

**PREVALENCE AND RISK FACTORS ASSOCIATED WITH FASCIOLOSIS IN THE  
SOUTHERN REGION OF MASVINGO PROVINCE**



**By**

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## ABSTRACT

Fasciolosis is a zoonotic disease of economic importance caused *fasciola* species and intermediate host *Lymnaeid natalensis*. The research aims to bring awareness to the farmers on the economic effects of fasciolosis in the beef production as well as its economic effects to the public health. A study to investigate the prevalence of fasciolosis and its associated risk factors was carried out at Koala park abattoir in Chiredzi district Zimbabwe. A total of 20553 cattle were delivered at Koala Park for slaughter with the objective of finding out if there is an association between prevalence and animal breed, animal sex, season of measurement and area of origin. From the animals slaughtered between January 2016 and December 2017, 1584 cattle were detected positive with adult and immature *fasciola* species. The average prevalence was 7.7% (n=1584). This study proves that, there was an association between prevalence of bovine fasciolosis and animal sex, animal breed and area of origin with ( $p < 0.05$ ) while there is no association between seasons of measurement and prevalence of fasciolosis with ( $p > 0.05$ ). I recommend that further research on disease prevalence should be intensified to facilitate its management and control. Further researches need to be done in the southern region of Masvingo province on the use of coprological examinations to compare prevalence of the disease with the post-mortem examinations in the abattoirs.

## **DECLARATION**

I hereby declare that this thesis is composed of work carried out by myself unless otherwise acknowledged and that this thesis is of my own composition. The research was carried out during the period of January 2016 to December 2017. This thesis has not in whole or in part been previously submitted for any other degree or professional qualification

Signature.....

## CERTIFICATION OF THESIS WORK

I the undersigned, certify that **Mashate Kudzai**, a candidate for Bsc Animal and Wildlife Sciences has presented this thesis with a title.

**Prevalence and risk factors associated with Fasciolosis in the Southern Region of Masvingo province**

That the thesis is acceptable in form and content, and that a satisfactory knowledge of the field covered by the thesis was demonstrated by the candidate through an oral examination held from January 2016 – December 2017

Supervisor

Name:        Mr    Muzvondiwa

Signature.....

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## **DEDICATIONS**

To my parents and siblings

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## **Chapter one**

### **1.0 Introduction**

Bovine fasciolosis is a parasitic disease of cattle caused by trematodes which are *Fasciola gigantica* and *Fasciola hepatica* in the tropics. The members of this genus are commonly known as liver flukes. The life cycle of these *trematodes* involves snail as an intermediate host. The disease is found in vast water lodged and marshy grazing field condition anticipated to be ideal for the propagation and maintenance of high prevalence of fasciolosis. This disease is widely distributed in areas where cattle are raised and there is a niche for *Lymnaeid* snail. The disease is usually characterized by a chronic, sometimes acute or sub-acute inflammation of the liver and bile ducts, accompanied by sub-mandibular oedema, anaemia, anorexia, general intoxication and death. Bovine fasciolosis is an important limiting factor for bovine production and it causes several economic losses. Fasciolosis has an impact to weight loss, reduced productivity, draught capacity, fertility and milk production .It is of public health importance due to its zoonotic aspect resulting in a number of human cases due to the two *Fasciola* species as well as the hybrid form being reported (Schweizer *et al.*, 2005).

According to Elkhtam *et al* (2016), the inclusion of animal health management activities based on endo-parasite control methods in primary health care of livestock is increasingly becoming an important intervention for improving livestock productivity in resource challenged smallholder farming areas. The liver flukes cause severe liver damage and result in total condemnation of liver. Diagnosis of bovine fasciolosis is based on clinical sign, grazing history, seasonal occurrence, examination of faeces by laboratory tests and post-mortem examination.

Certain areas of the world bear the burden of the highest prevalence of infection. The school age children are the most likely to be infected (Robert, 2010) and the major problem that faces livestock farmers is the high mortality rate in their herds either due to malnutrition or due to diseases, either bacterial, viral or parasitic .Among many parasitic problems of farm animals, fasciolosis is a major disease, which imposes direct and indirect economic impact on livestock production, particularly of sheep and cattle .

Humans can become accidentally infected by ingesting contaminated drinking water or plants in endemic area. After ingestion of the metacercariae, the larvae migrates through the intestinal

wall, pass into the peritoneal cavity, penetrate the liver capsule and finally matures in the bile ducts.

In humans the parasite cause biliary obstruction resulting in high fever, diarrhoea, chills, bile inflammation, liver enlargement and jaundice Durga and Pabitra( 2009).

In Zimbabwe, fasciolosis is assumed to be caused by *F. gigantica* in domestic animals and is endemic in most parts of the country (Vassilev 1999). The intermediate host of *F. gigantica* in Zimbabwe is *Lymnaeid natalensis* and it tolerates various climatic conditions and can be found in different reservoirs such as rivers, streams, ornamental ponds and cattle drinking troughs (Davies 1982). However, *Lymnaeid. natalensis* is less prevalent in the drier districts of the country compared to higher rainfall areas (Pfukenyi and Mukaratirwa 2004). It has also been noted that as the numbers of the intermediate host increases the prevalence of *F. gigantica* also increases (Pfukenyi *et al.*, 2004).

Diagnosis of *Fasciola* species infection in livestock has been based on parasitological methods such as coprological examination as well as identification of morphological characteristics of the fluke (Thanh 2012). Although coprological examination has a high specificity the sensitivity is low and species identification is not possible using the egg morphology (Adedokun *et al.*, 2008). Advanced techniques for identification and determining the phylogeny of parasites have been developed and include several molecular methods that are DNA based (Thanh 2012).

### **1.1 Problem statement**

Communal farmers in the Southern areas of Masvingo are facing economic losses due to fasciolosis when the disease causes mortality, and its subclinical infections have been shown to cause high losses from reduced feed efficiency, weight gains, milk production, reproductive performance, carcass quality and work output in draught animals. A large number of livers are being condemned in abattoirs and this eat away farmers' profit.

### **1.2 Justification**

Economic losses that occur through liver condemnation and trimming , other subclinical infection of *Fasciola* negatively affect farmer's productivity therefore the study seeks to establish the current prevalence of the disease and the risk factors associated in the area of study

and try to come out with possible measures that reduces its occurrence. Fasciolosis, is zoonotic disease has a public health concern. After ingestion of the larva metacercariae with humans, there is also costs that are incurred in treatment for the human population. Also, the researcher aims to bring awareness to the farmers in the beef production industry so that bovine fasciolosis free animals that are supplied to the slaughter houses.

### **1.3 Objectives**

#### **1.3.1 Main objective**

- To determine prevalence and risk factors associated with fasciolosis in the Southern Region of Masvingo province.

#### **1.3.2 Specific objectives**

- To determine prevalence of fasciolosis in southern region of Masvingo province
- To establish the risk factors associated with Fasciola infection in the southern region of Masvingo province

### **1.4 Research questions**

- What is the prevalence of Fasciolosis in the area of study?
- What are the determinants of fasciolosis infection?

## Chapter two

### Literature review

#### 2.0 Introduction

This chapter discusses some cardinal points in reviewing related literature on what other authors obtained about *fasciolosis* and its prevalence and the risk factors associated in different countries. Fasciolosis also known as distomatosis and liver rot, is an important helminthic disease caused by two trematodes *Fasciola hepatica* (the common liverfluke) and *Fasciola gigantica* (Mas-Coma, 2005). There are two other species *Fasciola. nyanzae* (Jooste 1989) and *Fasciola. tragelaphi* have been reported in wild life and cattle Mukaratirwa and Brand (1999) respectively. This disease belongs to the plant-borne trematode zoonosis. The parasite is transmitted by ingestion of metacercaria of *Fasciola* species on plants from contaminated fresh water.

#### Classification and Taxonomy of *Fasciola* species

Kingdom : *Animalia*

Phylum : *Platyhelminthes*

Class: *Trematoda*

Order: *Monogenea*

Family: *Fasciolidae*

Genus: *Fasciola*

Species: *Fasciola. hepatica*

*Fasciola.gigantica*

#### 2.1 Morphology of *Fasciola gigantica* and *Fasciola. hepatica*

*Fasciola. hepatica* is leaf shaped, flattened and is approximately 35mm long and 15mm wide on its widest part. The anterior and posterior ends of the fluke are narrow with the former end being conical with distinct shoulders (Stemmermann 1953). *Fasciola gigantica* is elongate, with a conical anterior end but however, bigger than *Fasciola. hepatica*, and is 75mm long and 15mm wide with less pronounced shoulders (Stemmermann 1953). On electron microscope, the surface of both flukes is covered with spines except the oral and ventral suckers. The spines are fewer on the ventral surface, small at the posterior end and they gradually increase in size from the middle

to the anterior end (Dangprasert et al., 2001). *Fasciola gigantica* is common liver fluke in Africa, it occurs in bile ducts and gall bladder, rarely under the peritoneum and in the lungs. The definitive host are sheep, cattle, and other ruminant such as rabbits and equines but it is rare. The intestinal tract has a wall, developed pharynx, a short esophagus and two divergent intestinal ceca with numerous lateral diverticula, there is a posterior elongate bladder with lateral branches. The highly dendritic testes are situated one behind the other in the middle of the body (David et al., 1969). *Fasciola. gigantica* is larger than *Fasciola. hepatica*, and eggs is larger in size, the anterior cone is smaller than *F. hepatica*.

### **2.3 Prevalence of fasciolosis in Zimbabwe**

The variation on the prevalence of fasciolosis in different researches done in Zimbabwe might be attributed to differences in agro-ecological regions with different climatic conditions in the study areas. According to (Pfukenyi 2003), the prevalence of *Fasciola .gigantica* infection observed in cattle slaughtered in the main abattoirs in the country was much higher 37.1% than that recorded as a result of the coprological examination of cattle (18.5 %). This variation could probably be due to the fact that reports in the abattoir study include livers damaged by immature fluke infection, which cannot be detected through coprological examination.

A study covering a period of 10 years (1990-1999) was conducted using post mortem meat inspection records of the Veterinary Department Information Management Unit to determine the prevalence and seasonal variation of bovine fasciolosis in Zimbabwe. 2 474 234 cattle were slaughtered in abattoirs and 917 565 livers (37.1%) were condemned due to *fasciola* infestation. The annual prevalence between 1990 and 1999 varied from approximately 28 % to 42 % and the prevalence was highest in 1991 with (42.4 %) and lowest in 1999 (27.6%).

Marondera prevalence of (44.9 %) and Chinhoyi prevalence of (42.1%) abattoirs serving the higher rainfall catchment areas had significantly higher prevalence and mean condemnation rates ( $P < 0.001$ ) than the other abattoirs. The prevalence of *Fasciola. gigantica* as observed in cattle slaughtered at the five main abattoirs in Zimbabwe was lower than that reported earlier by Chambers (1987) (46.3%) and by Vassilev & Jooste (1991) (40.4–43.2%). This variation was probably be attributed to the progressive intensification of veterinary and extension services in the country. Pfukenyi concluded that this probably made farmers more aware of fasciolosis and hence has accustomed them to apply regular anthelmintic treatment to their cattle.

## **2.4 Prevalence of Fasciolosis in Africa**

The prevalence of Fasciolosis, was found by most researchers to be much higher in developing countries compared to developed countries and this was assumed to be aggravated by poor sanitary conditions, inadequate meat inspection facilities and backward traditional cattle rearing systems (Semie 2014). Prevalence of bovine fasciolosis has been noted to be higher in Eastern African countries compared to other parts of Africa, (Kebede *et al*, 2009). It is a worldwide distributed disease striking both developed and developing countries although vulnerability differs with stage of development and it is considered to be a dangerous problem for the livestock economy and public health sector. According to Megard (2008) gave the prevalence rates in Kenya (33%), Sudan (37%), Cameroun (45%), Uganda (10%), Central African Republic (62%) and Rwanda (50%).

## **2.5 Prevalence of fasciolosis at global scale**

Epidemiological analysis of bovine fasciolosis has been carried out in different parts of the world. A low prevalence of Fasciolosis have been reported from Corsica (0.8%) and China (0.7%), an intermediate prevalence from Porto (3.2%) and Peru (8.7%) and a high prevalence from Montero valley and Bolivia with prevalence of 34.2 and 66.7 percent respectively (Jahangir, et.al., 2013).

The prevalence of *Fasciola* species is different in different study areas and prevalence of *Fasciola. hepatica* was observed in Kutaber (20.34%) followed by DessieZuria (17.74%) and the prevalence of *Fasciola.gigantica* was observed in Worehimmenu (9.88%) and Kutaber (2.54%). Across the world and different regions, the geographical differences in the habit of raw vegetables consumption, environmental and animal husbandry practices, and proximity to waste water and accessibility to anthelmintics for treating animals might also contribute to differences in prevalence, (Biruk, 2017). Cabaret *et al* (2002) postulated that, there is an association between the increase in fasciolosis prevalence and the importation of liver infected cattle, therefore in regions where cattle importation and exportation between countries is not strictly regulated prevalence is high.

Differences again among countries may exist due to heterogeneity in the exposure to risk factors among and within countries, the level of compliance with the officially established meat inspection protocols and also the characteristics of the facilities where meat inspection is carried

out, ( Kimari *et al* 2017). The distribution of *Fasciola. gigantica* and *Fasciola. hepatica* follows that of the snail intermediate hosts found in both the tropical and temperate regions (Prasad *et al.*, 2008). *Lymnaea truncatula*, the intermediate snail host for *Fasciola. hepatica* is mainly found in cold and mild climatic zones and hence, *Fasciola. hepatica* is mainly common in the temperate regions of Europe, Australia and America (Mas-Coma and Bargues 1997).According Dinnik (1964) other *Lymnaeid* species are mainly found in the tropical and sub-tropical regions of Africa and Asia making *F. gigantica* the most common species in these regions

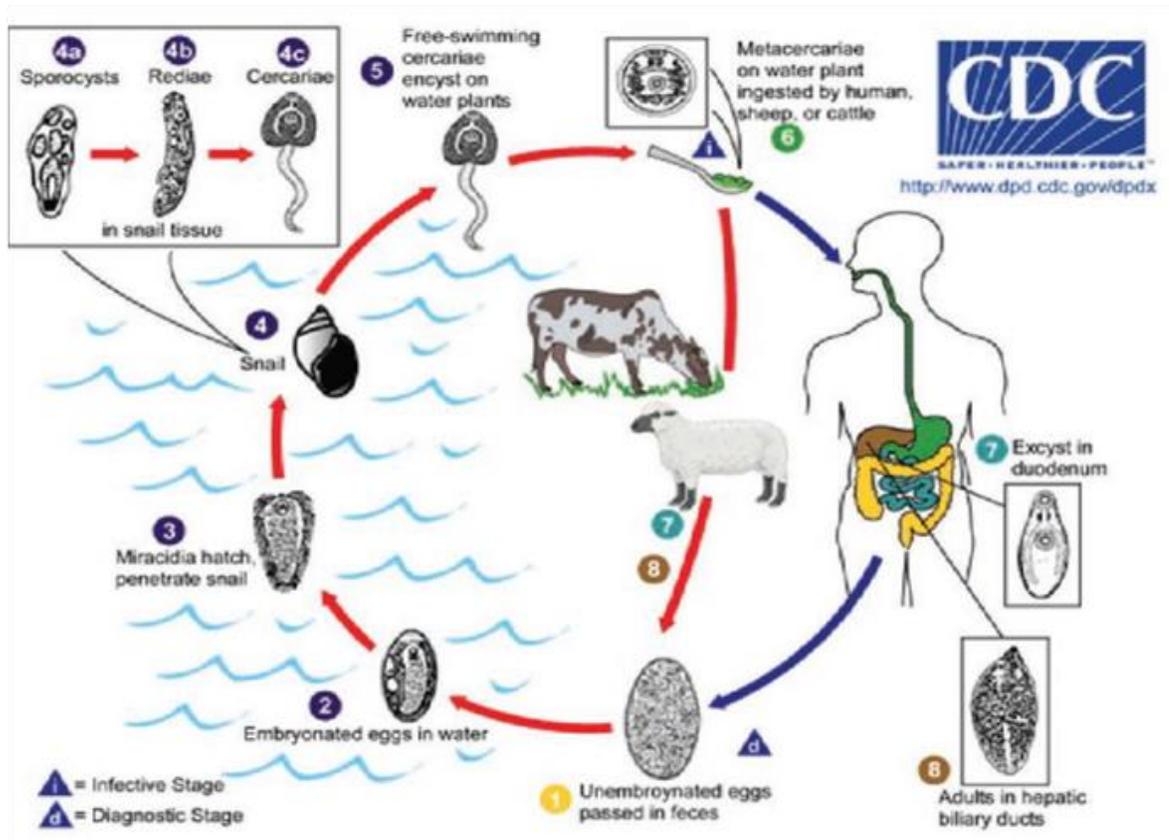
Kimari *et al* (2017) noted that, variation in prevalence between countries may be related to the level of environmental contamination and degree of awareness of different societies about fasciolosis transmission.

## **2.6 Life cycle of Fasciola**

Adult liver flukes are hermaphrodites and produce approximately 20 000 eggs/day which are passed out in faeces Durbin (1952). In wet environments with adequate light and temperatures above 10°C, eggs embryonate within 2 weeks (Graczyk and Fried 2014). Miracidia are released once the eggs hatch and these penetrate the intermediate snail host of the genus *Lymnaea*. In the intermediate host there is development and multiplication of the miracidia into sporocysts followed by rediae, daughter rediae and finally cercariae. Shedding cercariae then find plants on which they encyst as metacercariae. Animals and humans are infected by ingesting metacercariae on water plants and grass respectively or drinking water contaminated with the metacercariae (Graczyk and Fried 2014). Once inside the host, the metacercaria excysts in the stomach in humans and duodenum in animals and then penetrates the gut wall, peritoneal cavity and reaches the liver (Cheesbrough 2005). The immature liver flukes migrate in the liver parenchyma for a period of 8 weeks and then enter the bile duct where they mature to adults( Graczyk and Fried 2014).

Adult flukes reproduce by cross and self-fertilisation in the bile ducts of the host whereas the immature stages are involved in asexual reproduction (Cheesbrough 2005). The flukes survive for years in the liver and produce thousands of eggs that are passed out in faeces via the bile duct into intestinal tract and the cycle continues (Boray 2007). It may take approximately 3 to 4 months for a fluke to develop into an adult and start producing eggs and *Lymnaeid* snails act as the intermediate hosts (Miliotis and Bier 2003).

Final hosts ingest the metacercariae and these excyst in the small intestine, followed by migration through the intestinal wall, crossing of the peritoneum and penetration of the liver capsule. The immature flukes migrate through the parenchyma (6-8 weeks period), entering the small bile ducts and finally migrating to the larger bile ducts and sometimes the gallbladder.



**Figure 2.1: The life cycle of Fasciola (Robert, et al., 2010)**

### 2.6.2 Intermediate hosts

Lymnaeid snails are known to be the intermediate hosts of the main two *Fasciola* species (Thanh 2012). *Lymnaea truncatula* the intermediate host of *Fasciola hepatica* is common in mild climatic regions of America, Australia and especially Europe (Mascoma and Bargues 1997; Kock *et al.*, 2003). The distribution of *Lymnaea truncatula* in sub Saharan Africa is limited to regions in South Africa with lower temperatures and widely distributed in South Africa (Kock *et al.*, 2003). *Lymnaea columella* is more widely distributed in South Africa compared to *Lymnaea*.

*truncatula* but the importance of *Lymnaea. columella* in the transmission of *Fasciola* species has not been established in Zimbabwe (Kock *et al.*, 2003). In Zimbabwe, *Lymnae natalensis* is the intermediate host of *Fasciola. gigantica* and is found in a variety of water habitats; streams, dams, rivers and ponds (Davies 1982; Pfukenyi *et al.*, 2005).

## **2.7 Distribution of *Fasciola* species**

The distribution of *Fasciola. gigantica* and *Fasciola. hepatica* follows that of the snail intermediate hosts found in both the tropical and temperate regions (Prasad *et al.*, 2008). *Lymnaeatruncatula*, the intermediate snail host for *F. hepatica* is mainly found in cold and mild climatic zones and hence, *Fasciola. hepatica* is mainly common in the temperate regions of Europe, Australia and America (Mas-Coma and Bargues 1997). In Zimbabwe *Fasciola. gigantica* is widespread and occurs all year round, with a high prevalence in high rainfall compared to drier areas (Vassilev1999; Pfukenyi 2003). *Lymnaea natalensis*, the intermediate snail host is widespread in Zimbabwe and is known to thrive in a variety of conditions (Davies 1982). The fresh water snail has been collected in both the highveld and lowveld regions of Zimbabwe with more snails being found in the highveld (Chingwena *et al.*, 2002; Pfukenyi *et al.*, 2006)). High prevalence of *F. gigantica* in Zimbabwe is also attributed to the presence of numerous man-made water bodies such as dams as well as perennial streams in the highveld (Pfukenyi and Mukaratirwa 2004). Animals are normally infected during grazing especially when they ingest metacercariae on herbage closer to water bodies and this is common in drier months when grazing pastures are reduced (Pfukenyi 2003).

## **2.8 Economic importance of fasciolosis**

### **2.8.1 Fertility**

According to Copeman *et al.*, (2012), a link has also been observed between infection with *Fasciola .gigantica*, anaemia and fertility where there were significantly longer intercalving intervals and a lower packed cell volume in On gole cows in Indonesia infected with *F. gigantica* than in those treated with triclabendazole each july for two years. In other researches, it was found that treated cows had a mean inter calving interval of 18.5 months whereas in untreated cows the interval was 31.5 months and this give a reason to conclude that infection with *F. gigantica* is likely to adversely affect reproduction Copeman, *et al.*,( 2012).

### **2.8.2 Draught performance**

Anaemia resulting from fasciolosis has been shown to reduce work output by 7–15%. (Copeman 2012). Combined with a further indirect reduction of 20% in potential work capacity in animals whose growth has been restricted by fluke infection, it can be concluded that liver flukes can seriously lower the work potential of cattle. The economic significance of this may, however, be changing “rapidly in production systems where hand tractors are replacing animals as sources of draught power Copeman, et al.,( 2012).

### **2.8.3 Economic losses**

*Fasciola* species cause significant losses in the livestock sector due to reduced productivity, weight gain and decreased milk production and fertility (Charlier *et al.*, 2007). In sheep, reduced production and wool quality, poor growth rates of lambs and increased replacement of lambs has been observed Boray (2007). In Zimbabwe, most losses are as a result of liver trimming and condemnations hence there is reduction on the farmers profits. Fasciolosis has also gained public health importance due to its zoonotic aspect Thanh( 2012). In African countries, several millions of dollars have been lost due to this disease ( Pfukenyi and Mukaratirwa, 2004). Studies carried out in recent years have shown fasciolosis to be a significant public health problem. About 17 million persons in several countries are infected and 180 million people at risk of the infection worldwide ( Mas-Coma, 2014)

## **2.9 Risk factors associated with prevalence of fasciolosis**

Olsen et.al (2015) postulated that over 17 million people are affected globally, where humans become accidental hosts by ingestion of contaminated water, aquatic vegetation or occasionally through consumption of raw or undercooked liver products. The geographical distribution of *Fasciola hepatica* is strongly linked to climate and environmental conditions such as presence of water bodies, pastures and wetlands. These conditions create a favorable environment for the development and transmission of free living fluke stages and for the growth and reproduction of the intermediate host snail . Apart from climate and environmental factors, animal level factors like age and breed and herd level factors such as stocking rate and type of farm.

### **2.9.1 Prevalence of fasciolosis between animal age groups**

In a study that was conducted to determine the prevalence of *Fasciola hepatica* and to investigate the related risk factors in cattle from Kayseri, Turkey Yildirim1, etal.,( 2015). The

highest prevalence was observed in 6 years age group (87.2%) followed by 3-5years (79.5%) and  $\leq 2$  years age groups (51.6%). The differences between 2 and other age groups were found significant ( $p < 0.001$ ), this explain that infection are more in older animals compared to younger animals According to Pfukenyi (2003) in Zimbabwe, there was significant differences in prevalence of *F. gigantica* among the age categories ( $P < 0.001$ ) with adults having a higher prevalence than the younger animals . The higher infection rate in older animals is reported to be probably associated with age and consequently longer exposure time (Schillhorn van Veen *et al.* 1980; Vassilev 1999)

### **2.9.2 Prevalence of fasciolosis between different sexes**

According to Gathura (2015) differences were found in infection rate with regard to the host sex, females were more infected (2.1%) as compared to males (1.3%). The study further reveals that animal's 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.

The prevalence of *Fasciola* in male and female cattle differ due to several reasons, including grazing disparity between both sexes especially if the cow is pregnancy, sampling methods, and the fact that female animal are mainly used for reproductive purposes and seldom for beef production hence are likely not to be regularly slaughtered at abattoirs, thereby affecting the number of females sampled during the study (Dawa et al., 2013; Khan et al., 2010; Zeleke et al., 2013).

### **2.9.4 Prevalence of Fasciolosis between different seasons**

From Pfukenyi (2003) and also other studies (Schillhorn van Veen 1980; Mzembe & Chaudhry 2007), the prevalence of *Fasciola. gigantica* was found to be significantly higher during the wet season than the dry season. Reports on the duration of the period during which animals are exposed to infection with *Fasciola. gigantica* vary between habitats and the rate of infection is

not constant throughout the year but concentrated over a relatively few months (Spithill et al. 1999). The pattern of infection in any area is a reflection of the timing and duration of ecological circumstances favourable for the population of snails and survival of metacercariae, as well as the management of livestock which permits dung from infected stock to contaminate snail habitats and allows stock to feed on fringing vegetation from sites where metacercariae are present Spithill et al. (1999).

According to Pfukenyi (2003) the snail population was low during the period December to March, and high between April (end of wet season) and October (end of dry season). This agrees with earlier observations from other parts of the world (Mzembe & Chaudhry 1979; Schillhorn van Veen 1980). Therefore, towards the end of the wet season eggs of *Fasciola. gigantica* dropped on pasture survive to infect the new generation of snails. Investigations on the life cycle of *F. gigantica* indicated that the cercariae are released from mid- to end of the dry season and cattle are thus exposed to a high level of infection during this period

### **2.10 Control and prevention**

In the control of fasciolosis, several anthelmintics are used to control fasciolosis, however some drugs are only effective against mature stages of the parasite. Triclabandazole is an anthelmintic effective for both mature and immature stages of *F. hepatica* and *F. gigantica* (Waruiru *et al.*, 1994). Registered fluke anthelmintics may be used prophylactically to reduce contamination of pastures by fluke eggs at times most suitable for their development also to remove fluke populations (tactical treatment) at a time of heavy fluke burdens, or at periods of nutritional and pregnancy stress to animal. There is also deworming regime recommended by Pfukenyi and Mukaratirwa (2004) for Zimbabwe to control fasciolosis in domestic ruminants is to treat animals three times a year for example December/ January to control chronic fasciolosis, beginning of the cold season April/May to reduce contamination of pastures by the parasite and another treatment at the end of the dry season in August.

Control of the Intermediate snail host may be useful in reducing fasciolosis in ruminants and also the use of molluscicides in water reservoirs such as dams and rivers due to the persistence of the compound in the environment resulting in the killing of non-targeted animals and plants in the habitat Pfukenyi and Mukaratirwa (2004). Drainage or fencing-off of wet areas prevents infection of pastures but is rarely cost effective on grazing land in developed countries and

neither is it feasible in developing countries. Complete separation of livestock from snail-infested areas is only practical in intensive farming husbandry systems. Hence cultural and husbandry control methods can be applicable in the commercial farming areas. In communal grazing areas animals are communally grazed and therefore practices such as rotational grazing and provision of clean pastures would not be feasible (Pfukenyi, et al-2005).

Habitat management in the form of vegetation clearance is potentially effective both through reducing feed availability of snails and also by enhancing water flow rates during the rainy season. This method of control could probably be possible especially in commercial farming areas where snail habitats are not widespread.

## Chapter Three

### 3.0 Research Methodology

The research was conducted at Koala Park abattoir which is located less than one kilometer to the southern side of Chiredzi town. The catchment area for cattle slaughtered at the abattoir is the Southern region of Masvingo province which mainly covers four districts that is Zaka, Mwenezi, Bikita and Chiredzi district. The catchment area for the abattoir also extends covering some part of Manicaland West and part of Matabeleland South and Beitbridge.

In this research four districts targeted and conducted falls under agro-ecological regions 4 and 5. According to Murungweni *et al* (2012), the Southern region of Zimbabwe lies below 600 m above sea level. Rainfall distribution in the lowveld region is not reliable, with an annual average of 400 mm mainly falling between November and April, and only rare showers the rest of the year (Cumming, 2005). There are both communal and commercial farms in the area of study.

#### 3.1 Animals which are under study and how the infection was detected

The researcher collected data on animals slaughtered while paying particular attention on animals infected with *Fasciola* species during animal slaughter, routine meat inspections were carried out on the livers for all the cattle brought from four districts in Southern region of Masvingo. Records on the prevalence of *Fasciola* were collected from January 2016 to December 2017. Area origin of the slaughtered animals were noted, the year of slaughter was recorded and the researcher was paying particular attention on animal sexes and season of slaughter. The breed of the animal was also noted and the major breeds were the Crossbreeds, Mashona, Afrikanda, Brahman well as the Holstein breeds. In the study seasons were divided into two that is wet and dry season. Wet season was labeled from November to May and dry season starts from June to October. The total number of cattle slaughtered in the period covered by the research were 28850 with 20554 from the four targeted districts

Ante-mortem inspections was conducted on individual animals, both when the animals at rest and motion in the lairage of the Abattoir shortly prior to slaughter. Each animal was identified based on the enumerate marks on its body using a pen before slaughter. Attention was given to the factors such as body condition, breed, sex, and area of origin of the animals, to determine the impact of these factors on the disease.

### **3.2 Post mortem examination**

Each liver was palpated and inspected by making multiple deep incisions of about 1cm of the lobes and making a deep cut with a number of small sub cuts. Gall bladders duct was opened using a knife and thoroughly investigated for the presence of the adult stage of *Fasciola*. Palpation pressure exerted brownish fluid and immature *Fasciola*. In parallel, the data were recorded showing the negative and positive of *Fasciola* for each animal slaughtered and the liver found with *Fasciola* were condemned for human consumption.

### **3.3 Data Analysis**

Collected data by the researcher was entered into Microsoft excel 2013 and imported from Microsoft excel to STATA 13 for analysis, with all the potential risk factors analyzed. The binary logistic regression was used to find out which factor is a determinant to Fasciolosis. The significant level was determined at  $p < 0.05$ . Data was analyzed using Epi-info 3.1; for prevalence. To determine association of the risk factors associated with *Fasciola* and the confidence intervals.

## Chapter four

### 4.0 Results

**Table 4.1 prevalence of bovine Fasciolosis**

Fasciola	N of animals examined	Prevalence %	95% CI Wald (normal Approx.)
Overall prevalence	20553	7.7	
Sex			
Female	14807	6.3	5.89-6.58
Male	5746	11.4	10.59-12.27
Breed			
Crossbreed	9470	16.3	15.3-16.8
Mashona	5110	8.8	8.01-9.56
Brahman	3438	2.9	2.29-3.41
Afrikanda	1280	6.8	5.56-7.31
Holstein	1255	7.9	7.33-8.41
Season			
Wet	11526	7.9	7.36-8.34
Dry	9027	7.5	6.98-8.07
District			
Chiredzi	12291	5.9	5.53-6.37
Bikita	1114	16.2	14-18.32
Zaka	1980	13.8	12.32-15.36
Mwenezi	5166	7.7	6.99-8.452

The table 4.1 above shows the percentage prevalence of bovine fasciolosis of animals slaughtered at Koala Park abattoir and the 95% confidence intervals. The overall prevalence of fasciolosis was 7.7% where 1584 were affected by Fasciola. Males (11.4%) had a higher prevalence compared to female (6.3%). Statistical analysis indicates that, there was an association between animal sex and prevalence of bovine fasciolosis with a p value of 0.000, ( $p < 0.05$ ) because the 95 % CI are not overlapping.

From the table indicates that more animals detected positive in wet season with prevalence of 7.9 % while prevalence in dry season was 7.5%. Statistical analysis shows that, there was no

association between seasons and prevalence of *fasciolosis* with a p value of 0.417, ( $p > 0.05$ ) and also there is no association as the CI are overlapping.

According to breeds, Crossbreeds shows a highest prevalence of 16.3% followed by Mashona breeds with 8.8%. Holstein breeds had prevalence of 7.9% and Afrikanda had 6.8 percent. The breed with lowest prevalence was the Brahman with 2.9% the breeds shows that there is a strong association with the prevalence of *fasciolosis* with a p value of 0.000, ( $p > 0.05$ ) between breeds shows that there is an association as some of the confidence intervals are overlapping.

The table above indicates different prevalence on the targeted districts. From the table, Bikita district has the highest prevalence of 16, 2% compared to others. Zaka district has the prevalence of 13, 8 and Chiredzi has the lowest prevalence of 5, 9. Statistical results prove that, there was an association between the districts and prevalence of *fasciolosis* with a p value of 0.000, ( $p < 0.05$ ). There was an association among Zaka and Bikita district as the confidence interval are overlapping, also an association between Chiredzi district and Mwenezi.

**Table 4.2: Association of the risk factors and Fasciolosis**

Variables	Odds ratio	P value	95 % CI
Sex	0.537	0.000	0.483-0.598
Female	0.565	0.000	0.508-0.629
Male			
Breed	0.926	0.001	0.887-0.966
Brahman			
Afrikanda	0.948	0.406	0.837-1.074
Crossbreed	2.430	0.000	1.955-3.020
Mashona	1.067	0.583	0.845-1.347
Holstein	0.352	0.001	0.296-0.420
Season	1.044	0.417	0.940-1.158
Dry			
Wet	1.048	0.378	0.943-1.164
District	1.342	0.000	1.267-1.420
Zaka	0.563	0.001	0.477-0.665
Chiredzi	0.476	0.000	0.386-0.566
Bikita	1,408	0.000	1.237-1.164
Mwenezi			

Table 4.2 above shows the odds ratio for all risk factors in the study in which the odds ratio in the logistic regression represents how the odds change in an event that an outcome will occur in the event of an exposure as compared to the outcome occurring in the absence of the exposure. The odds ratio for wet season was 1.048 odd ratio meaning that it 1.048 more likely to get *Fasciola* than the dry season and the p value is 0.417 which means that there was no statistical significant association of season with prevalence of fasciolosis. Animals in the dry season have a chance of getting Fasciola by 1.048 compared to the animals in the wet season.

Sex had the OR of 0.538 and the p value is 0.000 meaning that it has a strong association with fasciolosis. Females have an odd ratio of 0.565 and this means females had 44% more likelihood of getting *Fasciola* infections than males. Fasciolosis was diverse between different breeds. Conversely, crossbreeds have a higher risk of having fasciolosis than Brahman (OR: 2.430, 95% confidence interval [CI] 1.955-3.020). Holstein have an OR OF 0.352 of getting Fasciola infections compared to crossbreeds and Afrikanda has 1,067 OR compared to the crossbreeds. Breed had an OR of 0.926 and area of origin had 1.342 OR and it shows that the is statistically an association with the prevalence of fasciolosis. Chiredzi district has (0.563 OR) of getting infections of Fasciola compared to Bikita district. Zaka district has 1.408 OR of getting Fasciola infections compared to Bikita district

## **Chapter five**

### **5.1 Discussions**

The study was based on the results which was obtained from routine meat inspection and statistical records on animal slaughtered, and liver condemnation at Koala Park abattoir from the department of veterinary, Chiredzi. The average percentage prevalence of bovine fasciolosis in this study was far much smaller (7.7%) as compared to other studies in Zimbabwe. According to Pfukenyi (2003) the prevalence was 18.5 % using coprological examination and also 37.1% from cattle slaughtered from 1990 to 1999 in five abattoirs. A low prevalence of Fasciolosis have been reported from Corsica (0.8%) and China (0.7%), an intermediate prevalence from Porto (3.2%) followed by Egypt (7.3%), and Peru (8.7%) (jahangir, et.al. 2013). Since the presence of the snail hosts is an important factor in the prevalence of fasciolosis, (Pfukenyi 2003) found out that *Lymnaea natalensis* is significantly more prevalent in the higher rainfall areas of Zimbabwe than the drier districts. This probably explains the lower percentage found in this study as the average annual rainfall is 400mm in the Lowveld.

### **5.2 Association of season and prevalence of Fasciolosis**

The research shows that, there was no association between season and prevalence of fasciolosis where both seasons (dry and wet) have similar vulnerability to the infection because the confidence intervals between seasons were overlapping. The association was highlighted by an odd ratio of 1.044 and wet season shows a higher prevalence of than the dry season .This was supported by Okon and Enyenihi (1977) saying rainy season favours the survival of the intermediate host, water snails and helminth parasite. Therefore a direct relationship between prevalence with the rainfall, humidity and temperature do occur resulting in higher prevalence in wet season.

### **5.3 Association of sex and prevalence of Fasciolosis**

The research found out that, there was an association between sex and prevalence of *fasciolosis* ( $p < 0.05$ ). In the study, males were more susceptible to infection with prevalence compared to their females counter partners . Higher prevalence on males recorded in the study was supported by the findings of Gathura (2015) females were more infected (2.1%) as compared to males (1.3%). However Odetokun(2014) reported that males has a higher prevalence than females

### **5.5 Association of breed and prevalence of fasciolosis**

The research found out that, there was an association between breed of the animal and prevalence of fasciolosis ( $p < 0.05$ ). High prevalence were found in the crossbreeds with prevalence of 16.3%, Mashona breed with 8.8%, Afrikanda 6.8% this could be the engagement in extensive farming systems with little or no veterinary input of the local breeds. Animals are kept under free range system where they graze together and drink at same marshy area of river, swamps, wells, springs and accumulated water bodies that increase contact between Fasciola eggs, snails, and water plants- watercress as most local breeds and mainly crossbreeds are found in communal areas. Lower prevalence was found in Brahman with 2.9% this could be due to the commercial farming where farmers deworm their animals. Holstein breed has the prevalence of 7.9 % and Odetokun(2014) also reported that dairy cows are more vulnerable to fasciolosis as they stay longer on farms producing milk making them more exposed and susceptible to parasitic diseases like fasciolosis and also farmers sometimes do not control internal parasites to produce clean milk. However in Zimbabwe recent studies did not included the association of breeds in the prevalence of fasciolosis.

### **5.5 Association of area of origin and prevalence**

There was an association between prevalence of fasciolosis and different veterinary districts. Chiredzi district had the lowest prevalence compared to other districts. In these areas, temperatures are extremely high with lower rainfall and these extreme condition reduce the occurrence of the intermediate host snail. Confidence intervals of Chiredzi and Mwenezi were overlapping and this might because Chiredzi and Mwenezi are close to each other, as we move from Chiredzi district to northern side of Zimbabwe with increasing in altitude, temperature decreases and at the same time annual rainfall increases. Due to increase in annual rainfall, the result is more occurrence of the intermediate host resulting in more prevalence of Fasciola infections in the district of Zaka and Bikita.

## **Chapter six**

### **6.1 conclusions**

The overall average percentage prevalence of fasciolosis in the Southern region of Masvingo province was 7.7% and that figure is much lower compared to other percentage prevalence recorded in other provinces of Zimbabwe.

From this study, the researcher concluded that statistically there was an association between prevalence and area of origin with Bikita district having the highest infection rate and Chiredzi district having the lowest infection rate. The research concludes that, there was an association between animal sex and prevalence. The findings shows that, males are more susceptible to bovine fasciolosis compared to their female counterparts. Breeds also shows an association with prevalence as crossbreeds are highly vulnerable to *Fasciola* infections and Brahman have a low prevalence.

The study indicates that, there was no association between prevalence and seasonality . However the study shows that more animals infected were slaughtered in the wet season compared to those in dry season.

### **6.2 Recommendations**

I recommend further research on disease prevalence should be intensified to facilitate its management and control. Further researches need to be done in the southern region of Masvingo province on the use of coprological examinations to compare prevalence of the disease with the post-mortem examinations in the abattoirs.

Farmers, veterinarians, extension officers and government must take actions to reduce these losses through awareness campaigns and correct use of antihelmints. Farmers should aim to prevent diseases like fasciolosis through good farm practices, veterinarians and meat inspection officers should not only involved in condemnation of livers but should enlighten farmers and the butchers on the dangers of infection with *Fasciola*.

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