Acta Parasitologica Globalis 16 (1): 19-26, 2025
ISSN 2079-2018

DOI: 10.5829/idosi.apg.2025.19.26

Major Gastro Intestinal Helminthes Parasites of Small Ruminant: Review

Alemineh Shime

Bahir Dar Animal Health Diagnostic and Investigation Laboratory Bahir Dar, Ethiopia

Abstract: The livestock sector is a massive transformational state to meet increased demand of animal origin foods for increasing human population. Sheep and goat production play an important role in the livelihood security and economic sustenance of poor farmers in semiarid, arid, hilly and mountainous regions of the world. Helminth infections, or helminthoses, thus refer to a complex of conditions caused by parasites of the Nematoda, Cestoda and Trematoda. Parasitic helminthes or worms are important cause of disease in all species of animal. The gastro intestinal tract may be inhibited by many species of parasite. Their cycle may be direct which eggs and larvae are passed in the feces and stadial development occurs in to the infective stage, which then ingested by the final host. The phylum *Platyhelminthes* contains Turbellaria, Trematode and Cestode, all one typically soft bodied, flattened dorso-ventrally and hermaphrodite. The Turbellaria (planarians) is mostly free living carnivore flat worms. The Trematode (fluke) of veterinary importance may be found as adult in the intestine, bile duct, lung, blood vessel or other organs of their vertebrate final host. Adult tape worm (cestode) is parasites of intestine of vertebrate and their larvae are parasites of different vertebrates or invertebrate. Phylum nemathelminth has six classes but only one of these the nematode, contains worms of parasitic significance. The nematode commonly called round worm from their appearance in cross section. The major risk factors can therefore be broadly classified as parasite factors (including epidemiology of the different species), host factors (genetic resistance, age and physiological status of the animal) and environmental factors (climate, nutrition, stocking density and management). The feeding behavior of ruminant species is major factors in the development of parasitism. Over stock of pasture general promotes increased parasitism. The most dramatic adaptation to hostile environment is hypobiosis or arrested development which is triggered by onset of hot and arid conditions.

Key words: Cestode · Helminthes · Nematode · Trematode · Small Ruminant

INTRODUCTION

The livestock sector is a massive transformational state to meet increased demand of animal origin foods for increasing human population [1].

Sheep and goat production play an important role in the livelihood security and economic sustenance of poor farmers in semiarid, arid, hilly and mountainous regions of the world. These animals survived under low input system depending mostly on seasonal grasses and crop straw [2]. Sheep and goats are widely adapted to different climates and are found in all production system. They also have lower feed requirement as compared to cattle because of their small body size. This allows easy integration of small ruminants in to different farming system [3].

In the varied agro-climatic zones of Ethiopia, small ruminants are important source of income for rural communities and are one of the nation's major sources of foreign currency from exports. In Ethiopia there are 41 millions of sheep and goats of which 8 millions are slaughtered annually and providing more than 30 % of domestic meat consumption. The rich potential from the small ruminant sector is not efficiently exploited; however, due to several constraints, including malnutrition, inefficient management and diseases [4].

Helminth infections, or helminthoses, thus refer to a complex of conditions caused by parasites of the Nematoda, Cestoda and Trematoda. Although all grazing sheep and goats may be infected with the above-mentioned parasites, low worm burdens usually have little

Corresponding Author: Alemineh Shime, Bahir Dar Animal Health Diagnostic and Investigation Laboratory Bahir Dar, Ethiopia.

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, diarrhoea, anaemia, or sub-mandibular oedema (bottle jaw) may develop [5].

Parasitic helminthes or worms are important cause of disease in all species of animal. Although in many case they produce little serious damage to the host, these parasites are never beneficial in some case they can produce sever and even fatal disease [6].

The gastro intestinal tract may be inhibited by many species of parasite. Their cycle may be direct which eggs and larvae are passed in the feces and stadial development occurs in to the infective stage, which then ingested by the final host. Alternatively the immature stage may be ingested by an intermediate host (usually invertebrate) in which further development occurs and an infection is acquired when the intermediates or free living stages shed by the host is ingested by final host. In host, resistance, age, nutrition and contaminant disease also influence the course parasitic infection. The economic importance of subclinical parasitism in farm animal is also determined by the above factors and it is well established that highly parasitized animal that show no clinical sing of the disease perform less efficiently in the feedlot, dairy or finishing [7].

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. Economic losses are caused by gastrointestinal parasites in a variety of ways: they cause losses through lowered fertility, reduced work capacity, involuntaryculling, a reduction in food intake, lower weight gains, lower milk production, treatment costs and mortality in heavily parasitized animals [8]. In Ethiopia, 5-7 million sheep and goats die each year due to diseases including helminthes infections. More significant, however, are losses resulting from inferior weight gains, condemnation of organs and carcasses and lower milk yields. The overall economic loss to the Ethiopian meat industry due to parasitic diseases is estimated at US$ 400 million annually [9].

Sheep and goats harbor a variety of gastrointestinal tract (GIT) parasites, many of which are shared by both species. Among these parasites, helminthes are the most important GIT parasites that affect the growth as well as production of the animals. Gastrointestinal nematodes of *Trichostrongylidae* family are perhaps the most important parasites of small ruminants worldwide, causing significant morbidity and loss of production. Helminthic infections can be treated by anthelmintic chemotherapy, however, treatment is costly and drug resistance has evolved in all major parasite species [10].

Parasitic infection ranges from acute disease frequently with high rates of mortality, chronic disease, resulting in various degrees of morbidity and premature culling to sub clinical infection with sheep appearing relatively healthy but frequently performing below their full potential. The parasitic helminthes of small ruminant can be sub divided in to nematodes /round worm/trematode /flukes/ and cestodes /tapeworms/ [11]. It is impossible to give an accurate estimate of the economic importance of parasite diseases because it varies so greatly between countries and between region, depending both on climate and on the intensive farming in the area [12].

Therefore the objectives of this review are:

- To know the major GIT helminthes parasites of small ruminants
- To recommend some control measures to livestock owners

The name ‘‘helminth” is derived from the Greek words ‘‘helmins” or ‘‘helminthos”, meaning a worm and is usually applied only to the parasitic and non-parasitic species belonging to the phylum *Platyhelminthes* (such as flukes and tapeworms) and *Nemathelminthes* (roundworms and their relatives) [13].

The phylum *Platyhelminthes* contains Turbellaria, Trematode and Cestode, all one typically soft bodied, flattened dorso ventrally and hermaphrodite. The Turbellaria (planarians) is mostly free living carnivore flat worms. The Trematode (fluke) of veterinary importance may be found as adult in the intestine, bile duct, lung, blood vessel or other organs of their vertebrate final host. Adult tape worm (cestode) is parasites of intestine of vertebrate and their larvae are parasites of different vertebrates or invertebrate [14].

Phylum nemathelminth has six classes but only one of these the nematode, contains worms of parasitic significance. The nematode commonly called round worm from their appreance in cross section [15]. Majority of nematode species are free living or saprozoic organism occurring everywhere as soil nematodes. They constitute the largest component of the biomass on earth [16].

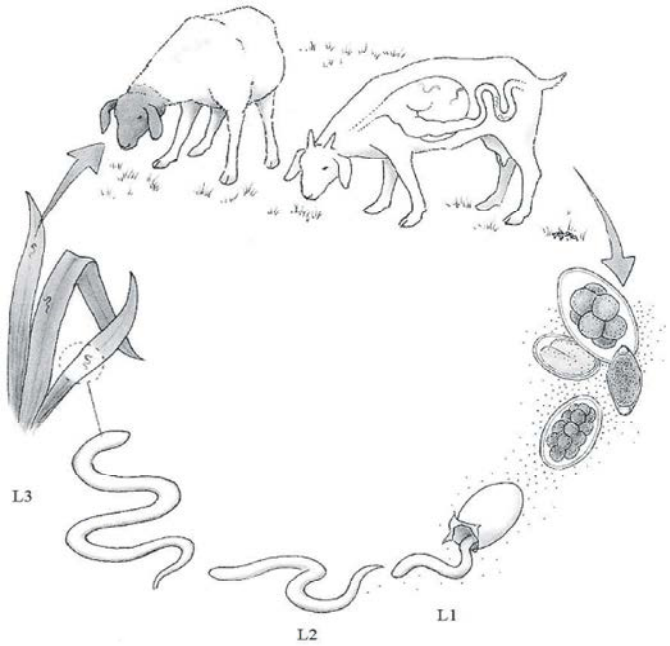

Fig. 1: Principal life-cycle of GIT nematodes of small ruminant
Source: [5]

Nematode: Most nematodes have cylindrical form, tapering at either end and the body is covered by a colorless somewhat translucent layer the cuticle. The cuticle is secreted by the underling hypodermis which projects in to the body cavity forming two lateral cording , which carry the excretory canals and dorsal and ventral cord carry the nerves. Locomotion is effected by undulating waves of muscle contraction and relaxation when alternate on the dorsal and ventral aspects of worm. Most of internal organs are filamentous and suspended in the fluid filled cavity [17].

Gastro intestinal nematode infection in sheep and goats are responsible for sever clinical syndromes and profound production losses. Young animals, periparturient ewes and does and animals on substandard planes of nutrition are most susceptible to out breaks of parasitic disease. Sheep and goats share the same species of GIT nematodes of primarily importance in both host are *Haemonchus, Ostertaigia* and *Tricostrongylus* species [18]. All have direct life cycle [19].

Life Cycle: Gastro intestinal tract nematode have simple direct life cycle. Adult laid eggs which passed in feces, L1 hatches to develop to infective L 3 within 1-2 weeks [20]. The nematode life cycle has three stages egg, four larval and adult. Nematode larva grows to the next stages by molting [21].

Larval development and survival depend on climate and pasture management. Desiccation and direct sunlight are lethal to eggs and larvae. Small ruminant acquires infection by ingestion of L3; depending on species of parasite, larvae may migrate into gastric glands then returns to the lumen of adult stage reached in 2-3 week (Figure 1) [22].

Epidemiology: The epidemiology of nematodiasis is determined by several factors governed by parasite-host-environment interactions. The major risk factors can therefore be broadly classified as parasite factors (including epidemiology of the different species), host factors (genetic resistance, age and physiological status of the animal) and environmental factors (climate, nutrition, stocking density and management) [23].

The feeding behavior of ruminant species is major factors in the development of parasitism. Over stock of pasture general promotes increased parasitism. The most dramatic adaptation to hostile environment is hypobiosis or arrested development which is triggered by onset of hot and arid conditions [19].

Pathogenesis: Various pathogenic mechanisms are involved in GIT nematodiasis depending on the genera involved. The principal effect of blood feeding worms on the host is a progressive debilitating anaemia [19].

Clinical Sign: In sheep the two most susceptible age groups are weaner lambs and yearlings. Those over 18 months of age are less prone because of immunity gained from previous infection. The onset of the disease is generally insidious with young animals initially falling to grow satisfactory and later become unthrifty and looking in vitality and blowm. There is profuse watery diarrhea and lambs and kids become dehydrated and mortality can be high and death may start within two day the first observed illness [12].

Diagnosis: Clinical signs are very nonspecific and little help. Knowing the grazing history and seasonal occurrences of parasitism in areas may helpful. Because of their size most of the nematodes missed on gross necropsy [20]. Combination of clinical signs of anaemia, poor body condition and diarrhea should suggest GIT nematodiasis. Evidence of increase fecal egg counts heavy worm burden in digestive tract and increased plasma pepsinogen levels supports the diagnosis [19].

Treatment: Clinically affected individual requires supportive care to reverse the process of parasite debilitation and anthelminthic therapy to eliminate exiting infection [19].

Money broad spectrum anthemintics now available that combine high efficacy against larval and adult worm with low toxicity which include benzimidazol, Avermeatin and imidazole (tetrahydro pyrimidine) group [12].

Control and Prevention: Sustainable disease control will not be possible unless there is sustainable national production systems. It therefore appears imperative to require that developing countries have a multidisciplinary approach to manage the parasite problem within the context of their own Productive system. The need to involve all of the parties, Governments, the pharmaceutical industry and private and international organizations in developing a sustainable and economically viable programme to combat parasitic diseases in general and resistance in particular, has become ever more crucial [24].

In recent years much emphasis has been placed on the strategy of modifying management of livestock, including small ruminants, to minimize exposure to parasite based on knowledge of parasite life cycle and ecological behavior [19].

Control measure aimed at reducing pasture contamination in order to minimize the uptake of infective larva thereby preventing animals and allowing optimal productivity [12].

Sustainable control of GIT nematode infection in sheep and goat require an integrated management system that incorporate strategic anthemihtics, use selective breeding and nutritional and environmental management [18].

Cestode: Cestodes are tape like and segmented body which consists of the head (scolex), the neck and strobila (chain of segment) proglottids) [16]. Tape worms belong to the class cestoda of the phylum Platyhelminthes and resemble to trematode in having acoelomate paranchymatous bodies and in having both sexes represented in the same individual or hermaphrodite [14].

Adult stages of the most tape worm species are found in the small intestine and attached to the mucosa by their scolex [16]. Infection with *monesia* species is common but not usually consider pathogenic, although occasionally so money tape worms are present that cause physical blockage of the intestine [25]. It is potentially the most pathogenic of the ruminant tape worms producing inflammatory nodules at the site of attachment in the duodenal and jejunal mucosa that can lead to enteritis and diarrhea. Other species of cestode that affect small ruminants are *Avitenell* in Europe, Asia and Africa; and *Stilasia plobipuncta* mainly in tropical regions of Africa and Asia [19].

Adult tapeworm developing in the small intestine of small ruminants can be up to several meters long [19]. This class differs from trermatode in having a tape like body with no alimentary canals. Each segment contains one and sometimes two sets of male and female reproductive organs [17].

Life Cycle: Cestodes have indirect life cycle which characterized by hetrogeny and heteroxely [16]. Matured proglottids or eggs are passed in the feces and on pasture where the onchospheres are ingested by forage mites. The embryos migrate in to the body cavity of the mite where they develop to cysticercoids and infection of the final host is by ingestion of infected mites during grazing [15]. Cysticercoids are released from ingested mite in the intestine and matured tape worms begin to develop [19].

Epidemiology: Infections are most often observed in young lambs and kids at pasture during their first grazing season. Pasture is not prerequisites for infection, however, as infective mites may be present in the barny and on carried forage. The patterns of infection may be varying with climate and geography. A natural resistance

to cetode infection develops with age and in population of small ruminant with constant exposure to tape worms, worm burdens are always less severing in older animal [19].

Pathogenesis: Light infestation of small ruminants by the common tape worm is generally nonpathogenic. This is largely because tape worms do not feed destructively with active mouth parts, but rather absorb nutrients from the intestinal lumen through their integument [19].

Heavy infection can cause unthriftiness, diarrhea and even intestinal obstruction [15].

The cestode parasite may produce luminal distention in intestine resulting distended potbellied appreance. Their presence may prolong transit time of ingesta in the gut. In feedlot lamb or kid on grain rations; this is believed to promote the development of clostridial enterotoxaemia [19].

Clinical Sign: A great variety of clinical sign includes untriftiness, diarrhea, respiratory sign and even convulsion [15] Affected animals may be show poor growth rates, potbellied appreance, proglottids are present in voided feces and constipation may also occur [19].

Diagnosis: Definitive diagnosis in the live animal is difficult and sometimes a post-mortem is necessary to confirm an accurate diagnosis. Tapeworm infection is more typically diagnosed when the moving segments are seen crawling around the anus or in a bowel movement. While tapeworm eggs can be seen in fecal flotation under a microscope, fecal analysis does not offer a definitive diagnosis [26].

Treatment: A wide range of anthelminthics are currently available for eliminating adult tape worm in small ruminants. Oral niclosamide is a high effective and has wide margin of safety; other drugs include preziquenel, benzimedazole group [19].

Control and Prevention: It is not possible to eliminate the oribatid mites in the pastures. The use of insecticides for this purpose is not advisable, because it is more expensive than the potential economic loss due to the infections and because it detrimental effect on the environment: it would kill not only the oribatid mites, but numerous beneficial insects as well. In endemic zones with high incidence it is recommended to harvest the hay, to deeply plow the fields (the mites tend to burrow deeply in the soil) and to reseed them. This can reduce the mite population. Nevertheless, some mites will survive in the unplowed borders and will re-infect the pastures in a few years. Since the mites prefer humid pastures and avoid light as well as dryness, they are more active early in the morning and at nightfall. This can be considered for deciding where and when to bring susceptible livestock for grazing [27].

Trematode: The class trematoda falls in to two subclasses: the monogenea which have direct life cycle and digenea, which requires an intermediate host. Adult diegenictrematode commonly called Flukes occurs primarily in the bile duct, alimentarytract and vascular system [17].

Trematode bodies are leaf lancet and con like but not segmented. They have two muscular sucker used for attachment oral sucker at the anterior end around the anterior mouth and ventral sucker located ventrally or caudally. They are hermaphrodites except Shcistosoma where both sex separate [28]. Trematodes have mouth and intestine but no anus. Most trematodes are endoparasite, Adult parasite can be 2 mm -10 cm long [21].

Adult Paramphistomums are mainly parasitic in the forestomach of ruminants, although a few species occur in the intestine of ruminants, pig and horse. Their shape is not typically of trematodes being conical rather than flat [17].

Life Cycle: They have indirect life cycle characterized by hetrogeny (exchange of larval generation) i.e. flukes develop from eggs to adult stage through several larval stage miracidium, sporocyst, redia, cercaria of which sporocyst and redia capable of asexual multiplication (parthenogony) and exchange of the vertebrate definitive host and one or two invertebrate intermediate host the first is always snail species (Figure 2). The cercaria may directly penetrate the final host, encyst in transport host or second intermediate host or encyst on grass and become metcercaria. Almost all trematodes infect the definitive host is by ingestion of metacercares cyst [16].

The essential point of the life cycle is that one nematode can develop in to only one adult one trematode egg may eventually develop in to hundreds of adults this is due to the phenomenon of asexual multiplication in the intermediate host [15].

Epidemiology: Infection is by ingestion of metacercaria on herbage, geographical distribution, seasonality and disease risk is determined by occurrence of intermediate host lymnaeid mud snail in Fasciolidae and aquatic planorbid snail in Paramphistomatidae [12].

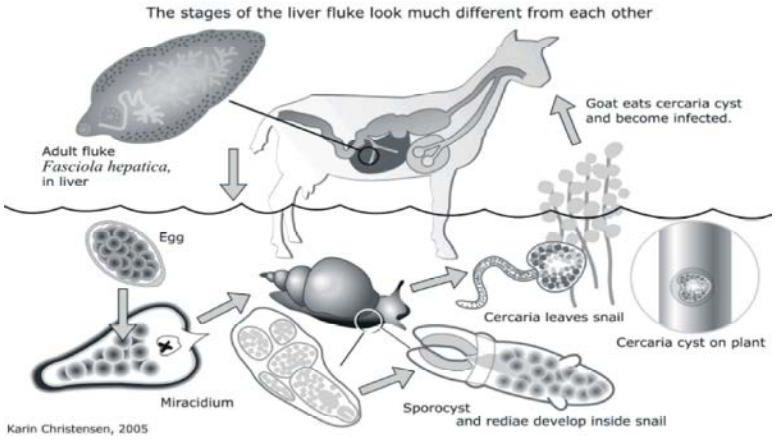

Fig. 2: life cycles of liver fluke
Source: [29].

Pathogenesis: The Pathogenesis of liver fluke varies according to the number metacercaria ingested, the phase or parasitic development in the liver and species of host involved. Essentially the pathogenesis has two fold. The first phase occurs during migration in the liver parenchyma and is associated with liver damage and haemorrhage. The second phase occurs when the parasite is in the bile duct and resulting from the haemorrhagic activity of the adult flukes and from damage to the biliary mucosa by their cuticle spines [15].

Immature rumen fluke develop in the upper small intestine is most responsible for the pathogenic effects of paramphistomum infection. These immature flukes imbed deeply in the intestinal mucosa via suckers and fed by drawing a plug of mucosa in to sucker. This mucosal plug become necrotic and sloughs leaving and an erosion and petechiation. The pathogenicity is correlated with the immature fluke burden [19].

Clinical Sign: Fasciollosis ranges in severity from devastating in sheep and asymptomatic in cattle. The course usually determined by number of metacercaria ingested over short period and manifested by a distended, painful abdomen, anemia and sudden death [7]. Intermandbular edema frequently occurs in longstanding case [19].

The clinical sign of Paramphistomum are similar to those of nematode gastroenteritis. Young animal are more frequently and seriously affected than older animal. Affected animals are listless and have diminished appetite. There may be diarrhea which may contain mucus and immature flukes which are characterized and pronounced fetid odor. Intermandibular edema is pronounced and may extend over face and brisket [19].

Diagnosis: This is based primarily on clinical signs seasonal occurrence, prevailing weather patterns and previous history of fasciollosis on the farm and identification snail habitat [17].

Treatment: Elimination of immature fluke with appropriate anthelmintics therapy is the major therapeutic objectives and is lifesaving treatment is started early in the course of the disease [19].

Control and Prevention: The major thrust in the prevention of trematode is to keep grazing animals away from areas where heavy concentration of infected snail and from herbage contaminated with metacercaria. This means avoidance of poorly drained or swampy area, ponds and puddfield and strategic use of anthelmintics can be helpful in controlling of trematodes [19].

CONCLUSION AND RECOMENDATIONS

The gastro intestinal parasites of small ruminant are highly affecting the productivity of the small ruminant in the different agro ecological content of the world. They may cause death and decreases any production such as meat milk, wool etc. the major gastro intestinal parasites of the small ruminant is nematode, trematod and cestode species are prevalent. Most of these parasites transmitted by ingetion and affected young animal that reared in extensive production system.

Based on the above conclusion the following recommendations are forwarded:

- The animal owner should be deworming their small ruminants by different anthelmintics based on order of the veterinarian to avoid drug resistance.

- The government should be create awareness to the animal owners to avoid communal grazing and keep their animal indoor to improve the production and productivity of the animal
- The animal owner should be restricted their animal to go the field during parasitic season of the year

REFERENCES

1. Karim, S.A., A. Joshi, R.S. Sankhyan, A.K. Shinde and D.M. Nafui, 2005. Climate change and stress management of Sheep and Goat production. SSPH.
2. Karim, S.A., M.K. Tripath, O.H. Chaturued and A.K. Shinde, 2008. Small ruminant production in India. SSPH.
3. Joseph, T. Internal Parasite Control in Grazing Ruminants. http://www.ansci.wisc.edu/extension-new%2520copy/sheep/wisline_03/parasite_control.pdf (accessed at 15/5/2014)
4. Abebe, W. and G. Esayas, 2001. Survey of ovine and caprine gastro-intestinal helminthosis in eastern part of Ethiopia during the dry season of the year. Revue Méd. Vét., 152(5): 379-384
5. Sissay, M.M., 2007. Helminth parasites of sheep and goats in eastern Ethiopia: Epidemiology and anthelmintic resistance and its management. Doctoral thesis, SwedishUniversity of Agricultural Sciences, Uppsala, Sweden.
6. Jones, T.C., R.D. Hunt and N.W. King, 1996. Veterinarypathology. 6th ed, pp: 601.
7. Kahn, C.M.B.A.M.A., 2005. Merck Veterinary manual. 9th ed. Merck and CO.INC.white house USA, pp: 127.
8. Fikru, R., S. Teshale, D. Reta and K. Yosef, 2006. Epidemiology of Gastrointestinal Parasites of Ruminants in Western Oromia, Ethiopia. Intern J. Appl. Res. Vet. Med., 4(1).
9. Esgpip, M.O.A.R.D., 2007. Ethiopia Sheep and Goat Productivity Improvement Program.
10. Ijaz, M., M.S. Khan, M. Avais, K. Ashraf, M.M. Ali and M.Z.U. Khan, 2009. Infection rate and chemotherapy of various helminthes in diarrhoeic sheep in and around Lahore. The Journal of Animal & Plant Sciences, 19(1): 13-16.
11. Aitken, 2007. Disease of sheep. 4th ed. Blackwell: pp: 185.
12. Radostits, O.M., C.C. Gay, K.W. Hinchdiff and P.D. Constable, 2007. Veterinary Medicine. Text book of Cattle, House, Sheep, Pig and Goat 10th ed. Saundes, pp: 1544-1546.
13. Mawahib Alhag Ali, A., 2010. Gastrointestinal (nematode) infections in small ruminants: Epidemiology, anthelmintic efficacy and the effect of wattle tannins. Submitted in partial fulfillment of the academic requirements for the degree of Master of Science in Animal Science Discipline of Animal and Poultry Sciences School of Agricultural Sciences and Agribusiness University of KwaZulu-Natal Pietermaritzburg.
14. Bowmann, D.D., 2003. Parasitology for Veterinarians. 3th ed. Saunders
15. Taylor, M.A., R.L. Coop and R.L. wall, 2007. Veterinaryparasitology.3rd ed. Black Well.
16. Kassal, T., 1999. Veterinary Helminthology.
17. Urquhart, M.G., J. Armour, L.J. Duncan, M.A. Dunn and W.F. Jannninss, 1996. Veterinary parasitology. 2nd ed. Black Well Science.
18. Smith, P.B., 2002. Large animal internal medicine. 3rd ed. Mospy, pp: 1447 1448.
19. Vihan, S.V., 2010. Disease of small Ruminant. SSPH.
20. Ballweber, R.L., 2001. Veterinary Parasitology, 110: 113-115.
21. Shapiro, L.S., 2004. Pathology and Parasitology for veterinary Technicians.
22. Mbuh, J.V., K.J.N. Ndamukong, N. Ntonifor and G.F. Nforlem, 2008. Parasites of sheep and goats and their prevalence in Bokova, a rural area of Buea Sub Division, Cameroon. Veterinary Parasitology, 156(3-4): 350-352
23. Agricola, O., J. M. Gotham, C.K. Gachuiri and A. Omore, 2007. Risk factors of gastrointestinal nematode parasite infections in small ruminants kept in smallholder mixed farms in Kenya. BMC Veterinary Research, 3: 6.
24. FAO, 2002. Biological control of nematode parasites of small ruminants in Asia.
25. Hindsun, J.C. and A.C. Winter, 2002. Manual of sheep disease. 2nd ed. Black Well Publishing, pp: 64-167.
26. Schoenian, S., 2013. Small RuminantInfo Sheet. Available at http:// www. Sheepandgoat.Com /articles/ tapeworms.html (last updated on 01-May-2013. accessed at 20/5/2014.)
27. Junquera, P., 2013. Moniezia expansa and Moniezia benedeni, parasitic tapeworms of sheep, goats, cattle and other livestock. Biology, prevention and control. Available at parasitipedia.net› home› TAPEWORMS(last update September 20/2013 :15:22.

28. Kuchai, J.A., M.Z. Chishti, M.M. Zaki, J. Ahmad, M. Rasool, S.A. Dar and H. Tak, 2011. Epidemiology of Helminth parasites in Small ruminants of Ladakh, India. Online Journal of Animal and Feed Research, 1(5): 239-242.

29. Christensen, K., 2005. Scientific animation and illustration. Available at www. Goat biolgy .com /parasites.html (accessed at 19/5/2014.).