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Prevalence of Ovine Fasciolosis in Ethiopia: A Review

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Abstract: Fasciolosis is one of the major constraint factors for ovine production development in Ethiopia by inflecting direct and indirect loss at different parts of the country. Ovine fasciolosis in Ethiopia annually losses estimated at 48.4 million Ethiopian birr due to morbidity, mortality, productivity (weight loss and reproductive wastage) and liver condemnation at slaughter. 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. Ovine fasciolosis is an economically important parasitic disease of sheep caused by trematodes species of the genus *Fasciola*, which migrate in the hepatic parenchyma and establish and develop in the bile ducts. The two species of the greatest veterinary importance are *Fasciola hepatica* and *Fasciola gigantica* and snails are their intermediate hosts. The snails of the genus *Lymnae* are mainly involved as an intermediate host in the life cycle of fasciolosis. 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 by drainage or by using correct anthelmintics.

Key words: Fasciolosis · *Fasciola hepatica* · *Fasciola gigantica* · Prevalence · Snail

INTRODUCTION

In Ethiopia, agriculture is the dominant sector of the economy and accounts for over 50% of the gross domestic product (GDP), 30% of the export revenue and provides livelihood for over 80% of its inhabitants. At present four-fifths of the Ethiopia population is engaged in agriculture as small holder farmers who are responsible for 95% of the total agricultural output. Among this livestock provides about 35% of agricultural products [1]. In Ethiopia, particularly the livestock sub sector shares about 65% of the potential agricultural land but contributes only 10% to the GDP [2]. The animal species important today for food and agriculture production are consequence of processes of domestication that have been continuing for almost 1200 years. These resulted in development of genetically distinct breeds through the combined response of selection pressures by human communities in identifying and making greater use of preferred genotypes amongst the available animals overtime and the selection pressures imposed by the environmental stress factors which operate through differential reproduction and survival of parent animals and their offspring to realize high adaptive fitness of the breed in the environment. This diversity is largely due to Ethiopia's geographical location near to the historical entry point of many livestock population, the size and diversity of agro-ecological zones, cultural condition, the huge population size and wide range of production systems [3]. Ethiopia has a largest livestock population in Africa, which is estimated to be around 34-40 million total livestock population, out of 12% of small ruminants are found in Ethiopia with the largest livestock in Africa including more than 18,075,580 sheep with livestock ownership currently contributing to the livelihoods of an estimated 80% of rural population [4]. In the arid and semi-arid extensive grazing areas in the North eastern, Eastern, Western as well as Southern lowlands sheep are managed under migratory pastoral production systems. However, the full exploitation of these huge resource was hindered due to a combination of factors such as drought, poor genetic potential of

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traditional system of husbandry and management as well as the presence of numerous diseases [5]. Sheep play a major role in sustaining house hold stability by serving as sources of meat, milk, skin, manure and generate income. Besides they play traditional, social and religious roles [6]. Production of sheep is an attractive agricultural enterprise for Ethiopian farmers because of the relatively low cost of breeding stock, the high productive rate of sheep, simply manageable by women and children and the source of cash income. Breeding of Sheep requires minimal inputs and maintenance costs to live in various conditions, from desert to humid rain forest [7]. In Ethiopia sheep are the dominant livestock providing up to 63% of income and 23% of the food subsistence value obtained from livestock production [8]. Regardless of the large size of sheep population and high potential of productivity in the country, the contribution of this sub-sector to national economy is relatively low due to multitude of constraining factors including drought, malnutrition, parasitic diseases, improper health care and other management problems [9]. Parasitic disease possesses a serious health trait and limits the productivity of livestock due to the associated morbidity and mortality. There are many numbers of parasitic disease are incriminated to play a detrimental role in hampering sheep production. Gastro intestinal tract helminthiasis is considered as one of the major parasitic problem that constrained livestock improvement programs in Ethiopia. One of the helminthiasis that causes direct or indirect losses especially in domestic ruminants is fasciolosis [10]. Many researchers have reported the prevalence of ovine fasciolosis in and around International Livestock Center for Africa (ILCA) Debre Berhan Branch Research Station and Debre Berhan sheep breeding and forage production. A prevalence rate of 100% by Njau *et al.* [11], 54.17% by Fikadu [12] and 48.21% by WHO [13] indicated that fasciolosis is one of the causes for mortality of lambs in the center. Fasciolosis is an economically important disease of domestic livestock, in particular cattle, sheep and occasionally man. The disease is caused by digenean trematodes of the genus *Fasciola* commonly referred to as liver flukes. The two species most commonly implicated, as the etiological agents of fasciolosis are *Fasciola hepatica* and *Fasciola gigantica.* In Ethiopia, both *F. hepatica* and *F. gigantica* have the greatest risk occurred in areas of extended high annual rain fall associated with high soil moisture and surplus water, with risk diminishing in areas of shorter wet season and or lower temperatures. For *F. gigantica* regions in the high lands of Ethiopia and Kenya were identified as unsuitable due to in adequate thermal regime. Average annual mean temperatures of 23°C or above were found to correspond to areas below the 1200 m elevation limit of *F. hepatica* in Ethiopia [14]. The disease is responsible for considerable economic losses in the ovine industry mainly through mortality, liver condemnation, reduced production of meat, milk and wool and expenditures for anthelmintics [15]. Since fasciolosis is major parasitic disease of small ruminants, an estimate of economic loss due to ovine fasciolosis in Ethiopia highlands was made based on available data on mortality, weight loss, reduced reproduction efficiency and liver condemnation at slaughter. The economic effects of fasciolosis where identified and models for estimating the financial loss presented. Ovine fasciolosis losses were estimated at 48.4 mill. Birr per/yr of which 46.5, 48.8 and 4.7% were due to mortality, productivity or weight loss and reproductive wastage and liver condemnation respectively. These losses can be reduced substantially by fasciolosis control programs that may be including the use of antihelmentics, grazing management and nutritional supplementation [16]. Therefore, the object of this seminar paper is to review the general characteristics of ovine fasciolosis, to highlight overview of the occurrence of ovine fascioliasis in Ethiopia and to indicate some risk factors for the spreading of the disease.

Fasciolosis: Fasciolosis is a disease of sheep, goat, cattle [17] and occasionally affects humans, thus considered as a zoonotic infection [18, 19]. According to Dargie [15], the taxonomic classification of the organisms that cause fasciolosis is presented as follows:

Phylum: Platyhelminthes,
Class: - Trematoda,
Sub- class: -Digenea,
Super Family: -Fasciolidea,
Genus: -Fasciola,
Species: - *Fasciola hepatica* [20] and *Fasciola gigantica* [21]

Fasciolosis is an old trematode found in prehistoric human populations of the Stone Age, living at the end of the Mesolithic period, 5000-5100 years ago and the Neolithic [22, 23] a period marked by the domestication of animals and the development of agriculture, among other characteristics. Fascioliasis is a worldwide zoonosis caused by *Fasciola* spp. and is often neglected despite its common occurrence in endemic areas and it is caused by two species of parasitic flat worms or trematodes that

mainly affect the liver [24, 25]. *Fasciola hepatica* was identified by Linnaeus [20]. "*Fasciola*" in Latin means fillet or small bandage and "*hepatica*" meaning liver [26]. It was confirmed that a snail infected with a single miracidium can produce about 4000 metacercariae. Fasciolosis is also considered as an important limiting factor for ovine and bovine production. 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 agricultural sector worldwide, with over 600 million animals' infected. Evidence suggests that sheep and cattle may be considered as the main reservoir host species, pigs and donkeys being secondary [27]. In tropical regions, fasciolosis is considered as the single most important helminth infection of sheep and cattle with prevalence rates of 30-90% in Africa, 25-100% in India and 25-90% in Indonesia. The disease has zoonotic importance and WHO has included it in list of neglected tropical diseases [28].

Biology and Life Cycle of Fasciolosis: The life cycle of *Fasciola* spp. is a typical of Digenetic trematodes. The life cycle of *Fasciola* species occurring in any particular area; the following conditions must be satisfied. There must be an initial presence of infected final hosts, the intermediate snail host must be present and there must be an opportunity for transmission of the parasite from the final host to the snail habitat and for its return. Infection with fasciolosis is usually associated with grazing wet land and drinking from the snail infesting watering places [29]. 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. At this stage, eggs are still not embryonated, further development to maturation taking approximately two weeks. 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 22-26°C and little development occurs below 10°C [5]. 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 intermediate host (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 [30].

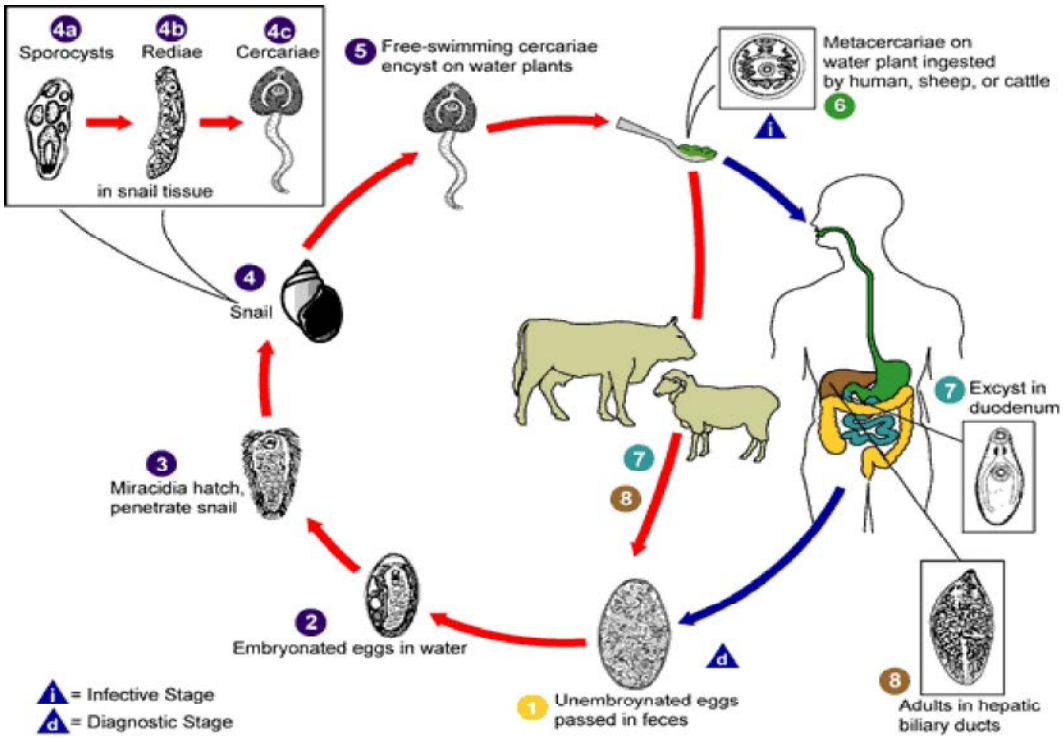

Fig. 1: The life cycle of *Fasciola* species [31].

Epidemiology: Epidemiology is the study of disease in populations and of factors that determine its occurrence; the key word being populations. Veterinary epidemiology additionally includes investigation and assessment of other health-related events, notably productivity [32]. The study of the epidemiology of fasciolosis in livestock encompasses the factors that affect the prevalence and intensity of infection with the parasite and how these impact on animals both in terms of clinical disease and of the economic effects of productivity losses. 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 [33-35]. In Ethiopia, both species coexist at different altitudes and transmitted by the snail called *Lymnea truncutula* and *Lymnea natalenesis*, respectively. *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 [30]. In Ethiopia both species have the greatest risk occurred in areas of extended high annual rainfall associated with high soil moisture and surplus water, with risk diminishing in areas of shorter wet season and or lower temperatures. Average annual mean temperature s of 23°C or above were found to correspond to areas below the 1200m elevation limit of *F. hepatica*in Ethiopia [36]. 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 [37]. Water land and blocked drainage are hazardous for grazing stock. 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 [29].

Transmission: Transmission occurs by ingestion of contaminated grass or hay and drinking from the snail infesting watering places [38].

Pathogenesis of Fasciolosis: 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 [39]. During the parenchyma stage of the infection, liver damage caused by the migrating flukes compromise liver function, which in sheep is reflected in a decline in plasma albumin concentrations, attributed partly to reduced rate of synthesis and partly to an expansion of the plasma volume. The hypo-albuminemia is associated with plasma volume expansion caused by liver damage and reduced albumin synthesis [4, 40]. 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 [39]. The biliary 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 and in biliary ducts, flukes mature, feed on blood and produce eggs. Hypertrophy of biliary ducts associated with obstruction of the lumen occurs as a result of tissue damage. Thus, a progressive loss of plasma albumin occurs in all infected host species, starting from around the time the fluke commences blood feeding [41].

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 [29]. 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 [29]. 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 [39].

Control and Prevention: Flock and pasture management: Fencing off snail habitats would help animals to avoid Contact with infected snails [42-44]. The most desirable and efficient method of fasciolosis control is improve drainage. If this is so it is used as; long term prevention is assured by eliminating snail habitats [42]. Mixed grazing of sheep and cattle was one of the causes of cross contamination, so continues follow up and treatment of cattle were necessary. Rotational grazing management is also a recommended means of control fasciolosis [44].

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 sheep 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 [45].

CONCULUSION AND RECCOMMENDATION

Fasciolosis is one of the major factors inflecting direct and indirect loss for livestock development in Ethiopia. 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 there by contributing to loss in productivity of livestock industry in Ethiopia. The two species of the greatest veterinary importance are *F. hepatica* and *F. gigantica* and snails are their intermediate hosts. Based on the above conclusion the following recommendations are forwarded. Education of farmers, prevention rather than treatment, reduction in the number of snail by drainage, fencing and use of molluscicides. 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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