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A Review on Gastrointestinal Nematodes in Small Ruminants

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Abstract

Small ruminants are important source of income for agricultural community and are one of Ethiopia's major sources of foreign currency through exportation of live animals, meat and skin. Internal parasites are an important cause of disease and lose of production in small ruminants. Gastrointestinal nematodes are recognized as a major constraint to both small and large-scale small ruminant production in developing countries. These could be harmful to the health of infected animals in different regions and causes economic losses due to mortalities, reduce weight gain and other production losses. The gastrointestinal nematode parasites are found livestock health problems including for small ruminants and are responsible for economic losses due to reduced production, morbidity and mortality. Therefore, Strategic treatment of small ruminants with anthelmintic, parasitic control and prevention should be practiced in the study area to minimize the impact of gastrointestinal nematodes on the health of animals.

Keywords: Gastrointestinal nematodes; Small ruminants

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Introduction

Livestock production in Ethiopia's agricultural economy is an important sector providing a significant contribution to gross domestic and export products and raw materials for industries [1]. Among this livestock population, small ruminant constitute a major part [2]. There are about 25.5 million sheep and 24.06 million goats in the country playing an important role in the livelihood of poor farmer's resource [3]. Small ruminants are important source of income for agricultural community and are one of Ethiopia's major sources of foreign currency through exportation of live animals, meat and skin [4]. Small ruminants play a great role in the economy of the country, as sources of meat, milk, fibre, cash income and skin and they can live in extreme climatic conditions, in which they can use herbage, which is unsuitable for large ruminants and they require few labour-intensive inputs [5]. Internal parasites are an important cause of disease and lose of production in small ruminants [6]. Gastrointestinal nematodes are recognized as a major constraint to both small and large-scale small ruminant production in developing countries [7]. These could be harmful to the health of infected animals in different regions and causes economic losses due to mortalities, reduce weight gain and other production losses [8]. In developed world, the greatest component of impact by these nematode parasites is probably found in the cost of control. But their impact is greater in the sub-Saharan Africa in general and Ethiopia is particular due to ecological factors suitable for diversified hosts and parasite species the epidemiology of gastro-intestinal (GIT) parasites in livestock varied depending on the local climatic condition, such as humidity, temperature, rainfall, vegetation and management practices. These factors largely determine the incidence and severity of various parasitic diseases in a region [9]. Small ruminants are the host to different species of gastrointestinal nematodes. The epidemiology of nematodes is determined by several factors governed by parasite host-environment interactions. The major risk factors can therefore be broadly classified as parasite factors, host factors and environmental factors [10]. *Haemonchus, Trichostrongylus, Bunostomum* are highly prevalent in small ruminants of warmer climates, whereas *Teladorsagia, Nematodirus and Cooperia* are responsible for severe diseases in small ruminants of temperate areas. This is, because of the fact that the free-living stages of these parasites are strongly affected by moisture conditions of the soil and the climate [11]. Gastrointestinal nematode infection is one of the major problems of the disease that difficult to easily detected and prevented by smallholder farmers and pastoralists because of subclinical nature of the infection. Thus subclinical nematode infections are responsible for serious economic losses due to reduce production, suppress immunity, morbidity and mortality [12].

Therefore, the objectives of this study were

- To review gastrointestinal nematode in small ruminants.
- To review the influence of host related risk factors such as age, sex, species and body condition on the occurrence of gastrointestinal nematodes.

Literature Review

Parasites and epidemiology

Gastrointestinal nematodes are the most damaging parasites in small ruminants. Helminthis are most frequently a problem in young animals reared in permanent animals' pasture, although cases of severe diseases may occur in adult animals kept in sub urban paddocks and subjected to overcrowding and poor management [13]. Many factors linked to this relationship determine the type and severity of infection. Host-related factors are age, immunity, sex, species and genetic resistance; parasite-related factors include life history, duration of the histotropic phase, survival of larvae in the environment and their location in the host. The interactions between host and parasite mainly determine the potential for disease to occur and the course of infection, whereas the interaction between host-environment and parasite-environment influence disease transmission [14]. In Ethiopia, the reported coproscopical and postmortem prevalence of small ruminant GI nematode infections range from 15.7% to 100% [8]. Such infections were due to diverse nematode genera both in sheep and goats. These include Haemonchus, Trichostrongylus, Oesophagostomum, and others [15]. According to Asmare et al. [16], *Haemonchus contortus* is the most prevalent parasite in sheep and goats and thus warrants special attention in GI parasite control programs. Indeed it is one of the most pathogenic nematode parasites in ruminants implicated in widespread morbidity and mortality of sheep and goats.

Morphology

Concerning the morphology of nematodes, the body is elongated, cylindrical and tapered at the extremities. The body is also unsegmented and covered with cuticle which is thick and continuous with the cuticular lining of the buccal cavity, the oesophagus, the rectum and the distal portions of the genital ducts [17].

General life cycle of gastrointestinal nematodes

Most GIT nematodes have the similar life cycle. Most of them are oviparous, and the eggs are similar and very characteristic type, and immediate transfer of infection from one host to another does not occur. The life cycle of the nematode can be direct or indirect. The sexes are usually separated. However, all the economically important gastrointestinal parasites of small ruminants have direct life cycles, requiring no intermediate hosts [18]. The mature parasites breed inside the host and lay eggs which pass through the host and are shed in the faeces. After the eggs pass out of the host, they hatch into first-stage larvae (L1) and moult into second-stage larvae (L2) under appropriate conditions of temperature and humidity. The larvae need moisture to develop and move. During this time the larvae feed on bacteria, (L2) moult into infective larvae (L3), which migrate out of the faeces and up blades of grass. When an animal (sheep or goat) grazes, they may ingest parasite larvae along with the grass. Normally L3 can moult into fourth-stage larvae (L4) within 2-3 days, remaining for further 10-14 days to moult into young adult parasites [19] **(Figure 1)**.

Effect of nematode parasites on animals

Effect of larval stages on the host: Considerable damage is caused by fourth-stage larvae (L4) of abomasal parasites (*Haemonchus, Ostertagia* and *T. axei*). The L3 enter the mucous membrane in the wall of the abomasum within six hours of entering the host and will usually stay in the mucous membrane for about two to three weeks. If large numbers of *Haemonchus, Ostertagia* and *T. axei* larvae enter the abomasum, the host will be affected. The larvae of *Trichostrongylus* in the small intestine may cause severe damage to the intestinal mucous membrane with similar effects. This development may be accompanied by destruction of the mucous membrane, the extent of which depends on the numbers of inhibited larvae emerging. The (L4) of *Haemonchus* is a blood sucker in the aboamasum. Animals infected with large numbers of larvae therefore may suffer from anemia before the parasite eggs can be detected in the animal's faeces [20].

Effect of adult worms on the host: Infections with gastrointestinal nematodes usually involve several different species of parasites, which may have an additive pathogenic effect on the host. The pathogenic effect of gastro-intestinal parasites may be sub-clinical or clinical. Young animals are most susceptible. Severe blood and protein loss into the abomasum and intestine due to damage caused by the parasites often results in oedema [18].

Diagnosis of nematode infestation

Clinical diagnosis of GIT nematodes of sheep and goats needs history of the area, history of anti-helminthes treatment, grazing history, age of animal and clinical signs manifested by the disease. However, GIT nematodosis share common clinical manifestations with other diseases laboratory diagnosis is important. The diagnosis of nematode parasites of small ruminants is based

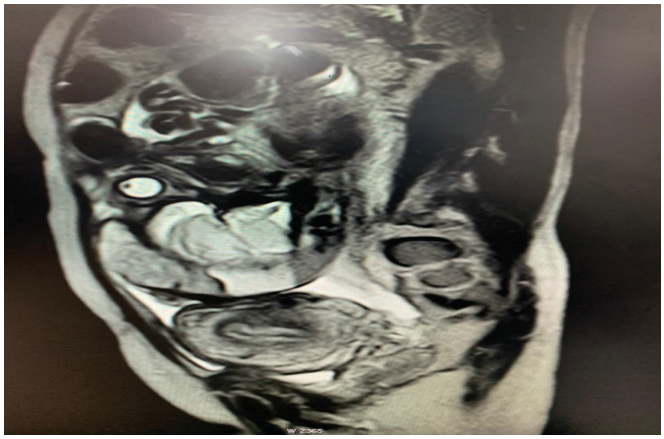

Figure 1 General life cycle of nematode parasites.

on demonstrating the presence of their eggs, or larvae, in fecal sample or the presence of parasites recovered from the digestive tracts of the animals [21].

Pathological impact of gastrointestinal nematodes

The type and degree of clinical manifestation are also influenced by factors, such as the species of worms involved, the present worm burden, and the plane of nutrition and reproductive/ immunological status of the host animal [22]. Pasture larval levels increase markedly during the summer months when conditions are optimal for rapid development of eggs to L3. There is also increase evidence that may infective L3 ingested during autumn show a degree hypobioxis under ileum in the large intestinal mucosa until the following spring [23]. Effects of nematodes on the host include loss of condition, rough coat, diarrhoea, bottle jaw, anaemia and death. Moreover, clinical signs such as diarrhoea, weight loss and loss of appetite can be indicators of nematode infection, especially in young animals. Parasitism by nematodes results in the loss of host protein like plasma and frequently erythrocytes exfoliated epithelial cells and mucus. A Pale to grayish colouring of mucus membranes like eye lids, gums, and vulva, can be seen due to lack of red blood cells. Nematode parasites also affect digestion, energy and nitrogen utilization in the parasitized animal and reduce the performance of the host [13].

Economic importance of gastrointestinal nematodes

The livestock industry plays a major role in the economies of many

developed and developing countries. The production of livestock animals provides food, animal products (e.g. leather, hides and wool), income, employment, a source of organic fertilizer and biogas as well as draught and work power [14]. Helminth infections are an important group of diseases in grazing ruminants affecting their health conditions and productivities [24]. Parasitic gastrointestinal nematode infections aremajor economic importance resulting in heavy production losses in small ruminants than cattle [13]. Internal parasitism of sheep and goats is the most significant medical problem affecting animal health and production throughout much of the world [25]. Gastrointestinal parasitism is associated with mortality and morbidity [26]. The current financial and agriculture losses caused by parasites have a substantial impact on farm profitability. For example, the annual cost associated with parasitic diseases in sheep and cattle in Australia has been estimated at 1 billion dollars and are proposed to be tens of billions of dollars worldwide, according to the sales of anti-parasitic compounds by pharmaceutical companies, excluding production losses [14].

Treatment

Small holder farmers and pastoralists of Ethiopia practice varying degrees of parasite control in their livestock. These practices range from the use of anthelmintic drugs of varying quality, to the use of traditional medicines [18]. However, anthelmintics are most effective when administered orally to small ruminants [27].

Control and Prevention

Control of nematode infection in small ruminants may be achieved by pasture management. Animal must be removed from infected ground, placed on dry pasture and supplied with clean drinking water. Draining and resting pasture during dry summer kill many larvae that readily survive cold winter. Their faeces should not be used for fertilizing lands on which crops for green feeding are grown, moist grasses should not be given to animals and adult should not graze together with young stock [28]. Therapeutic use of medicinal plants as a substitute to synthetic drugs for controlling gastrointestinal nematodes in small ruminants can be envisaged through strategic feeding regimen at times of higher seasonal incidence or as part of daily feed supplements/additives [29]. Successful vaccination against nematodes may be the most effective and long term strategy for prevention and control. Ideally, vaccines should have a high efficacy and be commercially viable for their proposed use in the livestock sector. Useful levels of protection can be defined as “reducing parasitism below that which causes a significant production loss” [30].

Conclusion and Recommendations

The gastrointestinal nematode parasites are livestock health problems including for small ruminants and are responsible for economic losses due to reduced production, morbidity and mortality. Thus, based on above conclusion, the following recommendations were suggested:-

- Community awareness creation should be practices regarding to control and prevention approaches on gastrointestinal nematodes in small ruminants.
- Strategic treatment of small ruminants with anthlmentics should be practiced to minimize the impact of gastrointestinal nematodes on the health of animals.
- Parasitic control and prevention should be implemented.

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