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Sheep and Goat Lungworms: A Review

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Abstract

Livestock production is a major component of the agrarian economy in developing countries and goes well beyond direct food production. Sales of livestock and their products provide immediate cash income to farmers and foreign exchange to the endowed countries. Among the predominant livestock species; sheep play an important role in the socio-economic development of the majority of African countries. Control of these parasites is therefore, essential for releasing the potentials of sheep production. For the proper control to be knowledge of parasitic diseases and their dynamics must dangerous to lay down rigid rules of their control which are applicable for all regions. For these reasons a study of epidemiology of each parasitic disease should limited small areas. Therefore, to increase the potential of small ruminant production and to get the maximum benefits from them prevention and control of lungworm is very important. Although environmental factors are conductive for lungworm infections in sheep and lungworm infection is considered as an important disease.

Keywords: Livestock production, parasitic diseases, lungworm infections.

Introduction

Livestock production is a major component of the agrarian economy in developing countries and goes well beyond direct food production. Sales of livestock and their products provide immediate cash income to farmers and foreign exchange to the endowed countries (ILCA, 1995). In Ethiopia, agriculture is the mainstay of the country and also the major resources of employment and income. About 85% of population live in rural areas and are primarily engaged in agriculture and related activities. Thus agriculture, directly or indirectly forms an important components of livelihood of more than 60 million people in the country (Atesmachew *et al.*, 2006).

Among the predominant livestock species, sheep play an important role in the socio-economic development of the majority of African countries. They supply more than 30% of domestic meat consumption and generate cash income from export of meat, mainly as live animals and skin and it also provides wool, milk, manures for the soil and serves as investment for the farmers. Hence an increase in sheep production and also to increase export earnings (Fletcher and Zelalem, 1991), however, several factors especially constrains their full utilization. Among these diseases, respiratory diseases have been identified as an important problem of sheep in the highlands of Ethiopia for the last two to three decades. It may account for up to 54% of the overall mortality of in central highlands of Ethiopia (Mukasa- Nugraw *et al.*, 2000).

Helminthes parasites of ruminants are ubiquitous and prevalent, with many tropical and sub-tropical environments of the world providing nearly perfect conditions for their survival and development. However, the clinical signs they cause in infected animals can be less obvious than signs of other of other livestock diseases partly for this reason,

infections with gastro-intestinal and other helminthes parasites are among the most neglected areas of veterinary in much of the developing world. It has however been established that high prevalence rates of infection with less obvious sign associated with poor production and unthriftness (Hansen and Perry, 1994).

Among the respiratory diseases endoparasites such as *dictyocaulidae* and/or certain *metastrongylidae* are known to exist in east Africa (Ethiopia, Kenya and Tanzania) and South Africa (Alemu *et al.*, 2006). Endoparasites including *Dictyocaulus filaria*, are major causes of death and morbidity on farms in Ethiopian highlands. Up to half of all sheep deaths and morbidity on farms in Ethiopia highlands are caused by pneumonia and endoparasites (ILCA, 1995).
The production losses due to helminthes is associated with direct direct consequences of clinical and sub-clinical infections resulting in low productivity due to stunted growth, reduce weight gain, poor feed utilization or loss due to mortality or indirect loss associated with cost of treatment and control measures (Ayalew, 1995; Desalegn, 1999).

Control of these parasites is therefore, essential for releasing the potentials of sheep production. For the proper control to be knowledge of parasitic diseases and their dynamics must dangerous to lay down rigid rules of their control which are applicable for all regions. For these reasons a study of epidemiology of each parasitic disease should limited small areas (Radostitis *et al*., 2006). Therefore, to increase the potential of small ruminant production and to get the maximum benefits from them prevention and control of lungworm is very important.

Although environmental factors are conductive for lungworm infections in sheep and lungworm infection is considered as an important disease.

Therefore, the objectives of this study were;

- To determine prevalence of ovine lungworms infection

Literature Review

Lungworm infection

Lungworms are used for a variety of different groups of nematodes, some of which also have names; what they have in common is that they migrate to the hosts lungs or respiratory tracts, and cause bronchitis or pneumonia. The lungworm will damage the air ways or lung tissue by inducing an inflammatory reaction inside the tissue. Ultimately the parasite survives and reproduces in the respiratory tissue (Kahn, 2005).

The common names of lungworm infection are verminous bronchitis or verminous pneumonia. It is a chronic and prolonged infection of sheep is characterized clinically by respiratory distress and pathologically by bronchitis and bronchopneumonia and is caused by nematode parasites. The lungworms in the super family *trichostrongyloidae* include several species in the genus *dictyocaulus* which infest hoofed animals, include most common domestic species. Different species are found in cattle deer (*Dictyocaulus viviparus*), Donkey and Horses (*Dictyocaulus arnfeldi*) and sheep and goats (*Dictyocaulus filaria, Protostrongylus rufescens* and *Mullerius capillaris*) (Kimberling, 1998).

Etiology

Lungworm infections in different species caused by different nematodes, but the common causes of verminous pneumonia in sheep are *D. filaria, P. rufescens* and *M. capillaris.* Although mixed infections may occur. *D. filaria* predominates in most outbreaks and it belongs to super family *Trichostrongyloidae* while the latter two belong to *Metastrongylidae*, which have direct and indirect life cycles respectively (Urquhart *et al.*, 1996).

Epidemiology

Infestations of animals with lungworms have a very wide distribution depending on climatic conditions. The larvae require moisture for the development and a temperature of 27^{o}c. they reach the infective stage in six or seven days. Disease is transmitted by coughing and a source of infection is infected pastures and water. L3 larvae for several months may survive in the bronchi of infected animals, particulary yearlings (Upadhayay, 2005).

Most outbreaks of Verminous pneumonia occurred during the cool season's especially autumn and early winter, due to the larvae stages of causative worms tolerate and prefer low temperature. The larvae of *D. filaria*, have considerable ability to resist cold and some will over winter even in extreme climates and it has worldwide distribution and causes serious loses but outbreak of infection, often with high mortality, occur in sheep in most temperate areas of the world.

The larvae requires moisture for development and can with stand moderately dry conditions for few days, but are able to live in moist conditions for several months and are fairly resistant to low temperature (Soulsby, 1986; Urquhart *et al.*, 1996). Animals 2 to 18 months old have higher incidence than do other age groups. Many fifth stage larvae are inhabited in their development during winter in the lungs of older animals but resume the process in the spring (Radostitis *et al.*, 2007).

In temperate areas, the epidemiology are somewhat similar to that of *D. viviparus* in both the survival of the over wintered larvae on pasture and the role of ewe as a carrier are significant factors in the presence of infection on the pasture from year to year in endemic areas. In ewes, it seems likely that the parasite is present largely as hypobiotic larvae in the lungs during each winter and mature during spring (Urquhart *et al.*, 1996). Development to L3 only occurs during the period from spring to autumn. In the lambs patent infections first occur in early summer but the heaviest infections are usually seen in autumn. In ewes, the prevalence of infection is lower and their larval output smaller. As with the other *Trichostrongloids*, it seems likely that only two cycles of the parasites occur during each grazing season (Tony, 2006; Urquhart *et al.*, 1996).

In warmer climates, were conditions are often unsuitable for survival of larvae, the carrier the carrier animals is a more important source of pasture contamination and outbreak of disease in lambs are most likely to occur after a period of prolonged rainfall round the time of weaning. Goats appear to be more suitable to infection than sheep and are thought to play a prominent in the dissemination of infection to the sheep at the time weaning (Johnston, 1998; Urquhart *et al.*, 1996). Although *D.filaria* is a primarily lungworm of sheep; it can infest and grow to maturity in cattle and can, after experimental infection, causes the death of calves (Blood *et al*., 1989).

Mullerius capillaris is by far the most common genus, and on many temperate areas such as Britannia, the eastern estates of USA and the winter rainfall regions of Australia almost all sheep carry the infection; the extensive distribution and high prevalence are partly attributable to its wide range of intermediate host (Urquhart *et al.*, 1996). The parasite is not usually found in lambs less than six months of ages. The larvae of M capillaries can resist a pair amount of drying, are most active relatively low temperature (17- 27^{o}c) and are not killed by freezing. The infective larvae can also live up to nine weeks after the death of snail (Urquhart *et al.*, 1996).

Protostrongylus rufescens, whose intermediate host range is restricted to certain species of snails, has low prevalence through its geographic range is just as wide. Additional factors which play a part in ensuring the epidemiology of this worm are, first, the ability of L1 to survive for months in the faecal pellets, and secondly the presence of L3 in the intermediate host for the life time of the mollusk. Although important in this respect are the long period of potency and the apparent inability of the final host to develop acquired immunity so that the adult sheep have the heaviest infections and the highest prevalence (Urquhart *et al*., 1996).

Economic importance

Verminous pneumonia is caused by *Dictyocaulus filaria* of small ruminants is ubiquitous of small parasitosis which has considerable economic repercussion all over the world. It is known that heavy infection by *Dictyocaulus filaria* caused unthriftness, coughing, loss of weight or reduced weight gain and respiratory system damage can be so severe to lead to the death (Bekele *et al.*, 1992).

Heavy infection weakened the lungs and assists in reducing the general health and resistance of the host (Soulsby, 1982). The cost of retarded growth diminished utility of infected pastures and cost of prevention, diagnosis and treatment of the disease are so important (Urquhart *et al.*, 1996).

Life cycle

The general life cycle of lungworm begins with an ingestion of infected larvae. The infected larvae then penetrate the intestinal wall where larvae migrate in to lungs through the blood stream and reside in the lungs until the development of adult larvae, after that the eggs of the adult larvae hatch to produce lungworm larvae. While the eggs that reside in the lungs are coughed up and then ingested back into the stomach then it passes to the rectum with faeces (Kahn, 2005).

The life cycle of *D. filaria* is direct. The egg may hatch in the lungs, but are usually coughed up and swallowed, and hatch while they pass through the alimentary tract of host. Some eggs may expel in the nasal discharge. The L1 migrates up to the trachea, are

swallowed and pass out in the faeces. The larvae are unique in that they are present in fresh faeces, are characteristically sluggish, and their intestinal cells are filled with dark brown food granules. In consequences the periparasitic stages do not require feed (Woldesenebet and Mohamed, 2012). Under days, but usually takes longer in the field. L3 stage reached in five days, but usually takes longer in the field. The L3 leaves the faecal pat to reach herbage either by their motility or through the agency of the fungus pilobolus. After the ingestion, L3 penetrates the intestinal mucosa and pass to the mesenteric lymph node where they moult. Then L4 travels via the lymph and blood vessels to the lungs and break out of capillaries in to the alveoli about one week after infection. The final moult occur in the bronchioles a few days later and the young adults then move up the bronchi and mature. The prepatent period is five weeks (Johnson, 1998; Soulsby, 1986 and Urquhart *et al.*, 1996).

The life cycle of *Metastrongylida*e is indirect, since larvae can only mature in an intermediate host. The eggs develop in the lungs of the host and the first stage larvae passes in to the faeces. For the further development in ti infective stage requires 12 to 14 days and two ecdyses are the larvae pass to the lungs of the host via the mesenteric lymphatic glands, in which the third ecdyses takes place. In *protostrongylus rufescencs* transplacental transmissions occurs and larvae can be found in the liver and in the lungs of fetuses and new born lambs (Soulsby, 1986).

Pathogenesis

The pathogenesis effect of lungworm depends on their location within the respiratory tract, the number of infective larvae ingested, the animal immune status, the nutritional status and the age of host (Fraser, 1991 and Blood *et al*., 1986). Larvae migrating through the alveoli and bronchioles produce an inflammatory response, which may block small bronchi and bronchioles with inflammatory exudates. The bronchi contain fluids and immature worms; latter adult worms and the exudates they produce also block the bronchi. Secondary bacterial pneumonia and concurrent viral infections are often complications of *dictyocaulosis* (Howard, 1993; Kahn, 2005 and Urquhart *et al.*, 1996).

Inflammatory process spreads to the surrounding per bronchial tissue and exudates pass back in to the bronchioles and alveoli causing atelectasis and catarrh or pneumonia (Soulsby, 1986). The young larvae passing through the intestine may irritate mucosa and cause the diarrhea and *D. filaria* is the most pathogenic of ovine lungworms (Kimberling, 1998).
In *M. capillaries* and *P. rufescens* infections, chronic, eosinophilic, granulomatous pneumonia seems to predominate; the reaction is in the bronchioles and alveoli that contain the parasites, their eggs or larvae. They are surrounded by macrophages, giant cells, eosinophiles and other inflammatory cells, which produce gray or beige plaques (1-2mm); greenish nodular lesions may also develop. The effect of these lesions in sheep is minor, perhaps the because of the predominantly subpleural location. This infection represents the lower end of the pathogenic spectrum for lung worms (Kahn, 2005).

In *P. rufescens* infection the affected alveolar and bronchiolar epithelium is desquamated, a blood vessel takes place in the area. The result is a small focus of lobular pneumonia roughly conical in shape and yellowish gray in color. It is suggested that when the larval stages of *M. capillarie*s migrated through the wall of small intestine, the resulting damage may predispose to enterotoxaemia (Denbarga *et al.,* 2013).

Clinical sign

The clinical sign of lungworm infection may range from moderate, coughing, to marked increase in respiratory rates accompanied by production losses (FOA, 1994). The disease is most frequently seen in young animals. This clinical manifestation may vary from animal to animals with the number of infecting worms (Kimberling, 1998).

The most common signs are coughing and unthriftness which is prevalent in endemic areas is usually confined to young animals. In more severe case dyspnea and tenacious nasal discharge are also present. This signs may be accompanied by diarrhea and anemia due to concurrent gastro-intestinal trichstrongylosis or fasciolosis (Urquhart *et al.*, 1996).

Necropsy finding

At necropsy, most lesions are found in respiratory system with infection by *D. filaria*, the bronchi, especially those of diaphragmatic lobes, contain tangled masses of worm mixed with frothy exudates. Atelectatic and infected lobules often surround or extend ventrally from infected bronchi. Bronchioles infected with *P. rufescens* often are closed with worms and exudates and consequently affected lobules may

be atelectatic and infected. Lungs infected with *M. capillaris* contain red, gray or green nodules 1 to 2 mm in diameter. These lesions, located in sub-pleura of diaphragmatic lobes, vary in consistency, number and shape (Kimberling, 1998). The nodules in the lungs as the result of *M. capillaris* infection have the feeling of leads hot. Infection of goats by *M. capillaris* leads to a diffuse infection quit different to the nodular reaction in sheep and to the production of an intestinal pneumonia (Blood *et al.,* 1989).

Diagnosis

Diagnosis is based on history, clinical sign, epidemiology, presence of first stage larvae in feaces, and necropsy of animals in some herd or flock (Urquhart *et al.,* 1996).

A convenient method for recovering of larvae is in the vermin technique in which faeces (25kg) are wrapped in cheese cloth and suspend or place in water container in conical flask. The water at the bottom of flask is examined for the larvae after four hours, in heavy infection; may be present in 30 minutes. The larvae (L1) of *D. filaria* differentiated from other two lungworms by having characteristic cuticular knob at the anterior extremity, large size, dark brown granular intestinal inclusion, and strait tail. The larvae of *P. rufescens* and *M. capillaris* differentiated by their characteristic feature at the tip of their tail. *P. rufescens* has a wavy outline at the tip of its tail, but devoid of dorsal spine, on the other hand *M. capillaris* has an undulating tip, dorsal spine, and they are smaller in size (Howard, 1993; Urquhart *et al.*, 1996).

Adults of *D. filaria* are easily found in trachea and bronchi at the necropsy but the finding immature stages usually necessitates dissection of pulmonary tissue and allowing it to set in physiological saline (Howard, 1993). In case *M. capillaris*, those larvae which reach the lungs of the animal remain in the parenchyma and become encysted in the fibrous nodules and such nodules may not contain adults. Febrile eggs may not be deposited in the air passage. For this reason, the number of larvae in the feaces is often no indication of the degree of infestation (Radostitis *et al.,* 2005).

Prevention and control

According to Urquhart *et al* (1996), specific control measures should be applied in that flock should be annually treated with suitable antihelimentics in late pregnancy. The ewe and lambs should them be grazed on pasture which, in temperate areas at least, should not have been used by sheep during the previous year. Animals must be removed from infected ground, place on dry pastures and supplied with clean drinking water. Draining and resting of pasture during dry summer kill larvae that readily survive cold winter. Their feaces should not be used for fertilizing lands on which crops for green feeding are grown. Moist pastures must be avoided, while dry pastures are fairly safe because the infective are not very resistant to dryness (Uphadhayay, 2005).

The larvae rarely live through the winter in the cold climates and older animals, which show no symptoms, usually carry on the infection. Adult should therefore not be grazed together with the young stock (Urquhart *et al.,* 1996). Grazing management should be improved, especially to provide clean pastures for the young. Artificial immunization has been markedly successful using X-irradiated infective larvae and a commercial vaccine is now available. This vaccine which consists of two doses of thousand irradiate larvae given at the interval of a month has been used in hundreds of thousands of animals in great Britain and various countries in Europe and USA with outstanding success (Soulsby, 1986).

Conclusion and Recommendation

Livestock production is a major component of the agrarian economy in developing countries and goes well beyond direct food production. Sales of livestock and their products provide immediate cash income to farmers and foreign exchange to the endowed countries The respiratory nematodes identified are *Dictyocaulus flaria, Mullerius capillaris* and *protostrongylus rufescens*. Control of these parasites is therefore, essential for releasing the potentials of sheep production. For the proper control to be knowledge of parasitic diseases and their dynamics must dangerous to lay down rigid rules of their control which are applicable for all regions. For these reasons a study of epidemiology of each parasitic disease should limited small areas. Therefore, to increase the potential of small ruminant production and to get the maximum benefits from them prevention and control of lungworm is very important.

Therefore, based on the present findings, the following recommendations are forwarded;

- ❖ Regular strategic deworming of the whole flock with broad spectrum antihelimentics should be undertaken.
- ❖ Animals should not be allowed to have access to moist and swampy area.
- ❖ Additional shed should be provided to sheep to make well nourished and good body condition.
- ❖ Farmers who keep small ruminants should advise not to keep their sheep in extensive management system.
- ❖ In the rainy weather conditions are intermediate host, snails and slugs, become active. Therefore, there should be prohibition of sheep to graze early in the morning and evening.

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