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REVIEW ARTICLE

A REVIEW ON OVINE FASCIOLOLSIS

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Abstract

Fascioliasis is a common disease of sheep and other ruminants caused by F. hepatica and F. gigantica. The disease is worldwide in distribution and is liable for causing extensive economic losses to the livestock industry encompassing reductions in weight gain, wool production and fertility. It is caused by two members of genus Fasciola; Fasciola (F.) gigantica and F. hepatica. Fasciolosis is also known as, fasciolasis, distomatosis and liver rot. It occasionally affects humans, hence considered as a zoonotic disease. The life cycle of these trematodes involves snail as an intermediate host (IH). The epidemiology of fascioliasis is strictly linked to the geographical and environmental characteristics of the area where transmission occurs. The disease mostly diagnosed by prior knowledge of the epidemiology of the disease in a given environment; observation of clinical signs, information on grazing history, seasonal occurrence and standard examination of feces in the laboratory. The affected sheep should be effectively treated with oral administration of a narrow spectrum anthelmintic such as Triclabendazole in addition to reducing the population of the intermediate host to control the disease. Now a days, fasciolosis is recognized as emerging human disease over the world even if only few case reports of human fascioliasis are available in Ethiopia, as the disease mostly affects animals in the country. It causes several economic losses. The losses may be direct or indirect. Treatment of infected animals will largely depend on the correct use of appropriate and registered anthelmintics. Ovine fasciolosis may be controlled by reducing the populations of the intermediate snail hosts and by appropriate anthelmintic treatment.

Key words: *Anthelmintic, Ethiopia, Fasciola, Ovine*

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Introduction

Ethiopia has a high livestock population, but productivity is low as a result of disease, malnutrition and other management problems. Livestock diseases are widely distributed and one of the major causes of livestock mortality, and sub-optimal productivity in all agro-ecological zones of the country is diminishing the benefit of their high productivity performance, productivity losses attributed to helminthes parasite in Ethiopia are considerable and Fasciolosis is a major factor in this respect (Desalegn and Yerminesh, 2004; MOF, 2008).

Fasciolosis is a parasitic disease that may infect all domestic animals, human and many of wild spp. The two important species of this genus are *Fasciola hepatica* and *F.gigantica* (WHO, 2008; Okewole *et al*., 2000). It has direct economic impact in increasing condemnation of liver, but far more effects are decreased animal productivity, lower calf birth weight and reduced growth in infected animals and cost of animal treatment. Moreover, the economic losses due to fasciolosis are included mortality, morbidity and increased susceptibility to secondary infections and the expenses of control measures (Ann *et al*., 2006). These Losses from parasitic diseases including fasciolosis expected to be high in tropical countries l. Most infections occur by grazing in and around water in fluctuating habitats that stay wet for more than half the year (Smith, 2009). Small streams, ponds and marshy areas are obvious snail breeding areas, but any depression such as hoof prints can hold a bit of infection (Kassai, 1999).

The parasite has cosmopolitan distribution but more common in places where water logging remains for many months. The spread of Fasciolosis is largely dependent on the ecology of the snails which act as intermediate hosts and the snails of genus Lymnaea are mainly involved as intermediate host in the life cycles (Mungube *et al*., 2006; Mulugeta *et al*., 2008). When encysted metacercariae are ingested by bovine with herbages, they encyst in small intestine, penetrate the wall and migrate through the hepatic parenchyma before entering the bile ducts and developing to a reproductively capable adult (Smith, 2009). Individual adult flukes will attach at various sites to the walls of the bile ducts and feed on blood. The multi-site feeding pattern in combination with the irritation from the spines on the fluke's cuticle irritate the bile ducts, which cause thickening of the bile duct walls and impairment of liver function (Dunn, 1998).

The main factors influence the production of large number of metacercariae necessary for outbreak of Fasciolosis which includes availability of suitable snail habitat, temperatures and moistures (Urquhart *et al*., 1996). In recent years small scale tradition of irrigated agriculture will create favorable habitat for fluke transmitting snail vectors and there by influence the life cycle progression occurrence of Fasciolosis (Michael *et al*., 2004).

The clinical pathology findings include sever or chronic anemia, eosinophilia, sever hyper albuminemia, increased glutamate dehydrogenase and gamma glutamyl transpeptidase levels (Radostits *et al*., 2004). The disease syndromes caused by liver flukes are acute and chronic fluke diseases (Smith, 2009). Acute fluke disease occurs during initial invasion of the liver by large populations of migrating immature flukes. Chronic disease is caused by the adult flukes in the bile ducts. It is the most common form of the disease in cattle (Mihreteab *et al*., 2010).

Diagnosis of fluke infections in primarily based on a combination of grazing history, clinical signs, and laboratory examination of dung samples, clinical pathology, and post mortem examination (Urquhart *et al*., 1996). Treatment of Fasciolosis has long relied on derivatives of halogenated hydrocarbons. Trichlabendazole is considered as the most commonly drug due to its efficacy against adult as well as juvenile flukes (Radostits *et al*., 2007).

Control of Fasciolosis may be approached in two ways that is by reducing the population of the intermediate snail hosts or by using antihelminthiasis. The best long-term method of reducing mud-snail populations such as *L.trancatula* is drainage, since it ensures permanent destruction of snail habitats (Taylor *et al*., 2007).

Therefore the objectives of this study are;

- To highlight the prevalence of ovine Fasciolosis
- To assess the risk factors of ovine Fasciolosis

Litreture review

Etiology

Fasciolosis is caused by different species of trematodes (commonly called "flukes") of the genus Fasciola. The taxonomic classification of the organisms that cause fasciolosis is presented as follows: Phylum: Platyhelminthes, Class: Trematoda, Sub class: Digenea, Order: Echinostomida, Super family: Fascioloidea, Genus: Fasciola, Species: F. hepatica and F. gigantica (Torgerson and Claxton, 1999).

Morphology

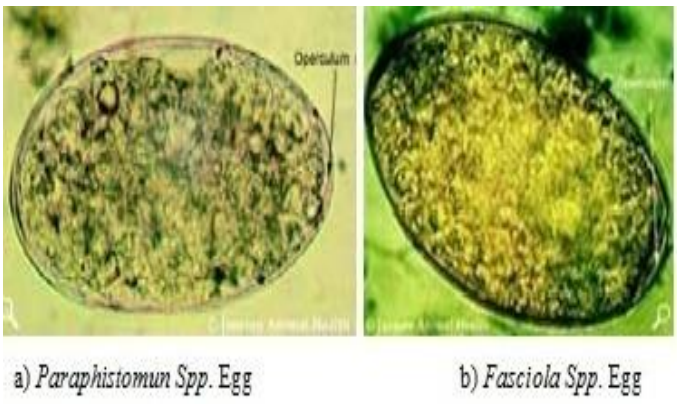
Adult liver flukes have a flat body, an oval shape, and are rather large: up to 30 mm long and 15 mm wide (Figure 1).They have a pink-grayish to dark red color, have two suckers, (both in the oral and ventral side) and have no external signs of segmentation. The mouth ends in the pharynx, a muscular tube that allows sucking (Mulat *et al*., 2011). The digestive system is blind (without anus) and not linear, as in most animals, but branched, ending in several blind ducts. Liver flukes are simultaneous hermaphrodites. The eggs of liver flukes are about 80x140 micrometers, with an oval form, operculated and of a yellowish to greenish color derived from the host's (Moll *et al*., 2000).

Fasciola eggs should be distinguished from the eggs of other flukes, especially from the eggs of paramphistomum (Figure 2). Fasciola egg has yellowish brown shell with an indistinct operculum and embryonic cells (Urquhart *et al*., 1996). Whereas paramphistomum egg has transparent shell, distinct operculum with embryonic clear cells and possess a small knob at their posterior end (Soulsby, 1982).

Fig.1.Adult stages of *Fasciola spp.*

Source: (Michael *et al*., 2004).

Fig.2. Rumen and Liver Fluke Egg Source: (Michael *et al*., 2004).



Host range

Intermediate host

Several snail species within the family Lymnaeidae play an essential role as intermediate hosts for this digenean. Snails of the genus Lymnaea,

of which *L.truncatula* are the most common amphibian snails with wide distribution throughout the world. Other important snails of *F.hepatica* are *L.tomentosa, L.collumella, L.bulimoides, L.humilis, L.viator*and *L.viridis* (Taylor *et al*., 2007). *L.natalensis* is the important intermediate host for *F.gigantica* which is strictly aquatic snail often found in Africa, requires well oxygenated non polluted water bodies and can activated during dry periods (Urquhart *et al*., 1996). Other important snails of *F.gigantica* are *L.rufescens, L.acuminata, L.viridis*and*L.rubiginosa* (Taylor *et al*., 2007).

Final host

Hosts of *F.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.* Adult sheep and cattle may remain carriers for many years because of the longevity of the adult flukes (Radostits *et al.,* 2007).

Epidemiology:

The development of liver flukes requires a suitable intermediate host, Lymnaea, a fresh water snail and various species of ruminants as the final definitive host. The geographical distribution of *F.hepatica*and *F.gigantica* is determined mainly by distribution pattern of snail that has a role as intermediate hosts (Soulsby, 1982). There are three main factors influencing the production of large number of metacercaria necessary for outbreak of Fasciolosis which includes availability of suitable snail habitat, temperature and moisture (Urquhart *et al*., 1996).The risk of hepatic Fasciolosis is determined by the number of infected Lymnaea snails in the grazing area. The disease has a predictable seasonal pattern in regions where snails are active for any part of the year (Radostits *et al*., 2007).

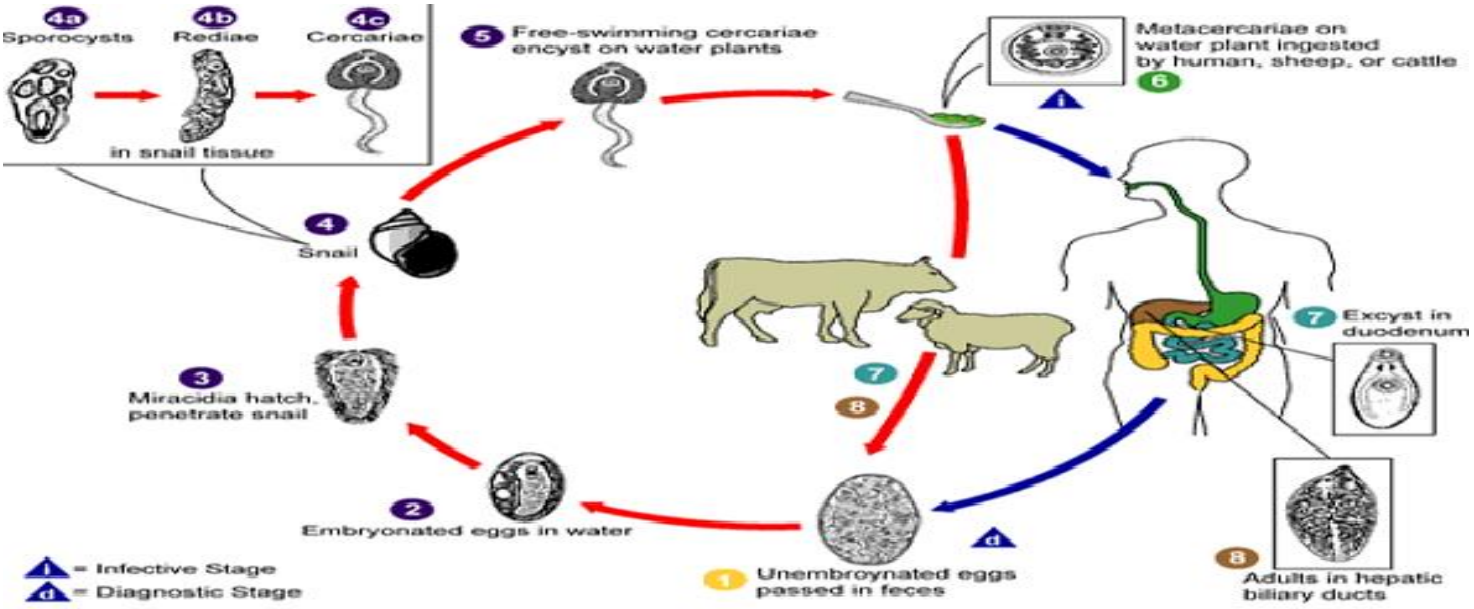
Life cycle

Adult *F.hepatica* flukes live in the bile ducts of ruminant and other mammalian hosts. These eggs reach the gall bladder and are passed to the host's gut when the gall bladder is emptied. They are passively transported to the anus and are expelled with the feces. A single liver fluke can produce up to 25'000 eggs a day (Chapuis *et al*., 2007).

Once outside the host, the larvae called miracidia hatch out of the eggs in 7 to 15 days. These larvae can survive for weeks off a host provided there is enough humidity. The miracidium is completely covered with cilia and has a conical papilla at its anterior end for boring into the snail intermediate host and it can swim and penetrate actively into the snails where they remain for 4 to 8 weeks and develop successively to sporocysts, rediae and cercariae, the usual larval stages of most fluke species. A single miracidium can asexually produce up to 600 cercariae (WHO, 2012; Muhsin *et al*., 2013).

The cercaria can infect the definitive mammalian host, including humans passively when the host drinks infected water or it can encyst on leaves and the mammalian host becomes infected when it eats leaves containing the metacercariae. The ingested metacercariae excyst in the duodenum and migrate into the peritoneal cavity and finally reach the liver (Ibrahim *et al*., 2010). They bore through the liver capsule and in about 12 weeks enter the bile ducts where they start to lay eggs. Inside the final host young immature flukes hatch out of the cysts and within a few hours they cross the intestinal wall and get into the peritoneal cavity where they migrate towards the liver, which they reach in about 3 weeks. To reach the biliary ducts they have to cross the hepatic tissue. After entering the bile duct, they grow more than double their size before egg laying starts at about 10-12 weeks after infestation. Adult cattle may remain carriers for many years because of the longevity of the adult flukes (Radostits *et al*., 2007).

Fig.3. Life Cycle of Fasciola Source: (Michael *et al*., 2004).



Pathogenesis

This varies according to the number of metacercaria ingested, the phase of parasitic development in the liver and the species of the host involved. Essentially the pathogenesis is two- fold. 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 ducts, and results the hematophagic activity of the adult flukes and from damage to the biliary mucosa by their cuticular spine (Menkir *et al*., 2007; Yohannes, 2008).

Fasciolosis may be acute, sub-acute or chronic. The acute disease occur 2-6 weeks after the ingestion of large numbers of metacercaria, usually over 2000, and is due to the sever haemorrhage which results when the young flukes, migrating in to the liver parencheyma, rapture blood vessels. Damage to the liver parenchyma is also severe. At necropsy the liver is enlarged, haemorragic and honey combed with the tract of migrating flukes. Outbreak of acute fasciolosis is generally presented as sudden deaths during autumn and early winter (Taylor *et al*., 2007).

In the sub-acute disease, metacercaria are ingested over a longer period and while some have reached the bile ducts, where they cause cholangitis, others are still migrating causing lesions less severe, but similar to those of the acute disease; thus the liver is enlarged with numerous necrotic or haemorrhagic tracts visible on the surface and in the substance. Subcapsular haemorrhages are usually evident, but rupture of these is rare (Bowman *et al*., 2003; Fufa *et al*., 2009). This form of the disease, occurring 6-10 weeks after ingestion of approximately 500-1500 metacercaria, also appears in the late autumn and winter. Hemorrhagic anaemia and hypoalbuminaemia are the consistent laboratory findings and if untreated, can result in high mortality rate. However it is not as rapidly fatal as the acute condition. The affected animal show clinical signs for 1-2 weeks prior to death; these include a rapid loss of condition, a marked pallor of the mucous membranes, and an enlarged and palpable liver. Sub mandibular or facial oedema and ascites may be present (Urquhart *et al*., 1996).

Chronic fasciolosis develops only after the adult flukes establish in the bile ducts. Here they

cause cholangitis, biliary obstruction, fibrosis, and a leakage of plasma protein across the epithelium. Although this protein can be re-absorbed in the intestine; there is poor utilization and retention of nitrogen leading to hypoalbuminemia. There is also a loss of whole blood due to the feeding activities of the fluke. This exacerbates the hypoalbuminemia and eventually gives rise to anemia (Radostits *et al*., 2007).

Clinical signs

In heavy infection in cattle, where anaemia and hypoalbuminaemia are severe, sub mandibular edema frequently occurs. With smaller fluke burdens, the clinical effect is minimal and the loss of productivity is difficult to differentiate from inadequate nutrition. It must be emphasized that diarrhea is not a feature of bovine fasciolosis unless it is complicated by the presence of ostertagia spp. Combined infection with these two parasites have been referred to as the fasciolosis/ostertagiosis complex (Taylor *et al*., 2007).

Fasciolosis ranges in severity from a devastating disease in a sheep to an asymptomatic infection in cattle (Kahn *et al*., 2005). 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. The disease is manifested by: dullness, weakness, lack of appetite, pallor and edema of mucosae and conjunctivae and pain when pressure is exerted over the area of the liver (Shiferaw et al., 2011; Fikrtemariam *et al.*, 2013). Death occurs quickly and may be accompanied by the passage of blood-stained discharge from the nostrils and anus. Most deaths occur within a period of 2-3 weeks. Acute fasciolosis are rarely occurrs in cattle. Acute and chronic fasciolosis are opposite end of the clinical spectrum. Intermediate forms occur and a sub-acute syndrome has been described in sheep. The major clinical signs are weight loss and pallor of the mucous membranes. Submandibular edema will be seen in only a few cases, but many animals will resent palpation over the region of the liver. Chronic fasciolosis does not become apparent until several weeks after the danger of acute disease has receded. Affected sheep lose weight, develop submandibular edema, and pallor of the mucosae over a period of weeks. Cattle also lose weight, especially if lactating, milk production falls and anemia may develop Yilma and Mesfine, 2000 ; Radostits *et al*., 2007).

Diagnosis

Diagnosis of fasciolosis may consist of tentative and confirmatory procedures. A tentative diagnosis of fasciolosis may be established based on prior knowledge of the epidemiology of the disease in a given environment; observations of clinical signs, information on grazing history and seasonal occurrence. Confirmatory diagnosis, however, is based on demonstration of Fasciola eggs through standard examination of feces in the laboratory; postmortem examination of infected animals and demonstration of immature and mature flukes in the liver**.** Diagnosis of Fasciolosis may be delayed because of the wide spectrum of the differential diagnosis and the low incidence of *F. hepatica* infection (Boray, 2003; Bowman *et al*., 2003).

In animals, intravital diagnosis is based on predominantly on faeces examination and immunological methods. However, clinical signs, season, climate conditions, epidemiology situation and examination of snails must be considered.Faecesexaminations are not reliable. Moreover, the fluke eggs are detectable in faeces 8-12 weeks post-infection. In spite of that fact, faecal examination is still the only used diagnostic tool in some countries (Torgerson and Claxton, 1999). Diagnosis is confirmed only by demonstrating live parasites in the bile. The disease cannot be ruled out by a negative faces examination. A high index of suspicion and specific radiological findings are very helpful in the diagnosis (Aksoy *et al*., 2006).

Treatment

Affected cattle are treated by administration of a fasciolocide. Of those currently used for cattle the commonest are triclabendazole, oxyclozinide,

rafoxanide, nitroxynil, albendazole and clorslon. All will remove more than 90 percent of adult flukes from the ducts, but they have variable efficiencies against the immature stages migrating through the liver (Bowman *et al*., 2003). The most effective is triclabendazole, which will remove developing flukes from a few days after ingestion. Rafoxanide, nitroxynil and clorslon are effective against six week old flukes at normal dose rates and at increased dose levels affect those four weeks old. Albendazole, netobimin and oxyclozanide at normal dose rates remove only adult flukes from the bile ducts and are in effective against immature flukes. All require withholding of meat and milk for human consumption for variable periods dependent on their pharmacokinetic (Andrew *et al.*, 2003; Tadele and Worku, 2007).

Prevention and control

Efficient control of Fasciolosis requires a well planned and executed, integrated control programme designed for each farm, area, country or region. The available strategies which can be used individually or in combination are: Strategic application of anthelminthics and eliminating the parasites from the host at the most appropriate time for effective prevention of pasture contamination, Reduction in the number of intermediate host snails by chemical or biological control, Reduction in the number of snails by drainage, fencing and other management practices, Reduction in the risk of infection by planned grazing management (FAO, 2013).

Before any scheme of snail control is undertaken a survey of the area for snail habitats should be made to determine whether these are localized or widespread. The best long term method of reducing mud-snail populations such as *L.truncatala* is drainage, since it ensures permanent destruction of snail habitats. When the snail habitat is limited a simple method control is fence off this area or treats annually with a mulluscicide(Abdu, 2008; Bitew *et al*., 2011).

Conclusion and recommendations

Liver fluke/fasciolosis continue to constrain, in a variety of different ways, livestock productivity, agricultural development, human well-being and poverty alleviation in many regions of the Ethiopia. Fasciolosis is a serious health problem of cattle which causes liver condemnation in the abattoir, reduction in the production of the animals. These include the effects due to death, illness leading to condemnation, poor weight gain and poor feed conversion. Disease of livestock have many additional direct and indirect impacts on human nutrition, community development and socio-cultural and also reduction in farm income, contributing to food insecurity and poor nutrition, therefore the control of the parasites based on the current review finding; the following points are recommended;

- Strict rules and regulations should be in place and enforced for hygienic meat inspection.
- Awareness should be created among for farmers about the disease prevalence and transmission.
- Veterinary service to be extended to the disease prevalent areas with provision of modern antihelemthtics for treatment of affected animals.
- Agriculture department should initiate actions for control of snails through drainage of stagnant water in swampy areas.
- Regular deworming of animals before and after the rainy season should be done.
- Applications of molluscides are important in the control of the intermediate hosts.
- Further epidemiological investigations should be initiated to assess the worm burden in Ethiopia to study the associated risk factors and indirect economic losses.

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