

Review Article

Review on Epidemiology, Control and Public Health Importance of Bovine Fasciolosis

Feyisa TT*

Department of Tropical Veterinary Parasitology and Pathology, Addis Ababa University, Bishoftu, Ethiopia

*Corresponding author: Tadesse Tilahun Feyisa, Department of Tropical Veterinary Parasitology and Pathology, Addis Ababa University, Bishoftu, Ethiopia

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Abstract

Fascioliasis is a trematode zoonotic snail-borne disease of public health and economic importance. Fasciolosis is a parasitic disease that affects most population of cattle and it exists in almost all parts of the world. It is caused by commonly known species of liver fluke that are *Fasciola hepatica* and *Fasciola gigantica*, which mainly affects domestic ruminants. Fasciolosis is more apparent in young cattle and is usually chronic in nature. Adult flukes in the bile ducts cause inflammation, biliary obstruction, distraction of liver tissue and anemia. Fasciolosis is the major burden for Animal production and by direct or indirect economic losses at different part of our country. Diagnosis of fasciolosis is based primarily on clinical signs and seasonal occurrence in endemic areas but previous history of fasciolosis on the farm or identification of snail habitats; postmortem examinations, hematological tests and examination of faeces for fluke eggs are useful. The life cycle of *Fasciola spp.* is a typical of digenetic trematodes. Eggs laid by the adult parasite in the bile ducts of their hosts pass into the duodenum with the bile. The life cycle of *Fasciola* goes through the intermediate host and several developmental stages in the intermediate host. On a herd basis, clinical signs of fluke infection are usually vague (i.e., reduced productivity) and can be difficult to differentiate from the effects of less-than-optimal management or other chronic disease conditions. Transmission of fasciolosis infection is depending on the presence of "lymnea snail", host and final host. Among many parasitic problems of farm animals, fasciolosis is a major disease which imposes economic impact on livestock production particularly of cattle and sheep and it has public health importance as it have zoonotic value.

Keywords: Bovine; *Fasciola gigantica*; *Fasciola hepatica*; Fasciolosis; liver fluke

Abbreviation

CDC: Center for Disease Control; ELISA: Enzyme Linked Immune Sorbent Assay; ES: Excretory-Secretory; ETB: Ethiopian Birr; FAO: Food and Agriculture Organization; FH: Fasciola Hepatica; FH: Final Host; FG: Fasciola Gigantica; IH: Inter Mediate Host; GGT: Gama Glutamate Transferase; LH: Lactate Hydrogenase; *m.a.s.l.*: Meter above sea level; PH: Potential of Hydrogen; WHO: World Health Organization

Introduction

Fasciolosis is among important parasitic diseases in tropical and subtropical countries which limit productivity of ruminants in particular cattle. *Fasciola hepatica* and *F.gigantica* are the two liver flukes commonly reported to cause fasciolosis in ruminants [1]. Fasciolosis is one of the economically important diseases of domestic livestock particularly in cattle and sheep, and occasionally human beings [2].

Recently, [2] highlighted the significance of fascioliasis as an emerging helminthic zoonosis and reported that currently there are 2.4 to 17 million human cases globally and 91.1 million people are living at risk of infection. The two species most commonly implicated as the etiological agents of fasciolosis are *Fasciola hepatica* and *Fasciola gigantica* [2].

F. hepatica and *F. gigantica* are the most common species of liver flukes that cause hepatobiliary system infection mainly in cattle and sheep that they have an impact on public health. Human fascioliasis is caused by *F. hepatica* is recently been recognized as an emerging and re-emerging zoonotic disease in several countries [3]. This disease in cattle and sheep causes an annual economic loss of three billion US dollars through the reduction of milk and meat yields [2].

Bovine fasciolosis is one of the most important parasitic diseases of cattle causing mortality and production losses in various parts of the world. It is the priority disease in the highland as well as in lowland areas of the country [4]. Fascioliasis is a well-known, devastating, food-borne trematode infection of herbivores; although human infection would occur accidentally [5]. It is estimated that 17 million individuals suffer from the liver fluke disease worldwide with 180 million at-risk people [6].

It affects humans, but its main host is ruminants such as cattle and sheep. In Europe, Americas and Oceania, only *F. hepatica* is a concern, but the distributions of both species overlap in many areas of Africa and Asia [7]. There are agricultural activities that expose human beings to infection of complicated fasciolosis.

The variation in climate-ecological conditions such as altitude, rainfall and temperature, and livestock management system influences the prevalence of fasciolosis together with survival and

distribution of the parasites as well as their intermediate host/snails.

Fascioliasis has great proliferation powers due to its large colonization capacities in its ruminant host and vector species. So the disease is limited to only those geographic areas where snail population is present [8]. So, the objective of this review is to assess and evaluate the epidemiology, etiology, pathogenesis, clinical sign, diagnosis method, control, economic losses and public health significance of bovine fasciolosis.

Literature Review

Taxonomy

Phylum Platyhelminthes contain the two classes of parasitic flat worms, Trematoda and Cestoda. The class Trematoda falls into two main subclasses, the Monogenea, which have a direct life cycle, and the Digenea which require an intermediate host. There are many families in the class Trematoda and those, which include parasites of the major veterinary importance are the Fasciolidae, Dicrocoeliidae, Paramphistomatidae and Schistosomatidae [9].

Fasciola belongs to the following taxonomic classification;

Kingdom: Animalia

Phylum: Platyhelminthes

Class: Trematoda

Subclass: Digenea

Order: Echinostomida

Family: Fasciolidae

Genus: Fasciola

Species: *F. hepatica*; *F. gigantica*

Etiology

Fasciolosis is a parasitic worm infection caused by the common liver fluke *Fasciola hepatica* as well as by *Fasciola gigantica*. *Fasciola hepatica* may infest all domestic animals, including equine and many wild life species, but chronically infected sheep are the most important source of pasture contamination. Human cases are usually associated with the ingestion of marsh plants such as water cress. The larger fluke, *F. gigantica* is restricted to warmer regions including parts of Africa, Asia and worlds [10].

Morphology

Fasciola hepatica is one of the temperate area and largest flukes of the world, reaching a length of 30mm and a width of 1mm. The adult parasite has a flat leaf-like body, typical of flukes, and measures 20 to 30mm long by 8 to 15mm wide [11] grossly the young fluke at the time of entry in to the liver is 1.2 mm in length, undifferentiated between species and lancet like in appearance [12].

Fasciola gigantica is a tropical countries of the fluke and are broader in the anterior region and possess an anterior cone shaped projection that is followed by a pair of prominent laterally directed shoulder [13]. *Fasciola parasites* are large hermaphrodites worm with leaf shaped body and spiny tegument [14].

The adult possesses two suckers for attachment. The oral sucker at the anterior end surrounds the mouth and the ventral suckers that

is placed at the level of the shoulders of the fluke. The body surface is a tegument, which is absorptive and is covered with spines. The digestive system is simple, the oral opening leading to the pharynx, esophagus and a pair of branched intestinal ceca, which end blindly. Undigested material is presumably regurgitated [9].

The excretory system consists of a large number of ciliated flame cells, which impel waste metabolic products along system of tubules, which ultimately joins and opens to the exterior. The nervous system is simple consisting of pair of longitudinal trunks connecting anteriorly with two ganglia. Trematodes in general are usually hermaphrodites and both cross- and self- fertilization may occur. The male reproductive system consisting of a pair of testes each leading to the vas-difference; these join to enter the cirrus sac containing a seminal vesicle and the cirrus, a primitive penis, which terminates at the common genital opening. The female system has a single ovary leading into an oviduct, which is expanded distally to form the oo type [9].

Epidemiology

Fasciolosis is a widely distributed disease which imposes economic impact on livestock production particularly of cattle and sheep [15]. *Fasciola hepatica* and *Fasciola gigantica* infections occur in areas above 1800 m and below 1200 m above sea level, respectively which has been attributed to variations in the climatic and ecological conditions such as rainfall, altitude, and temperature and livestock management system. In between these altitude limits, both species coexists where ecology is conducive for both snail hosts, and mixed infections prevail [16].

Fasciolosis which caused by *F. hepatica* and *F. gigantica* is one of the most prevalent helminthes infections of ruminants in different parts of the world including Ethiopia. *F. hepatica* was shown to be the most important fluke species in Ethiopian livestock with distribution over three quarter of the nation except in the arid northeast and east of the country. It is the most important trematode that causes liver fluke disease of domestic ruminants in temperate areas.

As Njau and Scholtens [17] reported that metacercaria can survive up to 3 months after harvesting in hay from endemic highland areas that are consumed by the ruminants in arid and lowland areas, particularly during the dry season when suitable grazing pastures are scarce; local crowding of animals along the banks of streams and ponds during the dry season.

The variation of prevalence rate in different study areas were probably due to the ecological and climatic difference between the localities and the characters of soils that is important for multiplication of snail hosts [18]. Irrigation would have major effects on transmission [16].

Geographical distribution: *F. hepatica* is a temperate species and it is found in Southern America, Northern America, Europe, Australia, and Africa. Its tropical counterpart, *F. gigantica*, on the other hand is widely distributed in tropical countries, parasitizing domestic ruminants and other herbivores in almost every continent. In Ethiopia, *F. gigantica* is found at altitudes below 1800 *m. a. s. l.* while *F. hepatica* is found at altitude between 1200-2560 *m. a. s. l.* [16]. Mixed infections by the two species can be encountered at 1200-1800 *m. a. s. l.* An increased prevalence of *F. hepatica* has been reported

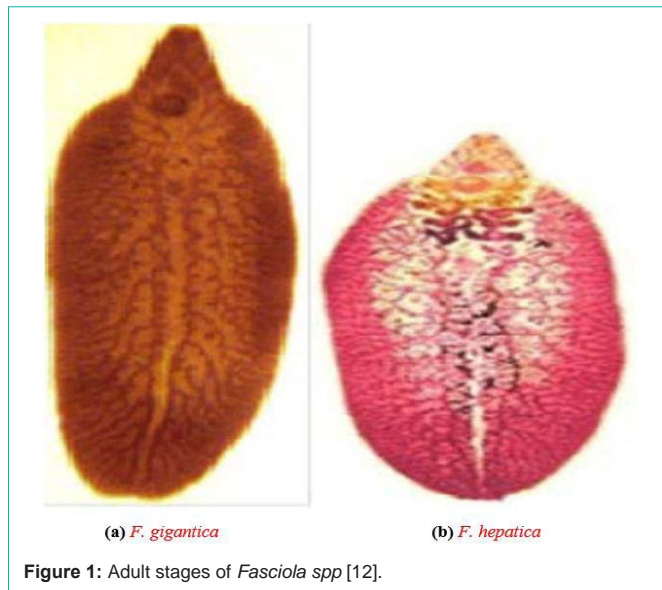


Figure 1: Adult stages of *Fasciola* spp [12].

in UK and Sweden, presumably as a result of climate change causing milder winter temperature and increased rainfall, as well as due to government subsidized schemes to utilize wet areas for grazing [19].

Ecology of intermediate host: Breeding of Lymnaea Snails and developments of intra Mollusca stages of the flukes often reach optimum threshold during the wet month of the year. During Dry period, breeding of the snails and developments of larval flukes slow down or stop completely and snails undergo states of aestivation [20]. The risk factors include climate and environmental factors, such as presence of streams, wetland and pastures, and higher rainfall and temperature are identified [21].

Fasciola spp. is a parasite threatening domestic ruminants and public health. Transmission of this trematode infection is depending on the presence of intermediate “lymnaea snail” host and final host. This snail host commonly presents in high density during rainfall period annually and/or in highly moist pastures soil [22]. Fasciolosis is commonly distributed in countries where cattle and sheep are raised and there is a niche for Lymnaea snail.

The life cycle takes place in Intermediate (IH) and Definitive Hosts (DH). Definitive hosts include cattle, sheep, many other ruminants, equidae, swine and rabbits Spread of fasciolosis is largely dependent on the ecology of the snails which act as IH and serve as means of transmission to animals. *Lymnaea natalensis* aquatic snails is important for *F. gigantica* in Africa, where as *Lymnaea natalensis truncatula* is an amphibian, wide distribution worldwide, and the most common IH for *F. hepatica* [12].

Factors influencing the agent

The variation in pathological changes of the liver may probably be due to different factors such as exposure of the animal in the infested area with the intermediate host and period of infection, and climate-ecological conditions caused by rainfall, altitude temperatures, pH, and suitability of the environment for the survival of the snails [23]. The risk factors include climate and environmental factors, such as presence of streams, wetland and pastures, and higher rainfall and temperature are identified [21].

Temperature: Temperature is an important factor affecting the development rate of snails and the stages of parasites outside the host. The mean day and night temperature of 100C or above is necessary for the snail host to breed and for the *Fasciola* to develop within the snail [24]. Metacercariae will not survive for more than six weeks at 25 degrees, but can survive for eight weeks at temperatures of -2 degrees [25].

All activities cease at temperature below 50C. This is also minimum range for the development and hatching of *Fasciola* eggs. However, when temperature rises to 150C and is maintained above this level that a significant multiplication of snails and flukes larvae stages ensures unfavorable condition [9].

Moisture: The ideal moisture condition for snail breeding and the development of *Fasciola* species within snails are provided when rainfall exceeds transpiration and field saturation is attained. Such conditions are also essential for the development of fluke eggs for miracidia searching snails and for the dispersal of cercariae being shed from the snail [9].

pH: Fields with clumps of rushes are common sites having a slight ph. Eggs incubated at 270C will develop and hatch within a pH range of 4.2 to 9.0, but development is prolonged when pH exceeds 8.0 [26].

Pathogenesis of fasciola

Many systemic changes will be induced by liver fluke infections that ultimately cause reduced productivity in livestock. Both anorexia (inappetance) and the quality of the diet of infected sheep contribute to hypoalbuminemia during the infection [27]. Infection with trematode parasites can lead to severe losses to farmers, hence affecting sustainability of food production. Acute hepatic fasciolosis mainly a condition on cattle and sheep, which may lead to death [20].

The development of infection in definitive host is divided into two phases, the parenchymal or migratory phase and biliary [28].

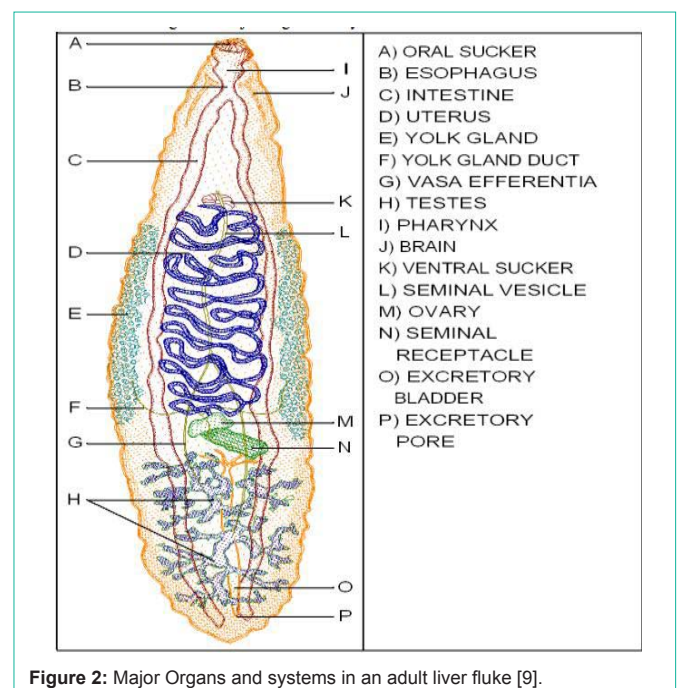


Figure 2: Major Organs and systems in an adult liver fluke [9].

Acute hepatic fasciolosis is caused by the passage of young *Fasciola hepatica* through the liver parenchyma. Acute hepatic insufficiency and hemorrhage result. The migration of larvae also been thought to stimulate the development of occasional case of bacillary hemoglobinuria in cattle.

Chronic hepatic fasciolosis develops only after the adult flukes establish in the bile duct. The severity reaction in cattle, calcification of the bile ducts appears to hinder the establishment and feeding of challenge infection. There by reinforcing immune response goes in there mode of resistance [29]. Pathogenesis of fasciolosis varies according to the parasitic development phases; parenchymal and biliary phases. The parenchymal phase occurs during migration of flukes through the liver Parenchyma and is associated with liver damage and hemorrhage. The biliary phase coincides with parasite residence in the bile ducts. The results from the haematophagic activity of the adult flukes which damage the bile duct mucosa by their circular spines [9].

Life cycle and host range

Life cycle: The life cycle of *Fasciola spp.* is a typical of digenetic trematodes. Eggs laid by the adult parasite in the bile ducts of their hosts pass into the duodenum with the bile [30]. Therefore, immature eggs are discharged in the biliary ducts and passed in the stool. Eggs become embryonated in freshwater over ~2 weeks; embryonated eggs release miracidia, which invade a suitable snail intermediate host. In the snail, the parasites undergo several developmental stages (sporocysts, rediae, and cercariae) [31].

The hatchling is called a *miracidium*, a free-swimming, ciliated larva. Miracidia will then grow and develop within the intermediate host into a sac-like structure known as a sporocyst or into rediae, either of which may give rise to free-swimming, motile cercariae larvae. Adult metacercariae depending on the individual trematode's life cycle, then infect the vertebrate host or be rejected and excreted through faeces [32].

Host range: Fasciolosis is a disease of sheep, goats, and cattle and occasionally affects humans and It is caused by genus *Fasciola* commonly called liver fluke, but all age groups are affected at different manner of acquisition of the infection depending on the host. Calves are susceptible to fasciolosis but in excess of 1000 metacercariae are usually required to cause clinical fasciolosis [27].

Clinical signs

Fluke infection may predispose to other conditions due to impaired liver function and can reduce milk yield, fertility production and productivity and also death of the host [33].

All age groups of cattle are potentially at risk of fluke infection. During the movement of the immature stages of *Fasciola hepatica*, which may continue for months, symptoms may include abdominal pain, an enlarged liver, fever, and diarrhea. Cattle develop a greater fibrotic reaction in the liver compared to sheep, therefore parasite survival is reduced [9].

On a herd basis, clinical signs of fluke infection are usually vague (i.e., reduced productivity) and can be difficult to differentiate from the effects of less-than-optimal management or other chronic disease conditions. From a clinical standpoint, bovine fascioliasis generally

can be considered a subclinical disease. Animals suffering from acute fasciolosis especially sheep and goat, may display no clinical signs prior to death; while some may display abdominal pain and discomfort and may develop jaundice [9,34].

In some cases the liver capsule may rupture and fluid may lick into the peritoneal cavity causing death due to peritonitis. More commonly on ingestion of fewer Metacercaria fever and eosinophilia is seen [34]. 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. Sub-acute fasciolosis is caused by ingestion of a moderate number of metacercaria and is characterized by anemia, jaundice and ill thrift. The migrating fluke causes extensive tissue damage, hemorrhage and in particular liver damage which result severe anemia, liver failure and death in 8- 10 weeks [9].

The clinical signs of chronic fasciolosis are variable and depend upon the number of metacercaria ingested, but often include: Weight loss, Anemia, Bottle jaw, diarrhea, Constipation [35]. In chronic cases, mineralization (calcification) and fibrosis around bile ducts also causes the elimination of liver flukes and Calcification tends to be minimal or absent in sheep [36].

Diagnosis

Diagnosis of fasciolosis may be established based on the epidemiology of the disease, observations of clinical signs, and information on grazing history. However, confirmatory diagnosis is based on horoscopic examination in the laboratory and post-mortem examination of infected animals by the detection of flukes in the liver [37].

Post mortem examination: Fasciolosis is associated with liver damage and hemorrhage due to migration of flukes through the liver parenchyma. Adult flukes found in the bile duct and can be identified by incising the liver and it shed eggs into the bile then enter into the intestine to pass outside with feces [9]. Adult flukes can survive for many years in the livers of infected hosts and lay between 20,000 and 50,000 eggs/day. Caprological analysis is still commonly employed to diagnose bovine fasciolosis, despite the fact that eggs cannot be detected until the latent period of infections, when much of liver damage has already occurred [22].

Fecal examination: Diagnosis of fasciola is confirmed by finding the eggs in the feces. These eggs must be distinguished from the eggs of especially the large eggs of paramphistomes. The *Fasciola* eggs are oval, yellow brown and measures (130 to 150µm by 60 to 90 µm). Each egg will possess a distinct operculum [13].

The rate of egg production is responsible for the degree of pasture contamination and thus greatly influences the epidemiology of the disease. The eggs of fasciola are maintained in conditions of high humidity and cool temperatures, they may survive for up to a year [30].

Serological detection: Early diagnosis of the fasciolosis disease is essential to control and treat the infection. To overcome the deficiencies of diagnosis, various Enzyme-Linked Immunosorbent Assays (ELISAs) have been developed, which aim at detecting anti-fasciola antibodies in serum or milk, and antigens in serum or faeces.

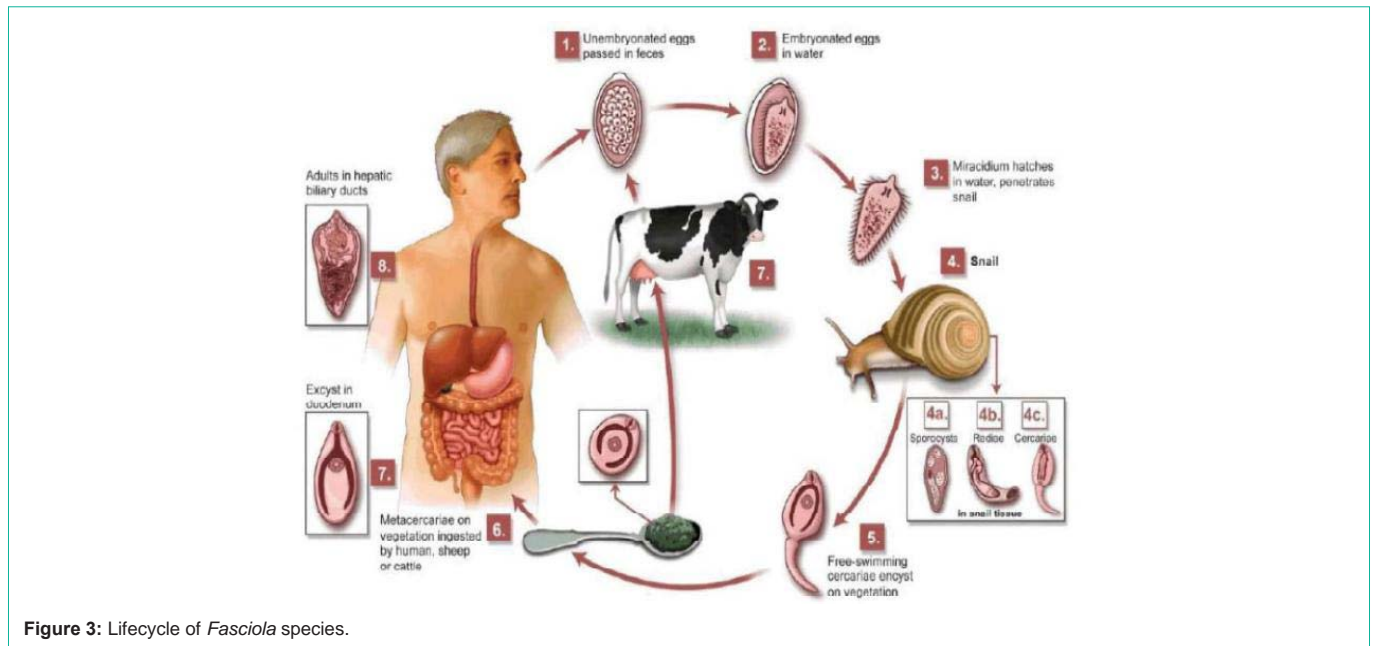


Figure 3: Lifecycle of *Fasciola* species.

The Excretory-Secretory (ES) antigens of *Fasciola* or their partially purified components, are the most common source of antigens used in ELISA. Antibodies to these antigens can be detected as early as 2 weeks, and their concentrations can be determined between 8 and 10 weeks post-infection [38].

The sensitivity and specificity of a copro antigen-based ELISA has been investigated by experimental infection [39] or by testing it on two distinct populations a positive population selected from an enzootic area and a negative population from a fluke-free area [40]. *In vivo* diagnosis of mild and pre patent infection is possible serologically. Example, detection of antibodies by ELISA in serum or milk is available and useful for diagnosis of infection in cattle in an individual or herd basis [24].

Detecting liver enzymes: Two enzymes are usually measured, Glutamate Dehydrogenase (GLDH), is released when parenchymal cells are damaged and levels become elevated within the first few weeks of infection. The other Gamma-Glutamyl Transferees (GGT) indicates damage of epithelial cells lining the bile ducts and raised levels are maintained for longer periods [12]. Elevation of liver enzyme activities, such a Glutamate Dehydrogenase (GLDH), Gamma-Glutamyl Transferees' (GGT) and Lactate Dehydrogenase (LDH) is detected in sub-acute or chronic fasciolosis from 12-15 week after ingestion of metacercariae [41].

Significance of bovine fasciolosis

Economic significance of fasciola: Ethiopia has the largest livestock population in Africa, with a total cattle population of 57.83 million. Among the animal diseases that hinder the animal health are parasitic infections that have great economic impact [42]. Among many parasitic problems of farm animals, fasciolosis is a major disease which imposes economic impact on livestock production particularly of cattle and sheep [43]. Fasciolosis is an important cause of both production and economic losses in the dairy and meat industries. Over the years, the prevalence has increased and it is likely

to continue increasing in the future [44].

Fasciolosis caused by *Fasciola hepatica* and *Fasciola gigantica* is responsible for heavy economic losses to farmers due to reduced weight gain, poor carcass quality, reduced milk yield, cost of treatment and control, mortality and condemnation of affected livers at abattoirs, increased susceptibility to secondary infections and the expense of control measures in Nigeria [45]. The annual loss due to these parasites in Ethiopia is estimated at 700 million Ethiopian birr/ annum [46].

The economic loss associated with an infected liver condemnation due to fasciolosis in different area of Ethiopia is ranging from 86, 83.2 ETB to 1,751,432 ETB or \$2459.52- \$50040.91 [47]. Fasciolosis is an economically important parasitic disease, which is caused by trematodes of the genus *Fasciola* that migrate in the hepatic parenchyma and establish in the bile ducts [48].

Public health significance of fasciolosis: Slaughterhouses provide an excellent meat inspection place where many zoonotic diseases observed but meat poor handling in or out the abattoir can leading to both economic losses and a lot of public health hazardous. Fasciolosis occasionally affects humans, thus Considered as a zoonotic infection but it is a disease of sheep, goat, and cattle mainly [10]. A person must ingest the metacercaria to become infected. Human acquire infection through ingestion of metacercaria that are attached to certain aquatic plant and vegetable. Experimental studies suggested that human consuming raw liver dish from liver infected with juvenile flukes could become infected [12].

A global analysis show that the expected correlation between animal and human fasciolosis only apparent a basic level. High prevalence in human infections is not found in areas where fasciolosis is a great veterinary problem. For instance, in South America, hyper endemics and mesoendemics are found in Bolivia and Peru where the veterinary problem is less important, while in countries such as Uruguay, Argentina and Chile, human fasciolosis only sporadic or

Table 1: Current prevalence of fasciolosis in Ethiopia by many outers.

	Annual economic loss in (ETB)	Reference
Asella	6,987,006	Shiferaw et al.
Hawzie	885,5000	Germany et al.
Wolkite	1825,82.4	Tesfaye and Tigisti [58]
Wolanchiti	4,522,550,000	Asefa and Tegang [52]
Nekemte	630.72	Alula et al.
Sheno municipal abattoir, Oromia	1,751,432 annually	Mekonnen et al. [47]
Addis Ababa abattoir enter price, A,A	157,684 annually	Bayou et al. [59]
Areka municipal abattoir, southern Ethiopia	47,124.5/month	Moje et al.
Awasa municipal abattoir southern Ethiopia	106,400/annum	Ababe et al.
Hosanna municipal abattoir southern Ethiopia	88,806.85/annum	Chakiso et al.
Dessie municipal abattoir south wolo zone	2,495,346.13/annum	Belay et al.
Nekemte municipal abattoir	63072/annum	Petrous et al.
Kombolcha Industrial Abattoir	49491/annum	Ibrahim et al.
Bedele, Ethiopia	228,360.6/annum	Yitagezu et al. [60]

hypo endemic [7].

F. hepatica may be acquired by man, but not directly from cattle. The person must ingest the metacercaria in order to become infected. The most common transmission route is ingestion of watercress although; depending up on the geographic location and a variety of edible aquatic plants can be vehicles of transmission [49].

The degree of pathogenicity of *Fasciola hepatica* to man depends on many factors, particularly the number of worms present and the organ infected, mechanical and the damage are characteristics. Global estimate prevalence is between 1.7 and 2.4 Million human infection worldwide and a further 180 Million at risk of infection [49].

Current status of prevalence and Estimation of economic losses by condemned organs dueto fasciolosis in different regions of Ethiopia (Table 1).

Control and Prevention Methods

Reduction of snail or inter mediate host

In most fasciolosis endemic areas, the control of the intermediate snail host population offers a good opportunity for the reduction of transmission and is general effective when combined with one or more other methods such as chemotherapy or environmental sanitation [50].

The use of molluscicides for the control of snail intermediate hosts is a potential tool for the control of fluke infections. Whereas, they are not species-specific and may destroy edible snails highly valued as food in some communities and expensive [51]. The best long term method of reducing mud snail population such as *Lymnaea truncatula* is drainage since it ensures permanent destruction of snail habitats. When snail habitats are limited, a simple method of control is to fence off this area or treat annually with a molluscicide (CuSO_4) [12].

Fascioliasis is a very debilitating snail-borne disease in the subtropical/cooler regions it is caused by *Fasciola hepatica*, whereas in the tropical/warmer regions is caused by *Fasciola gigantica* [52].

There are different types of snail poison available that are safe for stock but need care and precision in their application. Other useful methods of fluke control include biological control of the intermediate host, fencing the waterlogged area, breeding birds eating snails and so on. Draining swamps, building sewage systems and providing clean water supplies are used to control water-borne /including snail borne/ helminthes but it is very expensive compare to chemotherapy [53].

Anthelmintic or use of therapy

Chemotherapy with drugs remains the most cost-effective way of treating parasitic diseases and is usually at the heart of any major control campaign. Compared to environmental engineering, drug treatment is very cheap [53].

In order to avoid overuse of anthelmintic, recent research is therefore focused on describing the spatial distribution and identifying risk factors for fasciolosis [54]. Effective control of most trematode infections is based on strategically applied chemotherapy [55].

The drugs to be used against flukes should ideally destroy the migrating immature flukes as well as adults in the bile ducts. The drugs to be used against flukes include Rafoxanide, Nitrox nil, Brotanide, Closantel and Albendazole. Diamphentide that kills all immature flukes even a day old once and the Triclabendazole (TCBZ) are highly effective against all stages of fluke [53].

Effective treatment during the prepatent period for an extended duration could eliminate *Fasciola* infection or reduce contamination of pasture to a very low level, requiring less frequent treatments for a considerable time [55]. Clorsulon is applied in combination with ivermectin for combined flukes and round worm control both immature and adult [56]. Nitrox nil and oxclosanide are less effective against immature flukes and should be used in the treatment of chronic fasciolosis (adult flukes). Treated cattle should be moved to clean pastures wherever possible [57].

Conclusion and Recommendation

Bovine fasciolosis is an economically important parasitic disease

causing great loss of revenue through reduction in productivity of animal in terms of lowered growth rate, meat and milk production, fertility, feed efficiency and draught power. The occurrence of fasciolosis in the many study suggests that there was the presence of favorable ecological and climatic conditions for the development and survival of the *Fasciola* species as well as intermediate hosts. The disease aggravation depends on distribution of *Lymnae* species snails, which are the intermediate hosts of the fluke in areas where the cattle and sheep raised. The diagnosis may be conducted by demonstration of fasciola egg from fecal sample in the laboratory and examination of infected animal liver after slaughter. The disease prevention and control involve controlling snail or intermediate hosts, programed use of anthelmintic, facilitating environmental sanitation and good management practices of herds and their grazing conditions. Many reports show that fascioliasis is mainly an animal disease, causing a great economic burden in the highland as well as low land areas of the country. Control of snails (intermediate host for *Fasciola* species) is highly recommended to control and prevent the disease.

Therefore based on above conclusion remarks the following recommendation are forwarded

- Creating and further consolidation of farmers' awareness was necessary.
- Continuous and frequent control activity and hygienic interventions should be implemented on fasciolosis endemic area. Because fasciola is known to reproduce in different water bodies and water lodged areas to make environmental condition for their breeding favorable.
- Strategic use of anthelmintic should be performed to reduce the development and pasture contamination with fluke eggs.
- Deworming of all ages of animals by considering drug resistance.

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