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# A Review on Ruminant Fasciolosis

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## Abstract

**This work was conducted to touch the epidemiology and economic impact of ruminants' Fasciolosis. Ethiopia possesses the largest livestock population in Africa. Ruminants play a significant role in maintaining household stability. However, the productivity per animal and the contribution of this sub-sector to the national economy is relatively low due to multiple factors. The review reveals that Fasciolosis is an important limiting factor for ruminant production and causes for several economic losses due to morbidity and mortality in Ethiopia. The two species of the greatest veterinary importance are *Fasciola hepatica* and *Fasciola gigantica* and snails are their intermediate host. Clinical disease is usually characterized by weight loss, anemia and hypopotenaemia. Therefore, it can be concluded that Fasciolosis is an important parasitic disease which hinders the ruminants' production. So it is recommended to control the disease by reducing the snail population or by using anthelmintics.**

## Keywords

**Fasciolosis, Hepatica, Gigantia, Ruminant, Snail**

**Subject Areas:** **Animal Behavior, Genetics**

## 1. Introduction

Ethiopia possess the largest livestock population in Africa, with an estimated population of 7.8 million equines, 1 million camels, 47.5 million cattle, 39.6 million chickens, 26.1 million sheep and 21.7 million goats [1]. Ruminants play a significant role in maintaining household stability by providing meat, milk, skin and wool, generate cash income and play traditional social and religious roles. Even though Ethiopia is known in larger animal populations, the animals' performance and its contribution to the national economy are relatively low due to viral, bacterial, parasitic diseases, improper health care and other management problems [2]. Gastro-intestinal helminthosis is considered as one of the major parasitic problems that constrain livestock improvement programs in Ethiopia. Fasciolosis is the helminthosis that causes direct and indirect losses of domestic animal immunities [3]. In the tropics *Fasciola hepatica* and *F. gigantica* are the two commonly reported liver flukes to cause Fasciolosis in ruminants [4]. Pathogenesis of Fasciolosis varies according to the parasitic development phases: paren-

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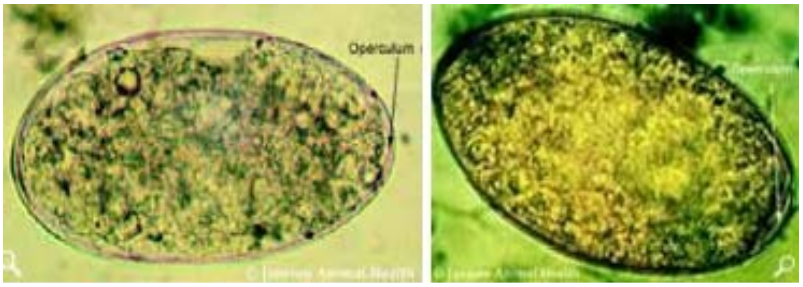
chymal and bilary phases. The parenchymal phase occurs during migration of flukes through the liver parenchyma and is associated with liver damage and hemorrhage. The biliary phase coincides with parasite residence in the bile ducts and results from the haematophagic activity of the adult flukes and from the damage to the bile duct mucosa by their cuticular spines [5]. Diagnosis is based primarily on clinical signs and seasonal occurrence in endemic areas but previous history of Fasciolosis on the area of snail habitats; postmortem examinations, hematological tests and examination of faces for fluke eggs are useful. Carpological analysis is commonly employed to diagnose Fasciolosis, despite the fact that eggs cannot be detected until the latent period of infections [6]. In general, infection of domestic ruminants with *F. hepatica* and *F. gigantica* causes significant economic loss estimated at over US $200 million per annum to the worldwide and 600 million animals' infected [7]. Whereas, in Ethiopia about 48.4 million Ethiopian Birr (1 US $ = 2.07 ETB) per year was lost due to the presence of ovine Fasciolosis [8]. Generally, knowledge of the disease in terms of the symptoms and prevention methods is important to improve ruminant productivity to touch the epidemiology of ruminants Fasciolosis and economic impact of ruminants Fasciolosis. Etiology: Fasciolosis is caused by different species of trematode (flukes) [9]. They are responsible for wide-spread morbidity and mortality in sheep characterized by decreased wool growth, weight loss and liver condemnation [10]. *F. hepatica is* found in temperate areas and in cooler area of high altitude in the tropics and sub tropics, and *F. gigantica* is predominantly found in tropics and sub-tropics [5].

**Morphology:** *Fasciola hepatica* is a leaf shaped fluke with broader anterior and cone shaped anterior projection. It is grayish brown in color changing to gray when preserved. Generally, the morphological statures of Paramphistomum and Fasciola species are characterized with a cuticle armed with sharpe spines (**Figure 1** and **Figure 2**). The young fluke at the time of entry in to the liver is 1 - 2 mm in length and lancet like when it has become fully mature in the bile ducts. It is leaf-shaped gray brown in color and is around 2.5 - 3.5 cm in length and 1 cm in width. The anterior end is conical and marked off by distinct shoulders from the body [11]. The egg of *F. hepatica* measures 150 µm by 90 µm in size and also similar in shape to that of *F. gigantica*. *Fasciola* eggs should be distinguished from the eggs of other flukes, especially from the large eggs of *paramphistomum. Fasciola* eggs have yellowish brown shell with an indistinct operculum and embryonic cells where as *paramphistomum* eggs have transparent shell, distinct operculum with embryonic clear cells, and possess a small knob at their posterior ends [12].

(a) (b)

**Figure 1.** Adult stage of *Fasciola* spp. which (a) is represented for *F. gigantics* and (b) for *F. hepatica*.




(a) (b)

**Figure 2.** Rumen and liver fluke egg. The above (a) represents *Paraphistomun* spp. egg and (b) is for *Fasciola* spp. egg.

**Fasciola gigantic:** *Fasciola gigantica* is larger than *F. hepatica* and can reach 7.5 cm length. The shape is more of leaf like, the conical anterior end is very short and the shoulder characteristic of *F. hepatica* is barely perceptible. The eggs are larger than those of *F. hepatica*, measuring 190 × 100 µm [5].

**Epidemiology:** The risk of hepatic Fasciolosis is determined by the number of infected *Lymnae* snails in the grazing area. The disease has a predictable seasonal pattern in regions where snails are active for only part of the year. Some *Lymnae* snails have more aquatic habit than others but most are restricted to damp [13]. Water, land and blocked drainage are hazardous for grazing stock [14]. Evidence suggests that sheep and cattle are the main reservoir host species [15]. In tropical regions, Fasciolosis is considered as the single most important helminthes infection of cattle with the prevalence rate of 30% - 90% in Africa, 25% - 100% in India and 25% - 90% in Indonesia [16].

**Risk factors:** The main factors determining the timing and severity of Fasciolosis depend on the number of metacercariae accumulating on herbage. Particularly, temperature and rainfall affect both the spatial and temporal abundance of snail hosts and the rate of development of fluke eggs and larvae [13]. The three most important factors that influence the occurrence of Fasciolosis are availability of suitable snail habitat, temperature and moisture.

**Host range:** Intermediate host of Fasciolosis is determined by the number of infected *lymnaeid* snails in the grazing area. The disease is seasonal pattern in regions where snails are active for only part of the year. Some *lymnaeid* snails have more aquatic habitat than others but most are restricted to damp or wet environments. In general, non acidic, low lying swampy areas with slow moving water and irrigated areas are highly suitable for infection to takes place. Snails burrow in to the soil to survive dry periods and release cercaria when free water is present [14]. The snails of the *genus Lymnae* are the IHs for the genus *Fasciola*. The epidemiology of Fasciolosis depends on the ecology of the snail. *Lymnae* species most important in transmission of *F. hepatica* Fasciolosis is *L. truncatula*, widespread in Australia. Other species, which have been incremented in the transmission of Fasciolosis, include *L. viator* and *L. diaphone* (South America), *L. celummella* (USA, Australia, Central America and Netherland) and *L. humilis* in Northern America [12]. The most important IHs of *F. gigantic* is *L. natalensis* and *L. auricular* [16].

**Final host:** Hosts of *Fasciola hepatica* are most mammals including man, sheep and cattle, cattle being most important. *F. gigantica* affects a wide range of domestic animals and is found in low land areas replacing *F. hepatica* [14]. Infection is by ingestion of contaminated grass or hay and transmission to lamb in utero is possible but infrequent [16]. Adult sheep and cattle may remain carriers for many years because of the longevity of the adult flukes [14].

**Life cycle:** Adult flukes in the bile duct shed eggs into the bile, which enter to the intestine. Eggs reach the outside by passing down the common bile duct and being voided with feces. They are undeveloped when passed and required minimum of ten days to reach miracidium stages [17]. The eggs of flukes passed in the feces of mammalian host develop and hatch releasing motile, ciliated miracidium. These takes 9 days at optimum temperature of 22˚C - 26˚C and little development occurs below 10˚C [18]. The liberated miracidium has a short life span and must locate a suitable snail within 3 hours if successful penetration of the tissue of snail occurs. In infected snails, development proceeds through the sporocyst and rediae stage to the final stage in the IH, the cercaria; these are shed from the snail as motile forms which attach themselves to frame surface, such as grass blades, and insisted there to form the infective metacercariae [19]. It takes a minimum of 6 - 7 weeks for completion of the development from miracidium to metacercariae. Infection of snail with one miracidium can produce over 600 metacercariae. Metacercariainfestes the final host and encysted in the small intestine, migrate through the gut wall, cross the peritoneum and penetrate the liver capsule. The young flukes tunnel through the liver parenchyma for 6 - 8 weeks and then enter to the bile duct where they migrate to the large ducts and occasionally the gall bladder. The prepatent period is 10 - 12 weeks [20]. Human beings are occasionally infected by ingestion of metacercariae which encysted in water plants and raw liver dishes infected with immature *Fasciola* species. Major symptoms are intestinal discomfort, painful liver regions and anemia [16].

**Pathogenesis:** The pathogenesis of Fasciolosis varies according to the phase of parasite development in the liver and species of host involved. The first phase occurs during migration in the liver parenchyma and is associated with liver damage and hemorrhage. The second occurs when the parasite is in the bile duct and result from the hemorrhage activity of the adult fluke and from damage to the biliary mucosa by their cuticular spines [18].

**Clinical sign:** Several clinical syndromes are acute Fasciolosis in sheep most often occurs as sudden death

without other apparent clinical abnormality. It is usually seen in the summer and autumn but may occur at any time when sheep have the opportunity to graze heavily contaminated herbage. If the disease is observed clinically in sheep it is manifested by dullness, weakness, lack of appetite, pallor and edema of mucosa and conjunctiva and pain when pressure is exerted over the area of the liver. It is rarely occurs in cattle [14]. Sub acute Fasciolosis is caused by ingestion of a moderate number of metacercariae and is characterized by anemia, jaundice and ill-thrift. The migrating fluke causes extensive tissue damage, hemorrhage and in particular liver damage. The result is severe damage, anemia, liver failure and death 8 - 10 weeks [21]. Chronic Fasciolosis does not become apparent until several weeks after the danger of acute disease has receded. It occurs when the parasite reaches the hepatic bile duct [22].

**Diagnosis:** Diagnosis of Fasciolosis is based on clinical sign, grazing history, and seasonal occurrence, examination of feces by laboratory tests and post mortem examination [18]. Fecal examination as chronic Fasciolosis is diagnosed by finding eggs in the feces by using sedimentation technique. However they must be distinguish from the eggs of the other flukes especially the large eggs of *paramphistomum*. Examination employing sedimentation technique, *Fasciola* eggs have specific gravity and sedimentation is preferred to floatation [23]. The oval percolated golden eggs of *F. hepatica* appear in the feces ten weeks after infection, while *F. gigantica* eggs only appear 15 weeks after infection. Excretion of fluke eggs shows considerable day to day and within day variation and distribution of eggs in feces are irregular thus single fecal egg count assay may lead to in correct conclusion [16].

**Serology:** *In vivo* diagnosis of mild and prevalent infection is possible serologically. For example detection of antibodies by ELISA in serum or milk is available and particularly useful for diagnosis of infection in sheep in an individual or herd basis. Arise in antibodies can be detected by two weeks after infection and keeps rises until week six [18].

**Necropsy:** The detection of adult flukes in the liver at necropsy is the most reliable method to confirm Fasciolosis. Prevalence studies should be based on abattoir survey other than coproscopic investigation [24]. Acute Fasciolosis which is common in sheep is manifested by severe anemia and sudden death. Confirmation is by post mortem examination when small fluke can be expressed from the liver parenchyma [25]. Whereas chronic Fasciolosis is confirmatory diagnosis could easily carried out by coproscopic examination employing sedimentation technique. Number of eggs in fecal sample is not an accurate indication of the number of the parasites neither in the liver nor of the amount of damage being done to the host [26]. Ultrasound can be used visualized the adult fluke in the bile duct and connecting tissue scan may reveal the burrow tract made by the worms and dilation of the bile duct [27].

**Treatment:** Not all compounds are equally effective against stages of development of *F. hepatica* in the body. For the treatment of acute Fasciolosis, it is essential to choose a product highly effective against the juveniles that damage the liver parenchyma. For chronic disease a compound active against adult fluke is required [14]. Triclabendazole (Fasinex) is considered as the most common drug due to its high efficacy against adult as well juvenile flukes. It is effective against adult *F. hepatica* at a dose rate of 7.5 mg/kg in sheep and 10 mg/kg in cattle. It is ovicidal and well kills any *F. hepatica* eggs present in the bile duct or the alimentary tract at the time of treatment. Clorsulon is supplied in combination with ivermectin for combined fluke and around warm control in cattle. Nitroxynil is given sub cutaneously at 10 mg/kg and has good efficacy against the adult fluke but the dose has to be increase by up to 50% to obtain adequate control of acute disease [14]. Until recently treatment was not highly successful due to the in efficiency of the old drugs against the early parenchymal stages, however efficient drug are now available on the choice of Triclabendazole which remove all developing stages over one week old [18].

**Control and prevention:** Program charts for Fasciolosis control can be produced based on average rainfall and temperature records of any geographic regions [28]. Reduction of snail population before any scheme of snail control is under taken as a survey of the snail habitat should be made to determine whether they are localized or wide spread. When the snail habitat is limited simple method of control is to fence off these areas or treat annually with a molluscides. Currently cupper sulphate is most widely used and more efficient molluscides such as N-trityl morphine [17] [18]. Control of snail by chemical such as niclosamide, sodium penta chlorophenate, cupper sulphate focally and seasonally possible, however, usually not practical due to labor, high cost, environmental consideration and rapid colonization of snail habitat [18].

**Use of anthelmintics:** It is true that seasonal strategic application of effective anthelmintics which is specific for trematode as well as timely prophylactic and curative treatment play an important role in the control of liver

fluke infection [26]. The prophylactic used of anthelmintics aiming to reduce pasture contamination by fluke eggs at times most suitable for development of fluke, April to august and removing fluke population at times of heavy burdens or at periods nutritional stress to animal. Prophylactic treatment in cattle is therefore directed at reducing the fluke burdens in the winter at a time when the nutritional status of the animal is at its lowest level [18]. Other control methods include environmental sanitation and manipulation (draining, swamps, building sewage system and providing clean water supplies), rotational grazing and also avoiding mixed grazing of animals of different age groups (young animals are generally susceptible to helminthes infection [29].

**Immunity and immunization:** It has been suggested that natural immunity is expressed both during the migratory parenchymal and adult bile duct stage of the infection. The formed is considered to be related to the distribution and amount of connective tissue in the hosts liver parenchyma, cattle are more resistance because of the relatively large amount of connective tissue in their liver. Possibly the connective tissue help to trap young migrating flukes. Immunity to *F. hepatica* has been demonstrated, and antibodies can be found in the blood of infected animal. Observation in the field indicated that older animals become resistance to infection [12]. Sheep and goat do not develop a strong protective immunity to *F. hepatica* and remain vulnerable throughout their life, where as cattle eventually expel most but not all of their flukes burden and go in partial but not complete protection against re infection [30].

## 2. Importance of Ovine Fasciolosis

**Public health importance:** Human Fasciolosis has been reported from countries in Europe, America, Asia, Africa and Oceania. The incidence of human case has been increasing in the 51 countries of 5 continents. A person must ingest the metacercariae to become infected [31]. Human acquire infection through ingestion of metacercariae that are attached to certain aquatic plant and vegetable. In addition experimental studies suggested that human consuming raw liver dish from liver infected with juvenile flukes could become infected [20]. The distribution of the disease is predominantly rural being associated with cattle and sheep breeding. The degree of pathogen city of *F. hepatica* to man depends on many factors; particularly the number of snails present and the origin infected mechanical and toxic damage are characteristics [32].

**Economic importance:** Fasciolosis causes major economic loss in sheep, goat, buffalo and cattle [33]. The disease causes considerable impact on the economy of the livestock industry. The economic losses consist of costs of anthelmintics, drenches, labor, liver condemnation at meat inspection; and losses in production due to mortality, reduction in meat, milk and wool production; and reduction in growth rate, fertility and decreased feed intake, conversion and lower resistance to other disease [34]. The prevalence of Fasciolosis in many parts of Africa has been determined mainly at slaughter. However estimation of economic loss due to fasciolosis at national or regional level is limited by lack of accurate estimation of the prevalence of disease [2]. The presence of fasciolosis due to *F. hepatica* and *F. gigantica* in Ethiopia has long been known and its prevalence and economic significance has been reported by several workers [8].

**The epidemiology of Fasciolosis in Ethiopia:** The geographical distribution of *F. hepatica* and *F. gigantica* is determined mainly by the distribution patterns of the snails that have a role as intermediate hosts [12]. In Ethiopia, both species coexist at different altitudes and transmitted by the snail called lymneatruncutula and lymneanatalenesis, respectively. The prevalence and distribution of Fasciolosis was widespread, particularly in the north and the west of the Great Rift Valley, which divides the country into two parts of unequal size [35]. Various reports indicated that, Ethiopia is one of the countries with suitable climatic condition for the existence of Fasciolosis. The disease causes serious problems in livestock population of the country [2].

According to Ahemed [8] who reported that there was highly significant difference between age groups. This report revealed that prevalence of Fasciolosis was higher in sheep with increase of age. The younger the age the lower the prevalence and the older the age the higher the prevalence is (**Table 1** and **Table 2**). This could be due to the fact that young animals are not allowed to go far with adult animals for grazing/feeding reducing the chance of exposure to infective metacercariae as compared to adults [2].

## 3. Conclusion and Recommendations

In general, it can be concluded that Fasciolosis is one of the major obstacles for ruminant production. Fasciolosis is one of the major factors for livestock development in Ethiopia by inflecting direct and indirect loss at different parts of the country. Fasciolosis is an important limiting factor for ruminant production and causes several

**Table 1.** Prevalence of ruminant Fasciolosis in Ethiopia determined on abattoir examination.

| Species | Administrative region | Faecal (%) | Abattoir (%) | References |
|---|---|---|---|---|
| Bovine | Debre Brehan | 87 | 88.57 | [36] |
| Bovine | Hawassa | | 30.43 | [37] |
| Bovine | Wolliso | 34 | | [38] |
| Bovine | Eastern Harerge | 42.9 | 12.1 | [39] |
| Caprine | Hirna | 5.5% | - | [40] |
| Ovine | Dewa-Cheffa | 49% | - | [41] |
| Ovine | Holota | 49% | - | [35] |
| Ovine | Middle Awash River Basin | 13.2% | - | [8] |

Source: [41].

**Table 2.** Prevalence of Fasciolosis in different areas of Ethiopia.

| Sites of study | Prevalence of disease (%) | Species of animal | Survey method | References (researcher) |
|---|---|---|---|---|
| Gonder | 83.88 | Bovine | Coprology | [42] |
| | 61 | Bovine | Abattoir | [43] |
| | 52 | Bovine | Coprology | [44] |
| Tigray | 26 | Bovine | Abattoir | [45] |
| Gojjam | 61.97 | Bovine | Abattoir | [46] |
| | 62.2 | Bovine | Abattoir | [47] |
| Wollo | 15.77 | Bovine | Coprology | [48] |
| Wollega | 18.99 | Bovine | Coprology | [49] |
| Shawa | 34 | Bovine | Coprology | [50] |
| Harerge | 14.8 | Bovine | Abattoir | [51] |
| Badale | 20.8 | Bovine | Coprology | [52] |

Source: [52].

economic losses due to morbidity and mortality and also due to liver condemnation thereby contributing to loss in productivity of livestock industry in Ethiopia. The two species of the greatest veterinary importance are *Fasciola hepatica* and *F. gigantia* and snails are their intermediate host with the recommendations of education of farmers, control rather than treatment, reduction in the number of snail by drainage, fencing, and use of molluscides. Strategic anthelmintics treatment with appropriate fluckicide drug should be practiced twice a year; before and after rainy seasons to eliminate fluke burden of the host of animal and minimize pasture contamination by fecal egg shedding thus interrupting the life cycle and cook water-grown vegetables thoroughly before eating.

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