

## Review

# Effects of *Elephantorrhiza elephantina* as an anthelmintic against gastrointestinal parasites in goats

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The main objective of this study was to investigate the effects of one of the most common traditional plant called *Elephantorrhiza elephantina*, as an anthelmintic against gastrointestinal parasites on goats. Infectious parasites like *Haemonchus contortus* (barberpole worm, stomach worms) in the gastrointestinal tract remain one of the main limiting factors in small stock especial goats because they are very difficult to manage because to their resistant ability to anthelmintics. These parasites cause high mortality rates in livestock, of about 3-4 million animals each year, production is decreased, and animals are characterized by scanty diarrhea with reproduction failures and results in reduced weight gains. The cost of the infections includes treatment expenses and production losses. However, herbal remedies are used by many farmers, but information is lacking on the appropriate dosage of the plant material to be used for controlling gastrointestinal parasites, and that information is necessary for the effective control of these parasites.

**Keywords:** *Elephantorrhiza elephantina*, *Haemonchus contortus*, anthelmintics, goats

## INTRODUCTION

Livestock production system is facing a major health issue of gastrointestinal parasites on goats. Therefore, use of medicinal plants as anthelmintics against gastrointestinal parasites will be imperative. Anthelmintics are drugs that expel parasitic worms (helminthes), by either controlling them to reduce their effectiveness or killing them (Tyasi and Nkohla, 2015; Tyasi et al., 2015). Helminthic parasites infect a quarter of the world's total population and a major cause of morbidity (Tyasi and Tyasi, 2015; Tyasi et al., 2015). Moreover, helminthes infections are the primary cause of productivity losses in livestock worldwide (Mottler *et al.*, 2006).

*Elephantorrhiza elephantina* has been used as a natural and traditional healing plant for both human beings and livestock (Tyasi and Tyasi, 2015). This plant

is commonly known as elephant's root, also as "intololwane" in Xhosa and Zulu (Tyasi and Nkohla, 2015). In this plant, dried roots are used to make desired concentration for treatment. Furthermore, *elephantorrhiza elephantina* is commonly used to treat disease such as mange, heartwater, blackquater, diarrhea, as well as tick-borne diseases in livestock (Tyasi and Tyasi, 2015). However, this plant is predominantly used to treat helminthiasis in goats (Maphosa et al., 2010; Tyasi and Nkohla, 2015; Tyasi and Tyasi, 2015).

In livestock, the dried and powdered roots are given to livestock for mange, heartwater, blackquater, diarrhea, as well as tick-borne diseases. But in goats the powdered roots are mainly given to treat helminthiasis (Maphosa et al., 2010; Tyasi and Nkohla, 2015; Tyasi

and Tyasi, 2015; Tyasi et al., 2015). The main objective of this study was to investigate the effects of one of the most common traditional plant called *Elephantorrhiza elephantina*, as an anthelmintic against gastrointestinal parasites on goats.

## **Anthelmintic against Gastrointestinal Parasites**

### **General**

The top three worms that cause the most persistent problems are the *Haemonchus Contortus*, *Trichostrongyles* and *Oesophangostenum*. These worms have two stages of development in sheep and goats. The first stage is the parasitic stage which occurs inside animals and the second stage is the free-living larval stage which occurs on pastures (Zojac and Gipson, 2000).

Internal parasites exist by feeding off their host. Some types attack the walls of the digestive system and feed on the host's blood, then anemia arise. Others will feed on the nutrients eaten by the host and cause weight loss, not anemia (Kaplan, 2004).

Poor body condition, anaemia, diarrhea, anorexia and death can be good indicators of actual nematode infection during the production. Goats are susceptible to worms due to their slowness to develop immunity (Ranaldi et al., 2009). The use of anthelmintic drugs can treat intestinal parasites and also vaccination to boost the immune system is vital on goats. Also tanniferous plants or tannins represent one alternative approach to treat and control the parasites (Virginie et al., 2003). The issue of controlling gastro intestinal parasites is of particular economic importance in goat production system worldwide (Ranaldi et al., 2009). Internal parasites, especially *Haemonchus contortus*, are difficult to manage since they develop resistance to dewormers (Kaplan, 2004). Pasture management must be the primary tool to control and prevent gastrointestinal parasites, since goats ingest infective parasite larvae from pastures (Githigia et al., 2001). *E. elephantina* has the potential to reduce and control the gastrointestinal worms on goats, and it is an infactice natural and herbal remedy for goats (Maphosa et al., 2010; Tyasi and Nkohla, 2015; Tyasi and Tyasi, 2015).

## **Gastrointestinal Parasites on Goats**

### **Major gastrointestinal parasites and their causes**

Gastrointestinal parasites are the chief and major organisms responsible for disease-related production and reproduction losses in goats (Maphosa et al., 2009;

Tyasi et al., 2015). These are mainly caused by parasite larvae found in pastures (Gadahi et al., 2009). Gastrointestinal parasites are mostly common in young ruminants because of their weak immune system that is not fully developed (Githigia et al., 2001). Goats also increase the economic status of the rural poor, but due to improper care, unhygienic environment and extreme climate can cause the parasites in them (Abuda et al., 2010). The prevalence of gastrointestinal helminthes is related to the climatic conditions like quantity and quality of pastures, humidity, temperature and the grazing behavior of the host (Gadahi et al., 2009). The most problematic gastrointestinal parasites are the round worms and coccidia. Important round worms are *Haemonchus contortus* (barber pole worms), protozoa of the genus *Eimeria* and the *Ostertagia circumcincta* (brown stomach worm) (Hoste et al., 2002). Other gastrointestinal parasites concerns are *Teladorsagia circumcincta*, *Trichostrongylus axei*, tapeworm, liver flukes and lungworms. The high incidence of all these parasites is attributed to lower immunity of the host, as a result of malnutrition (Gadahi et al., 2009). Genetic make-up of the goat, excessive usage of the same anthelmintic treatment, overstocking and overgrazing may also predispose gastrointestinal parasites (Cerbo et al., 2010). Tapeworms are non-pathogenic and they require pasture mites to complete their life cycle (Abuda et al., 2010).

### **Epidemiology of gastrointestinal parasites**

Epidemiology of parasites involves the distribution of the parasites and diseases from one animal to the other, or simply the spread of parasites among animals (Waller, 2003). Gastrointestinal parasite infections are a worldwide problem for both small scale and large scale farmer (Abuda et al., 2010). Animals raised in confinement or on pasture-based systems will almost certainly be exposed to gastrointestinal parasite at some point in their lives (Min and Hart, 2003). An adult female parasite will lay eggs on the rumen and abomasums, then passed to the intestines on an infected animal and excreted with feces (Waller, 2003). On favorable conditions, like high temperatures and humidity, eggs will hatch to form larvae on the grazing site or pastures (Abuda et al., 2010), then an uninfected goat, during grazing, will ingest the larvae and the larvae will grow into worms then they will multiply in the digestive system and will reproduce eggs that will be again passed out through feces (Hounzangbe-Adote et al., 2005).

### **Impact of gastrointestinal parasites on red blood cell and on animal's body**

Gastrointestinal parasites exist by feeding off of their host. Some types attach to the walls of digestive system and feed on the host's blood (Van Metre, 2010). *Haemonchus contortus* is a blood sucking parasite that pierces the lining of the abomasums, causing blood plasma and protein losses to the host (Burke et al., 2004). Each blood sucking *H. contortus* worm can remove 0.05 ml of blood per day. So a goat with 500 *H. contortus* may lose 25ml blood per day (Hayat et al., 2001). A decrease in erythrocytes, lymphocytes, haemoglobin, packed cell volume (PCV), weight and production may result due to the manifestation of *H. contortus* (Gadahi et al., 2009). Pale to grayish colouring of mucus membranes like eye lids, gums, and vulva, can be seen due to lack of red blood cells. Tapeworm feeds on the undigested nutrients on the abomasums and causes diarrhea, weight loss, emaciation and even death in goats. Lung worm larvae travel to the lungs where they cause respiratory problems, fever, anorexia, and pneumonia. Liverflukes will go and penetrate the livers, resulting in malfunctioning of the liver, swollen liver with watery substances (Ruiz et al., 2006). Coccidia parasites cause coccidiosis infection (Campbell, 2008; Tyasi et al., 2015). The clinical signs of coccidiosis infection are watery diarrhea without mucus or blood, constipation, lack of appetite accompanied by fever, dehydration as a result of diarrhea, weakness and emaciation caused by weight loss (Ibarra-Velarde and Alcala-Canto, 2007). Most of the gastrointestinal parasite infections reveal hemorrhagic and ulceration in the intestinal walls during necropsy or post mortem (Burke et al., 2004). Compared to all these nematodes and other nematodes, *H. contortus* is the most highly pathogenic parasites of small ruminants, capable of causing acute diseases and highly mortality in all classes of livestock (Kamaraj and Rahuman, 2010).

### **Treatment of gastrointestinal parasites on goats**

A strategic anthelmintic treatment increases productivity and financial profitability (Nwafor, 2004). Several treatment and dewormers are available for use in goats to kill internal parasites (Ogwang et al., 2008). Before even treating the animals, first isolate the infected ones from the herd (Githigia et al., 2001). Dehydrated animals due to diarrhea should be rehydrated by administering liquid nutritional supplement orally by nipple bottle (Ibarra-Velarde and Alcala-Canto, 2007). Types of dewormers commonly used and are effective are albendazole, fenbendazole, ivermectin, moxidectin, levamisole, pyrantel and morantel. Full dose of a

dewormer should always be used to ensure maximum kill (Kaplan, 2004). Dose levels are always indicated and the instruction on the treatment package and the choice of drug depends on personal preference and experience (Nguyen et al., 2005). *Elephantorrhiza elephantina* is also an effective gastrointestinal treatment on goats (Maphosa et al., 2009; Masika et al., 2002; Tyasi and Nkohla, 2015; Tyasi and Tyasi, 2015). Copper oxide wire particles dosage and feed supplement level are vital for treatment of intestinal parasites, especially *Haemonchus contortus* (Burke et al., 2004). According to Min and Hart (2003), there are also other forages that have been shown to control and kill gastrointestinal parasites. Tannin rich forages such as *Sericea lespedeza* that reduces internal parasite egg counts.

### **Prevention and control of gastrointestinal parasites on goats**

Control of the gastrointestinal parasites is required to prevent losses caused by helminth infections (Maphosa et al., 2010). Internal parasites get out of control when their load cannot be tolerated by the animal, so to manage them, it is important to understand the parasite cycle and factors encouraging their production and reproduction (Githigia et al., 2001). Management and medication have an important influence on parasite concentration and productivity goats (Nguyen et al., 2005), especially the management of *Haemonchus contortus* (barberpole worm) that is considered to be the biggest concern for small ruminants. Pasture management should be the primary tool to control and prevent internal parasites (Kaplan, 2004). All goats of age one month and older must be dewormed regularly and properly on the same day (Waller, 2003). The most important time to deworm is at the beginning of the year (kidding season) because worms, especially stomach round worms are so prolific (Githigia et al., 2001).

To prevent resistance from developing, the dewormer must be used in full dose and the labels must be read accurately (Kaplan, 2004). A farmer must reduce the frequent exposure to dewormers, meaning that the dewormers must be rotated annually so that worms don't get used and resistant to the drug (Waller, 2003). Rotational grazing must be practiced to prevent overgrazing the veld, also sanitation of the veld and get rid of snails since they are the carries of liverfluke larvae (Van Metre, 2010). Stocking rate must also be reduced because the more animals in a camp, the more densely the larvae will be deposited. New goats may bring parasites or larvae into the farm so strict quarantine and deworming is necessary before introducing them into the herd (Kaplan, 2004). Animals within the farm that have got heavy loads of parasites must be culled. It is very

important to keep deworming records, to accurately be precise about the deworming intervals (Githioria et al., 2006). Cattle do not share the same internal parasites with goats, so mixing the goats with cattle is helpful since cattle consume goat parasite larvae and that reduces the spread of the parasites (Min and Hart, 2003).

### **Anthelmintic and its Resistance**

Anthelmintics are drug treatments that get rid and destroy the worms that are susceptible to that particular drug, but the resistant parasites survive and pass on the resistant genes, resulting in resistant populations of gastrointestinal parasites (Kaplan, 2004). Common anthelmintic drugs are questioned because of the development of resistance by parasites (Dung et al., 2005). Combining knowledge of gastrointestinal parasite epizootiology with modern anthelmintics is vital for a great successful control of gastrointestinal parasites (Dold and Cocks, 2001).

### **Commercial drugs/ anthelmintics**

Drug resistance is the ability of worms in a population to survive drug treatments that are generally effective against the same species and stage of infection at the same dose level (Kaplan, 2004). Over-use of dewormers has led to resistance, and available dewormers are now ineffective (Ninja, 2004). The cost of chemical or commercial drugs, especially in developing countries, represents an additional restriction on their use and hence some farmers use alternative methods for intestinal parasites (Hounzangbe-Adote et al., 2005). Suppressive deworming is probably the most effective means of keeping parasite numbers lowered for a period of time, though eventually this method might lead to the resistance to the anthelmintics (Kaplan, 2004). The use of prophylactic anthelmintics has been proffered as a possible intervention strategy in developing countries to reduce gastrointestinal parasitism, but however the treatment is relatively expensive for small scale farmers (Nwafor, 2004). Common drugs used are Benzimidazoles (Fenbendazole, Albendazole, Oxybendazole and Thiabendazole), Macrolytic Lactones (Ivermectin, Doramectin and Moxidectin) and Nicotinics (Levamisole, Pyrantel and Mora) (Kaplan, 2004).

### **Natural remedies/anthelmintics**

Natural anthelmintics potentially represent a suitable

alternative to conventional chemotherapy and their interest in anti-parasitic properties is increasing (Waller, 2003). Traditional methods of controlling nematodes, used by small farmers, remain largely dependent on medical plants (Hounzangbe-Adote et al., 2005). There are various natural remedies used to control gastrointestinal parasites as an anthelmintic. These include the bark of the tropical leguminous tree, *Albiziaanthelmintica* (Ninja, 2004), *Zanthoxylum zanthoxyloids*, *Newbouldia leavis* and *Carica papaya* (Hounzangbe-Adote et al., 2005). *Elephantorrhiza elephantina* is the most commonly used plant in South Africa, by communal and small farmers (Masika and Afolayan. 2002). Livestock farmers in the Eastern Cape have a long history of using plants to treat animal ailments (Dold and Cocks, 2001). It is generally believed that natural products are safer, with fewer side effects and are more harmonious with biological systems (Maphosa et al., 2009), though scientific evidence on the anti-parasitic efficacy of most plants is limited, regardless of their large distribution and ethno veterinary usage, mostly by extensive and semi extensive farmers (Githioria et al., 2006). According to Maphosa et al. (2010), researchers have ventured into ethnoveterinary medicine investigations on efficacy of many natural plants with promising results, but the problem very few plants have been validated for their efficacy.

### ***Elephantorrhiza elephantina* as an anthelmintic**

*Elephantorrhiza elephantina* is widely used in South Africa as a traditional remedy to treat gastrointestinal parasites in livestock (Maphosa et al., 2009; Tyasi and Nkohla, 2015; Tyasi and Tyasi, 2015). Phytochemical screening, shows that *E. Elephantina* consists of condensed tannins, flavonoids and other phenolic substances, which are useful in treating preventing parasites that feed on walls of digestive system, by forming a protective layer on the skin and mucosa (Maphosa et al., 2010; Tyasi and Nkohla, 2015; Tyasi and Tyasi, 2015). *E. elephantina* is not only effective in larvae infections, but also in bacterial and tick-borne diseases like heartwater, red water, gal sickness and babesiosis (Naidoo et al., 2006). However, medicinal plants have long been used in control of helminthes in livestock in South Africa (McGaw et al., 2000), and they are very effective in controlling intestinal parasites, though there are no scientific proofs and studies regarding their efficacy (Naidoo et al., 2006). *Elephantorrhiza elephantina* is effective in treating gastrointestinal parasites in livestock (Maphosa et al., 2009; Tyasi and Nkohla, 2015; Tyasi and Tyasi, 2015). The high costs of commercial drugs and feeds have

focused interests on multipurpose trees as inexpensive sources of treatment, as leaves and root extracts (Dung et al., 2005). The use of *Elephantorrhiza elephantina* will needs people's knowledge, skills, methods and beliefs about care of livestock (Mwale and Masika, 2009). Anti-parasitic agents extracted from plants to control parasites in goats are successful and have an effective role in destroying internal parasites such as tapeworms, round worms, liver fluke and other common intestinal worms (Nguveni et al., 2005).

## CONCLUSION AND RECOMMENDATION

Gastrointestinal parasites are a major cause of intestinal diseases and infections in livestock, especially in goats and sheep. Therefore, *E. elephantina* is effective in controlling and treating resistant gastrointestinal parasites, that causes diseases in goats and other livestock animals. Proper precautions in preventing intestinal infections must be taken to reduce economic losses done by gastrointestinal parasites. Drug or dewormers should never be under and overused due to the fact that some parasites become resistant to them. In addition, many scientific studies on the efficacy effects of natural remedies are imperative, so that farmers who cannot afford the expensive commercial drugs can use the natural plants, like *E. elephantina*, with confidence. Lastly, since the gastrointestinal parasites become resistant to commercial drugs, the natural remedies should be introduced commercially because of the fact that they are also effective in treating intestinal parasites.

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