Review on Major Gastro Intestinal Tract Parasites in Small Ruminants in Ethiopia

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Abstract: Gastro intestinal tract parasites are an economically important parasitic disease of sheep and goat caused by trematode, cestode and nematode parasites. It is an important limiting factor for ovine and caprin Production and causes for several economic losses due to morbidity and mortality in Ethiopia. The problem of gastro intestinal tract parasites in Ethiopia, especially in small ruminants is much more severe due to very favorable environmental conditions for parasite multiplication, transmission, poor nutrition of host animals, and poor sanitation in facilities where animals are housing and grazing. As a result diseases caused by helminthes remain as one of the major impediments to small ruminant production. Economic losses caused by gastrointestinal parasites are losses through lowered fertility, a reduction in food intake and lower weight gains, lower milk production, treatment costs and mortality in heavily parasitized animals. The objective of this seminar paper is to review the epidemiology, diagnosis pathogenesis, treatment and control options of Gastro intestinal tract parasites. Diagnosis of Gastro intestinal tract parasites are based on clinical sign, grazing history, and seasonal occurrence, examination of feces by laboratory tests and post mortem examination. Treatment of infected animals will largely depend on the correct use of appropriate and registered anthelmintics. Gastro intestinal tract parasites may be controlled by reducing the populations of the intermediate hosts, grazing management and by appropriate anthelmintic treatment.
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1. Introduction

Small ruminants (goats and sheep) production systems in the developing countries are significantly constrained by gastrointestinal tract (GIT) parasites, reducing meat, milk, and fiber production (Piedrafita *et al.,* 2010). Gastro intestinal tract parasitism is one of the biggest problems in the small ruminant animals. Gastro intestinal parasite infections of herds and flocks can cause major health issues, which have a major effect on the animal's performance and cause great economic losses to the producer. In fact, most of the economic losses caused by GIT parasites are actually not due to mortality but production loss (Waller, P.J. and Thramsborg, S.M., 2004). Heavy parasitic burden in these animals is characterized by symptoms like diarrhea, gastritis, stunted growth, poor weight gain, reduced milk production, lack of appetite, and loss of wool and body hairs (Rehman and Ali, 2001).

Sheep and goats in Ethiopia harbor a variety of gastrointestinal tract (GIT) parasites, many of which are shared by both species. Among these parasites, Helminth such as nematodes (roundworms), cestodes (tapeworms), and trematodes (flukes) are the most important as they affect the growth as well as the production of the animals. Gastrointestinal nematodes of the Trichostrongylidae family are perhaps the most important parasites of small ruminants in the world, causing significant morbidity and loss of production (Pawel *et al*., 2004).

The problem of GIT parasite in Ethiopia, especially in small ruminants is much more severe due to very favorable environmental condition for parasite transmission, poor nutrition of host animals, and poor sanitation in facilities where animals are housing and grazing As a result diseases caused by helminthes remain one of the major impediments to small ruminant productions (Kumsa and Abebe, 2009).

Gastrointestinal parasite infections are a world-wide problem for both small- and large-scale farmers, but their impact is greater in sub-Saharan Africa in general and Ethiopia in particular due to the availability of a wide range of agro-ecological factors suitable for diversified hosts and parasite species. Gastrointestinal parasites induce a huge economic impact on small ruminant producers in Ethiopia, because of losses through lowered fertility, reduced work capacity, involuntary culling, a reduction in food intake and lower weight gains, lower milk production, treatment costs and mortality in heavily parasitized animals (Fikru *et al.,* 2006). Helminthosis has worldwide distribution and is also considered as one of the major problems to livestock productivity incurring huge direct and indirect losses in Ethiopia.

2. Literature Review

2.1. Helminthes

Helminth infections, or helminthosis, refer to a complex of conditions caused by the Nematode, Cestode, and Trematode parasites. Although all grazing sheep and goats may be infected with the above- mentioned parasites, low worm burdens usually have little impact on animal health. But as the worm numbers increase, effects in the form of reduced weight gain and decreased appetite occur. With heavier worm burdens clinical signs such as weight loss, diarrhea, anemia, or sub-mandibular oedema (bottle jaw) may develop (Lughano and Dominic, 1996).

2.1.1. Nematodes (roundworms)

Nematode parasites of small ruminants are primarily parasites of the gastrointestinal tract. A range of nematodes are usually present as mixed infections. The most important species are those found in the abomasums and small intestine. This includes Haemoncus, Cooperia, Ostertagia, Bunostomum, Trichostrongylus, Oesophagostomum and Nematodirus (Hutchinson, 2009).

Small ruminants are a treasure house of different GINs which are usually important members of the order Strongylida. This contains Trichostrongylidae, Strongylida, Metastrongyloidea and Ancylostomatoidea, but most of them belong to the super family Trichostrongylidae. Small ruminants are infected with a group of these strongylid nematodes, causing clinical effects collectively known as parasitic gastroenteritis. These nematodes are present in gastrointestinal tracts of sheep and goats in different parts of the world with varied prevalence and epidemiology. Generally, sheep and goats are reared together on pastures and in pens; this can be the reason behind the sharing of same GIN fauna between sheep and goats. However, usually sheep are more infected than goats. The reason could be that sheep are close grazers and there are maximum direct chances for them to get more infected with the infective stages present in grasses. Goats are not the close grazers but most often are seen browsing, so there is less direct contact between infective stages and goats. It has been reported that goats are found less infected with strongyles than sheep (Papadopoulos *et al*, 2003).

2.1.2. Life Cycle of the Species of Gastrointestinal Nematodes

The life cycles of almost all the GINs are direct, requiring no intermediate hosts, which applies to all of the economically important strongy lid parasites of small ruminants. Adult female nematodes produce eggs that are passed out of the host with the faeces. Under optimal condition in external environment first-stage larvae (L1) can develop and hatch egg within 24 hours. L1 grow and develop to the second stage larvae (L2) which in turn grow and develop in to third-stage larvae (L3), which is the infective stage. After ingestion L3 develop into fourth-stage larvae (L4), which then develop in to immature adults (L5). Sexually mature adult nematodes develop within 2 to 4 weeks after ingestion of the L3 unless arrested larvae development occurs (Smith, 2009).

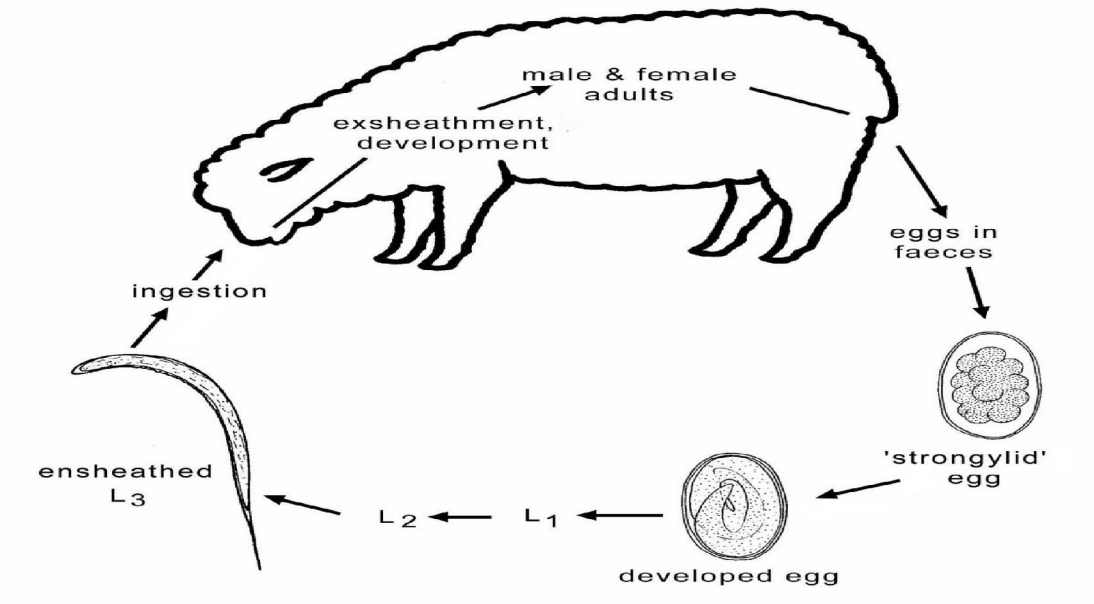


Figure 1: Life cycle representing gastrointestinal nematodes (order Strongylida) of small ruminants; adapted from (Demeler, 2005).

2.1.3. Factors Affecting Nematode parasite occurrence

The epidemiology of parasitic diseases depends on factors such as the infection pressure in the environment and the susceptibility of the host species (or individual). The infection pressure, in turn, depends on factors that affect the free-living and intermediate stages, such as temperature, rainfall and moisture. Furthermore, the availability of large numbers of susceptible definitive and intermediate hosts will increase the parasites' ability to reproduce and result in high parasite abundance (Torgerson & Claxton, 1999).

2.1.4. Climatic factors

The development, survival and transmission of the free-living stages of nematode parasites are influenced by micro-climatic factors within the faecal pellets and herbage. These include sunlight, temperature, rainfall, humidity and soil moisture (Lughano and Dominic, 1996). Under optimal conditions (high humidity and warm temperature), the development process takes 7 to 10 days (Urquhart *et al*., 1996).

2.1.5. Management systems

Management systems for the animals have a strong influence on the epidemiology of gastrointestinal nematodes. High stocking density increases the contamination of the environment with nematode eggs or larvae and thus makes the infective stages to be more accessible to susceptible animals. High stocking rates and intensive management with little or minimal rotational grazing, are associated with high pasture contamination and outbreaks of clinical helminthosis, On the other hand, low stocking rates and extensive management systems in the traditional husbandry systems decrease a built-up of high worm burdens (Lughano and Dominic, 1996).

2.1.6. Host factors

The incidence rate and severity of infection with gastrointestinal nematodes can also be influenced by host factors such as age, breed, nutrition, physiological state and presence or absence of intercurrent infections, for instance, kids and lambs are known to be more susceptible than adults and there is a tendency for the worm burdens in goats and sheep to decrease with increasing age. Some breeds of goats and sheep are known to be genetically resistant to gastrointestinal nematodes infections than others (Lughano and Dominic, 1996). For example in sheep and goats, adult female nematodes may increase their egg output around the time of parturition. This phenomenon, known as the peri-parturient rise (PPR), is of great importance in the epidemiology of nematodes of small ruminants, and has been reported in different African countries (Nganga *et al.,* 2006).

2.1.7. Trematodes

Fluke infections in small ruminants depend on many variables, including the presence of suitable intermediate hosts as well as favorable climatic and ecological conditions. Such environmental factors include temperature, rainfall, humidity and moisture. The factors influencing the development and survival of both the larval stages of the flukes and their intermediate hosts are similar to those of the nematode parasites (Torgerson and Claxton, 1999).

2.1.8. Lifecycles of Trematode parasites

The life cycles of important Trematode species (Fasciola hepatica, F.gigantica, Paramphistomum spp. and Dicrocoelium spp.) of small ruminants all involve intermediate hosts such as different species of aquatic or terrestrial snails, and ants for Dicrocoelium spp (Charleston, 1998). The trematodes are hermaphrodites, possessing both male and female sex organs.

Liver flukes live up to three years and can produce 10,000 eggs per day. Adult Fasciola spp laid eggs in the bile ducts and the eggs are transported to the gall bladder through the bile. When the gall bladder contracts, the eggs enter the duodenum and then are expelled from the host with the faeces. These eggs hatch into miracidia in Water under favorable condition. The life cycle depends on water and a temperature of 10°C or more: optimum rates of development (9 - 10 days) occur around 25 - 27°C (Charleston, 1997b). At 15°C development takes a month. The ciliated larvae (Miracidia) are quite mobile in water and can only develop further inside a particular Species of fresh water snail (Family Lymnaeidae) found in pools, dams, drains, marshy Areas and slow flowing streams. They must find the snail host and infect within 24 hours.

2.1.9. Cestodes

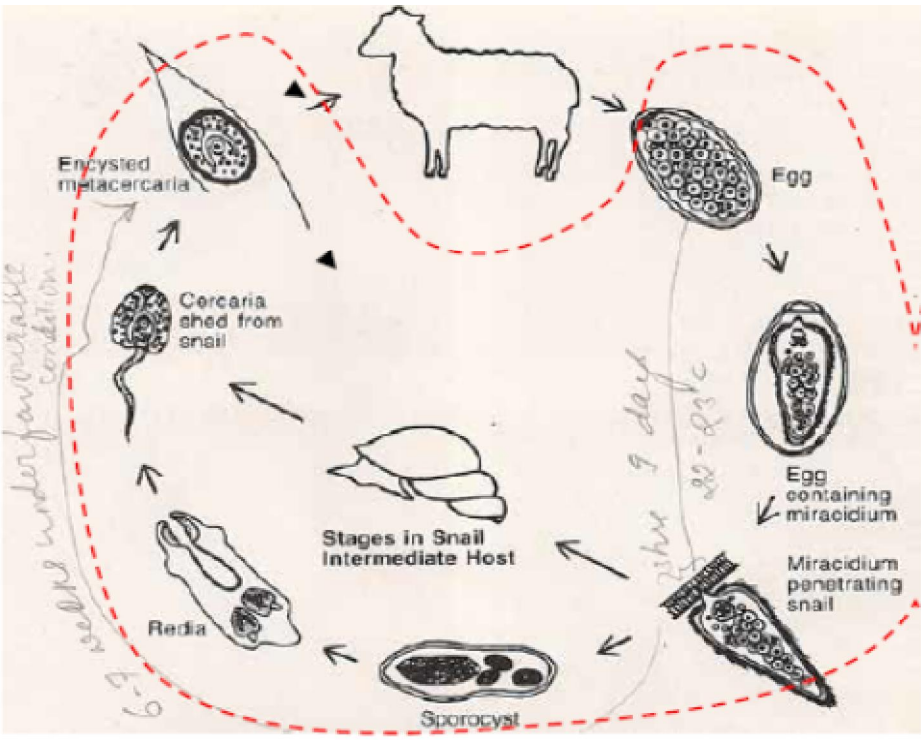
The pathogenic effects of Moniezia spp are limited and the parasite is considered to be Non-pathogenic. However, heavy infections in young animals may cause anorexia, Weight loss, and moderate anemia, inflammation of the intestinal mucosa and sometimes Obstruction of the intestines. Whether the intestinal cestodes are directly responsible for production losses is still a controversial issue and the pathogenicity of these parasites has not yet been established conclusively (Lughano and Dominic, 1996).

There are two species of tapeworm: *Moniezia expansa* most common in sheep and goats; *Moniezia benedeni* most common in cattle. Tapeworms of sheep, goats, cattle and deer have a simple lifecycle that also involves an intermediate host (Southey and Hosking, 1998).

2.1.10. Life cycle of gastrointestinal cestodes

The cestodes have indirect life cycles and the intermediate host may be the soil-inhabiting oribatid mites such as Oribatula spp, Galumna spp in case of Moniezia (Soulsby, 1982).

The adult worms are found in the small intestine of goats and sheep. Proglottids and eggs are passed out in the faeces of the infected animal. In the environment, the eggs may be ingested by oribatid mites where they develop into cysticercoids. The cysticercoids which are the infective forms are produced in 4 months. Ruminants are infected by the ingestion of the infected mites with herbage. The prepatent period is 37-40 days (Soulsby, 1982).



Source: Adopted from Urquhart et al. (1988).

Figure 2. The general life cycles of Trematode parasites

2.1.11. Diagnosis of parasites in small ruminants

The diagnosis of parasites of small ruminants is based on demonstrating the presence of eggs or oocyst and larvae, in faecal samples, or the presence of parasites recovered from the digestive tracts or other viscera of the animals. Although a great variety of methods and modifications have been described for such diagnosis, standardization of techniques, such as egg or larval counts, worm counts, pasture larval counts, etc., does not exist. Therefore, in practice, most diagnostic laboratories as well as teaching and research establishments apply their own set and protocols of test procedures (Kassai, 199

2.1.12. Simple flotation

This is one of the simplest methods of diagnosis of helminthosis. It is qualitative but it is a concentrated method. The principle of faecal flotation is based on the fact that there are differences in the specific gravity of parasite eggs, cysts, and larva and that of faecal debris. The faeces are mixed in a solution of about 1. 2 specific gravity. Many ova are less than 1. 2 specific gravity and will float to the top of the solution where they are collected. Most faecal debris is greater than 1. 2 specific gravity and will sink to the bottom of the tube. Parasite ova numbers found on this test are no indication of the actual worm burden the animal carries, since some worm species are more prolific ova producers than others. Some ova do not float because they are large and heavy, or dense, and will sink with the faecal debris. Ova that may be missed with This technique is Physaloptera (stomach worm), many flukes, and some tapeworms. Most faecal flotation's are either some kind of salt or sugar solution and include Sheather"s sugar solution, zinc sulfate, sodium nitrate, Sodium chloride, and magnesium sulfate (Zajac and Conboy, 2006).

2.1.13. Sedimentation

This is an ideal method for the concentration of all types of eggs and oocytes. It is especially used in the recovery of Trematode eggs in faeces and in bile (Soulsby, 1986; Olupinyo and Ajanusi, 2005).

2.1.14. Control

Successful control of parasitic diseases is highly dependent on available information on local conditions and the strength of the extension service transferring this knowledge to the farmer, Therefore, we need comprehensive information about the epidemiology of parasites of ruminants, on a regional or national basis, and also information about variables such as host resistance, climate, and management data which can be used to adequately quantify the occurrence of disease (Niezen *et al*., 1996; Waller, 1999). The issue of controlling gastrointestinal parasites is of particular economic importance in production systems worldwide (Rinaldi *et al*., 2007). Conventional methods of worm control involve treatment (s) of the whole flock with synthetic anthelmintic. However, in this day the global problem of anthelmintic resistance in small ruminants ensures that attention also needs to be given to the sustainability of anthelmintic treatment regimens as well as to their immediate economic benefit (Cringoli *et al*., 2007 and Cringoli *et al*., 2008). There is currently a general agreement to replace the practice of treating the whole flock with targeted selective treatments, where only animals showing clinical symptoms or reduced productivity are given drugs (Van Wyk *et al.,* 2006).

To control liver flukes must use narrow spectrum anthelmintics (Flukicide). Most broad spectrum anthelmintics (against most nematodes and cestodes) have little or no effect on liver flukes. If possible, delay grazing on flooded pasture until the area has been dry for at least eight weeks. Most fluke cysts will have been killed by them. It is also possible to leave the grass until it dries well and use it to make hay to feed the animals during the dry period. Pastures that remain wet for long periods are ideal environments for the survival of internal parasite larvae. Drainage of fields reduces the larvae chances of survival and extends grazing periods. It is also important that animal watering areas be situated in well drained places (ESGPIP, 2007).

Conclusion

Gastro intestinal tract parasites are an important limiting factor for ovine and caprin production and cause several economic losses due to morbidity and mortality and also there by contributing to loss hide and wool productivity of sheep and goat industry in Ethiopia. The three parasites of the greatest veterinary importance are trematode, cestode, and nematode. Strategic anthelmintics treatment with appropriate drugs should be practiced twice a year; before and after rainy seasons to eliminate Gastro intestinal tract parasites 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. Gastro intestinal tract parasites of small ruminants 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.

Based on the above conclusion, the following recommendations are forwarded:

- ❖ Improving of the veterinary service and infrastructure in prevalence area with provision of modern anthelmintic and treatment.
- ❖ Regular deworming of animals before and after the rainy season and grazing management (rotational grazing).
- ❖ Drainage of swampy area or fencing and applications of mulluscicide drugs are important in the control of the intermediate hosts.

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References

1. Cringoli, G, V., Veneziano, L., Rinaldi, C., Sauvè, R., Rubino, V., Fedele and Cabaret J., (2007). Resistance of trichostrongyles to benzimidazoles in Italy: a first report in a goat farm with multiple and repeated introductions, Parasitology Research, 101: 577-581.
2. Cringoli, G. V., Veneziano, F., Jackson, J., Vercruysse, A. W., Greer, V., Fedele, L., Mezzino and
3. Piedrafita, H. W. Raadsma, J. Gonzalez, and E. Meeusen (2010). "Increased production through parasite control: can ancient breeds of sheep teach us new lessons?" Trends in Parasitology, vol.26, no.12, pp.568-573.
4. Demeler, (2005). The Physiological Site of Action and the Site of Resistance to the Macro cyclic Lactone Anthelmintic in Sheep Parasitic Trichostrongyloid Nematodes. Hannover. Tierärztliche Hochschule Hannover.
5. ESGPIP, (2007). Ethiopia Sheep and Goat Productivity Improvement Program (ESGPIP). .
6. Technical bulletin no.3 control of internal parasites in sheep and goat. 2007,

7. Fikru S, Reta D and Yosef K, (2006). Epidemiology of gastrointestinal parasites of
8. Ruminants in Western Oromia, Ethiopia. International Journal of Applied Research Veterinary Medicine, 1:451-57.
9. Fikru, R., S. Teshale, D. Reta and K. Yosef, (2006). Epidemiology of Gastro intestinal Parasite of ruminant in Western Oromia, Faculty of Veterinary Medicine, Addis Ababa Univ. Debre - Zeit, Ethiopia.
10. Hutchinson, W. G., 2009. Nematode Parasites of Small Ruminants, Camelids and Cattle International Livestock Center for Africa (ILCA), (2007). International livestock center for Africa annual report, 2006. Addis Ababa, Ethiopia.
11. Kassai, T. (1999). Veterinary Helminthology. Butterworth-Heinemann, Reed Educational and Professional Publishing Ltd., Oxford, USA. .
12. Kumsa B, Abebe G (2009). Multiple anthelmintic resistances on a goat farm in Hawassa (southern Ethiopia). Trop. Anim. Health Prod. 41(4):655-662.
13. Lughano, K. and Dominic, K., (1996). Diseases of small ruminants in sub-Saharan Africa. Handbook. VETAID, Centre for Tropical Veterinary Medicine. Department of Veterinary Medicine and Public Health Sokoine University of Agriculture Morogoro, Tanzania.
14. Nganga, C. J., Kanyari, P. W., Maingi, N. and Munyua, W. K., (2006). The effect of weather on the occurrence and magnitude of periparturient rise in trichostronglyid nematode egg Output in Dorper ewes in a semi-arid area of Kajiado District of Kenya. Tropical Animal Health and Production, 38: 389-395.
15. Niezen, J. H., Charleston, W. A. G., Hodgson, J., Mc Kay, A. D. and Leathwick, D. M., (1996). Controlling internal parasites in grazing ruminants without recourse to anthelmintics; approaches, experiences, prospects, International Journal of Parasitology, 26: 983–992.
16. Papadopoulos E, Arsenos G, Sotiraki S, Deligiannis C, Lainas T, Zygoyiannis D (2003) The Epizootology of gastrointestinal nematode parasites in Greek dairy breeds of sheep and Goats. Small Rumin Res 47:193–202.
17. Pawel, G., Niznikowski, R., Strzelec, E., Popielarczyk, D., Gajewska, A and Wedrychowtcz, H. (2004). Prevalence of protozoan and helminth internal parasite infections in goat and sheep flocks in Poland. Arch. Tierz. Dummerstorf, 47: 43-49.
18. Rehman and Ali, (2001). Month wise prevalence of gastro-intestinal trematodes, Cestodes and nematodes infecting Damani sheep and goats in district D. I Khan. Pakistan Vet. J. 21(2): 111113.
19. Smith BP, (2009) Large Animal Internal Medicine. 4th. edn. Mosby Elsevier: 1632-1633.
20. Southey, C. and Hosking, B. (1998). Liver fluke and tapeworm Parasite, Notes 7. A New Zealand Sheep Council and Merial New Zealand Limited Publication: 23-26.
21. Soulsby, E. J. L, (1986). Helminthes, Arthropods and protozoa of domesticated Animals, 7th Edition Bailliere Tindall, London, pp. 119-218.
22. Soulsby, E. J. L., (1982). Helminthes, Arthropods and Protozoa of Domesticated animals, 7th Edition. The English Language Book Society and Bailliere Tindall, London.
23. Torgerson, P. and Claxton, J., (1999). Epidemiology and control. In Fasciolosis (ed. Dalton, J. P.). CAB International. Publishing, Wallingford, United Kingdom.
24. Urquhart, G. M., Armour, J., Duncan, J. L., Dunn, A. M. and Jennings, F. W., (1996). Veterinary Parasitology, 2nd ed. Blackwell Science, United Kingdom.
25. Urquhart, G. M., J. Armour, J. L. Duncan, A. M. Dunn, and F. W. Jennings. 1988. Veterinary Parasitology. Low Priced ed. Longman Group Ltd, Harlow, UK.
26. Van Wyk J. A., Hoste, H., Kaplan, R. M. and Besier, R. B., (2006). Targeted selective treatment for worm management—how do we sell rational programs to farmers?, veterinary Parasitology, 139: 336–346.
27. Waller, P. J., (1999). International approaches to the concept of integrated control of nematode parasites of livestock, International Journal for Parasitology, 29: 155–164.
28. Waller, P. J. and Thramsborg, S. M. (2004): Nematode control in 'green' ruminant Production systems. Trends in Parasitology. 20 (10):493-497.
29. Waller, P. J., (2006). From discovery to development: current industry perspectives for the Development of novel methods of helminth control in livestock. Veterinary Parasitology, 139: 1-14.
30. Zajac, A. M., (2006). Gastro-intestinal nematodes of small ruminants: life cycle, anthelmintic, and diagnosis. Veterinary Clinics, Food Animal Practice, 22: 529- 541.
31. Zajac, A. M and Conboy, G. A. (2006). Veterinary Clinical Parasitology 7th edition, Blackwell Publishing, Ames Iowa, 2006, pp. 4-6.

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