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Review on Ovine Fasciolosis

Mohammedkemal Mustefa Ame, MSc[1*]; Ahmedyasin Mohammed, MSc[2]; and Kedir Mohammed, BVSc[3]

[1]College of Veterinary Medicine, Department of Veterinary Public Health, Haramaya University, Eastern Hararghe, Ethiopia; PO Box 138, Dire Dawa, Ethiopia

[2]Department of Veterinary Medicine, Haramaya Woreda Veterinary Clinic, Eastern Hararghe, Ethiopia

[3]Department of Veterinary Medicine GirawaWoreda Dogu Veterinary Clinic, Eastern Hararghe, Ethiopia

Corresponding authors Mohammedkemal Mustefa Ame, MSc[1*]

Department of Veterinary Medicine, Haramaya University, East Hararghe, Ethiopia; Tel. +0912224332; E-mail: mohammedmustefa4@gmail.com

Abstract

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. Fasciolosis is an important limiting factor for ruminant production and causes for several economic losses due to morbidity and mortality. The main objective of this seminar is to review available articles on ovine fasciolosis. Ovine Fasciolosisoccurs world-wide and its occurrence is influenced by the availability of suitable snail habituates, temperature and moisture. It also has public health implication and its transmission depends on a snail intermediate host. Clinically it is characterized by weight loss, anaemia and hypoproteinaemia which are caused by extensive damage to the hepatic parenchyma by migration of juvenile flukes during 6–8 weeks post-infection. Ovine fasciolosis can be diagnosed tentatively based on history and by observing clinical signs. Detection of Fasciola eggs in the faeces of infected animals provides confirmatory based on history diagnoses. Fasciolosis can be controlled by elimination of the intermediate host, the parasite itself, adoption of good grazing practices (avoiding marshy pastures and strategic use of anthelmentics. Triclbendazole is highly effective against all stages of fluke. The two species of the greatest veterinary importance are Fasciola hepatica and Fasciolagigantica and snails are their intermediate host. Generally, ovine fasciolosis is an important parasitic disease which hinders the livestock's production and thus it is recommended to control the disease by reducing the snail population or by using anthelmintic.

Keywords: Fasciolosis, Ovine, Snail

Introduction

Ethiopia is believed to have the largest livestock population in Africa. This livestock sector has been contributing considerable portion to the economy of the country, and still promising to rally round the economic development of the country (CSA,2013).Small ruminants play a significant role significant role in maintaining household stability by providing meat, milk, skin and religious roles (ILCA ,2007) .

Gastro-intestinal helminthosis is considered as one of the major parasitic problems that constrain livestock improvement programs in Ethiopia. Among many parasitic problems of small ruminants, fasciolosis is major disease which is caused by digeniantermatodes of genes fasciola commonly referred to as liver fluke (ingestion of metacercariae of Fasciola) and imposes direct and indirect economic impact (morbidity and mortality) on livestock production in small ruminants which are the natural hosts for fasciola(Bitew and Abdela, 2010).

The parasite (Fasciola) is a flat leaf like worm which lives in the liver of various mammals including cattle sheep and goats where it causes severe damage. It occurs world-wide and causes substantial economic losses in animal production. It also has public health implication (Pfister, 2010) .
The two species of the greatest veterinary importance are *F. hepatica* and *F. gigantic* and amphibious snails are their intermediate hosts. *F. hepatica* has a worldwide distribution but predominates in temperate zones while *F. gigantic* is found on most continents, primarily in tropical regions. Both *Fasciola hepatica* and *Fasciolagigantica* are reported in Ethiopia (Ahmad *et al.*, 2007).

Clinically, fasciolosis is often seen as a chronic wasting disease. In cattle, sub-acute or acute outbreaks occasionally occur, whereas in sheep, acute and sub-acute diseases are more frequent (Pfister, 2010). Clinical disease is usually characterized by weight loss, anaemia and hypoproteinaemia caused by extensive damage to the hepatic parenchyma by migration of juvenile flukes during 6–8 weeks. Adult liver flukes reside in the bile ducts of host animals, and eggs are passed onto the pasture in the faeces. Egg production can begin as early as 8 weeks after infection, but most infections do not become patent until 11–12 weeks. Liver lesions predispose animals to infectious necrotic hepatitis, bacillary hemoglobinuria and decreased host fertility (Sa´nchez-Andrade,2002).

Early and reliable diagnostic techniques are necessary for preventing the economic losses due to the development of pathological lesions in infected animals (Sa´nchez-Andrade,2002). Laboratory confirmation depends mostly on faecal sedimentation tests, serology tests (ELISA) and possibly in some regions of the world PCR tests (Steyl, 2010) .

Post-mortem examination of fresh carcass is the best method of diagnosis if liver fluke is suspected as untreated animals provide the most accurate indication of the level of challenge .The treatment recommended will depend on the nature of the disease. Treatment of infected animals largely depends on the correct use of appropriate and registered anthelminthics. Fasciolosis may be controlled by reducing the populations of the intermediate snail host (Phiri *et al.*, 2006).

Ovine fasciolosis in Ethiopia is very frequent and causes a significant economic loss either in production loss or decrease productivity and loss of body condition .The annual losses due to ovine fasciolosis were estimated to be 48.4 million Ethiopian Birr per year of which 46.5, 48.8, and 4.7% were due to mortality, loss of productivity and liver condemnation, respectively (Ahmad *et al.*,2007). These require good well documented information which may help in designing effective control and prevention methods. Therefore, the main objectives of this seminar is

✓ To overview the available literature on etiology, epidemiology, diagnosis and control of ovine fasciolosis.
✓ To overview the economic and public health importance of ovine fasciolosis

Literature Review

2.1 Etiology

Fasciolosis also known as Fascioliasis, distomatosis and liver rot, is an important helminth disease caused by two trematodes Fasciola hepatica (the common liver fluke) and Fasciolagigantica(Mas-Coma,2005). Fasciolosis is a disease of sheep, goat, cattle and occasionally affects humans, thus considered as a zoonotic infection (Okewole *et al.,* 2000) .

The parasite is transmitted by ingestion of metacercaria of Fasciola species on plants from contaminated fresh water. The fluke species are hermaphroditic, have similar life cycles, and cause similar clinical manifestations in animals. The organism causes 'liver rot' among sheep and cattle which are the definitive hosts. The class trematoda also contains three orders: Monogenia, Aspidogastrea and Digenia in which the order of *Fasciola*belongs (Bowman,2010).

According to(Mufti, 2011)taxonomically *Fasciola*belongs to an invertebrates and its classification is presented as follows: Kingdom: Animalia, Phylum: Platyhelminthes, Class:Trematoda, Order: Digenea, Family: Fasciolidea, Genus: Fasciola, Species: Fasciola hepatica and Fasciolagigantica.

The adult parasite *F. hepatica* has a flat leaf-like body typical of flukes, and measures 20 to 30 mm long by 8 to 15 mm wide. It has an anterior elongation (a cephalic cone) on which the oral and ventral suckers, which are approximately of equal size, are located. The intestine of the adult parasite is highly branched, with numerous diverticulae extending from the anterior to the posterior of the body(Asrat ,2004).

Life Cycle

Eggs are passed in the faeces of the mammalian host, hatch and release motile miracidia. Hatching may take nine days and the optimal temperatures required are 22-26°C. Miracidia have a short life span and must locate a suitable snail within three hours. In infected snails sporocysts, redial stages and cercaria develop. Snails pass the motile cercaria which then attaches themselves to plant material, where they encyst and become the infective metacercariae. A minimum of 6-7 weeks is required for miracidia to form metacercariae(Joseph *et al.,* 2007).

Under unfavorable circumstances this may take several months. Following infection of one snail with one miracidium over 600 metacercariae may be produced. Final hosts ingest the metacercaria that excyst in the small intestine, followed by migration through the intestinal wall, crossing of the peritoneum and penetration of the liver capsule (Ray, 2001).

The immature flukes migrate through the parenchyma (6-8 weeks period), entering the small bile ducts and finally migrating to the larger bile ducts (and occasionally the gall bladder). Generally the life cycle of both fluke species is the same. The prepatent period of *F. hepatica* is 10-12 weeks and one entire life cycle of *F. hepatica* may be completed in a minimum of 17-18 weeks. For *F. gigantica*most phases of development take longer and the prepatent period 13 –16 weeks duct may produce 20 000 eggs per day establishing patent infestation (Steyl, 2010).
The adult flukes in the bile ducts produce eggs which are passed in the faeces. The eggs hatch when separated from faecal material in wet areas, under optimal conditions. The first larvae or miracidia released invade the lymnaeid snails in which they develop and multiply as sporocyst, rediae and cercariae. The tadpole-like cercariae leave the snails and swim until they encyst on vegetation, forming metacercariae, which are the infective stage of the fluke. The entire cycle of the liver flukes in the snails takes two to three months under favourable conditions in the field. If the metacercariae are ingested by sheep, cattle or

other hosts, including people, the metacercariaeexcyst in the small intestine and the released immature flukes penetrate the intestinal wall into the abdominal cavity. The young flukes penetrate the liver capsule and migrate through the liver tissue for six to seven weeks before entering the bile ducts to become adult flukes. The flukes reach sexual maturity and commence egg production at eight to ten weeks after infection (Joseph *et al.*, 2007).

Epidemiology

Fasciolosis is considered an important limiting factor for ovine and bovine production. In general, infection of domestic ruminants with *F. hepatica* and *F. gigantic* causes significant economic loss estimated at over US$ 200 million per annum to the agricultural sector worldwide, with over 600 million animals infected. In developed countries, the incidence of *F. hepatica* ranges up to 77%. Evidence suggests that sheep and cattle may be considered the main reservoir host species, pigs and donkeys being secondary (Asrat , 2004).

The two primary requirements for the establishment of liver fluke are a suitable snail (the intermediate host) and an environment that suits the fluke eggs (Joseph *et al.,* 2007). *F. hepatica* is mostly encountered in temperate areas, and in cooler areas of high altitude in the tropics and subtropics, whilst *F. gigantic* predominates in tropical areas. Snails are their intermediate hosts. Amphibious snails of the genus *Lymnaeaspp* are widely distributed throughout the world and *L. trunculata* is the most common of them all. In South Africa the most common intermediate hosts are *L. trunculata*(*F. hepatica*), *L. natalensis* (*F.gigantica*) and *L. columella* (*F.hepatica* and *F.gigantica*) (Steyl, 2010) .

Large numbers of metacercaria will usually be produced when there is optimal availability of suitable snail habitats, optimum temperatures and optimum moisture is present. This frequently results in seasonal patterns of emerging disease in certain parts of the world. Suitable snail habitats will include all areas where snails may survive in clear water or mud such as the edges of streams, ponds, rivers and permanent natural habitats; or temporary man-made depressions filled with water (tractor tracks etc). A slightly acid environment may be more optimal. Temperature requirements are mean day/night temperatures of 10°C at which both the snails and the flukes will propagate (Joseph *et al.*, 2007).

Below 5°C all activity will stop and above 15° C significant increase in both snails and fluke larval stages may be seen, with the optimum being 22 - 26° C. Moisture levels are described as optimal when rainfall exceeds transpiration and when field saturation is achieved (Steyl, 2010)

Pathogenesis and Clinical signs

Pathogenesis of fasciolosis varies according to the parasitic development phases: parenchymal 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. In the bile ducts of some permissive hosts, such as the sheep, rabbit, rat and mouse, the biliary stage of the disease is common. In others, such as cattle and humans, few flukes survive beyond the migratory phase and biliary disease is relatively rare (Behm, 1999).

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 (Tsega *et al.*, 2015).

Clinically fasciolosis is often seen as a chronic wasting disease. In cattle, subacute or acute outbreaks occasionally occur, whereas in sheep, acute and subacute diseases are more frequent. The clinical signs of acute disease are characterized by sudden acute deaths, weakness, anaemia and dyspnoea. Sub acute and chronic fasciolosis is characterized by progressive loss of condition, anaemia, hypoalbuminaemia, emaciation, pallor of the mucous membranes, submandibular oedema and ascite(Ray ,2001) ; (Bitew and Abdela, 2010) .

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When extremely high fluke burdens rapidly accumulate, however, outbreaks of acute or sub acute ovine fascioliasis can occur. In these situations, clinical disease is caused by extensive damage to the hepatic parenchyma produced by migrating immature flukes (Soliman, 2008).

Clinical disease resulting from chronic infection is uncommon in adult sheep; it is most frequently seen in sheep and cattle younger than two years and is characterized by weight loss, anemia, hypo proteinemia, general depression, and occasionally death. Acute fasciolosis corresponds to the migratory stages of the life cycle, whereas chronic fasciolosis is due to the presence of the mature adult flukes in the bile ducts (Garcia *et al.*, 2007). Acute disease is associated with mostly immature flukes, and usually seen in autumn and early winter, 2-6 weeks after ingestion of metacercariae in large numbers (> 2000). The liver may be enlarged and haemorrhagic with fibrinous to fibrous exudates on the capsular surface (usually the ventral lobes). The migratory tracts may be visible as dark acute haemorrhagic streaks to, more yellowish white streaks typical of post necrotic scarring and granulation. Sometimes flukes may be seen in the migratory tunnels. If severe haemorrhages are present it may result in large subcapsularhaemorrhages, which in turn may rupture with severe intra-abdominal haemorrhage and acute haemorrhagicanaemia as consequence. In some heavy and repeat infestations acute lesion of multifocal pinpoint serosalhaemorrhages and fibrinous peritonitis, to more chronic fibrous peritonitis may be present. Animals suffering from acute fasciolosis may not show any obvious symptoms (Joseph *et al.*, 2007).

Subacute fasciolosis is characterised by jaundice, some ill thrift and anemia. The burrowing fluke causes extensive tissue damage, leading to haemorrhaging and liver damage. The outcome is severe anaemia, liver failure and death in 8–10 weeks. At this stage some parasites may have reached the bile ducts whilst others may still be migrating through the parenchyma. Sub capsular haemorrhages may be present but usually these do not rupture (David, 1990).

Chronic fasciolosis is the most common form of liver fluke infection in sheep, goats and cattle and particularly in more resistant hosts, such as horses and pigs. It occurs when the parasites reach the bile ducts in the liver. The fluke ingests blood, which produces severe anaemia and chronic inflammation and enlargement of the bile ducts. The clinical signs develop slowly. The animals become increasingly anaemic, appetite is lowered, the mucous membranes of the mouth and eyes become pale and some animals develop oedema under the jaw (‘bottle jaw’) Affected animals are reluctant to travel (Joseph *et al.*, 2007).

The liver pathology of chronic disease is characterized by hepatic fibrosis and hyperplastic cholangitis. Several different types of fibrosis may be present and includes post-necrotic scarring (mainly in the ventral lobe and associated with healing of fluke tracts), ischaemic fibrosis (infarction as consequence of damage and thrombosis of large blood vessels, and peribiliary fibrosis (damage by flukes in the small bile

ducts). Fluke eggs may sometimes stimulate a granuloma-like reaction with obliteration of the affected bile ducts as consequence. In bovines calcification of bile ducts, enlargement of the gallbladder and aberrant migration of the flukes is more common. Encapsulated parasites are often seen in the lungs. If adult cows are re-infected, parasitic migration to the foetus and resultant prenatal infection has been reported. Ectopic infections through normal transmission are infrequent but can occur in the peritoneal cavity, intestinal wall, lungs, subcutaneous tissue, and very rarely in other locations (Steyl, 2010).

Immunity

It has been reported that sheep and cattle do not develop strong immunity to infection with *F. hepatica*, or to re-infections, and this lack of resistance in ruminants is believed to be associated with the inability of their macrophages to produce nitric oxide. It has been seen that *F. hepatica* and *F. gigantica*have different immunomodulation and strategies to invade the host immune responses and it seem that in practice *F.gigantica*homologues of antigens with protective properties against *F. hepatica* may not necessarily protect animals against *F.gigantica*. This may therefore require presentation of such antigens in different adjuvant formulations, or administration regimes. ELISA has also very successfully been employed to study the serum antibody type response (total IgG, IgG1, IgG2 IgM and IgG in *F. hepatica* and *F.gigantica*infected sheep and cattle, in a recent study, which may be worthwhile article to read (Phiri *et al.,* 2006).

Diagnosis

Apart from the presence of typical clinical signs, suggestive haematological and biochemistry findings, typical macroscopic and histological findings the laboratory confirmation may be depend mostly of faecal sedimentation tests, serology tests (ELISA) and possibly in some regions of the world PCR tests (Steyl, 2010).

Post mortem Examination

Post-mortem examination of fresh carcass is the best method of diagnosis if liver fluke is suspected as untreated animals provide the most accurate indication of the level of challenge. Measurement of the fluke recovered will also give an indication of the age the flukes and the period of challenge (Phiri *et al.,* 2006).

2.7. Treatment

The treatment recommended will depend on the nature of the disease. Some of the available anthelmintics are not effective against immature fluke and so are not recommended in acute fluke outbreaks. Also, they are less efficient for the strategic control of fasciolosis. The best prevention and control can be achieved with drugs such as bithionol, praziquantel, nitazoxanide, albendazole and triclabendazole (TCBZ) but triclabendazole, which is effective against early immature and adult fluke is not available in most countries (Joseph *et al.,* 2007).

2.8. Prevention and Control

Treatment of infected animals will largely depend on the correct use of appropriate and registered anthelminthics. Fasciolosis may be controlled by reducing the populations of the intermediate snail host, or by appropriate anthelminthic treatment. Long-term snail control can be achieved by drainage of the habitat, but permanent destruction of snail habitats may be expensive and ecologically sensitive, or controversial, especially in widespread habitats. When snail habitats are small and localised fencing of such areas, or annual treatment with a molluscicide, such as Metallic salts (copper sulfate), nicotinanilide, organotin, dibromo-nitraozo-benzene, sodium pentachlorophenate, tritylmorpholine, sodium dichloro-bromopheno, niclosamide, and acetamide may be more feasible. Registered fluke anthelminthics may be used prophylactically (strategic treatment) to reduce contamination of pastures by fluke eggs at times most suitable for their development; or to remove fluke populations (tactical treatment) at a time of heavy fluke

burdens, or at periods of nutritional and pregnancy stress to animal (Phiri *et al.*,2006).

Pasture management can also be used in various seasonal, and minimal or maximal rotational systems, with separate or mixed grazing by sheep and goats. Control by means of vaccination has also been extensively investigated. In some parts there may be overlap, and concurrent *Schistosomaspp*infections may be seen. Some efforts are therefore also directed at producing vaccines, which could produce cross reaction between *Schistosomaspp*and *F. hepatica.* During the past few years a number of proteins have been identified and investigated as potential candidates for vaccine production (Phiri *et al.,* 2006). Egg production seems vulnerable to the immunological response induced by vaccination. It is not clearly established to what extent reduced egg production would have on the transmission of eggs and this still needs to be mathematically investigated. No articles on field studies of an effective vaccine have been reported so far (Steyl, 2010).

2.9. Status of Fasciolosis in Ethiopia

Ethiopia's rich potential from the livestock sector is not efficiently exploited due to several constraints including suboptimal nutrition, traditional management and diseases. The presence of fasciolosis due to *Fasciola hepatica* and *F.gigantica*in Ethiopia has long been known and its prevalence and economic significance has been reported by several workers. A review of available literature strongly suggests that fasciolosis exists in almost all parts of the Ethiopia (Yilma, 2000).

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 (Jemal, 2009). It is regarded as one of the major setbacks to livestock productivity incurring huge direct and indirect losses in the country. The annual loss due to endo-parasite in Ethiopia is estimated at 700million Ethiopian birr/annum. Particularly financial loss due to ovine fasciolosis alone is estimated at 48.8 million Ethiopian birr/annum of which 46.5%, 48.8% and 4.7% were due to mortality productivity (weight loss) and liver condemnation, respectively (Michael, 2004).

2.10. Economic and Public Health Importance

2.10.1 Economic Significance

Fasciolosis is of great economic significance worldwide with losses estimated to exceed 2000 million dollars yearly; affecting more than 600 million animals(Biffa D, 2006).This would probably not accurately take into account losses due to the implications and consequences of zoonotic disease. It has been reported that currently the number of humans thought to be infected is 2.4 to 17 million with further 180 million people being at risk for infection (WHO, 2007).

In animals suffering from smaller fluke burdens, the clinical effect may be minimal and the loss of productivity is difficult to determine, or to differentiate from other cause such as nutritional deficiency. The effect of fascolosis is not limited to daily gain and it is reported that infected ewes have a delayed first oestrous cycle and that heifers treated for trematodes as well as nematodes had higher condition scores and weight gains at pregnancy diagnosis as well as higher rates of oestrous cycle. In cows a reduction in milk yield and quality, especially of the solids-not-fat component may be present, during winter months (Steyl, 2010).

2.10.2 Public Health Importance

Human cases of fascioliasis have been reported in South America, Europe, Africa, Australia and the Far East with an estimated 2.4 million cases worldwide. The number of people infected with Fasciola hepatica has increased significantly since 1980. Several geographical areas have been described as endemic for the diseases in humans. Humans acquire the infection through the ingestion of metacercaria that are attached to

certain aquatic plants and vegetables. Infection may also be acquired by the consumption of contaminated water, or the ingestion of food items washed with such water. Symptoms and signs usually subside as parasites reach the biliary duct (their final habitat). But some patients may continue to have abdominal symptoms, hepatomegally and jaundice. Extensive liver damage may eventually result in cirrhosis with a shrunken liver and portal hypertension (Cilla *et al.*,2002) ; (Bayu *et al.*, 2005).

In Ethiopia, fascioliasis is mainly an animal disease, causing a great economic burden in the highland areas of the country. There are only a few reported cases of the disease in humans and four cases of human fascioliasisis reported in Gondar town, northwest Ethiopia (Bayu *et al.*,2005).

3. Conclusion and Recommendations

Ovine fasciolosis is an economically important parasitic disease of sheep in tropical and subtropical countries that limit productivity of animals and is caused by fasciolidae, which are trematode of the genus *Fasciola*. It causes public health problems as humans can be infected from accidental ingestion of parasite eggs/larvae passed into the environment with faeces from definitive hosts. It remains a serious economic and public health problem in the world. Fasciolosis is an important limiting factor for ruminant production and causes several economic losses due to morbidity and mortality and also due to liver condemnation thereby contributing to loss in productivity of livestock industry in Ethiopia. Therefore, it is very important to support and implement control programmes so as to prevent further spread of the disease. Advances in knowledge and development/design of control tools for Fasciolosis including diagnostics and vaccines provide an excellent prospect for improved control programs.

Based on the above conclusion the following recommendations are forwarded.

- Education of the farmers should be carried out about the management system of their animals to minimize its risk of occurrence in their livestock population.
- Drainage of swampy area is also important in the reduction of the intermediate host.
- Applications of mulluscicide drugs are important in the control of the intermediate hot factors and its indirect economic loss.
- Anthelmintics treatment with appropriate flukicidal drugs should be practiced twice a year; improved before and after rainy seasons to eliminate fluke burden of the host animal and minimize pasture contamination by fecal egg shedding thus interrupting the life cycle.

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