae ingested and number reaching liver and maturing(infectious dose). (Behm and Sangster,1999).

In acute infection, immature flukes migrate through the intestinal wall, the peritoneal cavity, the liver capsule, and the parenchyma of the liver before entering the biliary ducts where they mature to adulthood in about 3 to 4 months.(infectious dose is more than 5000 ingested metacercariae. Acute

infection causes abdominal pain, hepatomegaly, nausea, vomiting, intermittent fever, urticaria, eosinophilia, malaise, and weight loss due to liver damage.

Chronic phase. The chronic phase begins when the worms reach the bile ducts, where they mature and start producing eggs. These eggs are released into the bile and reach the intestine, where they are evacuated in faeces, thereby completing the transmission cycle. Symptoms include intermittent pain, jaundice and anaemia. Pancreatitis, gallstones and bacterial super-infections may also occur. Patients with chronic infections experience hardening of the liver (fibrosis) as a result of the long-term inflammation.Infection may be asymptomatic or lead to intermittent abdominal pain, cholelithiasis, cholangitis, obstructive jaundice, or pancreatitis. Heavy infection can cause sclerosing cholangitis and biliary cirrhosis.

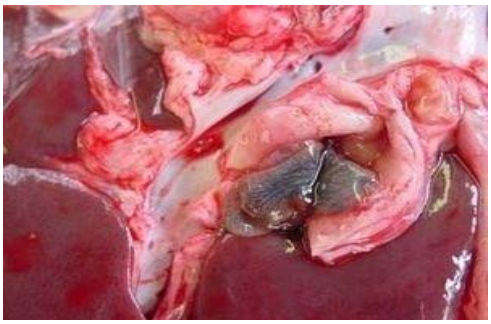

Figure 2. Adult flukes *Fasciola hepatica* in bile ducts

CHAPTER THREE

3.0STUDY METHODOLOGY

3.1 Area of the study.

Was carried out in Naitiri/Mbakalo and Misikhu slaughter slabs in the months of August, November and December, 2014 and January 2015.

3.2 Data collection methods.

3.2.1 Survey of Fascioliasis in Slaughter Houses:

A number of cattle at Naitiri and Misikhu slaughter slabs were examined to record the prevalence of the disease in a systematic survey of the two slaughter houses. It was carried by visiting the slaughter slabs on specified days during the study. Ethical approval was obtained from the management of local abattoirs and the meat inspectors working at the abattoirs with an approved letter from the DVO-Mukuyuni district. A post-mortem examination of slaughtered animals was carried out and livers thoroughly inspected for the presence of flukes.The date, age, sex would be recorded.The extent of liver damage was also noted. The numbers of total animals infected was recorded.

The fluke recovery and count were made following the approach of Hammond and Swell (1975): the gall bladder removed and washed to screen out mature flukes. The infected liver placed on a cleanboard and dissected in-situ using sharp knife, the bile duct opened and all the flukes found removed using blunt forceps and placed on board. The total number of flukes removed from each

liver recorded. Categorization of the affected livers carried out based on the approach of Ogunrinade and Adegoke (1982) as follows: severely affected: almost the entire organ is involved, the liver is cirrhotic and lobes are often atrophied. The intensity of the fluke infection (mean fluke burden) also correlated with the pathological lesions. Once a case was determined, the result was recorded as positive for fasciola.

Oral interviews were held with butchers, cattle traders and meat inspection officers. The average prevailing cost of a kilogram of liver tissue was also obtained through interactions and discussions with the butchers and traders.

3.2.2 Identification of Liver Flukes

Collected flukes from each animal were examined and classified on the basis of size and shape (morphologically) (Soulsby, 1982). Recovered flukes identified as *Fasciola hepatica* (less than 40 mm in length, leaf-shaped with broad shoulders and pointed posterior endsand *Fasciola gigantic* (more than 40 mm in length, more elongate than leaf-shapedwith sloping shoulders and had a rounded posterior ends.

CHAPTER FOUR

4.0 RESULTS

During the study period 1705 cattle at slaughterhouses were examined of which 28 (1.6%) found to be infected with *Fasciola*; (table1).

In all cattle, the overall recorded prevalence washigher during wet season - August (1.9%) as compared to the dry season December and January (1.5%), (Table 1). A positive correlation of disease prevalence to minimum temperature, morning andevening humidity and rainfall has been recorded. It was higher in month of August (1.9%) where there was rainfall and low in December (1.5%) where there were hot and dry climatic conditions. The correlation between disease prevalence and other meteorological factors was however, not significant.

The occurrence of fascioliasis was more frequently recorded in younger cattle (1.9%) than in adult ones (1.5%) which were above 5 years of age (Table 4). In both slaughter slabs there were a higher percent of infected young animals than older (table 2a and b).

Similarly differences were found in infection rate with regard to the host sex; females were more infected (2.1%) as compared to males (1.3%)(Table5).Furthermore the present study also revealed a correlation of disease prevalence with agro-ecology of thestudy area; the prevalence was high (1.997) in low land areas ï Naitiri (near R. Nzoia) compared to a comparatively high altitude (1.423)ï Misikhu (table 6).

Generally, of the 28 cases of the infected cattle with the infected livers, 22 (78.57%) had light worm burden of 0 ï 20 worms, in fact most were between 5-10. 2 (7.143%) had medium worm burden of 21 ï 50 worms, and 4(14.29%) had heavy worm; there livers were highly necrotized and destroyed architecture. Some liver samples had multiple abscess

4.1 DATA ANALYSIS.

The proposed data analysis procedure was quantitative analysis using descriptive statistics to interpret data.

4.1.0 Calculation of prevalence

Data collected from the abattoir survey entered into spreadsheet and analyzed. The prevalence of fascioliasiscalculated as the number of infected individuals divided by the number of individuals sampled multiplied by a hundred. (Records of the total number ofcattleslaughtered and the number that are positive for fasciolosis are obtained.*Fasciola*expressed as a percentage of the total number ofcattle slaughtered.(Thrusfield, 2005)

$$\text{Prevalence (\%)} = \frac{\text{No. positive for fasciola} \times 100}{\text{Total no. slaughtered}}$$

N/B * Data analysis excluded the month of January 2015 because the study was not entirely for the entire month but rather a week, hence the symbol * have been used to exclude the values in calculations.

Table 1: The Prevalence of Fascioliasis (on Monthly basis) at the TWO abattoirs.

Months	Naitiri mkt slaughter slab		Misikhu municipal slaughter house		total		%
	No. ex	no. inf.	No. ex.	No. inf.	No. ex	No. inf.	
August	218	05	311	05	529	10	**1.89**
November	180	04	119	01	299	05	**1.67**
December	253	04	624	09	877	13	**1.48**
January	50*	00*	35*	00*	85*	0*	**0***
total	**651**	**13**	**1054**	**15**	**1705**	**28**	**1.642**

Note: No. Ex = Number Examined. No. Inf= Number Infected

Table 2: The Prevalence of Fascioliasis in males and females

a) Naitiri / Mbakalo slaughter slab											
month	male		Female		Young-estimated 0-3yrs		Adult-estimated ➢ 3yrs		TOTAL NO.	++	prevalence
	NO. ex	NO. inf	NO. ex	NO. inf	NO. e	NO. inf	NO. e	NO. inf			
August	105	01	113	04	98	02	120	03	218	05	**2.294**
November	95	02	85	02	55	02	125	02	180	04	**2.222**
December	157	02	96	02	63	01	190	03	253	04	**1.581**
January	34*	0*	16*	0*	08*	0*	42*	0*	50*	0*	0*
TOTALS	**357**	**05**	**294**	**08**	**216**	**05**	**435**	**08**	**651**	**13**	
prevalence	**1.401**		**2.721**		**2.315**		**1.839**		**1.997**		

b) Misikhu municipal slaughter slab

month	male		Female		Young-estimated 0-3yrs		Adult-estimated ➢ 3yrs		TOTAL NO.		
	NO. ex	NO. inf	NO. ex	NO. inf	NO. e	NO. inf	NO. e	NO. inf		+ +	prevalence
August	215	03	96	02	137	02	174	03	311	05	1.608
November	98	01	21	0	33	0	86	01	119	01	0.840
December	287	03	337	06	135	03	489	06	624	09	1.442
January	25*	0*	10*	0*	11*	0*	24*	0*	35*	0*	0*
TOTALS	**600**	**07**	**454**	**08**	**316**	**05**	**749**	**10**	**1054**	**15**	
Prevalence	**1.167**		**1.724**		**1.762**		**1.335**		**1.423**		

Table 4: The Prevalence of Fascioliasis in relation to age-factor.

Month	Young (0-5yrs)		Adult (>5yrs)		total No. ex		
	No. ex	no. inf.	No. ex.	No. inf.		++	Prevalence
August	235	04	294	06	529	10	**1.890**
November	88	02	211	03	299	05	**1.672**
December	198	04	679	09	877	13	**1.482**
January	19*	0*	66*	0*	85*	0*	**0***
TOTAL	**521**	**10**	**1184**	**18**	**1705**	**28**	
%	**1.919**		**1.520**		**1.642**		

Note: No. Ex = Number Examined. No. Inf= Number Infected

Table 5: The Prevalence of Fascioliasis in relation to sex-factor

Month	males		females		total No. ex		
	No. ex	no. inf.	No. ex.	No. inf.		++	Prevalence
August	320	04	209	06	529	10	**1.890**
November	193	03	106	02	299	05	**1.672**
December	444	05	433	08	877	13	**1.482**
January	59*	0*	26*	0*	85*	0*	**0***
TOTAL	**957**	**12**	**748**	**16**	**1705**	**28**	
%	**1.254**		**2.139**		**1.642**		

Note: No. Ex = Number Examined. No. Inf= Number infected

Table 6: Prevalence in relation to Agro-ecology

Agro-ecology	No. Ex	No. +ve	Percentage (%)
Low-land- naitiri	**651**	**13**	**1.997**
High-altitude - misikhu	**1054**	**15**	**1.423**
Total	**1705**	**28**	**1.642**

4.1.1 Monetary Loss due to LiverCondemnation

The monetary losses due to condemnation of infected livers was determined by placing a monetary value on the total number oflivers condemned. Using an estimated average weight of 3.3 kg for a bovine liverand a market price of approximately ksh.500/kg (average price by local butcher men), the quantity in kilograms and monetary loss in US$ (using current exchange rate) could be calculated.

.The monthly economic loss was estimated as shown below.

Number of liver infected = 28

Average weight of infected liver = 3.3 kg

Total weight of infected liver = 3.3kg X28 =92.4 kg.

Mean market price of 1kg of liver = Ksh. 500.00

Cost of Total Condemned liver = 500 X 92.4=Ksh. 46,200.00 in three months.

The monthly estimated loss due to condemned livers due to fasciola disease is calculated as the average ofthe total of estimated studied months = 46200/3 =Ksh. **15400.00per** month

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CHAPTER FIVE

5.0 DISCUSSION

The results obtained in this study are an indication that fasciola infection occur in the study areas, with the prevalence rate of 1.6-% which was very low. No study was known to have been carried out in the same area. In that study, the highest prevalence rate of 1.9% (10 out of 529 cattle slaughtered) was recorded in wet season (August) as against dry season (1.5% (13out of 877 cattle slaughtered) in December. This high prevalence in August observed due to the rainy season (July ï August) and was attributed to contamination of pasture with metacercariae as well as to increased grazing time owing to the ample supply of vegetation and pasture that harbours lymaidsnails. he higher prevalence in wet season than dry season is in agreement with many reports around the world. Rainy season favours the survival of the intermediate host, water snails (*lymnaespecies*) and helminth parasite (Okon and Enyenihi, 1977; Suarez and Busetti, 1995). Therefore a direct relationship between prevalence with the rainfall, humidity and temperature do occur. In this study, the presence of sufficient rainfall and moisture during the wet season favored the survival of infective larvae in the pasture, emergence of cercaria from snails which results in higher probability of uptake of the infective larvae leading to higher prevalence rate.

Most livestock in this region are kept under free range system where they graze together and drink at same marshy area of river Nzoia, swamps, wells, springs and accumulated water bodies that increase contact between fasciola eggs,snails,water plants- watercress and cattles and also favours the survival of *Lymnae natalensis (* Bitakaramire,1969). This water masses increase the risk of acquisition of infection (Ogunrinade, 1980).The study further reveals that animals sex showed an association with the prevalence of the parasites,The possible explanation to the observation in this

study could be that both sexes (male and female cattle) move together during grazing. Therefore, the possibility for both male and female cattle to be exposed to equal risk of infection is very high. It was observed that females were more infected than their counter partners. This could be due to the physiological peculiarities of female animals, which usually constitute stress factors thus, reducing their immunity to infections and for being lactating mothers. Females are usually weak and malnourished and consequently are more susceptible to infections.

Similarly, a higher prevalence rate recorded in younger animals as compared to adult ones is in agreement with (Shah-Fischer and Say). The reason behind this observation may be the fact that younger animals are more susceptible to infections than adults. Adult animals may acquire immunity to parasites through frequent challenge and expel the ingested parasite before they establish infection. The study also shows higher prevalence at Naitiri which is comparatively lowland as compared to Misikhu (high altitudes) this statement is in line with reports from many parts of world. These low lands are characterized by a comparatively hot humid environmental situation that is favorable for the survivalof the infective larval stages.

Fasciola gigantic was the only liver fluke species recorded in the study. This may be associated with the existence of favourable ecological biotypes for *Lymnae species*, the recognized intermediate host of *Fasciola gigantic* in Kenya. This may be explained by the fact that most cattle for slaughtered came from low land and middle altitude zones. The period of this study was another factor that could have influenced the rate ofinfection. Such rates of prevalence are expected in tropical climates, since the rain favours the survival of the intermediate host, water snails (*lymnae species*) and helminth parasite (Okon and Enyenihi, 1977; Suarez and Busetti, 1995).

This research recorded many cattle without infection. A reasonable number of the infected ones were with light infections. The average worm burden (number of flukes per liver) recorded in this study was low. It was also observed during this research that all the 28 livers infected were condemned, and this has caused a serious monetary loss in the meat industry. The total estimated monetary loss due to condemned livers was found to be Ksh. 15,400.00, thus the rate of economic loss can, however, be said to be low. Diseased livers with heavy worm load were hard, small with rough and uneven surfaces with a lot of fibrous tissues and unfit for human consumption. This could be attributed to the fact that the slaughtered cattle were adult animal that might have been previously infected. This resulted in cirrhosis of the liver that opposed penetration of young flukes.

5.1 CONCLUSION AND RECOMMENDATION

This study has clearly demonstrated the presence of fascioliasis in cattle slaughtered at local slaughter slabs in Bungoma. The livers were examined for the adult flukes. The result of the investigation showed of out of 1705cattle consisting of 957males and 748 females examined, 28(1.6%) of the cattle were infected with fascioliasis. The prevalence recorded for female cattle was 2.1% compared to that of the males which was 1.3%.

It is evident from the study that comprehensive data on the impact of fasciolosis over several years are difficult and expensive to obtain. This is due mostly to the long-term and chronic nature of the disease, its multiple effects on productivity and the difficulty of making an accurate diagnosis.

In the three months study; about 92.4kg condemnable weight of livers from 28 cattle valued at Ksh. 46,200.00 was lost due to fasciola disease in three months. Fascioliasis is therefore of serious economic importance to the livestock industry, especially in Kenyan where most livestock farmers

are still ignorant of the disease. Although the rate of infection is very low, the economic implications should not be overlooked. This is because some infected liver were very bad and some of them were condemned but butcher men were always asking for them. The problem of fascioliasis is two-fold problem in domestic animals. The first and most important part is prevention, the second concerns elimination and treatment of disease when it occurs.

Research on disease prevalence should be intensified to facilitated its management. It devastates cattle throughout the world and continually drains the economic gains from these animals as is the case in local slaughter slabs in Bungoma County. Therefore, concerted efforts should be made to overcome this loss. This situation calls for serious attention of both the veterinary practioners and the public health planners in the country.In order to reduce the prevalence rate in county ingeneral, all stakeholders should evolve massive control measures to curb this condition:

Farmers, veterinarians, extension officers and government must take urgent actions to reduce these losses. While farmers should aim to prevent diseases like fascioliasis through good farm practices, veterinarians and meat inspection officers should not only derive pleasure in condemnation but should enlighten farmers and the butchers on the dangers of infection with *Fasciola spp*.

Regular deworming of farm animals should be encouraged and research into alternative meat sources should be intensified. The government should consider the options of creating and maintaining grazing reserves and the issue of compensation should be reviewed.

Finally, a good Trace-back system should be introduced in order to monitor the source of the infection and to control the infection at source.

5.2 Public Health and Prevention Strategies:

The presence of infection in a population is dependent upon and exacerbated by four factors:

- the presence of a substantial reservoir
- the presence of the intermediate host, the Lymnaea snails
- the opportunity for water source contamination by human and non-human hosts
- Dietary practices that include the consumption of raw, untreated aquatic vegetation.

Control measures include:

- Public enlightenment on the disease through farmers education.
- pasture/range management and elimination of the intermediate host;
    - spray molluscicides to decrease the population of snails (Malek, 1980)
    - prompt chemotherapy of live animals before slaughter with suitable antihelmetic to control morbidity and transmission (Sunn,1999)
    - Drain the land.
    - Use ducks and geese to feed on them.
    - Eliminate contact with encysted cercaria- fence off wet areas, move livestock to dry ground.
    - Prevent the fertilised eggs from hatching by liming the land

- The grazing of cattle should be highly restricted to areas of lesser snail infected site. The rangeland systems (artificial pasture land) seem to be the panacea to fasciolasis in cattle.

- If cattle are fed with hays, the rate of fasciola species will be at its low.
- Improved meat inspection qualities is recommended.

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CHAPTER SEVEN

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