IMPACT OF *ALLIUM SATIVUM* EXTRACT ON THE MANAGEMENT OF *HAEMONCHUS CONTORTUS* IN ARTIFICIALLY INFESTED WEST AFRICAN DWARF GOATS

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ABSTRACT

The quest to explore natural alternatives as a replacement for conventional management of helminths, necessitates the investigation of Allium sativum in the treatment of Haemonchus contortus. Twenty-five West African Dwarf goats were divided into five groups containing five animals per replicate. They were randomly assigned to five treatment groups: 7.5, 12.5, 17.5 mg/ml of the extract of A. sativum, 10 mg/ml of albendazole (positive control), and saline water (negative control). Data were collected on performance, and faecal egg counts of the animals. The results showed that final weight (8.77 - 10.64 kg), weight gain (1.33 - 2.10 kg), daily weight gain (23.77 - 37.48 g), dry matter intake (392.05 - 430.15 g/day) and feed conversion ratio (10.64-14.23) were significantly (P< 0.05) influenced. Final weight obtained in the group drenched with albendazole was comparable to values obtained in animals treated with various levels of the A. sativum extract. The comparable feed conversion ratio was obtained from the group drenched with albendazole (10.64) and 12.5 mg/ml of the extract (12.71). Faecal egg counts reduced across the treatment groups in which A. sativum worked alike compared with conventional albendazole. It could be recommended that A. sativum extract can be used in the management of Haemonchus contortus as well as improve the performance of WAD goats.

Keywords: Haemonchus contortus, Allium sativum, Anthelmintic, Performance, Faecal egg count

INTRODUCTION

Helminthiasis has been extensively reported to be one of the major challenges confronting livestock all over the world (Ayankoso, 2022). Diverse species of helminths that cause production losses in the digestive tract and related organs of animals include *Haemonchus, Cooperia, Bunostomum, Gaigeria, Fasciola, Oesphagostormum, Trichuris, Trichostronglus,* amongst others. Among these species *Haemonchus contortus* has been reported to be most populous all over the world and with numerous damages on ruminants. *H. contortus* has morphological structure which is difficult for animals to survive with (Torres-Fajardo *et al*., 2020). The conventional means of controlling these worms have been through the use of chemotherapeutic approach, which had resulted in the development of resistance by the parasites to the active ingredients in the drugs. Other alternative methods include the use of diets to improve the host resistance and use of browse plants that are high above the ground level to reduce contact to the worms (Butter *et al*., 2000)

This necessitates the research into the use of plants such as *Allium sativum* in controlling the growth and proliferation of *H.* ***contortus.*** *A. sativum* possess phyto-compounds such saponin which has been documented to enhance inducement of defensive mucosal membrane, thereby perform curative role in the body of the host (Njoku *et al*., 2021). It is rich in tannins which serve as a natural alternative to conventional anthelmintic which has been banned in some parts of the world (Yusuf *et al*., 2023). The tannins could hinder major processes in worms such as oxygen exchange between the inside and outside of the egg. The ability of tannins to bound to the surface of the eggshell, possibly through tannin−protein interactions, and either prevented the proteins that cause the actual hatching process (Molan and Faraj, 2010) or the tannin form coat around the egg and disabled the penetration of the larvae through the eggshell (Engstrom *et al.*, 2016). Thus, this study aimed at determining the effect of *A. sativu*m extract in controlling *H. contortus* in WAD goats.

MATERIALS AND METHODS

Experimental site

The study was carried out at the Veterinary Teaching Hospital, College of Veterinary Medicine and Post Graduate Research Laboratory of the Department of Animal Production and Health, College of Animal Science and Livestock Production, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria. The experimental site is located on latitude 71'10° N and longitude 3'2^0 E (Google earth, 2024). The climate is tropical with mean annual rainfall of 1, 037m. The mean ambient temperature ranges from 28-34° C. The vegetation represents an interphase between the tropical rainforest and the derived savannah with a yearly average humidity of 83% (Accuweather, 2024).

Collection and Extraction of *Allium sativum*

Cloves of garlic (*Allium sativum*) were purchased from open market in Abeokuta, Ogun State, Nigeria. It was carefully cleaned by removing pebbles and other debris materials. About 50g of cleaned *A. sativum* were measured and milled completely with 200ml of water with the use of blender. This was reconstituted to obtain 7.5, 12.5 and 17.5 mg/ml of the extract.

Inoculation and treatment of the animals

The animals were artificially infected with third stage larva (L3) of *H. contortus* obtained from the donor lamb. The level of the infestation was monitored through collection of faecal samples directly from the rectum of the experimental animals on daily basis to determine the level of their faecal worm egg count in egg per gram (epg). Each group was randomly allotted to one of the levels of concentration of the extracts at 7.5, 12.5 and 17.5 mg/ml, while positive control was given ALBENOR® (albendazole bolus 250 mg produced by Jubaili Agrotec) at 10 mg/ml consecutively for three days and negative control was given water, in a completely randomized design. The animals were drenched with the extracts and saline daily throughout the 56-day experiment, while positive control group was drenched for the first three days of the commencement of the experiment and another three consecutive days from 29th to 31st day of the experiment.

RESULTS

Effect of *Allium sativum* extract on growth performance characteristics of West African Dwarf goats artificially infected with *Haemonchus contortus*

Growth performance characteristics of artificially infected West African Dwarf goats drenched with *Allium sativum* is presented in Table 1. The results showed that final weight, weight gain, daily weight gain, dry matter intake and feed conversion ratio were significantly (P< 0.05) influenced. Final weight, weight gain and daily weight gain were highest (10.64 kg), (2.10 kg) and (37.48 g/day), respectively in the group drenched with albendazole.

Table 1: Effect of *Allium sativum* extract on Growth Performance Characteristics of West African Dwarf goats Artificially infected with *Haemonchus contortus*

Parameters	Saline water ml	Albendazole 10mg/ml	7.5mg/ml	12.5mg/ml	17.5mg/ml	SEM	P-value
Initial weight (kg)	7.18	8.54	8.41	8.07	8.20	0.29	0.628
Final weight (kg)	8.77^{b}	10.64^{a}	9.74^{ab}	9.69^{ab}	9.78^{ab}	0.33	0.042
Weight gain (kg)	1.59^{b}	2.10^{a}	1.33^{b}	1.66^{b}	1.59^{b}	0.08	0.042
Daily weight gain (g/day)	28.42^{b}	37.48^{a}	23.77^{b}	29.67^{b}	28.34^{b}	0.33	0.042
Metabolic weight gain (kgBW$^{0.75}$)	1.41	1.74	1.22	1.43	1.41	0.06	0.060
Total feed intake (kg)	21.64	22.17	21.37	19.98	21.92	3.22	0.221
Average feed intake (g/day)	386.39	395.94	381.66	356.77	391.43	5.76	0.221
Dry matter intake (g/day)	424.60^{a}	435.10^{a}	419.41^{ab}	392.05^{b}	430.15^{a}	6.33	0.044
Feed conversion ratio	14.19^{ab}	10.64^{b}	22.86^{a}	12.71^{b}	14.23^{ab}	1.84	0.011

^{a,b} = means with different superscripts along rows were significantly different (P<0.05)

However, the least final weight (8.77 kg) was obtained in group of animals drenched with saline water. Dry matter intake was similar and highest in all treatment groups except for the goats treated with 12.5

mg/ml which had the least value (392.05 g/day). Feed conversion ratio was not significantly (P>0.05) different (10.64 and 12.71) in the group drenched with albendazole, and 12.5 mg/ml of the extract, respectively.

Figure 1 shows effect of *A. sativum* extract on trend of *H. contortus* (eggs per gram) in WAD goats. The reference point of about 2000 eggs per gram (epg) was taken for all the treatments. There was a reduction in the faecal egg count at the third week for all the treatments. However, a sharp decline was obtained among the group of animals that received 17.5 mg/ml of the extract from week two to four. Faecal egg count observed in the group treated with albendazole was perpetually low throughout the study. Also, there was consistent increase between week 4 and 6 in faecal egg count for the group treated with 17.5 mg/ml of the extract, though it declines sharply between week 7 and 8. The faecal egg count for the fourth and fifth week was low in all the groups treated with different levels of the extract with slight increase in week 6. Consistent reduction was observed between week 7 and 8 in all the groups treated with *A. sativum* extract.

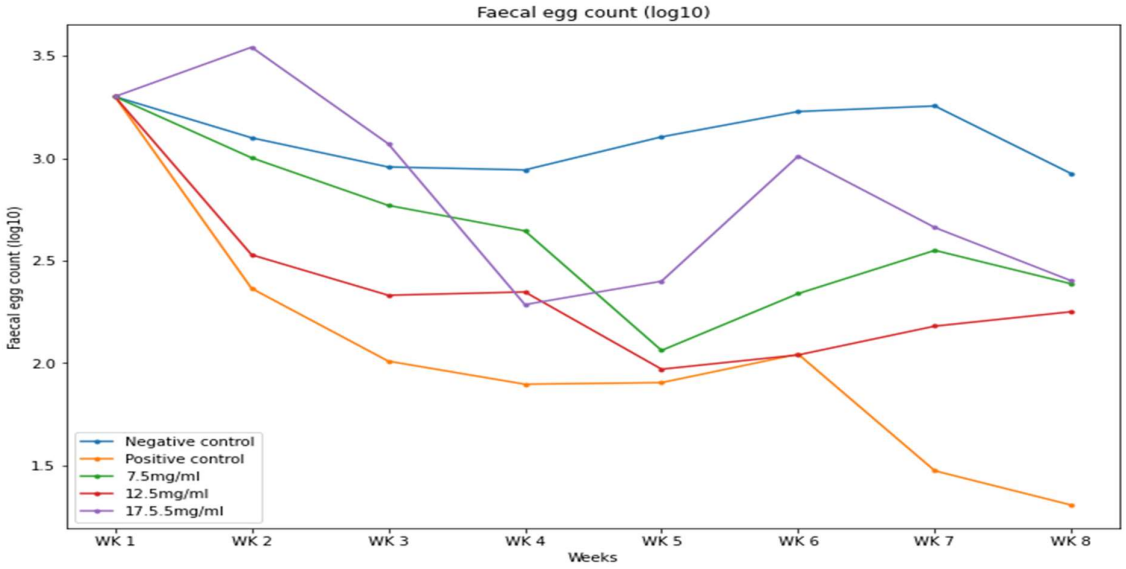

Figure 1: Effect of *Allium sativum* extract on *Haemonchus contortus* (eggs per gram) in artificially infected West African Dwarf goats

DISCUSSION

The performance indices; final weight and feed conversion ratio, obtained in group treated with conventional albendazole was comparable to values obtained in groups treated with *A. sativum* extract. This could be associated to the presence of alkaloids and phenol present in the extracts which are capable of combatting worms and consequently resulting in comparable final weight. Jain *et al.* (2013) reported that tannins could hinder available protein in the gastrointestinal tract, hence disallow nutrients availability for larva development and cause larva starvation. Tannins could also bind larvae cuticle and cause death (Kateregga *et al*., 2014) and/or disrupt both digestive and reproductive processes (Klongsiriwet *et al*., 2015) resulting in inhibition of larva development.

Regular monitoring of the faecal egg counts in animals remains a competent approach to determine the quantity, rate of multiplication and/or growth of parasitic worm. General reduction observed in faecal egg counts (epg) in all the treatment groups including those that received saline water might be due to balanced ration/nutrition which made the animals to cope despite the morphological structure possessed by *H. contortus* (Torres-Fajardo *et al*., 2020). Also, rapid increase in egg counts observed in week 2 was in consonance with Hepaworth *et al*. (2006) that reported 5,000-15,000 eggs per gram production in *H. contortus* per day and could also be due to the sex or gravid nature of the worms present which caused rapid production of eggs. Reduction in worms' load observed in all the groups treated with *A.*

sativum might be associated with the bioactive compounds present in the extracts. The presence of these bioactive compounds might be responsible for the control or ameliorative effect of *H. contortus* thereby enhancing immune system of animals. When these compounds are absorbed by adult worms, it could lead to autolysis resulting in binding of intestinal mucosa (Schultz, 1989) and could as well has direct effect through reduced metabolism in the intestines, thus inhibiting oxidative phosphorylation, thereby causing destruction and death of the worm (Kateregga *et al*., 2014). Consistent reduction observed in the group of animals that received 12.5 mg/ml of the *A. sativum* extract suggested that this might be the optimal level in which it could effectively control the proliferation and growth of the worm. Sharp increase observed in week 6 could be attributed to the findings of Duval (2004) who report that garlic does not hinder egg production but prevent hatching of the eggs and further development into an adult. This might be ascribed to the development of the initial worms into adult which could produce eggs but inhibit hatching of the eggs which could have developed to adult and produce another set of eggs.

CONCLUSION

Amongst the groups treated with *Allium sativum* extract*,* 12.5 mg/ml gave best reduction of *H. contortus* (eggs per gram) in artificially infected WAD goats. It could be recommeded that for effective and efficient treatment of *H. concortus* in West African Dwarf goats, 12.5 mg/ml *A. sativum* could be used as an alternative to conventional albendazole with little or no deleterious effect on the animals.

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