

## Economic Importance of Fasciolosis in Domestic Ruminants: A Review

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**Abstract:** Fasciolosis is a parasitic liver infection of ruminants caused by *Fasciola hepatica* and *Fasciola gigantica* which have a worldwide distribution. In this paper, the economic importance of fasciolosis in ruminants was discussed. The disease causes considerable impact on the economy of the livestock industry. Fasciolosis causes direct and indirect economic losses in domestic ruminants. The direct economic losses in cattle, sheep and goat are liver condemnations. But the far more damaging effects in these animals are lower calf birth weight, reduced growth in infected animals, costs of anthelmintics, labor for drenches, poor feed conversions, increased cost for replacement stock, losses in production due to mortality, reduction in meat, milk and wool production, effect on reproduction performance, reduction power of working animals and reduction of carcass weight at slaughter houses. To reduce the economic impact of this disease, integrated fasciolosis control method should be applied.

**Key words:** Condemnations • Domestic Ruminant • Economic Losses • Fasciolosis

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### INTRODUCTION

Ruminants play a significant role to maintain stability of household by providing meat, milk, skin and wool, generate cash income and play traditional, social and religious roles. Ethiopia possesses the largest livestock population in Africa. Even though Ethiopia is known in larger animal populations, the animal's performance and its contribution to the national economy are relatively low due to viral, bacterial, parasitic diseases, improper health care and other management problems [1]. Fasciolosis is among important parasitic diseases in tropical and subtropical countries which limit productivity of ruminants [2]. *Fasciola* is a common trematode (flat worm) that causes a parasitic disease called fasciolosis or fluke disease. It is also known as liver fluke and has a pathogenic effect on ruminants (cattle, sheep and goats) as well as other farm animals [3]. It is caused by *Fasciola hepatica* found in temperate area above 1800 m.a.s.l and in cooler areas of high altitude in the tropics and subtropics and *Fasciola gigantica*, which predominates in tropical area with a world-wide distribution [4].

*Fasciola* is responsible for morbidity and mortality in ruminants characterized by weight loss, anemia and hypoproteinemia [5]. The life cycle of liver flukes are always indirect, which involve intermediate host before invasion of definitive hosts. Both *F. hepatica* and *F. gigantica* are transmitted by the snails of the family Lymnaeidae [6]. Fasciolosis is an economically important disease of domestic livestock, in particular cattle and sheep and occasionally man [7]. The two species causes highly significant economic losses to global agriculture. The economic losses of fasciolosis in domestic ruminants are direct and indirect losses. The direct economic loss of fasciolosis is due to liver condemnation. The indirect losses are increased cost for replacement stock, reduced milk production, carcass weight loss, lower calf birth weight, reduced growth in infected animals, costs for control, reduction in production, fertility problem, reduction power of working animals and lower feed conversion rates in fattening cattle [8]. The worldwide losses in animal productivity of milk and meat due to fasciolosis were estimated at more than US\$ 3.2 billion annually. *F. hepatica* infects more than 300 million cattle and 250 million sheep worldwide [9-11].

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The direct economic losses due to fasciolosis in ruminants were reported from Nigeria (US\$134,000) [12]. A report from Kenya showed that, the economic loss due to condemnation of infected liver from cattle, sheep and goats was US\$ 2.6 million, US\$61,995 and US\$48,889, respectively [13]. Many authors have reported the economic loss due to fasciolosis from various parts of Ethiopia in different years. For instance, financial loss due to liver condemnation was estimated to be 4000 USD, 8312.5USD, 10339.57 USD and 2,566 USD per annum at Soddo, Hawassa, Bahir Dar and Gonder municipal abattoirs respectively [14-16]. In recent study, the direct and indirect losses incurred due to fasciolosis at Sheno municipal abattoir were estimated about 83,401USD [17]. Therefore, the objective of this paper was to highlight the financial losses of fasciolosis in domestic ruminants.

**Biology of Fasciolosis:** *Fasciola hepatica* is a leaf shaped fluke with broader and cone shaped anterior projection. The length of young fluke at the time of entry in to the liver is 1 - 2 mm and it looks like lancet but, the mature is around 2.5 - 3.5 cm in length and 1 cm in width in the bile ducts [18]. Fasciola eggs have yellowish brown shell with an indistinct operculum and embryonic cells [19]. The life cycle of liver flukes is always indirect, which involves intermediate host (snails) before invasion of definitive hosts [6]. Survival and multiplication of snails depends up on environmental condition which is nature of soil and climate conditions [20]. The adult fluke can produce up to 20,000 eggs per day in the bile duct that are passed with the Faeces to contaminate the environment. In a moist environment, Miracidia hatched from these eggs may penetrate the intermediate snail host. After development and multiplication inside the snail, Cercariae are released and attach to submerged of grass or other vegetation to become Metacercariae. Humans can acquire the infection by eating aquatic plants and animals get infected by grazing and drinking water contaminated with Metacercariae [9].

The distribution of fasciolosis depends on the grazing habitat preference of the animal. It appears in many parts of the world [9]. In Ethiopia, fasciolosis is widely distributed in north and western parts of the country mostly in rift valley where usage of running water and micro dams for irrigation is common [5]. 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 habitat than others but most are restricted to damp [21]. The water land and blocked drainage are hazardous for grazing stock [22]. Metacercariae can survive up to 3 months after harvesting

in hay from endemic high land areas [6]. The pathogenesis of fasciolosis involves two phases. The first phase occurs during migration in the liver parenchyma and is associated with liver damage and hemorrhage results hypoproteinemia, hyperglobulinemia and hypoalbuminemia. The second phase occurs when the parasite is in the bile ducts and results from the hematophagic activity of the adult flukes and from the damage to the mucosa, by their cuticles spines [23]. The damage caused by liver flukes to the animal host includes the destruction of tissues during their migrations in the body, especially in the liver and, in the case of *F. hepatica*, thickening of bile ducts. When the livers are seriously damaged, it will be subject to condemnation at meat inspection. The parasites are avid blood suckers, thus causing loss of blood. Also, the entire metabolism of the animal host undergoes functional deterioration [24].

The clinical manifestations of fasciolosis occur in the form of acute, sub-acute and chronic. The acute fasciolosis in sheep mostly occurs as sudden death without clinical abnormality and rarely occurs in cattle. It is manifested by dullness, weakness, lack of appetite, pallor and edema of mucosa and conjunctiva [22]. Sub-acute fasciolosis is characterized by anemia, jaundice, extensive tissue damage, hemorrhage and in particular liver damage and death 8 - 10 weeks [25]. In chronic fasciolosis, the clinical signs are: the animal become reluctant to travel, weight loss, anemia, chronic diarrhea, lower milk yield, swelling under the jaw (bottle jaw) and additional stress upon anemic animals, such as trekking on foot lead to collapse and death [26]. A tentative diagnosis of fasciolosis established based on prior knowledge of the distribution of the disease, observations of clinical signs, grazing history, seasonal occurrence and examinations of snails. Confirmatory diagnosis is based on demonstration of Fasciola species eggs through standard examination of feces in the laboratory, molecular method and post mortem examination of infected animals at slaughter [6].

Molecular methods are the most effective and highly sensitive for diagnosis of Fasciolosis [27]. The two common molecular techniques which used for diagnosis of domestic fasciolosis are polymerize chain reaction (PCR) and Loop mediated isothermal amplification (LAMP). They are rapid, sensitive and specific and detect infection. PCR assay is successful in identification of both species of Fasciola. This assay is validated on adult flukes alone [28]. The LAMP is a method of nucleic acid amplification with extremely high sensitivity and specificity to discriminate single nucleotide differences [29]. A diagnostic LAMP assay is validated on eggs,

larvae and adults of *F. hepatica* and *F. gigantica* [30]. The main control measures of fasciolosis are use of strategic anthelmintic treatment. The most important chemotherapy which used for control of Fasciolosis are Triclabendazole, Albendazole and Clorsulon mixed with Ivermectin. The other control methods are reducing the number of intermediate host snails and manage the area of snails such as, draining swamps, building sewage systems and providing clean water supplies to reduce exposure to infection. There is no vaccine for prevention of Fasciolosis [8].

#### **Economic Importance of Fasciolosis in Domestic**

**Ruminants:** Fasciolosis is one of the major bottlenecks to livestock development in the tropics area [31]. Diseases that occur in livestock have two major impacts. These two major impacts have highly pronounced effect on large scale abattoirs where there is large number of animals slaughtered [32, 33]. Economic impact of fasciolosis on livestock is enormous. Great losses are evident especially where farmers have little or no knowledge on the disease [34]. Losses are more encountered during rainy season when most stocks are exposed to fluke challenge. The reduction in milk and meat production, condemnation of liver, losses of power of working animals, reproduction failure and mortality are the more encountered losses due to Fasciolosis [35]. In Ethiopia each year significant economic losses resulted from condemnation of liver and carcass weight loss. The production loss in livestock industry due to fasciolosis was estimated at more than 900 million USD annually [36]. Disease causes extensive financial wastes to livestock as a result of direct and indirect economic losses.

**Direct Economic Losses:** A direct economic loss associated with fascioliasis is condemnation of liver of slaughtered animals [37].

**Direct Economic Losses in Bovines:** The direct economic impact of fasciolosis in cattle is associated with condemnation of liver in slaughter houses. The prevalence of fasciolosis in many parts of Africa has been determined mainly at slaughter [38]. For example, a 10 year study of slaughtered cattle in Kenya reported that 8% of the animals slaughtered were infected with *Fasciola hepatica*, with total weight of 1,283,793 condemned livers. The total direct economic loss incurred by the country during the 10 year period as a result of condemnation of the infected livers was approximately US\$2.6 million. The total annual economic losses during this period ranged from approximately US \$0.2 to 0.3

million [39]. In Nigeria, reports showed that 7.35% total condemnation and 81.42% partial condemnation of infected bovine liver. The average annual loss of (\$13,374.67) and a total periodic loss of (\$147,121.41) resulting from condemnation of 37,828 liver were quite enormous due to fasciolosis out of 1,640,095 cattle slaughtered during a ten year period [40].

In recent study at Sheno municipal abattoir the direct economic loss due to liver condemnation was 2079.23 USD [17]. Moreover, an economic loss of bovine fasciolosis due to liver Condemnation at Hawazien abattoir, Tigray region was 46,605 USD [41]. In Nekemte municipal abattoir 3504 USD economic loss was recorded from bovine liver condemnation [42].

#### **Direct Economic Losses in Small Ruminants:**

Fasciolosis is a major parasitic disease that incurred great economic loss in different parts of the country in small ruminants. There are various reports from different countries; report from Nigeria indicated that 96.65% and 18.58% total condemnation of liver in caprine and ovine species respectively. And also it has been reported 5.77% and 94.23% of partially condemned liver in caprine and ovine species respectively. In another report from Bangladesh the estimated economic losses due to condemnation of liver (7.54%) which amounted to 28.86 USD per thousand liver of slaughtered goat [43]. The studies conducted in different abattoirs of Ethiopia revealed that fasciolosis infection is the major cause of liver condemnation, with an approximate annual loss of 9720USD at DebreZeit abattoir [17]; 3784.52 USD in Modjo Modern export abattoir [44]. In report from central Ethiopia, the annual loss due to ovine fasciolosis was estimated to be 2.27 million Ethiopian Birr due to liver condemnation [7].

**Indirect Losses:** Fasciolosis causes a major impact on productivity of livestock production in tropical countries including Africa, Asia and South America. The indirect economic losses due to fasciolosis are reduction of carcass weight, poor feed conversion, weight loss, slow fattening, reduced milk yield, reproductive failure, mortality, morbidity, reduced growth rate, increased susceptibility to secondary infections and the expense of control measures [5].

**Indirect Economic Losses in Bovines:** Bovine fasciolosis have impact on beef producers. They are affected by increased culling of cows, reduced sale weights of culled cows, lowered reproductive performance in the cow herd, reduced calf weaning weights and reduced rates of growth in stockers. Economic losses in feedlots result from reduced feed conversion ratios and lowered average

daily gains. In cattle, liver fluke infection has been associated with reduced milk production, reduced milk fat content and increased calving interval in dairy cattle [10, 45, 46]. Losses in milk production can be as high as two kg milk per cow per day and decreased milk yields of between 8 and 15% are reported, depending on the level of anti-fluke antibodies [45].

The effect of fluke infection on milk quality and fertility is less well defined [47]. Estimates for damage due to liver fluke are highly variable, with values reported ranging from €6 to ~€250 per cow per year [46, 48]. In fasciolosis infected ruminants, the loss of weight gain and reduction of growth rate were estimated 9% [48]. *Fasciola hepatica*, found an 8 kg difference in total weight gain for heifers treated for *Fasciola hepatica* compared to untreated heifers [49]. The weight loss, primarily a notable less than 0.03 kg/week with low infection levels (45 flukes) and 0.13 to 0.30 kg/week with high infection levels (87 to 500 flukes) [50]. For instance, the financial loss due to bovine fasciolosis largely attributable to subclinical infection is approximately €52 million per annum [48]. The estimated economic loss caused by bovine fasciolosis in Maiduguri, Nigeria was \$1,415.85 within 6 years [51]. The indirect economic loss due to different control measures in cattle due to fascioliasis was estimated 30,000 naira [52].

A less clear picture is obtained for the effect of *F. hepatica* on reproductive performance. Using a high experimental infection dose of 600 Metacercariae found that first Oestrus was delayed by 39 days in infected heifers [53]. In fasciolosis infected animals effects on fertility vary, with some studies reporting an increased calving interval, or delayed puberty in young animals [10, 53].

#### **Indirect Economic Losses in Small Ruminants:**

Small ruminant fasciolosis is economically important in many parts of Ethiopia with prevalence ranging from 11.5% to 87.0% [54]. In Ethiopia, ovine fasciolosis is very frequent and causes a significant economic loss either by decreasing productivity or loss of body weight [16]. In report from central Ethiopia, the annual loss due to ovine fasciolosis was estimated to be 46.13 million Ethiopian Birr which 46.5% and 48.8% were due to mortality and loss of productivity respectively [7].

**Public Health Importance of Fasciolosis:** Fascioliasis is a zoonotic disease. Human is infected when metacercariae of the fluke is ingested along with water cress and vegetables grown along banks of water reservoirs inhabited by potential snail hosts. About 2.4 million

people are infected world wide and 180 million are at risk of the infection [35, 55]. Human fasciolosis is an emerging or re-emerging parasitic disease with increasing numbers of infected human cases [56].

Serious underreporting of this zoonotic disease is suspected, caused by limitations of accurate diagnosis and human fasciolosis is not a notifiable disease [9]. Human fascioliasis causes significant illness and morbidity, mainly among low income, farming communities. To date, no human deaths have been directly associated with fascioliasis. This fact accords the disease a low priority and contributes to its neglect as a significant cause of public health concern [57].

#### **CONCLUSION AND RECOMMENDATIONS**

Fasciolosis is one of the major obstacles for ruminant production. Extensive management, failure in controlling intermediate host and periodic deworming when the conditions are most favorable for development of larvae on pasture especially in marshy area leads to hinder the control measure of fasciolosis. There is no vaccine to protect the animal against the fasciola species. Because of this, fasciolosis is associated with significant financial losses in ruminants as a result of condemnation of liver and reduced productivity. Fasciolosis is now recognized as an emerging human disease.

Therefore, based on the above conclusion the following recommendations are forwarded.

- ✓ Integrated fasciolosis control methods should be applied for effective control of the disease.
- ✓ Awareness creation on the zoonotic importance of fasciolosis for the community should be mandatory.

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